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East Fork Poplar Creek — Sewer Line Beltway Remedial Investigation Report

Appendixes M - R

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East Fork Poplar Creek – Sewer Line Beltway Remedial Investigation Report

Volume IV
Appendixes M-R and
Raw Analytical Data and Diskette

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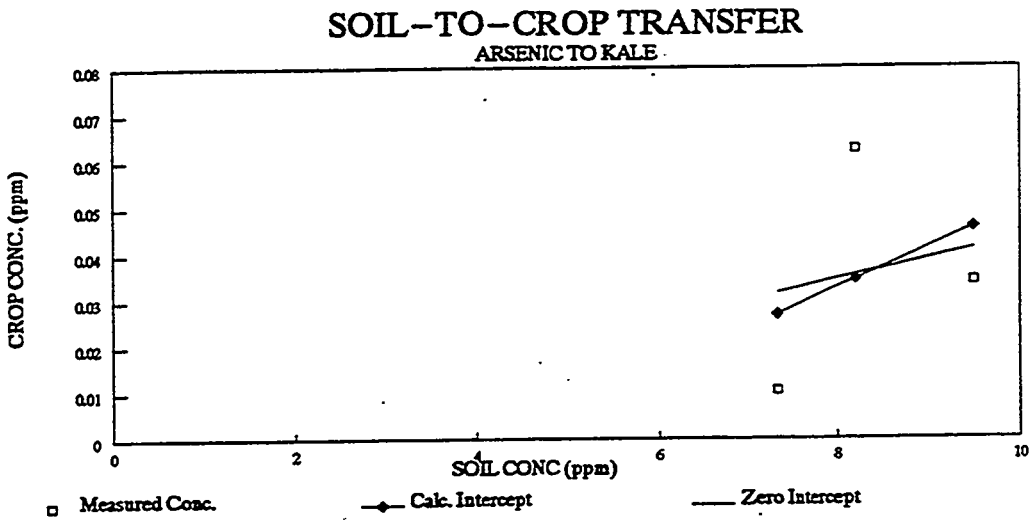
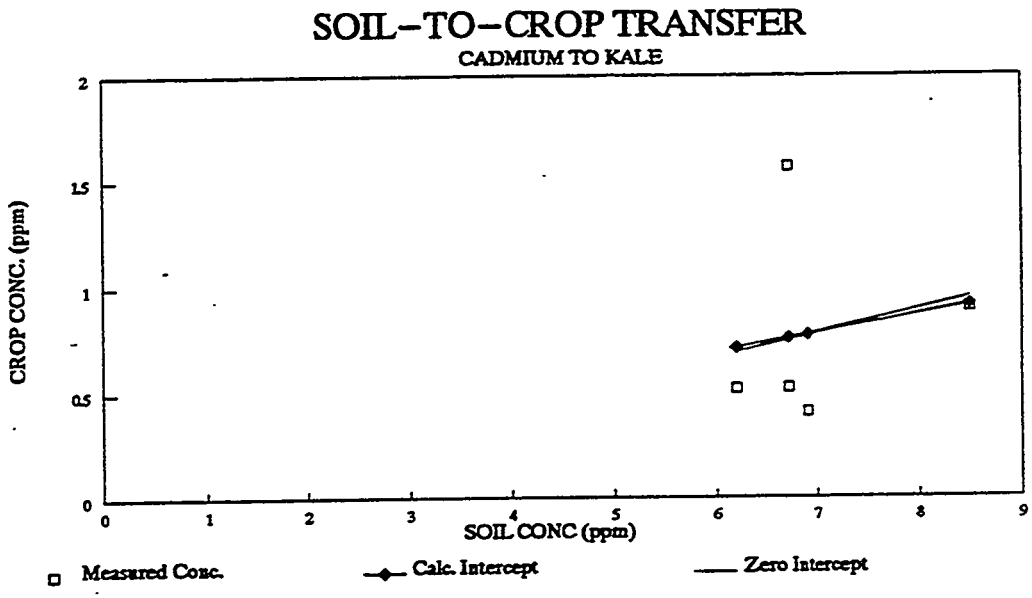
SOIL TO PLANT BIOTRANSFER FACTOR REGRESSION ANALYSES AND PROBABILITY PLOTS

Figure M.1. Soil to plant biotransfer factors





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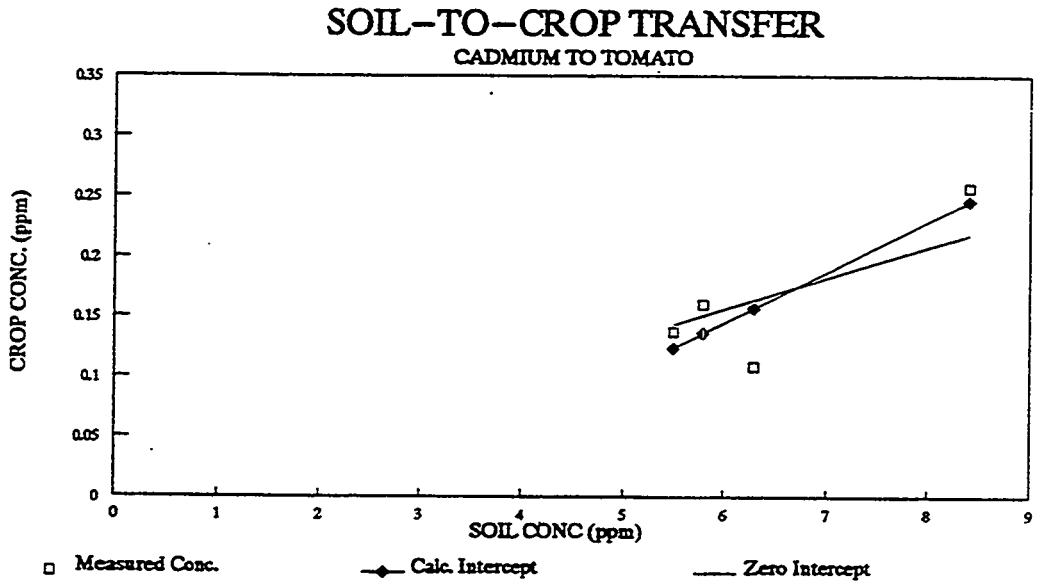


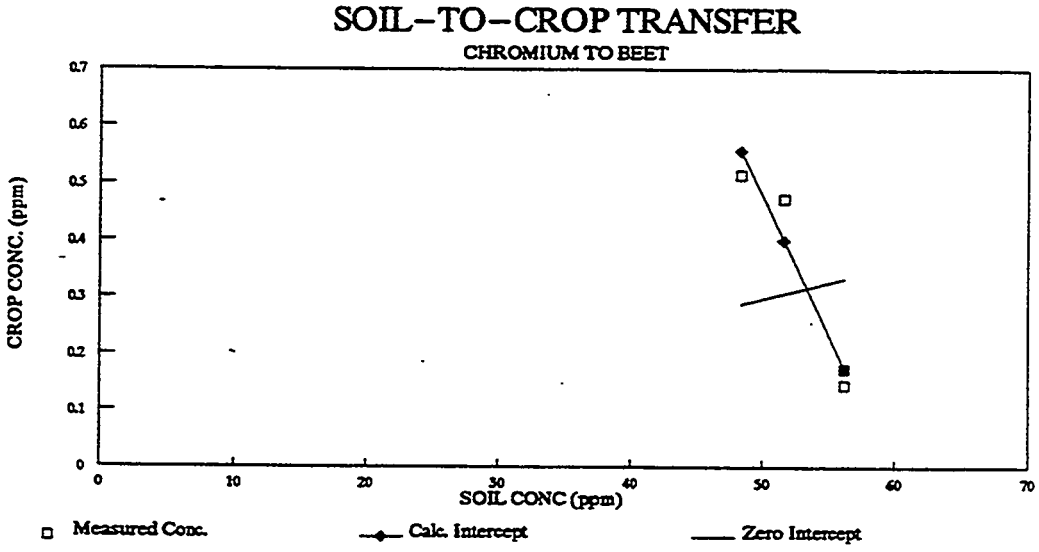
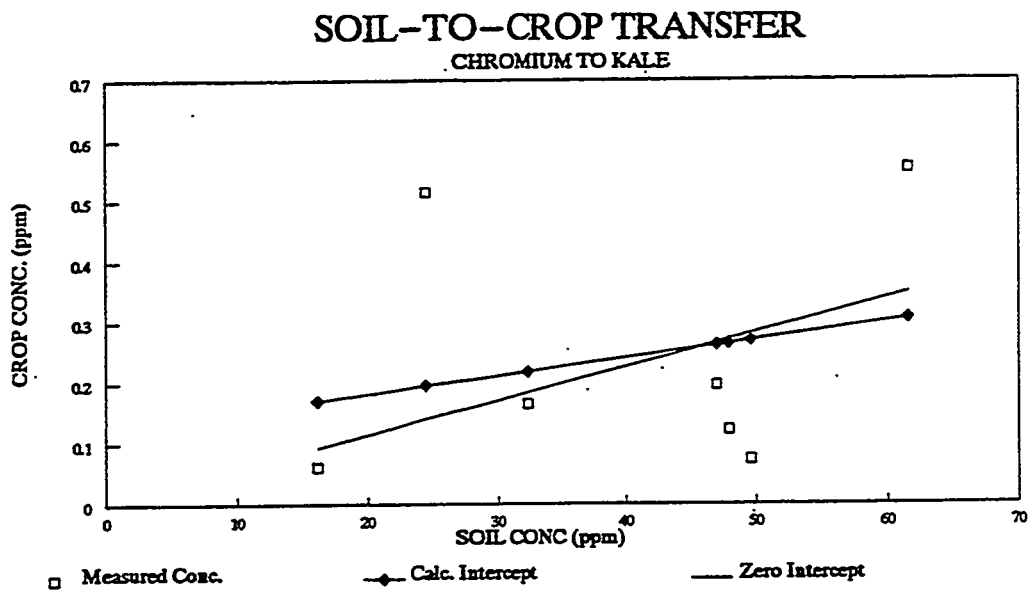
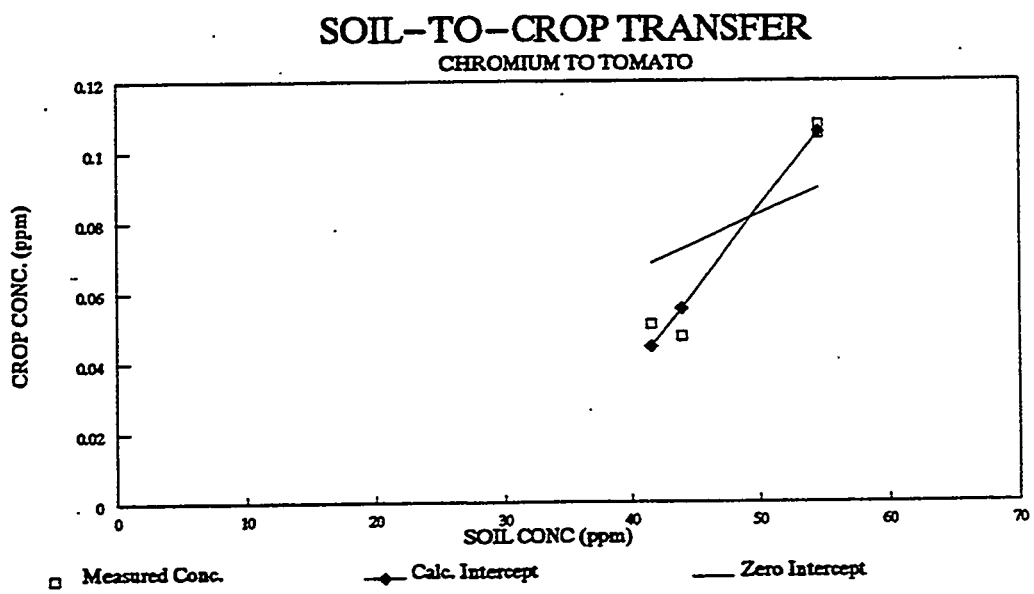


Figure M.1 (continued)





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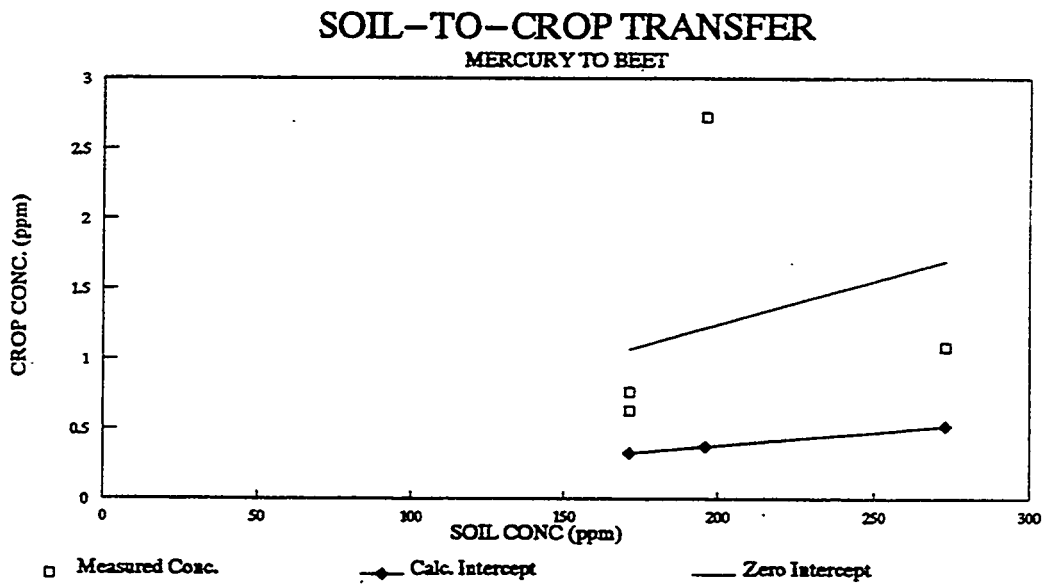

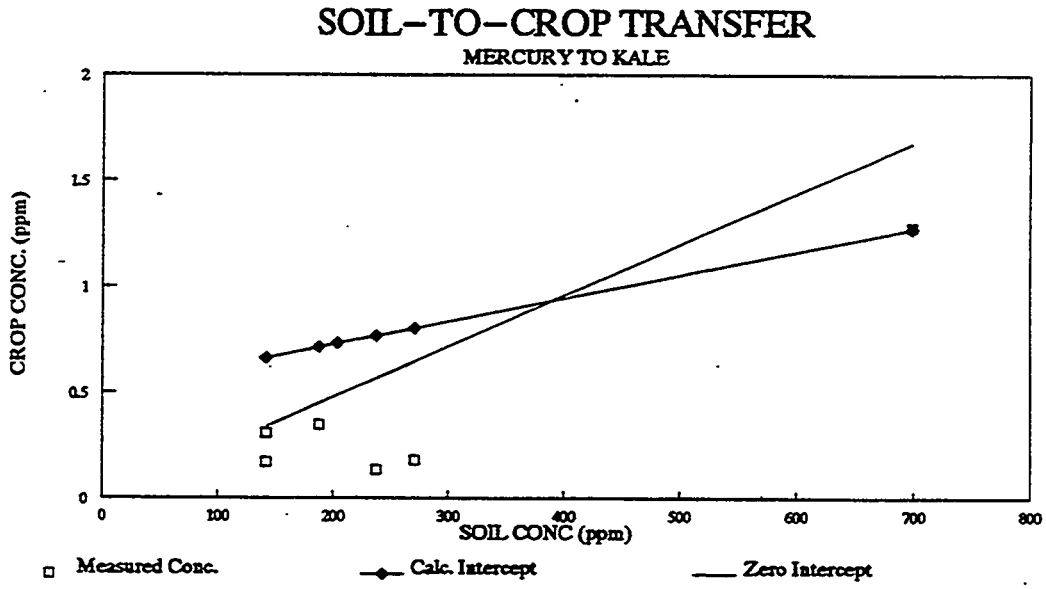

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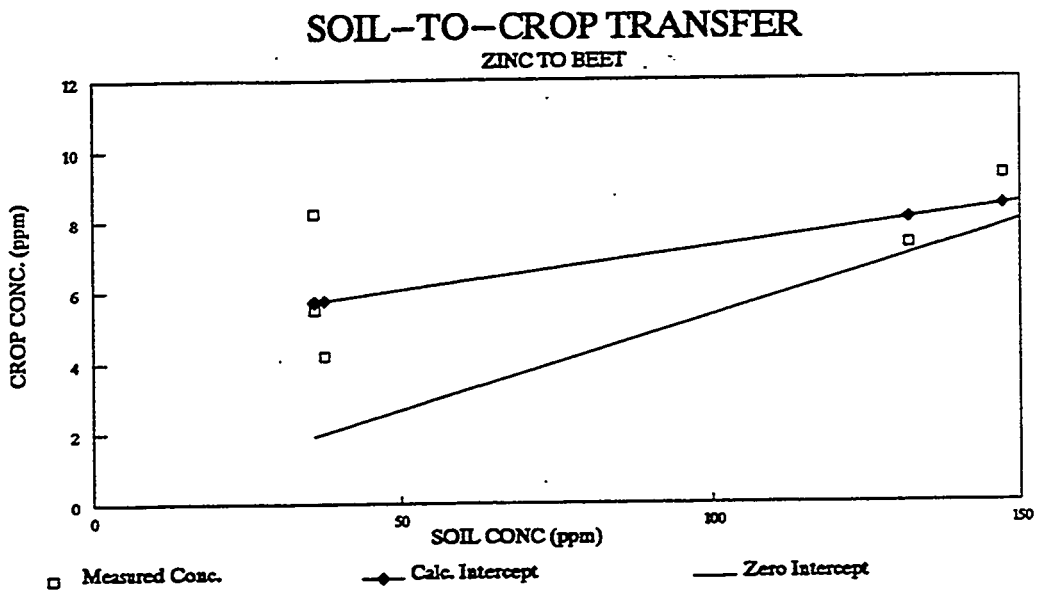


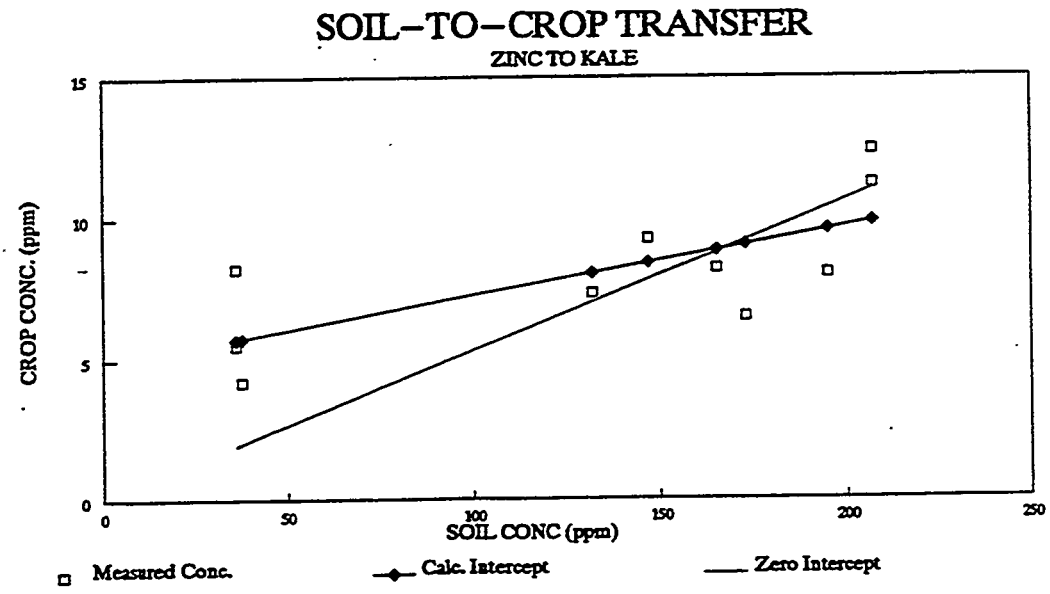


Figure M.1 (continued)

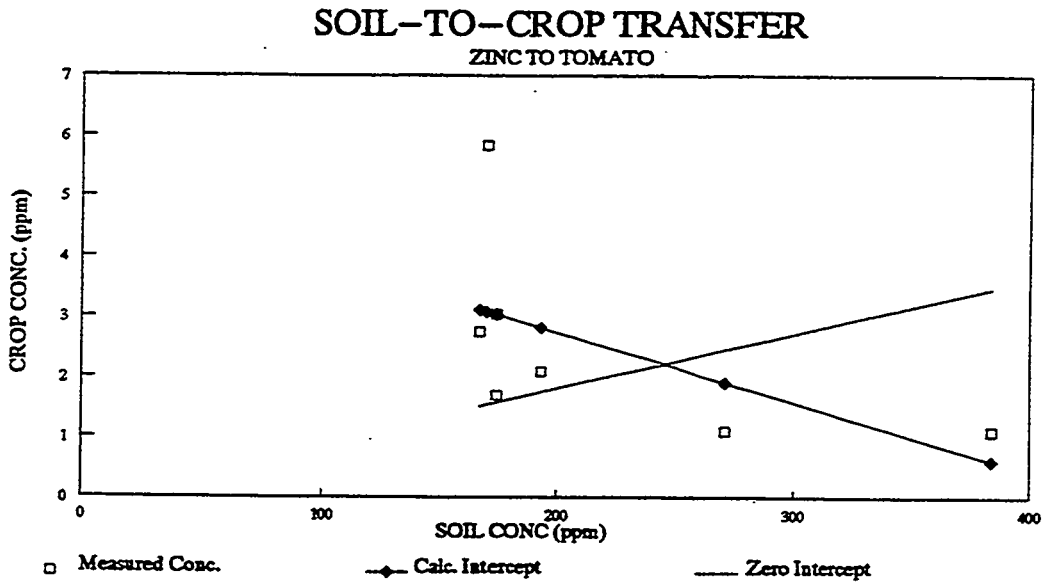


Figure M.2. Stem-and-leaf, probability, and box plots: arsenic (normal distribution)

```
 0M 00000000000000000111122222223346778 99
  1  12333344444555
  2  6
 3H  59
  4
  5
  6
  7  6
     ***OUTSIDE VALUES***
  9  47
 10  0
 16  1
 17  577
 19  5
 32  2
 80  00000
110  0
```

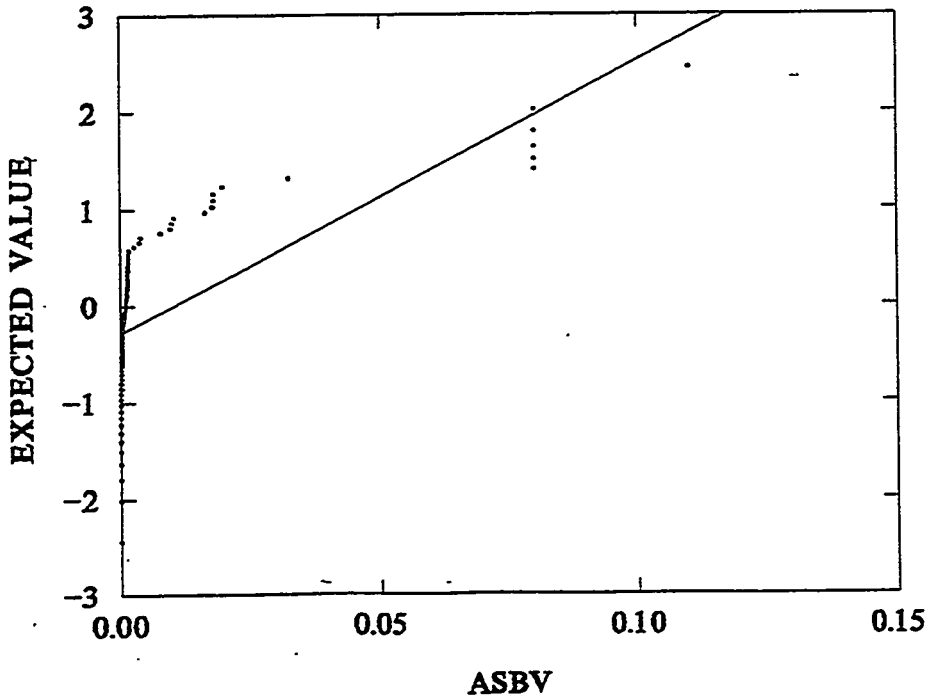


Figure M.3. Stem-and-leaf, probability, and box plots: arsenic (lognormal distribution)

```
-12   2
-11   8531
-10   977662
 -9   887430
 -8H  75544332210
 -7   963210
 -6M  9976666555555444
 -5H  965
 -4   86651000
 -3   94
 -2   555552
```

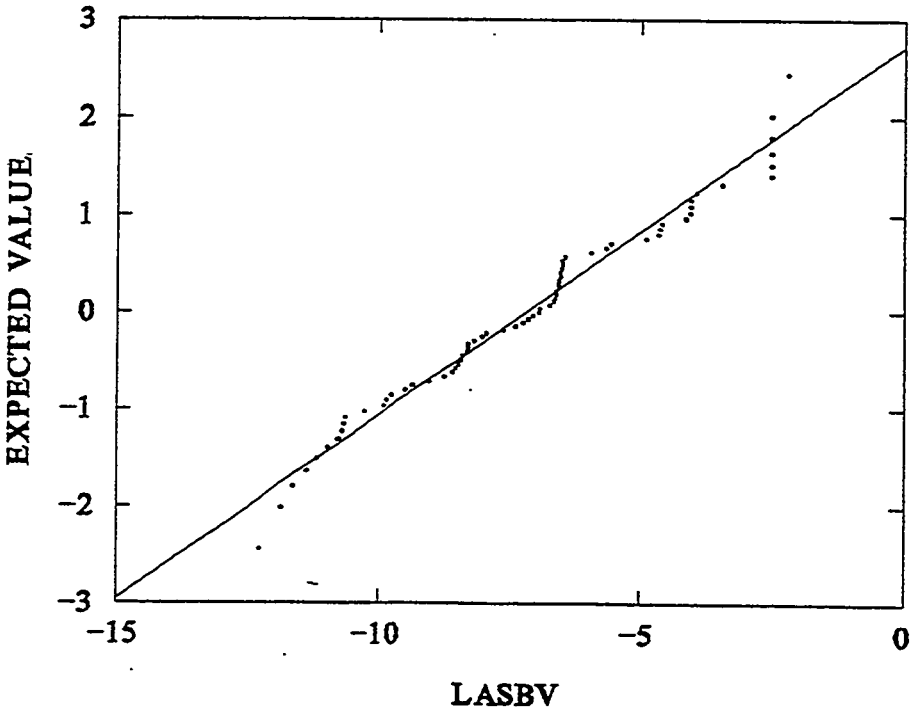
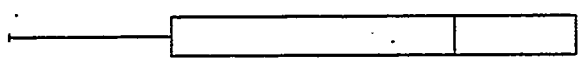


Figure M.4. Stem-and-leaf, probability, and box plots: beryllium (normal distribution)

```
0· 3
1H
2  4
3M
4H 00
```



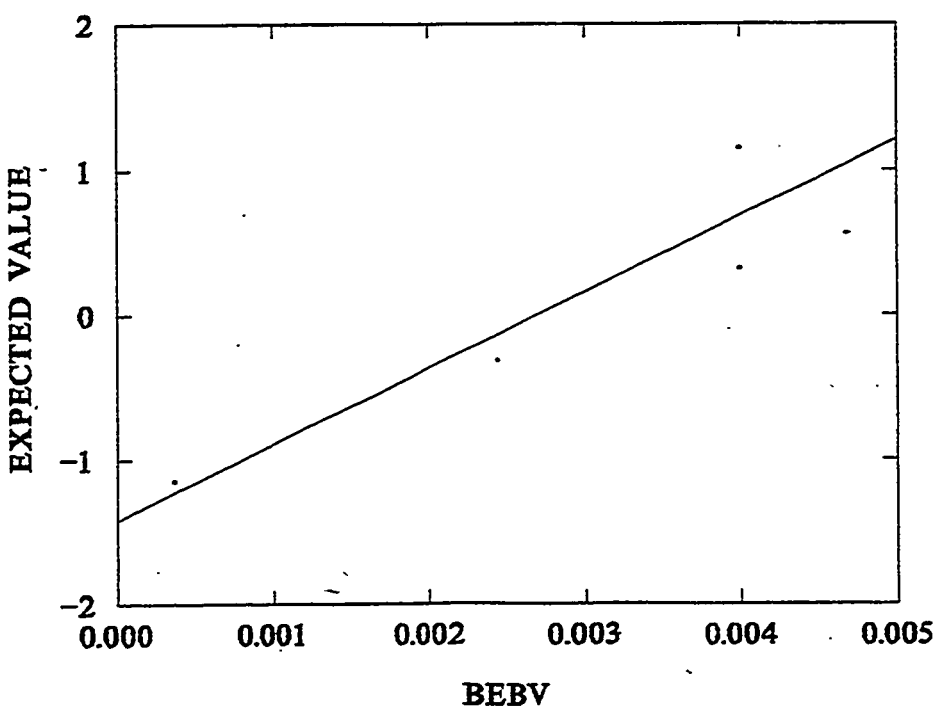
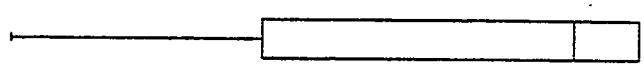


Figure M.5. Stem-and-leaf, probability, and box plots: beryllium (lognormal distribution)

```
-0H 76
-0H 55
```



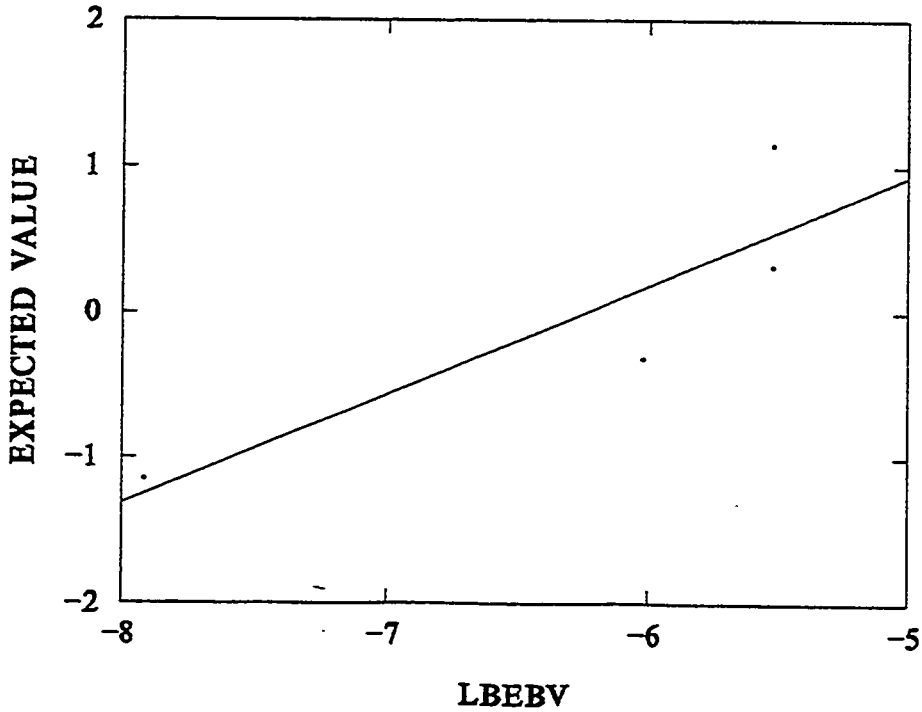
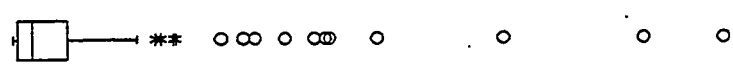


Figure M.6. Stem-and-leaf, probability, and box plots: cadmium (normal distribution)

```
0H 00000000000000000000000000111111122222333333344
0  55555567777777888899
1M 0112333334
1  55677889999
2  01233444
2  66778889
3  014
3  66689
4H 1114
4  8889
5  00000033
5  679
6  02
6  5
7
7  5
8  3
8
9  3
   ***OUTSIDE VALUES***
10 7
11 01
12 13
15 9
17 6
18 5
20 8
23 19
24 3
27 9
37 8
48 6
54 7
```



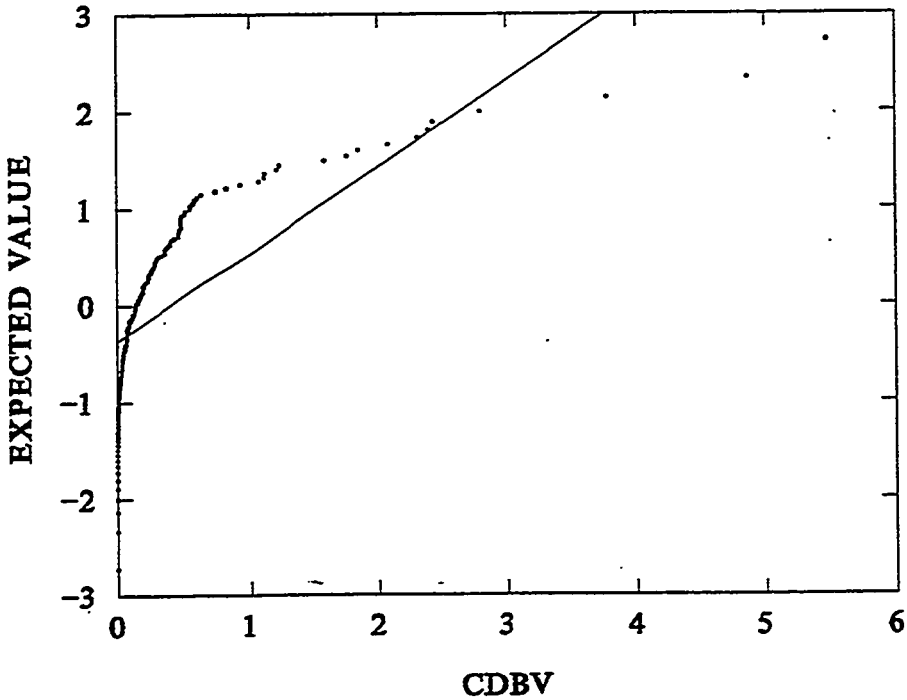
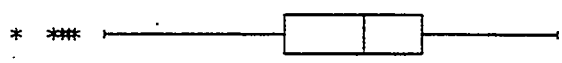


Figure M.7. Stem-and-leaf, probability, and box plots: cadmium (lognormal distribution)

```
-8   6
-7   9765
     ***OUTSIDE VALUES***
-6   9865
-6   410
-5   88665
-5   3110
-4   87765
-4   3110
-3H  998666555
-3   43332210
-2   999888666655555
-2   444443211000
-1M  999988877766666555
-1   4444433322222110
-0H  999998888777766666666555
-0   444210
 0   011124
 0   567888
 1   03
 1   57
```



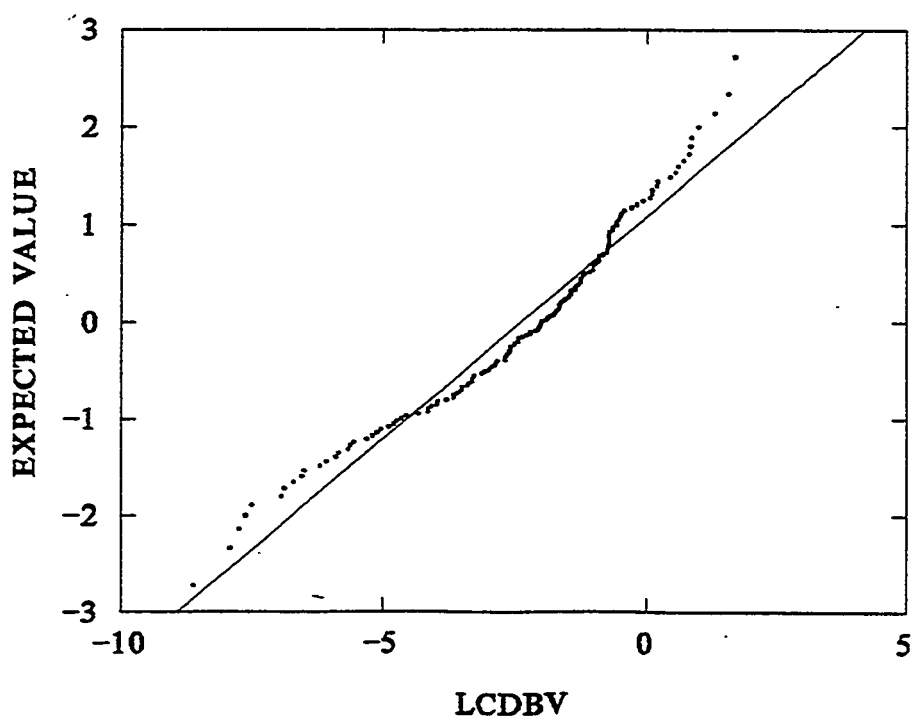


Figure M.8. Stem-and-leaf, probability, and box plots: manganese (normal distribution)

```
0H 00000011111234
0M 56677889
1   44
1   677.
2
2H 7
3   00000
3   6
4   1
4
5
5   8
    ***OUTSIDE VALUES***
7   2
```

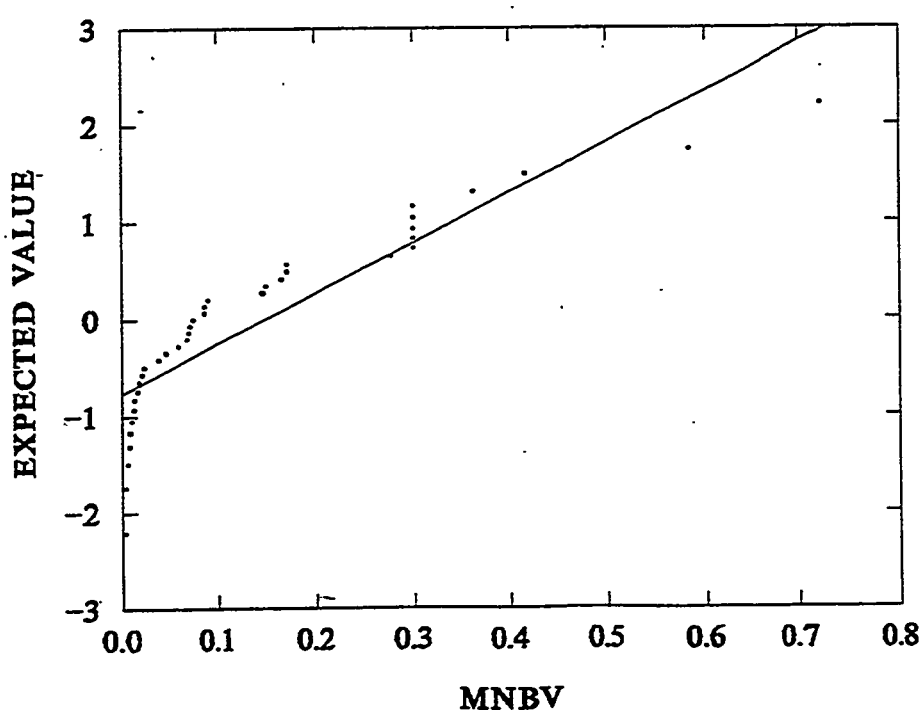
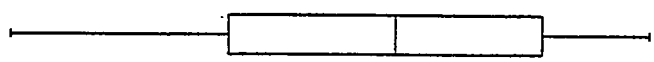


Figure M.9. Stem-and-leaf, probability, and box plots: manganese (lognormal distribution)

```
-6   0
-5   7
-5   2
-4   886
-4H  4410
-3   98
-3   21
-2M  87666
-2   444
-1   99877
-1H  2222220
-0   85
-0   3
```



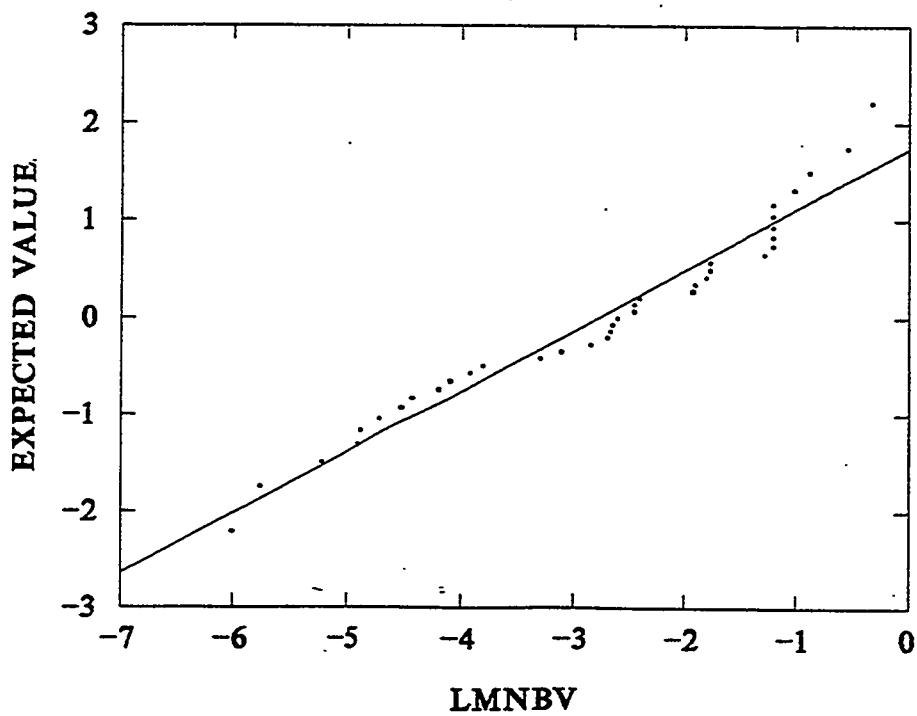


Figure M.10. Stem-and-leaf, probability, and box plots: mercury (normal distribution)

```
0M 000000000000000001
0
0H 445
   ***OUTSIDE VALUES***
3  00000
```

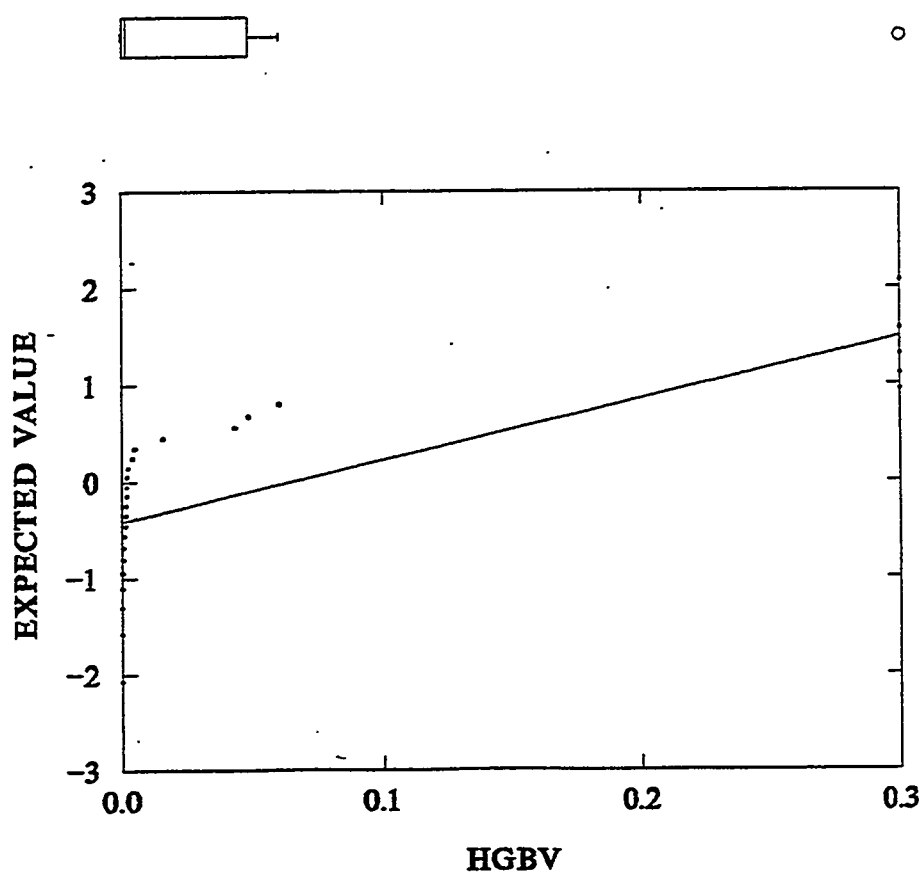
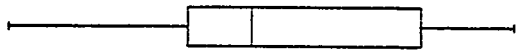
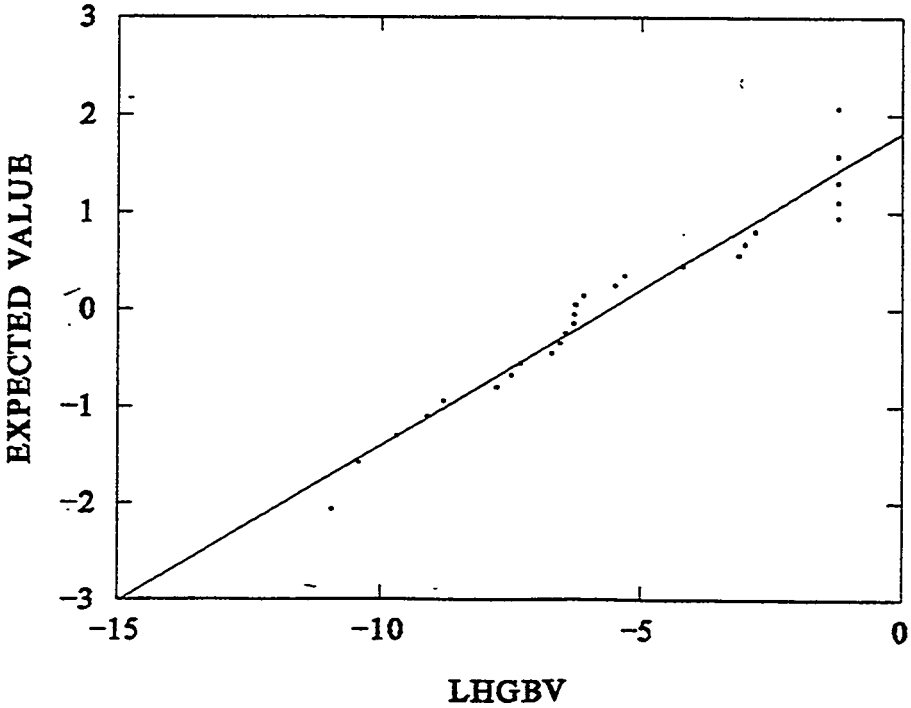


Figure M.11. Stem-and-leaf, probability, and box plots: mercury (lognormal distribution)

```
-10   94
 -9   61
 -8   7
 -7H  743
 -6M  7543221
 -5   53
 -4   1
 -3H  10
 -2   8
 -1   22222
```





EXPOSURE ASSUMPTION DEVELOPMENT AND SOIL TO PLANT BIOTRANSFER FACTOR STUDY RESULTS

Table M.1. Exposure parameters

Pathway 1 of 13
Dermal Contact with Surface Water While Swimming

Parameter	Age/Scenario	RME	MLE	Reference
Total Skin Area[a] (cm^2)	3 < 6	8,420	7,280	EPA 1992b
	6 < 9	10,900	**9,310**	
	9 < 12	14,200	11,600	
	12 < 15	17,700	**14,900**	
	15 < 18	20,100	17,500	
	3 < 12	**11,173**	9,396	
	9 < 18	**17,333**	14,667	
	Adult	**23,000**	**20,000**	
Fraction of Skin Exposed[b]	All	**1**	**1**	
Permeability Coefficient (cm/h)		Chemical Specific		EPA 1992b
Exposure Time[c] (h)	Residential/ Agricultural	**2.6**	**1**	EPA 1988c, 1989a, 1992b
	Open Land Use	**1**	**0.5**	EPA 1992b
Exposure Frequency[d] (d/year)	Resid./Agric.	**16**	**7**	EPA 1988c; 1989 a,b; 1992b
	Open Land Use	**5**	**1**	
Exposure Duration[e] (years)	3 < 12	**9**		
	6 < 9		**3**	
	12 < 15		**3**	
	9 < 18	**9**		
	Adult	**30**	**9**	
Body Weight[a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	**25**	
	9 < 12	36	36	
	12 < 15	50.6	**50.6**	
	15 < 18	61.2	61.2	
	3 < 12	**26**	26	
	9 < 18	**49**	49	
	Adult	**70**	**70**	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 2 of 13
Dermal Contact with Surface Water While Wading

Parameter	Age/Scenario	RME	MLE	Reference
Total Skin Area[a] (cm^2)	3 < 6	8,420	7,280	EPA 1992b
	6 < 9	10,900	**9,310**	
	9 < 12	14,200	11,600	
	12 < 15	17,700	**14,900**	
	15 < 18	20,100	17,500	
	3 < 12	**11,173**	9,396	
	9 < 18	**17,333**	14,667	
	Adult	**23,000**	**20,000**	
Fraction of Skin Exposed[f]	All	**0.38**	**.21**	
Permeability Coefficient (cm/h)		Chemical Specific		EPA 1992b
Exposure Time[c] (h/event)	Resid./Agric.	**2.6**	**1**	EPA 1988c
	Open Land Use	**1**	**0.5**	EPA 1992b
Frequency of Events (event/d)	All	**1**	**1**	
Exposure Frequency[g] (d/year)	Resid./Agric.	**36**	**7**	EPA 1988c
	Open Land Use	**5**	**1**	EPA 1992b
Exposure Duration[c] (years)	3 < 12	**9**		
	6 < 9		**3**	
	12 < 15		**3**	
	9 < 18	**9**		
	Adult	**30**	**9**	
Body Weight[a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	**25**	
	9 < 12	36	36	
	12 < 15	50.6	**50.6**	
	15 < 18	61.2	61.2	
	3 < 12	**26**	26	
	9 < 18	**49**	49	
	Adult	**70**	**70**	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 3 of 13
Ingestion of Surface Water While Swimming

Parameter	Age/Scenario	RME	MLE	Reference
Ingestion Rate (L/d)		0.05	0.05	EPA 1989a
Exposure Time (h/d)	Resid./Agric.	2.6	1	EPA 1988c
	Open Land Use	1	0.5	EPA 1992b
Exposure Frequency (d/year)	Resid./Agric.	16	7	EPA 1988c
	Open Land Use	5	1	EPA 1992b
Exposure Duration [c] (years)	3 < 12	9		
	6 < 9		3	
	12 < 15		3	
	9 < 18	9		
	Adult	30	9	
Body Weight[a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	25	
	9 < 12	36	36	
	12 < 15	50.6	50.6	
	15 < 18	61.2	61.2	
	3 < 12	26	26	
	9 < 18	49	49	
	Adult	70	70	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 4 of 13
Dermal Contact with Sediment While Wading

Parameter	Age/Scenario	RME	MLE	Reference
Total Skin Area[a] (cm^2)	3 < 6	8,420	7,280	EPA 1992b
	6 < 9	10,900	**9,310**	
	9 < 12	14,200	11,600	
	12 < 15	17,700	**14,900**	
	15 < 18	20,100	17,500	
	3 < 12	**11,173**	9,396	
	9 < 18	**17,333**	14,667	
	Adult	**23,000**	**20,000**	
Fraction of Skin Exposed[f]	All	0.38	0.10	EPA 1992b
Adherence Rate[b] (mg/cm^2)	All	0.5	0.3	EPA 1992a
Dermal Absorption Factor		Chemical Specific		EPA 1992b
Exposure Frequency[g] (d/year)	Resid./Agric.	36	7	EPA 1988c
	Open Land Use	5	1	EPA 1992b
Exposure Duration [e](years)	3 < 12	9		
	6 < 9		3	
	12 < 15		3	
	9 < 18	9		
	Adult	30	9	
Body Weight[a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	25	
	9 < 12	36	36	
	12 < 15	50.6	5[illegible]	
	15 < 18	61.2	61.2	
	3 < 12	**26**	26	
	9 < 18	**49**	49	
	Adult	**70**	**70**	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 5 of 13
Ingestion of Drinking Water (Groundwater)

Parameter	Age/Scenario	RME	MLE	Reference
Ingestion Rate[i] (L/d)	3 < 6	0.74	0.44	EPA 1989b
	6 < 9	0.86	0.52	
	9 < 12	1.03	0.62	
	12 < 15	1.03	0.62	
	15 < 18	1.24	0.66	
	3 < 12	0.88	0.53	
	Adult (Resid/Agric)	2	1.4	EPA 1989a, 1991a
	Adult (Comm)	1	0.7	EPA 1991a
Exposure Frequency (d/year)	Resid/Agric	350	350	EPA 1989b
	Commercial	250	250	EPA 1991a
Exposure Duration[c] (years)	3 < 12	9		
	6 < 9		3	
	Adult (Resid/Agric)	30	9	EPA 1989a
	Adult (Comm)	25	9	EPA 1991a
Body Weight[a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	25	
	9 < 12	36	36	
	12 < 15	50.6	50.6	
	15 < 18	61.2	61.2	
	3 < 12	26	26	
	Adult	70	70	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 6 of 13
Inhalation of Vapors (From Groundwater) While Showering

Parameter	Age/Scenario	RME	MLE	Reference
Inhalation Rate[j] (m^3/hr)	All	0.6	0.6	EPA 1989a
Volatization Constant (L/m^3)		0.5	0.5	EPA 1991c
Exposure Time[k] (h/d)	3 < 6	0.5	0.25	EPA 1989b
	6 < 9	0.5	0.25	
	9 < 12	0.25	0.12	
	12 < 15	0.25	0.12	
	15 < 18	0.25	0.12	
	3 < 12	**0.42**	0.21	
	Adult	**0.25**	**0.12**	
Exposure Frequency (d/year)	All	350	350	EPA 1989b
Exposure Duration[c] (years)	3 < 12	9		
	6 < 9		3	
	12 < 15		3	
	9 < 18	9		
	Adult	30	9	
Body Weight[a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	25	
	9 < 12	36	36	
	12 < 15	50.6	50.6	
	15 < 18	61.2	61.2	
	3 < 12	**26**	26	
	Adult	**70**	**70**	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 7 of 13
Ingestion of Contaminated Soil

Parameter	Age/Scenario	RME	MLE	Reference
Ingestion Rate [l] (mg/d)	3 < 6	200	50	EPA 1989a, 1991a
	6 < 9	100	50	
	9 < 12	100	50	
	12 < 15	100	50	
	15 < 18	100	50	
	3 < 12	133	50	
	9 < 18	100	50	
	Adult	100	40	
Exposure Frequency [m] (d/year)	Resid./Agric.	350	270	
	Open Land Use	150	40	EPA 1992b
Exposure Duration [e] (years)	3 < 12	9		
	6 < 9		3	
	12 < 15		3	
	9 < 18	9		
	Adult (All)	30	9	EPA 1988a, 1991a
Body Weight [a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	25	
	9 < 12	36	36	
	12 < 15	50.6	50.6	
	15 < 18	61.2	61.2	
	3 < 12	26	26	
	9 < 18	49	49	
	Adult	70	70	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 8 of 13
Dermal Contact with Contaminated Soil

Parameter	Age/Scenario	RME	MLE	Reference
Total Skin Area[a] (cm^2)	3 < 6	8,420	7,280	EPA 1992b
	6 < 9	10,900	**9,310**	
	9 < 12	14,200	11,600	
	12 < 15	17,700	**14,900**	
	15 < 18	20,100	17,500	
	3 < 12	**11,173**	9,396	
	9 < 18	**17,333**	14,667	
	Adult	**23,000**	**20,000**	
Fraction of Skin Exposed[a]	All	**0.47**	**0.10**	EPA 1992b
Dermal Absorption Factor		Chemical Specific		EPA 1992a
Adherence Rate[a] (mg/cm^2- event)	All	**1**	**0.6**	EPA 1992a
Exposure Frequency[m] (d/year)	Resid./Agric.	**350**	**270**	EPA 1989a, 1991a
	Open Land Use	**150**	**40**	EPA 1992b
Exposure Duration[c] (years)	3 < 12	**9**		
	6 < 9		3	
	12 < 15		3	
	9 < 18	**9**		
	Adult (All)	**30**	**9**	EPA 1989a
Body Weight[a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	**25**	
	9 < 12	36	36	
	12 < 15	50.6	**50.6**	
	15 < 18	61.2	61.2	
	3 < 12	**26**	26	
	9 < 18	**49**	49	
	Adult	**70**	**70**	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 9 of 13
Inhalation of Dust/Particulates While Mowing

Parameter	Age/Scenario	RME	MLE	Reference
Inhalation Rate[p] (m^3/hr)	Adult	0.83	0.83	EPA 1991a
Exposure Time (h/event)		8	8	
Exposure Frequency (events/year)		4	4	
Exposure Duration[c] (years)	Adult	30	9	
Body Weight (kg)	Adult	70	70	EPA 1989a
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.

Table M.1. (continued)

Pathway 10 of 13
Consumption of Home-Grown Fruits and Vegetables

Parameter	Age/Scenario	RME	MLE	Reference
Ingestion Rate [a] (kg/d)	3 < 6	0.20	0.06	Yang and Nelson 1986; EPA 1989b
	6 < 9	0.27	**0.09**	
	9 < 12	0.32	0.11	
	12 < 15	0.32	0.11	
	15 < 18	0.32	0.11	
	3 < 12	**0.26**	0.08	
	Adult	**0.34**	**0.11**	
Fraction from Contaminated Area [z]	All	0.35	0.23	EPA 1989a
Exposure Frequency [a] (d/year)	Residential	150	150	
	Agricultural	350	150	
Exposure Duration [c] (years)	3 < 12	9		
	6 < 9		3	
	Adult	30	9	
Body Weight [a] (kg)	3 < 6	17.4	17.4	EPA 1989a
	6 < 9	25	25	
	9 < 12	36	36	
	12 < 15	50.6	50.6	
	15 < 18	61.2	61.2	
	3 < 12	**26**	26	
	Adult	**70**	**70**	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 11 of 13
Consumption of Home-Grown Meat (Beef Only)

Parameter	Age/Scenario	RME	MLE	Reference
Ingestion Rate[t] (kg/d)	3 < 6	0.05	0.02	Yang and Nelson 1986; EPA 1989b
	6 < 9	0.07	**0.03**	
	9 < 12	0.09	0.04	
	12 < 15	0.09	0.04	
	15 < 18	0.11	0.04	
	3 < 12	**0.07**	0.03	
	Adult	**0.10**	**0.04**	
Fraction from Contaminated Area[u]	All	0.75	0.44	EPA 1989b, 1991a
Exposure Frequency (d/year)	All	350	350	
Exposure Duration[e] (years)	3 < 12	9		
	6 < 9		3	
	Adult	30	9	EPA 1989a
Body Weight[a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	25	
	9 < 12	36	36	
	12 < 15	50.6	50.6	
	15 < 18	61.2	61.2	
	3 < 12	26	26	
	Adult	**70**	**70**	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 12 of 13
Consumption of Home-Produced Dairy Products

Parameter	Age/Scenario	RME	MLE	Reference
Ingestion Rate[t] (kg/d)	3 < 6	0.54	0.27	Yang and Nelson 1986; EPA 1989b
	6 < 9	0.64	**0.26**	
	9 < 12	0.66	0.26	
	12 < 15	0.66	0.26	
	15 < 18	0.59	0.24	
	3 < 12	**0.61**	0.25	
	Adult	**0.40**	**0.16**	
Fraction from Contaminated Area[u]	All	0.75	0.44	EPA 1989b, 1991a
Exposure Frequency (d/year)	All	350	350	
Exposure Duration[c] (years)	3 < 12	9		
	6 < 9		3	
	Adult	30	9	EPA 1989a
Body Weight[a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	25	
	9 < 12	36	36	
	12 < 15	50.6	50.6	
	15 < 18	61.2	61.2	
	3 < 12	**26**	26	
	Adult	**70**	**70**	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Table M.1. (continued)

Pathway 13 of 13
Consumption of Recreationally Caught Contaminated Fish

Parameter	Age/Scenario	RME	MLE	Reference
Ingestion Rate [v] (kg/d)	3 < 6	0.03	0.01	Yang and Nelson 1986; EPA 1989b
	6 < 9	0.04	**0.01**	
	9 < 12	0.05	0.02	
	12 < 15	0.05	0.02	
	15 < 18	0.07	0.02	
	3 < 12	0.04	0.01	
	Adult	**0.05**	**0.02**	
Fraction from Contaminated Area [b]	All	0.05	0.01	EPA 1989b, 1991a
Exposure Frequency (d/year)	All	350	350	
Exposure Duration (years)	3 < 12	9		
	6 < 9		3	
	Adult	30	9	EPA 1989a
Body Weight [a] (kg)	3 < 6	17.4	17.4	EPA 1989b
	6 < 9	25	25	
	9 < 12	36	36	
	12 < 15	50.6	50.6	
	15 < 18	61.2	61.2	
	3 < 12	26	26	
	Adult	**70**	**70**	
Averaging Time	Noncarcinogens	ED × 365 d/year		
	Carcinogens	70 years × 365 d/year		

Footnotes are presented following the last page of Table M.1.
Bold identifies values used in exposure assessment.

Footnotes for Table M.1.

[a] Values are mean of male and female values for each age group.

[b] Best Professional Judgment (BPJ).

[c] Exposure time. References are as follows: for residential/homesteaders, RME is EPA (1988c), MLE is BPJ. For trespassers, RME and MLE are EPA (1992b).

[d] Exposure frequency. For residential/agricultural, RME is 1 day per week for 16 weeks (June, July, August, and September). MLE is 7 days national mean (EPA 1988c, 1989a).

[e] Exposure duration is range of each cohort. Adult exposure duration is 90th percentile at one residence for RME and 50th percentile at one residence for MLE.

[f] Fraction of skin exposed during wading is based on 50th percentile fraction of whole skin area for each adult body part. For water and sediments, RME is based on the surface area fraction of the feet, legs, and hands. For water, MLE is based on the surface area fraction of feet, lower legs, and hands. For sediments, MLE is based on the surface area fraction of feet and hands.

[g] Exposure frequency for wading. Residential/homesteader scenario assumes wading occurs 3 days per week for 12 weeks (April, May, and October). Value for MLE is mean national swimming frequency from EPA (1988c, 1989a).

[h] Adherence rate for sediments is one-half of the EPA (1992a) recommended soil adherence rate because of frequent wash-off during wading.

[i] Ingestion rate for residential/homesteader scenarios: RME is based on total daily beverage intake, including tap water; MLE is based on tap water intake only. Values are for nearest match age group as presented in EPA (1989b). Commercial receptor ingestion rate is as per EPA (1991a).

[j] Inhalation rates are uniform for all ages as per default value in EPA (1989a).

[k] Showering times are 50th and 95th percentile values. Children aged 3 to 12 are assumed to take baths lasting approximately twice as long as showers. All others are assumed to shower.

[l] For residential/homesteader and trespasser scenarios, ingestion rates are daily ingestion rates and are not adjusted for time spent in the contaminated area. RME is the reasonable maximum value recommended in EPA (1989a, 1990a). MLE is ingestion rate for children based on conclusions in Calabrese et al. (1989). MLE ingestion rates for adults are from Calabrese et al. (1990) and BPJ.

[m] Exposure frequency. For residential/homesteaders, RME is based on daily outdoor activity. For MLE, exposure frequency is 9 months per year.

[n] Fraction exposed is as for footnote f. RME value is based on surface area fraction of legs, feet, upper arms, forearms, and hands; the MLE value is based on the surface area of feet and hands.

[o] Adherence rate is as per EPA (1992a).

[p] Based on 20 m^3/d value recommended in EPA (1991a).

[q] Adult produce ingestion rates are based on default values and data presented in the EFH (EPA 1989b). Children's produce ingestion rates were calculated by multiplying the ingestion rate for the nearest match age group presented in Yang and Nelson (1986) by the ratio of RME or MLE adult total produce consumption rate from the EFH to adult consumption rate from Yang and Nelson (1986).

[r] Proportion ingested from contaminated area is assumed to be equal to proportion that is homegrown. These values are based on the mean of homegrown fruit and homegrown vegetable consumption presented in EPA (1989a). These are 0.3 and 0.4 for RME and 0.2 and 0.25 for MLE, respectively.

Footnotes for Table M.1.
(continued)

[s] Exposure frequency for homesteader RME assumes preservation and use of homegrown/local produce for 12 months per year. Exposure frequency for the homesteader MLE and for the residential MLE and RME assume that homegrown/local produce are available for only 5 months per year (June through October) with no preservation.

[t] For milk: Adult MLE and RME values are from the EFH (EPA 1989b) and EPA (1990b). Children's milk ingestion rates were calculated by multiplying the ingestion rate for the nearest match age group presented in Yang and Nelson (1986) by the ratio of RME or MLE adult dairy consumption rate from the EFH to the adult consumption rate from Yang and Nelson (1986).

For beef: The adult RME value was obtained from the EFH (EPA 1989b) and EPA (1990b). The adult MLE was calculated by multiplying the RME value by the ratio of the 50th to 95th percentile ingestion rates presented in RAGS (EPA 1989e). For children, beef ingestion rates were calculated using the meat ingestion rates for the nearest match age group, and the ratio of adult beef to meat ingestion rates presented by Yang and Nelson (1986). Children's RME and MLE values were calculated in the manner described for milk, using the calculated beef ingestion rate.

[u] Fraction ingested. RME assumes 75% beef, and all milk and dairy products ingested originate from cattle grazing the contaminated area. This value is the default recommended in EPA (1989b). MLE assumes that the average farm household homegrown beef consumption rate (44%) presented in EPA (1989b) applies to both the beef and the dairy ingestion scenarios.

[v] RME fish ingestion rate for adults is based on 90th percentile value, and MLE is the 50th percentile value for consumption rates by recreational fishermen derived by Pierce et al. (1981), presented in EPA (1989b and 1991a). Values for children are calculated as for milk ingestion, using ingestion rates for the nearest match age groups presented by Yang and Nelson (1986) and the ratio of adult ingestion rates from Pierce et al. (1981) to adult ingestion rates from Yang and Nelson (1986).

Table M.2. Comparison of measured and calculated chemical concentrations in crop tissue

Plant and Sample ID	Chemical	Measured Concentrations		Plant Conc. Calculated based on BTFs from		
		Soil	Vegetation	NCRP-20	Belcher and Travis	Baes et al
		(mg/kg wet weight)		(mg/kg wet weight)		
	Arsenic					
BEET						
VG5312470		7.9	0.070	0.632	0.016	0.008
KALE						
VG0002529		9.5	0.034	0.760	0.751	0.352
VG5312519		8.2	0.062	0.656	0.648	0.303
VG5312569		7.3	0.010	0.584	0.577	0.270
TOMATO						
VG5312747		8.9	0.008	0.712	1.041	0.009
	Cadmium					
BEET						
VG5312468		8.4	0.686	4.200	3.696	0.277
KALE						
VG5312521		6.2	0.517	3.100	0.490	0.229
VG5312533		6.7	0.521	3.350	0.529	0.248
VG5312533		6.7	1.564	3.350	0.529	0.248
VG5312545		8.5	0.900	4.250	0.672	0.315
VG5312557		6.9	0.407	3.450	0.545	0.255
TOMATO						
VG5312711		5.8	0.160	2.900	0.847	0.191
VG5312723		6.3	0.108	3.150	0.920	0.208
VG5312735		5.5	0.137	2.750	0.803	0.182
VG5312747		8.4	0.257	4.200	1.226	0.277
	Chromium					
BEET						
VG5312456		51.6	0.473	N/A	0.877	N/A
VG5312468		56.2	0.173	N/A	0.955	N/A
VG5312468		56.2	0.145	N/A	0.955	N/A
VG5312470		48.4	0.514	N/A	0.823	N/A
KALE						
VG0002517		16.3	0.061	N/A	0.049	N/A
VG0002529		32.4	0.164	N/A	0.097	N/A
VG0002531		24.7	0.514	N/A	0.074	N/A
VG5312519		61.6	0.552	N/A	0.185	N/A
VG5312521		47.9	0.122	N/A	0.144	N/A
VG5312545		49.6	0.074	N/A	0.149	N/A
VG5312569		46.9	0.196	N/A	0.141	N/A
TOMATO						
VG5312711		54.5	0.107	N/A	0.218	0.055
VG5312711		54.5	0.105	N/A	0.218	0.055
VG5312723		43.8	0.047	N/A	0.175	0.044
VG5312747		41.5	0.051	N/A	0.166	0.042

Table M.2 (continued)

Plant and Sample ID	Chemical	Measured Concentrations		Plant Conc. Calculated based on BTFs from		
		Soil	Vegetation	NCRP−20	Belcher and Travis	Baes et al
		(mg/kg wet weight)		(mg/kg wet weight)		
	Mercury					
BEET						
VG5312456		273	1.082	81.900	7.917	12.012
VG5312468		171	0.631	51.300	4.959	7.524
VG5312468		171	0.765	51.300	4.959	7.524
VG5312470		196	2.720	58.800	5.684	8.624
KALE						
VG5312519		204	3.198	61.200	0.612	12.240
VG5312521		188	0.348	56.400	0.564	11.280
VG5312533		141	0.170	42.300	0.423	8.460
VG5312533		141	0.309	42.300	0.423	8.460
VG5312545		270	0.180	81.000	0.810	16.200
VG5312557		237	0.133	71.100	0.711	14.220
VG5312569		699	1.278	209.700	2.097	41.940
TOMATO						
VG5312747		236	0.416	70.800	0.708	10.384
	Zinc					
BEET						
VG5312456		131	6.505	52.400	N/A	26.200
VG5312468		144	8.361	57.600	N/A	28.800
VG5312468		144	7.460	57.600	N/A	28.800
VG5312470		138	11.232	55.200	N/A	27.600
KALE						
VG0002517		35.9	8.223	14.360	N/A	3.590
VG0002529		37.6	4.203	15.040	N/A	3.760
VG0002531		36	5.497	14.400	N/A	3.600
VG5312519		173	6.488	69.200	N/A	17.300
VG5312521		195	8.037	78.000	N/A	19.500
VG5312533		207	12.390	82.800	N/A	20.700
VG5312533		207	11.189	82.800	N/A	20.700
VG5312545		147	9.270	58.800	N/A	14.700
VG5312557		132	7.339	52.800	N/A	13.200
VG5312569		165	8.210	66.000	N/A	16.500
TOMATO						
VG5312711		174	3.037	69.600	N/A	34.800
VG5312711		174	1.684	69.600	N/A	34.800
VG5312723		193	2.078	77.200	N/A	38.600
VG5312735		167	2.749	66.800	N/A	33.400
VG5312747		170	5.837	68.000	N/A	34.000
VG0002719		384	1.092	153.600	N/A	76.800
VG0002721		272	1.092	108.800	N/A	54.400

Calculated plant concentrations were determined using BTFs converted to a wet weight basis.
Dry weight to wet weight conversion factors are presented in Table 5.9.

Table M.3. Regression analyses for bio-uptake of contaminants by plants

Chemical	Plant	Computed Intercept		Intercept at Origin		n
		Slope	r^2	Slope	r^2	
Arsenic	Kale	0.009	0.13	0.004	0.09	3
Cadmium	Kale	0.088	0.02	0.111	0.02	5
	Tomato	0.042	0.74	0.026	0.04	4
Chromium	Beet	-0.049	0.93	0.006	-0.24	4
	Kale	0.003	0.05	0.006	0.01	7
	Tomato	0.005	0.97	0.002	0.55	4
Mercury	Beet	0.002	0.01	0.006	-0.04	4
	Kale	0.001	0.04	0.002	-0.04	7
Zinc	Beet	0.065	0.04	0.060	0.04	4
	Tomato	-0.012	0.33	0.009	-0.83	7
	Kale	0.024	0.50	0.053	-0.07	10

Table M.4. Compendium of soil–to–plant biotransfer factors

Element	Group	Plant	Dry weight Bv	Conversion	Wet weight BV	Author Year
Arsenic			8.00E–02			NCRP 1991 – for fresh veg.
Arsenic			2.00E–01			NCRP 1991 – for dry forage
Arsenic	Fruit	Tomato	7.00E–03	7.29	9.60E–04	SAIC
Arsenic	Grain	Corn	1.92E–05	4.11	4.66E–06	(3)–––>Chisholm 1972
Arsenic	Grain	Corn	3.79E–05	4.11	9.22E–06	(3)–––>Chisholm 1972
Arsenic	Grain	Millet	5.35E–03	4.11	1.30E–03	(3)–––>Elfving et al. 1978
Arsenic	Leafy		4.00E–02	15.02	2.66E–03	Baes et al. 1984a
Arsenic	Leafy	Beet Greens	2.25E–02	15.02	1.50E–03	USEPA 1992
Arsenic	Leafy	Beet Greens	2.00E–02	15.02	1.33E–03	USEPA 1992
Arsenic	Leafy	Beet Greens	1.90E–02	15.02	1.26E–03	USEPA 1992
Arsenic	Leafy	Beet Greens	2.10E–02	15.02	1.40E–03	USEPA 1992
Arsenic	Leafy	Beet Greens	1.76E–02	15.02	1.17E–03	USEPA 1992
Arsenic	Leafy	Cabbage	3.10E–03	15.02	2.06E–04	USEPA 1992
Arsenic	Leafy	Cabbage	3.70E–03	15.02	2.46E–04	USEPA 1992
Arsenic	Leafy	Cabbage	3.40E–03	15.02	2.26E–04	USEPA 1992
Arsenic	Leafy	Cabbage	4.20E–03	15.02	2.80E–04	USEPA 1992
Arsenic	Leafy	Cabbage	2.80E–03	15.02	1.86E–04	USEPA 1992
Arsenic	Leafy	Kale	5.40E–02	15.02	3.59E–03	SAIC
Arsenic	Leafy	Kale	1.14E–01	15.02	7.62E–03	SAIC
Arsenic	Leafy	Kale	2.13E–02	15.02	1.42E–03	SAIC
Arsenic	Leafy	Lettuce	2.26E–02	15.02	1.50E–03	USEPA 1992
Arsenic	Leafy	Lettuce	2.18E–02	15.02	1.45E–03	USEPA 1992
Arsenic	Leafy	Lettuce	2.39E–02	15.02	1.59E–03	USEPA 1992
Arsenic	Leafy	Lettuce	2.11E–02	15.02	1.40E–03	USEPA 1992
Arsenic	Leafy	Lettuce	2.01E–02	15.02	1.34E–03	USEPA 1992
Arsenic	Leafy	Swiss Chard	4.85E–01	15.02	3.23E–02	USEPA 1985b
Arsenic	Leafy	Swiss Chard	2.93E–01	15.02	1.95E–02	USEPA 1985b
Arsenic	Leafy	Swiss Chard	2.67E–01	15.02	1.78E–02	USEPA 1985b
Arsenic	Leafy	Swiss Chard	2.67E–01	15.02	1.78E–02	USEPA 1985b
Arsenic	Leafy	Swiss Chard	1.65E+00	15.02	1.10E–01	USEPA 1985b
Arsenic	Leafy	Swiss Chard	5.89E–02	15.02	3.92E–03	USEPA 1985b
Arsenic	Leafy	Swiss Chard	2.64E–01	15.02	1.76E–02	USEPA 1985b
Arsenic	Leafy	Swiss Chard	2.42E–01	15.02	1.61E–02	USEPA 1985b
Arsenic	Leafy	Swiss Chard	1.07E–02	15.02	7.12E–04	USEPA 1992
Arsenic	Leafy	Swiss Chard	1.29E–02	15.02	8.59E–04	USEPA 1992
Arsenic	Leafy	Swiss Chard	1.18E–02	15.02	7.86E–04	USEPA 1992
Arsenic	Leafy	Swiss Chard	9.20E–03	15.02	6.13E–04	USEPA 1992
Arsenic	Leafy	Swiss Chard	1.47E–02	15.02	9.79E–04	USEPA 1992
Arsenic	Leafy	Swiss Chard	3.52E–04	15.02	2.34E–05	(3)–––>Chisholm 1972
Arsenic	Leafy	Swiss Chard	1.52E–01	15.02	1.01E–02	(3)–––>Furr et al. 1976
Arsenic	Leafy	Swiss Chard	1.43E–01	15.02	9.49E–03	(3)–––>Furr et al. 1976
Arsenic	Leg	Bean	5.35E–05	7.29	7.34E–06	(3)–––>Chisholm 1972
Arsenic	Leg	Bean	8.47E–05	7.29	1.16E–05	(3)–––>Chisholm 1972
Arsenic	Leg	Bean	1.60E–04	7.29	2.20E–05	(3)–––>Chisholm 1972
Arsenic	Root		6.00E–03	4.11	1.46E–03	Baes et al. 1984a
Arsenic	Root	Beets	9.00E–04	4.11	2.19E–04	USEPA 1992
Arsenic	Root	Beets	1.44E–03	4.11	3.50E–04	USEPA 1992
Arsenic	Root	Beets	6.60E–04	4.11	1.61E–04	USEPA 1992
Arsenic	Root	Beets	3.20E–04	4.11	7.79E–05	USEPA 1992
Arsenic	Root	Beets	5.00E–04	4.11	1.22E–04	USEPA 1992
Arsenic	Root	Carrot	8.10E–04	4.11	1.97E–04	USEPA 1992
Arsenic	Root	Carrot	3.70E–04	4.11	9.00E–05	USEPA 1992
Arsenic	Root	Carrot	1.40E–04	4.11	3.41E–05	USEPA 1992
Arsenic	Root	Carrot	2.20E–04	4.11	5.35E–05	USEPA 1992
Arsenic	Root	Carrot	7.00E–05	4.11	1.70E–05	USEPA 1992
Arsenic	Root	Carrot	2.09E–04	4.11	5.10E–05	(3)–––>Chisholm 1972
Arsenic	Root	Carrot	2.45E–04	4.11	5.96E–05	(3)–––>Chisholm 1972
Arsenic	Root	Carrot	6.24E–03	4.11	1.52E–03	(3)–––>Elfving et al. 1978

Table M.4 (continued)

Element	Group	Plant	Dry weight Bv	Conversion	Wet weight BV	Author Year
Arsenic	Root	Onions	2.01E−03	4.11	4.88E−04	(3)−−>Elfving et al. 1978
Arsenic	Root	Potato	1.02E−03	4.11	2.49E−04	(3)−−>Chisholm 1972
Arsenic	Root	Potato	5.79E−05	4.11	1.41E−05	(3)−−>Chisholm 1972
Arsenic	Root	Potato	1.34E−03	4.11	3.25E−04	(3)−−>Chisholm 1972
Arsenic	Root	Potato	8.47E−05	4.11	2.06E−05	(3)−−>Chisholm 1972
Arsenic	Root	Turnip	9.36E−05	4.11	2.28E−05	(3)−−>Chisholm 1972
Arsenic	Root	Turnip	1.02E−03	4.11	2.49E−04	(3)−−>Chisholm 1972
Arsenic	Root	Beet	4.00E−02	4.11	9.74E−03	SAIC
Beryllium	Root		1.50E−03	4.11	3.65E−04	Baes et al. 1984a
Beryllium	Leafy		1.00E−02	4.11	2.43E−03	Baes et al. 1984a
Beryllium			4.00E−03		4.00E−03	NCRP 1991 – for fresh veg
Beryllium			1.00E−01	15.02	6.66E−03	NCRP 1991 – for dry forage
Cadmium	Leafy		5.50E−01	15.02	3.66E−02	Baes et al. 1984a
Cadmium	Root		1.50E−01	4.11	3.65E−02	Baes et al. 1984a
Cadmium			1.00E+00	15.02	6.66E−02	NCRP 1991 – for dry forage
Cadmium			5.00E−01		5.00E−01	NCRP 1991 – for fresh veg
Cadmium	Fruit	Squash	6.60E−01	7.29	9.05E−02	(1)−−>Bingham et al. 1975−6
Cadmium	Fruit	Squash	3.50E+00	7.29	4.80E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Fruit	Tomato	5.70E−01	7.29	7.82E−02	Page et al. 1987
Cadmium	Fruit	Tomato	1.37E−01	7.29	1.87E−02	SAIC
Cadmium	Fruit	Tomato	1.98E−01	7.29	2.72E−02	SAIC
Cadmium	Fruit	Tomato	2.43E−01	7.29	3.33E−02	SAIC
Cadmium	Fruit	Tomato	2.19E−01	7.29	3.01E−02	SAIC
Cadmium	Fruit	Tomato	1.35E+01	7.29	1.85E+00	(1)−−>Bingham et al. 1975−6
Cadmium	Fruit	Tomato	3.67E+00	7.29	5.03E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Grain	Corn	6.00E−03	4.11	1.46E−03	Page et al. 1987
Cadmium	Grain	Corn	1.50E−03	4.11	3.65E−04	Page et al. 1987
Cadmium	Grain	Corn	2.00E−03	4.11	4.87E−04	Page et al. 1987
Cadmium	Grain	Corn	2.25E−03	4.11	5.47E−04	Page et al. 1987
Cadmium	Grain	Corn	4.00E−03	4.11	9.73E−04	Page et al. 1987
Cadmium	Grain	Corn	7.50E−04	4.11	1.82E−04	Page et al. 1987
Cadmium	Grain	Corn	2.00E+01	4.11	4.87E+00	(1)−−>Bingham et al. 1975−6
Cadmium	Grain	Corn	1.42E+00	4.11	3.45E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Grain	Corn	1.58E+00	4.11	3.84E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	2.34E+00	4.11	5.69E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	5.38E−01	4.11	1.31E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	2.35E+00	4.11	5.73E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	2.88E−01	4.11	7.00E−02	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	4.68E−01	4.11	1.14E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	8.15E−01	4.11	1.98E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	9.69E−01	4.11	2.36E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	7.96E−01	4.11	1.94E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	4.59E+00	4.11	1.12E+00	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	1.25E+00	4.11	3.03E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Corn	1.51E+00	4.11	3.68E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Grain	Field Corn	3.43E−02	4.11	8.35E−03	(2)−−>Heffron et al. 1980
Cadmium	Grain	Field Corn	1.78E−03	4.11	4.34E−04	(2)−−>Lisk et al. 1972
Cadmium	Grain	Field Corn	1.52E+00	4.11	3.69E−01	(2)−−>Pepper et al. 1983
Cadmium	Grain	Field Corn	3.70E−01	4.11	9.00E−02	(2)−−>Pepper et al. 1983
Cadmium	Grain	Field Corn	6.68E−01	4.11	1.63E−01	(2)−−>Pepper et al. 1983
Cadmium	Grain	Field Corn	1.52E+00	4.11	3.69E−01	(2)−−>Pepper et al. 1983
Cadmium	Grain	Field Corn	6.24E−03	4.11	1.52E−03	(2)−−>Tellord et al. 1982
Cadmium	Grain	Oat	1.18E+00	4.11	2.87E−01	Page et al. 1987
Cadmium	Grain	Oat	9.17E−02	4.11	2.23E−02	Page et al. 1987

Table M.4 (continued)

Element	Group	Plant	Dry weight Bv	Conversion	Wet weight BV	Author Year
Cadmium	Grain	Oat	1.23E−01	4.11	3.00E−02	Page et al. 1987
Cadmium	Grain	Oat	6.91E−02	4.11	1.68E−02	Page et al. 1987
Cadmium	Grain	Oat	3.47E−01	4.11	8.43E−02	Page et al. 1987
Cadmium	Grain	Oat	5.78E−01	4.11	1.41E−01	Page et al. 1987
Cadmium	Grain	Oat	1.56E−01	4.11	3.80E−02	Page et al. 1987
Cadmium	Grain	Oat	1.55E−01	4.11	3.76E−02	Page et al. 1987
Cadmium	Grain	Oat	7.60E−01	4.11	1.85E−01	Page et al. 1987
Cadmium	Grain	Oat	3.95E−02	4.11	9.60E−03	Page et al. 1987
Cadmium	Grain	Oat	6.40E−01	4.11	1.56E−01	Page et al. 1987
Cadmium	Grain	Oat	2.46E−01	4.11	5.99E−02	Page et al. 1987
Cadmium	Grain	Oat	6.29E−01	4.11	1.53E−01	Page et al. 1987
Cadmium	Grain	Oat	7.29E−01	4.11	1.77E−01	Page et al. 1987
Cadmium	Grain	Oat	2.13E−01	4.11	5.19E−02	Page et al. 1987
Cadmium	Grain	Oat	4.29E−02	4.11	1.04E−02	Page et al. 1987
Cadmium	Grain	Rice	2.50E+00	4.11	6.08E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Grain	Rice	1.50E−02	4.11	3.65E−03	(1)−−>Bingham et al. 1975−6
Cadmium	Grain	Rice	1.00E+00	4.11	2.43E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Grain	Rice	6.50E−02	4.11	1.58E−02	(1)−−>Bingham et al. 1975−6
Cadmium	Grain	Sorghum	5.70E−01	4.11	1.39E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Grain	Sorghum	2.00E+00	4.11	4.87E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Grain	Wheat	1.45E−02	4.11	3.53E−03	Page et al. 1987
Cadmium	Grain	Wheat	2.50E−02	4.11	6.08E−03	Page et al. 1987
Cadmium	Grain	Wheat	1.15E−02	4.11	2.80E−03	Page et al. 1987
Cadmium	Grain	Wheat	1.60E−02	4.11	3.89E−03	Page et al. 1987
Cadmium	Grain	Wheat	8.50E−03	4.11	2.07E−03	Page et al. 1987
Cadmium	Grain	Wheat	1.20E−02	4.11	2.92E−03	Page et al. 1987
Cadmium	Grain	Wheat	8.70E−01	4.11	2.12E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Grain	Wheat	1.00E+00	4.11	2.43E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Leafy	Cabbage	2.04E+00	15.02	1.36E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Leafy	Cabbage	4.50E+00	15.02	3.00E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Leafy	Curlycress	8.90E+00	15.02	5.93E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Leafy	Curlycress	2.40E+01	15.02	1.60E+00	(1)−−>Bingham et al. 1975−6
Cadmium	Leafy	Kale	8.86E−01	15.02	5.90E−02	SAIC
Cadmium	Leafy	Kale	3.51E+00	15.02	2.33E−01	SAIC
Cadmium	Leafy	Kale	1.17E+00	15.02	7.78E−02	SAIC
Cadmium	Leafy	Kale	1.59E+00	15.02	1.06E−01	SAIC
Cadmium	Leafy	Kale	1.25E+00	15.02	8.34E−02	SAIC
Cadmium	Leafy	Lettuce	5.15E−01	15.02	3.43E−02	Page et al. 1987
Cadmium	Leafy	Lettuce	1.47E+00	15.02	9.75E−02	Page et al. 1987
Cadmium	Leafy	Lettuce	6.20E+00	15.02	4.13E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Leafy	Lettuce	8.00E+00	15.02	5.33E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Leafy	Spinach	4.07E+00	15.02	2.71E−01	Page et al. 1987
Cadmium	Leafy	Spinach	2.58E+00	15.02	1.71E−01	Page et al. 1987
Cadmium	Leafy	Spinach	3.60E+01	15.02	2.40E+00	(1)−−>Bingham et al. 1975−6
Cadmium	Leafy	Spinach	1.61E+01	15.02	1.07E+00	(1)−−>Bingham et al. 1975−6
Cadmium	Leafy	Swiss Chard	7.39E+00	15.02	4.92E−01	Chaney 1975
Cadmium	Leafy	Swiss Chard	1.25E+01	15.02	8.32E−01	Chaney 1975
Cadmium	Leafy	Swiss Chard	3.65E+01	15.02	2.43E+00	Chaney 1975
Cadmium	Leafy	Swiss Chard	1.67E+01	15.02	1.11E+00	Chaney 1975
Cadmium	Leafy	Swiss Chard	6.29E+00	15.02	4.18E−01	Page et al. 1987
Cadmium	Leafy	Swiss Chard	6.27E+00	15.02	4.17E−01	Page et al. 1987
Cadmium	Leafy	Swiss Chard	1.86E+01	15.02	1.24E+00	Page et al. 1987
Cadmium	Leafy	Swiss Chard	6.73E+00	15.02	4.48E−01	Page et al. 1987
Cadmium	Leafy	Swiss Chard	2.65E+01	15.02	1.76E+00	Page et al. 1987
Cadmium	Leafy	Swiss Chard	3.70E+00	15.02	2.46E−01	Page et al. 1987
Cadmium	Leafy	Swiss Chard	1.05E+00	15.02	6.97E−02	Page et al. 1987
Cadmium	Leafy	Swiss Chard	3.94E+00	15.02	2.62E−01	Page et al. 1987
Cadmium	Leafy	Swiss Chard	7.61E−01	15.02	5.06E−02	Page et al. 1987

Table M.4 (continued)

Element	Group	Plant	Dry weight Bv	Conversion	Wet weight BV	Author Year
Cadmium	Leafy	Swiss Chard	8.18E−01	15.02	5.44E−02	Page et al. 1987
Cadmium	Leafy	Swiss Chard	8.72E−01	15.02	5.81E−02	Page et al. 1987
Cadmium	Leafy	Swiss Chard	4.71E+00	15.02	3.14E−01	Page et al. 1987
Cadmium	Leafy	Swiss Chard	2.92E+00	15.02	1.94E−01	Page et al. 1987
Cadmium	Leafy	Swiss Chard	3.31E+00	15.02	2.20E−01	Page et al. 1987
Cadmium	Leafy	Swiss Chard	5.97E+00	15.02	3.97E−01	Page et al. 1987
Cadmium	Leafy	Swiss Chard	5.68E+01	15.02	3.78E+00	Page et al. 1987
Cadmium	Leafy	Swiss Chard	1.98E+00	15.02	1.32E−01	USEPA 1985a
Cadmium	Leafy	Swiss Chard	3.95E+00	15.02	2.63E−01	USEPA 1985a
Cadmium	Leafy	Swiss Chard	2.90E+00	15.02	1.93E−01	USEPA 1985a
Cadmium	Leafy	Swiss Chard	1.71E+00	15.02	1.14E−01	USEPA 1985a
Cadmium	Leafy	Swiss Chard	1.89E+00	15.02	1.25E−01	USEPA 1985a
Cadmium	Leafy	Swiss Chard	3.05E+00	15.02	2.03E−01	USEPA 1985a
Cadmium	Leafy	Swiss Chard	4.35E+00	15.02	2.90E−01	USEPA 1985a
Cadmium	Leafy	Swiss Chard	4.35E+00	15.02	2.90E−01	USEPA 1985a
Cadmium	Leafy	Swiss Chard	4.20E+00	15.02	2.80E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Leafy	Swiss Chard	1.40E+01	15.02	9.32E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Leg	Field bean	5.50E−01	7.29	7.54E−02	(1)−−>Bingham et al. 1975−6
Cadmium	Leg	Field bean	3.50E+00	7.29	4.80E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Leg	Pea	1.70E−02	7.29	2.33E−03	Page et al. 1987
Cadmium	Leg	Pea	3.63E−02	7.29	4.97E−03	Page et al. 1987
Cadmium	Leg	Pea	5.55E−02	7.29	7.61E−03	Page et al. 1987
Cadmium	Leg	Pea	6.40E−02	7.29	8.78E−03	Page et al. 1987
Cadmium	Leg	Pea	7.50E−03	7.29	1.03E−03	Page et al. 1987
Cadmium	Leg	Pea	9.00E−03	7.29	1.23E−03	Page et al. 1987
Cadmium	Leg	Snapbean	2.10E−01	7.29	2.89E−02	(1)−−>Giordano and Mays 197t.
Cadmium	Leg	Snapbean	4.06E−02	7.29	5.56E−03	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Snapbean	3.41E−01	7.29	4.67E−02	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Snapbean	1.36E−01	7.29	1.87E−02	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Snapbean	1.87E−01	7.29	2.56E−02	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Snapbean	1.85E−01	7.29	2.54E−02	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Snapbean	4.77E−02	7.29	6.54E−03	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Snapbean	3.23E−01	7.29	4.42E−02	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Snapbean	5.16E−01	7.29	7.08E−02	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Snapbean	9.52E−02	7.29	1.31E−02	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Snapbean	1.16E−01	7.29	1.59E−02	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Snapbean	1.00E+00	7.29	1.37E−01	(1)−−>Giordano and Mays 1976b
Cadmium	Leg	Soybean	5.50E+00	7.29	7.54E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Leg	Soybean	1.32E+00	7.29	1.80E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Root	Beet	3.67E−01	4.11	8.94E−02	SAIC
Cadmium	Root	Carrot	3.13E−01	4.11	7.60E−02	Page et al. 1987
Cadmium	Root	Carrot	3.18E−01	4.11	7.74E−02	Page et al. 1987
Cadmium	Root	Carrot	2.70E+00	4.11	6.57E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Root	Carrot	1.15E+01	4.11	2.80E+00	(1)−−>Bingham et al. 1975−6
Cadmium	Root	Radish	2.20E+00	4.11	5.35E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Root	Radish	2.25E+01	4.11	5.47E+00	(1)−−>Bingham et al. 1975−6
Cadmium	Root	Table beet	2.58E+00	4.11	6.27E−01	(1)−−>Bingham et al. 1975−6
Cadmium	Root	Table beet	5.00E+00	4.11	1.22E+00	(1)−−>Bingham et al. 1975−6
Cadmium	Root	Turnip	9.50E+00	4.11	2.31E+00	(1)−−>Bingham et al. 1975−6
Cadmium	Root	Turnip	8.56E+00	4.11	2.08E+00	(1)−−>Bingham et al. 1975−6
Cadmium	Root	Turnip	2.99E−01	4.11	7.26E−02	(2)−−>Miller and Boswell 1979
Manganese	Leafy		2.50E−01	15.02	1.66E−02	Baes et al. 1984a
Manganese	Root		5.00E−02	4.11	1.22E−02	Baes et al. 1984a
Manganese			1.00E+01	15.02	6.66E−01	NCRP 1991 − for dry forage
Manganese			3.00E−01		3.00E−01	NCRP 1991 − for fresh veg

Table M.4 (continued)

Element	Group	Plant	Dry weight Bv	Conversion	Wet weight BV	Author Year
Manganese			1.29E+00			Ng et al. 1982a
Manganese			3.21E−01			Ng et al. 1982a
Manganese			3.11E−01			Ng et al. 1982a
Manganese	Fruit	Tomato	1.10E−01	7.29	1.51E−02	(5)−−>Furr et al. 1976b
Manganese	Grain	Barley	3.17E−02	4.11	7.71E−03	(5)−−>Andersson and Nilsson 1976
Manganese	Grain	Barley	3.53E−01	4.11	8.60E−02	(5)−−>Steffens et al. 1980a
Manganese	Grain	Barley	1.14E+00	4.11	2.77E−01	(5)−−>Steffens et al. 1980a
Manganese	Grain	Barley	1.71E+00	4.11	4.16E−01	(5)−−>Steffens et al. 1980a
Manganese	Grain	Barley	3.53E−01	4.11	8.60E−02	(5)−−>Steffens et al. 1980a
Manganese	Grain	Millet	2.85E−01	4.11	6.93E−02	(5)−−>Furr et al. 1976b
Manganese	Grain	Oats	8.15E−02	4.11	1.98E−02	(5)−−>Andersson and Nilsson 1976
Manganese	Grain	Wheat	5.99E−01	4.11	1.46E−01	(5)−−>Andersson and Nilsson 1976
Manganese	Grain	Wheat	2.90E−01	4.11	7.06E−02	(5)−−>Andersson and Nilsson 1976
Manganese	Grain	Wheat	3.70E−01	4.11	9.00E−02	(5)−−>Andersson and Nilsson 1976
Manganese	Grain	Wheat	3.04E−01	4.11	7.39E−02	(5)−−>Steffens et al. 1980b
Manganese	Grain	Wheat	2.96E+00	4.11	7.20E−01	(5)−−>Steffens et al. 1980b
Manganese	Leafy	Cabbage	8.72E−01	15.02	5.81E−02	(5)−−>Furr et al. 1976b
Manganese	Leafy	Lettuce	1.13E−01	15.02	7.49E−03	(5)−−>Steffens et al. 1980a
Manganese	Leafy	Lettuce	3.36E−01	15.02	2.24E−02	(5)−−>Steffens et al. 1980a
Manganese	Leafy	Lettuce	1.68E−01	15.02	1.12E−02	(5)−−>Steffens et al. 1980a
Manganese	Leafy	Lettuce	3.70E−02	15.02	2.46E−03	(5)−−>Steffens et al. 1980a
Manganese	Leafy	Lettuce	4.70E−02	15.02	3.13E−03	(5)−−>Steffens et al. 1980ab
Manganese	Leafy	Lettuce	8.06E−02	15.02	5.37E−03	(5)−−>Steffens et al. 1980ab
Manganese	Leg	Bush bean	2.70E−01	7.29	3.70E−02	(5)−−>Furr et al. 1976b
Manganese	Root	Carrot	1.49E+00	4.11	3.63E−01	(5)−−>Furr et al. 1976b
Manganese	Root	Onion	6.76E−01	4.11	1.64E−01	(5)−−>Furr et al. 1976b
Manganese	Root	Potato	3.80E−02	4.11	9.25E−03	(5)−−>Furr et al. 1976b
Manganese	Root	Potato	7.00E−01	4.11	1.70E−01	(5)−−>Steffens et al. 1980a
Manganese	Root	Potato	7.00E−01	4.11	1.70E−01	(5)−−>Steffens et al. 1980ab
Manganese	Root	Radish	1.84E−01	4.11	4.48E−02	(5)−−>Steffens et al. 1980b
Manganese	Root	Radish	2.76E−01	4.11	6.72E−02	(5)−−>Steffens et al. 1980b
Manganese	Root	Sugar beet	2.40E+00	4.11	5.85E−01	(5)−−>Steffens et al. 1980ab
Manganese	Root	Sugar beet	6.12E−01	4.11	1.49E−01	(5)−−>Steffens et al. 1980ab
Mercury	Leafy		9.00E−01	15.02	5.99E−02	Baes et al. 1984a
Mercury	Root		2.00E−01	4.11	4.87E−02	Baes et al. 1984a
Mercury			1	15.02	6.66E−02	NCRP 1991 – for dry forage
Mercury			3.00E−01		3.00E−01	NCRP 1991 – for fresh veg
Mercury	Fruit	Tomato	1.31E−04	7.29	1.80E−05	SAIC
Mercury	Leafy	Kale	1.81E−02	15.02	1.21E−03	SAIC
Mercury	Leafy	Kale	3.29E−02	15.02	2.19E−03	SAIC
Mercury	Leafy	Kale	2.78E−02	15.02	1.85E−03	SAIC
Mercury	Leafy	Kale	1.00E−02	15.02	6.68E−04	SAIC
Mercury	Leafy	Kale	2.36E−02	15.02	1.57E−03	SAIC
Mercury	Leafy	Kale	2.75E−02	15.02	1.83E−03	SAIC
Mercury	Leafy	Kale	8.46E−03	15.02	5.63E−04	SAIC
Mercury	Root	Beet	1.78E−01	4.11	4.34E−02	SAIC
Mercury	Root	Beet	1.66E−02	4.11	4.04E−03	SAIC
Mercury	Root	Beet	2.01E−02	4.11	4.90E−03	SAIC
Mercury	Root	Beet	6.25E−02	4.11	1.52E−02	SAIC
Mercury	Leafy	Lettuce	4.55E−04	15.02	3.03E−05	USEPA 1985c
Mercury	Leafy	Spinach	6.36E−03	15.02	4.24E−04	USEPA 1985c
Mercury	Leg	Peas	4.55E−04	7.29	6.24E−05	USEPA 1985c
Mercury	Grain	Oat	4.55E−04	4.11	1.11E−04	USEPA 1985c
Mercury	Leafy	Lettuce	2.27E−03	15.02	1.51E−04	USEPA 1985c
Mercury	Leafy	Lettuce	2.14E−02	15.02	1.42E−03	USEPA 1985c
Mercury	Root	Radish	7.73E−03	4.11	1.88E−03	USEPA 1985c

Table M.5. Summary statistics and goodness of fit testing results for compendium of soil-to-plant biotransfer factors: arsenic

TOTAL OBSERVATIONS: 290

	ASBV	ASFT	ASGN	ASLF	ASLG	ASRT
N OF CASES	69	2	4	36	4	23
MINIMUM	0.000	0.001	0.000	0.000	0.000	0.000
MAXIMUM	0.110	0.080	0.080	0.110	0.080	0.080
RANGE	0.110	0.079	0.080	0.110	0.080	0.080
MEAN	0.010	0.040	0.020	0.010	0.020	0.004
VARIANCE	0.001	0.003	0.002	0.001	0.002	0.000
STANDARD DEV	0.024	0.056	0.040	0.022	0.040	0.017
STD. ERROR	0.003	0.040	0.020	0.004	0.020	0.003
SKEWNESS(G1)	2.769	0.000	1.154	3.393	1.155	4.378
KURTOSIS(G2)	6.461	-2.000	-0.667	11.231	-0.667	17.438
SUM	0.707	0.081	0.081	0.369	0.080	0.096
C.V.	2.365	1.381	1.957	2.192	1.999	4.011
MEDIAN	0.001	0.040	0.001	0.001	0.000	0.000

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	LILLIEFORS PROBABILITY (2-TAIL)
ASBV	69.000	0.371	0.000
ASLF	36.000	0.325	0.000
ASFT	2.000	0.260	1.000
ASGN	4.000	0.434	0.008
ASLG	4.000	0.441	0.007
ASRT	23.000	0.476	0.000

TOTAL OBSERVATIONS: 290

	LASBV	LASFT	LASGN	LASLF	LASLG	LASRT
N OF CASES	69	2	4	36	4	23
MINIMUM	-12.276	-6.949	-12.276	-10.661	-11.823	-11.170
MAXIMUM	-2.207	-2.526	-2.526	-2.207	-2.526	-2.526
RANGE	10.069	4.423	9.750	8.455	9.297	8.644
MEAN	-7.195	-4.737	-8.260	-6.120	-9.109	-8.575
VARIANCE	6.755	9.782	20.913	3.379	19.465	4.247
STANDARD DEV	2.599	3.128	4.573	1.838	4.412	2.061
STD. ERROR	0.313	2.212	2.287	0.306	2.206	0.430
SKEWNESS(G1)	0.094	0.000	0.366	0.093	1.119	1.264
KURTOSIS(G2)	-0.690	-2.000	-1.504	-0.091	-0.695	1.631
SUM	-496.487	-9.475	-33.041	-220.302	-36.436	-197.233
C.V.	-0.361	-0.660	-0.554	-0.300	-0.484	-0.240
MEDIAN	-6.949	-4.737	-9.120	-6.547	-11.044	-8.737

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	LILLIEFORS PROBABILITY (2-TAIL)
LASBV	69.000	0.111	0.035
LASLF	36.000	0.181	0.004
LASFT	2.000	0.260	1.000
LASGN	4.000	0.267	0.593
LASLG	4.000	-0.393	0.031
LASRT	23.000	0.165	0.106

Table M.6. Summary statistics and goodness-of-fit testing results for compendium of soil-to-plant biotransfer factors: beryllium

TOTAL OBSERVATIONS: 290

	BEBV	BELF	BERT
N OF CASES	4	2	2
MINIMUM	0.000	0.002	0.000
MAXIMUM	0.004	0.004	0.004
RANGE	0.004	0.002	0.004
MEAN	0.003	0.003	0.002
VARIANCE	0.000	0.000	0.000
STANDARD DEV	0.002	0.001	0.003
STD. ERROR	0.001	0.001	0.002
SKEWNESS(G1)	-0.628	0.000	0.000
KURTOSIS(G2)	-1.212	-2.000	-2.000
SUM	0.011	0.006	0.004
C.V.	0.638	0.344	1.178
MEDIAN	0.003	0.003	0.002

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	LILLIEFORS PROBABILITY (2-TAIL)
BEBV	4.000	0.275	0.516
BERT	2.000	0.260	1.000
BELF	2.000	0.260	1.000

TOTAL OBSERVATIONS: 290

	LBEBV	LBELF	LBERT
N OF CASES	4	2	2
MINIMUM	-7.916	-6.019	-7.916
MAXIMUM	-5.521	-5.521	-5.521
RANGE	2.394	0.497	2.394
MEAN	-6.244	-5.770	-6.719
VARIANCE	1.297	0.124	2.866
STANDARD DEV	1.139	0.352	1.693
STD. ERROR	0.569	0.249	1.197
SKEWNESS(G1)	-1.017	0.000	0.000
KURTOSIS(G2)	-0.792	-2.000	-2.000
SUM	-24.977	-11.540	-13.437
C.V.	-0.182	-0.061	-0.252
MEDIAN	-5.770	-5.770	-6.719

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	LILLIEFORS PROBABILITY (2-TAIL)
LBEBV	4.000	0.329	0.168
LBERT	2.000	0.260	1.000
LBELF	2.000	0.260	1.000

Table M.7. Summary statistics and godness-of-fit testing results for compendium of soil-to-plant biotransfer factors: cadmium

TOTAL OBSERVATIONS: 290

	CDBV	CDFT	CDGN	CDLF	CDLG	CDRT
N OF CASES	154	10	58	49	23	14
MINIMUM	0.000	0.019	0.000	0.034	0.001	0.036
MAXIMUM	5.474	1.852	4.866	3.782	0.754	5.474
RANGE	5.474	1.833	4.866	3.748	0.753	5.438
MEAN	0.411	0.361	0.248	0.537	0.107	1.182
VARIANCE	0.638	0.319	0.425	0.542	0.039	2.367
STANDARD DEV	0.799	0.565	0.652	0.736	0.197	1.539
STD. ERROR	0.064	0.179	0.086	0.105	0.041	0.411
SKEWNESS(G1)	3.901	2.028	6.311	2.603	2.250	1.702
KURTOSIS(G2)	17.681	3.047	41.948	7.163	3.908	2.273
SUM	63.354	3.613	14.404	26.328	2.455	16.554
C.V.	1.941	1.564	2.626	1.370	1.849	1.301
MEDIAN	0.140	0.084	0.102	0.271	0.025	0.581

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	LILLIEFORS PROBABILITY (2-TAIL)
CDBV	154.000	0.303	0.000
CDLF	49.000	0.278	0.000
CDRT	14.000	0.277	0.005
CDFT	10.000	0.301	0.011
CDGN	58.000	0.352	0.000
CDLG	23.000	0.346	0.000

TOTAL OBSERVATIONS: 290

	LCDBV	LCDFT	LCDGN	LCDLF	LCDLG	LCDRT
N OF CASES	154	10	58	49	23	14
MINIMUM	-8.609	-3.977	-8.609	-3.374	-6.879	-3.311
MAXIMUM	1.700	0.616	1.582	1.330	-0.282	1.700
RANGE	10.309	4.593	10.191	4.704	6.598	5.011
MEAN	-2.358	-2.093	-3.165	-1.277	-3.693	-0.799
VARIANCE	4.557	2.552	5.829	1.310	3.360	2.646
STANDARD DEV	2.135	1.597	2.414	1.145	1.833	1.627
STD. ERROR	0.172	0.505	0.317	0.164	0.382	0.435
SKEWNESS(G1)	-0.739	0.363	-0.572	0.236	0.170	-0.118
KURTOSIS(G2)	0.192	-1.297	-0.685	-0.489	-0.666	-1.331
SUM	-363.184	-20.935	-183.561	-62.554	-84.942	-11.192
C.V.	-0.905	-0.763	-0.763	-0.897	-0.496	-2.035
MEDIAN	-1.969	-2.475	-2.291	-1.307	-3.672	-0.546

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	LILLIEFORS PROBABILITY (2-TAIL)
LCDBV	154.000	0.099	0.001
LCDLF	49.000	0.071	0.774
LCDRT	14.000	-0.197	0.152
LCDFT	10.000	0.203	0.315
LCDGN	58.000	0.163	0.001
LCDLG	23.000	0.077	1.000

Table M.8. Summary statistics and goodness-of-fit testing results for compendium of soil-to-plant biotransfer factors: mercury

TOTAL OBSERVATIONS: 290

	HGBV	HGFT	HGGN	HGLF	HGLG	HGRT
N OF CASES	26	2	2	13	2	7
MINIMUM	0.000	0.000	0.000	0.000	0.000	0.002
MAXIMUM	0.300	0.300	0.300	0.300	0.300	0.300
RANGE	0.300	0.300	0.300	0.300	0.300	0.298
MEAN	0.065	0.150	0.150	0.029	0.150	0.060
VARIANCE	0.014	0.045	0.045	0.007	0.045	0.012
STANDARD DEV	0.118	0.212	0.212	0.083	0.212	0.108
STD. ERROR	0.023	0.150	0.150	0.023	0.150	0.041
SKEWNESS(G1)	1.497	0.000	0.000	2.986	0.000	1.910
KURTOSIS(G2)	0.330	-2.000	-2.000	7.258	-2.000	1.871
SUM	1.690	0.300	0.300	0.372	0.300	0.418
C.V.	1.816	1.414	1.413	2.907	1.414	1.803
MEDIAN	0.002	0.150	0.150	0.001	0.150	0.015

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	LILLIEFORS PROBABILITY (2-TAIL)
HGBV	26.000	0.356	0.000
HGLF	13.000	0.471	0.000
HGRT	7.000	0.398	0.001
HGFT	2.000	0.260	1.000
HGLG	2.000	0.260	1.000
HGGN	2.000	0.260	1.000

TOTAL OBSERVATIONS: 290

	LHGBV	LHGFT	LHGGN	LHGLF	LHGLG	LHGRT
N OF CASES	26	2	2	13	2	7
MINIMUM	-10.927	-10.927	-9.110	-10.406	-9.683	-6.276
MAXIMUM	-1.204	-1.204	-1.204	-1.204	-1.204	-1.204
RANGE	9.723	9.723	7.906	9.202	8.479	5.072
MEAN	-5.624	-6.065	-5.157	-6.479	-5.443	-4.094
VARIANCE	9.024	47.267	31.250	5.471	35.945	3.116
STANDARD DEV	3.004	6.875	5.590	2.339	5.995	1.765
STD. ERROR	0.589	4.861	3.953	0.649	4.239	0.667
SKEWNESS(G1)	0.099	0.000	0.000	0.809	0.000	0.365
KURTOSIS(G2)	-0.989	-2.000	-2.000	0.696	-2.000	-0.980
SUM	-146.222	-12.131	-10.314	-84.233	-10.887	28.658
C.V.	-0.534	-1.133	-1.084	-0.361	-1.101	-0.431
MEDIAN	-6.284	-6.065	-5.157	-6.555	-5.443	-4.187

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	LILLIEFORS PROBABILITY (2-TAIL)
LHGBV	26.000	0.143	0.185
LHGLF	13.000	0.286	0.005
LHGRT	7.000	0.185	0.883
LHGFT	2.000	0.260	1.000
LHGLG	2.000	0.260	1.000
LHGGN	2.000	0.260	1.000

Table M.9. Summary statistics and goodness-of-fit testing results for compendium of soil-to-plant biotransfer factors: manganese

TOTAL OBSERVATIONS: 290

	MNBV	MNFT	MNGN	MNLF	MNLG	MNRT
N OF CASES	37	2	13	9	2	11
MINIMUM	0.002	0.015	0.008	0.002	0.037	0.009
MAXIMUM	0.720	0.300	0.720	0.300	0.300	0.585
RANGE	0.718	0.285	0.712	0.298	0.263	0.575
MEAN	0.148	0.158	0.182	0.047	0.169	0.185
VARIANCE	0.029	0.041	0.041	0.009	0.035	0.030
STANDARD DEV	0.172	0.201	0.202	0.096	0.186	0.173
STD. ERROR	0.028	0.142	0.056	0.032	0.131	0.052
SKEWNESS(G1)	1.573	0.000	1.637	2.334	0.000	1.123
KURTOSIS(G2)	2.208	-2.000	1.871	3.692	-2.000	0.536
SUM	5.476	0.315	2.363	0.427	0.337	2.034
C.V.	1.160	1.279	1.111	2.030	1.103	0.938
MEDIAN	0.074	0.158	0.086	0.011	0.169	0.164

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	LILLIEFORS PROBABILITY (2-TAIL)
MNBV	37.000	0.227	0.000
MNLF	9.000	0.380	0.000
MNRT	11.000	0.261	0.035
MNFT	2.000	0.260	1.000
MNLG	2.000	0.260	1.000
MNGN	13.000	0.291	0.004

TOTAL OBSERVATIONS: 290

	LMNBV	LMNFT	LMNGN	LMNLF	LMNLG	LMNRT
N OF CASES	37	2	13	9	2	11
MINIMUM	-6.007	-4.194	-4.865	-6.007	-3.296	-4.684
MAXIMUM	-0.328	-1.204	-0.328	-1.204	-1.204	-0.537
RANGE	5.679	2.990	4.537	4.803	2.092	4.147
MEAN	-2.778	-2.699	-2.280	-4.259	-2.250	-2.264
VARIANCE	2.421	4.469	1.492	2.286	2.188	1.785
STANDARD DEV	1.556	2.114	1.221	1.512	1.479	1.336
STD. ERROR	0.256	1.495	0.339	0.504	1.046	0.403
SKEWNESS(G1)	-0.391	0.000	-0.445	0.825	0.000	-0.705
KURTOSIS(G2)	-0.924	-2.000	-0.052	-0.129	-2.000	-0.627
SUM	-102.778	-5.398	-29.643	-38.333	-4.500	-24.905
C.V.	-0.560	-0.783	-0.536	-0.355	-0.657	-0.590
MEDIAN	-2.605	-2.699	-2.454	-4.493	-2.250	-1.805

KOLMOGOROV-SMIRNOV ONE SAMPLE TEST USING STANDARD NORMAL DISTRIBUTION

VARIABLE	N-OF-CASES	MAXDIF	LILLIEFORS PROBABILITY (2-TAIL)
LMNBV	37.000	0.114	0.246
LMNLF	9.000	0.158	0.946
LMNRT	11.000	0.243	0.070
LMNFT	2.000	0.260	1.000
LMNLG	2.000	0.260	1.000
LMNGN	13.000	0.221	0.081

SEGMENT 1 RISK CHARACTERIZATION TABLES

Table M.10. Risk characterization summary for EFPC Segment 1: RME estimates for current land use

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index: Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	7.37E−01 B	3.88E−01 B	6.52E−06 W	1.14E−05 W	1.16E−07 B	2.90E−07 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	4.53E−02 B	4.21E−02 B	2.53E−06 W	7.84E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	1.48E−03 B	1.04E−03 B	3.10E−09 B	7.22E−09 B	4.89E−10 B	1.63E−09 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.28E−03 B	1.18E−03 B	3.01E−08 B	9.31E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	9.90E−05 B	9.19E−05 B	1.26E−08 B	3.89E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index: Combined Exposure		7.9E−01 B	4.3E−01 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				9E−06 W	2E−05 W					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						1E−07 B	3E−07 B					NA	NA

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR> 1 x 10^{-6} and < 1 x 10^{-4})
E – exceeds EPA target for noncancer hazard index (HI>1), or cancer risk (ELCR< 1 x 10^{-4})

Table M.11. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S1–C1–O adult long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	2.98E–02	3.88E–01	2.75E–07	1.14E–05
Dermal Contact	1.07E–03	4.21E–02	5.83E–08	7.84E–06
SURFACE WATER				
Ingestion	6.90E–05	1.04E–03	1.77E–10	7.22E–09
Dermal Contact	7.27E–05	1.18E–03	1.68E–09	9.31E–08
SEDIMENT				
Dermal Contact	1.94E–06	9.19E–05	2.29E–10	3.89E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			8.17E–09	2.90E–07
SURFACE WATER				
Ingestion			3.92E–11	1.63E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	3.1E–02	4.3E–01		
Excess Lifetime Cancer Risk: Combined Exposure			3E–07	2E–05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			8E–09	3E–07

Table M.12. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S1–C1–O children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	5.15E–02	7.37E–01	1.58E–07	6.52E–06
Dermal Contact	1.11E–03	4.53E–02	2.00E–08	2.53E–06
SURFACE WATER				
Ingestion	9.55E–05	1.48E–03	8.16E–11	3.10E–09
Dermal Contact	7.49E–05	1.28E–03	5.77E–10	3.01E–08
SEDIMENT				
Dermal Contact	2.00E–06	9.90E–05	7.87E–11	1.26E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.40E–09	1.16E–07
SURFACE WATER				
Ingestion			1.31E–11	4.89E–10
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.3E–02	7.9E–01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	9E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			3E–09	1E–07

Table M.13. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Area S1–C1–O

Chemical	MLB Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI)/(RfD) (MLB)	HQ Noncar. Effects (CDI)/(RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS **(mg/kg)**															
Antimony	1.11	1.37	6.94E-08	8.93E-09	8.05E-07	3.45E-07	1.74E-04	2.01E-03	0.5%	whole body, blood; inc. mortality	1000				
Arsenic	6.31	6.87	3.95E-07	5.08E-08	4.03E-06	1.73E-06	1.32E-03	1.34E-02	3.5%	skin; keratosis, hyperpigmentation	3	8.89E-08	3.02E-06	26.4%	[A]
Barium	150.10	185.00	9.40E-06	1.21E-06	1.09E-04	4.65E-05	1.34E-04	1.55E-03	0.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.06	1.50	6.64E-08	8.54E-09	8.82E-07	3.76E-07	1.33E-05	1.70E-04	0.0%	no observed effects	100	3.67E-08	1.63E-06	14.2%	[B2]
Cadmium	5.23	7.98	3.28E-07	4.21E-08	4.65E-06	2.01E-06	3.28E-04	4.65E-03	1.2%	kidney; proteinuria	10				
Chromium (III)	63.93	68.39	4.00E-06	5.15E-07	4.02E-05	1.72E-05	4.00E-06	4.02E-05	0.0%	no observed effects	100				
Copper	80.12	104.00	5.02E-06	6.45E-07	6.11E-05	2.62E-05	1.36E-04	1.65E-03	0.4%	Gastrointestinal system; irritation	--				[D]
Lead	40.24	47.67	2.52E-06	3.24E-07	2.80E-05	1.20E-05				CNS, blood	--				[B2]
Manganese	701.20	899.50	4.39E-05	5.65E-06	5.28E-04	2.26E-04	3.14E-04	3.77E-03	1.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	130.30	183.40	8.16E-06	1.05E-06	1.08E-04	4.61E-05	2.72E-02	3.59E-01	92.5%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	41.12	54.24	2.58E-06	3.31E-07	3.18E-05	1.36E-05	1.29E-04	1.59E-03	0.4%	dec. body and organ weight	300				
Selenium	8.25	9.89	5.16E-07	6.64E-08	5.86E-06	2.49E-06	1.03E-04	1.16E-03	0.3%	whole body; clinical selenosis	3				[D]
Silver	4.25	6.11	2.66E-07	3.42E-08	3.59E-06	1.54E-06	5.33E-05	7.17E-04	0.2%	skin; argyria	3				[D]
Zinc	66.11	73.45	4.14E-06	5.32E-07	4.31E-05	1.85E-05	1.38E-05	1.44E-04	0.0%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor-1254	0.17	0.26	1.05E-08	1.35E-09	1.52E-07	6.52E-08				--	--	1.04E-08	5.02E-07	4.4%	[B2]
Aroclor-1260	1.01	1.52	6.33E-08	8.14E-09	8.94E-07	3.83E-07				--	--	6.27E-08	2.95E-06	25.8%	[B2]
Benzo(a)anthracene	0.80	1.16	4.99E-08	6.42E-09	6.83E-07	2.93E-07	1.66E-06	2.26E-05	0.0%	--	--	4.68E-09	2.14E-07	1.9%	[B2]
Benzo(a)pyrene /	0.73	1.05	4.58E-08	5.88E-09	6.14E-07	2.63E-07	1.53E-06	2.05E-05	0.0%	--	--	4.30E-08	1.92E-06	16.8%	[B2]
Benzo(b)fluoranthene	1.01	1.42	6.32E-08	8.13E-09	8.32E-07	3.57E-07	2.11E-06	2.77E-05	0.0%	--	--	5.94E-09	2.60E-07	2.3%	[B2]
Benzo(k)fluoranthene	0.81	1.13	5.09E-08	6.54E-09	6.62E-07	2.84E-07	1.70E-06	2.21E-05	0.0%	--	--	4.77E-09	2.07E-07	1.8%	[B2]
Chrysene	0.79	1.15	4.92E-08	6.33E-09	6.77E-07	2.90E-07	1.64E-06	2.26E-05	0.0%	--	--	4.62E-10	2.12E-08	0.2%	[B2]
Dibenzo(a,h)anthracene	0.25	0.32	1.55E-08	1.99E-09	1.90E-07	8.14E-08	5.17E-07	6.33E-06	0.0%	--	--	1.46E-08	5.94E-07	5.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.48	0.64	3.00E-08	3.86E-09	3.79E-07	1.62E-07	1.00E-06	1.26E-05	0.0%	--	--	2.82E-09	1.18E-07	1.0%	[B2]
RADIONUCLIDES **(pCi/g)**															
Cesium 137+D	1.15	1.96		1.65E+01		8.82E+02									
Cobalt 60	0.01	0.02		8.06E-02		8.21E+00						4.65E-10	2.47E-08	8.5%	[A]
Neptunium 237+D	0.01	0.02		7.92E-02		7.08E+00						1.21E-12	1.23E-10	0.0%	[A]
Protactinium 233		0.06				2.72E+01						1.74E-11	1.56E-09	0.5%	[A]
Thorium 228+D	2.54	2.54		3.66E+01		1.14E+03							2.72E-11	0.0%	[A]
Thorium 230	4.58	4.58		6.59E+01		2.06E+03						2.01E-09	6.29E-08	21.7%	[A]
Thorium 232	1.90	1.90		2.73E+01		8.54E+02						8.57E-10	2.68E-08	9.2%	[A]
Uranium 234	6.57	7.72		9.47E+01		3.46E+03						3.28E-10	1.02E-08	3.5%	[A]
Uranium 235+D	0.33	0.39		4.74E+00		1.76E+02						1.51E-09	5.56E-08	19.2%	[A]
Uranium 238+D	7.19	8.35		1.04E+02		3.76E+03						7.59E-11	2.81E-09	1.0%	[A]
												2.90E-09	1.05E-07	36.3%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							2.98E-02	3.88E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.75E-07	1.14E-05	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.17E-09	2.98E-07	100.0%	

Table M.14. Risk characterization for soils: children – ingestion exposure (current land use – open) – Area S1–C1–O

Chemical	MLB Concentration in Soil	RMB Concentration in Soil	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA Wgt.
INORGANICS (mg/kg)															
Antimony	1.11	1.37	1.20E-07	5.15E-09	1.53E-06	1.97E-07	3.00E-04	3.82E-03	0.5%	whole body, blood; inc. mortality	1000				
Arsenic	6.31	6.87	6.88E-07	2.93E-08	7.66E-06	9.85E-07	2.28E-03	2.55E-02	3.5%	skin; keratosis, hyperpigmentation	3	5.12E-08	1.72E-06	26.4%	[A]
Barium	150.10	185.00	1.63E-05	6.97E-07	2.06E-04	2.65E-05	2.32E-04	2.95E-03	0.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.06	1.50	1.15E-07	4.92E-09	1.68E-06	2.15E-07	2.30E-05	3.35E-04	0.0%	no observed effects	100	2.12E-08	9.26E-07	14.2%	[B2]
Cadmium	5.23	7.98	5.66E-07	2.43E-08	8.91E-06	1.15E-06	5.66E-04	8.91E-03	1.2%	kidney; proteinuria	10				
Chromium (III)	63.93	68.39	6.92E-06	2.97E-07	7.63E-05	9.81E-06	6.92E-06	7.63E-05	0.0%	no observed effects	100				
Copper	80.12	104.00	8.68E-06	3.72E-07	1.16E-04	1.49E-05	2.34E-04	3.14E-03	0.4%	Gastrointestinal system; irritation	--				[D]
Lead	40.24	47.67	4.36E-06	1.87E-07	5.32E-05	6.84E-06				CNS, blood	--				[B2]
Manganese	701.20	899.50	7.59E-05	3.25E-06	1.00E-03	1.29E-04	5.42E-04	7.17E-03	1.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	130.30	183.40	1.41E-05	6.05E-07	2.05E-04	2.63E-05	4.70E-02	6.82E-01	92.5%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	41.12	54.24	4.45E-06	1.91E-07	6.05E-05	7.78E-06	2.23E-04	3.03E-03	0.4%	dec. body and organ weight	300				
Selenium	8.25	9.89	8.93E-07	3.83E-08	1.10E-05	1.42E-06	1.79E-04	2.21E-03	0.3%	whole body; clinical selenosis	3				[D]
Silver	4.25	6.11	4.61E-07	1.97E-08	6.81E-06	8.76E-07	9.21E-05	1.36E-03	0.2%	skin; argyria	3				[D]
Zinc	66.11	73.45	7.16E-06	3.07E-07	8.19E-05	1.05E-05	2.39E-05	2.73E-04	0.0%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.17	0.26	1.81E-08	7.77E-10	2.69E-07	3.72E-08				--	--	5.99E-09	2.86E-07	4.4%	[B2]
Aroclor-1260	1.01	1.52	1.09E-07	4.69E-09	1.70E-06	2.18E-07				--	--	3.61E-08	1.68E-06	25.8%	[B2]
Benzo(a)anthracene	0.80	1.16	8.63E-08	3.70E-09	1.30E-06	1.67E-07	2.88E-06	4.32E-05	0.0%	--	--	2.70E-09	1.22E-07	1.9%	[B2]
Benzo(a)pyrene	0.73	1.05	7.91E-08	3.39E-09	1.17E-06	1.50E-07	2.64E-06	3.89E-05	0.0%	--	--	2.48E-08	1.09E-06	16.8%	[B2]
Benzo(b)fluoranthene	1.01	1.42	1.09E-07	4.69E-09	1.58E-06	2.03E-07	3.63E-06	5.27E-05	0.0%	--	--	3.42E-09	1.48E-07	2.3%	[B2]
Benzo(k)fluoranthene	0.81	1.13	8.79E-08	3.77E-09	1.26E-06	1.62E-07	2.93E-06	4.19E-05	0.0%	--	--	2.75E-09	1.19E-07	1.8%	[B2]
Chrysene	0.79	1.15	8.51E-08	3.65E-09	1.29E-06	1.65E-07	2.84E-06	4.29E-05	0.0%	--	--	2.66E-10	1.21E-08	0.2%	[B2]
Dibenzo(a,h)anthracene	0.25	0.32	2.68E-08	1.15E-09	3.61E-07	4.64E-08	8.94E-07	1.20E-05	0.0%	--	--	8.35E-09	3.35E-07	5.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.48	0.64	5.19E-08	2.22E-09	7.19E-07	9.25E-08	1.73E-06	2.40E-05	0.0%	--	--	1.62E-09	6.75E-08	1.0%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.15	1.96		6.89E+00		3.52E+02						1.93E-10	9.85E-09	8.5%	[A]
Cobalt 60	0.01	0.02		3.36E-02		3.28E+00						5.04E-13	4.92E-11	0.0%	[A]
Neptunium 237+D	0.01	0.02		3.30E-02		2.82E+00						7.26E-12	6.21E-10	0.5%	[A]
Protactinium 233		0.06				1.05E+01							1.05E-11	0.0%	[A]
Thorium 228+D	2.54	2.54		1.53E+01		4.56E+02						8.39E-10	2.51E-08	21.7%	[A]
Thorium 230	4.58	4.58		2.75E+01		8.22E+02						3.57E-10	1.07E-08	9.2%	[A]
Thorium 232	1.90	1.90		1.14E+01		3.41E+02						1.37E-10	4.09E-09	3.5%	[A]
Uranium 234	6.57	7.72		3.94E+01		1.39E+03						6.31E-10	2.22E-08	19.2%	[A]
Uranium 235+D	0.33	0.39		1.98E+00		7.02E+01						3.16E-11	1.12E-09	1.0%	[A]
Uranium 238+D	7.19	8.35		4.31E+01		1.50E+03						1.21E-09	4.20E-08	36.3%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							5.15E-02	7.37E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.58E-07	6.52E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.40E-09	1.16E-07	100.0%	

Table M.15. Risk characterization for soils: adults – dermal exposure (current land use – open) – Area S1–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	1.11	1.37	2.50E-09	3.21E-10	8.70E-08	3.73E-08	6.25E-06	2.18E-04	0.5%	whole body, blood; inc. mortality	1000				
Arsenic	6.31	6.87	1.42E-08	1.83E-09	4.36E-07	1.87E-07	4.74E-05	1.45E-03	3.5%	skin; keratosis, hyperpigmentation	3	3.20E-09	3.27E-07	4.2%	[A]
Barium	150.10	185.00	3.38E-07	4.33E-08	1.17E-05	5.03E-06	4.83E-06	1.68E-04	0.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.06	1.50	2.39E-09	3.08E-10	9.53E-08	4.09E-08	4.78E-07	1.91E-05	0.0%	no observed effects	100	1.32E-09	1.70E-07	2.2%	[B2]
Cadmium	5.23	7.98	1.18E-08	1.52E-09	5.07E-07	2.17E-07	1.18E-05	5.07E-04	1.2%	kidney; proteinuria	10				
Chromium (III)	63.93	68.39	1.44E-07	1.85E-08	4.34E-06	1.86E-06	1.44E-07	4.34E-06	0.0%	no observed effects	100				
Copper	80.12	104.00	1.61E-07	2.32E-08	6.66E-06	2.83E-06	4.68E-06	1.78E-04	0.4%	Gastrointestinal system; irritation	--				[D]
Lead	40.24	47.67	9.07E-08	1.17E-08	3.03E-06	1.30E-06				CNS, blood	--				[B2]
Manganese	701.20	899.50	1.58E-06	2.03E-07	5.71E-05	2.45E-05	1.13E-05	4.08E-04	1.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	130.30	183.40	2.94E-07	3.78E-08	1.16E-05	4.99E-06	9.79E-04	3.88E-02	92.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	41.12	54.24	9.27E-08	1.19E-08	3.44E-06	1.48E-06	4.64E-06	1.72E-04	0.4%	dec. body and organ weight	300				
Selenium	8.25	9.89	1.86E-08	2.39E-09	6.27E-07	2.69E-07	3.72E-06	1.25E-04	0.3%	whole body; clinical selenosis	3				[D]
Silver	4.25	6.11	9.59E-09	1.23E-09	3.88E-07	1.66E-07	1.92E-06	7.75E-05	0.2%	skin; argyria	3				[D]
Zinc	66.11	73.45	1.49E-07	1.92E-08	4.66E-06	2.00E-06	4.97E-07	1.55E-05	0.0%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.17	0.26	3.78E-09	4.86E-10	1.64E-07	7.05E-08				--	--	3.74E-09	5.43E-07	6.9%	[B2]
Aroclor-1260	1.01	1.52	2.28E-08	2.93E-09	9.67E-07	4.14E-07				--	--	2.26E-08	3.19E-06	40.7%	[B2]
Benzo(a)anthracene	0.80	1.16	1.80E-08	2.31E-09	7.38E-07	3.16E-07	5.99E-07	2.46E-05	0.1%	--	--	1.69E-09	2.38E-07	2.9%	[B2]
Benzo(a)pyrene	0.73	1.05	1.65E-08	2.12E-09	6.63E-07	2.84E-07	5.49E-07	2.21E-05	0.1%	--	--	1.55E-08	2.07E-06	26.3%	[B2]
Benzo(b)fluoranthene	1.01	1.42	2.28E-08	2.93E-09	9.00E-07	3.86E-07	7.59E-07	3.00E-05	0.1%	--	--	2.14E-09	2.82E-07	3.6%	[B2]
Benzo(k)fluoranthene	0.81	1.13	1.83E-08	2.35E-09	7.15E-07	3.07E-07	6.10E-07	2.38E-05	0.1%	--	--	1.72E-09	2.24E-07	2.9%	[B2]
Chrysene	0.79	1.15	1.77E-08	2.28E-09	7.32E-07	3.14E-07	5.90E-07	2.44E-05	0.1%	--	--	1.66E-10	2.29E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.25	0.32	5.58E-09	7.16E-10	2.05E-07	8.80E-08	1.86E-07	6.84E-06	0.0%	--	--	5.24E-09	6.42E-07	8.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.48	0.64	1.08E-08	1.39E-09	4.09E-07	1.75E-07	3.60E-07	1.33E-05	0.0%	--	--	1.01E-09	1.28E-07	1.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.07E-03	4.21E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.83E-08	7.84E-06	100.0%	

Table M.16. Risk characterization for soils: children – dermal exposure (current land use – open) – Area S1–C1–O

Chemical	MLE Concentration (o.soil)	RME Concentration (o.soil)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	1.11	1.37	2.5E-09	1.1E-10	9.3E-08	1.2E-08	6.4E-06	2.3E-04	0.5%	whole body, blood; inc. mortality	1000				
Arsenic	6.31	6.87	1.4E-08	6.2E-10	4.6E-07	6.0E-08	4.8E-05	1.5E-03	3.5%	skin; keratosis, hyperpigmentation	3	1.1E-09	1.0E-07	4.2%	[A]
Barium	150.10	185.00	3.4E-07	1.4E-08	1.2E-05	1.6E-06	4.9E-06	1.8E-04	0.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.06	1.50	2.4E-09	1.0E-10	1.0E-07	1.3E-08	4.9E-07	2.0E-05	0.0%	no observed effects	100	4.5E-10	5.6E-08	2.2%	[B2]
Cadmium	5.23	7.98	1.2E-08	5.2E-10	5.4E-07	7.0E-08	1.2E-05	5.4E-04	1.2%	kidney; proteinuria	10				
Chromium (III)	63.93	68.39	1.4E-07	6.3E-09	4.6E-06	6.0E-07	1.4E-07	4.6E-06	0.0%	no observed effects	100				
Copper	80.12	104.00	1.8E-07	7.9E-09	7.1E-06	9.1E-07	5.0E-06	1.9E-04	0.4%	Gastrointestinal system; irritation	--				[D]
Lead	40.24	47.67	9.3E-08	4.0E-09	3.2E-06	4.1E-07				CNS, blood	--				[B2]
Manganese	701.20	899.50	1.6E-06	6.9E-08	6.1E-05	7.9E-06	1.1E-05	4.3E-04	1.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	130.30	183.40	3.0E-07	1.3E-08	1.2E-05	1.6E-06	1.0E-03	4.1E-02	92.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	41.12	54.24	9.5E-08	4.0E-09	3.7E-06	4.7E-07	4.7E-06	1.8E-04	0.4%	dec. body and organ weight	300				
Selenium	8.25	9.89	1.9E-08	8.2E-10	6.7E-07	8.6E-08	3.8E-06	1.3E-04	0.3%	whole body; clinical selenosis	3				[D]
Silver	4.25	6.11	9.8E-09	4.2E-10	4.1E-07	5.3E-08	1.9E-06	8.3E-05	0.2%	skin; argyria	3				[D]
Zinc	66.11	73.45	1.5E-07	6.5E-09	5.0E-06	6.4E-07	5.1E-07	1.6E-05	0.0%	blood; anemia	3				
ORGANICS (mg/kg)															
Aroclor-1254	0.17	0.26	3.8E-09	1.6E-10	1.7E-07	2.2E-08				--	--	1.2E-09	1.7E-07	6.9%	[B2]
Aroclor-1260	1.01	1.52	2.3E-08	1.0E-09	1.0E-06	1.3E-07				--	--	7.7E-09	1.0E-06	40.7%	[B2]
Benzo(a)anthracene	0.80	1.16	1.8E-08	7.9E-10	7.9E-07	1.0E-07	6.1E-07	2.6E-05	0.1%	--	--	5.7E-10	7.4E-08	2.9%	[B2]
Benzo(a)pyrene	0.73	1.05	1.7E-08	7.2E-10	7.1E-07	9.1E-08	5.6E-07	2.3E-05	0.1%	--	--	5.3E-09	6.7E-07	26.5%	[B2]
Benzo(b)fluoranthene	1.01	1.42	2.3E-08	1.0E-09	9.6E-07	1.2E-07	7.8E-07	3.2E-05	0.1%	--	--	7.3E-10	9.0E-08	3.6%	[B2]
Benzo(k)fluoranthene	0.81	1.13	1.8E-08	8.0E-10	7.7E-07	9.9E-08	6.2E-07	2.5E-05	0.1%	--	--	5.9E-10	7.2E-08	2.9%	[B2]
Chrysene	0.79	1.15	1.8E-08	7.8E-10	7.8E-07	1.0E-07	6.0E-07	2.6E-05	0.1%	--	--	5.7E-11	7.3E-09	0.3%	[B2]
Dibenzo(a,h)anthracene	0.25	0.32	5.7E-09	2.4E-10	2.2E-07	2.8E-08	1.9E-07	7.3E-06	0.0%	--	--	1.8E-09	2.0E-07	8.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.48	0.64	1.1E-08	4.7E-10	4.4E-07	5.6E-08	3.7E-07	1.4E-05	0.0%	--	--	3.4E-10	4.1E-08	1.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.1E-03	4.5E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.0E-08	2.5E-06	100.0%	

Table M.17. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – open) – Area S1–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Organ	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	7.75E-08	9.96E-09	1.03E-06	4.40E-07	1.1E-06	1.47E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.86E+00	1.32E+01	7.63E-09	9.81E-10	1.25E-07	5.54E-08	7.63E-09	1.25E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.81E-08	2.33E-09	2.14E-07	9.18E-08	4.85E-07	5.79E-06	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.65E+02	4.13E+02	2.63E-07	3.38E-08	4.04E-06	1.73E-06	5.26E-05	8.08E-04	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.62E-09	3.37E-10	3.85E-08	1.65E-08	8.72E-06	1.28E-04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.22E-09	1.06E-09	1.38E-07	5.91E-08	1.17E-06	1.97E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	6.72E-08	8.65E-09	8.85E-07	3.81E-07	2.24E-07	2.96E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	6.08E-09	7.82E-10	7.54E-08	3.23E-08	6.08E-08	7.54E-07	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.27E-11	2.92E-12	2.45E-10	1.05E-10	7.58E-07	8.15E-06	0.8%	liver; lesions, toxicity	1000	4.97E-11	1.78E-09	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	9.30E-09	1.20E-09	1.36E-07	5.81E-08	4.65E-07	6.78E-06	0.7%	liver; weight inc.	1000	1.67E-11	8.13E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.98E-09	5.12E-10	4.59E-08	1.97E-08	3.98E-07	4.59E-06	0.4%	liver; lesions, fattycyst formation	1000	3.12E-12	1.20E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	3.93E-11	5.06E-12	4.83E-10	2.07E-10	7.86E-08	9.67E-07	0.1%	liver; lesions	100	1.72E-12	7.04E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.79E-11	4.87E-12	4.85E-10	2.10E-10	7.58E-07	9.78E-06	0.9%	liver; lesions	100	7.80E-11	3.35E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	3.78E-11	4.87E-12	4.85E-10	2.10E-10	1.26E-07	1.63E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.78E-11	2.29E-12	2.29E-10	9.83E-11	5.93E-08	7.64E-07	0.1%	liver, kidney; toxicity		2.97E-12	1.28E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.11E-11	2.72E-12	2.45E-10	1.05E-10	1.63E-06	1.88E-05	1.8%	liver; inc. relative weight		2.47E-11	9.54E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	4.09E-09	5.26E-10	4.73E-08	2.03E-08	4.09E-07	4.73E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		8.27E-01		3.22E+01						1.32E-11	5.15E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		9.29E-01		3.98E+01						2.68E-11	1.12E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.98E-05	1.04E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.71E-10	7.22E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.92E-11	1.63E-09	100.0%	

Table M.18. Risk characterization for surface water: children – ingestion exposure (swimming)(current land use – open) – Area S1–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) * (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.07E-07	4.59E-09	1.47E-06	1.89E-07	1.53E-06	2.10E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.81E+00	1.32E+01	1.06E-08	4.52E-10	1.85E-07	2.37E-08	1.06E-08	1.85E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.50E-08	1.07E-09	3.06E-07	3.94E-08	6.77E-07	8.27E-06	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	3.64E-07	1.56E-08	5.77E-06	7.42E-07	7.27E-05	1.15E-03	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.62E-09	1.55E-10	5.50E-08	7.07E-09	1.21E-05	1.83E-04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.14E-08	4.87E-10	1.97E-07	2.53E-08	1.62E-06	2.82E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.30E-08	3.99E-09	1.27E-06	1.63E-07	3.10E-07	4.23E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.41E-09	3.60E-10	1.08E-07	1.38E-08	8.41E-08	1.08E-06	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.14E-11	1.35E-12	3.49E-10	4.49E-11	1.05E-06	1.16E-05	0.8%	liver; lesions, toxicity	1000	2.29E-11	7.64E-10	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.29E-08	5.51E-10	1.94E-07	2.49E-08	6.43E-07	9.68E-06	0.7%	liver; weight inc.	1000	7.72E-12	3.48E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.51E-09	2.36E-10	6.55E-08	8.42E-09	5.51E-07	6.55E-06	0.4%	liver; lesions, fatty cyst formation	1000	1.44E-12	5.14E-11	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.44E-11	2.33E-12	6.91E-10	8.88E-11	1.09E-07	1.38E-06	0.1%	liver; lesions	100	7.93E-13	3.02E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.24E-11	2.25E-12	6.99E-10	8.99E-11	1.05E-06	1.40E-05	0.9%	liver; lesions	100	3.59E-11	1.44E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.24E-11	2.24E-12	6.99E-10	8.99E-11	1.75E-07	2.33E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.46E-11	1.05E-12	3.28E-10	4.21E-11	8.20E-08	1.09E-06	0.1%	liver, kidney; toxicity		1.37E-12	5.47E-11	1.8%	[C]
Heptachlor Epoxide	2.10E-02	2.50E-02	2.92E-11	1.25E-12	3.49E-10	4.49E-11	2.25E-06	2.69E-05	1.8%	liver; inc. relative weight		1.14E-11	4.09E-10	13.2%	[B2]
Tetrachloroethylene	4.16E+00	4.84E+00	5.66E-09	2.42E-10	6.76E-08	8.70E-09	5.66E-07	6.76E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		2.76E-01		9.66E+00						4.41E-12	1.55E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		3.10E-01		1.19E+01						8.67E-12	3.35E-10	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.35E-05	1.48E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.16E-11	3.16E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E-11	4.89E-10	100.0%	

Table M.19. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – open) – Area S1–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.00E-09	7.71E-10	1.04E-07	4.47E-08	8.57E-08	1.49E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	5.91E-10	7.60E-11	1.31E-08	5.62E-09	5.91E-10	1.31E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.40E-09	1.80E-10	2.16E-08	9.33E-09	3.79E-08	5.88E-07	0.0%	Gastrointestinal system; irritation					
Manganese (water)	2.69E+02	4.13E+02	2.04E-08	2.62E-09	4.10E-07	1.76E-07	4.07E-06	8.21E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.03E-10	2.61E-11	3.91E-09	1.68E-09	6.76E-07	1.30E-05	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.36E-10	8.18E-11	1.40E-08	6.00E-09	9.09E-08	2.00E-06	0.2%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	5.21E-09	6.69E-10	9.09E-08	3.87E-08	1.74E-08	3.01E-07	0.0%	blood; anemia	3				
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.94E-09	3.78E-10	4.78E-08	2.05E-08	2.94E-08	4.78E-07	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.76E-11	2.26E-12	2.48E-10	1.06E-10	5.87E-07	8.28E-06	0.7%	liver; lesions, toxicity	1000	3.85E-11	1.81E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.48E-07	1.91E-08	2.84E-06	1.22E-06	7.42E-06	1.42E-04	12.0%	liver; weight inc.	1000	2.67E-10	1.70E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.72E-08	2.21E-09	2.59E-07	1.11E-07	1.72E-06	2.59E-05	2.2%	liver; lesions, fatty cyst formation	1000	1.35E-11	6.77E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.18E-09	1.05E-09	1.32E-07	5.65E-08	1.64E-05	2.64E-04	22.3%	liver; lesions	100	3.58E-10	1.92E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	5.87E-06	9.94E-05	8.4%	liver; lesions	100	6.04E-10	3.41E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	9.77E-07	1.66E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.21E-10	1.55E-11	2.04E-09	8.73E-10	4.02E-07	6.79E-06	0.6%	liver, kidney; toxicity		2.01E-11	1.14E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.23E-10	4.15E-11	4.93E-09	2.10E-09	2.49E-05	3.77E-04	31.9%	liver; inc. relative weight		3.78E-10	1.91E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.50E-08	1.22E-08	1.44E-06	6.18E-07	9.50E-06	1.44E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.27E-05	1.18E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.68E-09	9.31E-08	100.0%	

Table M.20. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – open) – Area S1–C1–O

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.18E-09	2.65E-10	1.12E-07	1.44E-08	8.83E-08	1.60E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	6.09E-10	2.61E-11	1.41E-08	1.82E-09	6.09E-10	1.41E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.44E-09	6.19E-11	2.34E-08	3.01E-09	3.90E-08	6.33E-07	0.0%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	2.10E-08	8.99E-10	4.42E-07	5.68E-08	4.20E-06	8.84E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.09E-10	8.95E-12	4.21E-09	5.41E-10	6.98E-07	1.40E-05	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.56E-10	2.81E-11	1.51E-08	1.94E-09	9.37E-08	2.16E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.37E-09	2.30E-10	9.72E-08	1.25E-08	1.79E-08	3.24E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	3.03E-09	1.30E-10	5.15E-08	6.62E-09	3.03E-08	5.15E-07	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.81E-11	7.77E-13	2.67E-10	3.44E-11	6.05E-07	8.92E-06	0.7%	liver; lesions, toxicity	1000	1.32E-11	5.85E-10	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.53E-07	6.56E-09	3.06E-06	3.93E-07	7.65E-06	1.53E-04	12.0%	liver; weight inc.	1000	9.18E-11	5.50E-09	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.77E-08	7.58E-10	2.79E-07	3.59E-08	1.77E-06	2.79E-05	2.2%	liver; lesions, fatty cyst formation	1000	4.62E-12	2.19E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	6.43E-09	3.66E-10	1.42E-07	1.83E-08	1.69E-05	2.84E-04	22.3%	liver; lesions	100	1.23E-10	6.21E-09	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.02E-10	1.30E-11	5.35E-09	6.88E-10	6.05E-06	1.07E-04	8.4%	liver; lesions	100	2.07E-10	1.10E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	3.02E-10	1.29E-11	5.35E-09	6.88E-10	1.01E-06	1.78E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.62E-02	2.34E-02	1.24E-10	5.32E-12	2.19E-09	2.82E-10	4.14E-07	7.31E-06	0.6%	liver, kidney; toxicity		6.92E-12	3.67E-10	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.33E-10	1.43E-11	5.28E-09	6.79E-10	2.56E-05	4.08E-04	31.9%	liver; inc. relative weight		1.30E-10	6.18E-09	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.79E-08	4.20E-09	1.55E-06	2.00E-07	9.79E-06	1.55E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.49E-05	1.28E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.77E-10	3.01E-08	100.0%	

Table M.21. Risk characterization for sediments: adults – dermal exposure (current land use – open) – Area S1–C1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.07E-10	1.37E-11	4.51E-09	1.93E-09	3.56E-07	1.50E-05	16.3%	skin; keratosis, hyperpigmentation	3	2.41E-11	3.38E-09	8.7%	[A]
Barium	78.13	88.46	1.83E-09	2.31E-10	7.56E-08	3.24E-08	2.62E-08	1.08E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.15E-11	2.71E-12	8.77E-10	3.76E-10	4.30E-09	1.75E-07	0.2%	no observed effects	100	1.19E-11	1.62E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.33E-11	4.28E-12	1.46E-09	6.27E-10	3.33E-08	1.46E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.12E-09	1.44E-10	4.71E-08	2.02E-08	1.12E-09	4.71E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.63E-10	7.24E-11	2.55E-08	1.09E-08	1.52E-08	6.90E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.24E-09	1.60E-10	8.51E-08	3.65E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.08E-08	2.68E-09	8.86E-07	3.80E-07	1.49E-07	6.33E-06	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.51E-10	4.51E-11	1.75E-08	7.50E-09	1.17E-06	5.83E-05	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.43E-10	6.99E-11	2.37E-08	1.02E-08	2.72E-08	1.18E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.82E-10	8.77E-11	2.89E-08	1.24E-08	9.74E-08	4.12E-06	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.28E-09	2.93E-10	1.03E-07	4.43E-08	7.60E-09	3.44E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.42E-11	3.11E-12	1.40E-09	5.99E-10				--	--	2.40E-11	4.61E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.90E-11	2.44E-12	1.19E-09	5.08E-10				--	--	1.88E-11	3.91E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.64E-11	9.82E-12	4.42E-09	1.90E-09	2.55E-09	1.47E-07	0.2%	--	--	7.17E-12	1.38E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.40E-11	9.52E-12	4.15E-09	1.78E-09	2.47E-09	1.38E-07	0.2%	--	--	6.95E-11	1.30E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.60E-11	1.11E-11	4.97E-09	2.13E-09	2.93E-09	1.66E-07	0.2%	--	--	8.26E-12	1.55E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.21E-11	9.27E-12	3.39E-09	1.45E-09	2.40E-09	1.13E-07	0.1%	--	--	6.77E-12	1.06E-09	2.7%	[B2]
Chrysene	0.31	0.49	7.26E-11	9.34E-12	4.20E-09	1.80E-09	2.42E-09	1.40E-07	0.2%	--	--	6.82E-13	1.31E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.15E-11	6.63E-12	2.06E-09	8.85E-10	1.72E-09	6.88E-08	0.1%	--	--	4.84E-11	6.46E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.80E-12	2.32E-13	1.16E-10	4.95E-11	3.60E-08	2.31E-06	2.5%	liver; lesions	100	3.71E-12	7.92E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.47E-11	8.32E-12	3.24E-09	1.39E-09	2.16E-09	1.08E-07	0.1%	--	--	6.07E-12	1.01E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.94E-06	9.19E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.29E-10	3.89E-08	100.0%	

Table M.22. Risk characterization for sediments: children — dermal exposure (current land use — open) — Area S1–C1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.1E-10	4.7E-12	4.8E-09	6.2E-10	3.6E-07	1.6E-05	16.3%	skin; keratosis, hyperpigmentation	3	8.2E-12	1.0E-09	8.7%	[A]
Barium	78.13	88.46	1.8E-09	8.1E-11	8.1E-08	1.0E-08	2.7E-08	1.1E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.2E-11	9.4E-13	9.4E-10	1.2E-10	4.4E-09	1.8E-07	0.2%	no observed effects	100	4.0E-12	5.2E-10	4.2%	[B2]
Cadmium	1.42	1.71	3.4E-11	1.4E-12	1.5E-09	2.0E-10	3.4E-08	1.5E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.01	1.1E-09	4.9E-11	5.0E-08	6.5E-09	1.1E-09	5.0E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.8E-10	2.4E-11	2.7E-08	3.5E-09	1.5E-08	7.4E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.2E-09	5.4E-11	9.1E-08	1.1E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.1E-08	9.1E-10	9.5E-07	1.2E-07	1.5E-07	6.8E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.6E-10	1.5E-11	1.8E-08	2.4E-09	1.2E-06	6.2E-05	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.6E-10	2.4E-11	2.5E-08	3.2E-09	2.8E-08	1.2E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	7.0E-10	3.0E-11	3.1E-08	3.9E-09	1.0E-07	4.4E-06	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.3E-09	1.0E-10	1.1E-07	1.4E-08	7.8E-09	3.7E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.5E-11	1.0E-12	1.5E-09	1.9E-10				--	--	8.2E-12	1.4E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.9E-11	8.3E-13	1.2E-09	1.6E-10				--	--	6.4E-12	1.2E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.8E-11	3.3E-12	4.7E-09	6.1E-10	2.6E-09	1.5E-07	0.2%	--	--	2.4E-12	4.4E-10	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.6E-11	3.2E-12	4.4E-09	5.7E-10	2.5E-09	1.4E-07	0.2%	--	--	2.3E-11	4.1E-09	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	9.0E-11	3.8E-12	5.3E-09	6.8E-10	3.0E-09	1.7E-07	0.2%	--	--	2.8E-12	5.0E-10	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.4E-11	3.1E-12	3.6E-09	4.6E-10	2.4E-09	1.2E-07	0.1%	--	--	2.3E-12	3.4E-10	2.7%	[B2]
Chrysene	0.31	0.49	7.4E-11	3.2E-12	4.5E-09	5.8E-10	2.4E-09	1.5E-07	0.2%	--	--	2.3E-13	4.2E-11	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.3E-11	2.2E-12	2.2E-09	2.8E-10	1.7E-09	7.4E-08	0.1%	--	--	1.6E-11	2.0E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.8E-12	7.9E-14	1.2E-10	1.6E-11	3.7E-08	2.4E-06	2.5%	liver; lesions	100	1.2E-12	2.5E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.6E-11	2.8E-12	3.4E-09	4.4E-10	2.2E-09	1.1E-07	0.1%	--	--	2.0E-12	3.2E-10	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.0E-06	9.9E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.8E-11	1.2E-08	100.0%	

Table M.23. Risk characterization summary for EFPC Segment 1: RME estimates for future land use

MEDIA	ROUTE	AGRICULTURAL LAND USE: NONCANCER CHILD	AGRICULTURAL LAND USE: NONCANCER ADULT	AGRICULTURAL LAND USE: CANCER CHILD	AGRICULTURAL LAND USE: CANCER ADULT	AGRICULTURAL LAND USE: RADIONUCLIDES (CANCER ONLY) CHILD	AGRICULTURAL LAND USE: RADIONUCLIDES (CANCER ONLY) ADULT	COMMERCIAL LAND USE: NONCANCER CHILD	COMMERCIAL LAND USE: NONCANCER ADULT	COMMERCIAL LAND USE: CANCER CHILD	COMMERCIAL LAND USE: CANCER ADULT	COMMERCIAL LAND USE: RADIONUCLIDES (CANCER ONLY) CHILD	COMMERCIAL LAND USE: RADIONUCLIDES (CANCER ONLY) ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	9.89E+00 *B*	NA	7.61E−05 W	NA	7.00E−06 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index: Combined Exposure		NA	NA					NA	9.9E+00 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	8E−05 W		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	7E−06 W

MEDIA	ROUTE	OPEN LAND USE: NONCANCER CHILD	OPEN LAND USE: NONCANCER ADULT	OPEN LAND USE: CANCER CHILD	OPEN LAND USE: CANCER ADULT	OPEN LAND USE: RADIONUCLIDES (CANCER ONLY) CHILD	OPEN LAND USE: RADIONUCLIDES (CANCER ONLY) ADULT	RESIDENTIAL LAND USE: NONCANCER CHILD	RESIDENTIAL LAND USE: NONCANCER ADULT	RESIDENTIAL LAND USE: CANCER CHILD	RESIDENTIAL LAND USE: CANCER ADULT	RESIDENTIAL LAND USE: RADIONUCLIDES (CANCER ONLY) CHILD	RESIDENTIAL LAND USE: RADIONUCLIDES (CANCER ONLY) ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	3.24E+00 *B*	9.05E−01 B	2.87E−05 W	2.67E−05 W	2.70E−07 B	6.77E−07 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.28E−01 B	9.82E−02 B	7.18E−06 W	1.83E−05 W	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	3.28E+01 *B*	2.77E+01 *B*	9.08E−05 W	2.56E−04 *B*	3.10E−06 W	2.35E−05 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	7.30E−04 B	1.61E−04 B	1.33E−07 B	9.78E−08 B	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	2.79E+02 *B*	1.35E+02 *B*	1.91E−04 *B*	3.07E−04 *B*	3.26E−07 B	1.41E−06 W
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index: Combined Exposure		NA	NA					3.2E+02 *B*	1.6E+02 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					4E−04 *B*	7E−04 *B*		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					4E−06 W	3E−05 W

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR> 1 x 10^{-6} and < 1 x 10^{-4})
E – exceeds EPA target for noncancer hazard index (HI>1), or cancer risk (ELCR< 1 x 10^{-4})

Table M.24. Human health risk characterization summary for EFPC residential scenario: future land use, Area S1–F1–R adult long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	2.01E–01	9.05E–01	1.86E–06	2.67E–05
Dermal Contact	7.25E–03	9.82E–02	3.93E–07	1.83E–05
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion	1.58E+01	2.77E+01	3.84E–05	2.56E–04
Inhalation (VOCs)	4.01E–05	1.61E–04	7.30E–09	9.78E–08
FOOD CHAIN				
Produce	2.09E+01	1.35E+02	1.82E–05	3.07E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			5.51E–08	6.77E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion			3.59E–06	2.35E–05
FOOD CHAIN				
Produce			6.14E–08	1.41E–06
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	3.7E+01	1.6E+02		
Excess Lifetime Cancer Risk: Combined Exposure			6E–05	7E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			4E–06	3E–05

Table M.25. Human health risk characterization summary for EFPC residential scenario: future land use, Area S1–F1–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	7.03E–01	3.24E+00	2.16E–06	2.87E–05
Dermal Contact	9.45E–03	1.28E–01	1.71E–07	7.18E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion	1.65E+01	3.28E+01	1.33E–05	9.08E–05
Inhalation (VOCs)	2.34E–04	7.30E–04	1.42E–08	1.33E–07
FOOD CHAIN				
Produce	4.68E+01	2.79E+02	1.36E–05	1.91E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.30E–08	2.70E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion			4.45E–07	3.10E–06
FOOD CHAIN				
Produce			1.63E–08	3.26E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	6.4E+01	3.2E+02		
Excess Lifetime Cancer Risk: Combined Exposure			3E–05	4E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–07	4E–06

Table M.26. Human health risk characterization summary: EFPC commercial scenario: future land use, Area S1–F2–C adult long term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion				
Dermal Contact				
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion	5.66E+00	9.89E+00	1.37E–05	7.61E–05
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion				
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion			1.28E–06	7.00E–06
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.66E+00	9.89E+00		
Excess Lifetime Cancer Risk: Combined Exposure			1.37E–05	7.61E–05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1.28E–06	7.00E–06

Table M.27. Risk characterization for soils: adults – ingestion exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration (6.86E1)	RME Concentration (6.86E1)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	1.11	1.37	4.69E-07	6.03E-08	1.86E-06	8.05E-07	1.17E-03	4.70E-03	0.5%	whole body, blood; inc. mortality	1000				
Arsenic	6.31	6.87	2.67E-06	3.43E-07	9.41E-06	4.03E-06	8.89E-03	3.14E-02	3.5%	skin; keratosis, hyperpigmentation	3	6.00E-07	7.06E-06	26.4%	[A]
Barium	150.10	185.00	6.34E-05	8.16E-06	2.53E-04	1.09E-04	9.06E-04	3.62E-03	0.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.06	1.50	4.46E-07	5.77E-08	2.06E-06	8.82E-07	8.97E-05	4.12E-04	0.0%	no observed effects	100	2.46E-07	3.79E-06	14.2%	[B2]
Cadmium	5.23	7.98	2.21E-06	2.84E-07	1.09E-05	4.69E-06	2.21E-03	1.09E-02	1.2%	kidney; proteinuria	10				
Chromium (III)	63.93	68.39	2.70E-05	3.47E-06	9.37E-05	4.02E-05	2.70E-05	9.37E-05	0.0%	no observed effects	100				
Copper	80.12	104.00	3.39E-05	4.35E-06	1.42E-04	6.11E-05	9.15E-04	3.85E-03	0.4%	Gastrointestinal system; irritation	--				[D]
Lead	40.24	47.67	1.70E-05	2.19E-06	6.53E-05	2.80E-05				CNS, blood	--				[B2]
Manganese	701.20	899.50	2.96E-04	3.81E-05	1.23E-03	5.28E-04	2.12E-03	8.80E-03	1.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	130.30	183.40	5.51E-05	7.08E-06	2.51E-04	1.08E-04	1.84E-01	8.37E-01	92.5%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	41.12	54.24	1.74E-05	2.23E-06	7.43E-05	3.18E-05	8.69E-04	3.72E-03	0.4%	dec. body and organ weight	300				
Selenium	8.25	9.89	3.49E-06	4.48E-07	1.35E-05	5.80E-06	6.97E-04	2.71E-03	0.3%	whole body; clinical selenosis	3				[D]
Silver	4.25	6.11	1.80E-06	2.31E-07	8.37E-06	3.59E-06	3.60E-04	1.67E-03	0.2%	skin; argyria	3				[D]
Zinc	66.11	73.45	2.79E-05	3.59E-06	1.01E-04	4.31E-05	9.31E-05	3.35E-04	0.0%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.17	0.26	7.08E-08	9.10E-09	3.55E-07	1.52E-07				--	--	7.01E-08	1.17E-06	4.4%	[B2]
Aroclor-1260	1.01	1.52	4.27E-07	5.49E-08	2.09E-06	8.94E-07				--	--	4.23E-07	6.88E-06	25.8%	[B2]
Benzo(a)anthracene	0.80	1.16	3.37E-07	4.33E-08	1.59E-06	6.88E-07	1.12E-05	5.31E-05	0.0%	--	--	3.16E-08	4.98E-07	1.9%	[B2]
Benzo(a)pyrene	0.73	1.05	3.09E-07	3.97E-08	1.43E-06	6.14E-07	1.03E-05	4.77E-05	0.0%	--	--	2.90E-07	4.48E-06	16.8%	[B2]
Benzo(b)fluoranthene	1.01	1.42	4.27E-07	5.49E-08	1.94E-06	8.32E-07	1.42E-05	6.47E-05	0.0%	--	--	4.01E-08	6.08E-07	2.3%	[B2]
Benzo(k)fluoranthene	0.81	1.13	3.43E-07	4.41E-08	1.54E-06	6.62E-07	1.14E-05	5.15E-05	0.0%	--	--	3.22E-08	4.83E-07	1.8%	[B2]
Chrysene	0.79	1.15	3.32E-07	4.27E-08	1.58E-06	6.77E-07	1.11E-05	5.26E-05	0.0%	--	--	3.12E-09	4.94E-08	0.2%	[B2]
Dibenzo(a,h)anthracene	0.25	0.32	1.05E-07	1.35E-08	4.43E-07	1.90E-07	3.49E-06	1.48E-05	0.0%	--	--	9.82E-08	1.39E-06	5.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.48	0.64	2.03E-07	2.60E-08	8.83E-07	3.79E-07	6.75E-06	2.94E-05	0.0%	--	--	1.90E-08	2.70E-07	1.0%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.15	1.96		1.12E+02		2.06E+03						3.12E-09	5.70E-08	8.5%	[A]
Cobalt 60	0.01	0.02		5.44E-01		1.92E+01						8.16E-12	2.87E-10	0.0%	[A]
Neptunium 237+D	0.01	0.02		5.35E-01		1.65E+01						1.18E-10	3.63E-09	0.5%	[A]
Protactinium 233		0.06				6.35E+01							6.35E-11	0.0%	[A]
Thorium 228+D	2.54	2.54		2.47E+02		2.67E+03						1.36E-08	1.47E-07	21.7%	[A]
Thorium 230	4.58	4.58		4.45E+02		4.80E+03						5.78E-09	6.25E-08	9.2%	[A]
Thorium 232	1.90	1.90		1.84E+02		1.99E+03						2.21E-09	2.39E-08	3.5%	[A]
Uranium 234	6.57	7.72		6.39E+02		8.11E+03						1.02E-08	1.30E-07	19.2%	[A]
Uranium 235+D	0.33	0.39		3.20E+01		4.10E+02						5.12E-10	6.57E-09	1.0%	[A]
Uranium 238+D	7.19	8.35		6.99E+02		8.77E+03						1.96E-08	2.40E-07	36.3%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	2.0E-01	9.0E-01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.8E-06	2.67E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	3.5E-08	6.71E-07	100.0%

Table M.28. Risk characterization for soils: children – ingestion exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	1.11	1.37	1.6E-06	7.0E-08	6.7E-06	8.6E-07	4.1E-03	1.6E-02	0.5%	whole body, blood; inc. mortality	1000				
Arsenic	6.31	6.87	9.3E-06	4.0E-07	3.3E-05	4.3E-06	3.1E-02	1.1E-01	3.5%	skin; keratosis, hyperpigmentation	3	7.0E-07	7.5E-06	26.4%	[A]
Barium	150.10	185.00	2.2E-04	9.5E-06	9.0E-04	1.1E-04	3.1E-03	1.3E-02	0.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.06	1.50	1.5E-06	6.7E-08	7.3E-06	9.4E-07	3.1E-04	1.4E-03	0.0%	no observed effects	100	2.8E-07	4.0E-06	14.2%	[B2]
Cadmium	5.23	7.98	7.7E-06	3.3E-07	3.9E-05	5.0E-06	7.7E-03	3.9E-02	1.2%	kidney; proteinuria	10				
Chromium (III)	63.93	68.39	9.4E-05	4.0E-06	3.3E-04	4.3E-05	9.4E-05	3.3E-04	0.0%	no observed effects	100				
Copper	80.12	104.00	1.1E-04	5.0E-06	5.1E-04	6.5E-05	3.2E-03	1.3E-02	0.4%	Gastrointestinal system; irritation	--				[D]
Lead	40.24	47.67	5.9E-05	2.5E-06	2.3E-04	3.0E-05				CNS, blood	--				[B2]
Manganese	701.20	899.50	1.0E-03	4.4E-05	4.4E-03	5.6E-04	7.4E-03	3.1E-02	1.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	130.30	183.40	1.9E-04	8.2E-06	9.0E-04	1.1E-04	6.4E-01	3.0E+00	92.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	41.12	54.24	6.0E-05	2.6E-06	2.6E-04	3.4E-05	3.0E-03	1.3E-02	0.4%	dec. body and organ weight	300				
Selenium	8.25	9.89	1.2E-05	5.2E-07	4.8E-05	6.2E-06	2.4E-03	9.7E-03	0.3%	whole body; clinical selenosis	3				[D]
Silver	4.25	6.11	6.2E-06	2.7E-07	3.0E-05	3.8E-06	1.2E-03	5.9E-03	0.2%	skin; argyria	3				[D]
Zinc	66.11	73.45	9.7E-05	4.1E-06	3.6E-04	4.6E-05	3.2E-04	1.2E-03	0.0%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.17	0.26	2.4E-07	1.0E-08	1.2E-06	1.6E-07				--	--	8.1E-08	1.2E-06	4.4%	[B2]
Aroclor–1260	1.01	1.52	1.5E-06	6.4E-08	7.4E-06	9.6E-07				--	--	4.9E-07	7.4E-06	25.8%	[B2]
Benzo(a)anthracene	0.80	1.16	1.1E-06	5.0E-08	5.7E-06	7.3E-07	3.9E-05	1.9E-04	0.0%	--	--	3.6E-08	5.3E-07	1.9%	[B2]
Benzo(a)pyrene	0.73	1.05	1.0E-06	4.6E-08	5.1E-06	6.5E-07	3.6E-05	1.7E-04	0.0%	--	--	3.3E-07	4.8E-06	16.8%	[B2]
Benzo(b)fluoranthene	1.01	1.42	1.4E-06	6.4E-08	6.9E-06	8.9E-07	4.9E-05	2.3E-04	0.0%	--	--	4.6E-08	6.5E-07	2.3%	[B2]
Benzo(k)fluoranthene	0.81	1.13	1.2E-06	5.1E-08	5.5E-06	7.1E-07	4.0E-05	1.8E-04	0.0%	--	--	3.7E-08	5.1E-07	1.8%	[B2]
Chrysene	0.79	1.15	1.1E-06	4.9E-08	5.6E-06	7.2E-07	3.8E-05	1.8E-04	0.0%	--	--	3.6E-09	5.3E-08	0.2%	[B2]
Dibenzo(a,h)anthracene	0.25	0.32	3.6E-07	1.5E-08	1.5E-06	2.0E-07	1.2E-05	5.2E-05	0.0%	--	--	1.1E-07	1.4E-06	5.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.48	0.64	7.0E-07	3.0E-08	3.1E-06	4.0E-07	2.3E-05	1.0E-04	0.0%	--	--	2.2E-08	2.9E-07	1.0%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.15	1.96		4.6E+01		8.2E+02						1.3E-09	2.3E-08	8.5%	[A]
Cobalt 60	0.01	0.02		2.2E-01		7.6E+00						3.4E-12	1.1E-10	0.0%	[A]
Neptunium 237+D	0.01	0.02		2.2E-01		6.5E+00						4.9E-11	1.4E-09	0.5%	[A]
Protactinium 233		0.06				2.5E+01							2.5E-11	0.0%	[A]
Thorium 228+D	2.54	2.54		1.0E+02		1.0E+03						5.6E-09	5.8E-08	21.7%	[A]
Thorium 230	4.58	4.58		1.8E+02		1.9E+03						2.4E-09	2.4E-08	9.2%	[A]
Thorium 232	1.90	1.90		7.6E+01		7.9E+02						9.2E-10	9.5E-09	3.5%	[A]
Uranium 234	6.57	7.72		2.6E+02		3.2E+03						4.2E-09	5.1E-08	19.2%	[A]
Uranium 235+D	0.33	0.39		1.3E+01		1.6E+02						2.1E-10	2.6E-09	1.0%	[A]
Uranium 238+D	7.19	8.35		2.9E+02		3.5E+03						8.1E-09	9.8E-08	36.3%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.0E-01	3.2E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.1E-06	2.8E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												2.3E-08	2.7E-07	100.0%	

Table M.29. Risk characterization for soils: adults – dermal exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	1.11	1.37	1.69E-08	2.17E-09	2.03E-07	8.70E-08	4.22E-05	5.08E-04	0.5%	whole body, blood; inc. mortality	1000				
Arsenic	6.31	6.87	9.60E-08	1.23E-08	1.02E-06	4.36E-07	3.20E-04	3.39E-03	3.5%	skin; keratosis, hyperpigmentation	3	2.16E-08	7.63E-07	4.2%	[A]
Barium	150.10	185.00	2.28E-06	2.94E-07	2.74E-05	1.17E-05	3.26E-05	3.91E-04	0.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.06	1.50	1.61E-08	2.08E-09	2.22E-07	9.53E-08	3.23E-06	4.45E-05	0.0%	no observed effects	100	8.93E-09	4.10E-07	2.2%	[B2]
Cadmium	5.23	7.98	7.96E-08	1.02E-08	1.18E-06	5.07E-07	7.96E-05	1.18E-03	1.2%	kidney; proteinuria	10				
Chromium (III)	63.93	68.39	9.73E-07	1.25E-07	1.01E-05	4.34E-06	9.73E-07	1.01E-05	0.0%	no observed effects	100				
Copper	80.12	104.00	1.22E-06	1.57E-07	1.54E-05	6.60E-06	3.30E-05	4.16E-04	0.4%	Gastrointestinal system; irritation	--				[D]
Lead	40.24	47.67	6.12E-07	7.87E-08	7.06E-06	3.03E-06				CNS, blood	--				[B2]
Manganese	701.20	899.50	1.07E-05	1.37E-06	1.33E-04	5.71E-05	7.62E-05	9.51E-04	1.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	130.30	183.40	1.98E-06	2.55E-07	2.72E-05	1.16E-05	6.61E-03	9.05E-02	92.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	41.12	54.24	6.26E-07	8.05E-08	8.03E-06	3.44E-06	3.13E-05	4.02E-04	0.4%	dec. body and organ weight	300				
Selenium	8.25	9.89	1.25E-07	1.61E-08	1.46E-06	6.27E-07	2.51E-05	2.93E-04	0.3%	whole body; clinical selenosis	3				[D]
Silver	4.25	6.11	6.47E-08	8.32E-09	9.04E-07	3.88E-07	1.29E-05	1.81E-04	0.2%	skin; argyria	3				[D]
Zinc	66.11	73.45	1.01E-06	1.29E-07	1.09E-05	4.66E-06	3.35E-06	3.63E-05	0.0%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.17	0.26	2.55E-08	3.28E-09	3.84E-07	1.64E-07				--	--	2.52E-08	1.27E-06	6.9%	[B2]
Aroclor-1260	1.01	1.52	1.54E-07	1.98E-08	2.26E-06	9.67E-07				--	--	1.52E-07	7.44E-06	40.7%	[B2]
Benzo(a)anthracene	0.80	1.16	1.21E-07	1.56E-08	1.72E-06	7.38E-07	4.04E-06	5.74E-05	0.1%	--	--	1.14E-08	5.39E-07	2.9%	[B2]
Benzo(a)pyrene	0.73	1.05	1.11E-07	1.43E-08	1.55E-06	6.65E-07	3.70E-06	5.16E-05	0.1%	--	--	1.04E-07	4.84E-06	26.5%	[B2]
Benzo(b)fluoranthene	1.01	1.42	1.54E-07	1.98E-08	2.10E-06	9.00E-07	5.12E-06	7.00E-05	0.1%	--	--	1.44E-08	6.57E-07	3.6%	[B2]
Benzo(k)fluoranthene	0.81	1.15	1.24E-07	1.59E-08	1.67E-06	7.15E-07	4.12E-06	5.56E-05	0.1%	--	--	1.16E-08	5.22E-07	2.9%	[B2]
Chrysene	0.79	1.15	1.20E-07	1.54E-08	1.71E-06	7.32E-07	3.98E-06	5.69E-05	0.1%	--	--	1.12E-09	5.34E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.25	0.32	3.77E-08	4.84E-09	4.79E-07	2.05E-07	1.26E-06	1.60E-05	0.0%	--	--	3.54E-08	1.50E-06	8.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.48	0.64	7.24E-08	9.37E-09	9.55E-07	4.09E-07	2.43E-06	3.18E-05	0.0%	--	--	6.84E-09	2.99E-07	1.6%	[B2]
Chemical Hazards:															
Hazard Index (HI):							7.25E-03	9.82E-02	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												3.93E-07	1.83E-05	100.0%	

Table M.30. Risk characterization for soils: children – dermal exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration to Soils	RME Concentration to Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Antimony	1.11	1.37	2.2E-08	9.4E-10	2.6E-07	3.4E-08	5.5E-05	6.6E-04	0.5%	whole body, blood; inc. mortality	1000				
Arsenic	6.31	6.87	1.2E-07	5.3E-09	1.3E-06	1.7E-07	4.1E-04	4.4E-03	3.5%	skin; keratosis, hyperpigmentation	3	9.3E-09	2.9E-07	4.2%	[A]
Barium	150.10	185.00	2.9E-06	1.2E-07	3.5E-05	4.6E-06	4.2E-05	5.1E-04	0.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.06	1.50	2.1E-08	9.0E-10	2.9E-07	3.7E-08	4.2E-06	5.8E-05	0.0%	no observed effects	100	3.8E-09	1.6E-07	2.2%	[B2]
Cadmium	5.23	7.98	1.0E-07	4.4E-09	1.5E-06	1.9E-07	1.0E-04	1.5E-03	1.2%	kidney; proteinuria	10				
Chromium (III)	63.93	68.39	1.2E-06	5.4E-08	1.3E-05	1.7E-06	1.2E-06	1.3E-05	0.0%	no observed effects	100				
Copper	80.12	104.00	1.5E-06	6.8E-08	2.0E-05	2.5E-06	4.2E-05	5.4E-04	0.4%	Gastrointestinal system; irritation	--				[D]
Lead	40.24	47.67	7.9E-07	3.4E-08	9.2E-06	1.1E-06				CNS, blood	--				[B2]
Manganese	701.20	899.50	1.3E-05	5.9E-07	1.7E-04	2.2E-05	9.9E-05	1.2E-03	1.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	130.30	183.40	2.5E-06	1.1E-07	3.5E-05	4.5E-06	8.6E-03	1.1E-01	92.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	41.12	54.24	8.1E-07	3.5E-08	1.0E-05	1.3E-06	4.0E-05	5.2E-04	0.4%	dec. body and organ weight	300				
Selenium	8.25	9.89	1.6E-07	7.0E-09	1.9E-06	2.4E-07	3.2E-05	3.8E-04	0.3%	whole body; clinical selenosis	3				[D]
Silver	4.25	6.11	8.4E-08	3.6E-09	1.1E-06	1.5E-07	1.6E-05	2.3E-04	0.2%	skin; argyria	3				[D]
Zinc	66.11	73.45	1.3E-06	5.6E-08	1.4E-05	1.8E-06	4.3E-06	4.7E-05	0.0%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.17	0.26	3.3E-08	1.4E-09	5.0E-07	6.4E-08				--	--	1.1E-08	4.9E-07	6.9%	[B2]
Aroclor-1260	1.01	1.52	2.0E-07	8.5E-09	2.9E-06	3.7E-07				--	--	6.6E-08	2.9E-06	40.7%	[B2]
Benzo(a)anthracene	0.80	1.16	1.5E-07	6.7E-09	2.2E-06	2.9E-07	5.2E-06	7.5E-05	0.1%	--	--	4.9E-09	2.1E-07	2.9%	[B2]
Benzo(a)pyrene	0.73	1.05	1.4E-07	6.2E-09	2.0E-06	2.6E-07	4.8E-06	6.7E-05	0.1%	--	--	4.5E-08	1.9E-06	26.5%	[B2]
Benzo(b)fluoranthene	1.01	1.42	2.0E-07	8.5E-09	2.7E-06	3.5E-07	6.6E-06	9.1E-05	0.1%	--	--	6.2E-09	2.5E-07	3.6%	[B2]
Benzo(k)fluoranthene	0.81	1.13	1.6E-07	6.9E-09	2.1E-06	2.8E-07	5.3E-06	7.2E-05	0.1%	--	--	5.0E-09	2.0E-07	2.9%	[B2]
Chrysene	0.79	1.15	1.5E-07	6.6E-09	2.2E-06	2.8E-07	5.1E-06	7.4E-05	0.1%	--	--	4.8E-10	2.1E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.25	0.32	4.9E-08	2.1E-09	6.2E-07	8.0E-08	1.6E-06	2.0E-05	0.0%	--	--	1.5E-08	5.8E-07	8.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.48	0.64	9.5E-08	4.0E-09	1.2E-06	1.6E-07	3.1E-06	4.1E-05	0.0%	--	--	2.9E-09	1.1E-07	1.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.4E-03	1.2E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.7E-07	7.1E-06	100.0%	

Table M.31. Risk characterization for surface water: adults – ingestion exposure (swimming) (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Nonca. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Nonca. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (μg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	3.69E-06	4.73E-07	3.36E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.71E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				[D]
ORGANICS (μg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	[B2]
Chloroform	4.07E+00	4.65E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	0.4%	liver; lesions, fattycyst formation	1000	4.37E-11	9.97E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.86E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.09E-09	2.79E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity		4.16E-11	1.00E-09	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	1.8%	liver; inc. relative weight		3.46E-10	7.94E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.3%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							9.67E-04	8.62E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.48E-09	6.01E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.49E-10	1.36E-08	100.0%	

Table M.32. Risk characterization for surface water: children – ingestion exposure (swimming) (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E-06	1.30E-07	2.30E-05	2.96E-06	4.34E-05	3.29E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E-07	1.28E-08	2.89E-06	3.72E-07	2.99E-07	2.89E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E-07	3.04E-08	4.80E-06	6.17E-07	1.92E-05	1.30E-04	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E-05	4.42E-07	9.05E-05	1.16E-05	2.06E-03	1.81E-02	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E-07	4.40E-09	8.62E-07	1.11E-07	3.42E-04	2.87E-03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E-07	1.38E-08	3.09E-06	3.97E-07	4.60E-05	4.41E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E-06	1.13E-07	1.99E-05	2.56E-06	8.79E-06	6.64E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E-07	1.02E-08	1.69E-06	2.17E-07	2.38E-06	1.69E-05	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	8.91E-10	3.82E-11	5.48E-09	7.05E-10	2.97E-05	1.83E-04	0.8%	liver; lesions, toxicity	1000	6.49E-10	1.20E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E-07	1.56E-08	3.04E-06	3.90E-07	1.82E-05	1.52E-04	0.7%	liver; weight inc.	1000	2.19E-10	5.40E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E-07	6.69E-09	1.03E-06	1.32E-07	1.56E-05	1.03E-04	0.4%	liver; lesions, fattycyst formation	1000	4.08E-11	8.06E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.54E-09	6.61E-11	1.08E-08	1.39E-09	3.08E-06	2.17E-05	0.1%	liver; lesions	100	2.25E-11	4.73E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	1.49E-09	6.37E-11	1.10E-08	1.41E-09	2.97E-05	2.19E-04	0.9%	liver; lesions	100	1.02E-09	2.25E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	1.48E-09	6.36E-11	1.10E-08	1.41E-09	4.95E-06	3.65E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	6.97E-10	2.99E-11	5.14E-09	6.60E-10	2.32E-06	1.71E-05	0.1%	liver, kidney; toxicity		3.89E-11	8.58E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	8.28E-10	3.55E-11	5.48E-09	7.05E-10	6.37E-05	4.21E-04	1.8%	liver; inc. relative weight		3.23E-10	6.41E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E-07	6.87E-09	1.06E-06	1.36E-07	1.60E-05	1.06E-04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E-11	1.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E-10	2.78E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.71E-03	2.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E-09	4.85E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E-10	4.04E-09	100.0%	

Table M.33. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (future land use – agricultural/homesteader) – Area S1–P1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.58E-06	0.0%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	loc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.40E-10	3.17E-11	2.76E-09	1.19E-09	8.21E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fattycyst formation	1000	1.88E-10	7.57E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity		2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; loc. relative weight		5.29E-09	2.14E-07	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.02E-03	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.35E-08	1.04E-06	100.0%	

Table M.34. Risk characterization for surface waters: children — dermal exposure (swimming and wading) (future land use — agricultural/homesteader) — Area S1–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E−07	4.69E−09	1.53E−06	1.96E−07	1.56E−06	2.18E−05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E−08	4.62E−10	1.92E−07	2.47E−08	1.08E−08	1.92E−07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E−08	1.10E−09	3.16E−07	4.09E−08	6.91E−07	8.60E−06	0.0%	Gastrointestinal system; irritation	– –				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E−07	1.59E−08	6.00E−06	7.72E−07	7.43E−05	1.20E−03	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E−09	1.59E−10	5.72E−08	7.35E−09	1.23E−05	1.91E−04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E−08	4.98E−10	2.05E−07	2.64E−08	1.66E−06	2.93E−05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.50E−08	4.07E−09	1.32E−06	1.70E−07	3.17E−07	4.40E−06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E−08	2.30E−09	7.00E−07	9.00E−08	5.37E−07	7.00E−06	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E−02	2.50E−02	3.21E−10	1.38E−11	3.63E−09	4.67E−10	1.07E−05	1.21E−04	0.7%	liver; lesions, toxicity	1000	2.34E−10	7.94E−09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.35E+01	2.71E−06	1.16E−07	4.15E−05	5.34E−06	1.35E−04	2.08E−03	12.0%	liver; weight inc.	1000	1.63E−09	7.47E−08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E−07	1.34E−08	3.79E−06	4.87E−07	3.13E−05	3.79E−04	2.2%	liver; lesions, fatty cyst formation	1000	8.19E−11	2.97E−09	0.7%	[B2]
4,4'-DDT	4.02E−02	4.94E−02	1.49E−07	6.41E−09	1.93E−06	2.48E−07	2.99E−04	3.86E−03	22.3%	liver; lesions	100	2.18E−09	8.44E−08	20.7%	[B2]
Dieldrin	3.67E−02	5.00E−02	5.36E−09	2.30E−10	7.27E−08	9.34E−09	1.07E−04	1.45E−03	8.4%	liver; lesions	100	3.67E−09	1.50E−07	36.6%	[B2]
Endrin	3.87E−02	5.00E−02	5.35E−09	2.29E−10	7.27E−08	9.34E−09	1.78E−05	2.42E−04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E−02	2.34E−02	2.20E−09	9.43E−11	2.98E−08	3.83E−09	7.33E−06	9.93E−05	0.6%	liver, kidney; toxicity		1.23E−10	4.98E−09	1.2%	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	5.90E−09	2.53E−10	7.18E−08	9.23E−09	4.54E−04	5.52E−03	31.9%	liver; inc. relative weight		2.30E−09	8.40E−08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.64E+00	1.73E−06	7.43E−08	2.11E−05	2.71E−06	1.73E−04	2.11E−03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.33E−03	1.73E−02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E−08	4.08E−07	100.0%	

Table M.35. Risk characterization for sediments: adults – dermal exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%	--	--	5.02E-11	9.94E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.36E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-09	2.80E-07	100.0%	

Table M.36. Risk characterization for sediments: children – dermal exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.76E-10	4.18E-11	4.24E-08	5.45E-09	3.25E-06	1.41E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.32E-11	9.55E-09	8.7%	[A]
Barium	78.13	88.46	1.67E-08	7.17E-10	7.12E-07	9.16E-08	2.39E-07	1.02E-05	1.2%	*oral*–cardiovasc. sys.; loc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.96E-10	8.40E-12	8.25E-09	1.06E-09	3.92E-08	1.65E-06	0.2%	no observed effects	100	3.61E-11	4.56E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.04E-10	1.30E-11	1.38E-08	1.77E-09	3.04E-07	1.38E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.02E-08	4.38E-10	4.43E-07	5.70E-08	1.02E-08	4.43E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.14E-09	2.20E-10	2.41E-07	3.09E-08	1.39E-07	6.50E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.13E-08	4.86E-10	8.01E-07	1.03E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.90E-07	8.14E-09	8.34E-06	1.07E-06	1.36E-06	5.96E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.20E-09	1.37E-10	1.65E-07	2.12E-08	1.07E-05	5.49E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.96E-09	2.12E-10	2.23E-07	2.87E-08	2.48E-07	1.12E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.22E-09	2.67E-10	2.72E-07	3.49E-08	8.89E-07	3.88E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.08E-08	8.91E-10	9.73E-07	1.25E-07	6.93E-08	3.24E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.21E-10	9.47E-12	1.32E-08	1.65E-09				--	--	7.29E-11	1.30E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.73E-10	7.42E-12	1.12E-08	1.44E-09				--	--	5.71E-11	1.11E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.97E-10	2.99E-11	4.16E-08	5.35E-09	2.32E-08	1.39E-06	0.2%	--	--	2.18E-11	3.91E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.75E-10	2.89E-11	3.93E-08	5.02E-09	2.25E-08	1.30E-06	0.2%	--	--	2.11E-10	3.67E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.03E-10	3.44E-11	4.68E-08	6.01E-09	2.68E-08	1.56E-06	0.2%	--	--	2.51E-11	4.39E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.58E-10	2.82E-11	3.19E-08	4.10E-09	2.19E-08	1.06E-06	0.1%	--	--	2.06E-11	2.99E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.62E-10	2.84E-11	3.96E-08	5.09E-09	2.21E-08	1.32E-06	0.2%	--	--	2.07E-12	3.71E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.70E-10	2.02E-11	1.94E-08	2.50E-09	1.57E-08	6.48E-07	0.1%	--	--	1.47E-10	1.82E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.64E-11	7.05E-13	1.09E-09	1.40E-10	3.25E-07	2.18E-05	2.5%	liver; lesions	100	1.13E-11	2.24E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.90E-10	2.53E-11	3.05E-08	3.92E-09	1.97E-08	1.02E-06	0.1%	--	--	1.85E-11	2.86E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.77E-05	8.66E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.97E-10	1.10E-07	100.0%	

Table M.37. Risk characterization for groundwater: adults – ingestion exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	IRIS UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.60E-05	9.78E-06	1.53E-04	6.55E-05	2.54E-01	5.09E-01	1.8%	skin; keratosis, hyperpigmentation	3	1.7E-05	1.15E-04	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.58E-03	9.74E-04	1.33E-02	5.70E-03	1.08E-01	1.90E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.60E-05	4.64E-06	7.01E-05	3.00E-05	7.22E-03	1.40E-02	0.1%	no observed effects	100	2.0E-05	1.29E-04	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.33E-04	8.14E-05	1.12E-03	4.80E-04	6.33E-04	1.12E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.20E-04	4.12E-05	8.87E-03	3.80E-03	8.66E-03	2.40E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.13E-04	6.60E-05	9.68E-04	4.15E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E-02	9.22E-03	1.21E-01	5.19E-02	1.43E+01	2.42E+01	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.15E+01	2.66E-04	3.42E-05	5.99E-04	2.57E-04	8.86E-01	2.00E+00	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.88E+01	6.43E+01	9.21E-04	1.18E-04	1.76E-03	7.55E-04	4.61E-02	8.81E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.49E-04	9.64E-05	1.34E-03	5.76E-04	1.07E-01	1.92E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	6.89E-03	8.86E-04	1.87E-02	8.01E-03	6.89E-02	1.87E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E-03	1.72E-04	3.69E-03	1.58E-03	2.23E-02	6.15E-02	0.2%	*oral and inhal.*–liver; toxicity	100	1.2E-06	1.19E-05	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.44E+04		8.54E+04						1.4E-06	8.54E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05						8.9E-07	6.1E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05						1.2E-06	8.8E-06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI):							1.5E+01	2.7E+01	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:												3.8E-05	2.5E-04	100.0%	
Combined Exposure (d)															
Radiological Hazards:															
Excess Lifetime Cancer Risk:												3.5E-06	2.3E-05	100.0%	
Combined Exposure (d)															

Table M.38. Risk characterization for groundwater: adult – ingestion exposure (future land use – agricultural/homesteader) – East Fork Poplar Creek

Chemical	MLE Concentration (a) GW (µ)	RME Concentration (a) GW (µ)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Arsenic	2.9E+00	3.5E+00	5.6E-05	7.2E-06	9.7E-05	4.1E-05	1.8E-01	3.2E-01	1.6%	skin; keratosis, hyperpigmentation	3	1.2E-05	7.3E-05	64.5%	[A]
Barium	1.6E+02	1.9E+02	3.1E-03	4.0E-04	5.2E-03	2.2E-03	4.4E-02	7.5E-02	0.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	6.5E-01	7.9E-01	1.2E-05	1.6E-06	2.1E-05	9.3E-06	2.5E-03	4.3E-03	0.0%	no observed effects	100	6.9E-06	4.0E-05	35.5%	[B2]
Chromium (III)	3.2E+00	4.0E+00	6.3E-05	8.1E-06	1.1E-04	4.7E-05	6.3E-05	1.1E-04	0.0%	no observed effects	100				
Copper	3.9E+00	6.1E+00	7.6E-05	9.8E-06	1.6E-04	7.1E-05	2.0E-03	4.5E-03	0.0%	Gastrointestinal system; irritation	--				[D]
Lead	1.4E+00	1.6E+00	2.7E-05	3.5E-06	4.6E-05	1.9E-05				CNS, blood	--				[B2]
Manganese (water)	2.9E+03	3.6E+03	5.6E-02	7.2E-03	1.0E-01	4.2E-02	1.1E+01	2.0E+01	97.2%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	5.7E-01	1.3E+00	1.1E-05	1.4E-06	3.6E-05	1.5E-05	3.6E-02	1.2E-01	0.6%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	1.0E+01	1.3E+01	2.0E-04	2.6E-05	3.8E-04	1.6E-04	1.0E-02	1.9E-02	0.1%	dec. body and organ weight	300				
Vanadium	5.1E+00	8.9E+00	9.8E-05	1.2E-05	2.4E-04	1.0E-04	1.4E-02	3.4E-02	0.2%	no observed effects	100				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.1E+01	2.0E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.9E-05	1.1E-04	100.0%	

(a) The MLE exposure point concentration is the mean concentration of the dissolved metal analysis results, and the RME exposure point concentration is the upper 95% confidence limit on the arithmetic mean of the dissolved metal analysis res

Table M.39. Risk characterization for groundwater: children – ingestion exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.56E+00	7.90E-05	3.39E-06	1.81E-04	2.33E-05	2.64E-01	6.03E-01	1.8%	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.86E-03	3.36E-04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.61E-06	8.31E-05	1.07E-05	7.51E-03	1.66E-02	0.1%	no observed effects	100	6.92E-06	4.59E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.59E-04	2.82E-05	1.33E-03	1.71E-04	6.59E-04	1.33E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.84E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	1.49E+01	2.87E+01	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.35E+01	2.19E+01	2.70E-04	1.18E-05	7.09E-04	9.12E-05	9.21E-01	2.36E+00	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.86E+01	6.43E+01	9.58E-04	4.11E-05	2.09E-03	2.68E-04	4.79E-02	1.04E-01	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	0.7%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.28E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.47E-07	4.21E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.78E+03		1.13E+04						1.78E-07	1.13E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		6.90E+03		5.04E+04						1.10E-07	8.06E-07	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.59E+03		4.17E+04						1.56E-07	1.17E-06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.65E+01	3.28E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.33E-05	9.08E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.45E-07	3.10E-06	100.0%	

Table M.40. Risk characterization for groundwater: children — ingestion exposure (future land use — agricultural/homesteader) — East Fork Poplar Creek

Chemical	MLE Concentration in GW (a)	RME Concentration in GW (a)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs Wt of
INORGANICS (µg/L)															
Arsenic	2.95E+00	3.57E+00	5.88E-05	2.52E-06	1.16E-04	1.45E-05	1.96E-01	3.86E-01	1.6%	skin; keratosis, hyperpigmentation	3	4.41E-06	2.61E-05	64.5%	[A]
Barium	1.62E+02	1.92E+02	3.24E-03	1.39E-04	6.22E-03	8.00E-04	4.62E-02	8.89E-02	0.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	6.58E-01	7.98E-01	1.31E-05	5.62E-07	2.59E-05	3.33E-06	2.62E-03	5.18E-03	0.0%	no observed effects	100	2.42E-06	1.43E-05	35.5%	[D2]
Chromium (III)	3.29E+00	4.01E+00	6.56E-05	2.81E-06	1.30E-04	1.67E-05	6.56E-05	1.30E-04	0.0%	no observed effects	100				
Copper	3.98E+00	6.12E+00	7.93E-05	3.40E-06	1.99E-04	2.55E-05	2.14E-03	5.37E-03	0.0%	Gastrointestinal system; irritation	--				[D]
Lead	1.44E+00	1.69E+00	2.88E-05	1.23E-06	5.49E-05	7.06E-06				CNS, blood	--				[D2]
Manganese (water)	2.95E+03	3.66E+03	5.88E-02	2.52E-03	1.19E-01	1.53E-02	1.16E+01	2.37E+01	97.2%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	5.77E-01	1.33E+00	1.15E-05	4.93E-07	4.31E-05	5.54E-06	3.84E-02	1.44E-01	0.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.06E+01	1.39E+01	2.12E-04	9.10E-06	4.55E-04	5.84E-05	1.06E-02	2.26E-02	0.1%	dec. body and organ weight	300				
Vanadium	5.11E+00	8.91E+00	1.02E-04	4.37E-06	2.89E-04	3.72E-05	1.46E-02	4.13E-02	0.2%	no observed effects	100				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.21E+01	2.44E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.85E-06	4.04E-05	100.0%	

(a) The MLE exposure point concentration is the mean concentration of the dissolved metal analysis results, and the RME exposure point concentration is the upper 95% confidence limit on the arithmetic mean of the dissolved metal analysis res

Table M.41. Risk characterization for groundwater: adults – inhalation exposure (future land use – residential) – Area S1–F1–R

Chemical	MLB Concentration in GW	RMB Concentration in GW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	1.77E-04	2.28E-05	7.01E-04	3.00E-04				Inc. liver, kidney weights, nephrotoxicity	--				
Methylene Chloride	6.97E+01	1.35E+02	3.44E-05	4.42E-06	1.36E-04	5.93E-05	4.0E-05	1.6E-04	100.0%	*oral and inhal.*–liver; toxicity	100	7.3E-09	9.7E-08	100.0%	(B2)
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							4.0E-05	1.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.3E-09	9.7E-08	100.0%	

Table M.42. Risk characterization for groundwater: children – inhalation exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.0E-03	4.4E-05	3.1E-03	4.0E-04				Inc. liver, kidney weights, nephrotoxicity	--				
Methylene Chloride	6.9E+01	1.3E+02	2.0E-04	8.6E-06	6.2E-04	8.0E-05	2.3E-04	7.3E-04	100.0%	*oral and inhal.*–liver; toxicity	100	1.4E-08	1.3E-07	100.0%	[D2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.3E-04	7.3E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.4E-08	1.3E-07	100.0%	

Table M.43. Risk characterization for produce: adults – ingestion exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncancer Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	RfD WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	1.1E-02	1.3E-02	1.6E-06	2.1E-07	9.5E-06	4.1E-06	4.2E-03	2.3E-02	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	5.0E-01	5.4E-01	7.7E-05	9.9E-06	3.8E-04	1.6E-04	2.5E-01	1.2E+00	1.0%	skin; keratosis, hyperpigmentation	3	1.7E-05	2.8E-04	93.6%	[A]
Barium	1.5E+00	1.8E+00	2.2E-04	2.9E-05	1.2E-03	5.5E-04	3.2E-03	1.8E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	4.2E-03	6.0E-03	6.4E-07	8.3E-08	4.2E-06	1.8E-06	1.3E-04	8.3E-04	0.0%	no observed effects	100	3.5E-07	7.7E-06	2.5%	[B2]
Cadmium	2.6E+00	3.9E+00	3.9E-04	5.1E-05	2.7E-03	1.2E-03	3.9E-01	2.7E+00	2.1%	kidney; proteinuria	10				
Chromium (III)	6.3E-01	6.8E-01	9.7E-05	1.2E-05	4.7E-04	2.0E-04	9.7E-03	4.7E-02	0.0%	no observed effects	100				
Copper	4.0E+00	5.2E+00	6.1E-04	7.8E-05	3.6E-03	1.5E-03	1.6E-02	9.8E-02	0.1%	Gastrointestinal system; irritation	--				[D]
Lead	4.0E-01	4.7E-01	6.1E-05	7.8E-06	3.3E-04	1.4E-04				CNS, blood	--				[B2]
Manganese	2.8E+02	3.6E+02	4.2E-02	5.5E-03	2.5E-01	1.0E-01	3.0E-01	1.8E+00	1.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	3.9E+01	5.5E+01	5.9E-03	7.6E-04	3.8E-02	1.6E-02	1.9E+01	1.2E+02	95.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	2.0E+00	2.7E+00	3.1E-04	4.0E-05	1.8E-03	8.1E-04	1.5E-02	9.4E-02	0.1%	dec. body and organ weight	300				
Selenium	8.2E-01	9.8E-01	1.2E-04	1.6E-05	6.9E-04	2.9E-04	2.5E-02	1.3E-01	0.1%	whole body; clinical selenosis	3				[D]
Silver	8.5E-01	1.2E+00	1.3E-04	1.6E-05	8.5E-04	3.6E-04	2.6E-02	1.7E-01	0.1%	skin; argyria	3				[D]
Zinc	2.6E+01	2.9E+01	4.0E-03	5.1E-04	2.0E-02	8.8E-03	1.3E-02	6.8E-02	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor–1254	2.9E-04	4.5E-04	4.4E-08	5.7E-09	3.1E-07	1.3E-07				--	--	4.4E-08	1.0E-06	0.3%	[B2]
Aroclor–1260	9.9E-04	1.5E-03	1.5E-07	1.9E-08	1.0E-06	4.4E-07				--	--	1.5E-07	3.4E-06	1.1%	[B2]
Benzo(a)anthracene	2.9E-03	4.3E-03	4.5E-07	5.8E-08	3.0E-06	1.2E-06	1.5E-05	1.0E-04	0.0%	--	--	4.2E-08	9.4E-07	0.3%	[B2]
Benzo(a)pyrene	1.3E-03	1.9E-03	2.1E-07	2.7E-08	1.3E-06	5.9E-07	7.0E-06	4.5E-05	0.0%	--	--	1.9E-07	4.3E-06	1.4%	[B2]
Benzo(b)fluoranthene	1.5E-03	2.1E-03	2.2E-07	2.9E-08	1.4E-06	6.3E-07	7.6E-06	4.9E-05	0.0%	--	--	2.1E-08	4.6E-07	0.1%	[B2]
Benzo(k)fluoranthene	8.6E-04	1.2E-03	1.3E-07	1.6E-08	8.3E-07	3.5E-07	4.3E-06	2.7E-05	0.0%	--	--	1.2E-08	2.6E-07	0.1%	[B2]
Chrysene	3.4E-03	5.0E-03	5.2E-07	6.7E-08	3.5E-06	1.5E-06	1.7E-05	1.1E-04	0.0%	--	--	4.9E-09	1.1E-07	0.0%	[B2]
Dibenzo(a,h)anthracene	4.1E-04	5.4E-04	6.4E-08	8.2E-09	3.8E-07	1.6E-07	2.1E-06	1.2E-05	0.0%	--	--	6.0E-08	1.2E-06	0.4%	[B2]
Indeno(1,2,3-cd)pyrene	1.7E-04	2.3E-04	2.6E-08	3.4E-09	1.6E-07	6.9E-08	8.8E-07	5.4E-06	0.0%	--	--	2.4E-09	5.1E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	3.4E-02	5.8E-02		1.2E+03		3.1E+04						3.3E-08	8.8E-07	62.5%	[A]
Cobalt 60	1.6E-04	5.4E-04		5.8E+00		2.9E+02						8.8E-11	4.4E-09	0.3%	[A]
Neptunium 237+D	2.2E-04	6.2E-04		7.7E+00		3.3E+02						1.7E-09	7.4E-08	5.3%	[A]
Protactinium 233		6.0E-04				3.2E+02							3.2E-10	0.0%	[A]
Thorium 228+D	1.2E-03	1.2E-03		4.4E+01		6.8E+02						2.4E-09	3.7E-08	2.7%	[A]
Thorium 230	2.2E-03	2.2E-03		8.0E+01		1.2E+03						1.0E-09	1.5E-08	1.1%	[A]
Thorium 232	9.4E-04	9.4E-04		3.3E+01		5.0E+02						4.0E-10	6.1E-09	0.4%	[A]
Uranium 234	1.3E-02	1.5E-02		4.6E+02		8.2E+03						7.3E-09	1.3E-07	9.4%	[A]
Uranium 235+D	6.5E-04	7.8E-04		2.3E+01		4.1E+02						3.7E-10	6.7E-09	0.5%	[A]
Uranium 238+D	1.4E-02	1.6E-02		5.0E+02		8.9E+03						1.4E-08	2.5E-07	17.8%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	2.0E+01	1.3E+02	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)		1.8E-05	3.0E-04 100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)		6.1E-08	1.4E-06 100.0%

Table M.44. Risk characterization for produce: children — ingestion exposure (future land use — residential) — Area S1–F1–R

Chemical	MLE Concentration from Mean Concentration (mg/kg)	RME Concentration from UCL Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	1.1E-02	1.3E-02	3.7E-06	1.6E-07	1.9E-05	2.5E-06	9.4E-03	4.9E-02	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	5.0E-01	5.4E-01	1.7E-04	7.3E-06	7.9E-04	1.0E-04	5.7E-01	2.6E+00	1.0%	skin; keratosis, hyperpigmentation	3	1.2E-05	1.7E-04	93.6%	[A]
Barium	1.5E+00	1.8E+00	5.1E-04	2.1E-05	2.6E-03	3.4E-04	7.3E-03	3.8E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	4.2E-03	6.0E-03	1.4E-06	6.2E-08	8.7E-06	1.1E-06	2.8E-04	1.7E-03	0.0%	no observed effects	100	2.6E-07	4.8E-06	2.5%	[D2]
Cadmium	2.6E+00	3.9E+00	8.9E-04	3.8E-05	5.7E-03	7.4E-04	8.9E-01	5.7E+00	2.1%	kidney; proteinuria	10				
Chromium (III)	6.3E-01	6.8E-01	2.1E-04	9.3E-06	9.9E-04	1.2E-04	2.1E-04	9.9E-04	0.0%	no observed effects	100				
Copper	4.0E+00	5.2E+00	1.3E-03	5.8E-05	7.5E-03	9.6E-04	3.6E-02	2.0E-01	0.1%	Gastrointestinal system; irritation	--				[D]
Lead	4.0E-01	4.7E-01	1.3E-04	5.8E-06	6.9E-04	8.8E-05				CNS, blood	--				[D2]
Manganese	2.8E+02	3.6E+02	9.5E-02	4.1E-03	5.2E-01	6.7E-02	6.8E-01	3.7E+00	1.3%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	3.9E+01	5.5E+01	1.3E-02	5.7E-04	7.9E-02	1.0E-02	4.4E+01	2.6E+02	93.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	2.0E+00	2.7E+00	7.0E-04	3.0E-05	3.9E-03	5.0E-04	3.5E-02	1.9E-01	0.1%	dec. body and organ weight	300				
Selenium	8.2E-01	9.8E-01	2.8E-04	1.2E-05	1.4E-03	1.8E-04	5.6E-02	2.8E-01	0.1%	whole body; clinical selenosis	3				[D]
Silver	8.5E-01	1.2E+00	2.9E-04	1.2E-05	1.7E-03	2.2E-04	5.8E-02	3.5E-01	0.1%	skin; argyria	3				[D]
Zinc	2.6E+01	2.9E+01	9.0E-03	3.8E-04	4.2E-02	5.4E-03	3.0E-02	1.4E-01	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1254	2.9E-04	4.5E-04	9.9E-08	4.2E-09	6.5E-07	8.4E-08				--	--	3.2E-08	6.4E-07	0.3%	[B2]
Aroclor-1260	9.9E-04	1.5E-03	3.3E-07	1.4E-08	2.1E-06	2.7E-07				--	--	1.1E-07	2.1E-06	1.1%	[B2]
Benzo(a)anthracene	2.9E-03	4.3E-03	1.0E-06	4.3E-08	6.2E-06	8.0E-07	3.3E-05	2.0E-04	0.0%	--	--	3.1E-08	5.8E-07	0.3%	[B2]
Benzo(a)pyrene	1.3E-03	1.9E-03	4.7E-07	2.0E-08	2.8E-06	3.6E-07	1.5E-05	9.5E-05	0.0%	--	--	1.4E-07	2.6E-06	1.4%	[B2]
Benzo(b)fluoranthene	1.5E-03	2.1E-03	5.1E-07	2.1E-08	3.0E-06	3.9E-07	1.7E-05	1.0E-04	0.0%	--	--	1.6E-08	2.8E-07	0.1%	[B2]
Benzo(k)fluoranthene	8.6E-04	1.2E-03	2.9E-07	1.2E-08	1.7E-06	2.2E-07	9.8E-06	5.7E-05	0.0%	--	--	9.2E-09	1.6E-07	0.1%	[B2]
Chrysene	3.4E-03	5.0E-03	1.1E-06	5.0E-08	7.2E-06	9.3E-07	3.8E-05	2.4E-04	0.0%	--	--	3.6E-09	6.8E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	4.1E-04	5.4E-04	1.4E-07	6.1E-09	7.9E-07	1.0E-07	4.7E-06	2.6E-05	0.0%	--	--	4.4E-08	7.4E-07	0.4%	[B2]
Indeno(1,2,3-cd)pyrene	1.7E-04	2.3E-04	5.9E-08	2.5E-09	3.3E-07	4.3E-08	1.9E-06	1.1E-05	0.0%	--	--	1.8E-09	3.1E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	3.4E-02	5.8E-02		3.2E+02		7.2E+03						9.0E-09	2.0E-07	62.5%	[A]
Cobalt 60	1.6E-04	5.4E-04		1.5E+00		6.7E+01						2.3E-11	1.0E-09	0.3%	[A]
Neptunium 237+D	2.2E-04	6.2E-04		2.0E+00		7.7E+01						4.5E-10	1.7E-08	5.3%	[A]
Protactinium 233		6.0E-04				7.4E+01							7.4E-11	0.0%	[A]
Thorium 228+D	1.2E-03	1.2E-03		1.1E+01		1.5E+02						6.5E-10	8.6E-09	2.7%	[A]
Thorium 230	2.2E-03	2.2E-03		2.1E+01		2.8E+02						2.7E-10	3.6E-09	1.1%	[A]
Thorium 232	9.4E-04	9.4E-04		8.8E+00		1.1E+02						1.0E-10	1.4E-09	0.4%	[A]
Uranium 234	1.3E-02	1.5E-02		1.2E+02		1.9E+03						1.9E-09	3.0E-08	9.4%	[A]
Uranium 235+D	6.5E-04	7.8E-04		6.1E+00		9.6E+01						9.8E-11	1.5E-09	0.5%	[A]
Uranium 238+D	1.4E-02	1.6E-02		1.3E+02		2.0E+03						3.7E-09	5.7E-08	17.8%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.6E+01	2.7E+02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.3E-05	1.9E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-08	3.2E-07	100.0%	

Table M.45. Risk characterization for fish: adults – ingestion exposure (future land use – residential) – Area S1–F1–R

Chemical	MLE Concentration in Fish Tissue	RME Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (mg/kg)															
Mercury	0.76	0.78	2.3E3-06	3.0E3-07	2.8E3-05	1.2E3-05	7.9E3-03	9.6E3-02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.20	0.22	6.4E3-07	8.2E3-08	8.2E3-06	3.5E3-06						6.3E3-07	2.7E3-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.1E3-06	1.4E3-07	1.4E3-05	6.1E3-06						1.1E3-06	4.7E3-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.9E3-03	9.6E3-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.7E3-06	7.4E3-05	100.0%	

Table M.46. Risk characterization for fish: children – ingestion exposure (future land use – residential) – Area S1–F1–R

Chemical	MLB Concentration in Fish Tissue	RMB Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Mercury	0.76	0.78	4.1E-06	1.7E-07	6.0E-05	7.7E-06	1.3E-02	2.0E-01	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.20	0.22	1.1E-06	4.8E-08	1.7E-05	2.2E-06						3.7E-07	1.7E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.9E-06	8.4E-08	3.0E-05	3.8E-06						6.5E-07	2.9E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-02	2.0E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-06	4.6E-05	100.0%	

Table M.47. Risk characterization for groundwater: adults – ingestion exposure (future land use – commercial) – area S1–F2–C

Chemical	MLB Concentration in GW	RMB Concentration in GW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.56E+00	2.72E-05	3.49E-06	5.45E-05	1.95E-05	9.05E-02	1.82E-01	1.8%	skin; keratosis, hyperpigmentation	3	6.1E-06	3.41E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	2.71E-03	3.48E-04	4.75E-03	1.70E-03	3.87E-02	6.78E-02	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	1.29E-05	1.66E-06	2.50E-05	8.94E-06	2.58E-03	5.01E-03	0.1%	no observed effects	100	7.13E-06	3.85E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	2.26E-04	2.91E-05	4.00E-04	1.43E-04	2.26E-04	4.00E-04	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	1.14E-04	1.47E-05	3.17E-03	1.13E-03	3.09E-03	8.56E-02	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	1.83E-04	2.36E-05	3.46E-04	1.23E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	2.56E-02	3.29E-03	4.32E-02	1.54E-02	5.12E+00	8.64E+00	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	9.49E-05	1.22E-05	2.14E-04	7.64E-05	3.16E-01	7.13E-01	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	3.29E-04	4.22E-05	6.29E-04	2.25E-04	1.65E-02	3.14E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	2.68E-04	3.44E-05	4.80E-04	1.71E-04	3.82E-02	6.85E-02	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.55E+02	6.82E+02	2.46E-03	3.16E-04	6.67E-03	2.38E-03	2.46E-02	6.67E-02	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	4.78E-04	6.14E-05	1.32E-03	4.70E-04	7.96E-03	2.20E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.6E-07	3.53E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		5.14E+03		2.54E+04						5.14E-07	2.54E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		1.99E+04		1.14E+05						3.16E-07	1.82E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		1.61E+04		9.41E+04						4.51E-07	2.64E-06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							5.66E+00	9.89E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.37E-05	7.61E-05	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.28E-06	7.00E-06	100.0%	

SEGMENT 2 RISK CHARACTERIZATION TABLES

Table M.48. Risk characterization summary for EFPC Segment 2: RME estimates for current land use

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA.	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index: Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	1.95E−01 B	1.03E−01 B	5.91E−06 W	1.04E−05 W	7.77E−08 B	1.95E−07 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.21E−02 B	1.13E−02 B	1.90E−06 W	5.89E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	1.48E−03 B	1.04E−03 B	3.10E−09 B	7.22E−09 B	4.89E−10 B	1.63E−09 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.28E−03 B	1.18E−03 B	3.01E−08 B	9.31E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	9.90E−05 B	9.19E−05 B	1.26E−08 B	3.89E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index: Combined Exposure		2.1E−01 B	1.2E−01 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				8E−06 W	2E−05 W					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						8E−08 B	2E−07 B					NA	NA

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.49. human health risk characterization summary for EFPC open land use scenario: current land use, Area S2–C1–O adult long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	7.84E–03	1.03E–01	2.45E–07	1.04E–05
Dermal Contact	2.86E–04	1.13E–02	3.91E–08	5.89E–06
SURFACE WATER				
Ingestion	6.90E–05	1.04E–03	1.77E–10	7.22E–09
Dermal Contact	7.27E–05	1.18E–03	1.68E–09	9.31E–08
SEDIMENT				
Dermal Contact	1.94E–06	9.19E–05	2.29E–10	3.89E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			4.76E–09	1.95E–07
SURFACE WATER				
Ingestion			3.92E–11	1.63E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	8.3E–03	1.2E–01		
Excess Lifetime Cancer Risk: Combined Exposure			3E–07	2E–05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–09	2E–07

Table M.50. human health risk characterization summary for EFPC open land use scenario: current land use, Area S2–C1–O children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.35E–02	1.95E–01	1.41E–07	5.91E–06
Dermal Contact	2.94E–04	1.21E–02	1.34E–08	1.90E–06
SURFACE WATER				
Ingestion	9.55E–05	1.48E–03	8.16E–11	3.10E–09
Dermal Contact	7.49E–05	1.28E–03	5.77E–10	3.01E–08
SEDIMENT				
Dermal Contact	2.00E–06	9.90E–05	7.87E–11	1.26E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.98E–09	7.77E–08
SURFACE WATER				
Ingestion			1.31E–11	4.89E–10
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.4E–02	2.1E–01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	8E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–09	8E–08

Table M.51. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Area S2–C1–O

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Antimony	0.82	0.98	5.1E-08	6.5E-09	5.7E-07	2.4E-07	1.2E-04	1.4E-03	1.4%	whole body, blood; inc. mortality	1000				
Arsenic	8.55	9.77	5.3E-07	6.8E-08	5.7E-06	2.4E-06	1.7E-03	1.9E-02	18.6%	skin; keratosis, hyperpigmentation	3	1.2E-07	4.3E-06	41.5%	[A]
Barium	146.50	203.70	9.1E-06	1.1E-06	1.2E-04	5.1E-05	1.3E-04	1.7E-03	1.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.90	1.07	5.6E-08	7.2E-09	6.2E-07	2.6E-07	1.1E-05	1.2E-04	0.1%	no observed effects	100	3.1E-08	1.1E-06	11.2%	[B2]
Cadmium	4.83	7.08	3.0E-07	3.8E-08	4.1E-06	1.7E-06	3.0E-04	4.1E-03	4.0%	kidney; proteinuria	10				
Chromium (III)	61.17	63.90	3.8E-06	4.9E-07	3.7E-05	1.6E-05	3.8E-06	3.7E-05	0.0%	no observed effects	100				
Copper	152.30	255.90	9.5E-06	1.2E-06	1.5E-04	6.4E-05	2.5E-04	4.0E-03	4.0%	Gastrointestinal system; irritation	--				[D]
Lead	42.97	55.85	2.6E-06	3.4E-07	3.2E-05	1.4E-05				CNS, blood	--				[D2]
Manganese	814.70	860.10	5.1E-05	6.5E-06	5.0E-04	2.1E-04	3.6E-04	3.6E-03	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	22.03	33.26	1.3E-06	1.7E-07	1.9E-05	8.3E-06	4.6E-03	6.5E-02	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	39.28	56.75	2.4E-06	3.1E-07	3.3E-05	1.4E-05	1.2E-04	1.6E-03	1.6%	dec. body and organ weight	300				
Selenium	12.34	14.57	7.7E-07	9.9E-08	8.5E-06	3.6E-06	1.5E-04	1.7E-03	1.7%	whole body; clinical selenosis	3				[D]
Silver	2.33	3.34	1.4E-07	1.8E-08	1.9E-06	8.4E-07	2.9E-05	3.9E-04	0.4%	skin; argyria	3				[D]
Zinc	307.40	436.40	1.9E-05	2.4E-06	2.5E-04	1.1E-04	6.4E-05	8.5E-04	0.8%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.37	0.65	2.3E-08	2.9E-09	3.8E-07	1.6E-07				--	--	2.2E-08	1.2E-06	12.1%	[B2]
Benzo(a)anthracene	0.85	1.50	5.3E-08	6.8E-09	8.8E-07	3.7E-07	1.7E-06	2.9E-05	0.0%	--	--	4.9E-09	2.7E-07	2.7%	[B2]
Benzo(a)pyrene	0.63	1.08	3.9E-08	5.0E-09	6.3E-07	2.7E-07	1.3E-06	2.1E-05	0.0%	--	--	3.7E-08	1.9E-06	19.1%	[B2]
Benzo(b)fluoranthene	1.23	1.97	7.7E-08	9.9E-09	1.1E-06	4.9E-07	2.5E-06	3.8E-05	0.0%	--	--	7.2E-09	3.6E-07	3.5%	[B2]
Benzo(k)fluoranthene	1.23	1.97	7.7E-08	9.9E-09	1.1E-06	4.9E-07	2.5E-06	3.8E-05	0.0%	--	--	7.2E-09	3.6E-07	3.5%	[B2]
Chrysene	0.62	1.00	3.8E-08	4.9E-09	5.6E-07	2.5E-07	1.2E-06	1.9E-05	0.0%	--	--	3.6E-10	1.8E-08	0.2%	[B2]
Dibenzo(a,h)anthracene	0.18	0.27	1.1E-08	1.4E-09	1.5E-07	6.8E-08	3.7E-07	5.2E-06	0.0%	--	--	1.0E-08	4.9E-07	4.8%	[B2]
Indeno(1,2,3-cd)pyrene	0.53	0.88	3.3E-08	4.2E-09	5.1E-07	2.2E-07	1.1E-06	1.7E-05	0.0%	--	--	3.1E-09	1.6E-07	1.6%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.76	1.23		1.1E+01		5.5E+02						3.0E-10	1.5E-08	7.9%	[A]
Cobalt 60	0.02	0.08		2.6E-01		3.4E+01						3.9E-12	5.1E-10	0.3%	[A]
Neptunium 237+D	0.02	0.03		2.1E-01		1.5E+01						4.8E-11	3.3E-09	1.7%	[A]
Protactinium 233	0.02	0.09		2.3E-01		3.8E+01						2.3E-13	3.8E-11	0.0%	[A]
Thorium 228+D	1.52	2.11		2.1E+01		9.5E+02						1.2E-09	5.2E-08	26.8%	[A]
Thorium 230	4.56	6.52		6.5E+01		2.9E+03						8.5E-10	3.8E-08	19.6%	[A]
Thorium 232	1.31	1.74		1.8E+01		7.8E+02						2.2E-10	9.4E-09	4.8%	[A]
Uranium 234	3.09	3.59		4.4E+01		1.6E+03						7.1E-10	2.5E-08	13.3%	[A]
Uranium 235+D	0.14	0.16		1.9E+00		7.0E+01						3.1E-11	1.1E-09	0.6%	[A]
Uranium 238+D	3.40	3.86		4.9E+01		1.7E+03						1.3E-09	4.8E-08	25.0%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	7.8E-03	1.0E-01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.4E-07	1.0E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	4.7E-09	1.9E-07	100.0%

Table M.52. Risk characterization for soils: children – ingestion exposure (current land use – open) – Area S2–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.82	0.98	8.84E-08	3.79E-09	1.09E-06	1.40E-07	2.21E-04	2.72E-03	1.4%	whole body, blood; inc. mortality	1000				
Arsenic	8.55	9.77	9.22E-07	3.97E-08	1.09E-05	1.40E-06	3.08E-03	3.63E-02	18.6%	skin; keratosis, hyperpigmentation	3	6.94E-08	2.45E-06	41.5%	[A]
Barium	146.50	203.70	1.59E-05	6.86E-07	2.27E-04	2.92E-05	2.27E-04	3.25E-03	1.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.90	1.07	9.78E-08	4.19E-09	1.19E-06	1.53E-07	1.96E-05	2.38E-04	0.1%	no observed effects	100	1.80E-08	6.59E-07	11.2%	[B2]
Cadmium	4.83	7.08	5.23E-07	2.24E-08	7.90E-06	1.02E-06	5.23E-04	7.90E-03	4.0%	kidney; proteinuria	10				
Chromium (III)	61.17	63.90	6.62E-06	2.84E-07	7.13E-05	9.16E-06	6.62E-06	7.13E-05	0.0%	no observed effects	100				
Copper	152.30	255.90	1.65E-05	7.07E-07	2.85E-04	3.67E-05	4.46E-04	7.71E-03	4.0%	Gastrointestinal system; irritation	--				[D]
Lead	42.97	55.85	4.65E-06	1.99E-07	6.23E-05	8.01E-06				CNS, blood	--				[B2]
Manganese	814.70	860.10	8.82E-05	3.78E-06	9.59E-04	1.23E-04	6.30E-04	6.85E-03	3.5%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	22.03	33.26	2.39E-06	1.02E-07	3.71E-05	4.77E-06	7.95E-03	1.24E-01	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	39.28	56.75	4.25E-06	1.82E-07	6.33E-05	8.14E-06	2.13E-04	3.17E-03	1.6%	dec. body and organ weight	300				
Selenium	12.34	14.57	1.34E-06	5.73E-08	1.63E-05	2.09E-06	2.67E-04	3.25E-03	1.7%	whole body; clinical selenosis	3				[D]
Silver	2.33	3.34	2.53E-07	1.08E-08	3.73E-06	4.79E-07	5.05E-05	7.46E-04	0.4%	skin; argyria	3				[D]
Zinc	307.40	436.40	3.33E-05	1.43E-06	4.87E-04	6.26E-05	1.11E-04	1.62E-03	0.8%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.37	0.65	3.98E-08	1.70E-09	7.22E-07	9.28E-08				--	--	1.31E-08	7.15E-07	12.1%	[B2]
Benzo(a)anthracene	0.85	1.50	9.17E-08	3.93E-09	1.67E-06	2.15E-07	3.06E-06	5.55E-05	0.0%	--	--	2.87E-09	1.57E-07	2.7%	[B2]
Benzo(a)pyrene	0.63	1.08	6.84E-08	2.93E-09	1.20E-06	1.54E-07	2.28E-06	4.00E-05	0.0%	--	--	2.14E-08	1.13E-06	19.1%	[B2]
Benzo(b)fluoranthene	1.23	1.97	1.34E-07	5.72E-09	2.20E-06	2.83E-07	4.45E-06	7.32E-05	0.0%	--	--	4.18E-09	2.06E-07	3.5%	[B2]
Benzo(k)fluoranthene	1.23	1.97	1.34E-07	5.72E-09	2.20E-06	2.83E-07	4.45E-06	7.32E-05	0.0%	--	--	4.18E-09	2.06E-07	3.5%	[B2]
Chrysene	0.62	1.00	6.70E-08	2.87E-09	1.12E-06	1.44E-07	2.23E-06	3.73E-05	0.0%	--	--	2.09E-10	1.03E-08	0.2%	[B2]
Dibenzo(a,h)anthracene	0.18	0.27	1.94E-08	8.32E-10	3.01E-07	3.88E-08	6.47E-07	1.00E-05	0.0%	--	--	6.07E-09	2.83E-07	4.8%	[B2]
Indeno(1,2,3-cd)pyrene	0.53	0.88	5.72E-08	2.45E-09	9.86E-07	1.27E-07	1.91E-06	3.29E-05	0.0%	--	--	1.79E-09	9.25E-08	1.6%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.76	1.23		4.57E+00		2.20E+02						1.28E-10	6.17E-09	7.9%	[A]
Cobalt 60	0.02	0.08		1.10E-01		1.37E+01						1.64E-12	2.05E-10	0.3%	[A]
Neptunium 237+D	0.02	0.03		9.10E-02		6.01E+00						2.00E-11	1.32E-09	1.7%	[A]
Protactinium 233	0.02	0.09		9.91E-02		1.53E+01						9.91E-14	1.53E-11	0.0%	[A]
Thorium 228+D	1.52	2.11		9.10E+00		3.79E+02						5.01E-10	2.08E-08	26.8%	[A]
Thorium 230	4.56	6.52		2.74E+01		1.17E+03						3.56E-10	1.52E-08	19.6%	[A]
Thorium 232	1.31	1.74		7.85E+00		3.13E+02						9.42E-11	3.75E-09	4.8%	[A]
Uranium 234	3.09	3.59		1.85E+01		6.44E+02						2.96E-10	1.03E-08	13.3%	[A]
Uranium 235+D	0.14	0.16		8.14E-01		2.83E+01						1.30E-11	4.52E-10	0.6%	[A]
Uranium 238+D	3.40	3.86		2.04E+01		6.93E+02						5.72E-10	1.94E-08	25.0%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.35E-02	1.95E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.41E-07	5.91E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.98E-09	7.77E-08	100.0%	

Table M.53. Risk characterization for soils: adults – dermal exposure (current land use – open) – Area S2–C1–O

Chemical	MLE Concentration (ug/g)	BMG Concentration (ug/g)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (BMG)	CDI Carc. Effects (BMG)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (BMG)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (BMG)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Antimony	0.82	0.98	1.8E-09	2.3E-10	6.2E-08	2.6E-08	4.6E-06	1.5E-04	1.4%	whole body, blood; inc. mortality	1000				
Arsenic	8.55	9.77	1.9E-08	2.4E-09	6.2E-07	2.6E-07	6.4E-05	2.0E-03	18.3%	skin; keratosis, hyperpigmentation	3	4.3E-09	4.6E-07	7.9%	[A]
Barium	146.50	203.70	3.3E-07	4.2E-08	1.2E-05	5.5E-06	4.7E-06	1.8E-04	1.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.90	1.07	2.0E-09	2.6E-10	6.7E-08	2.9E-08	4.0E-07	1.3E-05	0.1%	no observed effects	100	1.1E-09	1.2E-07	2.1%	[B2]
Cadmium	4.83	7.08	1.0E-08	1.4E-09	4.4E-07	1.9E-07	1.0E-05	4.4E-04	4.0%	kidney; proteinuria	10				
Chromium (III)	61.17	63.90	1.3E-07	1.7E-08	4.0E-06	1.7E-06	1.3E-07	4.0E-06	0.0%	no observed effects	100				
Copper	152.30	255.90	3.4E-07	4.4E-08	1.6E-05	6.9E-06	9.2E-06	4.3E-04	3.9%	Gastrointestinal system; irritation	--				[D]
Lead	42.97	55.85	9.6E-08	1.2E-08	3.5E-06	1.5E-06				CNS, blood	--				[B2]
Manganese	814.70	860.10	1.8E-06	2.3E-07	5.4E-05	2.3E-05	1.3E-05	3.9E-04	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	22.03	33.26	4.9E-08	6.3E-09	2.1E-06	9.0E-07	1.6E-04	7.0E-03	62.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	39.28	56.75	8.8E-08	1.1E-08	3.6E-06	1.5E-06	4.4E-06	1.8E-04	1.6%	dec. body and organ weight	300				
Selenium	12.34	14.57	2.7E-08	3.5E-09	9.2E-07	3.9E-07	5.5E-06	1.8E-04	1.6%	whole body; clinical selenosis	3				[D]
Silver	2.33	3.34	5.2E-09	6.7E-10	2.1E-07	9.0E-08	1.0E-06	4.2E-05	0.4%	skin; argyria	3				[D]
Zinc	307.40	436.40	6.9E-07	8.9E-08	2.7E-05	1.1E-05	2.3E-06	9.2E-05	0.8%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.37	0.65	8.2E-09	1.0E-09	4.1E-07	1.7E-07				--	--	8.2E-09	1.3E-06	23.0%	[B2]
Benzo(a)anthracene	0.85	1.50	1.9E-08	2.4E-09	9.5E-07	4.0E-07	6.3E-07	3.1E-05	0.3%	--	--	1.7E-09	2.9E-07	5.1%	[B2]
Benzo(a)pyrene	0.63	1.08	1.4E-08	1.8E-09	6.8E-07	2.9E-07	4.7E-07	2.2E-05	0.2%	--	--	1.3E-08	2.1E-06	36.2%	[B2]
Benzo(b)fluoranthene	1.23	1.97	2.7E-08	3.5E-09	1.2E-06	5.3E-07	9.2E-07	4.1E-05	0.4%	--	--	2.6E-09	3.9E-07	6.6%	[B2]
Benzo(k)fluoranthene	1.23	1.97	2.7E-08	3.5E-09	1.2E-06	5.3E-07	9.2E-07	4.1E-05	0.4%	--	--	2.6E-09	3.9E-07	6.6%	[B2]
Chrysene	0.62	1.00	1.3E-08	1.7E-09	6.3E-07	2.7E-07	4.6E-07	2.1E-05	0.2%	--	--	1.3E-10	1.9E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.18	0.27	4.0E-09	5.1E-10	1.7E-07	7.3E-08	1.3E-07	5.7E-06	0.1%	--	--	3.7E-09	5.3E-07	9.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.53	0.88	1.1E-08	1.5E-09	5.6E-07	2.4E-07	3.9E-07	1.8E-05	0.2%	--	--	1.1E-09	1.7E-07	3.0%	[B2]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	2.8E-04	1.1E-02	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	3.9E-08	5.8E-06	100.0%

Table M.54. Risk characterization for soils: children – dermal exposure (current land use – open) – Area S2–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.82	0.98	1.9E-09	8.1E-11	6.6E-08	8.5E-09	4.7E-06	1.6E-04	1.4%	whole body, blood; inc. mortality	1000				
Arsenic	8.55	9.77	1.9E-08	8.5E-10	6.6E-07	8.5E-08	6.6E-05	2.2E-03	18.3%	skin; keratosis, hyperpigmentation	3	1.4E-09	1.5E-07	7.9%	[A]
Barium	146.50	203.70	3.4E-07	1.4E-08	1.3E-05	1.7E-06	4.8E-06	1.9E-04	1.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.90	1.07	2.1E-09	8.9E-11	7.3E-08	9.3E-09	4.2E-07	1.4E-05	0.1%	no observed effects	100	3.8E-10	4.0E-08	2.1%	[B2]
Cadmium	4.83	7.08	1.1E-08	4.8E-10	4.8E-07	6.2E-08	1.1E-05	4.8E-04	4.0%	kidney; proteinuria	10				
Chromium (III)	61.17	63.90	1.4E-07	6.0E-09	4.3E-06	5.6E-07	1.4E-07	4.3E-06	0.0%	no observed effects	100				
Copper	152.30	255.90	3.5E-07	1.5E-08	1.7E-05	2.2E-06	9.5E-06	4.7E-04	3.9%	Gastrointestinal system; irritation	--				[D]
Lead	42.97	55.85	9.9E-08	4.2E-09	3.8E-06	4.9E-07				CNS, blood	--				[B2]
Manganese	814.70	860.10	1.8E-06	8.1E-08	5.8E-05	7.5E-06	1.3E-05	4.2E-04	3.5%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	22.03	33.26	5.1E-08	2.1E-09	2.2E-06	2.9E-07	1.7E-04	7.5E-03	62.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	39.28	56.75	9.1E-08	3.9E-09	3.8E-06	4.9E-07	4.5E-06	1.9E-04	1.6%	dec. body and organ weight	300				
Selenium	12.34	14.57	2.8E-08	1.2E-09	9.9E-07	1.2E-07	5.7E-06	1.9E-04	1.6%	whole body; clinical selenosis	3				[D]
Silver	2.33	3.34	5.4E-09	2.3E-10	2.2E-07	2.9E-08	1.0E-06	4.5E-05	0.4%	skin; argyria	3				[D]
Zinc	307.40	436.40	7.1E-07	3.0E-08	2.9E-05	3.8E-06	2.3E-06	9.9E-05	0.8%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.37	0.65	8.5E-09	3.6E-10	4.4E-07	5.6E-08				--	--	2.8E-09	4.3E-07	23.0%	[B2]
Benzo(a)anthracene	0.85	1.50	1.9E-08	8.4E-10	1.0E-06	1.3E-07	6.5E-07	3.4E-05	0.3%	--	--	6.1E-10	9.6E-08	5.1%	[B2]
Benzo(a)pyrene	0.63	1.08	1.4E-08	6.2E-10	7.3E-07	9.4E-08	4.8E-07	2.4E-05	0.2%	--	--	4.5E-09	6.8E-07	36.2%	[B2]
Benzo(b)fluoranthene	1.23	1.97	2.8E-08	1.2E-09	1.3E-06	1.7E-07	9.5E-07	4.4E-05	0.4%	--	--	8.9E-10	1.2E-07	6.6%	[B2]
Benzo(k)fluoranthene	1.23	1.97	2.8E-08	1.2E-09	1.3E-06	1.7E-07	9.5E-07	4.4E-05	0.4%	--	--	8.9E-10	1.2E-07	6.6%	[B2]
Chrysene	0.62	1.00	1.4E-08	6.1E-10	6.8E-07	8.8E-08	4.7E-07	2.2E-05	0.2%	--	--	4.4E-11	6.4E-09	0.3%	[B2]
Dibenzo(a,h)anthracene	0.18	0.27	4.1E-09	1.7E-10	1.8E-07	2.3E-08	1.3E-07	6.1E-06	0.1%	--	--	1.3E-09	1.7E-07	9.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.53	0.88	1.2E-08	5.2E-10	6.0E-07	7.7E-08	4.0E-07	2.0E-05	0.2%	--	--	3.8E-10	5.6E-08	3.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.9E-04	1.2E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.3E-08	1.9E-06	100.0%	

Table M.55. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – open) – Area S2–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	7.75E−08	9.96E−09	1.03E−06	4.40E−07	1.11E−06	1.47E−05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	7.63E−09	9.81E−10	1.29E−07	5.54E−08	7.63E−09	1.29E−07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.81E−08	2.33E−09	2.14E−07	9.18E−08	4.89E−07	5.79E−06	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	2.63E−07	3.38E−08	4.04E−06	1.73E−06	5.26E−05	8.08E−04	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.62E−09	3.37E−10	3.88E−08	1.65E−08	8.72E−06	1.28E−04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.22E−09	1.06E−09	1.36E−07	5.91E−08	1.17E−06	1.97E−05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	6.72E−08	8.65E−09	8.89E−07	3.81E−07	2.24E−07	2.96E−06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	6.06E−09	7.82E−10	7.54E−08	3.23E−08	6.06E−08	7.54E−07	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E−02	2.50E−02	2.27E−11	2.92E−12	2.45E−10	1.05E−10	7.58E−07	8.15E−06	0.8%	liver; lesions, toxicity	1000	4.97E−11	1.78E−09	24.7%	[B2]
Bis(2–ethylhexyl)phthalate	9.50E+00	1.39E+01	9.30E−09	1.20E−09	1.36E−07	5.81E−08	4.65E−07	6.78E−06	0.7%	liver; weight inc.	1000	1.67E−11	8.13E−10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.98E−09	5.12E−10	4.59E−08	1.97E−08	3.98E−07	4.59E−06	0.4%	liver; lesions, fatty cyst formation	1000	3.12E−12	1.20E−10	1.7%	[B2]
4,4'–DDT	4.02E−02	4.94E−02	3.93E−11	5.06E−12	4.83E−10	2.07E−10	7.86E−08	9.67E−07	0.1%	liver; lesions	100	1.72E−12	7.04E−11	1.0%	[B2]
Dieldrin	3.87E−02	5.00E−02	3.79E−11	4.87E−12	4.89E−10	2.10E−10	7.58E−07	9.78E−06	0.9%	liver; lesions	100	7.80E−11	3.35E−09	46.5%	[B2]
Endrin	3.87E−02	5.00E−02	3.78E−11	4.87E−12	4.89E−10	2.10E−10	1.26E−07	1.63E−06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.62E−02	2.34E−02	1.78E−11	2.29E−12	2.29E−10	9.83E−11	5.93E−08	7.64E−07	0.1%	liver, kidney; toxicity		2.97E−12	1.28E−10	1.8%	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	2.11E−11	2.72E−12	2.45E−10	1.05E−10	1.63E−06	1.88E−05	1.8%	liver; inc. relative weight		2.47E−11	9.54E−10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	4.09E−09	5.26E−10	4.73E−08	2.03E−08	4.09E−07	4.73E−06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		8.27E−01		3.22E+01						1.32E−11	5.15E−10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		9.29E−01		3.98E+01						2.60E−11	1.12E−09	68.4%	[A]
Chemical Hazards:															
Hazard Index (HI):															
Combined Exposure (d)							6.90E−05	1.04E−03	100.0%						
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												1.77E−10	7.22E−09	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												3.92E−11	1.63E−09	100.0%	

Table M.56. Risk characterization for surface water: children – ingestion exposure (swimming)(current land use – open) – Area S2–C1–O

Chemical	MLB Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RFA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RFA WOE
INORGANICS (μg/L)															
Barium	7.92E+01	1.05E+02	1.07E-07	4.59E-09	1.47E-06	1.89E-07	1.53E-06	2.10E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.06E-08	4.52E-10	1.85E-07	2.37E-08	1.06E-08	1.85E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.50E-08	1.07E-09	3.06E-07	3.94E-08	6.77E-07	8.27E-06	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	3.66E-07	1.56E-08	5.77E-06	7.42E-07	7.27E-05	1.15E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.62E-09	1.55E-10	5.50E-08	7.07E-09	1.21E-05	1.83E-04	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.14E-08	4.87E-10	1.97E-07	2.53E-08	1.62E-06	2.82E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.30E-08	3.99E-09	1.27E-06	1.63E-07	3.10E-07	4.23E-06	0.3%	blood; anemia	3				[D]
ORGANICS (μg/L)															
Acetone	6.21E+00	7.70E+00	8.41E-09	3.60E-10	1.08E-07	1.38E-08	8.41E-08	1.08E-06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.37E-02	2.50E-02	3.14E-11	1.35E-12	3.49E-10	4.49E-11	1.05E-06	1.16E-05	0.8%	liver; lesions, toxicity	1000	2.29E-11	7.64E-10	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.29E-08	5.51E-10	1.94E-07	2.49E-08	6.43E-07	9.66E-06	0.7%	liver; weight inc.	1000	7.72E-12	3.48E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.51E-09	2.36E-10	6.55E-08	8.42E-09	5.51E-07	6.55E-06	0.4%	liver; lesions, fattycyst formation	1000	1.44E-12	5.14E-11	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.44E-11	2.33E-12	6.91E-10	8.88E-11	1.09E-07	1.38E-06	0.1%	liver; lesions	100	7.93E-13	3.02E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.24E-11	2.25E-12	6.99E-10	8.99E-11	1.05E-06	1.40E-05	0.9%	liver; lesions	100	3.59E-11	1.44E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.24E-11	2.24E-12	6.99E-10	8.99E-11	1.75E-07	2.33E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.46E-11	1.05E-12	3.28E-10	4.21E-11	8.20E-08	1.09E-06	0.1%	liver, kidney; toxicity		1.37E-12	5.47E-11	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.92E-11	1.25E-12	3.49E-10	4.49E-11	2.25E-06	2.69E-05	1.8%	liver; inc. relative weight		1.14E-11	4.09E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.66E-09	2.42E-10	6.76E-08	8.70E-09	5.66E-07	6.76E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		2.76E-01		9.66E+00						4.41E-12	1.55E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		3.10E-01		1.19E+01						8.67E-12	3.35E-10	68.4%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							9.35E-05	1.48E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.10E-11	3.10E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E-11	4.84E-10	100.0%	

Table M.57. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – open) – Area S2–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.00E-09	7.70E-10	1.04E-07	4.47E-08	8.57E-08	1.49E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	5.91E-10	7.60E-11	1.31E-08	5.62E-09	5.91E-10	1.31E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.40E-09	1.80E-10	2.18E-08	9.33E-09	3.79E-08	5.88E-07	0.0%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	2.04E-08	2.62E-09	4.10E-07	1.76E-07	4.07E-06	8.21E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.03E-10	2.61E-11	3.91E-09	1.68E-09	6.76E-07	1.30E-05	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.36E-10	8.18E-11	1.40E-08	6.01E-09	9.09E-08	2.00E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.21E-09	6.69E-10	9.03E-08	3.87E-08	1.74E-08	3.01E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.94E-09	3.78E-10	4.78E-08	2.05E-08	2.94E-08	4.78E-07	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.70E-11	2.26E-12	2.48E-10	1.06E-10	5.87E-07	8.28E-06	0.7%	liver; lesions, toxicity	1000	3.85E-11	1.81E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.48E-07	1.93E-08	2.84E-06	1.22E-06	7.42E-06	1.42E-04	12.0%	liver; weight inc.	1000	2.67E-10	1.70E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.72E-08	2.21E-09	2.59E-07	1.11E-07	1.72E-06	2.59E-05	2.2%	liver; lesions, fatty cyst formation	1000	1.35E-11	6.77E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.18E-09	1.05E-09	1.32E-07	5.65E-08	1.64E-05	2.64E-04	22.3%	liver; lesions	100	3.58E-10	1.92E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	5.87E-06	9.94E-05	8.4%	liver; lesions	100	6.04E-10	3.41E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	9.77E-07	1.66E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.62E-02	2.34E-02	1.21E-10	1.55E-11	2.04E-09	8.73E-10	4.02E-07	6.79E-06	0.6%	liver, kidney; toxicity		2.01E-11	1.14E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.23E-10	4.15E-11	4.91E-09	2.10E-09	2.49E-05	3.77E-04	31.9%	liver; inc. relative weight		3.78E-10	1.91E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.50E-08	1.22E-08	1.44E-06	6.18E-07	9.50E-06	1.44E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.27E-05	1.18E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.68E-09	9.31E-08	100.0%	

Table M.58. Risk characterization for surface waters: children — dermal exposure (swimming and wading) (current land use — open) — Area S2–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	Risk Estimates: HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD Uncertainty Factor	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.18E−09	2.65E−10	1.12E−07	1.44E−08	8.83E−08	1.60E−06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	6.09E−10	2.61E−11	1.41E−08	1.82E−09	6.09E−10	1.41E−08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.44E−09	6.19E−11	2.34E−08	3.01E−09	3.99E−08	6.33E−07	0.0%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	2.10E−08	8.99E−10	4.42E−07	5.68E−08	4.20E−06	8.84E−05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.69E+00	3.93E+00	2.09E−10	8.95E−12	4.21E−09	5.41E−10	6.99E−07	1.40E−05	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.56E−10	2.81E−11	1.51E−08	1.94E−09	9.37E−08	2.16E−06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.37E−09	2.30E−10	9.72E−08	1.25E−08	1.79E−08	3.24E−07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	3.03E−09	1.30E−10	5.15E−08	6.62E−09	3.03E−08	5.15E−07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E−02	2.50E−02	1.81E−11	7.77E−13	2.67E−10	3.44E−11	6.05E−07	8.92E−06	0.7%	liver; lesions, toxicity	1000	1.32E−11	5.89E−10	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.53E−07	6.56E−09	3.06E−06	3.93E−07	7.65E−06	1.53E−04	12.0%	liver; weight inc.	1000	9.18E−11	5.50E−09	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.77E−08	7.58E−10	2.79E−07	3.59E−08	1.77E−06	2.79E−05	2.2%	liver; lesions, fatty cyst formation	1000	4.62E−12	2.19E−10	0.7%	[B2]
4,4'–DDT	4.02E−02	4.94E−02	8.43E−09	3.61E−10	1.42E−07	1.83E−08	1.69E−05	2.84E−04	22.3%	liver; lesions	100	1.23E−10	6.21E−09	20.7%	[B2]
Dieldrin	3.87E−02	5.00E−02	3.02E−10	1.30E−11	5.35E−09	6.88E−10	6.05E−06	1.07E−04	8.4%	liver; lesions	100	2.07E−10	1.10E−08	36.6%	[B2]
Endrin	3.87E−02	5.00E−02	3.02E−10	1.29E−11	5.35E−09	6.88E−10	1.00E−06	1.78E−05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.82E−02	2.34E−02	1.24E−10	5.32E−12	2.19E−09	2.82E−10	4.14E−07	7.31E−06	0.6%	liver, kidney; toxicity		6.92E−12	3.67E−10	1.2%	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	3.33E−10	1.43E−11	3.28E−09	6.79E−10	2.56E−05	4.06E−04	31.9%	liver; inc. relative weight		1.30E−10	6.18E−09	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.79E−08	4.20E−09	1.55E−06	2.00E−07	9.79E−06	1.55E−04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.49E−05	1.28E−03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.77E−10	3.00E−08	100.0%	

Table M.59. Risk characterization for sediments: adults – dermal exposure (current land use – open) – Area S2–C1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (RME)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.07E-10	1.37E-11	4.51E-09	1.93E-09	3.56E-07	1.50E-05	16.3%	skin; keratosis, hyperpigmentation	3	2.41E-11	3.38E-09	8.7%	[A]
Barium	78.13	88.46	1.83E-09	2.36E-10	7.56E-08	3.24E-08	2.62E-08	1.08E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.15E-11	2.76E-12	8.77E-10	3.76E-10	4.30E-09	1.75E-07	0.2%	no observed effects	100	1.19E-11	1.62E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.33E-11	4.28E-12	1.46E-09	6.27E-10	3.33E-08	1.46E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.12E-09	1.44E-10	4.71E-08	2.02E-08	1.12E-09	4.71E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.63E-10	7.24E-11	2.55E-08	1.09E-08	1.52E-08	6.90E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.24E-09	1.60E-10	8.51E-08	3.65E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.08E-08	2.68E-09	8.86E-07	3.80E-07	1.49E-07	6.33E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.51E-10	4.51E-11	1.75E-08	7.50E-09	1.17E-06	5.83E-05	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.43E-10	6.99E-11	2.37E-08	1.02E-08	2.72E-08	1.18E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.82E-10	8.77E-11	2.89E-08	1.24E-08	9.74E-08	4.12E-06	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.28E-09	2.93E-10	1.03E-07	4.43E-08	7.60E-09	3.44E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.42E-11	3.11E-12	1.40E-09	5.99E-10				--	--	2.40E-11	4.61E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.90E-11	2.44E-12	1.19E-09	5.08E-10				--	--	1.88E-11	3.91E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.64E-11	9.82E-12	4.42E-09	1.90E-09	2.55E-09	1.47E-07	0.2%	--	--	7.17E-12	1.38E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.40E-11	9.52E-12	4.15E-09	1.78E-09	2.47E-09	1.38E-07	0.2%	--	--	6.95E-11	1.30E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.60E-11	1.13E-11	4.97E-09	2.13E-09	2.93E-09	1.66E-07	0.2%	--	--	8.26E-12	1.55E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.21E-11	9.27E-12	3.39E-09	1.45E-09	2.40E-09	1.13E-07	0.1%	--	--	6.77E-12	1.06E-09	2.7%	[B2]
Chrysene	0.31	0.49	7.26E-11	9.34E-12	4.20E-09	1.80E-09	2.42E-09	1.40E-07	0.2%	--	--	6.82E-13	1.31E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.15E-11	6.63E-12	2.06E-09	8.85E-10	1.72E-09	6.88E-08	0.1%	--	--	4.84E-11	6.41E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.80E-12	2.32E-13	1.16E-10	4.95E-11	3.61E-08	2.31E-06	2.5%	liver; lesions	100	3.71E-12	7.92E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.47E-11	8.32E-12	3.24E-09	1.39E-09	2.16E-09	1.08E-07	0.1%	--	--	6.07E-12	1.01E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.94E-06	9.19E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.29E-10	3.89E-08	100.0%	

Table M.60. Risk characterization for sediments: children – dermal exposure (current land use – open) – Area S2–C1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.1E-10	4.7E-12	4.8E-09	6.2E-10	3.6E-07	1.6E-05	16.3%	skin; keratosis, hyperpigmentation	3	8.2E-12	1.0E-09	8.7%	[A]
Barium	78.13	88.46	1.8E-09	8.1E-11	8.1E-08	1.0E-08	2.7E-08	1.1E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.2E-11	9.4E-13	9.4E-10	1.2E-10	4.4E-09	1.8E-07	0.2%	no observed effects	100	4.0E-12	5.2E-10	4.2%	[B2]
Cadmium	1.42	1.71	3.4E-11	1.4E-12	1.5E-09	2.0E-10	3.4E-08	1.5E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.1E-09	4.9E-11	5.0E-08	6.5E-09	1.1E-09	5.0E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.8E-10	2.4E-11	2.7E-08	3.5E-09	1.5E-08	7.4E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.2E-09	5.4E-11	9.1E-08	1.1E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.1E-08	9.1E-10	9.5E-07	1.2E-07	1.5E-07	6.8E-06	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.6E-10	1.5E-11	1.8E-08	2.4E-09	1.2E-06	6.2E-05	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.6E-10	2.4E-11	2.5E-08	3.2E-09	2.8E-08	1.2E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	7.0E-10	3.0E-11	3.1E-08	3.9E-09	1.0E-07	4.4E-06	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.3E-09	1.0E-10	1.1E-07	1.4E-08	7.8E-09	3.7E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.5E-11	1.0E-12	1.5E-09	1.9E-10				--	--	8.2E-12	1.4E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.9E-11	8.3E-13	1.2E-09	1.6E-10				--	--	6.4E-12	1.2E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.8E-11	3.3E-12	4.7E-09	6.1E-10	2.6E-09	1.5E-07	0.2%	--	--	2.4E-12	4.4E-10	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.6E-11	3.2E-12	4.4E-09	5.7E-10	2.5E-09	1.4E-07	0.2%	--	--	2.3E-11	4.1E-09	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	9.0E-11	3.8E-12	5.3E-09	6.8E-10	3.0E-09	1.7E-07	0.2%	--	--	2.8E-12	5.0E-10	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.4E-11	3.1E-12	3.6E-09	4.6E-10	2.4E-09	1.2E-07	0.1%	--	--	2.3E-12	3.4E-10	2.7%	[B2]
Chrysene	0.31	0.49	7.4E-11	3.2E-12	4.5E-09	5.8E-10	2.4E-09	1.5E-07	0.2%	--	--	2.3E-13	4.2E-11	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.3E-11	2.2E-12	2.2E-09	2.8E-10	1.7E-09	7.4E-08	0.1%	--	--	1.6E-11	2.0E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.8E-12	7.9E-14	1.2E-10	1.6E-11	3.7E-08	2.4E-06	2.5%	liver; lesions	100	1.2E-12	2.5E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.6E-11	2.8E-12	3.4E-09	4.4E-10	2.2E-09	1.1E-07	0.1%	--	--	2.0E-12	3.2E-10	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.0E-06	9.9E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.8E-11	1.2E-08	100.0%	

Table M.61. Risk characterization summary for EFPC Segment 2: RME estimates for future land use

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	9.89E+00 *B*	NA	7.61E−05 W	NA	7.00E−06 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards:													
Hazard Index: Combined Exposure		NA	NA					NA	9.9E+00 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	8E−05 W		
Radiological Hazards:													
Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	7E−06 W

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	8.58E−01 B	2.40E−01 B	2.60E−05 W	2.42E−05 W	1.81E−07 B	4.54E−07 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	3.44E−02 B	2.63E−02 B	5.39E−06 W	1.37E−05 W	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	3.28E+01 *B*	2.77E+01 *B*	9.08E−05 W	2.56E−04 *B*	3.10E−06 W	2.35E−05 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	7.30E−04 B	1.61E−04 B	1.33E−07 B	9.78E−08 B	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	6.29E+01 *B*	3.03E+01 *B*	2.64E−04 *B*	4.24E−04 *B*	2.24E−07 B	9.68E−07 B
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards:													
Hazard Index: Combined Exposure		NA	NA					9.7E+01 *B*	5.8E+01 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					4E−04 *B*	8E−04 *B*		
Radiological Hazards:													
Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					4E−06 W	2E−05 W

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.62. human health risk characterization summary for EFPC residential scenario: future land use, Area S2–F1–R adult long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	5.29E–02	2.40E–01	1.65E–06	2.42E–05
Dermal Contact	1.93E–03	2.63E–02	2.64E–07	1.37E–05
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion	1.58E+01	2.77E+01	3.84E–05	2.56E–04
Inhalation (VOCs)	4.01E–05	1.61E–04	7.30E–09	9.78E–08
FOOD CHAIN				
Produce	4.60E+00	3.03E+01	2.41E–05	4.24E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.21E–08	4.54E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion			3.59E–06	2.35E–05
FOOD CHAIN				
Produce			4.05E–08	9.68E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.1E+01	5.8E+01		
Excess Lifetime Cancer Risk: Combined Exposure			7E–05	8E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			4E–06	2E–05

Table M.63. human health risk characterization summary for EFPC residential scenario: future land use, Area S2–F1–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.85E–01	8.58E–01	1.93E–06	2.60E–05
Dermal Contact	2.51E–03	3.44E–02	1.15E–07	5.39E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion	1.65E+01	3.28E+01	1.33E–05	9.08E–05
Inhalation (VOCs)	2.34E–04	7.30E–04	1.42E–08	1.33E–07
FOOD CHAIN				
Produce	1.03E+01	6.29E+01	1.80E–05	2.64E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.34E–08	1.81E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion			4.45E–07	3.10E–06
FOOD CHAIN				
Produce			1.08E–08	2.24E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.7E+01	9.7E+01		
Excess Lifetime Cancer Risk: Combined Exposure			3E–05	4E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–07	4E–06

Table M.64. Human health risk characterization summary: EFPC commercial scenario: future land use, Area S2–F2–C adult long term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion				
Dermal Contact				
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion	5.66E+00	9.89E+00	1.37E−05	7.61E−05
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion				
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion			1.28E−06	7.00E−06
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.66E+00	9.89E+00		
Excess Lifetime Cancer Risk: Combined Exposure			1.37E−05	7.61E−05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1.28E−06	7.00E−06

Table M.65. Risk characterization for soils: adults – ingestion exposure (future land use – residential) – Area S2–F1–R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	0.82	0.98	3.45E-07	4.43E-08	1.34E-06	5.73E-07	8.62E-04	3.34E-03	1.4%	whole body, blood; inc. mortality	1000				
Arsenic	8.55	9.77	3.60E-06	4.64E-07	1.34E-05	5.74E-06	1.20E-02	4.46E-02	18.6%	skin; keratosis, hyperpigmentation	3	8.13E-07	1.00E-05	41.5%	[A]
Barium	146.50	203.70	6.19E-05	7.96E-06	2.79E-04	1.20E-04	8.85E-04	3.99E-03	1.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.90	1.07	3.86E-07	4.91E-08	1.46E-06	6.28E-07	7.64E-05	2.93E-04	0.1%	no observed effects	100	2.11E-07	2.70E-06	11.2%	[B2]
Cadmium	4.83	7.08	2.04E-06	2.63E-07	9.70E-06	4.16E-06	2.04E-03	9.70E-03	4.0%	kidney; proteinuria	10				
Chromium (III)	61.17	63.90	2.59E-05	3.32E-06	8.75E-05	3.75E-05	2.59E-05	8.75E-05	0.0%	no observed effects	100				
Copper	152.30	255.90	6.44E-05	8.28E-06	3.51E-04	1.50E-04	1.74E-03	9.47E-03	4.0%	Gastrointestinal system; irritation	--				[D]
Lead	42.97	55.85	1.82E-05	2.34E-06	7.65E-05	3.28E-05				CNS, blood	--				[B2]
Manganese	814.70	860.10	3.44E-04	4.43E-05	1.18E-03	5.05E-04	2.46E-03	8.42E-03	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	22.03	33.26	9.31E-06	1.20E-06	4.56E-05	1.95E-05	3.10E-02	1.52E-01	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	39.28	56.75	1.66E-05	2.13E-06	7.77E-05	3.33E-05	8.30E-04	3.89E-03	1.6%	dec. body and organ weight	300				
Selenium	12.34	14.57	5.22E-06	6.71E-07	2.00E-05	8.55E-06	1.04E-03	3.99E-03	1.7%	whole body; clinical selenosis	3				[D]
Silver	2.33	3.34	9.86E-07	1.27E-07	4.58E-06	1.96E-06	1.97E-04	9.16E-04	0.4%	skin; argyria	3				[D]
Zinc	307.40	436.40	1.30E-04	1.67E-05	5.98E-04	2.56E-04	4.33E-04	1.99E-03	0.8%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.37	0.65	1.55E-07	2.00E-08	8.87E-07	3.80E-07			--		--	1.54E-07	2.93E-06	12.1%	[B2]
Benzo(a)anthracene	0.85	1.50	3.58E-07	4.60E-08	2.05E-06	8.81E-07	1.19E-05	6.85E-05	0.0%	--	--	3.36E-08	6.43E-07	2.7%	[B2]
Benzo(a)pyrene	0.63	1.08	2.67E-07	3.43E-08	1.47E-06	6.31E-07	8.90E-06	4.91E-05	0.0%	--	--	2.51E-07	4.61E-06	19.1%	[B2]
Benzo(b)fluoranthene	1.23	1.97	5.21E-07	6.70E-08	2.70E-06	1.16E-06	1.74E-05	9.00E-05	0.0%	--	--	4.89E-08	8.44E-07	3.5%	[B2]
Benzo(k)fluoranthene	1.23	1.97	5.21E-07	6.70E-08	2.70E-06	1.16E-06	1.74E-05	9.00E-05	0.0%	--	--	4.89E-08	8.44E-07	3.5%	[B2]
Chrysene	0.62	1.00	2.61E-07	3.36E-08	1.37E-06	5.89E-07	8.71E-06	4.58E-05	0.0%	--	--	2.45E-09	4.30E-08	0.2%	[B2]
Dibenzo(a,h)anthracene	0.18	0.27	7.57E-08	9.74E-09	3.70E-07	1.59E-07	2.52E-06	1.23E-05	0.0%	--	--	7.11E-08	1.16E-06	4.8%	[B2]
Indeno(1,2,3–cd)pyrene	0.53	0.88	2.23E-07	2.87E-08	1.21E-06	5.19E-07	7.44E-06	4.04E-05	0.0%	--	--	2.10E-08	3.79E-07	1.6%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.76	1.23		7.40E+01		1.29E+03						2.07E-09	3.61E-08	7.9%	[A]
Cobalt 60	0.02	0.08		1.78E+00		8.00E+01						2.66E-11	1.20E-09	0.3%	[A]
Neptunium 237+D	0.02	0.03		1.47E+00		3.51E+01						3.24E-10	7.73E-09	1.7%	[A]
Protactinium 233	0.02	0.09		1.61E+00		8.97E+01						1.61E-12	8.97E-11	0.0%	[A]
Thorium 228+D	1.52	2.11		1.47E+02		2.22E+03						8.11E-09	1.22E-07	26.8%	[A]
Thorium 230	4.56	6.52		4.44E+02		6.84E+03						5.77E-09	8.89E-08	19.6%	[A]
Thorium 232	1.31	1.74		1.27E+02		1.83E+03						1.53E-09	2.19E-08	4.8%	[A]
Uranium 234	3.09	3.59		3.00E+02		3.76E+03						4.80E-09	6.02E-08	13.3%	[A]
Uranium 235+D	0.14	0.16		1.32E+01		1.65E+02						2.11E-10	2.64E-09	0.6%	[A]
Uranium 238+D	3.40	3.86		3.31E+02		4.05E+03						9.26E-09	1.13E-07	25.0%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	3.29E-02	2.40E-01	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.65E-06	2.42E-05	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	3.21E-08	4.54E-07	100.0%

Table M.66. Risk characterization for soils: children – ingestion exposure (future land use – residential) – Area S2–F1–R

Chemical	MLB Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	IRIS UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Antimony	0.82	0.98	1.2E-06	5.1E-08	4.7E-06	6.1E-07	3.0E-03	1.2E-02	1.4%	whole body, blood; inc. mortality	1000				
Arsenic	8.55	9.77	1.2E-05	5.4E-07	4.7E-05	6.1E-06	4.2E-02	1.6E-01	18.6%	skin; keratosis, hyperpigmentation	3	9.4E-07	1.0E-05	41.5%	[A]
Barium	146.50	203.70	2.1E-04	9.2E-06	9.9E-04	1.2E-04	3.1E-03	1.4E-02	1.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.90	1.07	1.3E-06	5.7E-08	5.2E-06	6.7E-07	2.6E-04	1.0E-03	0.1%	no observed effects	100	2.4E-07	2.9E-06	11.2%	[B2]
Cadmium	4.83	7.08	7.1E-06	3.0E-07	3.4E-05	4.4E-06	7.1E-03	3.4E-02	4.0%	kidney; proteinuria	10				
Chromium (III)	61.17	63.90	9.0E-05	3.8E-06	3.1E-04	4.0E-05	9.0E-05	3.1E-04	0.0%	no observed effects	100				
Copper	152.30	255.90	2.2E-04	9.6E-06	1.2E-03	1.6E-04	6.0E-03	3.3E-02	4.0%	Gastrointestinal system; irritation	--				[D]
Lead	42.97	55.85	6.3E-05	2.7E-06	2.7E-04	3.5E-05				CNS, blood	--				[B2]
Manganese	814.70	860.10	1.2E-03	5.1E-05	4.2E-03	5.4E-04	8.6E-03	3.0E-02	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	22.03	33.26	3.2E-05	1.4E-06	1.6E-04	2.1E-05	1.0E-01	5.4E-01	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	39.28	56.75	5.8E-05	2.4E-06	2.7E-04	3.5E-05	2.9E-03	1.3E-02	1.6%	dec. body and organ weight	300				
Selenium	12.34	14.57	1.8E-05	7.8E-07	7.1E-05	9.1E-06	3.6E-03	1.4E-02	1.7%	whole body; clinical selenosis	3				[D]
Silver	2.33	3.34	3.4E-06	1.4E-07	1.6E-05	2.1E-06	6.9E-04	3.2E-03	0.4%	skin; argyria	3				[D]
Zinc	307.40	436.40	4.5E-04	1.9E-05	2.1E-03	2.7E-04	1.5E-03	7.1E-03	0.8%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.37	0.65	5.4E-07	2.3E-08	3.1E-06	4.0E-07				--	--	1.7E-07	3.1E-06	12.1%	[B2]
Benzo(a)anthracene	0.85	1.50	1.2E-06	5.3E-08	7.3E-06	9.4E-07	4.1E-05	2.4E-04	0.0%	--	--	3.9E-08	6.9E-07	2.7%	[B2]
Benzo(a)pyrene	0.63	1.08	9.3E-07	4.0E-08	5.2E-06	6.7E-07	3.1E-05	1.7E-04	0.0%	--	--	2.9E-07	4.9E-06	19.1%	[B2]
Benzo(b)fluoranthene	1.23	1.97	1.8E-06	7.8E-08	9.6E-06	1.2E-06	6.0E-05	3.2E-04	0.0%	--	--	5.7E-08	9.0E-07	3.5%	[B2]
Benzo(k)fluoranthene	1.23	1.97	1.8E-06	7.8E-08	9.6E-06	1.2E-06	6.0E-05	3.2E-04	0.0%	--	--	5.7E-08	9.0E-07	3.5%	[B2]
Chrysene	0.62	1.00	9.1E-07	3.9E-08	4.9E-06	6.3E-07	3.0E-05	1.6E-04	0.0%	--	--	2.8E-09	4.6E-08	0.2%	[B2]
Dibenzo(a,h)anthracene	0.18	0.27	2.6E-07	1.1E-08	1.3E-06	1.7E-07	8.8E-06	4.4E-05	0.0%	--	--	8.2E-08	1.2E-06	4.8%	[B2]
Indeno(1,2,3-cd)pyrene	0.53	0.88	7.8E-07	3.3E-08	4.3E-06	5.5E-07	2.6E-05	1.4E-04	0.0%	--	--	2.4E-08	4.0E-07	1.6%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.76	1.23		3.0E+01		5.1E+02						8.6E-10	1.4E-08	7.9%	[A]
Cobalt 60	0.02	0.08		7.4E-01		3.1E+01						1.1E-11	4.7E-10	0.3%	[A]
Neptunium 237+D	0.02	0.03		6.1E-01		1.4E+01						1.3E-10	3.0E-09	1.7%	[A]
Protactinium 233	0.02	0.09		6.6E-01		3.5E+01						6.6E-13	3.5E-11	0.0%	[A]
Thorium 228+D	1.52	2.11		6.1E+01		8.8E+02						3.3E-09	4.8E-08	26.8%	[A]
Thorium 230	4.56	6.52		1.8E+02		2.7E+03						2.4E-09	3.5E-08	19.6%	[A]
Thorium 232	1.31	1.74		5.3E+01		7.3E+02						6.3E-10	8.7E-09	4.8%	[A]
Uranium 234	3.09	3.59		1.2E+02		1.5E+03						2.0E-09	2.4E-08	13.3%	[A]
Uranium 235+D	0.14	0.16		5.4E+00		6.5E+01						8.7E-11	1.0E-09	0.6%	[A]
Uranium 238+D	3.40	3.86		1.3E+02		1.6E+03						3.8E-09	4.5E-08	25.0%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.6E-01	8.3E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.9E-06	2.6E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.3E-08	1.8E-07	100.0%	

Table M.67. Risk characterization for soils: adults – dermal exposure (future land use – residential) – Area S2–F1–R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Antimony	0.82	0.98	1.24E-08	1.60E-09	1.45E-07	6.20E-08	3.10E-05	3.62E-04	1.4%	whole body, blood; inc. mortality	1000				
Arsenic	8.55	9.77	1.30E-07	1.67E-08	1.45E-06	6.20E-07	4.33E-04	4.82E-03	18.3%	skin; keratosis, hyperpigmentation	3	2.93E-08	1.09E-06	7.9%	[A]
Barium	146.50	203.70	2.22E-06	2.87E-07	3.02E-05	1.25E-05	3.18E-05	4.31E-04	1.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.90	1.07	1.37E-08	1.77E-09	1.58E-07	6.78E-08	2.75E-06	3.17E-05	0.1%	no observed effects	100	7.60E-09	2.97E-07	2.1%	[B2]
Cadmium	4.83	7.08	7.35E-08	9.46E-09	1.05E-06	4.45E-07	7.35E-05	1.05E-03	4.0%	kidney; proteinuria	10				
Chromium (III)	61.17	63.90	9.31E-07	1.20E-07	9.46E-06	4.06E-06	9.31E-07	9.46E-06	0.0%	no observed effects	100				
Copper	152.30	255.90	2.32E-06	2.98E-07	3.79E-05	1.62E-05	6.26E-05	1.02E-03	3.9%	Gastrointestinal system; irritation	--				[D]
Lead	42.97	55.85	6.54E-07	8.41E-08	8.27E-06	3.54E-06				CNS, blood	--				[B2]
Manganese	814.70	860.10	1.24E-05	1.59E-06	1.27E-04	5.46E-05	8.86E-05	9.10E-04	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	22.03	33.26	3.35E-07	4.31E-08	4.93E-06	2.11E-06	1.12E-03	1.64E-02	62.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	39.28	56.75	5.98E-07	7.69E-08	8.40E-06	3.60E-06	2.99E-05	4.20E-04	1.6%	doc. body and organ weight	300				
Selenium	12.34	14.57	1.88E-07	2.41E-08	2.16E-06	9.25E-07	3.76E-05	4.32E-04	1.6%	whole body; clinical selenosis	3				[D]
Silver	2.33	3.34	3.55E-08	4.56E-09	4.95E-07	2.12E-07	7.10E-06	9.90E-05	0.4%	skin; argyria	3				[D]
Zinc	307.40	436.40	4.68E-06	6.01E-07	6.46E-05	2.77E-05	1.56E-05	2.15E-04	0.8%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.37	0.65	5.55E-08	7.19E-09	9.55E-07	4.11E-07				--	--	5.53E-08	3.10E-06	23.0%	[B2]
Benzo(a)anthracene	0.85	1.50	1.25E-07	1.66E-08	2.22E-06	9.52E-07	4.25E-06	7.40E-05	0.3%	--	--	1.21E-08	6.95E-07	5.1%	[B2]
Benzo(a)pyrene	0.63	1.08	9.61E-08	1.24E-08	1.59E-06	6.82E-07	3.20E-06	5.31E-05	0.2%	--	--	9.02E-08	4.95E-06	36.2%	[B2]
Benzo(b)fluoranthene	1.23	1.97	1.86E-07	2.41E-08	2.92E-06	1.25E-06	6.25E-06	9.72E-05	0.4%	--	--	1.76E-08	9.13E-07	6.6%	[B2]
Benzo(k)fluoranthene	1.23	1.97	1.86E-07	2.41E-08	2.92E-06	1.25E-06	6.25E-06	9.72E-05	0.4%	--	--	1.76E-08	9.13E-07	6.6%	[B2]
Chrysene	0.62	1.00	9.41E-08	1.21E-08	1.49E-06	6.37E-07	3.14E-06	4.95E-05	0.2%	--	--	8.83E-10	4.65E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.18	0.27	2.73E-08	3.51E-09	4.00E-07	1.71E-07	9.09E-07	1.33E-05	0.1%	--	--	2.56E-08	1.25E-06	9.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.53	0.88	8.04E-08	1.03E-08	1.31E-06	5.61E-07	2.68E-06	4.36E-05	0.2%	--	--	7.55E-09	4.10E-07	3.0%	[B2]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	1.93E-03	2.63E-02	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.64E-07	1.37E-05	100.0%

Table M.68. Risk characterization for soils: children – dermal exposure (future land use – residential) – Area S2–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.82	0.98	1.6E-08	6.9E-10	1.8E-07	2.4E-08	4.0E-05	4.7E-04	1.4%	whole body, blood; inc. mortality	1000				
Arsenic	8.55	9.77	1.6E-07	7.2E-09	1.8E-06	2.4E-07	5.6E-04	6.3E-03	18.3%	skin; keratosis, hyperpigmentation	3	1.2E-08	4.2E-07	7.9%	[A]
Barium	146.50	203.70	2.9E-06	1.2E-07	3.9E-05	5.0E-06	4.1E-05	5.6E-04	1.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.90	1.07	1.7E-08	7.6E-10	2.0E-07	2.6E-08	3.5E-06	4.1E-05	0.1%	no observed effects	100	3.3E-09	1.1E-07	2.1%	[B2]
Cadmium	4.83	7.08	9.5E-08	4.1E-09	1.3E-06	1.7E-07	9.5E-05	1.3E-03	4.0%	kidney; proteinuria	10				
Chromium (III)	61.17	63.90	1.2E-06	5.2E-08	1.2E-05	1.5E-06	1.2E-06	1.2E-05	0.0%	no observed effects	100				
Copper	152.30	255.90	3.0E-06	1.2E-07	4.9E-05	6.3E-06	8.1E-05	1.3E-03	3.9%	Gastrointestinal system; irritation	--				[D]
Lead	42.97	55.85	8.5E-07	3.6E-08	1.0E-05	1.3E-06				CNS, blood	--				[B2]
Manganese	814.70	860.10	1.6E-05	6.9E-07	1.6E-04	2.1E-05	1.1E-04	1.1E-03	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	22.03	33.26	4.3E-07	1.8E-08	6.4E-06	8.2E-07	1.4E-03	2.1E-02	62.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	39.28	56.75	7.7E-07	3.3E-08	1.1E-05	1.4E-06	3.9E-05	5.5E-04	1.6%	dec. body and organ weight	300				
Selenium	12.34	14.57	2.4E-07	1.0E-08	2.8E-06	3.6E-07	4.9E-05	5.6E-04	1.6%	whole body; clinical selenosis	3				[D]
Silver	2.33	3.34	4.6E-08	1.9E-09	6.4E-07	8.3E-08	9.2E-06	1.2E-04	0.4%	skin; argyria	3				[D]
Zinc	307.40	436.40	6.1E-06	2.6E-07	8.4E-05	1.0E-05	2.0E-05	2.8E-04	0.8%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.37	0.65	7.2E-08	3.1E-09	1.2E-06	1.6E-07				--	--	2.4E-08	1.2E-06	23.0%	[B2]
Benzo(a)anthracene	0.85	1.50	1.6E-07	7.2E-09	2.9E-06	3.7E-07	5.6E-06	9.6E-05	0.3%	--	--	5.2E-09	2.7E-07	5.1%	[B2]
Benzo(a)pyrene	0.63	1.08	1.2E-07	5.3E-09	2.0E-06	2.6E-07	4.1E-06	6.9E-05	0.2%	--	--	3.9E-08	1.9E-06	36.2%	[B2]
Benzo(b)fluoranthene	1.23	1.97	2.4E-07	1.0E-08	3.8E-06	4.9E-07	8.1E-06	1.2E-04	0.4%	--	--	7.6E-09	3.5E-07	6.6%	[B2]
Benzo(k)fluoranthene	1.23	1.97	2.4E-07	1.0E-08	3.8E-06	4.9E-07	8.1E-06	1.2E-04	0.4%	--	--	7.6E-09	3.5E-07	6.6%	[B2]
Chrysene	0.62	1.00	1.2E-07	5.2E-09	1.9E-06	2.5E-07	4.0E-06	6.4E-05	0.2%	--	--	3.8E-10	1.8E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.18	0.27	3.5E-08	1.5E-09	5.2E-07	6.7E-08	1.1E-06	1.7E-05	0.1%	--	--	1.1E-08	4.9E-07	9.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.53	0.88	1.0E-07	4.4E-09	1.7E-06	2.2E-07	3.4E-06	5.7E-05	0.2%	--	--	3.2E-09	1.6E-07	3.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.5E-03	3.4E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.1E-07	5.3E-06	100.0%	

Table M.69. Risk characterization for surface water: adults – ingestion exposure (swimming) (future land use – residential) – Area S2–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation					
Manganese (water)	2.69E+02	4.13E+02	3.68E-06	4.73E-07	3.36E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.71E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	[D2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	[D2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	0.4%	liver; lesions, fatty cyst formation	1000	4.37E-11	9.97E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.86E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.09E-09	2.79E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity		4.16E-11	1.00E-09	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	1.8%	liver; inc. relative weight		3.46E-10	7.94E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	9.67E-04	8.62E-03	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.46E-09	6.01E-08	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	3.49E-10	1.30E-08	100.0%

Table M.70. Risk characterization for surface water: children – ingestion exposure (swimming) (future land use – residential) – Area S2–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	Risk Estimates: HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfCo WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E-06	1.30E-07	2.30E-05	2.96E-06	4.34E-05	3.29E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.60E+00	1.32E+01	2.95E-07	1.26E-08	2.89E-06	3.72E-07	2.99E-07	2.89E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E-07	3.04E-08	4.86E-06	6.17E-07	1.92E-05	1.30E-04	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E-05	4.42E-07	9.05E-05	1.16E-05	2.06E-03	1.81E-02	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E-07	4.40E-09	8.62E-07	1.11E-07	3.42E-04	2.87E-03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E-07	1.38E-08	3.09E-06	3.97E-07	4.60E-05	4.41E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E-06	1.13E-07	1.99E-05	2.56E-06	8.79E-06	6.64E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E-07	1.02E-08	1.69E-06	2.17E-07	2.38E-06	1.69E-05	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	8.91E-10	3.82E-11	5.48E-09	7.05E-10	2.97E-05	1.83E-04	0.8%	liver; lesions, toxicity	1000	6.49E-10	1.20E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E-07	1.56E-08	3.04E-06	3.90E-07	1.82E-05	1.52E-04	0.7%	liver; weight inc.	1000	2.19E-10	5.46E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E-07	6.69E-09	1.03E-06	1.32E-07	1.56E-05	1.03E-04	0.4%	liver; lesions, fattycyst formation	1000	4.08E-11	8.06E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.54E-09	6.6E-11	1.08E-08	1.39E-09	3.08E-06	2.17E-05	0.1%	liver; lesions	100	2.25E-11	4.73E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	1.49E-09	6.37E-11	1.10E-08	1.41E-09	2.97E-05	2.19E-04	0.9%	liver; lesions	100	1.02E-09	2.25E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	1.48E-09	6.36E-11	1.10E-08	1.41E-09	4.95E-06	3.65E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	6.97E-10	2.99E-11	5.14E-09	6.66E-10	2.32E-06	1.71E-05	0.1%	liver, kidney; toxicity		3.89E-11	8.56E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	8.28E-10	3.55E-11	5.48E-09	7.05E-10	6.37E-05	4.21E-04	1.8%	liver; inc. relative weight		3.23E-10	6.41E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E-07	6.87E-09	1.06E-06	1.36E-07	1.60E-05	1.06E-04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E-11	1.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E-10	2.78E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.71E-03	2.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E-09	4.85E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E-10	4.07E-09	100.0%	

Table M.71. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (future land use – residential) – Area S2–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.58E-06	0.0%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.87E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.35E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.76E-09	1.19E-09	8.21E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[D2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[D2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fatty cyst formation	1000	1.88E-10	7.57E-09	0.7%	[D2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[D2]
Dieldrin	3.87E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[D2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.65E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity		2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.45E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; inc. relative weight		5.29E-09	2.14E-07	20.6%	[D2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.02E-03	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.35E-08	1.04E-06	100.0%	

Table M.72. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (future land use – residential) – Area S2–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E-07	4.69E-09	1.53E-06	1.96E-07	1.56E-06	2.18E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	3.18E-07	4.09E-08	6.91E-07	8.60E-06	0.0%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	7.43E-05	1.20E-03	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E-09	1.59E-10	5.72E-08	7.35E-09	1.23E-05	1.91E-04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E-08	4.98E-10	2.05E-07	2.64E-08	1.66E-06	2.93E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.21E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.21E-04	0.7%	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	12.0%	liver; weight inc.	1000	1.63E-09	7.47E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E-07	1.34E-08	3.79E-06	4.87E-07	3.13E-05	3.79E-04	2.2%	liver; lesions, fatty cyst formation	1000	8.19E-11	2.97E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.99E-04	3.86E-03	22.3%	liver; lesions	100	2.18E-09	8.44E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.45E-03	8.4%	liver; lesions	100	3.67E-09	1.50E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	0.6%	liver, kidney; toxicity		1.23E-10	4.98E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	31.9%	liver; inc. relative weight		2.30E-09	8.40E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.71E-06	1.73E-04	2.11E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.33E-03	1.73E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-08	4.08E-07	100.0%	

Table M.73. Risk characterization for sediments: adults – dermal exposure (future land use – residential) – Area S2–F1–R

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[D2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.50E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.60	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%	--	--	5.02E-11	9.99E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-09	2.8E-07	100.0%	

Table M.74. Risk characterization for sediments: children – dermal exposure (future land use – residential) – Area S2–F1–R

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.76E-10	4.18E-11	4.24E-08	5.45E-09	3.25E-06	1.41E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.32E-11	9.55E-09	8.7%	[A]
Barium	78.13	88.46	1.67E-08	7.17E-10	7.12E-07	9.16E-08	2.39E-07	1.02E-05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.98E-10	8.47E-12	8.25E-09	1.06E-09	3.92E-08	1.65E-06	0.2%	no observed effects	100	3.61E-11	4.56E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.04E-10	1.30E-11	1.38E-08	1.77E-09	3.04E-07	1.38E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.02E-08	4.38E-10	4.43E-07	5.70E-08	1.02E-08	4.43E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.14E-09	2.20E-10	2.41E-07	3.09E-08	1.39E-07	6.53E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.13E-08	4.86E-10	8.01E-07	1.03E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.90E-07	8.14E-09	8.34E-06	1.07E-06	1.36E-06	5.96E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.20E-09	1.37E-10	1.65E-07	2.12E-08	1.07E-05	5.49E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.96E-09	2.12E-10	2.23E-07	2.87E-08	2.48E-07	1.12E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.22E-09	2.67E-10	2.72E-07	3.49E-08	8.89E-07	3.88E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.08E-08	8.91E-10	9.73E-07	1.25E-07	6.93E-08	3.24E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.21E-10	9.47E-12	1.32E-08	1.69E-09				--	--	7.29E-11	1.30E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.73E-10	7.42E-12	1.12E-08	1.44E-09				--	--	5.71E-11	1.11E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.97E-10	2.99E-11	4.16E-08	5.35E-09	2.32E-08	1.39E-06	0.2%	--	--	2.16E-11	3.91E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.75E-10	2.89E-11	3.99E-08	5.02E-09	2.25E-08	1.30E-06	0.2%	--	--	2.11E-10	3.67E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.03E-10	3.44E-11	4.68E-08	6.01E-09	2.68E-08	1.56E-06	0.2%	--	--	2.51E-11	4.39E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.58E-10	2.82E-11	3.19E-08	4.10E-09	2.19E-08	1.06E-06	0.1%	--	--	2.06E-11	2.99E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.62E-10	2.84E-11	3.96E-08	5.09E-09	2.20E-08	1.32E-06	0.2%	--	--	2.07E-12	3.71E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.70E-10	2.02E-11	1.94E-08	2.50E-09	1.57E-08	6.48E-07	0.1%	--	--	1.47E-10	1.82E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.64E-11	7.05E-13	1.09E-09	1.40E-10	3.29E-07	2.18E-05	2.5%	liver; lesions	100	1.13E-11	2.24E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.96E-10	2.55E-11	3.05E-08	3.92E-09	1.97E-08	1.02E-06	0.1%	--	--	1.85E-11	2.86E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.77E-05	8.66E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.97E-10	1.10E-07	100.0%	

Table M.75. Risk characterization for groundwater: adults – ingestion exposure (future land use – residential) – Area S2–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern; Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.61E-05	9.78E-06	1.53E-04	6.55E-05	2.54E-01	5.09E-01	1.8%	skin; keratosis, hyperpigmentation	3	1.71E-05	1.15E-04	44.8%	[A]
Barium	3.95E+02	4.65E+02	7.58E-03	9.74E-04	1.33E-02	5.70E-03	1.08E-01	1.90E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.61E-05	4.64E-06	7.01E-05	3.00E-05	7.22E-03	1.40E-02	0.1%	no observed effects	100	2.00E-05	1.29E-04	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.33E-04	8.14E-05	1.12E-03	4.81E-04	6.33E-04	1.12E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.20E-04	4.12E-05	8.87E-03	3.86E-03	8.66E-03	2.40E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.13E-04	6.60E-05	9.68E-04	4.15E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E-02	9.22E-03	1.21E-01	5.19E-02	1.43E+01	2.42E+01	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.66E-04	3.42E-05	5.99E-04	2.57E-04	8.86E-01	2.00E+00	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.21E-04	1.18E-04	1.76E-03	7.55E-04	4.61E-02	8.81E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.49E-04	9.64E-05	1.34E-03	5.76E-04	1.07E-01	1.92E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	6.89E-03	8.86E-04	1.87E-02	8.01E-03	6.89E-02	1.87E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E-03	1.72E-04	3.69E-03	1.58E-03	2.23E-02	6.15E-02	0.2%	*oral and inhal.*–liver; toxicity	100	1.29E-06	1.19E-05	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.44E+04		8.54E+04						1.44E-06	8.54E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05						8.91E-07	6.11E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05						1.28E-06	8.86E-06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.58E+01	2.77E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.84E-05	2.56E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.59E-06	2.35E-05	100.0%	

Table M.76. Risk characterization for groundwater: children — ingestion exposure (future land use — residential) — Area S2—F1—R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.91E-05	3.39E-06	1.81E-04	2.33E-05	2.64E-01	6.03E-01	1.8%	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.88E-03	3.38E-04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	0.7%	*oral*—cardiovasc. sys.; inc. blood pressure. *Inhal.*—fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.61E-06	8.31E-05	1.07E-05	7.51E-03	1.66E-02	0.1%	no observed effects	100	6.92E-06	4.59E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.59E-04	2.82E-05	1.33E-03	1.71E-04	6.59E-04	1.33E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.84E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	1.49E+01	2.87E+01	87.4%	*oral*—CNS effects. *Inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.76E-04	1.18E-05	7.09E-04	9.12E-05	9.21E-01	2.36E+00	7.2%	*oral*—CNS; neurotoxicity. *Inhal.*—kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.58E-04	4.11E-05	2.09E-03	2.68E-04	4.79E-02	1.04E-01	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.26E-02	0.2%	*oral and inhal.*—liver; toxicity	100	4.47E-07	4.21E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D[j]	3.27E+00	4.07E+00		1.76E+03		1.13E+04						1.78E-07	1.13E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		6.99E+03		5.04E+04						1.10E-07	8.06E-07	26.0%	[A]
Uranium 238+D	1.02E+01	1.5E+01		5.55E+03		4.17E+04						1.50E-07	1.17E-06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.65E+01	3.28E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.33E-05	9.08E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.45E-07	3.10E-06	100.0%	

Table M.77. Risk characterization for groundwater: adults – inhalation exposure (future land use – residential) – Area S2–F1–R

Chemical	Chronic Daily Intake (CDI)						Risk Estimates								
	MLE Concentration in GW	RME Concentration in GW	CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CD/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	1.77E-04	2.2E-05	7.0E-04	3.0E-04				inc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.97E+01	1.3E+02	3.44E-05	4.4E-06	1.3E-04	5.9E-05	4.0E-05	1.6E-04	100.0%	*oral and inhal.*–liver; toxicity	100	7.3E-09	9.7E-08	100.0%	(B2)
Chemical Hazards:															
Hazard Index (HI):															
Combined Exposure (d)							4.0E-05	1.6E-04	100.0%						
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												7.3E-09	9.7E-08	100.0%	

Table M.78. Risk characterization for groundwater: children – inhalation exposure (future land use – residential) – Area S2–F1–R

Chemical	MLB Concentration in GW	RMB Concentration in GW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.0E–03	4.4E–05	3.1E–03	4.0E–04				Inc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.9E+01	1.3E+02	2.0E–04	8.6E–06	6.2E–04	8.0E–05	2.3E–04	7.3E–04	100.0%	*oral and inhal.*–liver; toxicity	100	1.4E–08	1.3E–07	100.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.3E–04	7.3E–04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.4E–08	1.3E–07	100.0%	

Table M.79. Risk characterization for produce: adults – ingestion exposure (future land use – residential) – Area S2–F1–R

Chemical	MLB Concentration from Mean Concentration in Soil	RMB Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	8.16E-03	9.77E-03	1.24E-06	1.60E-07	6.82E-06	2.92E-06	3.1E-03	1.7E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	6.84E-01	7.82E-01	1.04E-04	1.34E-05	5.46E-04	2.34E-04	3.4E-01	1.82E+00	6.0%	skin; keratosis, hyperpigmentation	3	2.35E-05	4.10E-04	96.5%	[A]
Barium	1.47E+00	2.04E+00	2.24E-04	2.87E-05	1.42E-03	6.10E-04	3.19E-03	2.03E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	3.61E-03	4.28E-03	5.51E-07	7.09E-08	2.99E-06	1.28E-06	1.1E-04	5.97E-04	0.0%	no observed effects	100	3.05E-07	5.51E-06	1.3%	[B2]
Cadmium	2.42E+00	3.54E+00	3.69E-04	4.74E-05	2.47E-03	1.06E-03	3.6E-01	2.47E+00	8.2%	kidney; proteinuria	10				
Chromium (III)	6.12E-01	6.39E-01	9.33E-05	1.20E-05	4.46E-04	1.91E-04	9.33E-05	4.46E-04	0.0%	no observed effects	100				
Copper	7.62E+00	1.28E+01	1.16E-03	1.49E-04	8.94E-03	3.83E-03	3.14E-02	2.42E-01	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	4.30E-01	5.59E-01	6.56E-05	8.43E-06	3.90E-04	1.67E-04				CNS, blood	--				[B2]
Manganese	3.26E+02	3.44E+02	4.97E-02	6.39E-03	2.40E-01	1.03E-01	3.5E-01	1.72E+00	5.7%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	6.6E+00	9.98E+00	1.01E-03	1.30E-04	6.97E-03	2.99E-03	3.3E+00	2.32E+01	76.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.96E+00	2.84E+00	3.00E-04	3.85E-05	1.98E-03	8.50E-04	1.5E-02	9.9E-02	0.3%	dec. body and organ weight	300				
Selenium	1.23E+00	1.46E+00	1.88E-04	2.42E-05	1.02E-03	4.36E-04	3.7E-02	2.04E-01	0.7%	whole body; clinical selenosis	3				[D]
Silver	4.67E-01	6.68E-01	7.12E-05	9.15E-06	4.67E-04	2.00E-04	1.4E-02	9.34E-02	0.3%	skin; argyria	3				[D]
Zinc	1.23E+02	1.75E+02	1.88E-02	2.41E-03	1.22E-01	5.23E-02	6.25E-02	4.07E-01	1.3%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor–1260	3.61E-04	6.36E-04	5.50E-08	7.07E-09	4.44E-07	1.90E-07				--	--	5.45E-08	1.47E-06	0.3%	[B2]
Benzo(a)anthracene	3.15E-03	5.57E-03	4.80E-07	6.17E-08	3.88E-06	1.67E-06	1.6E-05	1.3E-04	0.0%	--	--	4.50E-08	1.22E-06	0.3%	[B2]
Benzo(a)pyrene	1.19E-03	2.03E-03	1.82E-07	2.34E-08	1.42E-06	6.07E-07	6.0E-06	4.72E-05	0.0%	--	--	1.70E-07	4.43E-06	1.0%	[B2]
Benzo(b)fluoranthene	1.83E-03	2.92E-03	2.79E-07	3.59E-08	2.04E-06	8.75E-07	9.3E-06	6.80E-05	0.0%	--	--	2.62E-08	6.39E-07	0.2%	[B2]
Benzo(k)fluoranthene	1.31E-03	2.09E-03	2.00E-07	2.57E-08	1.46E-06	6.27E-07	6.67E-06	4.88E-05	0.0%	--	--	1.88E-08	4.58E-07	0.1%	[B2]
Chrysene	2.69E-03	4.37E-03	4.11E-07	5.29E-08	3.05E-06	1.31E-06	1.37E-05	1.02E-04	0.0%	--	--	3.86E-09	9.55E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	3.04E-04	4.38E-04	4.63E-08	5.96E-09	3.20E-07	1.37E-07	1.5E-06	1.07E-05	0.0%	--	--	4.35E-08	1.00E-06	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	1.91E-04	3.20E-04	2.92E-08	3.75E-09	2.23E-07	9.58E-08	9.72E-07	7.45E-06	0.0%	--	--	2.74E-09	6.99E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	2.28E-02	3.68E-02		8.02E+02		1.97E+04						2.24E-08	5.52E-07	57.1%	[A]
Cobalt 60	5.48E-04	2.29E-03		1.92E+01		1.22E+03						2.88E-10	1.84E-08	1.9%	[A]
Neptunium 237+D	6.07E-04	1.34E-03		2.13E+01		7.17E+02						4.68E-09	1.58E-07	16.3%	[A]
Protactinium 233	1.65E-04	8.54E-04		5.80E+00		4.57E+02						5.80E-12	4.57E-10	0.0%	[A]
Thorium 228+D	7.59E-04	1.06E-03		2.66E+01		5.65E+02						1.40E-09	3.11E-08	3.2%	[A]
Thorium 230	2.28E-03	3.26E-03		8.01E+01		1.74E+03						1.04E-09	2.27E-08	2.3%	[A]
Thorium 232	6.55E-04	8.71E-04		2.30E+01		4.66E+02						2.70E-10	5.60E-09	0.6%	[A]
Uranium 234	6.17E-03	7.17E-03		2.17E+02		3.84E+03						3.44E-09	6.14E-08	6.3%	[A]
Uranium 235+D	2.71E-04	3.15E-04		9.52E+00		1.69E+02						1.52E-10	2.70E-09	0.3%	[A]
Uranium 238+D	6.81E-03	7.72E-03		2.39E+02		4.13E+03						6.69E-09	1.16E-07	12.0%	[A]

Chemical Hazards:			
Hazard Index (HI):	4.60E+00	3.03E+01	100.0%
Combined Exposure (d)			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.41E-05	4.24E-04	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	4.05E-08	9.68E-07	100.0%

Table M.80. Risk characterization for produce: children – ingestion exposure (future land use – residential) – Area S2–F1–R

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	8.16E-03	9.77E-03	2.78E-06	1.19E-07	1.42E-05	1.82E-06	6.96E-03	3.54E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	6.84E-01	7.82E-01	2.33E-04	9.99E-06	1.13E-03	1.44E-04	7.77E-01	3.78E+00	6.0%	skin; keratosis, hyperpigmentation	3	1.75E-05	2.55E-04	96.5%	[A]
Barium	1.47E+00	2.04E+00	5.00E-04	2.14E-05	2.93E-03	3.86E-04	7.14E-03	4.22E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	3.61E-03	4.28E-03	1.23E-06	5.28E-08	6.20E-06	7.97E-07	2.46E-04	1.24E-03	0.0%	no observed effects	100	2.27E-07	3.43E-06	1.3%	[D2]
Cadmium	2.42E+00	3.54E+00	8.24E-04	3.53E-05	5.13E-03	6.66E-04	8.24E-01	5.13E+00	8.2%	kidney; proteinuria	10				
Chromium (III)	6.12E-01	6.35E-01	2.09E-04	8.94E-06	9.26E-04	1.15E-04	2.09E-04	9.26E-04	0.0%	no observed effects	100				
Copper	7.62E+00	1.28E+01	2.60E-03	1.11E-04	1.85E-02	2.38E-03	7.02E-02	5.01E-01	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	4.30E-01	5.55E-01	1.47E-04	6.28E-06	8.10E-04	1.04E-04				CNS, blood	--				[B2]
Manganese	3.26E+02	3.46E+02	1.11E-01	4.76E-03	4.99E-01	6.41E-02	7.94E-01	3.56E+00	5.7%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	6.61E+00	9.98E+00	2.25E-03	9.66E-05	1.45E-02	1.86E-03	7.51E+00	4.82E+01	76.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.98E+00	2.84E+00	6.70E-04	2.87E-05	4.11E-03	5.29E-04	3.35E-02	2.06E-01	0.3%	dec. body and organ weight	300				
Selenium	1.23E+00	1.46E+00	4.21E-04	1.80E-05	2.11E-03	2.72E-04	8.42E-02	4.22E-01	0.7%	whole body; clinical selenosis	3				[D]
Silver	4.67E-01	6.68E-01	1.59E-04	6.82E-06	9.69E-04	1.25E-04	3.18E-02	1.94E-01	0.3%	skin; argyria	3				[D]
Zinc	1.23E+02	1.75E+02	4.19E-02	1.80E-03	2.53E-01	3.25E-02	1.40E-01	8.43E-01	1.3%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	3.65E-04	6.36E-04	1.23E-07	5.27E-09	9.21E-07	1.18E-07				--	--	4.06E-08	9.12E-07	0.3%	[B2]
Benzo(a)anthracene	3.15E-03	5.57E-03	1.07E-06	4.60E-08	8.08E-06	1.04E-06	3.58E-05	2.69E-04	0.0%	--	--	3.36E-08	7.58E-07	0.3%	[B2]
Benzo(a)pyrene	1.19E-03	2.03E-03	4.06E-07	1.74E-08	2.94E-06	3.78E-07	1.35E-05	9.79E-05	0.0%	--	--	1.27E-07	2.76E-06	1.0%	[B2]
Benzo(b)fluoranthene	1.83E-03	2.92E-03	6.24E-07	2.67E-08	4.23E-06	5.44E-07	2.08E-05	1.41E-04	0.0%	--	--	1.95E-08	3.97E-07	0.2%	[B2]
Benzo(k)fluoranthene	1.31E-03	2.09E-03	4.47E-07	1.92E-08	3.03E-06	3.90E-07	1.49E-05	1.01E-04	0.0%	--	--	1.40E-08	2.85E-07	0.1%	[B2]
Chrysene	2.69E-03	4.37E-03	9.19E-07	3.94E-08	6.34E-06	8.15E-07	3.06E-05	2.11E-04	0.0%	--	--	2.88E-09	5.95E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	3.04E-04	4.58E-04	1.04E-07	4.44E-09	6.63E-07	8.53E-08	3.45E-06	2.21E-05	0.0%	--	--	3.24E-08	6.23E-07	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	1.91E-04	3.20E-04	6.52E-08	2.79E-09	4.64E-07	5.96E-08	2.17E-06	1.55E-05	0.0%	--	--	2.04E-09	4.35E-08	0.0%	[B2]
RADIONUCLIDES (pCi/g PLANT TISSUE)															
Cesium 137+D	2.28E-02	3.68E-02		2.13E+02		4.56E+03						5.97E-09	1.28E-07	57.1%	[A]
Cobalt 60	5.48E-04	2.25E-03		5.12E+00		2.88E+02						7.68E-11	4.24E-09	1.9%	[A]
Neptunium 237+D	6.07E-04	1.34E-03		5.67E+00		1.66E+02						1.25E-09	3.65E-08	16.3%	[A]
Protactinium 233	1.65E-04	8.54E-04		1.54E+00		1.06E+02						1.54E-12	1.06E-10	0.0%	[A]
Thorium 228+D	7.55E-04	1.06E-03		7.08E+00		1.31E+02						3.90E-10	7.18E-09	3.2%	[A]
Thorium 230	2.28E-03	3.26E-03		2.13E+01		4.03E+02						2.77E-10	5.24E-09	2.3%	[A]
Thorium 232	6.55E-04	8.71E-04		6.11E+00		1.08E+02						7.33E-11	1.29E-09	0.6%	[A]
Uranium 234	6.17E-03	7.17E-03		5.76E+01		8.88E+02						9.22E-10	1.42E-08	6.3%	[A]
Uranium 235+D	2.71E-04	3.15E-04		2.53E+00		3.90E+01						4.05E-11	6.24E-10	0.3%	[A]
Uranium 238+D	6.81E-03	7.72E-03		6.36E+01		9.56E+02						1.78E-09	2.68E-08	12.0%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.03E+01	6.29E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.86E-05	2.64E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.08E-08	2.24E-07	100.0%	

Table M.81. Risk characterization for fish: adults – ingestion exposure (future land use – residential) – Area S2–F1–R

Chemical	MLB Concentration in Fish Tissue	RMB Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfD WOE
INORGANICS															
Mercury	0.76	0.78	2.38E–06	3.06E–07	2.89E–05	1.24E–05	7.94E–03	9.63E–02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	6.43E–07	8.27E–08	8.21E–06	3.52E–06						6.37E–07	2.71E–05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.13E–06	1.45E–07	1.44E–05	6.18E–06						1.12E–06	4.76E–05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E–03	9.63E–02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.75E–06	7.47E–05	100.0%	

Table M.82. Risk characterization for fish: children – ingestion exposure (future land use – residential) – Area S2–F1–R

Chemical	MLB Concentration in Fish (mg/kg)	RMB Concentration in Fish (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Organ	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS															
Mercury	0.76	0.78	4.1E-06	1.7E-07	6.0E-05	7.7E-06	1.3E-02	2.0E-01	100.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	1.1E-06	4.8E-08	1.7E-05	2.2E-06						3.7E-07	1.7E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.9E-06	8.4E-08	3.0E-05	3.8E-06						6.5E-07	2.9E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-02	2.0E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-06	4.6E-05	100.0%	

Table M.83. Risk characterization for groundwater: adults – ingestion exposure (future land use – commercial) – Area S2–F2–C

Chemical	Chronic Daily Intake (CDI): MLE Concentration (mg/L)	RME Concentration (mg/L)	CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern, Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	2.72E-05	3.49E-06	5.45E-05	1.95E-05	9.05E-02	1.82E-01	1.8%	skin; keratosis, hyperpigmentation	3	6.1E-06	3.4E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	2.71E-03	3.48E-04	4.75E-03	1.70E-03	3.87E-02	6.78E-02	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	1.29E-05	1.65E-06	2.50E-05	8.94E-06	2.58E-03	5.01E-03	0.1%	no observed effects	100	7.1E-06	3.8E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	2.26E-04	2.91E-05	4.00E-04	1.43E-04	2.26E-04	4.00E-04	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	1.14E-04	1.47E-05	3.17E-03	1.13E-03	3.09E-03	8.56E-02	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	1.83E-04	2.36E-05	3.46E-04	1.23E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	2.56E-02	3.29E-03	4.32E-02	1.54E-02	5.12E+00	8.64E+00	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	9.49E-05	1.22E-05	2.14E-04	7.64E-05	3.16E-01	7.13E-01	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	3.29E-04	4.23E-05	6.29E-04	2.25E-04	1.65E-02	3.14E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	2.68E-04	3.44E-05	4.80E-04	1.71E-04	3.82E-02	6.85E-02	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	2.46E-03	3.16E-04	6.67E-03	2.38E-03	2.46E-02	6.67E-02	0.7%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	4.78E-04	6.14E-05	1.32E-03	4.70E-04	7.96E-03	2.20E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.6E-07	3.5E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		5.14E+03		2.54E+04						5.14E-07	2.54E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		1.95E+04		1.14E+05						3.18E-07	1.82E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		1.62E+04		9.41E+04						4.51E-07	2.64E-06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							5.66E+00	9.85E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.37E-05	7.61E-05	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.28E-06	7.00E-06	100.0%	

SEGMENT 3 RISK CHARACTERIZATION TABLES

Table M.84. Risk characterization summary for EFPC Segment 3: RME estimates for current land use

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	2.80E−01 B	1.47E−01 B	5.80E−06 W	1.02E−05 W	6.95E−08 B	1.74E−07 B	1.23E+00 *B*	3.44E−01 B	2.55E−05 W	2.37E−05 W	1.62E−07 B	4.06E−07 B
	Dermal Contact	1.74E−02 B	1.61E−02 B	1.97E−06 W	6.10E−06 W	NA	NA	4.92E−02 B	3.76E−02 B	5.58E−06 W	1.42E−05 W	NA	NA
Surface Water	Ingestion	1.48E−03 B	1.04E−03 B	3.10E−09 B	7.22E−09 B	4.89E−10 B	1.63E−09 B	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	1.28E−03 B	1.18E−03 B	3.01E−08 B	9.31E−08 B	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	9.90E−05 B	9.19E−05 B	1.26E−08 B	3.89E−08 B	NA	NA	8.66E−04 B	6.02E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	9.83E+01 *B*	4.74E+01 *B*	2.57E−04 *B*	4.13E−04 *B*	1.65E−07 B	7.13E−07 B
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		3.0E−01 B	1.7E−01 B					1.0E+02 *B*	4.8E+01 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				8E−06 W	2E−05 W					3E−04 *B*	5E−04 *B*		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						7E−08 B	2E−07 B					3E−07 B	1E−06 W

B – below or equal to target noncancer hazard index (HI<1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.85. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S3–C1–O adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.08E–02	1.47E–01	2.47E–07	1.02E–05
Dermal Contact	3.92E–04	1.61E–02	4.10E–08	6.10E–06
SURFACE WATER				
Ingestion	6.90E–05	1.04E–03	1.77E–10	7.22E–09
Dermal Contact	7.27E–05	1.18E–03	1.68E–09	9.31E–08
SEDIMENT				
Dermal Contact	1.94E–06	9.19E–05	2.29E–10	3.89E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			4.65E–09	1.74E–07
SURFACE WATER				
Ingestion			3.92E–11	1.63E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.1E–02	1.7E–01		
Excess Lifetime Cancer Risk: Combined Exposure			3E–07	2E–05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–09	2E–07

Table M.86. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S3–C1–O children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.86E–02	2.80E–01	1.42E–07	5.80E–06
Dermal Contact	4.04E–04	1.74E–02	1.41E–08	1.97E–06
SURFACE WATER				
Ingestion	9.55E–05	1.48E–03	8.16E–11	3.10E–09
Dermal Contact	7.49E–05	1.28E–03	5.77E–10	3.01E–08
SEDIMENT				
Dermal Contact	2.00E–06	9.90E–05	7.87E–11	1.26E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.94E–09	6.95E–08
SURFACE WATER				
Ingestion			1.31E–11	4.89E–10
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.9E–02	3.0E–01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	8E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–09	7E–08

Table M.87. Human health risk characterization summary for EFPC residential scenario: current land use, Area S3–C2–R adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	7.28E–02	3.44E–01	1.67E–06	2.37E–05
Dermal Contact	2.64E–03	3.76E–02	2.77E–07	1.42E–05
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce	6.83E+00	4.74E+01	2.48E–05	4.13E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.14E–08	4.06E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce			3.34E–08	7.13E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	6.9E+00	4.8E+01		
Excess Lifetime Cancer Risk: Combined Exposure			3E–05	5E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			7E–08	1E–06

Table M.88. Human health risk characterization summary for EFPC residential scenario: current land use, Area S3–C2–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	2.55E–01	1.23E+00	1.94E–06	2.55E–05
Dermal Contact	3.45E–03	4.92E–02	1.20E–07	5.58E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce	1.53E+01	9.83E+01	1.85E–05	2.57E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.31E–08	1.62E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce			8.90E–09	1.65E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.6E+01	1.0E+02		
Excess Lifetime Cancer Risk: Combined Exposure			2E–05	3E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–08	3E–07

Table M.89. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Area S3–C1–O

Chemical	MLB Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	1.48	1.87	9.28E-08	1.19E-08	1.10E-06	4.71E-07	2.32E-04	2.75E-03	1.9%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	5.51E-07	7.08E-08	5.59E-06	2.39E-06	1.84E-03	1.86E-02	12.6%	skin; keratosis, hyperpigmentation	3	1.24E-07	4.19E-06	41.2%	[A],
Barium	99.86	115.60	6.25E-06	8.04E-07	6.86E-05	2.91E-05	8.93E-05	9.71E-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	4.33E-08	5.56E-09	4.56E-07	1.96E-07	8.65E-06	9.13E-05	0.1%	no observed effects	100	2.39E-08	8.41E-07	8.3%	[B2]
Cadmium	2.30	3.38	1.44E-07	1.85E-08	1.98E-06	8.50E-07	1.44E-04	1.98E-03	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	4.32E-06	5.55E-07	4.41E-05	1.89E-05	4.32E-06	4.41E-05	0.0%	no observed effects	100				
Copper	43.64	60.90	2.73E-06	3.51E-07	3.58E-05	1.53E-05	7.39E-05	9.66E-04	0.7%	Gastrointestinal system; irritation	--				
Lead	69.08	89.54	4.33E-06	5.56E-07	5.26E-05	2.25E-05				CNS, blood	--				[D]
Manganese	1023.00	1193.00	6.41E-05	8.24E-06	7.00E-04	3.00E-04	4.58E-04	5.00E-03	3.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[B2]
Mercury	37.41	58.93	2.34E-06	3.01E-07	3.46E-05	1.48E-05	7.81E-03	1.15E-01	78.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	1.80E-06	2.31E-07	2.16E-05	9.27E-06	8.98E-05	1.08E-03	0.7%	dec. body and organ weight	300				[D]
Selenium	12.79	15.51	8.01E-07	1.03E-07	9.11E-06	3.90E-06	1.60E-04	1.82E-03	1.2%	whole body; clinical selenosis	3				
Silver	2.44	3.71	1.53E-07	1.96E-08	2.16E-06	9.34E-07	3.05E-05	4.36E-04	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	1.96E-05	2.52E-06	2.73E-04	1.17E-04	6.53E-05	9.11E-04	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.14	0.18	8.80E-09	1.13E-09	1.08E-07	4.62E-08				--	--	8.72E-09	3.56E-07	3.5%	[B2]
Aroclor-1260	0.23	0.33	1.45E-08	1.87E-09	1.94E-07	8.32E-08				--	--	1.44E-08	6.40E-07	6.3%	[B2]
Benzo(a)anthracene	0.71	1.28	4.42E-08	5.69E-09	7.50E-07	3.21E-07	1.47E-06	2.50E-05	0.0%	--	--	4.15E-09	2.35E-07	2.3%	[B2]
Benzo(a)pyrene	0.68	1.20	4.24E-08	5.45E-09	7.05E-07	3.02E-07	1.41E-06	2.35E-05	0.0%	--	--	3.98E-08	2.21E-06	21.7%	[B2]
Benzo(b)fluoranthene	1.18	2.28	7.39E-08	9.50E-09	1.34E-06	5.73E-07	2.46E-06	4.45E-05	0.0%	--	--	6.94E-09	4.18E-07	4.1%	[B2]
Benzo(k)fluoranthene	1.14	2.25	7.11E-08	9.15E-09	1.32E-06	5.65E-07	2.37E-06	4.39E-05	0.0%	--	--	6.68E-09	4.12E-07	4.1%	[B2]
Chrysene	0.78	1.47	4.90E-08	6.30E-09	8.66E-07	3.70E-07	1.63E-06	2.88E-05	0.0%	--	--	4.60E-10	2.70E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	1.61E-08	2.06E-09	2.22E-07	9.50E-08	5.35E-07	7.39E-06	0.0%	--	--	1.51E-08	6.93E-07	6.8%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	3.15E-08	4.05E-09	4.76E-07	2.04E-07	1.05E-06	1.59E-05	0.0%	--	--	2.96E-09	1.49E-07	1.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.61	0.82		8.75E+00		3.65E+02						2.45E-10	1.03E-08	5.9%	[A]
Cobalt 60	0.01	0.02		8.12E-02		7.02E+00						1.22E-12	1.05E-10	0.1%	[A]
Neptunium 237+D	0.01	0.02		1.30E-01		1.07E+01						2.86E-11	2.36E-09	1.4%	[A]
Protactinium 233	0.05	0.12		7.33E-01		5.56E+01						7.33E-13	5.56E-11	0.0%	[A]
Thorium 228+D	2.10	2.36		3.03E+01		1.06E+03						1.67E-09	5.85E-08	33.6%	[A]
Thorium 230	2.37	3.16		3.41E+01		1.42E+03						4.44E-10	1.85E-08	10.6%	[A]
Thorium 232	1.50	1.90		2.16E+01		8.56E+02						2.59E-10	1.03E-08	5.9%	[A]
Uranium 234	3.12	3.71		4.49E+01		1.67E+03						7.19E-10	2.67E-08	15.3%	[A]
Uranium 235+D	0.15	0.18		2.15E+00		8.17E+01						3.43E-11	1.31E-09	0.8%	[A]
Uranium 238+D	3.10	3.66		4.46E+01		1.65E+03						1.25E-09	4.61E-08	26.5%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	1.08E-02	1.47E-01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.47E-07	1.02E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	4.65E-09	1.74E-07	100.0%

Table M.90. Risk characterization for soils: children – ingestion exposure (current land use – open) – Area S3–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Antimony	1.48	1.87	1.60E-07	6.88E-09	2.09E-06	2.69E-07	4.00E-04	5.22E-03	1.9%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	9.52E-07	4.08E-08	1.06E-05	1.36E-06	3.17E-03	3.54E-02	12.6%	skin; keratosis, hyperpigmentation	3	7.14E-08	2.39E-06	41.2%	[A]
Barium	99.86	115.80	1.08E-05	4.63E-07	1.29E-04	1.66E-05	1.54E-04	1.85E-03	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	7.48E-08	3.21E-09	8.67E-07	1.11E-07	1.50E-05	1.73E-04	0.1%	no observed effects	100	1.38E-08	4.79E-07	8.3%	[D2]
Cadmium	2.30	3.38	2.49E-07	1.07E-08	3.77E-06	4.84E-07	2.49E-04	3.77E-03	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	7.48E-06	3.20E-07	8.38E-05	1.08E-05	7.48E-06	8.38E-05	0.0%	no observed effects	100				
Copper	43.64	60.90	4.73E-06	2.03E-07	6.79E-05	8.73E-06	1.28E-04	1.84E-03	0.7%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	7.48E-06	3.21E-07	9.99E-05	1.28E-05				CNS, blood	--				[D2]
Manganese	1023.00	1193.00	1.11E-04	4.75E-06	1.33E-03	1.71E-04	7.91E-04	9.51E-03	3.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	4.05E-06	1.74E-07	6.57E-05	8.45E-06	1.35E-02	2.19E-01	78.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	3.10E-06	1.33E-07	4.11E-05	5.28E-06	1.55E-04	2.05E-03	0.7%	dec. body and organ weight	300				
Selenium	12.79	15.51	1.39E-06	5.94E-08	1.73E-05	2.22E-06	2.77E-04	3.46E-03	1.2%	whole body; clinical selenosis	3				[D]
Silver	2.44	3.71	2.64E-07	1.13E-08	4.14E-06	5.33E-07	5.28E-05	8.29E-04	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	3.39E-05	1.45E-06	5.19E-04	6.66E-05	1.13E-04	1.73E-03	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.14	0.18	1.52E-08	6.53E-10	2.05E-07	2.64E-08				--	--	5.02E-09	2.03E-07	3.5%	[D2]
Aroclor–1260	0.23	0.33	2.52E-08	1.08E-09	3.69E-07	4.74E-08				--	--	8.30E-09	3.65E-07	6.3%	[D2]
Benzo(a)anthracene	0.71	1.28	7.65E-08	3.28E-09	1.42E-06	1.83E-07	2.55E-06	4.75E-05	0.0%	--	--	2.39E-09	1.34E-07	2.3%	[D2]
Benzo(a)pyrene	0.68	1.20	7.34E-08	3.14E-09	1.34E-06	1.72E-07	2.45E-06	4.47E-05	0.0%	--	--	2.29E-08	1.26E-06	21.7%	[D2]
Benzo(b)fluoranthene	1.18	2.28	1.28E-07	5.48E-09	2.54E-06	3.26E-07	4.26E-06	8.46E-05	0.0%	--	--	4.00E-09	2.38E-07	4.1%	[D2]
Benzo(k)fluoranthene	1.14	2.25	1.23E-07	5.27E-09	2.50E-06	3.22E-07	4.10E-06	8.35E-05	0.0%	--	--	3.85E-09	2.35E-07	4.1%	[D2]
Chrysene	0.78	1.47	8.47E-08	3.63E-09	1.64E-06	2.11E-07	2.82E-06	5.47E-05	0.0%	--	--	2.65E-10	1.54E-08	0.3%	[D2]
Dibenzo(a,h)anthracene	0.26	0.38	2.78E-08	1.19E-09	4.21E-07	5.41E-08	9.25E-07	1.40E-05	0.0%	--	--	8.68E-09	3.95E-07	6.8%	[D2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	5.45E-08	2.33E-09	9.05E-07	1.16E-07	1.82E-06	3.02E-05	0.0%	--	--	1.70E-09	8.49E-08	1.5%	[D2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.61	0.82		3.65E+00		1.47E+02						1.02E-10	4.12E-09	5.9%	[A]
Cobalt 60	0.01	0.02		3.38E-02		2.80E+00						5.08E-13	4.20E-11	0.1%	[A]
Neptunium 237+D	0.01	0.02		5.43E-02		4.27E+00						1.19E-11	9.40E-10	1.4%	[A]
Protactinium 233	0.05	0.12		3.06E-01		2.22E+01						3.00E-13	2.22E-11	0.0%	[A]
Thorium 228+D	2.10	2.36		1.22E+01		4.24E+02						6.94E-10	2.33E-08	33.6%	[A]
Thorium 230	2.37	3.16		1.42E+01		5.66E+02						1.85E-10	7.36E-09	10.6%	[A]
Thorium 232	1.50	1.90		8.99E+00		3.42E+02						1.08E-10	4.10E-09	5.9%	[A]
Uranium 234	3.12	3.71		1.87E+01		6.66E+02						3.00E-10	1.07E-08	15.3%	[A]
Uranium 235+D	0.15	0.18		8.94E-01		3.26E+01						1.43E-11	5.21E-10	0.8%	[A]
Uranium 238+D	3.10	3.66		1.86E+01		6.57E+02						5.20E-10	1.84E-08	26.5%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.68E-02	2.80E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.42E-07	5.80E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.94E-09	6.95E-08	100.0%	

Table M.91. Risk characterization for soils: adults – dermal exposure (current land use – open) – Area S3–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Antimony	1.48	1.87	3.34E-09	4.30E-10	1.19E-07	5.09E-08	8.35E-06	2.97E-04	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	1.98E-08	2.55E-09	6.04E-07	2.59E-07	6.61E-05	2.01E-03	12.5%	skin; keratosis, hyperpigmentation	3	4.46E-09	4.53E-07	7.4%	[A]
Barium	99.86	115.80	2.25E-07	2.89E-08	7.35E-06	3.15E-06	3.22E-06	1.05E-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	1.56E-09	2.00E-10	4.93E-08	2.11E-08	3.11E-07	9.86E-06	0.1%	no observed effects	100	8.61E-10	9.09E-08	1.5%	[B2]
Cadmium	2.30	3.38	5.18E-09	6.66E-10	2.14E-07	9.19E-08	5.18E-06	2.14E-04	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	1.56E-07	2.00E-08	4.77E-06	2.04E-06	1.56E-07	4.77E-06	0.0%	no observed effects	100				
Copper	43.64	60.90	9.84E-08	1.26E-08	3.86E-06	1.66E-06	2.66E-06	1.04E-04	0.6%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	1.56E-07	2.00E-08	5.68E-06	2.44E-06				CNS, blood	--				[B2]
Manganese	1023.00	1193.00	2.31E-06	2.97E-07	7.57E-05	3.24E-05	1.65E-05	5.41E-04	3.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	8.43E-08	1.08E-08	3.74E-06	1.60E-06	2.81E-04	1.25E-02	77.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	6.46E-08	8.31E-09	2.34E-06	1.00E-06	3.23E-06	1.17E-04	0.7%	dec. body and organ weight	300				[D]
Selenium	12.79	15.51	2.88E-08	3.71E-09	9.84E-07	4.22E-07	5.77E-06	1.97E-04	1.2%	whole body; clinical selenosis	3				
Silver	2.44	3.71	5.50E-09	7.07E-10	2.36E-07	1.01E-07	1.10E-06	4.71E-05	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	7.04E-07	9.07E-08	2.95E-05	1.27E-05	2.35E-06	9.85E-05	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.14	0.18	3.17E-09	4.08E-10	1.17E-07	5.00E-08				--	--	3.14E-09	3.85E-07	6.3%	[B2]
Aroclor-1260	0.23	0.33	5.24E-09	6.73E-10	2.10E-07	8.99E-08				--	--	5.18E-09	6.92E-07	11.4%	[B2]
Benzo(a)anthracene	0.71	1.28	1.59E-08	2.05E-09	8.10E-07	3.47E-07	5.31E-07	2.70E-05	0.2%	--	--	1.49E-09	2.54E-07	4.2%	[B2]
Benzo(a)pyrene	0.68	1.20	1.53E-08	1.96E-09	7.62E-07	3.27E-07	5.09E-07	2.54E-05	0.2%	--	--	1.43E-08	2.38E-06	39.1%	[B2]
Benzo(b)fluoranthene	1.18	2.28	2.66E-08	3.42E-09	1.44E-06	6.19E-07	8.87E-07	4.81E-05	0.3%	--	--	2.50E-09	4.52E-07	7.4%	[B2]
Benzo(k)fluoranthene	1.14	2.25	2.56E-08	3.29E-09	1.42E-06	6.11E-07	8.54E-07	4.75E-05	0.3%	--	--	2.40E-09	4.46E-07	7.3%	[B2]
Chrysene	0.78	1.47	1.76E-08	2.27E-09	9.34E-07	4.00E-07	5.88E-07	3.11E-05	0.2%	--	--	1.65E-10	2.92E-08	0.5%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	5.78E-09	7.43E-10	2.40E-07	1.03E-07	1.93E-07	7.99E-06	0.0%	--	--	5.42E-09	7.50E-07	12.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	1.13E-08	1.46E-09	5.15E-07	2.21E-07	3.76E-07	1.72E-05	0.1%	--	--	1.06E-09	1.61E-07	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.92E-04	1.61E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												4.10E-08	6.10E-06	100.0%	

Table M.92. Risk characterization for soils: children – dermal exposure (current land use – open) – Area S3–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	1.48	1.87	3.4E3-09	1.4E3-10	1.2E3-07	1.6E3-08	8.6E3-06	3.2E3-04	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	2.0E3-08	8.7E3-10	6.5E3-07	8.3E3-08	6.8E3-05	2.1E3-03	12.5%	skin; keratosis, hyperpigmentation	3	1.5E3-09	1.4E3-07	7.4%	[A]
Barium	99.85	115.80	2.3E3-07	9.9E3-09	7.9E3-06	1.0E3-06	3.3E3-06	1.1E3-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	1.6E3-09	6.8E3-11	5.3E3-08	6.8E3-09	3.2E3-07	1.0E3-05	0.1%	no observed effects	100	2.9E3-10	2.9E3-08	1.5%	[B2]
Cadmium	2.30	3.38	5.3E3-09	2.2E3-10	2.3E3-07	2.9E3-08	5.3E3-06	2.3E3-04	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	1.6E3-07	6.8E3-09	5.1E3-06	6.6E3-07	1.6E3-07	5.1E3-06	0.0%	no observed effects	100				
Copper	43.64	60.90	1.0E3-07	4.3E3-09	4.1E3-06	5.3E3-07	2.7E3-06	1.1E3-04	0.6%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	1.6E3-07	6.8E3-09	6.1E3-06	7.8E3-07				CNS, blood	--				[B2]
Manganese	1023.00	1193.00	2.3E3-06	1.0E3-07	8.1E3-05	1.0E3-05	1.7E3-05	5.8E3-04	3.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	8.6E3-08	3.7E3-09	4.0E3-06	5.1E3-07	2.9E3-04	1.3E3-02	77.3%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	6.6E3-08	2.8E3-09	2.5E3-06	3.2E3-07	3.3E3-06	1.2E3-04	0.7%	dec. body and organ weight	300				
Selenium	12.79	15.51	2.9E3-08	1.2E3-09	1.0E3-06	1.3E3-07	5.9E3-06	2.1E3-04	1.2%	whole body; clinical selenosis	3				[D]
Silver	2.44	3.71	5.6E3-09	2.4E3-10	2.5E3-07	3.2E3-08	1.1E3-06	5.0E3-05	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	7.2E3-07	3.1E3-08	3.1E3-05	4.0E3-06	2.4E3-06	1.0E3-04	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.14	0.18	3.2E3-09	1.4E3-10	1.2E3-07	1.6E3-08				--	--	1.0E3-09	1.2E3-07	6.3%	[B2]
Aroclor-1260	0.23	0.33	5.4E3-09	2.3E3-10	2.2E3-07	2.9E3-08				--	--	1.7E3-09	2.2E3-07	11.4%	[B2]
Benzo(a)anthracene	0.71	1.28	1.6E3-08	7.0E3-10	8.7E3-07	1.1E3-07	5.4E3-07	2.9E3-05	0.2%	--	--	5.1E3-10	8.1E3-08	4.2%	[B2]
Benzo(a)pyrene	0.68	1.20	1.5E3-08	6.7E3-10	8.2E3-07	1.0E3-07	5.2E3-07	2.7E3-05	0.2%	--	--	4.9E3-09	7.7E3-07	39.1%	[B2]
Benzo(b)fluoranthene	1.18	2.28	2.7E3-08	1.1E3-09	1.5E3-06	2.0E3-07	9.1E3-07	5.1E3-05	0.3%	--	--	8.5E3-10	1.4E3-07	7.4%	[B2]
Benzo(k)fluoranthene	1.14	2.25	2.6E3-08	1.1E3-09	1.5E3-06	1.9E3-07	8.8E3-07	5.1E3-05	0.3%	--	--	8.2E3-10	1.4E3-07	7.3%	[B2]
Chrysene	0.78	1.47	1.8E3-08	7.7E3-10	1.0E3-06	1.2E3-07	6.0E3-07	3.3E3-05	0.2%	--	--	5.6E3-11	9.4E3-09	0.5%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	5.9E3-09	2.5E3-10	2.5E3-07	3.3E3-08	1.9E3-07	8.6E3-06	0.0%	--	--	1.8E3-09	2.4E3-07	12.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	1.1E3-08	5.0E3-10	5.5E3-07	7.1E3-08	3.9E3-07	1.8E3-05	0.1%	--	--	3.6E3-10	5.2E3-08	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.0E3-04	1.7E3-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.4E3-08	1.9E3-06	100.0%	

Table M.93. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – open) – Area S3–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	7.75E-08	9.96E-09	1.03E-06	4.40E-07	1.11E-06	1.47E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.60E+00	1.32E+01	7.63E-09	9.80E-10	1.29E-07	5.54E-08	7.63E-09	1.29E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.81E-08	2.33E-09	2.14E-07	9.18E-08	4.89E-07	5.79E-06	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	2.63E-07	3.38E-08	4.04E-06	1.73E-06	5.26E-05	8.08E-04	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.66E+00	3.93E+00	2.62E-09	3.37E-10	3.85E-08	1.65E-08	8.72E-06	1.28E-04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.22E-09	1.06E-09	1.38E-07	5.91E-08	1.17E-06	1.97E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.05E+01	6.72E-08	8.65E-09	8.85E-07	3.81E-07	2.24E-07	2.95E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	6.08E-09	7.82E-10	7.54E-08	3.23E-08	6.08E-08	7.54E-07	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.27E-11	2.92E-12	2.45E-10	1.05E-10	7.58E-07	8.15E-06	0.8%	liver; lesions, toxicity	1000	4.97E-11	1.78E-09	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.35E+01	9.30E-09	1.20E-09	1.36E-07	5.81E-08	4.65E-07	6.78E-06	0.7%	liver; weight inc.	1000	1.67E-11	8.13E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.98E-09	5.12E-10	4.55E-08	1.97E-08	3.98E-07	4.59E-06	0.4%	liver; lesions, fattycyst formation	1000	3.12E-12	1.20E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	3.93E-11	5.06E-12	4.83E-10	2.07E-10	7.86E-08	9.67E-07	0.1%	liver; lesions	100	1.72E-12	7.04E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.79E-11	4.87E-12	4.89E-10	2.10E-10	7.58E-07	9.78E-06	0.9%	liver; lesions	100	7.80E-11	3.35E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	3.78E-11	4.87E-12	4.89E-10	2.10E-10	1.26E-07	1.63E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.78E-11	2.29E-12	2.25E-10	9.83E-11	5.93E-08	7.64E-07	0.1%	liver, kidney; toxicity		2.97E-12	1.28E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.11E-11	2.72E-12	2.45E-10	1.05E-10	1.63E-06	1.88E-05	1.8%	liver; inc. relative weight		2.47E-11	9.54E-10	13.2%	[B2]
Tetrachloroethylene	4.16E+00	4.84E+00	4.09E-09	5.26E-10	4.73E-08	2.03E-08	4.09E-07	4.73E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		8.27E-01		3.22E+01						1.32E-11	5.15E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		9.29E-01		3.98E+01						2.60E-11	1.12E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.90E-05	1.04E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.77E-10	7.22E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.92E-11	1.63E-09	100.0%	

Table M.94. Risk characterization for surface water: children – ingestion exposure (swimming)(current land use – open) – Area S3–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.07E-07	4.59E-09	1.47E-06	1.89E-07	1.53E-06	2.10E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.06E-08	4.52E-10	1.85E-07	2.37E-08	1.06E-08	1.85E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.50E-08	1.07E-09	3.06E-07	3.94E-08	6.77E-07	8.27E-06	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.64E-07	1.56E-08	5.77E-06	7.42E-07	7.27E-05	1.15E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.62E-09	1.55E-10	5.50E-08	7.07E-09	1.21E-05	1.83E-04	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.14E-08	4.87E-10	1.97E-07	2.53E-08	1.62E-06	2.82E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.30E-08	3.99E-09	1.27E-06	1.63E-07	3.10E-07	4.23E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.41E-09	3.60E-10	1.05E-07	1.35E-08	8.41E-08	1.05E-06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.14E-11	1.35E-12	3.49E-10	4.49E-11	1.05E-06	1.16E-05	0.8%	liver; lesions, toxicity	1000	2.29E-11	7.64E-10	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.29E-08	5.51E-10	1.94E-07	2.49E-08	6.43E-07	9.68E-06	0.7%	liver; weight inc.	1000	7.72E-12	3.48E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.51E-09	2.36E-10	6.55E-08	8.42E-09	5.51E-07	6.55E-06	0.4%	liver; lesions, fatty cyst formation	1000	1.44E-12	5.14E-11	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.44E-11	2.33E-12	6.91E-10	8.88E-11	1.09E-07	1.38E-06	0.1%	liver; lesions	100	7.93E-13	3.02E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.24E-11	2.25E-12	6.99E-10	8.99E-11	1.05E-06	1.40E-05	0.9%	liver; lesions	100	3.59E-11	1.44E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.24E-11	2.24E-12	6.99E-10	8.99E-11	1.75E-07	2.33E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.87E-02	2.34E-02	2.46E-11	1.05E-12	3.28E-10	4.21E-11	8.20E-08	1.09E-06	0.1%	liver, kidney; toxicity		1.37E-12	5.47E-11	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.92E-11	1.25E-12	3.49E-10	4.49E-11	2.25E-06	2.60E-05	1.8%	liver; inc. relative weight		1.14E-11	4.09E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.66E-09	2.42E-10	6.76E-08	8.70E-09	5.66E-07	6.76E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		2.76E-01		9.66E+00						4.41E-12	1.55E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		3.10E-01		1.19E+01						8.67E-12	3.35E-10	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.55E-05	1.48E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.16E-11	3.10E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E-11	4.89E-10	100.0%	

Table M.95. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – open) – Area S3–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.00E-09	7.70E-10	1.04E-07	4.47E-08	8.57E-08	1.49E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	5.91E-10	7.60E-11	1.31E-08	5.62E-09	5.91E-10	1.31E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.40E-09	1.80E-10	2.16E-08	9.33E-09	3.79E-08	5.88E-07	0.0%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	2.04E-08	2.62E-09	4.10E-07	1.76E-07	4.07E-06	8.21E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.03E-10	2.61E-11	3.91E-09	1.68E-09	6.76E-07	1.30E-05	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.36E-10	8.16E-11	1.40E-08	6.01E-09	9.09E-08	2.00E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.21E-09	6.69E-10	9.03E-08	3.87E-08	1.74E-08	3.01E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.94E-09	3.78E-10	4.78E-08	2.05E-08	2.94E-08	4.78E-07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.76E-11	2.26E-12	2.48E-10	1.06E-10	5.87E-07	8.28E-06	0.7%	liver; lesions, toxicity	1000	3.85E-11	1.81E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.48E-07	1.91E-08	2.84E-06	1.22E-06	7.42E-06	1.42E-04	12.0%	liver; weight inc.	1000	2.67E-10	1.70E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.72E-08	2.21E-09	2.59E-07	1.11E-07	1.72E-06	2.59E-05	2.2%	liver; lesions, fattycyst formation	1000	1.35E-11	6.77E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.18E-09	1.05E-09	1.32E-07	5.65E-08	1.64E-05	2.64E-04	22.3%	liver; lesions	100	3.56E-10	1.92E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	5.87E-06	9.94E-05	8.4%	liver; lesions	100	6.04E-10	3.41E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	9.77E-07	1.66E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.21E-10	1.55E-11	2.04E-09	8.73E-10	4.02E-07	6.79E-06	0.6%	liver, kidney; toxicity		2.01E-11	1.14E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.23E-10	4.15E-11	4.91E-09	2.10E-09	2.49E-05	3.77E-04	31.9%	liver; inc. relative weight		3.78E-10	1.91E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.50E-08	1.22E-08	1.44E-06	6.18E-07	9.50E-06	1.44E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.27E-05	1.18E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.68E-09	9.31E-08	100.0%	

Table M.96. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – open) – Area S3–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.18E-09	2.65E-10	1.12E-07	1.44E-08	8.83E-08	1.60E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	6.09E-10	2.61E-11	1.41E-08	1.82E-09	6.09E-10	1.41E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.15E+01	1.44E-09	6.19E-11	2.34E-08	3.03E-09	3.90E-08	6.33E-07	0.0%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	2.10E-08	8.95E-10	4.42E-07	5.68E-08	4.20E-06	8.84E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.09E-10	8.95E-12	4.21E-09	5.41E-10	6.96E-07	1.40E-05	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.56E-10	2.81E-11	1.51E-08	1.94E-09	9.37E-08	2.16E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.37E-09	2.30E-10	9.72E-08	1.25E-08	1.79E-08	3.24E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	3.03E-09	1.30E-10	5.15E-08	6.62E-09	3.03E-08	5.15E-07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.81E-11	7.77E-13	2.67E-10	3.44E-11	6.03E-07	8.92E-06	0.7%	liver; lesions, toxicity	1000	1.32E-11	5.85E-10	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.35E+01	1.53E-07	6.56E-09	3.06E-06	3.93E-07	7.65E-06	1.53E-04	12.0%	liver; weight inc.	1000	9.18E-11	5.50E-09	18.3%	[B2]
Chloroform	4.07E+00	4.65E+00	1.77E-08	7.58E-10	2.79E-07	3.59E-08	1.77E-06	2.79E-05	2.2%	liver; lesions, fatty cyst formation	1000	4.62E-12	2.19E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.43E-09	3.61E-10	1.42E-07	1.83E-08	1.69E-05	2.84E-04	22.3%	liver; lesions	100	1.25E-10	6.21E-09	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.02E-10	1.30E-11	5.35E-09	6.88E-10	6.03E-06	1.07E-04	8.4%	liver; lesions	100	2.07E-10	1.10E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	3.02E-10	1.29E-11	5.35E-09	6.88E-10	1.01E-06	1.78E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.24E-10	5.32E-12	2.19E-09	2.82E-10	4.14E-07	7.31E-06	0.6%	liver, kidney; toxicity		6.92E-12	3.67E-10	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.33E-10	1.43E-11	5.28E-09	6.79E-10	2.56E-05	4.06E-04	31.9%	liver; inc. relative weight		1.30E-10	6.18E-09	20.6%	[B2]
Tetrachloroethylene	4.16E+00	4.84E+00	9.79E-08	4.20E-09	1.55E-06	2.00E-07	9.79E-06	1.55E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.49E-05	1.28E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.77E-10	3.01E-08	100.0%	

Table M.97. Risk characterization for sediments: adults – dermal exposure (current land use – open) – Area S3–C1–O

Chemical	MLE Concentration (µg/kg)	RME Concentration (µg/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.07E-10	1.37E-11	4.51E-09	1.93E-09	3.56E-07	1.50E-05	16.3%	skin; keratosis, hyperpigmentation	3	2.41E-11	3.38E-09	8.7%	[A]
Barium	78.13	88.46	1.83E-09	2.36E-10	7.56E-08	3.24E-08	2.62E-08	1.08E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.15E-11	2.76E-12	8.77E-10	3.76E-10	4.30E-09	1.75E-07	0.2%	no observed effects	100	1.19E-11	1.62E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.33E-11	4.28E-12	1.46E-09	6.27E-10	3.33E-08	1.46E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.12E-09	1.44E-10	4.71E-08	2.02E-08	1.12E-09	4.71E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.63E-10	7.24E-11	2.55E-08	1.09E-08	1.52E-08	6.90E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.24E-09	1.60E-10	8.51E-08	3.65E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.08E-08	2.68E-09	8.86E-07	3.80E-07	1.49E-07	6.33E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.51E-10	4.51E-11	1.75E-08	7.50E-09	1.17E-06	5.83E-05	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.43E-10	6.99E-11	2.37E-08	1.02E-08	2.72E-08	1.18E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.82E-10	8.77E-11	2.89E-08	1.24E-08	9.74E-08	4.12E-06	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.28E-09	2.93E-10	1.03E-07	4.43E-08	7.60E-09	3.44E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.42E-11	3.11E-12	1.40E-09	5.99E-10				--	--	2.40E-11	4.61E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.90E-11	2.44E-12	1.19E-09	5.08E-10				--	--	1.88E-11	3.91E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.64E-11	9.82E-12	4.42E-09	1.90E-09	2.55E-09	1.47E-07	0.2%	--	--	7.17E-12	1.38E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.40E-11	9.52E-12	4.15E-09	1.78E-09	2.47E-09	1.38E-07	0.2%	--	--	6.95E-11	1.30E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.60E-11	1.13E-11	4.97E-09	2.13E-09	2.93E-09	1.66E-07	0.2%	--	--	8.26E-12	1.59E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.23E-11	9.27E-12	3.39E-09	1.45E-09	2.40E-09	1.13E-07	0.1%	--	--	6.77E-12	1.06E-09	2.7%	[B2]
Chrysene	0.31	0.49	7.26E-11	9.34E-12	4.20E-09	1.80E-09	2.42E-09	1.40E-07	0.2%	--	--	6.82E-13	1.31E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.15E-11	6.63E-12	2.06E-09	8.85E-10	1.72E-09	6.88E-08	0.1%	--	--	4.84E-11	6.46E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.80E-12	2.32E-13	1.16E-10	4.95E-11	3.61E-08	2.31E-06	2.5%	liver; lesions	100	3.71E-12	7.92E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.47E-11	8.32E-12	3.24E-09	1.39E-09	2.16E-09	1.08E-07	0.1%	--	--	6.07E-12	1.01E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.94E-06	9.19E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.29E-10	3.89E-08	100.0%	

Table M.98. Risk characterization for sediments: children – dermal exposure (current land use – open) – Area S3–C1–O

Chemical	MLB Concentration in sediment	RMB Concentration in sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.1E-10	4.7E-12	4.8E-09	6.2E-10	3.6E-07	1.6E-05	16.3%	skin; keratosis, hyperpigmentation	3	8.2E-12	1.0E-09	8.7%	[A]
Barium	78.13	88.46	1.8E-09	8.1E-11	8.1E-08	1.0E-08	2.7E-08	1.1E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.2E-11	9.4E-13	9.4E-10	1.2E-10	4.4E-09	1.8E-07	0.2%	no observed effects	100	4.0E-12	5.2E-10	4.2%	[B2]
Cadmium	1.42	1.71	3.4E-11	1.4E-12	1.5E-09	2.0E-10	3.4E-08	1.5E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.1E-09	4.9E-11	5.0E-08	6.5E-09	1.1E-09	5.0E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.8E-10	2.4E-11	2.7E-08	3.5E-09	1.5E-08	7.4E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.2E-09	5.4E-11	9.1E-08	1.1E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.1E-08	9.1E-10	9.5E-07	1.2E-07	1.5E-07	6.8E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.6E-10	1.5E-11	1.8E-08	2.4E-09	1.2E-06	6.2E-05	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.6E-10	2.4E-11	2.5E-08	3.2E-09	2.8E-08	1.2E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.01	33.74	7.0E-10	3.0E-11	3.1E-08	3.9E-09	1.0E-07	4.4E-06	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.3E-09	1.0E-10	1.1E-07	1.4E-08	7.8E-09	3.7E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.5E-11	1.0E-12	1.5E-09	1.9E-10				--	--	8.2E-12	1.4E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.9E-11	8.3E-13	1.2E-09	1.6E-10				--	--	6.4E-12	1.2E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.8E-11	3.3E-12	4.7E-09	6.1E-10	2.6E-09	1.5E-07	0.2%	--	--	2.4E-12	4.4E-10	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.6E-11	3.2E-12	4.4E-09	5.7E-10	2.5E-09	1.4E-07	0.2%	--	--	2.3E-11	4.1E-09	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	9.0E-11	3.8E-12	5.3E-09	6.8E-10	3.0E-09	1.7E-07	0.2%	--	--	2.8E-12	5.0E-10	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.4E-11	3.1E-12	3.6E-09	4.6E-10	2.4E-09	1.2E-07	0.1%	--	--	2.3E-12	3.4E-10	2.7%	[B2]
Chrysene	0.31	0.49	7.4E-11	3.2E-12	4.5E-09	5.8E-10	2.4E-09	1.5E-07	0.2%	--	--	2.3E-13	4.2E-11	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.3E-11	2.2E-12	2.2E-09	2.8E-10	1.7E-09	7.4E-08	0.1%	--	--	1.6E-11	2.0E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.8E-12	7.9E-14	1.2E-10	1.6E-11	3.7E-08	2.4E-06	2.5%	liver; lesions	100	1.2E-12	2.5E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.6E-11	2.8E-12	3.4E-09	4.4E-10	2.2E-09	1.1E-07	0.1%	--	--	2.0E-12	3.2E-10	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.0E-06	9.9E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.8E-11	1.2E-08	100.0%	

Table M.99. Risk characterization for soils: adults – ingestion exposure (current land use – residential) – Area S3–C2–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	1.48	1.87	6.2E3-07	8.0E3-08	2.5E3-06	1.1E3-06	1.5E3-03	6.4E3-03	1.9%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	3.7E3-06	4.7E3-07	1.3E3-05	5.5E3-06	1.2E3-02	4.3E3-02	12.6%	skin; keratosis, hyperpigmentation	3	8.3E3-07	9.7E3-06	41.2%	[A]
Barium	99.86	115.80	4.2E3-05	5.4E3-06	1.5E3-04	6.8E3-05	6.0E3-04	2.2E3-03	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	2.9E3-07	3.7E3-08	1.0E3-06	4.5E3-07	5.8E3-05	2.1E3-04	0.1%	no observed effects	100	1.6E3-07	1.9E3-06	8.3%	[B2]
Cadmium	2.30	3.38	9.7E3-07	1.2E3-07	4.6E3-06	1.9E3-06	9.7E3-04	4.6E3-03	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	2.9E3-05	3.7E3-06	1.0E3-04	4.4E3-05	2.9E3-05	1.0E3-04	0.0%	no observed effects	100				
Copper	43.64	60.90	1.8E3-05	2.3E3-06	8.3E3-05	3.5E3-05	4.9E3-04	2.2E3-03	0.7%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	2.9E3-05	3.7E3-06	1.2E3-04	5.2E3-05				CNS, blood	--				[B2]
Manganese	1023.00	1193.00	4.3E3-04	5.5E3-05	1.6E3-03	7.0E3-04	3.0E3-03	1.1E3-02	3.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	1.5E3-05	2.0E3-06	8.0E3-05	3.4E3-05	5.2E3-02	2.6E3-01	78.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	1.2E3-05	1.5E3-06	5.0E3-05	2.1E3-05	6.0E3-04	2.5E3-03	0.7%	dec. body and organ weight	300				
Selenium	12.79	15.51	5.4E3-06	6.9E3-07	2.1E3-05	9.1E3-06	1.0E3-03	4.2E3-03	1.2%	whole body; clinical selenosis	3				[D]
Silver	2.44	3.71	1.0E3-06	1.3E3-07	5.0E3-06	2.1E3-06	2.0E3-04	1.0E3-03	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	1.3E3-04	1.7E3-05	6.3E3-04	2.7E3-04	4.4E3-04	2.1E3-03	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.14	0.18	5.9E3-08	7.6E3-09	2.5E3-07	1.0E3-07				--	--	5.8E3-08	8.3E3-07	3.5%	[B2]
Aroclor-1260	0.23	0.33	9.8E3-08	1.2E3-08	4.5E3-07	1.9E3-07				--	--	9.7E3-08	1.4E3-06	6.3%	[B2]
Benzo(a)anthracene	0.71	1.28	2.9E3-07	3.8E3-08	1.7E3-06	7.5E3-07	9.9E3-06	5.8E3-05	0.0%	--	--	2.8E3-08	5.4E3-07	2.3%	[B2]
Benzo(a)pyrene	0.68	1.20	2.8E3-07	3.6E3-08	1.6E3-06	7.0E3-07	9.5E3-06	5.4E3-05	0.0%	--	--	2.6E3-07	5.1E3-06	21.7%	[B2]
Benzo(b)fluoranthene	1.18	2.28	4.9E3-07	6.4E3-08	3.1E3-06	1.3E3-06	1.6E3-05	1.0E3-04	0.0%	--	--	4.6E3-08	9.7E3-07	4.1%	[B2]
Benzo(k)fluoranthene	1.14	2.25	4.8E3-07	6.1E3-08	3.0E3-06	1.3E3-06	1.6E3-05	1.0E3-04	0.0%	--	--	4.5E3-08	9.6E3-07	4.1%	[B2]
Chrysene	0.78	1.47	3.3E3-07	4.2E3-08	2.0E3-06	8.6E3-07	1.1E3-05	6.7E3-05	0.0%	--	--	3.1E3-09	6.3E3-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	1.0E3-07	1.3E3-08	5.1E3-07	2.2E3-07	3.6E3-06	1.7E3-05	0.0%	--	--	1.0E3-07	1.6E3-06	6.8%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	2.1E3-07	2.7E3-08	1.1E3-06	4.7E3-07	7.0E3-06	3.7E3-05	0.0%	--	--	2.0E3-08	3.4E3-07	1.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.61	0.82		5.9E3+01		8.6E3+02									
Cobalt 60	0.01	0.02		5.4E3-01		1.6E3+01						1.6E3-09	2.4E3-08	5.9%	[A]
Neptunium 237+D	0.01	0.02		8.7E3-01		2.5E3+01						8.2E3-12	2.4E3-10	0.1%	[A]
Protactinium 233	0.05	0.12		4.9E3+00		1.3E3+02						1.9E3-10	5.5E3-09	1.4%	[A]
Thorium 228+D	2.10	2.36		2.0E3+02		2.4E3+03						4.9E3-12	1.3E3-10	0.0%	[A]
Thorium 230	2.37	3.16		2.3E3+02		3.3E3+03						1.1E3-08	1.3E3-07	33.6%	[A]
Thorium 232	1.50	1.90		1.4E3+02		2.0E3+03						2.9E3-09	4.3E3-08	10.6%	[A]
Uranium 234	3.12	3.71		3.0E3+02		3.8E3+03						1.7E3-09	2.4E3-08	5.9%	[A]
Uranium 235+D	0.15	0.18		1.4E3+01		1.9E3+02						4.8E3-09	6.2E3-08	15.3%	[A]
Uranium 238+D	3.10	3.66		3.0E3+02		3.8E3+03						2.3E3-10	3.0E3-09	0.8%	[A]
												8.4E3-09	1.0E3-07	26.5%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	7.2E3-02	3.4E3-01	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.6E3-06	2.3E3-05	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	3.1E3-08	4.0E3-07	100.0%

Table M.100. Risk characterization for soils: children – ingestion exposure (current land use – residential) – Area S3–C2–R

Chemical	MLE Concentration in Soil	RME Concentration in Soil	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	1.48	1.87	2.19E-06	9.40E-08	9.19E-06	1.18E-06	5.48E-03	2.30E-02	1.9%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	1.30E-05	5.57E-07	4.67E-05	6.00E-06	4.34E-02	1.56E-01	12.6%	skin; keratosis, hyperpigmentation	3	9.70E-07	1.05E-05	41.2%	[A]
Barium	99.85	115.60	1.48E-04	6.33E-06	5.68E-04	7.30E-05	2.11E-03	8.11E-03	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	1.02E-06	4.38E-08	3.81E-06	4.90E-07	2.04E-04	7.62E-04	0.1%	no observed effects	100	1.88E-07	2.11E-06	8.3%	[B2]
Cadmium	2.30	3.38	3.40E-06	1.46E-07	1.66E-05	2.13E-06	3.40E-03	1.66E-02	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	1.02E-04	4.38E-06	3.68E-04	4.74E-05	1.02E-04	3.68E-04	0.0%	no observed effects	100				
Copper	43.64	60.90	6.46E-05	2.77E-06	2.99E-04	3.84E-05	1.74E-03	8.07E-03	0.7%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	1.02E-04	4.38E-06	4.39E-04	5.65E-05				CNS, blood	--				[B2]
Manganese	1023.00	1193.00	1.51E-03	6.49E-05	5.85E-03	7.52E-04	1.08E-02	4.18E-02	3.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	5.53E-05	2.37E-06	2.89E-04	3.72E-05	1.84E-01	9.64E-01	78.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	4.24E-05	1.82E-06	1.81E-04	2.32E-05	2.12E-03	9.04E-03	0.7%	dec. body and organ weight	300				
Selenium	12.79	15.51	1.89E-05	8.11E-07	7.65E-05	9.78E-06	3.78E-03	1.52E-02	1.2%	whole body; clinical selenosis	3				[D]
Silver	2.44	3.71	3.61E-06	1.55E-07	1.82E-05	2.34E-06	7.21E-04	3.64E-03	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	4.63E-04	1.98E-05	2.28E-03	2.94E-04	1.54E-03	7.61E-03	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.14	0.18	2.08E-07	8.91E-09	9.02E-07	1.16E-07				--	--	6.86E-08	8.93E-07	3.5%	[B2]
Aroclor-1260	0.23	0.33	3.44E-07	1.47E-08	1.62E-06	2.08E-07				--	--	1.13E-07	1.61E-06	6.3%	[B2]
Benzo(a)anthracene	0.71	1.28	1.04E-06	4.48E-08	6.26E-06	8.05E-07	3.46E-05	2.09E-04	0.0%	--	--	3.27E-08	5.88E-07	2.3%	[B2]
Benzo(a)pyrene	0.68	1.20	1.00E-06	4.30E-08	5.89E-06	7.57E-07	3.34E-05	1.98E-04	0.0%	--	--	3.14E-07	5.53E-06	21.7%	[B2]
Benzo(b)fluoranthene	1.18	2.28	1.73E-06	7.44E-08	1.12E-05	1.44E-06	5.82E-05	3.72E-04	0.0%	--	--	5.46E-08	1.05E-06	4.1%	[B2]
Benzo(k)fluoranthene	1.14	2.25	1.68E-06	7.20E-08	1.10E-05	1.42E-06	5.60E-05	3.67E-04	0.0%	--	--	5.26E-08	1.03E-06	4.1%	[B2]
Chrysene	0.78	1.47	1.16E-06	4.98E-08	7.22E-06	9.28E-07	3.86E-05	2.41E-04	0.0%	--	--	3.62E-09	6.77E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	3.79E-07	1.63E-08	1.85E-06	2.38E-07	1.26E-05	6.17E-05	0.0%	--	--	1.19E-07	1.74E-06	6.8%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	7.44E-07	3.19E-08	3.98E-06	5.12E-07	2.48E-05	1.33E-04	0.0%	--	--	2.33E-08	3.74E-07	1.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.61	0.82		2.46E+01		3.43E+02						6.89E-10	9.61E-09	5.9%	[A]
Cobalt 60	0.01	0.02		2.28E-01		6.54E+00						3.43E-12	9.80E-11	0.1%	[A]
Neptunium 237+D	0.01	0.02		3.66E-01		9.97E+00						8.06E-11	2.19E-09	1.4%	[A]
Protactinium 233	0.05	0.12		2.06E+00		5.17E+01						2.06E-12	5.17E-11	0.0%	[A]
Thorium 228+D	2.10	2.36		8.52E+01		9.90E+02						4.69E-09	5.44E-08	33.6%	[A]
Thorium 230	2.37	3.16		9.60E+01		1.32E+03						1.25E-09	1.72E-08	10.6%	[A]
Thorium 232	1.50	1.90		6.07E+01		7.97E+02						7.28E-10	9.56E-09	5.9%	[A]
Uranium 234	3.12	3.71		1.26E+02		1.55E+03						2.02E-09	2.49E-08	15.3%	[A]
Uranium 235+D	0.15	0.18		6.03E+00		7.60E+01						9.66E-11	1.22E-09	0.8%	[A]
Uranium 238+D	3.10	3.66		1.25E+02		1.53E+03						3.51E-09	4.29E-08	26.5%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.35E-01	1.23E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.94E-06	2.55E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E-08	1.62E-07	100.0%	

Table M.101. Risk characterization for soils: adults – dermal exposure (current land use – residential) – Area S3–C2–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Antimony	1.48	1.87	2.2E-08	2.9E-09	2.7E-07	1.1E-07	5.6E-05	6.9E-04	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	1.3E-07	1.7E-08	1.4E-06	6.0E-07	4.4E-04	4.7E-03	12.5%	skin; keratosis, hyperpigmentation	3	3.0E-08	1.0E-06	7.4%	[A]
Barium	99.86	115.80	1.5E-06	1.9E-07	1.7E-05	7.3E-06	2.1E-05	2.4E-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	1.0E-08	1.3E-09	1.1E-07	4.9E-08	2.1E-06	2.3E-05	0.1%	no observed effects	100	5.8E-09	2.1E-07	1.5%	[B2]
Cadmium	2.30	3.38	3.5E-08	4.5E-09	5.0E-07	2.1E-07	3.5E-05	5.0E-04	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	1.0E-06	1.3E-07	1.1E-05	4.7E-06	1.0E-06	1.1E-05	0.0%	no observed effects	100				
Copper	43.64	60.90	6.6E-07	8.5E-08	9.0E-06	3.8E-06	1.7E-05	2.4E-04	0.6%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	1.0E-06	1.3E-07	1.3E-05	5.6E-06				CNS, blood	--				[B2]
Manganese	1023.00	1193.00	1.5E-05	2.0E-06	1.7E-04	7.5E-05	1.1E-04	1.2E-03	3.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	5.6E-07	7.3E-08	8.7E-06	3.7E-06	1.9E-03	2.9E-02	77.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	4.3E-07	5.6E-08	5.4E-06	2.3E-06	2.1E-05	2.7E-04	0.7%	dec. body and organ weight	300				
Selenium	12.79	15.51	1.9E-07	2.5E-08	2.3E-06	9.8E-07	3.8E-05	4.5E-04	1.2%	whole body; clinical selenosis	3				[D]
Silver	2.44	3.71	3.7E-08	4.7E-09	5.5E-07	2.3E-07	7.4E-06	1.1E-04	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	4.7E-06	6.1E-07	6.8E-05	2.9E-05	1.5E-05	2.3E-04	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.14	0.18	2.1E-08	2.7E-09	2.7E-07	1.1E-07				--	--	2.1E-08	8.9E-07	6.3%	[B2]
Aroclor-1260	0.23	0.33	3.5E-08	4.5E-09	4.9E-07	2.1E-07				--	--	3.5E-08	1.6E-06	11.4%	[B2]
Benzo(a)anthracene	0.71	1.28	1.0E-07	1.3E-08	1.8E-06	8.1E-07	3.5E-06	6.3E-05	0.2%	--	--	1.0E-08	5.9E-07	4.2%	[B2]
Benzo(a)pyrene	0.68	1.20	1.0E-07	1.3E-08	1.7E-06	7.6E-07	3.4E-06	5.9E-05	0.2%	--	--	9.6E-08	5.5E-06	39.1%	[B2]
Benzo(b)fluoranthene	1.18	2.28	1.8E-07	2.3E-08	3.3E-06	1.4E-06	5.9E-06	1.1E-04	0.3%	--	--	1.6E-08	1.0E-06	7.4%	[B2]
Benzo(k)fluoranthene	1.14	2.25	1.7E-07	2.2E-08	3.3E-06	1.4E-06	5.7E-06	1.1E-04	0.3%	--	--	1.6E-08	1.0E-06	7.3%	[B2]
Chrysene	0.78	1.47	1.1E-07	1.5E-08	2.1E-06	9.3E-07	3.9E-06	7.2E-05	0.2%	--	--	1.1E-09	6.8E-08	0.5%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	3.9E-08	5.0E-09	5.5E-07	2.4E-07	1.3E-06	1.8E-05	0.0%	--	--	3.6E-08	1.7E-06	12.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	7.6E-08	9.8E-09	1.2E-06	5.1E-07	2.5E-06	4.0E-05	0.1%	--	--	7.1E-09	3.7E-07	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.6E-03	3.7E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.7E-07	1.4E-05	100.0%	

Table M.102. Risk characterization for soils: children – dermal exposure (current land use – residential) – Area S3–C2–R

Chemical	MLB Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Car. Effects (MLB)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	1.48	1.87	2.94E-08	1.26E-09	3.63E-07	4.66E-08	7.35E-05	9.07E-04	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	1.74E-07	7.47E-09	1.84E-06	2.37E-07	5.81E-04	6.14E-03	12.5%	skin; keratosis, hyperpigmentation	3	1.31E-08	4.15E-07	7.4%	[A]
Barium	99.86	115.80	1.98E-06	8.48E-08	2.24E-05	2.88E-06	2.83E-05	3.20E-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	1.37E-08	5.87E-10	1.51E-07	1.94E-08	2.74E-06	3.01E-05	0.1%	no observed effects	100	2.52E-09	8.32E-08	1.5%	[B2]
Cadmium	2.30	3.38	4.56E-08	1.95E-09	6.54E-07	8.41E-08	4.56E-05	6.54E-04	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	1.37E-06	5.87E-08	1.45E-05	1.87E-06	1.37E-06	1.45E-05	0.0%	no observed effects	100				
Copper	43.64	60.90	8.66E-07	3.71E-08	1.18E-05	1.52E-06	2.34E-05	3.19E-04	0.6%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	1.37E-06	5.87E-08	1.73E-05	2.23E-06				CNS, blood	--				[B2]
Manganese	1023.00	1193.00	2.03E-05	8.70E-07	2.31E-04	2.97E-05	1.45E-04	1.65E-03	3.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	7.42E-07	3.18E-08	1.14E-05	1.47E-06	2.47E-03	3.80E-02	77.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	5.69E-07	2.44E-08	7.13E-06	9.17E-07	2.84E-05	3.57E-04	0.7%	dec. body and organ weight	300				
Selenium	12.79	15.51	2.54E-07	1.09E-08	3.00E-06	3.86E-07	5.07E-05	6.01E-04	1.2%	whole body; clinical selenosis	3				[D]
Silver	2.44	3.71	4.84E-08	2.07E-09	7.19E-07	9.25E-08	9.67E-06	1.44E-04	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	6.21E-06	2.66E-07	9.02E-05	1.16E-05	2.07E-05	3.01E-04	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.14	0.18	2.79E-08	1.20E-09	3.56E-07	4.58E-08				--	--	9.20E-09	3.52E-07	6.3%	[B2]
Aroclor-1260	0.23	0.33	4.61E-08	1.97E-09	6.40E-07	8.23E-08				--	--	1.52E-08	6.34E-07	11.4%	[B2]
Benzo(a)anthracene	0.71	1.28	1.40E-07	6.00E-09	2.47E-06	3.18E-07	4.67E-06	8.24E-05	0.2%	--	--	4.38E-09	2.32E-07	4.2%	[B2]
Benzo(a)pyrene	0.68	1.20	1.34E-07	5.76E-09	2.33E-06	2.99E-07	4.46E-06	7.75E-05	0.2%	--	--	4.20E-08	2.18E-06	39.1%	[B2]
Benzo(b)fluoranthene	1.18	2.28	2.34E-07	1.00E-08	4.41E-06	5.67E-07	7.80E-06	1.47E-04	0.3%	--	--	7.32E-09	4.14E-07	7.4%	[B2]
Benzo(k)fluoranthene	1.14	2.25	2.25E-07	9.66E-09	4.35E-06	5.59E-07	7.51E-06	1.45E-04	0.3%	--	--	7.05E-09	4.08E-07	7.3%	[B2]
Chrysene	0.78	1.47	1.53E-07	6.65E-09	2.85E-06	3.66E-07	5.17E-06	9.50E-05	0.2%	--	--	4.85E-10	2.67E-08	0.5%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	5.08E-08	2.18E-09	7.31E-07	9.40E-08	1.69E-06	2.44E-05	0.0%	--	--	1.59E-08	6.86E-07	12.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	9.98E-08	4.28E-09	1.57E-06	2.02E-07	3.33E-06	5.24E-05	0.1%	--	--	3.12E-09	1.47E-07	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.45E-03	4.92E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.20E-07	3.58E-06	100.0%	

Table M.103. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – residential) – Area S3–C2–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation	--				
Manganese (water)	2.69E+02	4.12E+02	3.68E-06	4.73E-07	3.36E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.71E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				[D]
Zinc	6.67E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	Inc. liver, kidney weights, nephrotoxicity					
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000				[D]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	6.9E-10	1.48E-08	24.7%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	0.4%	liver; lesions, fattycyst formation	1000	2.3E-10	6.77E-09	11.3%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	1000	4.3E-11	9.97E-10	1.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	2.4E-11	5.86E-10	1.0%	[B2]
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100	1.0E-09	2.79E-08	46.5%	[B2]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.30E-06	0.1%	liver, kidney; toxicity	100				[D]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	1.8%	liver; inc. relative weight		4.1E-11	1.06E-09	1.8%	[C]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000	3.4E-10	7.94E-09	13.2%	[B2]
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.8E-10	4.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.6E-10	9.28E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.67E-04	8.62E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.48E-09	6.01E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												5.49E-10	1.36E-08	100.0%	

Table M.104. Risk characterization for surface water: children – ingestion exposure (swimming) (current land use – residential) – Area S3–C2–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Nonca. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Nonca. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E-06	1.30E-07	2.31E-05	2.96E-06	4.34E-05	3.29E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E-07	1.28E-08	2.89E-06	3.72E-07	2.99E-07	2.89E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E-07	3.04E-08	4.80E-06	6.17E-07	1.92E-05	1.30E-04	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E-05	4.42E-07	9.09E-05	1.16E-05	2.06E-03	1.81E-02	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E-07	4.40E-09	8.62E-07	1.11E-07	3.42E-04	2.87E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E-07	1.38E-08	3.09E-06	3.97E-07	4.60E-05	4.41E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E-06	1.13E-07	1.99E-05	2.56E-06	8.79E-06	6.64E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E-07	1.02E-08	1.69E-06	2.17E-07	2.38E-06	1.69E-05	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	8.91E-10	3.82E-11	5.46E-09	7.05E-10	2.97E-05	1.83E-04	0.6%	liver; lesions, toxicity	1000	6.49E-10	1.20E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E-07	1.56E-08	3.04E-06	3.99E-07	1.82E-05	1.52E-04	0.7%	liver; weight inc.	1000	2.19E-10	5.46E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E-07	6.69E-09	1.03E-06	1.32E-07	1.56E-05	1.03E-04	0.4%	liver; lesions, fattycyst formation	1000	4.08E-11	8.06E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.54E-09	6.61E-11	1.08E-08	1.39E-09	3.08E-06	2.17E-05	0.1%	liver; lesions	100	2.25E-11	4.73E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	1.49E-09	6.37E-11	1.10E-08	1.41E-09	2.97E-05	2.19E-04	0.9%	liver; lesions	100	1.02E-09	2.25E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	1.48E-09	6.36E-11	1.10E-08	1.41E-09	4.95E-06	3.65E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	6.97E-10	2.99E-11	5.14E-09	6.60E-10	2.32E-06	1.71E-05	0.1%	liver, kidney; toxicity		3.89E-11	8.58E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	8.28E-10	3.55E-11	5.48E-09	7.05E-10	6.37E-05	4.21E-04	1.8%	liver; inc. relative weight		3.23E-10	6.41E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E-07	6.87E-09	1.06E-06	1.36E-07	1.60E-05	1.06E-04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E-11	1.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E-10	2.78E-09	68.4%	[A]
Chemical Hazards:															
Hazard Index (HI):							2.71E-03	2.32E-02	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:												2.31E-09	4.85E-08	100.0%	
Combined Exposure (d)															
Radiological Hazards:															
Excess Lifetime Cancer Risk:												1.83E-10	4.07E-09	100.0%	
Combined Exposure (d)															

Table M.105. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – residential) – Area S3–C2–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Care. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Care. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.65E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.58E-06	0.0%	Gastrointestinal system; irritation					
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.21E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fattycyst formation	1000	1.88E-10	7.57E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.10E-03	8.4%	liver; lesions	100	8.45E-09	3.88E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity		2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; inc. relative weight		5.29E-09	2.14E-07	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	1.02E-03	1.32E-02	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.35E-08	1.04E-06	100.0%

Table M.106. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – residential) – Area S3–C2–R

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.05E-07	4.65E-09	1.55E-06	1.96E-07	1.56E-06	2.18E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	3.18E-07	4.09E-08	6.91E-07	8.60E-06	0.0%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.65E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	7.43E-05	1.20E-03	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.76E-09	1.59E-10	5.72E-08	7.35E-09	1.25E-05	1.91E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E-08	4.98E-10	2.05E-07	2.64E-08	1.66E-06	2.93E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.21E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.21E-04	0.7%	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	12.0%	liver; weight inc.	1000	1.63E-09	7.47E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.15E-07	1.34E-08	3.75E-06	4.87E-07	3.15E-05	3.79E-04	2.2%	liver; lesions, fattycyst formation	1000	8.19E-11	2.97E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.99E-04	3.86E-03	22.3%	liver; lesions	100	2.18E-09	8.44E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.49E-03	8.4%	liver; lesions	100	3.67E-09	1.50E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	0.6%	liver, kidney; toxicity		1.23E-10	4.98E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	31.9%	liver; inc. relative weight		2.30E-09	8.40E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.71E-06	1.73E-04	2.11E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.39E-03	1.73E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-08	4.08E-07	100.0%	

Table M.107. Risk characterization for sediments: adults – dermal exposure (current land use – residential) – Area S3–C2–R

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	UFA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UFA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%	--	--	5.02E-11	9.92E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.95E-08	1.26E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazard: Hazard Index (HI): Combined Exposure (d)							1.36E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-09	2.80E-07	100.0%	

Table M.108. Risk characterization for sediments: children – dermal exposure (current land use – residential) – Area S3–C2–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.7E-10	4.1E-11	4.2E-08	5.4E-09	3.2E-06	1.4E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.3E-11	9.5E-09	8.7%	[A]
Barium	78.13	88.46	1.6E-08	7.1E-10	7.1E-07	9.1E-08	2.3E-07	1.0E-05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.9E-10	8.4E-12	8.2E-09	1.0E-09	3.9E-08	1.6E-06	0.2%	no observed effects	100	3.6E-11	4.5E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.0E-10	1.3E-11	1.3E-08	1.7E-09	3.0E-07	1.3E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.0E-08	4.3E-10	4.4E-07	5.7E-08	1.0E-08	4.4E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.1E-09	2.2E-10	2.4E-07	3.0E-08	1.3E-07	6.5E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.1E-08	4.8E-10	8.0E-07	1.0E-07				CNS, blood	--				[B2]
Manganese	885.40	1036.00	1.9E-07	8.1E-09	8.3E-06	1.0E-06	1.3E-06	5.9E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.2E-09	1.3E-10	1.6E-07	2.1E-08	1.0E-05	5.4E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.9E-09	2.1E-10	2.2E-07	2.8E-08	2.4E-07	1.1E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.2E-09	2.6E-10	2.7E-07	3.4E-08	8.8E-07	3.8E-05	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.0E-08	8.9E-10	9.7E-07	1.2E-07	6.9E-08	3.2E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.10	0.16	2.2E-10	9.4E-12	1.3E-08	1.6E-09				--	--	7.2E-11	1.3E-08	11.9%	[B2]
Aroclor–1260	0.08	0.14	1.7E-10	7.4E-12	1.1E-08	1.4E-09				--	--	5.7E-11	1.1E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.9E-10	2.9E-11	4.1E-08	5.3E-09	2.3E-08	1.3E-06	0.2%	--	--	2.1E-11	3.9E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.7E-10	2.6E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.1E-10	3.6E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.0E-10	3.4E-11	4.6E-08	6.0E-09	2.6E-08	1.5E-06	0.2%	--	--	2.5E-11	4.3E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.5E-10	2.8E-11	3.1E-08	4.1E-09	2.1E-08	1.0E-06	0.1%	--	--	2.0E-11	2.9E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.6E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.0E-12	3.7E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.7E-10	2.0E-11	1.9E-08	2.5E-09	1.5E-08	6.4E-07	0.1%	--	--	1.4E-10	1.8E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.6E-11	7.0E-13	1.0E-09	1.4E-10	3.2E-07	2.1E-05	2.5%	liver; lesions	100	1.1E-11	2.2E-09	2.0%	[B2]
Indeno(1,2,3–cd)pyrene	0.28	0.38	5.9E-10	2.5E-11	3.0E-08	3.9E-09	1.9E-08	1.0E-06	0.1%	--	--	1.8E-11	2.8E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.7E-05	8.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.9E-10	1.1E-07	100.0%	

Table M.109. Risk characterization for produce: adults – ingestion exposure (current land use – residential) – Area S3–C2–R

Chemical	MLE Concentration from Main Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Cars. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Cars. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Cars. Risk	RfDA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	1.4E3–02	1.8E3–02	2.2E3–06	2.9E3–07	1.3E3–05	5.6E3–06	5.6E3–03	3.2E3–02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	7.0E3–01	7.6E3–01	1.0E3–04	1.3E3–05	5.3E3–04	2.2E3–04	3.5E3–01	1.7E3+00	3.7%	skin; keratosis, hyperpigmentation	3	2.4E3–05	3.9E3–04	96.5%	[A]
Barium	9.9E3–01	1.1E3+00	1.5E3–04	1.9E3–05	8.0E3–04	3.4E3–04	2.1E3–03	1.1E3–02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.7E3–03	3.1E3–03	4.2E3–07	5.4E3–08	2.1E3–06	9.3E3–07	8.4E3–05	4.3E3–04	0.0%	no observed effects	100	2.3E3–07	4.0E3–06	1.0%	[B2]
Cadmium	1.1E3+00	1.6E3+00	1.7E3–04	2.2E3–05	1.1E3–03	5.0E3–04	1.7E3–01	1.1E3+00	2.5%	kidney; proteinuria	10				
Chromium (III)	6.9E3–01	7.5E3–01	1.0E3–04	1.3E3–05	5.2E3–04	2.2E3–04	1.0E3–04	5.2E3–04	0.0%	no observed effects	100				
Copper	2.1E3+00	3.0E3+00	3.3E3–04	4.2E3–05	2.1E3–03	9.1E3–04	9.0E3–03	5.7E3–02	0.1%	Gastrointestinal system; irritation	--				[D]
Lead	6.9E3–01	8.9E3–01	1.0E3–04	1.3E3–05	6.2E3–04	2.6E3–04				CNS, blood	--				[B2]
Manganese	4.0E3+02	4.7E3+02	6.2E3–02	8.0E3–03	3.3E3–01	1.4E3–01	4.4E3–01	2.3E3+00	5.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.1E3+01	1.7E3+01	1.7E3–03	2.2E3–04	1.2E3–02	5.2E3–03	5.7E3+00	4.1E3+01	86.9%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	1.4E3+00	1.8E3+00	2.1E3–04	2.8E3–05	1.2E3–03	5.5E3–04	1.0E3–02	6.4E3–02	0.1%	dec. body and organ weight	300				
Selenium	1.2E3+00	1.5E3+00	1.9E3–04	2.5E3–05	1.0E3–03	4.6E3–04	3.9E3–02	2.1E3–01	0.5%	whole body; clinical selenosis	3				[D]
Silver	4.8E3–01	7.4E3–01	7.4E3–05	9.5E3–06	5.1E3–04	2.2E3–04	1.4E3–02	1.0E3–01	0.2%	skin; argyria	3				[D]
Zinc	1.2E3+02	1.8E3+02	1.9E3–02	2.4E3–03	1.3E3–01	5.5E3–02	6.3E3–02	4.3E3–01	0.9%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor–1254	2.4E3–04	3.2E3–04	3.7E3–08	4.8E3–09	2.2E3–07	9.5E3–08				--	--	3.7E3–08	7.3E3–07	0.2%	[B2]
Aroclor–1260	2.2E3–04	3.2E3–04	3.4E3–08	4.4E3–09	2.2E3–07	9.7E3–08				--	--	3.4E3–08	7.4E3–07	0.2%	[B2]
Benzo(a)anthracene	2.6E3–03	4.7E3–03	4.0E3–07	5.1E3–08	3.3E3–06	1.4E3–06	1.3E3–05	1.1E3–04	0.0%	--	--	3.7E3–08	1.0E3–06	0.3%	[B2]
Benzo(a)pyrene	1.2E3–03	2.2E3–03	1.9E3–07	2.5E3–08	1.5E3–06	6.7E3–07	6.4E3–06	5.2E3–05	0.0%	--	--	1.8E3–07	4.9E3–06	1.2%	[B2]
Benzo(b)fluoranthene	1.7E3–03	3.3E3–03	2.6E3–07	3.4E3–08	2.3E3–06	1.0E3–06	8.9E3–06	7.8E3–05	0.0%	--	--	2.5E3–08	7.3E3–07	0.2%	[B2]
Benzo(k)fluoranthene	1.2E3–03	2.3E3–03	1.8E3–07	2.3E3–08	1.6E3–06	7.1E3–07	6.1E3–06	5.5E3–05	0.0%	--	--	1.7E3–08	5.2E3–07	0.1%	[B2]
Chrysene	3.4E3–03	6.4E3–03	5.2E3–07	6.6E3–08	4.4E3–06	1.9E3–06	1.7E3–05	1.4E3–04	0.0%	--	--	4.8E3–09	1.4E3–07	0.0%	[B2]
Dibenzo(a,h)anthracene	4.3E3–04	6.4E3–04	6.6E3–08	8.5E3–09	4.4E3–07	1.9E3–07	2.2E3–06	1.4E3–05	0.0%	--	--	6.2E3–08	1.4E3–06	0.3%	[B2]
Indeno(1,2,3–cd)pyrene	1.8E3–04	2.9E3–04	2.7E3–08	3.5E3–09	2.0E3–07	8.7E3–08	9.2E3–07	6.8E3–06	0.0%	--	--	2.6E3–09	6.4E3–08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	1.8E3–02	2.4E3–02		6.4E3+02		1.3E3+04						1.7E3–08	3.6E3–07	51.6%	[A]
Cobalt 60	1.6E3–04	4.6E3–04		5.9E3+00		2.5E3+02						8.9E3–11	3.7E3–09	0.5%	[A]
Neptunium 237+D	3.6E3–04	9.5E3–04		1.2E3+01		5.1E3+02						2.7E3–09	1.1E3–07	15.7%	[A]
Protactinium 233	5.0E3–04	1.2E3–03		1.7E3+01		6.6E3+02						1.7E3–11	6.6E3–10	0.1%	[A]
Thorium 228+D	1.0E3–03	1.1E3–03		3.6E3+01		6.3E3+02						2.0E3–09	3.4E3–08	4.9%	[A]
Thorium 230	1.1E3–03	1.5E3–03		4.1E3+01		8.4E3+02						5.4E3–10	1.1E3–08	1.5%	[A]
Thorium 232	7.4E3–04	9.5E3–04		2.6E3+01		5.0E3+02						3.1E3–10	6.1E3–09	0.9%	[A]
Uranium 234	6.2E3–03	7.4E3–03		2.1E3+02		3.9E3+03						3.5E3–09	6.3E3–08	8.9%	[A]
Uranium 235+D	2.9E3–04	3.6E3–04		1.0E3+01		1.9E3+02						1.6E3–10	3.1E3–09	0.4%	[A]
Uranium 238+D	6.1E3–03	7.3E3–03		2.1E3+02		3.9E3+03						6.0E3–09	1.1E3–07	15.4%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	6.8E3+00	4.7E3+01	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.4E3–05	4.1E3–04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	3.3E3–08	7.1E3–07	100.0%

Table M.110. Risk characterization for produce: children – ingestion exposure (current land use – residential) – Area S3–C2–R

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	1.4E-02	1.8E-02	3.0E-06	2.1E-07	2.7E-05	3.4E-06	1.2E-02	6.7E-02	0.1%	whole body, blood; loc. mortality	1000				
Arsenic	7.0E-01	7.6E-01	2.0E-04	1.0E-05	1.1E-03	1.4E-04	8.0E-01	3.6E+00	3.7%	skin; keratosis, hyperpigmentation	3	1.8E-05	2.4E-04	96.5%	[A]
Barium	9.9E-01	1.1E+00	3.4E-04	1.4E-05	1.6E-03	2.1E-04	4.8E-03	2.4E-02	0.0%	*oral*–cardiovasc. sys.; loc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.7E-03	3.1E-03	9.4E-07	4.0E-08	4.5E-06	5.7E-07	1.8E-04	9.0E-04	0.0%	no observed effects	100	1.7E-07	2.4E-06	1.0%	[B2]
Cadmium	1.1E+00	1.6E+00	3.9E-04	1.6E-05	2.4E-03	3.1E-04	3.9E-01	2.4E+00	2.5%	kidney; proteinuria	10				
Chromium (III)	6.9E-01	7.5E-01	2.3E-04	1.0E-05	1.0E-03	1.4E-04	2.3E-04	1.0E-03	0.0%	no observed effects	100				
Copper	2.1E+00	3.0E+00	7.4E-04	3.1E-05	4.4E-03	5.6E-04	2.0E-02	1.1E-01	0.1%	Gastrointestinal system; irritation	--				[D]
Lead	6.9E-01	8.9E-01	2.3E-04	1.0E-05	1.3E-03	1.6E-04				CNS, blood	--				[B2]
Manganese	4.0E+02	4.7E+02	1.4E-01	5.9E-03	6.9E-01	8.8E-02	9.9E-01	4.9E+00	5.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.1E+01	1.7E+01	3.8E-03	1.6E-04	2.5E-02	3.2E-03	1.2E+01	8.5E+01	86.9%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	1.4E+00	1.8E+00	4.8E-04	2.1E-05	2.6E-03	3.4E-04	2.4E-02	1.3E-01	0.1%	dec. body and organ weight	300				
Selenium	1.2E+00	1.5E+00	4.3E-04	1.8E-05	2.2E-03	2.8E-04	8.7E-02	4.5E-01	0.5%	whole body; clinical selenosis	3				[D]
Silver	4.8E-01	7.4E-01	1.6E-04	7.1E-06	1.0E-03	1.3E-04	3.3E-02	2.1E-01	0.2%	skin; argyria	3				[D]
Zinc	1.2E+02	1.8E+02	4.2E-02	1.8E-03	2.7E-01	3.4E-02	1.4E-01	9.0E-01	0.9%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1254	2.4E-04	3.2E-04	8.3E-08	3.5E-09	4.6E-07	5.9E-08				--	--	2.7E-08	4.5E-07	0.2%	[B2]
Aroclor-1260	2.2E-04	3.2E-04	7.7E-08	3.5E-09	4.7E-07	6.0E-08				--	--	2.5E-08	4.6E-07	0.2%	[B2]
Benzo(a)anthracene	2.6E-03	4.7E-03	8.9E-07	3.8E-08	6.8E-06	8.8E-07	2.9E-05	2.2E-04	0.0%	--	--	2.8E-08	6.4E-07	0.3%	[B2]
Benzo(a)pyrene	1.2E-03	2.2E-03	4.3E-07	1.8E-08	3.2E-06	4.2E-07	1.4E-05	1.0E-04	0.0%	--	--	1.3E-07	3.0E-06	1.2%	[B2]
Benzo(b)fluoranthene	1.7E-03	3.3E-03	5.9E-07	2.5E-08	4.8E-06	6.2E-07	1.9E-05	1.6E-04	0.0%	--	--	1.8E-08	4.5E-07	0.2%	[B2]
Benzo(k)fluoranthene	1.2E-03	2.3E-03	4.1E-07	1.7E-08	3.4E-06	4.4E-07	1.3E-05	1.1E-04	0.0%	--	--	1.2E-08	3.2E-07	0.1%	[B2]
Chrysene	3.4E-03	6.4E-03	1.1E-06	4.9E-08	9.2E-06	1.1E-06	3.8E-05	3.1E-04	0.0%	--	--	3.6E-09	8.7E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	4.3E-04	6.4E-04	1.4E-07	6.3E-09	9.2E-07	1.1E-07	4.9E-06	3.0E-05	0.0%	--	--	4.6E-08	8.7E-07	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	1.8E-04	2.9E-04	6.2E-08	2.6E-09	4.2E-07	5.4E-08	2.0E-06	1.4E-05	0.0%	--	--	1.9E-09	3.9E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	1.8E-02	2.4E-02		1.7E+02		3.0E+03						4.7E-09	8.5E-08	51.6%	[A]
Cobalt 60	1.6E-04	4.6E-04		1.5E+00		5.7E+01						2.3E-11	8.6E-10	0.5%	[A]
Neptunium 237+D	3.6E-04	9.5E-04		3.3E+00		1.1E+02						7.4E-10	2.5E-08	15.7%	[A]
Protactinium 233	5.0E-04	1.2E-03		4.7E+00		1.5E+02						4.7E-12	1.5E-10	0.1%	[A]
Thorium 228+D	1.0E-03	1.1E-03		9.8E+00		1.4E+02						5.4E-10	8.0E-09	4.9%	[A]
Thorium 230	1.1E-03	1.5E-03		1.1E+01		1.9E+02						1.4E-10	2.5E-09	1.5%	[A]
Thorium 232	7.4E-04	9.5E-04		6.9E+00		1.1E+02						6.3E-11	1.4E-09	0.9%	[A]
Uranium 234	6.2E-03	7.4E-03		5.8E+01		9.1E+02						9.3E-10	1.4E-08	8.9%	[A]
Uranium 235+D	2.9E-04	3.6E-04		2.7E+00		4.4E+01						4.5E-11	7.1E-10	0.4%	[A]
Uranium 238+D	6.1E-03	7.5E-03		5.7E+01		9.0E+02						1.6E-09	2.5E-08	15.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.5E+01	9.8E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.8E-05	2.5E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												8.9E-09	1.6E-07	100.0%	

Table M.111. Risk characterization for fish: adults – ingestion exposure (current land use – residential) – Area S3–C2–R

Chemical	MLB Concentration in Fish Tissue	RMB Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS															
Mercury	0.76	0.78	2.38E-06	3.06E-07	2.89E-05	1.24E-05	7.94E-03	9.63E-02	100.0%	*oral*–CNS; neurotoxicity, *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	6.43E-07	8.27E-08	8.21E-06	3.52E-06						6.37E-07	2.71E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.13E-06	1.45E-07	1.44E-05	6.18E-06						1.12E-06	4.76E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E-03	9.63E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.75E-06	7.47E-05	100.0%	

Table M.112. Risk characterization for fish: children – ingestion exposure (current land use – residential) – Area S3–C2–R

Chemical	MLB Concentration in Fish Tissue	BMB Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (BMB)	CDI Carc. Effects (BMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (BMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (BMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS															
Mercury	0.76	0.78	4.1E-06	1.7E-07	6.0E-05	7.7E-06	1.3E-02	2.0E-01	100.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	1.1E-06	4.8E-08	1.7E-05	2.2E-06						3.7E-07	1.7E-05	36.3%	[D2]
Aroclor-1260	0.36	0.39	1.9E-06	8.4E-08	3.0E-05	3.8E-06						6.5E-07	2.9E-05	63.7%	[D2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-02	2.0E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-06	4.6E-05	100.0%	

Table M.113. Risk characterization summary for EFPC Segment 3: RME estimates for future land use

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	9.89E+00 *B*	NA	7.61E−05 W	NA	7.00E−06 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	9.9E+00 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	8E−05 W		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	7E−06 W

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	1.23E+00 *B*	3.44E−01 B	2.55E−05 W	2.37E−05 W	1.62E−07 B	4.06E−07 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	4.92E−02 B	3.76E−02 B	5.58E−06 W	1.42E−05 W	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	3.28E+01 *B*	2.77E+01 *B*	9.08E−05 W	2.56E−04 *B*	3.10E−06 W	2.35E−05 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	7.30E−04 B	1.61E−04 B	1.33E−07 B	9.78E−08 B	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	9.83E+01 *B*	4.74E+01 *B*	2.57E−04 *B*	4.13E−04 *B*	1.65E−07 B	7.13E−07 B
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					1.3E+02 *B*	7.6E+01 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					4E−04 *B*	8E−04 *B*		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					3E−06 W	2E−05 W

B – below or equal to target noncancer hazard index (HI<1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.114. Human health risk characterization summary for EFPC residential scenario: future land use, Area S3–F1–R adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	7.28E–02	3.44E–01	1.67E–06	2.37E–05
Dermal Contact	2.64E–03	3.76E–02	2.77E–07	1.42E–05
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion	1.58E+01	2.77E+01	3.84E–05	2.56E–04
Inhalation (VOCs)	4.01E–05	1.61E–04	7.30E–09	9.78E–08
FOOD CHAIN				
Produce	6.83E+00	4.74E+01	2.48E–05	4.13E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.14E–08	4.06E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion			3.59E–06	2.35E–05
FOOD CHAIN				
Produce			3.34E–08	7.13E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.3E+01	7.6E+01		
Excess Lifetime Cancer Risk: Combined Exposure			7E–05	8E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			4E–06	2E–05

Table M.115. Human health risk characterization summary for EFPC residential scenario: future land use, Area S3–F1–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	2.55E–01	1.23E+00	1.94E–06	2.55E–05
Dermal Contact	3.45E–03	4.92E–02	1.20E–07	5.58E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion	1.65E+01	3.28E+01	1.33E–05	9.08E–05
Inhalation (VOCs)	2.34E–04	7.30E–04	1.42E–08	1.33E–07
FOOD CHAIN				
Produce	1.53E+01	9.83E+01	1.85E–05	2.57E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.31E–08	1.62E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion			4.45E–07	3.10E–06
FOOD CHAIN				
Produce			8.90E–09	1.65E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	3.2E+01	1.3E+02		
Excess Lifetime Cancer Risk: Combined Exposure			3E–05	4E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–07	3E–06

Table M.116. Human health risk characterization summary: EFPC commercial scenario: future land use, Area S3–F2–C adults long term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion				
Dermal Contact				
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion	5.66E+00	9.89E+00	1.37E−05	7.61E−05
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion				
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion			1.28E−06	7.00E−06
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.66E+00	9.89E+00		
Excess Lifetime Cancer Risk: Combined Exposure			1.37E−05	7.61E−05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1.28E−06	7.00E−06

Table M.117. Risk characterization for soils: adults – ingestion exposure (future land use – residential) – Area S3–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	1.48	1.87	6.2E-07	8.0E-08	2.5E-06	1.1E-06	1.5E-03	6.4E-03	1.9%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	3.7E-06	4.7E-07	1.3E-05	5.5E-06	1.2E-02	4.3E-02	12.6%	skin; keratosis, hyperpigmentation	3	8.3E-07	9.7E-06	41.2%	[A]
Barium	99.86	115.80	4.2E-05	5.4E-06	1.5E-04	6.8E-05	6.0E-04	2.2E-03	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	2.9E-07	3.7E-08	1.0E-06	4.5E-07	5.8E-05	2.1E-04	0.1%	no observed effects	100	1.6E-07	1.9E-06	8.3%	[B2]
Cadmium	2.30	3.38	9.7E-07	1.2E-07	4.6E-06	1.9E-06	9.7E-04	4.6E-03	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	2.9E-05	3.7E-06	1.0E-04	4.4E-05	2.9E-05	1.0E-04	0.0%	no observed effects	100				
Copper	43.64	60.90	1.8E-05	2.3E-06	8.3E-05	3.5E-05	4.9E-04	2.2E-03	0.7%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	2.9E-05	3.7E-06	1.2E-04	5.2E-05				CNS, blood	--				[B2]
Manganese	1023.00	1193.00	4.3E-04	5.5E-05	1.6E-03	7.0E-04	3.0E-03	1.1E-02	3.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	1.5E-05	2.0E-06	8.0E-05	3.4E-05	5.2E-02	2.6E-01	78.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	1.2E-05	1.5E-06	5.0E-05	2.1E-05	6.0E-04	2.5E-03	0.7%	dec. body and organ weight	300				
Selenium	12.79	15.51	5.4E-06	6.9E-07	2.1E-05	9.1E-06	1.0E-03	4.2E-03	1.2%	whole body; clinical selenosis	3				[D]
Silver	2.44	3.71	1.0E-06	1.3E-07	5.0E-06	2.1E-06	2.0E-04	1.0E-03	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	1.3E-04	1.7E-05	6.3E-04	2.7E-04	4.4E-04	2.1E-03	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.14	0.18	5.9E-08	7.6E-09	2.5E-07	1.0E-07				--	--	5.8E-08	8.3E-07	3.5%	[B2]
Aroclor-1260	0.23	0.33	9.6E-08	1.2E-08	4.5E-07	1.9E-07				--	--	9.7E-08	1.4E-06	6.3%	[B2]
Benzo(a)anthracene	0.71	1.28	2.9E-07	3.8E-08	1.7E-06	7.5E-07	9.9E-06	5.8E-05	0.0%	--	--	2.8E-08	5.4E-07	2.3%	[B2]
Benzo(a)pyrene	0.68	1.20	2.8E-07	3.6E-08	1.6E-06	7.0E-07	9.5E-06	5.4E-05	0.0%	--	--	2.6E-07	5.1E-06	21.7%	[B2]
Benzo(b)fluoranthene	1.18	2.28	4.9E-07	6.4E-08	3.1E-06	1.3E-06	1.6E-05	1.0E-04	0.0%	--	--	4.6E-08	9.7E-07	4.1%	[B2]
Benzo(k)fluoranthene	1.14	2.25	4.8E-07	6.1E-08	3.0E-06	1.3E-06	1.6E-05	1.0E-04	0.0%	--	--	4.5E-08	9.6E-07	4.1%	[B2]
Chrysene	0.78	1.47	3.3E-07	4.2E-08	2.0E-06	8.6E-07	1.1E-05	6.7E-05	0.0%	--	--	3.1E-09	6.3E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	1.0E-07	1.3E-08	5.1E-07	2.2E-07	3.6E-06	1.7E-05	0.0%	--	--	1.0E-07	1.6E-06	6.8%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	2.1E-07	2.7E-08	1.1E-06	4.7E-07	7.0E-06	3.7E-05	0.0%	--	--	2.0E-08	3.4E-07	1.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.61	0.82		5.9E+01		8.6E+02						1.6E-09	2.4E-08	5.9%	[A]
Cobalt 60	0.01	0.02		5.4E-01		1.6E+01						8.2E-12	2.4E-10	0.1%	[A]
Neptunium 237+D	0.01	0.02		8.7E-01		2.5E+01						1.9E-10	5.5E-09	1.4%	[A]
Protactinium 233	0.05	0.12		4.9E+00		1.3E+02						4.9E-12	1.3E-10	0.0%	[A]
Thorium 228+D	2.10	2.36		2.0E+02		2.4E+03						1.1E-08	1.3E-07	33.6%	[A]
Thorium 230	2.37	3.16		2.3E+02		3.3E+03						2.9E-09	4.3E-08	10.6%	[A]
Thorium 232	1.50	1.90		1.4E+02		2.0E+03						1.7E-09	2.4E-08	5.9%	[A]
Uranium 234	3.12	3.71		3.0E+02		3.8E+03						4.8E-09	6.2E-08	15.3%	[A]
Uranium 235+D	0.15	0.18		1.4E+01		1.9E+02						2.3E-10	3.0E-09	0.8%	[A]
Uranium 238+D	3.10	3.66		3.0E+02		3.8E+03						8.4E-09	1.0E-07	26.5%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	7.2E-02	3.4E-01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.6E-06	2.3E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	3.1E-08	4.0E-07	100.0%

Table M.118. Risk characterization for soils: children – ingestion exposure (future land use – residential) – Area S3–F1–R

Chemical	MLB Concentration (mg/kg)	RMB Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	1.48	1.87	2.19E-06	9.40E-08	9.19E-06	1.18E-06	5.48E-03	2.30E-02	1.9%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	1.30E-05	3.57E-07	4.67E-05	6.00E-06	4.34E-02	1.56E-01	12.6%	skin; keratosis, hyperpigmentation	3	9.76E-07	1.05E-05	41.2%	[A]
Barium	99.86	115.80	1.48E-04	6.33E-06	5.68E-04	7.30E-05	2.11E-03	8.11E-03	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	1.02E-06	4.36E-08	3.81E-06	4.90E-07	2.04E-04	7.62E-04	0.1%	no observed effects	100	1.88E-07	2.11E-06	8.3%	[B2]
Cadmium	2.30	3.38	3.40E-06	1.46E-07	1.66E-05	2.13E-06	3.40E-03	1.66E-02	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	1.02E-04	4.38E-06	3.68E-04	4.74E-05	1.02E-04	3.68E-04	0.0%	no observed effects	100				
Copper	43.64	60.90	6.46E-05	2.77E-06	2.99E-04	3.84E-05	1.74E-03	8.07E-03	0.7%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	1.02E-04	4.38E-06	4.39E-04	5.65E-05				CNS, blood	--				[B2]
Manganese	1023.00	1193.00	1.51E-03	6.49E-05	5.85E-03	7.52E-04	1.08E-02	4.18E-02	3.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	5.53E-05	2.37E-06	2.89E-04	3.72E-05	1.84E-01	9.64E-01	78.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	4.24E-05	1.82E-06	1.81E-04	2.32E-05	2.12E-03	9.04E-03	0.7%	dec. body and organ weight	300				
Selenium	12.79	15.51	1.89E-05	8.11E-07	7.65E-05	9.78E-06	3.78E-03	1.52E-02	1.2%	whole body; clinical selenosis	3				[D]
Silver	2.44	3.71	3.61E-06	1.55E-07	1.82E-05	2.34E-06	7.21E-04	3.64E-03	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	4.63E-04	1.98E-05	2.28E-03	2.94E-04	1.54E-03	7.61E-03	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.14	0.18	2.08E-07	8.91E-09	9.02E-07	1.16E-07				--	--	6.88E-08	8.93E-07	3.5%	[B2]
Aroclor-1260	0.23	0.33	3.44E-07	1.47E-08	1.62E-06	2.08E-07				--	--	1.13E-07	1.61E-06	6.3%	[B2]
Benzo(a)anthracene	0.71	1.28	1.04E-06	4.46E-08	6.26E-06	8.05E-07	3.48E-05	2.09E-04	0.0%	--	--	3.27E-08	5.88E-07	2.3%	[B2]
Benzo(a)pyrene	0.68	1.20	1.00E-06	4.30E-08	5.89E-06	7.57E-07	3.34E-05	1.96E-04	0.0%	--	--	3.14E-07	5.53E-06	21.7%	[B2]
Benzo(b)fluoranthene	1.18	2.28	1.75E-06	7.48E-08	1.12E-05	1.44E-06	5.82E-05	3.72E-04	0.0%	--	--	5.46E-08	1.05E-06	4.1%	[B2]
Benzo(k)fluoranthene	1.14	2.25	1.68E-06	7.20E-08	1.10E-05	1.42E-06	5.60E-05	3.67E-04	0.0%	--	--	5.26E-08	1.03E-06	4.1%	[B2]
Chrysene	0.78	1.47	1.16E-06	4.96E-08	7.22E-06	9.28E-07	3.86E-05	2.41E-04	0.0%	--	--	3.62E-09	6.77E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	3.79E-07	1.63E-08	1.85E-06	2.38E-07	1.26E-05	6.17E-05	0.0%	--	--	1.19E-07	1.74E-06	6.8%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	7.44E-07	3.19E-08	3.98E-06	5.12E-07	2.48E-05	1.33E-04	0.0%	--	--	2.33E-08	3.74E-07	1.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.61	0.82		2.46E+01		3.43E+02						6.85E-10	9.61E-09	5.9%	[A]
Cobalt 60	0.01	0.02		2.28E-01		6.54E+00						3.43E-12	9.81E-11	0.1%	[A]
Neptunium 237+D	0.01	0.02		3.66E-01		9.97E+00						8.00E-11	2.19E-09	1.4%	[A]
Protactinium 233	0.05	0.12		2.06E+00		5.17E+01						2.06E-12	5.17E-11	0.0%	[A]
Thorium 228+D	2.10	2.36		8.52E+01		9.90E+02						4.69E-09	5.44E-08	33.6%	[A]
Thorium 230	2.37	3.16		9.66E+01		1.32E+03						1.25E-09	1.72E-08	10.6%	[A]
Thorium 232	1.50	1.90		6.07E+01		7.97E+02						7.28E-10	9.56E-09	5.9%	[A]
Uranium 234	3.12	3.71		1.26E+02		1.55E+03						2.02E-09	2.49E-08	15.3%	[A]
Uranium 235+D	0.15	0.18		6.03E+00		7.60E+01						9.66E-11	1.22E-09	0.8%	[A]
Uranium 238+D	3.10	3.66		1.25E+02		1.55E+03						3.51E-09	4.29E-08	26.5%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							2.55E-01	1.23E+00	100.0%						
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												1.94E-06	2.55E-05	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E-08	1.62E-07	100.0%	

Table M.119. Risk characterization for soils: adults – dermal exposure (future land use – residential) – Area S3–F1–R

Chemical	MLB Concentration (mg/kg)	RMB Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS **(mg/kg)**															
Antimony	1.48	1.87	2.2E3-08	2.9E3-09	2.7E3-07	1.1E3-07	5.6E3-05	6.9E3-04	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	1.3E3-07	1.7E3-08	1.4E3-06	6.0E3-07	4.4E3-04	4.7E3-03	12.5%	skin; keratosis, hyperpigmentation	3	3.0E3-08	1.0E3-06	7.4%	(A)
Barium	99.86	115.80	1.5E3-06	1.9E3-07	1.7E3-05	7.3E3-06	2.1E3-05	2.4E3-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	1.0E3-08	1.3E3-09	1.1E3-07	4.9E3-08	2.1E3-06	2.3E3-05	0.1%	no observed effects	100	5.8E3-09	2.1E3-07	1.5%	[B2]
Cadmium	2.30	3.38	3.5E3-08	4.5E3-09	5.0E3-07	2.1E3-07	3.5E3-05	5.0E3-04	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	1.0E3-06	1.3E3-07	1.1E3-05	4.7E3-06	1.0E3-06	1.1E3-05	0.0%	no observed effects	100				
Copper	43.64	60.90	6.6E3-07	8.5E3-08	9.0E3-06	3.8E3-06	1.7E3-05	2.4E3-04	0.6%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	1.0E3-06	1.3E3-07	1.3E3-05	5.6E3-06				CNS, blood	--				[B2]
Manganese	1023.00	1193.00	1.5E3-05	2.0E3-06	1.7E3-04	7.5E3-05	1.1E3-04	1.2E3-03	3.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	5.6E3-07	7.3E3-08	8.7E3-06	3.7E3-06	1.9E3-03	2.9E3-02	77.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	4.3E3-07	5.6E3-08	5.4E3-06	2.3E3-06	2.1E3-05	2.7E3-04	0.7%	dec. body and organ weight	300				
Selenium	12.79	15.51	1.9E3-07	2.5E3-08	2.3E3-06	9.8E3-07	3.8E3-05	4.5E3-04	1.2%	whole body; clinical selenosis	3				[D]
Silver	2.44	3.71	3.7E3-08	4.7E3-09	5.5E3-07	2.3E3-07	7.4E3-06	1.1E3-04	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	4.7E3-06	6.1E3-07	6.8E3-05	2.9E3-05	1.5E3-05	2.3E3-04	0.6%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor-1254	0.14	0.18	2.1E3-08	2.7E3-09	2.7E3-07	1.1E3-07				--	--	2.1E3-08	8.9E3-07	6.3%	[B2]
Aroclor-1260	0.23	0.33	3.5E3-08	4.5E3-09	4.9E3-07	2.1E3-07				--	--	3.5E3-08	1.6E3-06	11.4%	[B2]
Benzo(a)anthracene	0.71	1.28	1.0E3-07	1.3E3-08	1.8E3-06	8.1E3-07	3.5E3-06	6.3E3-05	0.2%	--	--	1.0E3-08	5.9E3-07	4.2%	[B2]
Benzo(a)pyrene	0.68	1.20	1.0E3-07	1.3E3-08	1.7E3-06	7.6E3-07	3.4E3-06	5.9E3-05	0.2%	--	--	9.6E3-08	5.5E3-06	39.1%	[B2]
Benzo(b)fluoranthene	1.18	2.28	1.8E3-07	2.3E3-08	3.3E3-06	1.4E3-06	5.9E3-06	1.1E3-04	0.3%	--	--	1.6E3-08	1.0E3-06	7.4%	[B2]
Benzo(k)fluoranthene	1.14	2.25	1.7E3-07	2.2E3-08	3.3E3-06	1.4E3-06	5.7E3-06	1.1E3-04	0.3%	--	--	1.6E3-08	1.0E3-06	7.3%	[B2]
Chrysene	0.78	1.47	1.1E3-07	1.5E3-08	2.1E3-06	9.3E3-07	3.9E3-06	7.2E3-05	0.2%	--	--	1.1E3-09	6.8E3-08	0.5%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	3.9E3-08	5.0E3-09	5.5E3-07	2.4E3-07	1.3E3-06	1.8E3-05	0.0%	--	--	3.6E3-08	1.7E3-06	12.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	7.6E3-08	9.8E3-09	1.2E3-06	5.1E3-07	2.5E3-06	4.0E3-05	0.1%	--	--	7.1E3-09	3.7E3-07	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.6E3-03	3.7E3-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.7E3-07	1.4E3-05	100.0%	

Table M.120. Risk characterization for soils: children – dermal exposure (future land use – residential) – Area S3–F1–R

Chemical	MLB Concentration (ug/g soil)	RMB Concentration (ug/g soil)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates: HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfD WOE
INORGANICS **(mg/kg)**															
Antimony	1.48	1.87	2.9E-08	1.2E-09	3.6E-07	4.6E-08	7.3E-05	9.0E-04	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	8.79	9.51	1.7E-07	7.4E-09	1.8E-06	2.3E-07	5.8E-04	6.1E-03	12.5%	skin; keratosis, hyperpigmentation	3	1.3E-08	4.1E-07	7.4%	[A]
Barium	99.85	115.80	1.9E-06	8.4E-08	2.2E-05	2.8E-06	2.8E-05	3.2E-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.69	0.78	1.3E-08	5.8E-10	1.5E-07	1.9E-08	2.7E-06	3.0E-05	0.1%	no observed effects	100	2.5E-09	8.3E-08	1.5%	[B2]
Cadmium	2.30	3.38	4.5E-08	1.9E-09	6.5E-07	8.4E-08	4.5E-05	6.5E-04	1.3%	kidney; proteinuria	10				
Chromium (III)	69.04	75.10	1.3E-06	5.8E-08	1.4E-05	1.8E-06	1.3E-06	1.4E-05	0.0%	no observed effects	100				
Copper	43.64	60.90	8.6E-07	3.7E-08	1.1E-05	1.5E-06	2.3E-05	3.1E-04	0.6%	Gastrointestinal system; irritation	--				[D]
Lead	69.08	89.54	1.3E-06	5.8E-08	1.7E-05	2.2E-06				CNS, blood	--				[B2]
Manganese	1023.00	1193.00	2.0E-05	8.7E-07	2.3E-04	2.9E-05	1.4E-04	1.6E-03	3.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	37.41	58.93	7.4E-07	3.1E-08	1.1E-05	1.4E-06	2.4E-03	3.8E-02	77.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	28.67	36.84	5.6E-07	2.4E-08	7.1E-06	9.1E-07	2.8E-05	3.5E-04	0.7%	dec. body and organ weight	300				
Selenium	12.79	15.51	2.5E-07	1.0E-08	3.0E-06	3.8E-07	5.0E-05	6.0E-04	1.2%	whole body; clinical selenosis	3				[D]
Silver	2.44	3.71	4.8E-08	2.0E-09	7.1E-07	9.2E-08	9.6E-06	1.4E-04	0.3%	skin; argyria	3				[D]
Zinc	313.00	465.60	6.2E-06	2.6E-07	9.0E-05	1.1E-05	2.0E-05	3.0E-04	0.6%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor–1254	0.14	0.18	2.7E-08	1.2E-09	3.5E-07	4.5E-08				--	--	9.2E-09	3.5E-07	6.3%	[B2]
Aroclor–1260	0.23	0.33	4.6E-08	1.9E-09	6.4E-07	8.2E-08				--	--	1.5E-08	6.3E-07	11.4%	[B2]
Benzo(a)anthracene	0.71	1.28	1.4E-07	6.0E-09	2.4E-06	3.1E-07	4.6E-06	8.2E-05	0.2%	--	--	4.3E-09	2.3E-07	4.2%	[B2]
Benzo(a)pyrene	0.68	1.20	1.3E-07	5.7E-09	2.3E-06	2.9E-07	4.4E-06	7.7E-05	0.2%	--	--	4.2E-08	2.1E-06	39.1%	[B2]
Benzo(b)fluoranthene	1.18	2.28	2.3E-07	1.0E-08	4.1E-06	5.6E-07	7.6E-06	1.4E-04	0.3%	--	--	7.3E-09	4.1E-07	7.4%	[B2]
Benzo(k)fluoranthene	1.14	2.25	2.2E-07	9.6E-09	4.3E-06	5.5E-07	7.5E-06	1.4E-04	0.3%	--	--	7.0E-09	4.0E-07	7.3%	[B2]
Chrysene	0.78	1.47	1.5E-07	6.6E-09	2.8E-06	3.6E-07	5.1E-06	9.5E-05	0.2%	--	--	4.8E-10	2.6E-08	0.5%	[B2]
Dibenzo(a,h)anthracene	0.26	0.38	5.0E-08	2.1E-09	7.3E-07	9.4E-08	1.6E-05	2.4E-05	0.0%	--	--	1.5E-08	6.8E-07	12.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.50	0.81	9.9E-08	4.2E-09	1.5E-06	2.0E-07	3.3E-06	5.2E-05	0.1%	--	--	3.1E-09	1.4E-07	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.4E-03	4.9E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.2E-07	3.3E-06	100.0%	

Table M.121. Risk characterization for surface water: adults – ingestion exposure (swimming) (future land use – residential) – Area S3–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	Risk Estimates: HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD^ UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	RfD^ WOE
INORGANICS (μg/L)															
Barium	7.92E+01	1.05E+02	1.08E−06	1.39E−07	8.55E−06	3.66E−06	1.55E−05	1.22E−04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E−07	1.37E−08	1.07E−06	4.61E−07	1.07E−07	1.07E−06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E−07	3.26E−08	1.78E−06	7.64E−07	6.85E−06	4.82E−05	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.68E−06	4.73E−07	3.36E−05	1.44E−05	7.36E−04	6.72E−03	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E−08	4.70E−09	3.20E−07	1.37E−07	1.22E−04	1.07E−03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E−07	1.48E−08	1.15E−06	4.92E−07	1.64E−05	1.64E−04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E−07	1.21E−07	7.40E−06	3.17E−06	3.14E−06	2.47E−05	0.3%	blood; anemia	3				[D]
ORGANICS (μg/L)															
Acetone	6.21E+00	7.70E+00	8.51E−08	1.09E−08	6.27E−07	2.69E−07	8.51E−07	6.27E−06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E−02	2.50E−02	3.18E−10	4.09E−11	2.04E−09	8.72E−10	1.06E−05	6.78E−05	0.8%	liver; lesions, toxicity	1000	6.96E−10	1.48E−08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E−07	1.67E−08	1.13E−06	4.83E−07	6.51E−06	5.64E−05	0.7%	liver; weight inc.	1000	2.34E−10	6.77E−09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E−08	7.17E−09	3.81E−07	1.63E−07	5.58E−06	3.81E−05	0.4%	liver; lesions, fattycyst formation	1000	4.37E−11	9.97E−10	1.7%	[B2]
4,4'-DDT	4.02E−02	4.94E−02	5.51E−10	7.08E−11	4.02E−09	1.72E−09	1.10E−05	8.04E−06	0.1%	liver; lesions	100	2.41E−11	5.86E−10	1.0%	[B2]
Dieldrin	3.87E−02	5.00E−02	5.31E−10	6.82E−11	4.07E−09	1.74E−09	1.06E−05	8.14E−05	0.9%	liver; lesions	100	1.09E−09	2.79E−08	46.5%	[B2]
Endrin	3.87E−02	5.00E−02	5.30E−10	6.81E−11	4.07E−09	1.74E−09	1.77E−06	1.36E−05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E−02	2.34E−02	2.49E−10	3.20E−11	1.91E−09	8.17E−10	8.30E−07	6.36E−06	0.1%	liver, kidney; toxicity		4.16E−11	1.06E−09	1.8%	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	2.96E−10	3.80E−11	2.04E−09	8.72E−10	2.28E−05	1.57E−04	1.8%	liver; inc. relative weight		3.46E−10	7.94E−09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E−08	7.36E−09	3.94E−07	1.69E−07	5.72E−06	3.94E−05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E−10	4.29E−09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E−10	9.28E−09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.67E−04	8.62E−03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.48E−09	6.01E−08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												5.49E−10	1.31E−08	100.0%	

Table M.122. Risk characterization for surface water: children – ingestion exposure (swimming) (future land use – residential) – Area S3–F1–R

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E-06	1.30E-07	2.30E-05	2.96E-06	4.34E-05	3.29E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E-07	1.28E-08	2.89E-06	3.72E-07	2.99E-07	2.89E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E-07	3.04E-08	4.80E-06	6.17E-07	1.97E-05	1.30E-04	0.6%	Gastrointestinal system; irritation	– –				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E-05	4.42E-07	9.05E-05	1.16E-05	2.06E-03	1.80E-02	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E-07	4.40E-09	8.62E-07	1.11E-07	3.42E-04	2.87E-03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E-07	1.38E-08	3.09E-06	3.97E-07	4.60E-05	4.41E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E-06	1.13E-07	1.99E-05	2.56E-06	8.79E-06	6.64E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E-07	1.02E-08	1.69E-06	2.17E-07	2.38E-06	1.69E-05	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	8.91E-10	3.82E-11	5.48E-09	7.05E-10	2.97E-05	1.83E-04	0.8%	liver; lesions, toxicity	1000	6.49E-10	1.20E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E-07	1.56E-08	3.04E-06	3.90E-07	1.82E-05	1.52E-04	0.7%	liver; weight inc.	1000	2.19E-10	5.46E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E-07	6.69E-09	1.03E-06	1.32E-07	1.56E-05	1.03E-04	0.4%	liver; lesions, fattycyst formation	1000	4.08E-11	8.06E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.54E-09	6.61E-11	1.08E-08	1.39E-09	3.08E-06	2.17E-05	0.1%	liver; lesions	100	2.25E-11	4.73E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	1.49E-09	6.37E-11	1.10E-08	1.41E-09	2.97E-05	2.19E-04	0.9%	liver; lesions	100	1.02E-09	2.25E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	1.48E-09	6.36E-11	1.10E-08	1.41E-09	4.95E-06	3.65E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	6.97E-10	2.99E-11	5.14E-09	6.60E-10	2.32E-06	1.71E-05	0.1%	liver, kidney; toxicity		3.89E-11	8.58E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	8.28E-10	3.55E-11	5.48E-09	7.05E-10	6.37E-05	4.21E-04	1.8%	liver; inc. relative weight		3.23E-10	6.41E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E-07	6.87E-09	1.06E-06	1.36E-07	1.60E-05	1.06E-04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.25E+00		3.86E+00		8.04E+01						6.18E-11	1.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.04E+01						1.21E-10	2.78E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.71E-03	2.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E-09	4.85E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E-10	4.07E-09	100.0%	

Table M.123. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (future land use – residential) – Area S3–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	RfDs WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.55E-06	0.0%	Gastrointestinal system; irritation					
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.40E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	loc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.20E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fatty cyst formation	1000	1.68E-10	7.57E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity		2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; inc. relative weight		5.29E-09	2.14E-07	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.02E-03	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.35E-08	1.04E-06	100.0%	

Table M.124. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (future land use – residential) – Area S3–F1–R

Chemical	Chronic Daily Intake (CDI)						Risk Estimates							
	MLE Concentration in SW	RME Concentration in SW	CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RFA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E−07	4.69E−09	1.53E−06	1.96E−07	1.56E−06	2.18E−05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E−08	4.62E−10	1.92E−07	2.47E−08	1.08E−08	1.92E−07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E−08	1.10E−09	3.18E−07	4.09E−08	6.91E−07	8.60E−06	0.0%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E−07	1.59E−08	6.00E−06	7.72E−07	7.45E−05	1.20E−03	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E−09	1.59E−10	5.72E−08	7.35E−09	1.23E−05	1.91E−04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E−08	4.98E−10	2.05E−07	2.64E−08	1.66E−06	2.93E−05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.50E−08	4.07E−09	1.32E−06	1.70E−07	3.17E−07	4.40E−06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E−08	2.30E−09	7.00E−07	9.00E−08	5.37E−07	7.00E−06	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E−02	2.50E−02	3.21E−10	1.38E−11	3.63E−09	4.67E−10	1.07E−05	1.21E−04	0.7%	liver; lesions, toxicity	1000	2.34E−10	7.94E−09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.35E+01	2.71E−06	1.16E−07	4.15E−05	5.34E−06	1.35E−04	2.08E−03	12.0%	liver; weight inc.	1000	1.63E−09	7.47E−08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E−07	1.34E−08	3.79E−06	4.87E−07	3.13E−05	3.79E−04	2.2%	liver; lesions, fatty cyst formation	1000	8.19E−11	2.97E−09	0.7%	[B2]
4,4'–DDT	4.02E−02	4.94E−02	1.49E−07	6.40E−09	1.93E−06	2.48E−07	2.99E−04	3.86E−03	22.3%	liver; lesions	100	2.18E−09	8.44E−08	20.7%	[B2]
Dieldrin	3.87E−02	5.00E−02	5.36E−09	2.30E−10	7.27E−08	9.34E−09	1.07E−04	1.45E−03	8.4%	liver; lesions	100	3.67E−09	1.50E−07	36.6%	[B2]
Endrin	3.87E−02	5.00E−02	5.35E−09	2.29E−10	7.27E−08	9.34E−09	1.78E−05	2.42E−04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.87E−02	2.34E−02	2.20E−09	9.43E−11	2.98E−08	3.83E−09	7.33E−06	9.93E−05	0.6%	liver, kidney; toxicity		1.23E−10	4.98E−09	1.2%	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	5.90E−09	2.53E−10	7.18E−08	9.23E−09	4.54E−04	5.52E−03	31.9%	liver; inc. relative weight		2.30E−09	8.40E−08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E−06	7.43E−08	2.11E−05	2.71E−06	1.73E−04	2.11E−03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.33E−03	1.73E−02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E−08	4.08E−07	100.0%	

Table M.125. Risk characterization for sediments: adults – dermal exposure (future land use – residential) – Area S3–F1–R

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.69E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[D2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.64E-07	7.68E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[D]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.36E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[B2]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.70E-07	7.30E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				[D]
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.60	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor–1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.64E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%	--	--	5.02E-11	9.99E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.36E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-09	2.88E-07	100.0%	

Table M.126. Risk characterization for sediments: children – dermal exposure (future land use – residential) – Area S3–F1–R

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.76E-10	4.18E-11	4.24E-08	5.45E-09	3.25E-06	1.41E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.32E-11	9.55E-09	8.7%	[A]
Barium	78.13	88.46	1.67E-08	7.17E-10	7.12E-07	9.16E-08	2.39E-07	1.02E-05	1.2%	*oral*–cardiovasc. sys.; loc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.95E-10	8.40E-12	8.25E-09	1.06E-09	3.92E-08	1.65E-06	0.2%	no observed effects	100	3.61E-11	4.56E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.04E-10	1.30E-11	1.38E-08	1.77E-09	3.04E-07	1.38E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.02E-08	4.38E-10	4.43E-07	5.70E-08	1.02E-08	4.43E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.14E-09	2.20E-10	2.41E-07	3.09E-08	1.39E-07	6.50E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.95	99.48	1.13E-08	4.86E-10	8.01E-07	1.03E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.90E-07	8.14E-09	8.34E-06	1.07E-06	1.36E-06	5.96E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.20E-09	1.37E-10	1.65E-07	2.12E-08	1.07E-05	5.49E-04	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.96E-09	2.12E-10	2.23E-07	2.87E-08	2.48E-07	1.12E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.22E-09	2.67E-10	2.72E-07	3.49E-08	8.89E-07	3.88E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.08E-08	8.91E-10	9.73E-07	1.25E-07	6.93E-08	3.24E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.21E-10	9.47E-12	1.32E-08	1.69E-09				--	--	7.29E-11	1.30E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.73E-10	7.42E-12	1.12E-08	1.44E-09				--	--	5.71E-11	1.11E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.97E-10	2.99E-11	4.16E-08	5.35E-09	2.32E-08	1.39E-06	0.2%	--	--	2.18E-11	3.91E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.75E-10	2.89E-11	3.91E-08	5.02E-09	2.25E-08	1.30E-06	0.2%	--	--	2.11E-10	3.67E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.03E-10	3.44E-11	4.68E-08	6.01E-09	2.68E-08	1.56E-06	0.2%	--	--	2.51E-11	4.39E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.58E-10	2.82E-11	3.19E-08	4.10E-09	2.19E-08	1.06E-06	0.1%	--	--	2.06E-11	2.99E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.62E-10	2.84E-11	3.96E-08	5.09E-09	2.21E-08	1.32E-06	0.2%	--	--	2.07E-12	3.71E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.70E-10	2.02E-11	1.94E-08	2.50E-09	1.57E-08	6.48E-07	0.1%	--	--	1.47E-10	1.82E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.64E-11	7.05E-13	1.09E-09	1.40E-10	3.29E-07	2.18E-05	2.5%	liver; lesions	100	1.13E-11	2.24E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.90E-10	2.53E-11	3.05E-08	3.92E-09	1.97E-08	1.02E-06	0.1%	--	--	1.85E-11	2.86E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.77E-05	8.66E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.97E-10	1.10E-07	100.0%	

Table M.127. Risk characterization for groundwater: adults – ingestion exposure (future land use – residential) – Area S3–F1–R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.61E-05	9.78E-06	1.53E-04	6.55E-05	2.54E-01	5.09E-01	1.8%	skin; keratosis, hyperpigmentation	3	1.71E-05	1.15E-04	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.56E-03	9.74E-04	1.33E-02	5.70E-03	1.08E-01	1.90E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.61E-05	4.64E-06	7.01E-05	3.00E-05	7.22E-03	1.40E-02	0.1%	no observed effects	100	2.00E-05	1.29E-04	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.33E-04	8.14E-05	1.12E-03	4.88E-04	6.33E-04	1.12E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.20E-04	4.12E-05	8.87E-03	3.86E-03	8.66E-03	2.40E-01	0.9%	Gastrointestinal system; irritation	- -				[D]
Lead	2.68E+01	3.53E+01	5.13E-04	6.60E-05	9.68E-04	4.15E-04				CNS, blood	- -				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E-02	9.22E-03	1.21E-01	5.19E-02	1.43E+01	2.42E+01	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.66E-04	3.42E-05	5.99E-04	2.57E-04	8.86E-01	2.00E+00	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.21E-04	1.18E-04	1.76E-03	7.55E-04	4.61E-02	8.81E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.49E-04	9.64E-05	1.34E-03	5.76E-04	1.07E-01	1.92E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	6.89E-03	8.86E-04	1.87E-02	8.01E-03	6.89E-02	1.87E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000	0.00E+00	0.00E+00	0.0%	[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E-03	1.72E-04	3.65E-03	1.56E-03	2.23E-02	6.15E-02	0.2%	*oral and inhal.*–liver; toxicity	100	1.29E-06	1.19E-05	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.46E+04		8.54E+04						1.44E-06	8.54E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05						8.91E-07	6.11E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05						1.26E-06	8.86E-06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.38E+01	2.77E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.84E-05	2.56E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.59E-06	2.35E-05	100.0%	

Table M.128. Risk characterization for groundwater: children – ingestion exposure (future land use – residential) – Area S3–F1–R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.91E-05	3.35E-06	1.81E-04	2.33E-05	2.64E-01	6.03E-01	1.8%	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.88E-03	3.33E-04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.61E-06	8.31E-05	1.07E-05	7.51E-03	1.66E-02	0.1%	no observed effects	100	6.92E-06	4.59E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.59E-04	2.82E-05	1.33E-03	1.71E-04	6.59E-04	1.33E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.84E-01	0.9%	Gastrointestinal system; irritation	- -				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04				CNS, blood	- -				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	1.49E+01	2.87E+01	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.76E-04	1.18E-05	7.09E-04	9.12E-05	9.21E-01	2.36E+00	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.88E+01	6.43E+01	9.58E-04	4.11E-05	2.09E-03	2.68E-04	4.79E-02	1.04E-01	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	0.7%	loc. liver, kidney weights, nephrotoxicity	1000	0.00E+00	0.00E+00	0.0%	[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.28E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.47E-07	4.21E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.78E+03		1.13E+04						1.78E-07	1.13E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		6.90E+03		5.04E+04						1.10E-07	8.00E-07	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.59E+03		4.17E+04						1.56E-07	1.17E-06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.65E+01	3.28E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.33E-05	9.08E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.45E-07	3.10E-06	100.0%	

Table M.129. Risk characterization for groundwater: adults – inhalation exposure (future land use – residential) – Area S3–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.7E-04	2.2E-05	7.0E-04	3.0E-04				inc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.9E+01	1.3E+02	3.4E-05	4.4E-06	1.3E-04	5.9E-05	4.0E-05	1.6E-04	100.0%	*oral and inhal.*–liver; toxicity	100	7.3E-09	9.7E-08	100.0%	[H2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.0E-05	1.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.3E-09	9.7E-08	100.0%	

Table M.130. Risk characterization for groundwater: children – inhalation exposure (future land use – residential) – Area S3–F1–R

Chemical	MLB Concentration in GW	RMB Concentration in GW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	RfA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfA WOE
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.0E–03	4.4E–05	3.1E–03	4.0E–04				inc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.9E+01	1.3E+02	2.0E–04	8.6E–06	6.2E–04	8.0E–05	2.3E–04	7.3E–04	100.0%	*oral and inhal.*–liver; toxicity	100	1.4E–08	1.3E–07	100.0%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							2.3E–04	7.3E–04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.4E–08	1.3E–07	100.0%	

Table M.131. Risk characterization for produce: adults – ingestion exposure (future land use – residential) – Area S3–F1–R

Chemical	MLB Concentration from Mean Concentration in Soil	RMB Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	UPA UP	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	1.4E3-02	1.8E3-02	2.2E3-06	2.9E3-07	1.3E3-05	5.6E3-06	5.6E3-03	3.2E3-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	7.0E3-01	7.6E3-01	1.0E3-04	1.3E3-05	5.3E3-04	2.2E3-04	3.5E3-01	1.7E3+00	3.7%	skin; keratosis, hyperpigmentation	3	2.4E3-05	3.9E3-04	96.5%	(A)
Barium	9.9E3-01	1.1E3+00	1.5E3-04	1.9E3-05	8.0E3-04	3.4E3-04	2.1E3-03	1.1E3-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.7E3-03	3.1E3-03	4.2E3-07	5.4E3-08	2.1E3-06	9.3E3-07	8.4E3-05	4.3E3-04	0.0%	no observed effects	100	2.3E3-07	4.0E3-06	1.0%	(B2)
Cadmium	1.1E3+00	1.6E3+00	1.7E3-04	2.2E3-05	1.1E3-03	5.0E3-04	1.7E3-01	1.1E3+00	2.5%	kidney; proteinuria	10				
Chromium (III)	6.9E3-01	7.5E3-01	1.0E3-04	1.3E3-05	5.2E3-04	2.2E3-04	1.0E3-04	5.2E3-04	0.0%	no observed effects	100				
Copper	2.1E3+00	3.0E3+00	3.3E3-04	4.2E3-05	2.1E3-03	9.1E3-04	9.0E3-03	5.7E3-02	0.1%	Gastrointestinal system; irritation	--				[D]
Lead	6.9E3-01	8.9E3-01	1.0E3-04	1.3E3-05	6.2E3-04	2.6E3-04				CNS, blood	--				[D2]
Manganese	4.0E3+02	4.7E3+02	6.2E3-02	8.0E3-03	3.3E3-01	1.4E3-01	4.4E3-01	2.3E3+00	5.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.1E3+01	1.7E3+01	1.7E3-03	2.2E3-04	1.2E3-02	5.2E3-03	5.7E3+00	4.1E3+01	86.9%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.4E3+00	1.8E3+00	2.1E3-04	2.8E3-05	1.2E3-03	5.3E3-04	1.0E3-02	6.4E3-02	0.1%	dec. body and organ weight	300				
Selenium	1.2E3+00	1.5E3+00	1.9E3-04	2.5E3-05	1.0E3-03	4.6E3-04	3.9E3-02	2.1E3-01	0.5%	whole body; clinical selenosis	3				[D]
Silver	4.8E3-01	7.4E3-01	7.4E3-05	9.5E3-06	5.1E3-04	2.2E3-04	1.4E3-02	1.0E3-01	0.2%	skin; argyria	3				[D]
Zinc	1.2E3+02	1.8E3+02	1.9E3-02	2.4E3-03	1.3E3-01	5.5E3-02	6.3E3-02	4.3E3-01	0.9%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1254	2.4E3-04	3.2E3-04	3.7E3-08	4.8E3-09	2.2E3-07	9.5E3-08			--		--	3.7E3-08	7.3E3-07	0.2%	[B2]
Aroclor-1260	2.2E3-04	3.2E3-04	3.4E3-08	4.4E3-09	2.2E3-07	9.7E3-08			--		--	3.4E3-08	7.4E3-07	0.2%	[B2]
Benzo(a)anthracene	2.6E3-03	4.7E3-03	4.0E3-07	5.1E3-08	3.3E3-06	1.4E3-06	1.3E3-05	1.1E3-04	0.0%	--	--	3.7E3-08	1.0E3-06	0.3%	[B2]
Benzo(a)pyrene	1.2E3-03	2.2E3-03	1.9E3-07	2.5E3-08	1.5E3-06	6.7E3-07	6.4E3-06	5.2E3-05	0.0%	--	--	1.8E3-07	4.9E3-06	1.2%	[B2]
Benzo(b)fluoranthene	1.7E3-03	3.3E3-03	2.6E3-07	3.4E3-08	2.3E3-06	1.0E3-06	8.9E3-06	7.8E3-05	0.0%	--	--	2.5E3-08	7.3E3-07	0.2%	[B2]
Benzo(k)fluoranthene	1.2E3-03	2.3E3-03	1.8E3-07	2.3E3-08	1.6E3-06	7.1E3-07	6.1E3-06	5.5E3-05	0.0%	--	--	1.7E3-08	5.2E3-07	0.1%	[B2]
Chrysene	3.4E3-03	6.4E3-03	5.2E3-07	6.6E3-08	4.4E3-06	1.9E3-06	1.7E3-05	1.4E3-04	0.0%	--	--	4.8E3-09	1.4E3-07	0.0%	[B2]
Dibenzo(a,h)anthracene	4.3E3-04	6.4E3-04	6.6E3-08	8.5E3-09	4.4E3-07	1.9E3-07	2.2E3-06	1.4E3-05	0.0%	--	--	6.2E3-08	1.4E3-06	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	1.8E3-04	2.9E3-04	2.7E3-08	3.5E3-09	2.0E3-07	8.7E3-08	9.2E3-07	6.8E3-06	0.0%	--	--	2.6E3-09	6.4E3-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	1.8E3-02	2.4E3-02		6.4E3+02		1.3E3+04									
Cobalt 60	1.6E3-04	4.6E3-04		5.9E3+00		2.5E3+02						1.7E3-08	3.6E3-07	51.6%	[A]
Neptunium 237+D	3.6E3-04	9.5E3-04		1.2E3+01		5.1E3+02						8.9E3-11	3.7E3-09	0.5%	[A]
Protactinium 233	5.0E3-04	1.2E3-03		1.7E3+01		6.6E3+02						2.7E3-09	1.1E3-07	15.7%	[A]
Thorium 228+D	1.0E3-03	1.1E3-03		3.6E3+01		6.3E3+02						1.7E3-11	6.6E3-10	0.1%	[A]
Thorium 230	1.1E3-03	1.5E3-03		4.1E3+01		8.4E3+02						2.0E3-09	3.4E3-08	4.9%	[A]
Thorium 232	7.4E3-04	9.5E3-04		2.6E3+01		5.0E3+02						5.4E3-10	1.1E3-08	1.5%	[A]
Uranium 234	6.2E3-03	7.4E3-03		2.1E3+02		3.9E3+03						3.1E3-10	6.1E3-09	0.9%	[A]
Uranium 235+D	2.9E3-04	3.6E3-04		1.0E3+01		1.9E3+02						3.5E3-09	6.3E3-08	8.9%	[A]
Uranium 238+D	6.1E3-03	7.3E3-03		2.1E3+02		3.9E3+03						1.6E3-10	3.1E3-09	0.4%	[A]
												6.0E3-09	1.1E3-07	15.4%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	6.8E3+00	4.7E3+01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.4E3-05	4.1E3-04	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	3.3E3-08	7.1E3-07	100.0%

Table M.132. Risk characterization for produce: children – ingestion exposure (future land use – residential) – Area S3–F1–R

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	1.4E-02	1.8E-02	5.0E-06	2.1E-07	2.7E-05	3.4E-06	1.2E-02	6.7E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	7.0E-01	7.6E-01	2.4E-04	1.0E-05	1.1E-03	1.4E-04	8.0E-01	3.6E+00	3.7%	skin; keratosis, hyperpigmentation	3	1.8E-05	2.4E-04	96.5%	[A]
Barium	9.9E-01	1.1E+00	3.4E-04	1.4E-05	1.6E-03	2.1E-04	4.8E-03	2.4E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.7E-03	3.1E-03	9.4E-07	4.0E-08	4.5E-06	5.7E-07	1.8E-04	9.0E-04	0.0%	no observed effects	100	1.7E-07	2.4E-06	1.0%	[B2]
Cadmium	1.1E+00	1.6E+00	3.9E-04	1.6E-05	2.4E-03	3.1E-04	3.9E-01	2.4E+00	2.5%	kidney; proteinuria	10				
Chromium (III)	6.9E-01	7.5E-01	2.3E-04	1.0E-05	1.0E-03	1.4E-04	2.3E-04	1.0E-03	0.0%	no observed effects	100				
Copper	2.1E+00	3.0E+00	7.4E-04	3.1E-05	4.4E-03	5.6E-04	2.0E-02	1.1E-01	0.1%	Gastrointestinal system; irritation	--				[D]
Lead	6.9E-01	8.9E-01	2.3E-04	1.0E-05	1.3E-03	1.6E-04				CNS, blood	--				[B2]
Manganese	4.0E+02	4.7E+02	1.4E-01	5.9E-03	6.9E-01	8.8E-02	9.9E-01	4.9E+00	5.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.1E+01	1.7E+01	3.8E-03	1.6E-04	2.5E-02	3.2E-03	1.2E+01	8.5E+01	86.9%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	1.4E+00	1.8E+00	4.8E-04	2.1E-05	2.6E-03	3.4E-04	2.4E-02	1.3E-01	0.1%	dec. body and organ weight	300				
Selenium	1.2E+00	1.5E+00	4.3E-04	1.8E-05	2.2E-03	2.8E-04	8.7E-02	4.5E-01	0.5%	whole body; clinical selenosis	3				[D]
Silver	4.8E-01	7.4E-01	1.6E-04	7.1E-06	1.0E-03	1.3E-04	3.3E-02	2.1E-01	0.2%	skin; argyria	3				[D]
Zinc	1.2E+02	1.8E+02	4.2E-02	1.8E-03	2.7E-01	3.4E-02	1.4E-01	9.0E-01	0.9%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1254	2.4E-04	3.2E-04	8.3E-08	3.5E-09	4.6E-07	5.9E-08				--	--	2.7E-08	4.5E-07	0.2%	[B2]
Aroclor-1260	2.2E-04	3.2E-04	7.7E-08	3.3E-09	4.7E-07	6.0E-08				--	--	2.5E-08	4.6E-07	0.2%	[B2]
Benzo(a)anthracene	2.6E-03	4.7E-03	8.9E-07	3.8E-08	6.8E-06	8.8E-07	2.9E-05	2.2E-04	0.0%	--	--	2.8E-08	6.4E-07	0.3%	[B2]
Benzo(a)pyrene	1.2E-03	2.2E-03	4.3E-07	1.8E-08	3.2E-06	4.2E-07	1.4E-05	1.0E-04	0.0%	--	--	1.3E-07	3.0E-06	1.2%	[B2]
Benzo(b)fluoranthene	1.7E-03	3.3E-03	5.9E-07	2.5E-08	4.8E-06	6.2E-07	1.9E-05	1.6E-04	0.0%	--	--	1.8E-08	4.5E-07	0.2%	[B2]
Benzo(k)fluoranthene	1.2E-03	2.3E-03	4.1E-07	1.7E-08	3.4E-06	4.4E-07	1.3E-05	1.1E-04	0.0%	--	--	1.2E-08	3.2E-07	0.1%	[B2]
Chrysene	3.4E-03	6.4E-03	1.1E-06	4.9E-08	9.2E-06	1.1E-06	3.8E-05	3.1E-04	0.0%	--	--	3.6E-09	8.7E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	4.3E-04	6.4E-04	1.4E-07	6.3E-09	9.2E-07	1.1E-07	4.9E-06	3.0E-05	0.0%	--	--	4.6E-08	8.7E-07	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	1.8E-04	2.9E-04	6.2E-08	2.6E-09	4.2E-07	5.4E-08	2.0E-06	1.4E-05	0.0%	--	--	1.9E-09	3.9E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	1.8E-02	2.4E-02		1.7E+02		3.0E+03						4.7E-09	8.5E-08	51.6%	[A]
Cobalt 60	1.6E-04	4.6E-04		1.5E+00		5.7E+01						2.3E-11	8.6E-10	0.5%	[A]
Neptunium 237+D	3.6E-04	9.5E-04		3.3E+00		1.1E+02						7.4E-10	2.5E-08	15.7%	[A]
Protactinium 233	3.0E-04	1.2E-03		4.7E+00		1.5E+02						4.7E-12	1.5E-10	0.1%	[A]
Thorium 228+D	1.0E-03	1.1E-03		9.8E+00		1.4E+02						5.4E-10	8.0E-09	4.9%	[A]
Thorium 230	1.1E-03	1.5E-03		1.1E+01		1.9E+02						1.4E-10	2.5E-09	1.5%	[A]
Thorium 232	7.4E-04	9.5E-04		6.9E+00		1.1E+02						8.3E-11	1.4E-09	0.9%	[A]
Uranium 234	6.2E-03	7.4E-03		5.8E+01		9.1E+02						9.3E-10	1.4E-08	8.9%	[A]
Uranium 235+D	2.9E-04	3.6E-04		2.7E+00		4.4E+01						4.4E-11	7.1E-10	0.4%	[A]
Uranium 238+D	6.1E-03	7.3E-03		5.7E+01		9.0E+02						1.6E-09	2.5E-08	15.4%	[A]

Chemical Hazards:			
Hazard Index (HI):	1.5E+01	9.8E+01	100.0%
Combined Exposure (d)			
Excess Lifetime Cancer Risk:	1.6E-05	2.3E-04	100.0%
Combined Exposure (d)			
Radiological Hazards:			
Excess Lifetime Cancer Risk:	8.9E-09	1.6E-07	100.0%
Combined Exposure (d)			

Table M.133. Risk characterization for fish: adults – ingestion exposure (future land use – residential) – Area S3–F1–R

Chemical	MLB Concentration in Fish Tissue	RMB Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern/ Target Tissue	EPA UP	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS															
Mercury	0.76	0.78	2.3E-06	3.0E-07	2.8E-05	1.2E-05	7.9E-03	9.6E-02	100.0%	*oral*-CNS; neurotoxicity. *inhal.*-kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	6.4E-07	8.2E-08	8.2E-06	3.5E-06						6.3E-07	2.7E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.1E-06	1.4E-07	1.4E-05	6.1E-06						1.1E-06	4.7E-05	63.7%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							7.9E-03	9.6E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.7E-06	7.4E-05	100.0%	

Table M.134. Risk characterization for fish: children – ingestion exposure (future land use – residential) – Area S3–F1–R

Chemical	MLE Concentration in Fish Tissue	RME Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS															
Mercury	0.76	0.78	4.1E-06	1.7E-07	6.0E-05	7.7E-06	1.3E-02	2.0E-01	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	1.1E-06	4.8E-08	1.7E-05	2.2E-06						3.7E-07	1.7E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.9E-06	8.4E-08	3.0E-05	3.8E-06						6.5E-07	2.9E-05	63.7%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.3E-02	2.0E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-06	4.6E-05	100.0%	

Table M.135. Risk characterization for groundwater: adults – ingestion exposure (future land use – commercial) – Area S3–F2–C

Chemical	MLB Concentration in GW	RMB Concentration in GW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	2.72E–05	3.49E–06	5.45E–05	1.95E–05	9.05E–02	1.82E–01	1.8%	skin; keratosis, hyperpigmentation	3	6.1E–06	3.4E–05	44.8%	[A]
Barium	3.95E+02	4.85E+02	2.71E–03	3.48E–04	4.75E–03	1.70E–03	3.87E–02	6.78E–02	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	1.29E–05	1.66E–06	2.50E–05	8.94E–06	2.58E–03	5.01E–03	0.1%	no observed effects	100	7.1E–06	3.8E–05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	2.26E–04	2.91E–05	4.01E–04	1.43E–04	2.26E–04	4.01E–04	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	1.14E–04	1.47E–05	3.17E–03	1.13E–03	3.09E–03	8.56E–02	0.9%	Gastrointestinal system; irritation	– –				[D]
Lead	2.68E+01	3.53E+01	1.83E–04	2.36E–05	3.46E–04	1.23E–04				CNS, blood	– –				[B2]
Manganese (water)	3.74E+03	4.42E+03	2.50E–02	3.29E–03	4.32E–02	1.54E–02	5.12E+00	8.64E+00	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	9.49E–05	1.22E–05	2.14E–04	7.64E–05	3.16E–01	7.13E–01	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	3.29E–04	4.23E–05	6.29E–04	2.25E–04	1.65E–02	3.14E–02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	2.68E–04	3.44E–05	4.80E–04	1.71E–04	3.82E–02	6.85E–02	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	2.46E–03	3.16E–04	6.67E–03	2.38E–03	2.46E–02	6.67E–02	0.7%	inc. liver, kidney weights, nephrotoxicity	1000	0.0E+00	0.0E+00	0.0%	[D]
Methylene Chloride	6.97E+01	1.35E+02	4.78E–04	6.14E–05	1.32E–03	4.70E–04	7.96E–03	2.20E–02	0.2%	*oral and inhal.*–liver; toxicity	100	4.6E–07	3.5E–06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		5.14E+03		2.54E+04						5.14E–07	2.54E–06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		1.99E+04		1.14E+05						3.18E–07	1.82E–06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		1.61E+04		9.41E+04						4.51E–07	2.64E–06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							5.66E+00	9.85E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.37E–05	7.6E–05	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.28E–06	7.00E–06	100.0%	

SEGMENT 4 RISK CHARACTERIZATION TABLES

Table M.136. Risk characterization summary for EFPC Segment 4: RME estimates for the current land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	8.18E−01 B	4.31E−01 B	8.99E−06 W	1.58E−05 W	8.39E−08 B	2.10E−07 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	5.02E−02 B	4.66E−02 B	3.51E−06 W	1.09E−05 W	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	1.48E−03 B	1.04E−03 B	3.10E−09 B	7.22E−09 B	4.89E−10 B	1.63E−09 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.19E−03 B	1.11E−03 B	3.01E−08 B	9.31E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	9.78E−05 B	9.19E−05 B	1.26E−08 B	3.89E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		8.7E−01 B	4.8E−01 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				1E−05 W	3E−05 W					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						8E−08 B	2E−07 B					NA	NA

B – below or equal to limit of noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds EPA target for noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.137. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S4–C1–O adult long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	3.67E–02	4.31E–01	3.79E–07	1.58E–05
Dermal Contact	1.32E–03	4.66E–02	7.84E–08	1.09E–05
SURFACE WATER				
Ingestion	6.90E–05	1.04E–03	1.77E–10	7.22E–09
Dermal Contact	6.88E–05	1.11E–03	1.68E–09	9.31E–08
SEDIMENT				
Dermal Contact	1.94E–06	9.19E–05	2.29E–10	3.89E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			5.62E–09	2.10E–07
SURFACE WATER				
Ingestion			3.92E–11	1.63E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	3.8E–02	4.8E–01		
Excess Lifetime Cancer Risk: Combined Exposure			5E–07	3E–05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			6E–09	2E–07

Table M.138. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S4–C1–O children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	6.35E–02	8.18E–01	2.18E–07	8.99E–06
Dermal Contact	1.36E–03	5.02E–02	2.69E–08	3.51E–06
SURFACE WATER				
Ingestion	9.55E–05	1.48E–03	8.16E–11	3.10E–09
Dermal Contact	7.09E–05	1.19E–03	5.77E–10	3.01E–08
SEDIMENT				
Dermal Contact	1.97E–06	9.78E–05	7.87E–11	1.26E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.34E–09	8.39E–08
SURFACE WATER				
Ingestion			1.31E–11	4.89E–10
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	6.5E–02	8.7E–01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	1E–05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–09	8E–08

Table M.139. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Area S4–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	1.15	1.30	7.17E-08	9.22E-09	7.66E-07	3.28E-07	1.79E-04	1.91E-03	0.4%	whole body, blood; inc. mortality	1000				
Arsenic	10.05	10.75	6.29E-07	8.09E-08	6.31E-06	2.70E-06	2.10E-03	2.10E-02	4.9%	skin; keratosis, hyperpigmentation	3	1.42E-07	4.73E-06	30.0%	[A]
Barium	227.70	294.50	1.43E-05	1.85E-06	1.73E-04	7.41E-05	2.04E-04	2.47E-03	0.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.08	1.52	6.74E-08	8.67E-09	8.90E-07	3.81E-07	1.35E-05	1.78E-04	0.0%	no observed effects	100	3.73E-08	1.64E-06	10.4%	[B2]
Cadmium	13.15	20.88	8.23E-07	1.06E-07	1.23E-05	5.25E-06	8.23E-04	1.23E-02	2.8%	kidney; proteinuria	10				
Chromium (III)	82.40	87.84	5.16E-06	6.63E-07	5.16E-05	2.21E-05	5.16E-06	5.16E-05	0.0%	no observed effects	100				
Copper	183.80	262.00	1.15E-05	1.48E-06	1.54E-04	6.59E-05	3.11E-04	4.16E-03	1.0%	Gastrointestinal system; irritation	--				[D]
Lead	103.40	135.50	6.48E-06	8.33E-07	7.95E-05	3.41E-05				CNS, blood	--				[B2]
Manganese	1143.00	1323.00	7.16E-05	9.20E-06	7.77E-04	3.33E-04	5.11E-04	5.55E-03	1.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	154.20	193.20	9.66E-06	1.24E-06	1.13E-04	4.86E-05	3.22E-02	3.78E-01	87.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	87.63	116.80	5.49E-06	7.06E-07	6.86E-05	2.94E-05	2.74E-04	3.43E-03	0.8%	dec. body and organ weight	300				
Selenium	7.39	7.97	4.63E-07	5.95E-08	4.68E-06	2.00E-06	9.26E-05	9.35E-04	0.2%	whole body; clinical selenosis	3				[D]
Silver	12.42	17.95	7.78E-07	1.00E-07	1.05E-05	4.52E-06	1.56E-04	2.11E-03	0.5%	skin; argyria	3				[D]
Zinc	102.50	115.70	6.42E-06	8.25E-07	6.75E-05	2.91E-05	2.14E-05	2.26E-04	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.92	1.62	5.77E-08	7.42E-09	9.52E-07	4.08E-07				--	--	5.7E-08	3.14E-06	19.9%	[B2]
Aroclor-1260	1.50	2.23	9.40E-08	1.21E-08	1.31E-06	5.60E-07				--	--	9.3E-08	4.3E-06	27.3%	[B2]
Benzo(a)anthracene	0.54	0.68	3.41E-08	4.38E-09	4.01E-07	1.72E-07	1.14E-06	1.34E-05	0.0%	--	--	3.20E-09	1.26E-07	0.8%	[B2]
Benzo(a)pyrene	0.57	0.70	3.56E-08	4.57E-09	4.12E-07	1.77E-07	1.19E-06	1.37E-05	0.0%	--	--	3.34E-08	1.29E-06	8.2%	[B2]
Benzo(b)fluoranthene	0.97	1.24	6.07E-08	7.81E-09	7.26E-07	3.11E-07	2.02E-06	2.42E-05	0.0%	--	--	5.70E-09	2.27E-07	1.4%	[B2]
Benzo(k)fluoranthene	0.91	1.22	5.68E-08	7.31E-09	7.17E-07	3.07E-07	1.89E-06	2.39E-05	0.0%	--	--	5.34E-09	2.24E-07	1.4%	[B2]
Chrysene	0.65	0.84	4.08E-08	5.25E-09	4.91E-07	2.10E-07	1.36E-06	1.64E-05	0.0%	--	--	3.83E-10	1.54E-08	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.39	1.74E-08	2.24E-09	2.28E-07	9.75E-08	5.80E-07	7.59E-06	0.0%	--	--	1.63E-09	7.12E-08	0.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.46	1.92		2.11E+01		8.66E+02						5.89E-10	2.42E-08	11.5%	[A]
Cobalt 60	0.02	0.04		2.67E-01		1.65E+01						4.01E-12	2.48E-10	0.1%	[A]
Neptunium 237+D	0.02	0.06		3.50E-01		2.64E+01						7.70E-11	5.81E-09	2.8%	[A]
Uranium 234	7.82	9.17		1.13E+02		4.15E+03						1.80E-09	6.60E-08	31.4%	[A]
Uranium 235+D	0.37	0.43		5.28E+00		1.94E+02						8.45E-11	3.10E-09	1.5%	[A]
Uranium 238+D	7.59	8.81		1.09E+02		3.96E+03						3.06E-09	1.11E-07	52.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.67E-02	4.31E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.79E-07	1.58E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												5.62E-09	2.10E-07	100.0%	

Table M.140. Risk characterization for soils: children – ingestion exposure (current land use – open) – Area S4–C1–O

Chemical	MLE Concentration (6 soils)	RME Concentration (6 soils)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Antimony	1.15	1.30	1.24E-07	5.31E-09	1.45E-06	1.87E-07	3.10E-04	3.64E-03	0.4%	whole body, blood; inc. mortality	1000				
Arsenic	10.05	10.75	1.09E-06	4.66E-08	1.20E-05	1.54E-06	3.63E-03	4.00E-02	4.9%	skin; keratosis, hyperpigmentation	3	8.16E-08	2.70E-06	30.0%	[A]
Barium	227.70	294.50	2.47E-05	1.06E-06	3.29E-04	4.22E-05	3.52E-04	4.69E-03	0.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.08	1.52	1.17E-07	5.00E-09	1.69E-06	2.17E-07	2.33E-05	3.38E-04	0.0%	no observed effects	100	2.15E-08	9.35E-07	10.4%	[D2]
Cadmium	13.15	20.88	1.42E-06	6.10E-08	2.33E-05	2.99E-06	1.42E-03	2.33E-02	2.8%	kidney; proteinuria	10				
Chromium (III)	82.40	87.84	8.92E-06	3.82E-07	9.86E-05	1.26E-05	8.92E-06	9.86E-05	0.0%	no observed effects	100				
Copper	183.80	262.00	1.99E-05	8.53E-07	2.92E-04	3.76E-05	5.31E-04	7.90E-03	1.0%	Gastrointestinal system; irritation	--				[D]
Lead	103.40	135.50	1.12E-05	4.80E-07	1.51E-04	1.94E-05				CNS, blood	--				[B2]
Manganese	1143.00	1323.00	1.24E-04	5.30E-06	1.48E-03	1.90E-04	8.86E-04	1.05E-02	1.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	154.20	193.20	1.67E-05	7.16E-07	2.16E-04	2.77E-05	5.57E-02	7.18E-01	87.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	87.63	116.60	9.49E-06	4.07E-07	1.30E-04	1.66E-05	4.74E-04	6.51E-03	0.8%	dec. body and organ weight	300				
Selenium	7.39	7.97	8.01E-07	3.43E-08	8.89E-06	1.14E-06	1.60E-04	1.78E-03	0.2%	whole body; clinical selenosis	3				[D]
Silver	12.42	17.95	1.34E-06	5.76E-08	2.00E-05	2.57E-06	2.69E-04	4.00E-03	0.5%	skin; argyria	3				[D]
Zinc	102.50	115.70	1.11E-05	4.76E-07	1.29E-04	1.66E-05	3.70E-05	4.30E-04	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.92	1.62	9.98E-08	4.28E-09	1.88E-06	2.32E-07				--	--	3.29E-08	1.79E-06	19.9%	[B2]
Aroclor-1260	1.50	2.23	1.63E-07	6.97E-09	2.48E-06	3.19E-07				--	--	5.36E-08	2.46E-06	27.3%	[B2]
Benzo(a)anthracene	0.54	0.68	5.90E-08	2.53E-09	7.62E-07	9.80E-08	1.97E-06	2.54E-05	0.0%	--	--	1.84E-09	7.15E-08	0.8%	[B2]
Benzo(a)pyrene	0.57	0.70	6.15E-08	2.64E-09	7.83E-07	1.01E-07	2.05E-06	2.61E-05	0.0%	--	--	1.92E-08	7.35E-07	8.2%	[B2]
Benzo(b)fluoranthene	0.97	1.24	1.05E-07	4.50E-09	1.38E-06	1.77E-07	3.50E-06	4.60E-05	0.0%	--	--	3.29E-09	1.30E-07	1.4%	[B2]
Benzo(k)fluoranthene	0.91	1.22	9.83E-08	4.21E-09	1.36E-06	1.75E-07	3.28E-06	4.54E-05	0.0%	--	--	3.08E-09	1.28E-07	1.4%	[B2]
Chrysene	0.65	0.84	7.06E-08	3.03E-09	9.33E-07	1.20E-07	2.35E-06	3.11E-05	0.0%	--	--	2.21E-10	8.75E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.39	3.01E-08	1.29E-09	4.32E-07	5.56E-08	1.00E-06	1.44E-05	0.0%	--	--	9.41E-10	4.06E-08	0.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.46	1.92		8.77E+00		3.45E+02						2.46E-10	9.67E-09	11.5%	[A]
Cobalt 60	0.02	0.04		1.11E-01		6.60E+00						1.67E-12	9.90E-11	0.1%	[A]
Neptunium 237+D	0.02	0.06		1.46E-01		1.05E+01						3.21E-11	2.32E-09	2.8%	[A]
Uranium 234	7.82	9.17		4.69E+01		1.65E+03						7.51E-10	2.63E-08	31.4%	[A]
Uranium 235+D	0.37	0.43		2.20E+00		7.74E+01						3.52E-11	1.24E-09	1.5%	[A]
Uranium 238+D	7.59	8.81		4.55E+01		1.58E+03						1.27E-09	4.43E-08	52.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.35E-02	6.18E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.18E-07	8.99E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												2.34E-09	8.39E-08	100.0%	

Table M.141. Risk characterization for soils: adults – dermal exposure (current land use – open) – Area S4–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS **(mg/kg)**															
Antimony	1.15	1.30	2.5E-09	3.3E-10	8.2E-08	3.5E-08	6.4E-06	2.0E-04	0.4%	whole body, blood; inc. mortality	1000				
Arsenic	10.05	10.75	2.2E-08	2.9E-09	6.8E-07	2.9E-07	7.5E-05	2.2E-03	4.9%	skin; keratosis, hyperpigmentation	3	5.1E-09	5.1E-07	4.7%	[A]
Barium	227.70	294.50	5.1E-07	6.6E-08	1.8E-05	8.0E-06	7.3E-06	2.6E-04	0.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.08	1.52	2.4E-09	3.1E-10	9.6E-08	4.1E-08	4.8E-07	1.9E-05	0.0%	no observed effects	100	1.3E-09	1.7E-07	1.6%	[B2]
Cadmium	13.15	20.88	2.9E-08	3.8E-09	1.3E-06	5.6E-07	2.9E-05	1.3E-03	2.8%	kidney; proteinuria	10				
Chromium (III)	82.40	87.84	1.6E-07	2.3E-08	5.5E-06	2.3E-06	1.8E-07	5.5E-06	0.0%	no observed effects	100				
Copper	183.80	262.00	4.1E-07	5.3E-08	1.6E-05	7.1E-06	1.1E-05	4.4E-04	1.0%	Gastrointestinal system; irritation	--				[D]
Lead	103.40	135.50	2.3E-07	3.0E-08	8.6E-06	3.6E-06				CNS, blood	--				[B2]
Manganese	1143.00	1323.00	2.5E-06	3.3E-07	8.4E-05	3.6E-05	1.8E-05	6.0E-04	1.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	154.20	193.20	3.4E-07	4.4E-08	1.2E-05	5.2E-06	1.1E-03	4.0E-02	87.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	87.63	116.60	1.9E-07	2.5E-08	7.4E-06	3.1E-06	9.8E-06	3.7E-04	0.8%	dec. body and organ weight	300				
Selenium	7.39	7.97	1.6E-08	2.1E-09	5.0E-07	2.1E-07	3.3E-06	1.0E-04	0.2%	whole body; clinical selenosis	3				[D]
Silver	12.42	17.95	2.8E-08	3.6E-09	1.1E-06	4.8E-07	5.6E-06	2.2E-04	0.5%	skin; argyria	3				[D]
Zinc	102.50	115.70	2.3E-07	2.9E-08	7.3E-06	3.1E-06	7.7E-07	2.4E-05	0.1%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor–1254	0.92	1.62	2.0E-08	2.6E-09	1.0E-06	4.4E-07				--	--	2.0E-08	3.3E-06	31.3%	[B2]
Aroclor–1260	1.50	2.23	3.3E-08	4.3E-09	1.4E-06	6.0E-07				--	--	3.3E-08	4.6E-06	42.9%	[B2]
Benzo(a)anthracene	0.54	0.68	1.2E-08	1.5E-09	4.3E-07	1.8E-07	4.0E-07	1.4E-05	0.0%	--	--	1.1E-09	1.3E-07	1.2%	[B2]
Benzo(a)pyrene	0.57	0.70	1.2E-08	1.6E-09	4.4E-07	1.9E-07	4.2E-07	1.4E-05	0.0%	--	--	1.2E-08	1.3E-06	12.8%	[B2]
Benzo(b)fluoranthene	0.97	1.24	2.1E-08	2.8E-09	7.8E-07	3.3E-07	7.2E-07	2.6E-05	0.1%	--	--	2.0E-09	2.4E-07	2.3%	[B2]
Benzo(k)fluoranthene	0.91	1.22	2.0E-08	2.6E-09	7.7E-07	3.3E-07	6.8E-07	2.5E-05	0.1%	--	--	1.9E-09	2.4E-07	2.2%	[B2]
Chrysene	0.65	0.84	1.4E-08	1.8E-09	5.3E-07	2.2E-07	4.9E-07	1.7E-05	0.0%	--	--	1.3E-10	1.6E-08	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.39	6.2E-09	8.0E-10	2.4E-07	1.0E-07	2.0E-07	8.2E-06	0.0%	--	--	5.8E-10	7.7E-08	0.7%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.3E-03	4.6E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.8E-08	1.0E-05	100.0%	

Table M.142. Risk characterization for soils: children – dermal exposure (current land use – open) – Area S4–C1–O

Chemical	MLE Concentration in Soil	RME Concentration in Soil	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	1.15	1.30	2.6E-09	1.1E-10	8.9E-08	1.1E-08	6.6E-06	2.2E-04	0.4%	whole body, blood; inc. mortality	1000				
Arsenic	10.05	10.75	2.3E-08	1.0E-09	7.3E-07	9.4E-08	7.7E-05	2.4E-03	4.9%	skin; keratosis, hyperpigmentation	3	1.7E-09	1.6E-07	4.7%	[A]
Barium	227.70	294.50	5.2E-07	2.2E-08	2.0E-05	2.5E-06	7.5E-06	2.8E-04	0.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.08	1.52	2.5E-09	1.0E-10	1.0E-07	1.3E-08	5.0E-07	2.0E-05	0.0%	no observed effects	100	4.6E-10	5.7E-08	1.6%	[D2]
Cadmium	13.15	20.88	3.0E-08	1.3E-09	1.4E-06	1.8E-07	3.0E-05	1.4E-03	2.8%	kidney; proteinuria	10				
Chromium (III)	82.40	87.84	1.9E-07	8.2E-09	6.0E-06	7.7E-07	1.9E-07	6.0E-06	0.0%	no observed effects	100				
Copper	183.80	262.00	4.2E-07	1.8E-08	1.7E-05	2.3E-06	1.1E-05	4.8E-04	1.0%	Gastrointestinal system; irritation	--				[D]
Lead	103.40	135.50	2.4E-07	1.0E-08	9.2E-06	1.1E-06				CNS, blood	--				[D2]
Manganese	1143.00	1323.00	2.6E-06	1.1E-07	9.0E-05	1.1E-05	1.9E-05	6.4E-04	1.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	154.20	193.20	3.5E-07	1.5E-08	1.3E-05	1.7E-06	1.1E-03	4.4E-02	87.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	87.63	116.80	2.0E-07	8.7E-09	7.9E-06	1.0E-06	1.0E-05	3.9E-04	0.8%	dec. body and organ weight	300				
Selenium	7.39	7.97	1.7E-08	7.3E-10	5.4E-07	7.0E-08	3.4E-06	1.0E-04	0.2%	whole body; clinical selenosis	3				[D]
Silver	12.42	17.95	2.8E-08	1.2E-09	1.2E-06	1.5E-07	5.7E-06	2.4E-04	0.5%	skin; argyria	3				[D]
Zinc	102.50	115.70	2.3E-07	1.0E-08	7.9E-06	1.0E-06	7.9E-07	2.6E-05	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.92	1.62	2.1E-08	9.1E-10	1.1E-06	1.4E-07				--	--	7.0E-09	1.1E-06	31.3%	[B2]
Aroclor-1260	1.50	2.23	3.4E-08	1.4E-09	1.5E-06	1.9E-07				--	--	1.1E-08	1.5E-06	42.9%	[B2]
Benzo(a)anthracene	0.54	0.68	1.2E-08	5.4E-10	4.6E-07	6.0E-08	4.2E-07	1.5E-05	0.0%	--	--	3.9E-10	4.3E-08	1.2%	[B2]
Benzo(a)pyrene	0.57	0.70	1.3E-08	5.6E-10	4.8E-07	6.1E-08	4.4E-07	1.6E-05	0.0%	--	--	4.1E-09	4.5E-07	12.8%	[B2]
Benzo(b)fluoranthene	0.97	1.24	2.2E-08	9.6E-10	8.4E-07	1.0E-07	7.5E-07	2.8E-05	0.1%	--	--	7.0E-10	7.9E-08	2.3%	[B2]
Benzo(k)fluoranthene	0.91	1.22	2.1E-08	9.0E-10	8.3E-07	1.0E-07	7.0E-07	2.7E-05	0.1%	--	--	6.6E-10	7.8E-08	2.2%	[B2]
Chrysene	0.65	0.84	1.5E-08	6.4E-10	5.7E-07	7.3E-08	5.0E-07	1.9E-05	0.0%	--	--	4.7E-11	5.3E-09	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.39	6.4E-09	2.7E-10	2.6E-07	3.4E-08	2.1E-07	8.8E-06	0.0%	--	--	2.0E-10	2.4E-08	0.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-03	5.0E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.6E-08	3.5E-06	100.0%	

Table M.143. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – open) – Area S4–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	7.75E-08	9.96E-09	1.03E-06	4.40E-07	1.11E-06	1.47E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	7.63E-09	9.81E-10	1.29E-07	5.54E-08	7.63E-09	1.29E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.81E-08	2.33E-09	2.14E-07	9.18E-08	4.85E-07	5.79E-06	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.65E+02	4.13E+02	2.61E-07	3.36E-08	4.04E-06	1.73E-06	5.26E-05	8.08E-04	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.62E-09	3.37E-10	3.85E-08	1.65E-08	8.72E-06	1.28E-04	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.22E-09	1.06E-09	1.38E-07	5.91E-08	1.17E-06	1.97E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.05E+01	6.72E-08	8.65E-09	8.85E-07	3.81E-07	2.24E-07	2.95E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	6.08E-09	7.82E-10	7.54E-08	3.23E-08	6.08E-08	7.54E-07	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.27E-11	2.92E-12	2.45E-10	1.05E-10	7.58E-07	8.15E-06	0.8%	liver; lesions, toxicity	1000	4.97E-11	1.78E-09	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	9.30E-09	1.20E-09	1.36E-07	5.81E-08	4.65E-07	6.78E-06	0.7%	liver; weight inc.	1000	1.67E-11	8.13E-10	11.3%	[B2]
Chloroform	4.07E+00	4.65E+00	3.98E-09	5.12E-10	4.55E-08	1.97E-08	3.98E-07	4.55E-06	0.4%	liver; lesions, fatty cyst formation	1000	3.12E-12	1.20E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	3.93E-11	5.06E-12	4.83E-10	2.07E-10	7.86E-08	9.67E-07	0.1%	liver; lesions	100	1.72E-12	7.04E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.79E-11	4.87E-12	4.89E-10	2.10E-10	7.58E-07	9.78E-06	0.9%	liver; lesions	100	7.80E-11	3.35E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	3.78E-11	4.87E-12	4.89E-10	2.10E-10	1.26E-07	1.63E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.78E-11	2.29E-12	2.29E-10	9.83E-11	5.93E-08	7.64E-07	0.1%	liver, kidney; toxicity		2.97E-12	1.28E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.11E-11	2.72E-12	2.45E-10	1.05E-10	1.63E-06	1.88E-05	1.8%	liver; inc. relative weight		2.47E-11	9.54E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	4.09E-09	5.26E-10	4.73E-08	2.03E-08	4.09E-07	4.73E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		8.27E-01		3.22E+01						1.32E-11	5.15E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		9.29E-01		3.98E+01						2.60E-11	1.12E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.90E-05	1.04E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.77E-10	7.22E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.92E-11	1.63E-09	100.0%	

Table M.144. Risk characterization for surface water: children – ingestion exposure (swimming)(current land use – open) – Area S4–C1–O

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.07E–07	4.59E–09	1.47E–06	1.89E–07	1.53E–06	2.10E–05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.86E+00	1.32E+01	1.06E–08	4.52E–10	1.85E–07	2.37E–08	1.06E–08	1.85E–07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.50E–08	1.07E–09	3.06E–07	3.94E–08	6.77E–07	8.27E–06	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	3.64E–07	1.56E–08	5.77E–06	7.42E–07	7.27E–05	1.15E–03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.62E–09	1.55E–10	5.50E–08	7.07E–09	1.21E–05	1.83E–04	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.14E–08	4.87E–10	1.97E–07	2.53E–08	1.62E–06	2.82E–05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.30E–08	3.99E–09	1.27E–06	1.63E–07	3.10E–07	4.23E–06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.41E–09	3.60E–10	1.08E–07	1.38E–08	8.41E–08	1.08E–06	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E–02	2.50E–02	3.14E–11	1.35E–12	3.49E–10	4.49E–11	1.05E–06	1.16E–05	0.8%	liver; lesions, toxicity	1000	2.29E–11	7.64E–10	24.7%	[B2]
Bis(2–ethylhexyl)phthalate	9.50E+00	1.35E+01	1.29E–08	5.51E–10	1.94E–07	2.49E–08	6.43E–07	9.66E–06	0.7%	liver; weight inc.	1000	7.72E–12	3.48E–10	11.3%	[B2]
Chloroform	4.07E+00	4.65E+00	5.51E–09	2.36E–10	6.55E–08	8.42E–09	5.51E–07	6.55E–06	0.4%	liver; lesions, fatty cyst formation	1000	1.44E–12	5.14E–11	1.7%	[B2]
4,4'–DDT	4.02E–02	4.94E–02	5.44E–11	2.33E–12	6.91E–10	8.88E–11	1.09E–07	1.38E–06	0.1%	liver; lesions	100	7.93E–13	3.02E–11	1.0%	[B2]
Dieldrin	3.87E–02	5.00E–02	5.24E–11	2.25E–12	6.99E–10	8.99E–11	1.05E–06	1.40E–05	0.9%	liver; lesions	100	3.59E–11	1.44E–09	46.5%	[B2]
Endrin	3.87E–02	5.00E–02	5.24E–11	2.24E–12	6.99E–10	8.99E–11	1.75E–07	2.33E–06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.62E–02	2.34E–02	2.46E–11	1.05E–12	3.28E–10	4.21E–11	8.20E–08	1.09E–06	0.1%	liver, kidney; toxicity		1.37E–12	5.47E–11	1.8%	[C]
Heptachlor Epoxide	2.16E–02	2.50E–02	2.92E–11	1.25E–12	3.49E–10	4.49E–11	2.25E–06	2.69E–05	1.8%	liver; inc. relative weight		1.14E–11	4.09E–10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.66E–09	2.42E–10	6.76E–08	8.70E–09	5.66E–07	6.76E–06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		2.76E–01		9.66E+00						4.41E–12	1.55E–10	31.6%	
Uranium 238+D	4.13E+00	5.31E+00		3.10E–01		1.19E+01						8.67E–12	3.35E–10	68.4%	
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							9.55E–05	1.46E–03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.16E–11	3.10E–09	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.30E–11	4.89E–10	100.0%	

Table M.145. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – open) – Area S4–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	UF/A UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.00E-09	7.71E-10	1.04E-07	4.47E-08	8.57E-08	1.49E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	5.91E-10	7.60E-11	1.31E-08	5.62E-09	5.91E-10	1.31E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.40E-09	1.80E-10	2.18E-08	9.33E-09	3.79E-08	5.88E-07	0.1%	Gastrointestinal system; irritation					[D]
Manganese	2.69E+02	4.13E+02	2.04E-08	2.62E-09	4.10E-07	1.76E-07	1.45E-07	2.93E-06	0.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.03E-10	2.61E-11	3.90E-09	1.68E-09	6.76E-07	1.30E-05	1.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.36E-10	8.18E-11	1.40E-08	6.01E-09	9.09E-08	2.00E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.21E-09	6.69E-10	9.03E-08	3.87E-08	1.74E-08	3.01E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.94E-09	3.78E-10	4.78E-08	2.05E-08	2.94E-08	4.78E-07	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.76E-11	2.26E-12	2.48E-10	1.06E-10	5.87E-07	8.28E-06	0.7%	liver; lesions, toxicity	1000	3.85E-11	1.81E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.48E-07	1.91E-08	2.84E-06	1.22E-06	7.42E-06	1.42E-04	12.8%	liver; weight inc.	1000	2.67E-10	1.70E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.72E-08	2.21E-09	2.59E-07	1.11E-07	1.72E-06	2.59E-05	2.3%	liver; lesions, fatty cyst formation	1000	1.35E-11	6.77E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.18E-09	1.05E-09	1.32E-07	5.65E-08	1.64E-05	2.64E-04	23.9%	liver; lesions	100	3.58E-10	1.92E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	5.87E-06	9.94E-05	9.0%	liver; lesions	100	6.04E-10	3.41E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	9.77E-07	1.66E-05	1.5%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.21E-10	1.55E-11	2.04E-09	8.73E-10	4.02E-07	6.79E-06	0.6%	liver, kidney; toxicity		2.01E-11	1.14E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.23E-10	4.15E-11	4.90E-09	2.10E-09	2.49E-05	3.77E-04	34.1%	liver; inc. relative weight		3.78E-10	1.91E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.50E-08	1.22E-08	1.44E-06	6.18E-07	9.50E-06	1.44E-04	13.1%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.88E-05	1.11E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.68E-09	9.31E-08	100.0%	

Table M.146. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – open) – Area S4–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.18E-09	2.65E-10	1.12E-07	1.44E-08	8.83E-08	1.60E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	6.09E-10	2.61E-11	1.41E-08	1.82E-09	6.09E-10	1.41E-08	0.0%	no observed effects	100				[D]
Copper	1.85E+01	2.19E+01	1.44E-09	6.19E-11	2.34E-08	3.01E-09	3.90E-08	6.33E-07	0.1%	Gastrointestinal system; irritation	1				[D]
Manganese	2.69E+02	4.13E+02	2.10E-08	8.99E-10	4.42E-07	5.68E-08	1.50E-07	3.16E-06	0.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1000				[D]
Mercury	2.68E+00	3.93E+00	2.09E-10	8.95E-12	4.23E-09	5.41E-10	6.96E-07	1.40E-05	1.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	100				
Vanadium	8.40E+00	1.41E+01	6.56E-10	2.81E-11	1.51E-08	1.94E-09	9.37E-08	2.16E-06	0.2%	no observed effects	3				[D]
Zinc	6.87E+01	9.09E+01	5.37E-09	2.30E-10	9.72E-08	1.25E-08	1.79E-08	3.24E-07	0.0%	blood; anemia					
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	3.03E-09	1.30E-10	5.15E-08	6.62E-09	3.03E-08	5.15E-07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.81E-11	7.77E-13	2.67E-10	3.44E-11	6.05E-07	8.92E-06	0.7%	liver; lesions, toxicity	1000	1.32E-11	5.85E-10	1.9%	[D2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.35E+01	1.53E-07	6.56E-09	3.06E-06	3.93E-07	7.65E-06	1.53E-04	12.8%	liver; weight inc.	1000	9.18E-11	5.50E-09	18.3%	[D2]
Chloroform	4.07E+00	4.69E+00	1.77E-08	7.58E-10	2.79E-07	3.59E-08	1.77E-06	2.79E-05	2.3%	liver; lesions, fattycyst formation	1000	4.62E-12	2.19E-10	0.7%	[D2]
4,4'-DDT	4.02E-02	4.94E-02	8.43E-09	3.61E-10	1.42E-07	1.83E-08	1.69E-05	2.84E-04	23.9%	liver; lesions	100	1.23E-10	6.21E-09	20.7%	[D2]
Dieldrin	3.87E-02	5.00E-02	3.02E-10	1.30E-11	5.35E-09	6.88E-10	6.05E-06	1.07E-04	9.0%	liver; lesions	100	2.07E-10	1.10E-08	36.6%	[D2]
Endrin	3.87E-02	5.00E-02	3.02E-10	1.29E-11	5.35E-09	6.88E-10	1.01E-06	1.78E-05	1.5%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.24E-10	5.32E-12	2.19E-09	2.82E-10	4.14E-07	7.31E-06	0.6%	liver, kidney; toxicity		6.92E-12	3.67E-10	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.33E-10	1.43E-11	5.28E-09	6.79E-10	2.56E-05	4.06E-04	34.1%	liver; inc. relative weight		1.30E-10	6.18E-09	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.79E-08	4.20E-09	1.55E-06	2.00E-07	9.79E-06	1.55E-04	13.1%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.09E-05	1.19E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.77E-10	3.00E-08	100.0%	

Table M.147. Risk characterization for sediments: adults – dermal exposure (current land use – open) – Area S4–C1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.07E-10	1.37E-11	4.51E-09	1.93E-09	3.56E-07	1.50E-05	16.3%	skin; keratosis, hyperpigmentation	3	2.41E-11	3.38E-09	8.7%	[A]
Barium	78.13	88.46	1.83E-09	2.36E-10	7.56E-08	3.24E-08	2.62E-08	1.08E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.15E-11	2.76E-12	8.77E-10	3.76E-10	4.30E-09	1.75E-07	0.2%	no observed effects	100	1.19E-11	1.62E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.33E-11	4.28E-12	1.46E-09	6.27E-10	3.33E-08	1.46E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.12E-09	1.44E-10	4.71E-08	2.02E-08	1.12E-09	4.71E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.63E-10	7.24E-11	2.55E-08	1.09E-08	1.52E-08	6.90E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.24E-09	1.60E-10	8.51E-08	3.65E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.08E-08	2.68E-09	8.86E-07	3.80E-07	1.49E-07	6.33E-06	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.51E-10	4.51E-11	1.75E-08	7.50E-09	1.17E-06	5.83E-05	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.43E-10	6.99E-11	2.37E-08	1.02E-08	2.72E-08	1.18E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.82E-10	8.77E-11	2.85E-08	1.24E-08	9.74E-08	4.12E-06	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.28E-09	2.93E-10	1.03E-07	4.43E-08	7.60E-09	3.44E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.42E-11	3.11E-12	1.40E-09	5.99E-10				--	--	2.40E-11	4.61E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.90E-11	2.44E-12	1.19E-09	5.08E-10				--	--	1.88E-11	3.91E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.64E-11	9.82E-12	4.42E-09	1.90E-09	2.55E-09	1.47E-07	0.2%	--	--	7.17E-12	1.38E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.40E-11	9.52E-12	4.15E-09	1.78E-09	2.47E-09	1.38E-07	0.2%	--	--	6.95E-11	1.30E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.86E-11	1.13E-11	4.97E-09	2.13E-09	2.95E-09	1.66E-07	0.2%	--	--	8.26E-12	1.55E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.21E-11	9.27E-12	3.39E-09	1.45E-09	2.40E-09	1.13E-07	0.1%	--	--	6.77E-12	1.06E-09	2.7%	[B2]
Chrysene	0.31	0.49	7.26E-11	9.34E-12	4.20E-09	1.80E-09	2.42E-09	1.40E-07	0.2%	--	--	6.82E-13	1.31E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.15E-11	6.63E-12	2.06E-09	8.85E-10	1.72E-09	6.88E-08	0.1%	--	--	4.84E-11	6.46E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.80E-12	2.32E-13	1.16E-10	4.95E-11	3.60E-08	2.31E-06	2.5%	liver; lesions	100	3.71E-12	7.92E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.47E-11	8.32E-12	3.24E-09	1.39E-09	2.16E-09	1.08E-07	0.1%	--	--	6.07E-12	1.01E-09	2.6%	[B2]
Chemical Hazards:															
Hazard Index (HI):							1.94E-06	9.19E-05	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:												2.29E-10	3.89E-08	100.0%	
Combined Exposure (d)															

Table M.148. Risk characterization for sediments: children – dermal exposure (current land use – open) – Area S4–C1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Nonarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.1E-10	4.7E-12	4.8E-09	6.2E-10	3.6E-07	1.6E-05	16.5%	skin; keratosis, hyperpigmentation	3	8.2E-12	1.0E-09	8.7%	[A]
Barium	78.13	88.46	1.8E-09	8.1E-11	8.1E-08	1.0E-08			0.0%						
Beryllium	0.92	1.03	2.2E-11	9.4E-13	9.4E-10	1.2E-10	4.4E-09	1.8E-07	0.2%	no observed effects	100	4.0E-12	5.2E-10	4.2%	[B2]
Cadmium	1.42	1.71	3.4E-11	1.4E-12	1.5E-09	2.0E-10	3.4E-08	1.5E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.1E-09	4.9E-11	5.0E-08	6.5E-09	1.1E-09	5.0E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.8E-10	2.4E-11	2.7E-08	3.5E-09	1.5E-08	7.4E-07	0.8%	Gastrointestinal system; irritation					[D]
Lead	52.96	99.48	1.2E-09	5.4E-11	9.1E-08	1.1E-08				CNS, blood					[B2]
Manganese	886.40	1036.00	2.1E-08	9.1E-10	9.5E-07	1.2E-07	1.5E-07	6.8E-06	7.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.6E-10	1.5E-11	1.8E-08	2.4E-09	1.2E-06	6.2E-05	64.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.6E-10	2.4E-11	2.5E-08	3.2E-09	2.8E-08	1.2E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	7.0E-10	3.0E-11	3.1E-08	3.9E-09	1.0E-07	4.4E-06	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.3E-09	1.0E-10	1.1E-07	1.4E-08	7.8E-09	3.7E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.5E-11	1.0E-12	1.5E-09	1.9E-10						8.2E-12	1.4E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.9E-11	8.3E-13	1.2E-09	1.6E-10						6.4E-12	1.2E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.8E-11	3.3E-12	4.7E-09	6.1E-10	2.6E-09	1.5E-07	0.2%			2.4E-12	4.4E-10	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.6E-11	3.2E-12	4.4E-09	5.7E-10	2.5E-09	1.4E-07	0.2%			2.3E-11	4.1E-09	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	9.0E-11	3.8E-12	5.3E-09	6.8E-10	3.0E-09	1.7E-07	0.2%			2.8E-12	5.0E-10	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.4E-11	3.1E-12	3.6E-09	4.6E-10	2.4E-09	1.2E-07	0.1%			2.3E-12	3.4E-10	2.7%	[B2]
Chrysene	0.31	0.49	7.4E-11	3.2E-12	4.5E-09	5.8E-10	2.4E-09	1.5E-07	0.2%			2.3E-13	4.2E-11	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.3E-11	2.2E-12	2.2E-09	2.8E-10	1.7E-09	7.4E-08	0.1%	--		1.6E-11	2.0E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.8E-12	7.9E-14	1.2E-10	1.6E-11	3.7E-08	2.4E-06	2.5%	liver; lesions		1.2E-12	2.5E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.6E-11	2.8E-12	3.4E-09	4.4E-10	2.2E-09	1.1E-07	0.1%	--		2.0E-12	3.2E-10	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.9E-06	9.7E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.8E-11	1.2E-08	100.0%	

Table M.149. Risk characterization summary for EFPC Segment 4: RME estimates for the future land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	9.89E+00 E	NA	7.61E−05 W	NA	7.00E−06 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	9.9E+00 E				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	8E−05 W		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	7E−06 W

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	3.60E+00 E	1.00E+00 E	3.96E−05 W	3.68E−05 W	1.96E−07 B	4.91E−07 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.42E−01 B	1.09E−01 B	9.94E−06 W	2.53E−05 W	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	3.28E+01 E	2.77E+01 E	9.08E−05 W	2.56E−04 E	3.10E−06 W	2.35E−05 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	7.30E−04 B	1.61E−04 B	1.33E−07 B	9.78E−08 B	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	3.07E+02 E	1.48E+02 E	2.95E−04 E	4.74E−04 E	3.65E−07 B	1.58E−06 W
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					3.4E+02 E	1.8E+02 E				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					5E−04 E	9E−04 E		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					4E−06 W	3E−05 W

B – below or equal to limit of noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
E – exceeds EPA target for noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.150. Human health risk characterization summary for EFPC residential scenario: future land use, Area S4–F1–R adult long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	2.48E–01	1.00E+00	2.56E–06	3.68E–05
Dermal Contact	8.94E–03	1.09E–01	5.29E–07	2.53E–05
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion	1.58E+01	2.77E+01	3.84E–05	2.56E–04
Inhalation (VOCs)	4.01E–05	1.61E–04	7.30E–09	9.78E–08
FOOD CHAIN				
Produce	2.56E+01	1.48E+02	2.87E–05	4.74E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.79E–08	4.91E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion			3.59E–06	2.35E–05
FOOD CHAIN				
Produce			7.50E–08	1.58E–06
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	4.2E+01	1.8E+02		
Excess Lifetime Cancer Risk: Combined Exposure			7E–05	9E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			4E–06	3E–05

Table M.151. Human health risk characterization summary for EFPC residential scenario: future land use, Area S4–F1–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	8.67E–01	3.60E+00	2.98E–06	3.96E–05
Dermal Contact	1.16E–02	1.42E–01	2.30E–07	9.94E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion	1.65E+01	3.28E+01	1.33E–05	9.08E–05
Inhalation (VOCs)	2.34E–04	7.30E–04	1.42E–08	1.33E–07
FOOD CHAIN				
Produce	5.73E+01	3.07E+02	2.13E–05	2.95E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.58E–08	1.96E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion			4.45E–07	3.10E–06
FOOD CHAIN				
Produce			2.00E–08	3.65E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	7.5E+01	3.4E+02		
Excess Lifetime Cancer Risk: Combined Exposure			4E–05	5E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–07	4E–06

Table M.152. Human health risk characterization summary: EFPC commercial scenario: future land use, Area S4–F2–C adult long term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion				
Dermal Contact				
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion	5.66E+00	9.89E+00	1.37E–05	7.61E–05
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion				
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion			1.28E–06	7.00E–06
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.66E+00	9.89E+00		
Excess Lifetime Cancer Risk: Combined Exposure			1.37E–05	7.61E–05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1.28E–06	7.00E–06

Table M.153. Risk characterization for soils: adults – ingestion exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (mg/kg)															
Antimony	1.15	1.30	4.84E-07	6.22E-08	1.79E-06	7.66E-07	1.21E-03	4.47E-03	0.4%	whole body, blood; inc. mortality	1000				
Arsenic	10.05	10.75	4.25E-06	5.46E-07	1.47E-05	6.31E-06	1.42E-02	4.91E-02	4.9%	skin; keratosis, hyperpigmentation	3	9.56E-07	1.10E-05	30.0%	[A]
Barium	227.70	294.50	9.62E-05	1.24E-05	4.03E-04	1.73E-04	1.37E-03	5.76E-03	0.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.08	1.52	4.55E-07	5.85E-08	2.08E-06	8.90E-07	9.10E-05	4.15E-04	0.0%	no observed effects	100	2.52E-07	3.88E-06	10.4%	[B2]
Cadmium	13.15	20.88	5.56E-06	7.15E-07	2.86E-05	1.23E-05	5.56E-03	2.86E-02	2.8%	kidney; proteinuria	10				
Chromium (III)	82.40	87.84	3.48E-05	4.48E-06	1.20E-04	5.16E-05	3.48E-05	1.20E-04	0.0%	no observed effects	100				
Copper	183.80	262.00	7.77E-05	9.99E-06	3.59E-04	1.54E-04	2.10E-03	9.70E-03	1.0%	Gastrointestinal system; irritation	--				[D]
Lead	103.40	135.50	4.37E-05	5.62E-06	1.86E-04	7.95E-05				CNS, blood	--				[D2]
Manganese	1143.00	1323.00	4.83E-04	6.21E-05	1.81E-03	7.77E-04	3.45E-03	1.29E-02	1.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	154.20	193.20	6.52E-05	8.38E-06	2.65E-04	1.13E-04	2.17E-01	8.82E-01	87.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	87.63	116.80	3.70E-05	4.76E-06	1.60E-04	6.86E-05	1.85E-03	8.00E-03	0.8%	dec. body and organ weight	300				
Selenium	7.39	7.97	3.13E-06	4.02E-07	1.09E-05	4.68E-06	6.25E-04	2.18E-03	0.2%	whole body; clinical selenosis	3				[D]
Silver	12.42	17.95	5.25E-06	6.75E-07	2.46E-05	1.05E-05	1.05E-03	4.92E-03	0.5%	skin; argyria	3				[D]
Zinc	102.50	115.70	4.33E-05	5.57E-06	1.58E-04	6.79E-05	1.44E-04	5.26E-04	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.92	1.62	3.90E-07	5.01E-08	2.22E-06	9.52E-07				--	--	3.86E-07	7.33E-06	19.9%	[B2]
Aroclor-1260	1.50	2.23	6.34E-07	8.16E-08	3.05E-06	1.31E-06				--	--	6.28E-07	1.01E-05	27.3%	[B2]
Benzo(a)anthracene	0.34	0.68	2.30E-07	2.96E-08	9.36E-07	4.01E-07	7.67E-06	3.12E-05	0.0%	--	--	2.16E-08	2.93E-07	0.8%	[B2]
Benzo(a)pyrene /	0.57	0.70	2.40E-07	3.09E-08	9.62E-07	4.12E-07	8.00E-06	3.21E-05	0.0%	--	--	2.25E-07	3.01E-06	8.2%	[B2]
Benzo(b)fluoranthene	0.97	1.24	4.10E-07	5.27E-08	1.69E-06	7.26E-07	1.37E-05	5.65E-05	0.0%	--	--	3.85E-08	5.30E-07	1.4%	[B2]
Benzo(k)fluoranthene	0.91	1.22	3.84E-07	4.93E-08	1.67E-06	7.17E-07	1.28E-05	5.58E-05	0.0%	--	--	3.60E-08	5.24E-07	1.4%	[B2]
Chrysene	0.65	0.84	2.76E-07	3.54E-08	1.15E-06	4.91E-07	9.19E-06	3.82E-05	0.0%	--	--	2.59E-09	3.58E-08	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.39	1.17E-07	1.51E-08	5.31E-07	2.28E-07	3.91E-06	1.77E-05	0.0%	--	--	1.10E-08	1.65E-07	0.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.46	1.92		1.42E+02		2.02E+03						3.98E-09	5.66E-08	11.5%	[A]
Cobalt 60	0.02	0.04		1.81E+00		3.86E+01						2.71E-11	5.79E-10	0.1%	[A]
Neptunium 237+D	0.02	0.06		2.36E+00		6.16E+01						5.19E-10	1.36E-08	2.8%	[A]
Uranium 234	7.82	9.17		7.60E+02		9.63E+03						1.22E-08	1.54E-07	31.4%	[A]
Uranium 235+D	0.37	0.43		3.57E+01		4.52E+02						5.70E-10	7.24E-09	1.5%	[A]
Uranium 238+D	7.59	8.81		7.37E+02		9.25E+03						2.00E-08	2.59E-07	52.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.4E-01	1.0E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.5E-06	3.6E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.7E-08	4.9E-07	100.0%	

Table M.154. Risk characterization for soils: children – ingestion exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Antimony	1.15	1.30	1.6E-06	7.2E-08	6.4E-06	8.2E-07	4.2E-03	1.6E-02	0.4%	whole body, blood; inc. mortality	1000				
Arsenic	10.05	10.75	1.4E-05	6.3E-07	5.2E-05	6.7E-06	4.9E-02	1.7E-01	4.9%	skin; keratosis, hyperpigmentation	3	1.1E-06	1.1E-05	30.0%	[A]
Barium	227.70	294.50	3.3E-04	1.4E-05	1.4E-03	1.8E-04	4.8E-03	2.0E-02	0.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.08	1.52	1.5E-06	6.8E-08	7.4E-06	9.5E-07	3.1E-04	1.4E-03	0.0%	no observed effects	100	2.9E-07	4.1E-06	10.4%	[D2]
Cadmium	13.15	20.68	1.9E-05	8.3E-07	1.0E-04	1.3E-05	1.9E-02	1.0E-01	2.8%	kidney; proteinuria	10				
Chromium (III)	82.40	87.84	1.2E-04	5.2E-06	4.3E-04	5.5E-05	1.2E-04	4.3E-04	0.0%	no observed effects	100				
Copper	183.80	262.00	2.7E-04	1.1E-05	1.2E-03	1.6E-04	7.3E-03	3.4E-02	1.0%	Gastrointestinal system; irritation	--				[D]
Lead	103.40	135.50	1.5E-04	6.5E-06	6.6E-04	8.5E-05				CNS, blood	--				[B2]
Manganese	1143.00	1323.00	1.6E-03	7.2E-05	6.4E-03	8.3E-04	1.2E-02	4.6E-02	1.3%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	154.20	193.20	2.2E-04	9.7E-06	9.4E-04	1.2E-04	7.6E-01	3.1E+00	87.8%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	87.63	116.80	1.3E-04	5.5E-06	5.7E-04	7.3E-05	6.4E-03	2.8E-02	0.8%	dec. body and organ weight	300				
Selenium	7.39	7.97	1.0E-05	4.6E-07	3.9E-05	5.0E-06	2.1E-03	7.8E-03	0.2%	whole body; clinical selenosis	3				[D]
Silver	12.42	17.95	1.8E-05	7.8E-07	8.8E-05	1.1E-05	3.6E-03	1.7E-02	0.5%	skin; argyria	3				[D]
Zinc	102.50	115.70	1.5E-04	6.5E-06	5.6E-04	7.3E-05	5.0E-04	1.8E-03	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.92	1.62	1.3E-06	5.8E-08	7.9E-06	1.0E-06				--	--	4.5E-07	7.8E-06	19.9%	[B2]
Aroclor–1260	1.50	2.23	2.2E-06	9.5E-08	1.0E-05	1.4E-06				--	--	7.3E-07	1.0E-05	27.3%	[B2]
Benzo(a)anthracene	0.54	0.68	8.0E-07	3.4E-08	3.3E-06	4.3E-07	2.6E-05	1.1E-04	0.0%	--	--	2.5E-08	3.1E-07	0.8%	[B2]
Benzo(a)pyrene	0.57	0.70	8.4E-07	3.6E-08	3.4E-06	4.4E-07	2.8E-05	1.1E-04	0.0%	--	--	2.6E-07	3.2E-06	8.2%	[B2]
Benzo(b)fluoranthene	0.97	1.24	1.4E-06	6.1E-08	6.0E-06	7.8E-07	4.7E-05	2.0E-04	0.0%	--	--	4.4E-08	5.6E-07	1.4%	[B2]
Benzo(k)fluoranthene	0.91	1.22	1.3E-06	5.7E-08	5.9E-06	7.7E-07	4.4E-05	2.0E-04	0.0%	--	--	4.2E-08	5.6E-07	1.4%	[B2]
Chrysene	0.65	0.84	9.6E-07	4.1E-08	4.1E-06	5.2E-07	3.2E-05	1.3E-04	0.0%	--	--	3.0E-09	3.8E-08	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.39	4.1E-07	1.7E-08	1.9E-06	2.4E-07	1.3E-05	6.3E-05	0.0%	--	--	1.2E-08	1.7E-07	0.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.46	1.92		5.9E+01		8.0E+02						1.6E-09	2.2E-08	11.5%	[A]
Cobalt 60	0.02	0.04		7.5E-01		1.5E+01						1.1E-11	2.3E-10	0.1%	[A]
Neptunium 237+D	0.02	0.06		9.8E-01		2.4E+01						2.1E-10	5.4E-09	2.8%	[A]
Uranium 234	7.82	9.17		3.1E+02		3.8E+03						5.0E-09	6.1E-08	31.4%	[A]
Uranium 235+D	0.37	0.43		1.4E+01		1.8E+02						2.3E-10	2.8E-09	1.5%	[A]
Uranium 238+D	7.59	8.81		3.0E+02		3.6E+03						8.6E-09	1.0E-07	52.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							8.6E-01	3.6E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.9E-06	3.9E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.3E-08	1.9E-07	100.0%	

Table M.155. Risk characterization for soils: adults – dermal exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Antimony	1.15	1.30	1.74E-08	2.24E-09	1.93E-07	8.28E-08	4.36E-05	4.83E-04	0.4%	whole body, blood; inc. mortality	1000				
Arsenic	10.05	10.75	1.53E-07	1.97E-08	1.59E-06	6.82E-07	5.10E-04	5.31E-03	4.9%	skin; keratosis, hyperpigmentation	3	3.44E-08	1.19E-06	4.7%	[A]
Barium	227.70	294.50	3.46E-06	4.45E-07	4.36E-05	1.87E-05	4.95E-05	6.23E-04	0.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.08	1.52	1.64E-08	2.11E-09	2.24E-07	9.62E-08	3.28E-06	4.45E-05	0.0%	no observed effects	100	9.06E-09	4.14E-07	1.6%	[B2]
Cadmium	13.15	20.88	2.00E-07	2.57E-08	3.09E-06	1.33E-06	2.00E-04	3.09E-03	2.8%	kidney; proteinuria	10				
Chromium (III)	82.40	87.84	1.25E-06	1.61E-07	1.30E-05	5.57E-06	1.25E-06	1.30E-05	0.0%	no observed effects	100				
Copper	183.80	262.00	2.80E-06	3.60E-07	3.88E-05	1.66E-05	7.36E-05	1.05E-03	1.0%	Gastrointestinal system; irritation	--				
Lead	103.40	135.50	1.57E-06	2.02E-07	2.01E-05	8.60E-06				CNS, blood	--				[D]
Manganese	1143.00	1323.00	1.74E-05	2.24E-06	1.96E-04	8.40E-05	1.24E-04	1.40E-03	1.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D2]
Mercury	154.20	193.20	2.35E-06	3.02E-07	2.86E-05	1.23E-05	7.82E-03	9.54E-02	87.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	87.63	116.60	1.33E-06	1.71E-07	1.73E-05	7.41E-06	6.67E-05	8.65E-04	0.8%	dec. body and organ weight	300				[D]
Selenium	7.39	7.97	1.13E-07	1.45E-08	1.18E-06	5.06E-07	2.25E-05	2.36E-04	0.2%	whole body; clinical selenosis	3				
Silver	12.42	17.95	1.89E-07	2.43E-08	2.66E-06	1.14E-06	3.78E-05	5.32E-04	0.5%	skin; argyria	3				[D]
Zinc	102.50	115.70	1.56E-06	2.01E-07	1.71E-05	7.34E-06	5.20E-06	5.71E-05	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.92	1.62	1.40E-07	1.80E-08	2.40E-06	1.03E-06				--	--	1.39E-07	7.92E-06	31.3%	[B2]
Aroclor–1260	1.50	2.23	2.28E-07	2.94E-08	3.30E-06	1.41E-06				--	--	2.26E-07	1.09E-05	42.9%	[B2]
Benzo(a)anthracene	0.54	0.68	8.28E-08	1.07E-08	1.01E-06	4.34E-07	2.76E-06	3.37E-05	0.0%	--	--	7.76E-09	3.17E-07	1.2%	[B2]
Benzo(a)pyrene	0.57	0.70	8.64E-08	1.11E-08	1.04E-06	4.46E-07	2.88E-06	3.47E-05	0.0%	--	--	8.11E-08	3.25E-06	12.8%	[B2]
Benzo(b)fluoranthene	0.97	1.24	1.46E-07	1.90E-08	1.83E-06	7.85E-07	4.92E-06	6.11E-05	0.1%	--	--	1.39E-08	5.73E-07	2.3%	[B2]
Benzo(k)fluoranthene	0.91	1.22	1.38E-07	1.78E-08	1.81E-06	7.76E-07	4.60E-06	6.03E-05	0.1%	--	--	1.30E-08	5.66E-07	2.2%	[B2]
Chrysene	0.65	0.84	9.92E-08	1.28E-08	1.24E-06	5.31E-07	3.31E-06	4.13E-05	0.0%	--	--	9.32E-10	3.87E-08	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.39	4.23E-08	5.43E-09	5.74E-07	2.46E-07	1.41E-06	1.91E-05	0.0%	--	--	3.97E-09	1.80E-07	0.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							8.94E-03	1.09E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.29E-07	2.53E-05	100.0%	

Table M.156. Risk characterization for soils: children – dermal exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Cancer Effects (MLE)	CDI Noncar. Effects (RME)	CDI Cancer Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (RME)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS **(mg/kg)**															
Antimony	1.15	1.30	2.27E-08	9.73E-10	2.53E-07	3.25E-08	5.68E-05	6.31E-04	0.4%	whole body, blood; inc. mortality	1000				
Arsenic	10.05	10.75	1.99E-07	8.54E-09	2.08E-06	2.68E-07	6.64E-04	6.94E-03	4.9%	skin; keratosis, hyperpigmentation	3	1.49E-08	4.68E-07	4.7%	[A]
Barium	227.70	294.50	4.52E-06	1.94E-07	5.70E-05	7.33E-06	6.45E-05	8.15E-04	0.6%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.08	1.52	2.14E-08	9.15E-10	2.94E-07	3.77E-08	4.27E-06	5.87E-05	0.0%	no observed effects	100	3.94E-09	1.62E-07	1.6%	[B2]
Cadmium	13.15	20.88	2.61E-07	1.12E-08	4.04E-06	5.20E-07	2.61E-04	4.04E-03	2.8%	kidney; proteinuria	10				
Chromium (III)	82.40	87.84	1.63E-06	7.00E-08	1.70E-05	2.19E-06	1.63E-06	1.70E-05	0.0%	no observed effects	100				
Copper	183.80	262.00	3.65E-06	1.56E-07	5.07E-05	6.52E-06	9.85E-05	1.37E-03	1.0%	Gastrointestinal system; irritation	--				[D]
Lead	103.40	135.50	2.05E-06	8.79E-08	2.62E-05	3.37E-06				CNS, blood	--				[B2]
Manganese	1143.00	1323.00	2.27E-05	9.72E-07	2.56E-04	3.29E-05	1.62E-04	1.83E-03	1.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	154.20	193.20	3.06E-06	1.31E-07	3.74E-05	4.81E-06	1.02E-02	1.25E-01	87.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	87.63	116.80	1.74E-06	7.45E-08	2.26E-05	2.91E-06	8.69E-05	1.13E-03	0.8%	dec. body and organ weight	300				
Selenium	7.39	7.97	1.47E-07	6.29E-09	1.54E-06	1.98E-07	2.93E-05	3.09E-04	0.2%	whole body; clinical selenosis	3				[D]
Silver	12.42	17.95	2.46E-07	1.06E-08	3.48E-06	4.47E-07	4.93E-05	6.95E-04	0.5%	skin; argyria	3				[D]
Zinc	102.50	115.70	2.03E-06	8.71E-08	2.24E-05	2.88E-06	6.78E-06	7.47E-05	0.1%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor-1254	0.92	1.62	1.83E-07	7.83E-09	3.14E-06	4.04E-07				--	--	6.03E-08	3.11E-06	31.3%	[B2]
Aroclor-1260	1.50	2.23	2.98E-07	1.28E-08	4.31E-06	5.54E-07				--	--	9.82E-08	4.27E-06	42.9%	[B2]
Benzo(a)anthracene	0.54	0.68	1.08E-07	4.63E-09	1.32E-06	1.70E-07	3.60E-06	4.41E-05	0.0%	--	--	3.38E-09	1.24E-07	1.2%	[B2]
Benzo(a)pyrene	0.57	0.70	1.13E-07	4.83E-09	1.36E-06	1.75E-07	3.75E-06	4.53E-05	0.0%	--	--	3.52E-08	1.28E-06	12.8%	[B2]
Benzo(b)fluoranthene	0.97	1.24	1.92E-07	8.25E-09	2.40E-06	3.08E-07	6.41E-06	7.99E-05	0.1%	--	--	6.02E-09	2.25E-07	2.3%	[B2]
Benzo(k)fluoranthene	0.91	1.22	1.80E-07	7.72E-09	2.37E-06	3.04E-07	6.00E-06	7.89E-05	0.1%	--	--	5.63E-09	2.22E-07	2.2%	[B2]
Chrysene	0.65	0.84	1.29E-07	5.54E-09	1.62E-06	2.08E-07	4.31E-06	5.40E-05	0.0%	--	--	4.05E-10	1.52E-08	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.39	5.51E-08	2.36E-09	7.51E-07	9.65E-08	1.84E-06	2.50E-05	0.0%	--	--	1.72E-09	7.05E-08	0.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.16E-02	1.42E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.30E-07	9.94E-06	100.0%	

Table M.157. Risk characterization for surface water: adults – ingestion exposure (swimming) (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.34E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	3.68E-06	4.73E-07	3.36E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.71E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	0.4%	liver; lesions, fatty cyst formation	1000	4.37E-11	9.97E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.86E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.09E-09	2.79E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity		4.16E-11	1.00E-09	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.26E-05	1.57E-04	1.8%	liver; inc. relative weight		3.46E-10	7.94E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							9.67E-04	8.62E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.48E-09	6.01E-08	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.49E-10	1.30E-08	100.0%	

Table M.158. Risk characterization for surface water: children – ingestion exposure (swimming) (future land use – residential) – Area S4–F1–R

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD Up	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E-06	1.30E-07	2.30E-05	2.95E-06	4.34E-05	3.29E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E-07	1.28E-08	2.85E-06	3.72E-07	2.99E-07	2.85E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E-07	3.04E-08	4.80E-06	6.17E-07	1.92E-05	1.30E-04	0.6%	Gastrointestinal system; irritation					[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E-05	4.42E-07	9.05E-05	1.16E-05	2.06E-03	1.81E-02	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E-07	4.40E-09	8.62E-07	1.11E-07	3.42E-04	2.87E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E-07	1.38E-08	3.09E-06	3.97E-07	4.60E-05	4.41E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E-06	1.13E-07	1.99E-05	2.56E-06	8.79E-06	6.64E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E-07	1.02E-08	1.69E-06	2.17E-07	2.38E-06	1.69E-05	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	8.91E-10	3.82E-11	5.48E-09	7.05E-10	2.97E-05	1.83E-04	0.8%	liver; lesions, toxicity	1000	6.49E-10	1.20E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E-07	1.56E-08	3.04E-06	3.90E-07	1.82E-05	1.52E-04	0.7%	liver; weight inc.	1000	2.19E-10	5.46E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E-07	6.69E-09	1.03E-06	1.32E-07	1.56E-05	1.03E-04	0.4%	liver; lesions, fatty cyst formation	1000	4.08E-11	8.00E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.54E-09	6.60E-11	1.08E-08	1.39E-09	3.08E-06	2.17E-05	0.1%	liver; lesions	100	2.25E-11	4.73E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	1.49E-09	6.37E-11	1.10E-08	1.41E-09	2.97E-05	2.19E-04	0.9%	liver; lesions	100	1.02E-09	2.25E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	1.49E-09	6.38E-11	1.10E-08	1.41E-09	4.95E-06	3.65E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	6.97E-10	2.99E-11	5.14E-09	6.60E-10	2.32E-06	1.71E-05	0.1%	liver, kidney; toxicity		3.89E-11	8.58E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	8.28E-10	3.55E-11	5.48E-09	7.05E-10	6.37E-05	4.21E-04	1.8%	liver; inc. relative weight		3.23E-10	6.41E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E-07	6.87E-09	1.06E-06	1.36E-07	1.60E-05	1.06E-04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E-11	1.29E-09	31.6%	
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E-10	2.78E-09	68.4%	
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.71E-03	2.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E-09	4.89E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E-10	4.07E-09	100.0%	

Table M.159. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration µg/SW	RME Concentration µg/SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.58E-06	0.0%	Gastrointestinal system; irritation					
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.16E-04	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.76E-09	1.19E-09	8.21E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fattycyst formation	1000	1.88E-10	7.57E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity		2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.46E-04	4.22E-03	31.9%	liver; inc. relative weight		5.29E-09	2.14E-07	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				

Chemical Hazard:
Hazard Index (HI):
Combined Exposure (d) — 1.02E-03 | 1.32E-02 | 100.0%

Excess Lifetime Cancer Risk:
Combined Exposure (d) — 2.35E-08 | 1.04E-06 | 100.0%

Table M.160. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E-07	4.69E-09	1.53E-06	1.96E-07	1.56E-06	2.18E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	8.18E-07	4.09E-08	6.91E-07	8.60E-06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	7.43E-05	1.20E-03	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E-09	1.59E-10	5.72E-08	7.35E-09	1.23E-05	1.91E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.40E+01	1.16E-08	4.98E-10	2.09E-07	2.64E-08	1.66E-06	2.93E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.05E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.21E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.21E-04	0.7%	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	12.0%	liver; weight inc.	1000	1.63E-09	7.47E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E-07	1.34E-08	3.79E-06	4.87E-07	3.13E-05	3.79E-04	2.2%	liver; lesions, fattycyst formation	1000	8.19E-11	2.97E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.99E-04	3.86E-03	22.3%	liver; lesions	100	2.18E-09	8.44E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.45E-03	8.4%	liver; lesions	100	3.67E-09	1.50E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	0.6%	liver, kidney; toxicity		1.23E-10	4.98E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	31.9%	liver; inc. relative weight		2.30E-09	8.40E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.71E-06	1.73E-04	2.11E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.35E-03	1.73E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-08	4.08E-07	100.0%	

Table M.161. Risk characterization for sediments: adults – dermal exposure (future land use – residential) – Area S4–F1–R

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%						
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.01	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.86E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation					
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood					[D]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[B2]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.88E-10	1.77E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				[D]
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09						1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09						1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%			5.02E-11	9.96E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%			4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%			5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%			4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--		4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--		3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions		2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--		4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.36E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-09	2.86E-07	100.0%	

Table M.162. Risk characterization for sediments: children – dermal exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration (µg/g Sediment)	RME Concentration (µg/g Sediment)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.76E-10	4.18E-11	4.24E-08	5.45E-09	3.25E-06	1.41E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.32E-11	9.55E-09	8.7%	[A]
Barium	78.13	88.46	1.67E-08	7.17E-10	7.12E-07	9.16E-08	2.39E-07	1.02E-05	1.2%						
Beryllium	0.92	1.03	1.96E-10	8.40E-12	8.25E-09	1.06E-09	3.92E-08	1.65E-06	0.2%	no observed effects	100	3.61E-11	4.56E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.04E-10	1.30E-11	1.38E-08	1.77E-09	3.04E-07	1.38E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.02E-08	4.38E-10	4.43E-07	5.70E-08	1.02E-08	4.43E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.14E-09	2.20E-10	2.41E-07	3.09E-08	1.39E-07	6.50E-06	0.8%	Gastrointestinal system; irritation					[D]
Lead	52.96	99.48	1.13E-08	4.86E-10	8.01E-07	1.03E-07				CNS, blood					[B2]
Manganese	886.40	1036.00	1.90E-07	8.14E-09	8.34E-06	1.07E-06	1.36E-06	5.96E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.20E-09	1.37E-10	1.65E-07	2.12E-08	1.07E-05	5.49E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.96E-09	2.12E-10	2.28E-07	2.87E-08	2.48E-07	1.12E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.22E-09	2.67E-10	2.72E-07	3.49E-08	8.89E-07	3.88E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.08E-08	8.91E-10	9.73E-07	1.25E-07	6.93E-08	3.24E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.21E-10	9.47E-12	1.32E-08	1.69E-09						7.29E-11	1.30E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.73E-10	7.42E-12	1.12E-08	1.44E-09						5.71E-11	1.10E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.97E-10	2.99E-11	4.16E-08	5.35E-09	2.32E-08	1.39E-06	0.2%			2.18E-11	3.91E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.75E-10	2.89E-11	3.91E-08	5.02E-09	2.25E-08	1.30E-06	0.2%			2.11E-10	3.67E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.03E-10	3.44E-11	4.68E-08	6.01E-09	2.68E-08	1.56E-06	0.2%			2.51E-11	4.39E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.58E-10	2.82E-11	3.19E-08	4.10E-09	2.19E-08	1.06E-06	0.1%			2.06E-11	2.99E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.62E-10	2.84E-11	3.96E-08	5.09E-09	2.21E-08	1.32E-06	0.2%	--		2.07E-12	3.71E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.70E-10	2.02E-11	1.94E-08	2.50E-09	1.57E-08	6.46E-07	0.1%	--		1.47E-10	1.82E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.64E-11	7.05E-13	1.09E-09	1.40E-10	3.29E-07	2.18E-05	2.5%	liver; lesions		1.13E-11	2.24E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.90E-10	2.53E-11	3.05E-08	3.92E-09	1.97E-08	1.02E-06	0.1%	--		1.85E-11	2.86E-09	2.6%	[B2]
Chemical Hazard: Hazard Index (HI): Combined Exposure (d)							1.77E-05	8.66E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.97E-10	1.10E-07	100.0%	

Table M.163. Risk characterization for groundwater: adults – ingestion exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Nonca. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Nonca. Effects (RME)	CDI Carc. Effects (RME)	HQ Nonca. Effects (CDI/RfD) (MLE)	HQ Nonca. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.61E-05	9.78E-06	1.53E-04	6.55E-05	2.54E-01	5.09E-01	1.6%	skin; keratosis, hyperpigmentation	3	1.7E-05	1.15E-04	44.6%	[A]
Barium	3.95E+02	4.85E+02	7.58E-03	9.74E-04	1.33E-02	5.70E-03	1.08E-01	1.94E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.61E-05	4.64E-06	7.01E-05	3.00E-05	7.22E-03	1.40E-02	0.1%	no observed effects	100	2.00E-05	1.29E-04	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.33E-04	8.14E-05	1.12E-03	4.81E-04	6.33E-04	1.12E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.20E-04	4.12E-05	8.87E-03	3.80E-03	8.64E-03	2.40E-01	0.9%	Gastrointestinal system; irritation	– –				[D]
Lead	2.68E+01	3.53E+01	5.13E-04	6.60E-05	9.68E-04	4.15E-04				CNS, blood	– –				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E-02	9.22E-03	1.21E-01	5.19E-02	1.43E+01	2.42E+01	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.66E-04	3.42E-05	5.99E-04	2.57E-04	8.86E-01	2.00E+00	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.21E-04	1.18E-04	1.76E-03	7.55E-04	4.61E-02	8.81E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.49E-04	9.64E-05	1.34E-03	5.76E-04	1.07E-01	1.92E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	6.89E-03	8.86E-04	1.87E-02	8.01E-03	6.89E-02	1.87E-01	0.7%	loc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E-03	1.72E-04	3.69E-03	1.58E-03	2.23E-02	6.15E-02	0.2%	*oral and inhal.*–liver; toxicity	100	1.29E-06	1.19E-05	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.44E+04		8.54E+04						1.4E-06	8.5E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05						8.9E-07	6.1E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05						1.2E-06	8.8E-06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI):							1.58E+01	2.77E+01	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:												3.8E-05	2.5E-04	100.0%	
Combined Exposure (d)															
Radiological Hazards:															
Excess Lifetime Cancer Risk:												3.5E-06	2.3E-05	100.0%	
Combined Exposure (d)															

Table M.164. Risk characterization for groundwater: children – ingestion exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.91E-05	3.39E-06	1.81E-04	2.33E-05	2.64E-01	6.03E-01	1.8%	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.88E-03	3.38E-04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.61E-06	8.31E-05	1.07E-05	7.51E-03	1.66E-02	0.1%	no observed effects	100	6.92E-06	4.55E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.59E-04	2.82E-05	1.33E-03	1.71E-04	6.59E-04	1.33E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.84E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	1.49E+01	2.87E+01	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.76E-04	1.18E-05	7.05E-04	9.12E-05	9.21E-01	2.36E+00	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.86E+01	6.43E+01	9.58E-04	4.11E-05	2.09E-03	2.68E-04	4.79E-02	1.06E-01	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.28E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.47E-07	4.21E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.76E+03		1.13E+04						1.78E-07	1.13E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		6.90E+03		5.04E+04						1.10E-07	8.00E-07	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.59E+03		4.17E+04						1.56E-07	1.17E-06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.65E+01	3.28E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.33E-05	9.08E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.45E-07	3.10E-06	100.0%	

Table M.165. Risk characterization for groundwater: adults – inhalation exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	1.77E-04	2.28E-05	7.01E-04	3.00E-04				Inc. liver, kidney weights, nephrotoxicity	--				
Methylene Chloride	6.97E+01	1.35E+02	3.44E-05	4.42E-06	1.38E-04	5.93E-05	4.01E-05	1.61E-04	100.0%	*oral and inhal.*–liver; toxicity	100	7.30E-09	9.78E-08	100.0%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							4.01E-05	1.61E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.30E-09	9.78E-08	100.0%	

Table M.166. Risk characterization for groundwater: children – inhalation exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	1.03E-03	4.43E-05	3.17E-03	4.07E-04				loc. liver, kidney weights, nephrotoxicity	--				
Methylene Chloride	6.97E+01	1.35E+02	2.01E-04	8.60E-06	6.25E-04	8.04E-05	2.34E-04	7.30E-04	100.0%	*oral and inhal.*–liver; toxicity	100	1.42E-08	1.33E-07	100.0%	(D2)
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							2.34E-04	7.30E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.42E-08	1.33E-07	100.0%	

Table M.167. Risk characterization for produce: adults – ingestion exposure (future land use – residential) – Area S4–F1–R

Chemical	MLB Concentration from Mean Concentration in Soil	RMB Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	1.15E-02	1.30E-02	1.75E-06	2.25E-07	9.11E-06	3.90E-06	4.37E-03	2.28E-02	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	8.04E-01	8.60E-01	1.23E-04	1.58E-05	6.00E-04	2.57E-04	4.09E-01	2.00E+00	1.4%	skin; keratosis, hyperpigmentation	3	2.70E-05	4.51E-04	95.0%	[A]
Barium	2.28E+00	2.95E+00	3.47E-04	4.47E-05	2.06E-03	8.82E-04	4.96E-03	2.94E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	4.31E-03	6.06E-03	6.57E-07	8.45E-08	4.24E-06	1.82E-06	1.31E-04	8.47E-04	0.0%	no observed effects	100	3.63E-07	7.81E-06	1.6%	[B2]
Cadmium	6.56E+00	1.04E+01	1.00E-03	1.29E-04	7.29E-03	3.13E-03	1.00E+00	7.29E+00	4.9%	kidney; proteinuria	10				
Chromium (III)	8.24E-01	8.78E-01	1.26E-04	1.62E-05	6.14E-04	2.63E-04	1.26E-04	6.14E-04	0.0%	no observed effects	100				
Copper	9.19E+00	1.31E+01	1.40E-03	1.80E-04	9.15E-03	3.92E-03	3.79E-02	2.47E-01	0.2%	Gastrointestinal system; irritation	--				[D]
Lead	1.03E+00	1.36E+00	1.58E-04	2.03E-05	9.47E-04	4.06E-04				CNS, blood	--				[B2]
Manganese	4.57E+02	5.29E+02	6.98E-02	8.97E-03	3.70E-01	1.58E-01	4.98E-01	2.64E+00	1.8%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	4.63E+01	5.80E+01	7.06E-03	9.08E-04	4.05E-02	1.74E-02	2.35E+01	1.35E+02	91.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.38E+00	5.84E+00	6.69E-04	8.60E-05	4.08E-03	1.75E-03	3.34E-02	2.04E-01	0.1%	dec. body and organ weight	300				
Selenium	7.39E-01	7.97E-01	1.13E-04	1.45E-05	5.57E-04	2.39E-04	2.26E-02	1.11E-01	0.1%	whole body; clinical selenosis	3				[D]
Silver	2.48E+00	3.59E+00	3.79E-04	4.87E-05	2.51E-03	1.07E-03	7.58E-02	5.02E-01	0.3%	skin; argyria	3				[D]
Zinc	4.10E+01	4.63E+01	6.26E-03	8.04E-04	3.23E-02	1.39E-02	2.09E-02	1.08E-01	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1254	1.60E-03	2.82E-03	2.45E-07	3.15E-08	1.97E-06	8.44E-07				--	--	2.42E-07	6.50E-06	1.4%	[B2]
Aroclor-1260	1.47E-03	2.19E-03	2.25E-07	2.89E-08	1.53E-06	6.54E-07				--	--	2.23E-07	5.04E-06	1.1%	[B2]
Benzo(a)anthracene	2.02E-03	2.54E-03	3.09E-07	3.97E-08	1.77E-06	7.60E-07	1.03E-05	5.91E-05	0.0%	--	--	2.90E-08	5.55E-07	0.1%	[B2]
Benzo(a)pyrene	1.07E-03	1.32E-03	1.63E-07	2.10E-08	9.24E-07	3.96E-07	5.44E-06	3.08E-05	0.0%	--	--	1.53E-07	2.89E-06	0.6%	[B2]
Benzo(b)fluoranthene	1.44E-03	1.83E-03	2.19E-07	2.82E-08	1.28E-06	5.49E-07	7.32E-06	4.27E-05	0.0%	--	--	2.06E-08	4.01E-07	0.1%	[B2]
Benzo(k)fluoranthene	9.65E-04	1.30E-03	1.47E-07	1.89E-08	9.08E-07	3.89E-07	4.91E-06	3.03E-05	0.0%	--	--	1.38E-08	2.84E-07	0.1%	[B2]
Chrysene	2.84E-03	3.64E-03	4.34E-07	5.58E-08	2.53E-06	1.05E-06	1.45E-05	8.49E-05	0.0%	--	--	4.07E-09	7.96E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%	--	--	0.00E+00	0.00E+00	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	1.00E-04	1.40E-04	1.53E-08	1.97E-09	9.80E-08	4.20E-08	5.11E-07	3.27E-06	0.0%	--	--	1.44E-09	3.07E-08	0.0%	[B2]
RADIONUCLIDES (pCi/g PLANT TISSUE)															
Cesium 137+D	4.39E-02	5.77E-02		1.54E+03		3.09E+04									
Cobalt 60	5.57E-04	1.10E-03		1.95E+01		5.91E+02						4.31E-08	8.65E-07	54.8%	[A]
Neptunium 237+D	9.72E-04	2.35E-03		3.41E+01		1.26E+03						2.93E-10	8.86E-09	0.6%	[A]
Uranium 234	1.56E-02	1.83E-02		5.49E+02		9.82E+03						7.50E-09	2.77E-07	17.5%	[A]
Uranium 235+D	7.34E-04	8.62E-04		2.57E+01		4.61E+02						8.78E-09	1.57E-07	9.9%	[A]
Uranium 238+D	1.52E-02	1.76E-02		5.32E+02		9.43E+03						4.12E-10	7.38E-09	0.5%	[A]
												1.49E-08	2.64E-07	16.7%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	2.56E+01	1.48E+02	100.0%		
Excess Lifetime Cancer Risk: Combined Exposure (d)				2.87E-05	4.74E-04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)				7.50E-08	1.58E-06	100.0%

Table M.168. Deterministic risk estimates to support comparison with results of Monte Carlo analysis risk characterization for produce: adults – ingestion exposure (future land use – residential) – Area S4–F1–R

Chemical	MLB Concentration from Mean Concentration in Soil	RMB Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Nonca. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Nonca. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Arsenic	8.0E-01	8.6E-01	1.2E-04	1.5E-05	6.0E-04	2.5E-04	4.0E-01	2.0E+00	1.4%	skin; keratosis, hyperpigmentation	3	2.7E-05	4.5E-04	95.0%	[A]
Beryllium	4.3E-03	6.0E-03	6.5E-07	8.4E-08	4.2E-06	1.8E-06	1.3E-04	8.4E-04	0.0%	no observed effects	100	3.6E-07	7.8E-06	1.6%	[D2]
Cadmium	6.5E+00	1.0E+01	1.0E-03	1.2E-04	7.2E-03	3.1E-03	1.0E+00	7.2E+00	5.0%	kidney; proteinuria	10				
Chromium (III)	8.2E-01	8.7E-01	1.2E-04	1.6E-05	6.1E-04	2.6E-04	1.2E-04	6.1E-04	0.0%	no observed effects	100				
Lead	1.0E+00	1.3E+00	1.5E-04	2.0E-05	9.4E-04	4.0E-04				CNS, blood	--				[D2]
Manganese	4.5E+02	5.2E+02	6.9E-02	8.9E-03	3.7E-01	1.5E-01	4.9E-01	2.6E+00	1.8%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	4.6E+01	5.6E+01	7.0E-03	9.0E-04	4.0E-02	1.7E-02	2.3E+01	1.3E+02	91.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.3E+00	5.8E+00	6.6E-04	8.6E-05	4.0E-03	1.7E-03	3.3E-02	2.0E-01	0.1%	dec. body and organ weight	300				
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1254	1.6E-03	2.8E-03	2.4E-07	3.1E-08	1.9E-06	8.4E-07				--	--	2.4E-07	6.5E-06	1.4%	[B2]
Aroclor-1260	1.4E-03	2.1E-03	2.2E-07	2.8E-08	1.5E-06	6.5E-07				--	--	2.2E-07	5.0E-06	1.1%	[B2]
Benzo(a)anthracene	2.0E-03	2.5E-03	3.0E-07	3.9E-08	1.7E-06	7.6E-07	1.0E-05	5.9E-05	0.0%	--	--	2.9E-08	5.5E-07	0.1%	[B2]
Benzo(a)pyrene	1.0E-03	1.3E-03	1.6E-07	2.1E-08	9.2E-07	3.9E-07	5.4E-06	3.0E-05	0.0%	--	--	1.5E-07	2.8E-06	0.6%	[B2]
Benzo(b)fluoranthene	1.4E-03	1.8E-03	2.1E-07	2.8E-08	1.2E-06	5.4E-07	7.3E-06	4.2E-05	0.0%	--	--	2.0E-08	4.0E-07	0.1%	[B2]
Benzo(k)fluoranthene	9.6E-04	1.3E-03	1.4E-07	1.8E-08	9.0E-07	3.8E-07	4.9E-06	3.0E-05	0.0%	--	--	1.3E-08	2.8E-07	0.1%	[B2]
Chrysene	2.8E-03	3.6E-03	4.3E-07	5.5E-08	2.5E-06	1.0E-06	1.4E-05	8.4E-05	0.0%	--	--	4.0E-09	7.9E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	1.0E-04	1.4E-04	1.5E-08	1.9E-09	9.8E-08	4.2E-08	5.1E-07	3.2E-06	0.0%	--	--	1.4E-09	3.0E-08	0.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.5E+01	1.4E+02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.8E-05	4.7E-04	100.0%	

This characterization was conducted to support comparison with the results of Monte Carlo simulation. COCs were removed from the deterministic analysis if corresponding PDFs for foodchain transfer are not available.

Table M.169. Risk characterization for produce: children – ingestion exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	1.15E-02	1.30E-02	3.90E-06	1.67E-07	1.89E-05	2.43E-06	9.76E-03	4.73E-02	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	8.04E-01	8.60E-01	2.74E-04	1.18E-05	1.29E-03	1.66E-04	9.14E-01	4.16E+00	1.4%	skin; keratosis, hyperpigmentation	3	2.06E-05	2.80E-04	95.0%	[A]
Barium	2.28E+00	2.95E+00	7.77E-04	3.33E-05	4.27E-03	5.49E-04	1.11E-02	6.10E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	4.31E-03	6.06E-03	1.47E-06	6.30E-08	8.79E-06	1.13E-06	2.94E-04	1.76E-03	0.0%	no observed effects	100	2.71E-07	4.86E-06	1.6%	[B2]
Cadmium	6.58E+00	1.04E+01	2.24E-03	9.60E-05	1.51E-02	1.95E-03	2.24E+00	1.51E+01	4.9%	kidney; proteinuria	10				
Chromium (III)	8.24E-01	8.78E-01	2.81E-04	1.20E-05	1.27E-03	1.64E-04	2.81E-04	1.27E-03	0.0%	no observed effects	100				
Copper	9.19E+00	1.31E+01	3.13E-03	1.34E-04	1.90E-02	2.44E-03	8.47E-02	5.13E-01	0.2%	Gastrointestinal system; irritation	--				[D]
Lead	1.03E+00	1.36E+00	3.53E-04	1.51E-05	1.96E-03	2.53E-04				CNS, blood	--				[D2]
Manganese	4.57E+02	5.29E+02	1.56E-01	6.68E-03	7.67E-01	9.86E-02	1.11E+00	5.48E+00	1.8%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	4.63E+01	5.80E+01	1.58E-02	6.76E-04	8.40E-02	1.08E-02	5.26E+01	2.80E+02	91.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.38E+00	5.84E+00	1.49E-03	6.40E-05	8.46E-03	1.09E-03	7.47E-02	4.23E-01	0.1%	dec. body and organ weight	300				
Selenium	7.39E-01	7.97E-01	2.52E-04	1.08E-05	1.15E-03	1.48E-04	5.04E-02	2.31E-01	0.1%	whole body; clinical selenosis	3				[D]
Silver	2.48E+00	3.59E+00	8.47E-04	3.63E-05	5.20E-03	6.69E-04	1.69E-01	1.04E+00	0.3%	skin; argyria	3				[D]
Zinc	4.10E+01	4.63E+01	1.40E-02	5.99E-04	6.71E-02	8.62E-03	4.66E-02	2.24E-01	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1254	1.60E-03	2.82E-03	5.47E-07	2.34E-08	4.09E-06	5.26E-07				--	--	1.80E-07	4.05E-06	1.4%	[B2]
Aroclor-1260	1.47E-03	2.19E-03	5.03E-07	2.15E-08	3.17E-06	4.07E-07				--	--	1.66E-07	3.14E-06	1.1%	[B2]
Benzo(a)anthracene	2.02E-03	2.54E-03	6.90E-07	2.96E-08	3.68E-06	4.73E-07	2.30E-05	1.23E-04	0.0%	--	--	2.16E-08	3.45E-07	0.1%	[B2]
Benzo(a)pyrene	1.07E-03	1.32E-03	3.65E-07	1.56E-08	1.92E-06	2.47E-07	1.22E-05	6.39E-05	0.0%	--	--	1.14E-07	1.80E-06	0.6%	[B2]
Benzo(b)fluoranthene	1.44E-03	1.83E-03	4.91E-07	2.10E-08	2.66E-06	3.42E-07	1.64E-05	8.86E-05	0.0%	--	--	1.53E-08	2.50E-07	0.1%	[B2]
Benzo(k)fluoranthene	9.65E-04	1.30E-03	3.29E-07	1.41E-08	1.88E-06	2.42E-07	1.10E-05	6.28E-05	0.0%	--	--	1.03E-08	1.77E-07	0.1%	[B2]
Chrysene	2.84E-03	3.64E-03	9.69E-07	4.15E-08	5.28E-06	6.79E-07	3.23E-05	1.76E-04	0.0%	--	--	3.03E-09	4.99E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.0%	--	--	0.00E+00	0.00E+00	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	1.00E-04	1.40E-04	3.43E-08	1.47E-09	2.03E-07	2.61E-08	1.14E-06	6.78E-06	0.0%	--	--	1.07E-09	1.91E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	4.39E-02	5.77E-02		4.10E+02		7.15E+03						1.15E-08	2.00E-07	54.8%	[A]
Cobalt 60	5.57E-04	1.10E-03		5.20E+00		1.37E+02						7.81E-11	2.05E-09	0.6%	[A]
Neptunium 237+D	9.72E-04	2.35E-03		9.07E+00		2.91E+02						2.00E-09	6.39E-08	17.5%	[A]
Uranium 234	1.56E-02	1.83E-02		1.46E+02		2.27E+03						2.34E-09	3.63E-08	9.9%	[A]
Uranium 235+D	7.34E-04	8.62E-04		6.85E+00		1.07E+02						1.10E-10	1.71E-09	0.5%	[A]
Uranium 238+D	1.52E-02	1.76E-02		1.42E+02		2.18E+03						3.97E-09	6.10E-08	16.7%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	5.73E+01	3.07E+02	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)		2.15E-05	2.95E-04 100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)		2.00E-08	3.65E-07 100.0%

Table M.170. Deterministic risk estimates to support comparison with results of Monte Carlo analysis
risk characterization for produce: children – ingestion exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration from Mean Concentration (mg/kg)	RME Concentration from UCL Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Arsenic	8.0E-01	8.6E-01	2.7E-04	1.1E-05	1.2E-03	1.6E-04	9.1E-01	4.1E+00	1.4%	skin; keratosis, hyperpigmentation	3	2.0E-05	2.8E-04	95.0%	[A]
Beryllium	4.3E-03	6.0E-03	1.4E-06	6.3E-08	8.7E-06	1.1E-06	2.9E-04	1.7E-03	0.0%	no observed effects	100	2.7E-07	4.8E-06	1.6%	[B2]
Cadmium	6.5E+00	1.0E+01	2.2E-03	9.6E-05	1.5E-02	1.9E-03	2.2E+00	1.5E+01	5.0%	kidney; proteinuria	10				
Chromium (III)	8.2E-01	8.7E-01	2.8E-04	1.2E-05	1.2E-03	1.6E-04	2.8E-04	1.2E-03	0.0%	no observed effects	100				
Lead	1.0E+00	1.3E+00	3.5E-04	1.5E-05	1.9E-03	2.5E-04				CNS, blood	--				[B2]
Manganese	4.5E+02	5.2E+02	1.5E-01	6.6E-03	7.6E-01	9.8E-02	1.1E+00	5.4E+00	1.8%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	4.6E+01	5.8E+01	1.5E-02	6.7E-04	8.4E-02	1.0E-02	5.2E+01	2.8E+02	91.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.3E+00	5.8E+00	1.4E-03	6.4E-05	8.4E-03	1.0E-03	7.4E-02	4.2E-01	0.1%	dec. body and organ weight	300				
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1254	1.6E-03	2.8E-03	5.4E-07	2.3E-08	4.0E-06	5.2E-07				--	--	1.8E-07	4.0E-06	1.4%	[B2]
Aroclor-1260	1.4E-03	2.1E-03	5.0E-07	2.1E-08	3.1E-06	4.0E-07				--	--	1.6E-07	3.1E-06	1.1%	[B2]
Benzo(a)anthracene	2.0E-03	2.5E-03	6.9E-07	2.9E-08	3.6E-06	4.7E-07	2.3E-05	1.2E-04	0.0%	--	--	2.1E-08	3.4E-07	0.1%	[B2]
Benzo(a)pyrene	1.0E-03	1.3E-03	3.6E-07	1.5E-08	1.9E-06	2.4E-07	1.2E-05	6.3E-05	0.0%	--	--	1.1E-07	1.8E-06	0.6%	[B2]
Benzo(b)fluoranthene	1.4E-03	1.8E-03	4.9E-07	2.1E-08	2.6E-06	3.4E-07	1.6E-05	8.8E-05	0.0%	--	--	1.5E-08	2.5E-07	0.1%	[B2]
Benzo(k)fluoranthene	9.6E-04	1.3E-03	3.2E-07	1.4E-08	1.8E-06	2.4E-07	1.1E-05	6.2E-05	0.0%	--	--	1.0E-08	1.7E-07	0.1%	[B2]
Chrysene	2.8E-03	3.6E-03	9.6E-07	4.1E-08	5.2E-06	6.7E-07	3.2E-05	1.7E-04	0.0%	--	--	3.0E-09	4.9E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	1.0E-04	1.4E-04	3.4E-08	1.4E-09	2.0E-07	2.6E-08	1.1E-06	6.7E-06	0.0%	--	--	1.0E-09	1.9E-08	0.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.6E+01	3.0E+02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.1E-05	2.9E-04	100.0%	

This characterization was conducted to support comparison with the results of Monte Carlo simulation. COCs were removed from the deterministic analysis if corresponding PDFs for foodchain transfer are not available.

Table M.171. Risk characterization for fish: adults – ingestion exposure (future land use – residential) – Area S4–F1–R

Chemical	MLE Concentration in Fish Tissue	RME Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates Hq Noncarc. Effects (CDI/RfD) (MLE)	Hq Noncarc. Effects (CDI/RfD) (RME)	Hq Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS															
Mercury	0.76	0.78	2.3E-06	3.0E-07	2.8E-05	1.2E-05	7.9E-03	9.6E-02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	6.4E-07	8.2E-08	8.2E-06	3.5E-06						6.3E-07	2.7E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.1E-06	1.4E-07	1.4E-05	6.1E-06						1.1E-06	4.7E-05	63.7%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							7.9E-03	9.6E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.7E-06	7.4E-05	100.0%	

Table M.172. Risk characterization for fish: children – ingestion exposure (future land use – residential) – Area S4–F1–R

Chemical	MLB Concentration in Fish Tissue	RMB Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	UPA WOE
INORGANICS															
Mercury	0.76	0.78	4.16E-06	1.78E-07	6.04E-05	7.76E-06	1.39E-02	2.01E-01	100.0%	*oral*-CNS; neurotoxicity. *inhal.*-kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	1.12E-06	4.81E-08	1.72E-05	2.21E-06						3.70E-07	1.70E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.97E-06	8.44E-08	3.01E-05	3.88E-06						6.50E-07	2.98E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.39E-02	2.01E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-06	4.68E-05	100.0%	

Table M.173. Risk characterization for groundwater: adults – ingestion exposure (future land use – commercial) – Area S4–F2–C

Chemical	Chronic Daily Intake (CDI) MLE Concentration (µg/L)	RME Concentration (µg/L)	CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	2.72E-05	3.49E-06	5.45E-05	1.95E-05	9.05E-02	1.82E-01	1.8%	skin; keratosis, hyperpigmentation	3	6.1E-06	3.4E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	2.71E-03	3.48E-04	4.75E-03	1.70E-03	3.87E-02	6.78E-02	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	1.29E-05	1.66E-06	2.50E-05	8.94E-06	2.58E-03	5.01E-03	0.1%	no observed effects	100	7.1E-06	3.8E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	2.26E-04	2.91E-05	4.01E-04	1.43E-04	2.26E-04	4.01E-04	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	1.14E-04	1.47E-05	3.17E-03	1.13E-03	3.09E-03	8.56E-02	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	1.83E-04	2.36E-05	3.46E-04	1.23E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	2.56E-02	3.29E-03	4.32E-02	1.54E-02	5.12E+00	8.64E+00	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	9.49E-05	1.22E-05	2.14E-04	7.64E-05	3.16E-01	7.13E-01	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	3.29E-04	4.23E-05	6.29E-04	2.25E-04	1.65E-02	3.14E-02	0.3%	dec. body and organ weight	300				[D]
Vanadium	3.91E+01	4.90E+01	2.68E-04	3.44E-05	4.80E-04	1.71E-04	3.82E-02	6.85E-02	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	2.46E-03	3.16E-04	6.67E-03	2.38E-03	2.46E-02	6.67E-02	0.7%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	4.78E-04	6.14E-05	1.32E-03	4.70E-04	7.96E-03	2.20E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.6E-07	3.5E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		5.14E+03		2.54E+04						5.14E-07	2.54E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		1.95E+04		1.14E+05						3.18E-07	1.82E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		1.61E+04		9.41E+04						4.51E-07	2.64E-06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI):							3.66E+00	9.89E+00	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												1.37E-05	7.61E-05	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												1.28E-06	7.00E-06	100.0%	

SEGMENT 5 RISK CHARACTERIZATION TABLES

Table M.174. Risk characterization summary for EFPC Segment 5: RME risk estimates for current land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards:													
Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards:													
Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	2.81E−01 B	1.48E−01 B	4.52E−06 W	7.93E−06 W	5.01E−08 B	1.26E−07 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.73E−02 B	1.61E−02 B	1.47E−06 W	4.54E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	1.48E−03 B	1.04E−03 B	3.10E−09 B	7.22E−09 B	4.89E−10 B	1.63E−09 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.28E−03 B	1.18E−03 B	3.01E−08 B	9.31E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	9.90E−05 B	9.19E−05 B	1.26E−08 B	3.89E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards:													
Hazard Index (HI): Combined Exposure		3.0E−01 B	1.7E−01 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				6E−06 W	1E−05 W					NA	NA		
Radiological Hazards:													
Excess Lifetime Cancer Risk: Combined Exposure						5E−08 B	1E−07 B					NA	NA

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.175. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S5–C1–O adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.22E–02	1.48E–01	1.93E–07	7.93E–06
Dermal Contact	4.42E–04	1.61E–02	2.99E–08	4.54E–06
SURFACE WATER				
Ingestion	6.90E–05	1.04E–03	1.77E–10	7.22E–09
Dermal Contact	7.27E–05	1.18E–03	1.68E–09	9.31E–08
SEDIMENT				
Dermal Contact	1.94E–06	9.19E–05	2.29E–10	3.89E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.29E–09	1.26E–07
SURFACE WATER				
Ingestion			3.92E–11	1.63E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.3E–02	1.7E–01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	1E–05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			3E–09	1E–07

Table M.176. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S5–C1–O children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	2.11E–02	2.81E–01	1.12E–07	4.52E–06
Dermal Contact	4.55E–04	1.73E–02	1.03E–08	1.47E–06
SURFACE WATER				
Ingestion	9.55E–05	1.48E–03	8.16E–11	3.10E–09
Dermal Contact	7.49E–05	1.28E–03	5.77E–10	3.01E–08
SEDIMENT				
Dermal Contact	2.00E–06	9.90E–05	7.87E–11	1.26E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.37E–09	5.01E–08
SURFACE WATER				
Ingestion			1.31E–11	4.89E–10
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.2E–02	3.0E–01		
Excess Lifetime Cancer Risk: Combined Exposure			1E–07	6E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1E–09	5E–08

Table M.177. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Area S5–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern/ Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	0.67	1.01	5.43E-08	6.98E-09	5.92E-07	2.54E-07	1.36E-04	1.48E-03	1.0%	whole body, blood; inc. mortality	1000				
Arsenic	8.70	9.42	5.45E-07	7.01E-08	5.53E-06	2.37E-06	1.82E-03	1.84E-02	12.5%	skin; keratosis, hyperpigmentation	3	1.23E-07	4.15E-06	52.3%	[A]
Barium	104.30	119.50	6.53E-06	8.40E-07	7.02E-05	3.01E-05	9.33E-05	1.00E-03	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Cadmium	4.27	7.01	2.67E-07	3.44E-08	4.12E-06	1.76E-06	2.67E-04	4.12E-03	2.8%	kidney; proteinuria	10				
Chromium (III)	71.11	75.19	4.45E-06	5.73E-07	4.40E-05	1.89E-05	4.45E-06	4.40E-05	0.0%	no observed effects	100				
Copper	87.90	147.40	5.50E-06	7.08E-07	8.65E-05	3.71E-05	1.49E-04	2.34E-03	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	58.83	72.20	3.68E-06	4.74E-07	4.24E-05	1.82E-05				CNS, blood	--				[B2]
Manganese	1054.00	1248.00	6.60E-05	8.49E-06	7.33E-04	3.14E-04	4.71E-04	5.23E-03	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	43.50	57.59	2.72E-06	3.50E-07	3.38E-05	1.45E-05	9.08E-03	1.13E-01	76.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	35.98	50.54	2.25E-06	2.90E-07	2.97E-05	1.27E-05	1.13E-04	1.48E-03	1.0%	dec. body and organ weight	300				
Selenium	9.66	10.86	6.05E-07	7.78E-08	6.38E-06	2.73E-06	1.21E-04	1.28E-03	0.9%	whole body; clinical selenosis	3				[D]
Silver	3.87	6.48	2.42E-07	3.11E-08	3.80E-06	1.63E-06	4.84E-05	7.60E-04	0.5%	skin; argyria	3				[D]
Zinc	81.86	95.78	5.13E-06	6.59E-07	5.62E-05	2.41E-05	1.71E-05	1.87E-04	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.22	0.37	1.38E-08	1.77E-09	2.17E-07	9.31E-08				--	--	1.36E-08	7.17E-07	9.0%	[B2]
Benzo(a)anthracene	0.46	0.82	2.86E-08	3.68E-09	4.81E-07	2.06E-07	9.55E-07	1.60E-05	0.0%	--	--	2.69E-09	1.51E-07	1.9%	[B2]
Benzo(a)pyrene	0.50	0.94	3.12E-08	4.01E-09	5.52E-07	2.37E-07	1.04E-06	1.84E-05	0.0%	--	--	2.92E-08	1.73E-06	21.8%	[B2]
Benzo(b)fluoranthene	0.98	1.60	6.14E-08	7.89E-09	1.06E-06	4.53E-07	2.05E-06	3.52E-05	0.0%	--	--	5.76E-09	3.31E-07	4.2%	[B2]
Benzo(k)fluoranthene	0.98	1.60	6.14E-08	7.89E-09	1.06E-06	4.53E-07	2.05E-06	3.52E-05	0.0%	--	--	5.76E-09	3.31E-07	4.2%	[B2]
Chrysene	0.59	1.10	3.71E-08	4.77E-09	6.46E-07	2.77E-07	1.24E-06	2.15E-05	0.0%	--	--	3.48E-10	2.02E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	1.21E-08	1.55E-09	1.24E-07	5.33E-08	4.02E-07	4.15E-06	0.0%	--	--	1.13E-08	3.85E-07	4.9%	[B2]
Indeno(1,2,3-cd)pyrene	0.36	0.64	2.24E-08	2.88E-09	3.76E-07	1.61E-07	7.46E-07	1.25E-05	0.0%	--	--	2.11E-09	1.18E-07	1.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.72	0.99		1.03E+01		4.45E+02						2.89E-10	1.24E-08	9.9%	[A]
Cobalt 60		0.01				6.62E+00							9.94E-11	0.1%	[A]
Neptunium 237+D	0.02	0.06		3.12E-01		2.70E+01						6.87E-11	5.94E-09	4.7%	[A]
Uranium 234	4.45	5.29		6.41E+01		2.38E+03						1.03E-09	3.81E-08	30.4%	[A]
Uranium 235+D	0.20	0.24		2.92E+00		1.09E+02						4.68E-11	1.74E-09	1.4%	[A]
Uranium 238+D	4.61	5.33		6.63E+01		2.40E+03						1.86E-09	6.72E-08	53.5%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.22E-02	1.48E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.93E-07	7.93E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.29E-09	1.28E-07	100.0%	

Table M.178. Risk characterization for soils: children – ingestion exposure (current land use – open) – Area S5–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Care. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Care. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Care. Risk	RfDA WOE
INORGANICS (mg/kg)															
Antimony	0.87	1.01	9.3E-08	4.0E-09	1.1E-06	1.4E-07	2.3E-04	2.8E-03	1.0%	whole body; blood; inc. mortality	1000				
Arsenic	8.70	9.42	9.4E-07	4.0E-08	1.0E-05	1.3E-06	3.1E-03	3.5E-02	12.5%	skin; keratosis, hyperpigmentation	3	7.0E-08	2.3E-06	52.3%	[A]
Barium	104.30	119.50	1.1E-05	4.8E-07	1.3E-04	1.7E-05	1.6E-04	1.9E-03	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Cadmium	4.27	7.01	4.6E-07	1.9E-08	7.8E-06	1.0E-06	4.6E-04	7.8E-03	2.8%	kidney; proteinuria	10				
Chromium (III)	71.11	75.19	7.7E-06	3.3E-07	8.3E-05	1.0E-05	7.7E-06	8.3E-05	0.0%	no observed effects	100				
Copper	87.90	147.40	9.5E-06	4.0E-07	1.6E-04	2.1E-05	2.5E-04	4.4E-03	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	58.83	72.20	6.3E-06	2.7E-07	8.0E-05	1.0E-05				CNS, blood	--				[B2]
Manganese	1054.00	1248.00	1.1E-04	4.8E-06	1.3E-03	1.7E-04	8.1E-04	9.9E-03	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	43.50	57.59	4.7E-06	2.0E-07	6.4E-05	8.2E-06	1.5E-02	2.1E-01	76.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	35.98	50.54	3.9E-06	1.6E-07	5.6E-05	7.2E-06	1.9E-04	2.8E-03	1.0%	dec. body and organ weight	300				
Selenium	9.66	10.86	1.0E-06	4.4E-08	1.2E-05	1.5E-06	2.0E-04	2.4E-03	0.9%	whole body; clinical selenosis	3				[D]
Silver	3.87	6.48	4.1E-07	1.7E-08	7.2E-06	9.2E-07	8.3E-05	1.4E-03	0.5%	skin; argyria	3				[D]
Zinc	81.86	95.78	8.8E-06	3.8E-07	1.0E-04	1.3E-05	2.9E-05	3.5E-04	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.22	0.37	2.3E-08	1.0E-09	4.1E-07	5.3E-08				--	--	7.8E-09	4.0E-07	9.0%	[B2]
Benzo(a)anthracene	0.46	0.82	4.9E-08	2.1E-09	9.1E-07	1.1E-07	1.6E-06	3.0E-05	0.0%	--	--	1.5E-09	8.5E-08	1.9%	[B2]
Benzo(a)pyrene	0.50	0.94	5.3E-08	2.3E-09	1.0E-06	1.3E-07	1.8E-06	3.5E-05	0.0%	--	--	1.6E-08	9.8E-07	21.8%	[B2]
Benzo(b)fluoranthene	0.98	1.80	1.0E-07	4.5E-09	2.0E-06	2.5E-07	3.5E-06	6.6E-05	0.0%	--	--	3.3E-09	1.8E-07	4.2%	[B2]
Benzo(k)fluoranthene	0.98	1.80	1.0E-07	4.5E-09	2.0E-06	2.5E-07	3.5E-06	6.6E-05	0.0%	--	--	3.3E-09	1.8E-07	4.2%	[B2]
Chrysene	0.59	1.10	6.4E-08	2.7E-09	1.2E-06	1.5E-07	2.1E-06	4.0E-05	0.0%	--	--	2.0E-10	1.1E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	2.0E-08	8.9E-10	2.3E-07	3.0E-08	6.9E-07	7.8E-06	0.0%	--	--	6.5E-09	2.2E-07	4.9%	[B2]
Indeno(1,2,3-cd)pyrene	0.36	0.64	3.8E-08	1.6E-09	7.1E-07	9.1E-08	1.2E-06	2.3E-05	0.0%	--	--	1.2E-09	6.7E-08	1.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.72	0.99		4.3E+00		1.7E+02						1.2E-10	4.9E-09	9.9%	[A]
Cobalt 60		0.01				2.6E+00							3.9E-11	0.1%	[A]
Neptunium 237+D	0.02	0.06		1.3E-01		1.0E+01						2.8E-11	2.3E-09	4.7%	[A]
Uranium 234	4.45	5.29		2.6E+01		9.5E+02						4.2E-10	1.5E-08	30.4%	[A]
Uranium 235+D	0.20	0.24		1.2E+00		4.3E+01						1.9E-11	6.9E-10	1.4%	[A]
Uranium 238+D	4.61	5.33		2.7E+01		9.5E+02						7.7E-10	2.6E-08	53.5%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.1E-02	2.8E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.1E-07	4.5E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.3E-09	3.0E-08	100.0%	

Table M.179. Risk characterization for soils: adults – dermal exposure (current land use – open) – Area S5–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.87	1.01	1.9E-09	2.5E-10	6.4E-08	2.7E-08	4.8E-06	1.6E-04	1.0%	whole body, blood; inc. mortality	1000				
Arsenic	6.70	9.42	1.9E-08	2.5E-09	5.9E-07	2.5E-07	6.5E-05	1.9E-03	12.4%	skin; keratosis, hyperpigmentation	3	4.4E-09	4.4E-07	9.9%	[A]
Barium	104.30	119.50	2.3E-07	3.0E-08	7.5E-06	3.2E-06	3.3E-06	1.0E-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Cadmium	4.27	7.01	9.6E-09	1.2E-09	4.4E-07	1.9E-07	9.6E-06	4.4E-04	2.8%	kidney; proteinuria	10				
Chromium (III)	71.11	75.19	1.6E-07	2.0E-08	4.7E-06	2.0E-06	1.6E-07	4.7E-06	0.0%	no observed effects	100				
Copper	87.90	147.40	1.9E-07	2.5E-08	9.3E-06	4.0E-06	5.3E-06	2.5E-04	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	58.83	72.20	1.3E-07	1.7E-08	4.5E-06	1.9E-06				CNS, blood	--				[B2]
Manganese	1054.00	1248.00	2.3E-06	3.0E-07	7.9E-05	3.3E-05	1.7E-05	5.6E-04	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	43.50	57.59	9.8E-08	1.2E-08	3.6E-06	1.5E-06	3.2E-04	1.2E-02	75.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	35.98	50.54	8.1E-08	1.0E-08	3.2E-06	1.3E-06	4.0E-06	1.6E-04	1.0%	dec. body and organ weight	300				
Selenium	9.66	10.86	2.1E-08	2.8E-09	6.8E-07	2.9E-07	4.3E-06	1.3E-04	0.9%	whole body; clinical selenosis	3				[D]
Silver	3.87	6.48	8.7E-09	1.1E-09	4.1E-07	1.7E-07	1.7E-06	8.2E-05	0.5%	skin; argyria	3				[D]
Zinc	81.86	95.78	1.8E-07	2.3E-08	6.0E-06	2.6E-06	6.1E-07	2.0E-05	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.22	0.37	4.9E-09	6.3E-10	2.3E-07	1.0E-07				--	--	4.9E-09	7.7E-07	17.1%	[B2]
Benzo(a)anthracene	0.46	0.82	1.0E-08	1.3E-09	5.2E-07	2.2E-07	3.4E-07	1.7E-05	0.1%	--	--	9.6E-10	1.6E-07	3.6%	[B2]
Benzo(a)pyrene	0.50	0.94	1.1E-08	1.4E-09	5.9E-07	2.5E-07	3.7E-07	1.9E-05	0.1%	--	--	1.0E-08	1.8E-06	41.1%	[B2]
Benzo(b)fluoranthene	0.98	1.80	2.2E-08	2.8E-09	1.1E-06	4.9E-07	7.3E-07	3.8E-05	0.2%	--	--	2.0E-09	3.5E-07	7.9%	[B2]
Benzo(k)fluoranthene	0.98	1.80	2.2E-08	2.8E-09	1.1E-06	4.9E-07	7.3E-07	3.8E-05	0.2%	--	--	2.0E-09	3.5E-07	7.9%	[B2]
Chrysene	0.59	1.10	1.3E-08	1.7E-09	6.9E-07	2.9E-07	4.4E-07	2.3E-05	0.1%	--	--	1.2E-10	2.1E-08	0.5%	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	4.3E-09	5.5E-10	1.3E-07	5.7E-08	1.4E-07	4.4E-06	0.0%	--	--	4.0E-09	4.2E-07	9.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.36	0.64	8.0E-09	1.0E-09	4.0E-07	1.7E-07	2.6E-07	1.3E-05	0.1%	--	--	7.5E-10	1.2E-07	2.8%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.4E-04	1.6E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.9E-08	4.5E-06	100.0%	

Table M.180. Risk characterization for soils: children – dermal exposure (current land use – open) – Area S5–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	0.87	1.01	2.0E-09	8.6E-11	6.8E-08	8.8E-09	5.0E-06	1.7E-04	1.0%	whole body, blood; inc. mortality	1000				
Arsenic	8.70	9.42	2.0E-08	8.6E-10	6.4E-07	8.2E-08	6.7E-05	2.1E-03	12.4%	skin; keratosis, hyperpigmentation	3	1.5E-09	1.4E-07	9.9%	[A]
Barium	104.30	119.50	2.4E-07	1.0E-08	8.1E-06	1.0E-06	3.4E-06	1.1E-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Cadmium	4.27	7.01	9.9E-09	4.2E-10	4.7E-07	6.1E-08	9.9E-06	4.7E-04	2.8%	kidney; proteinuria	10				
Chromium (III)	71.11	75.19	1.6E-07	7.0E-09	5.1E-06	6.6E-07	1.6E-07	5.1E-06	0.0%	no observed effects	100				
Copper	87.90	147.40	2.0E-07	8.7E-09	1.0E-05	1.2E-06	5.5E-06	2.7E-04	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	58.83	72.20	1.3E-07	5.8E-09	4.9E-06	6.3E-07				CNS, blood	--				[B2]
Manganese	1054.00	1248.00	2.4E-06	1.0E-07	8.5E-05	1.1E-05	1.7E-05	6.0E-04	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	43.50	57.59	1.0E-07	4.3E-09	3.9E-08	5.0E-07	3.3E-04	1.3E-02	75.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	35.98	50.54	8.3E-08	3.5E-09	3.4E-06	4.4E-07	4.1E-06	1.7E-04	1.0%	dec. body and organ weight	300				
Selenium	9.66	10.86	2.2E-08	9.6E-10	7.4E-07	9.5E-08	4.4E-06	1.4E-04	0.9%	whole body; clinical selenosis	3				[D]
Silver	3.87	6.48	8.9E-09	3.8E-10	4.4E-07	5.6E-08	1.8E-06	8.8E-05	0.5%	skin; argyria	3				[D]
Zinc	81.86	95.78	1.9E-07	8.1E-09	6.5E-06	8.4E-07	6.3E-07	2.1E-05	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.22	0.37	5.1E-09	2.1E-10	2.5E-07	3.2E-08				--	--	1.6E-09	2.5E-07	17.1%	[B2]
Benzo(a)anthracene	0.46	0.82	1.0E-08	4.5E-10	5.6E-07	7.2E-08	3.5E-07	1.8E-05	0.1%	--	--	3.3E-10	5.2E-08	3.6%	[B2]
Benzo(a)pyrene	0.50	0.94	1.1E-08	4.9E-10	6.4E-07	8.2E-08	3.8E-07	2.1E-05	0.1%	--	--	3.6E-09	6.0E-07	41.1%	[B2]
Benzo(b)fluoranthene	0.98	1.80	2.2E-08	9.7E-10	1.2E-06	1.5E-07	7.5E-07	4.1E-05	0.2%	--	--	7.1E-10	1.1E-07	7.9%	[B2]
Benzo(k)fluoranthene	0.98	1.80	2.2E-08	9.7E-10	1.2E-06	1.5E-07	7.5E-07	4.1E-05	0.2%	--	--	7.1E-10	1.1E-07	7.9%	[B2]
Chrysene	0.59	1.10	1.3E-08	5.9E-10	7.5E-07	9.6E-08	4.5E-07	2.5E-05	0.1%	--	--	4.3E-11	7.0E-09	0.5%	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	4.4E-09	1.9E-10	1.4E-07	1.8E-08	1.4E-07	4.8E-06	0.0%	--	--	1.4E-09	1.3E-07	9.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.36	0.64	8.3E-09	3.5E-10	4.3E-07	5.6E-08	2.7E-07	1.4E-05	0.1%	--	--	2.6E-10	4.1E-08	2.8%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.5E-04	1.7E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-08	1.4E-06	100.0%	

Table M.181. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – open) – Area S5–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	7.75E-08	9.96E-09	1.03E-06	4.40E-07	1.11E-06	1.47E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.60E+00	1.32E+01	7.63E-09	9.81E-10	1.29E-07	5.54E-08	7.63E-09	1.29E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.81E-08	2.33E-09	2.14E-07	9.18E-08	4.89E-07	5.79E-06	0.6%	Gastrointestinal system; irritation	--				
Manganese (water)	2.69E+02	4.13E+02	2.63E-07	3.38E-08	4.04E-06	1.73E-06	5.26E-05	8.08E-04	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				(D)
Mercury	2.68E+00	3.93E+00	2.62E-09	3.37E-10	3.85E-08	1.65E-08	8.72E-06	1.28E-04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				(D)
Vanadium	8.40E+00	1.41E+01	8.22E-09	1.06E-09	1.38E-07	5.91E-08	1.17E-06	1.97E-05	1.9%	no observed effects	100				(D)
Zinc	6.87E+01	9.09E+01	6.72E-08	8.65E-09	8.89E-07	3.81E-07	2.24E-07	2.96E-06	0.3%	blood; anemia	3				(D)
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	6.08E-09	7.82E-10	7.54E-08	3.23E-08	6.08E-08	7.54E-07	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				(D)
Aldrin	2.32E-02	2.50E-02	2.27E-11	2.92E-12	2.45E-10	1.05E-10	7.58E-07	8.15E-06	0.8%	liver; lesions, toxicity	1000	4.97E-11	1.78E-09	24.7%	(B2)
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	9.30E-09	1.20E-09	1.36E-07	5.81E-08	4.65E-07	6.78E-06	0.7%	liver; weight inc.	1000	1.67E-11	8.13E-10	11.3%	(B2)
Chloroform	4.07E+00	4.69E+00	3.98E-09	5.12E-10	4.59E-08	1.97E-08	3.98E-07	4.59E-06	0.4%	liver; lesions, fatty cyst formation	1000	3.12E-12	1.20E-10	1.7%	(B2)
4,4'-DDT	4.02E-02	4.94E-02	3.93E-11	5.06E-12	4.83E-10	2.07E-10	7.86E-08	9.67E-07	0.1%	liver; lesions	100	1.72E-12	7.04E-11	1.0%	(B2)
Dieldrin	3.87E-02	5.00E-02	3.79E-11	4.87E-12	4.89E-10	2.10E-10	7.58E-07	9.78E-06	0.9%	liver; lesions	100	7.80E-11	3.35E-09	46.5%	(B2)
Endrin	3.87E-02	5.00E-02	3.78E-11	4.87E-12	4.89E-10	2.10E-10	1.26E-07	1.63E-06	0.2%	CNS, liver; convulsions, lesions	100				(D)
gamma-BHC	1.62E-02	2.34E-02	1.76E-11	2.29E-12	2.29E-10	9.83E-11	5.93E-08	7.64E-07	0.1%	liver, kidney; toxicity	1000	2.97E-12	1.28E-10	1.8%	(C)
Heptachlor Epoxide	2.16E-02	2.50E-02	2.11E-11	2.72E-12	2.45E-10	1.05E-10	1.63E-06	1.88E-05	1.8%	liver; inc. relative weight	1000	2.47E-11	9.54E-10	13.2%	(B2)
Tetrachloroethylene	4.18E+00	4.84E+00	4.09E-09	5.26E-10	4.73E-08	2.03E-08	4.09E-07	4.73E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		8.27E-01		3.22E+01						1.32E-11	5.15E-10	31.6%	(A)
Uranium 238+D	4.13E+00	5.3E+00		9.29E-01		3.98E+01						2.60E-11	1.12E-09	68.4%	(A)
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.90E-05	1.04E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.77E-10	7.22E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.92E-11	1.65E-09	100.0%	

Table M.182. Risk characterization for surface water: children – ingestion exposure (swimming)(current land use – open) – Area S5–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Noncarc. Effects Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.07E-07	4.55E-09	1.47E-06	1.85E-07	1.53E-06	2.10E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.06E-08	4.52E-10	1.85E-07	2.37E-08	1.06E-08	1.85E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.50E-08	1.07E-09	3.06E-07	3.94E-08	6.77E-07	8.27E-06	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.64E-07	1.56E-08	5.77E-06	7.42E-07	7.27E-05	1.15E-03	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.62E-09	1.55E-10	5.50E-08	7.07E-09	1.21E-05	1.83E-04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.14E-08	4.87E-10	1.97E-07	2.53E-08	1.62E-06	2.82E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.30E-08	3.99E-09	1.27E-06	1.63E-07	3.10E-07	4.23E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.41E-09	3.60E-10	1.08E-07	1.38E-08	8.41E-08	1.08E-06	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.14E-11	1.35E-12	3.49E-10	4.49E-11	1.05E-06	1.16E-05	0.8%	liver; lesions, toxicity	1000	2.29E-11	7.64E-10	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.29E-08	5.51E-10	1.94E-07	2.49E-08	6.43E-07	9.68E-06	0.7%	liver; weight inc.	1000	7.72E-12	3.48E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.51E-09	2.36E-10	6.55E-08	8.42E-09	5.51E-07	6.55E-06	0.4%	liver; lesions, fatty cyst formation	1000	1.44E-12	5.14E-11	1.7%	[B2]
4,4'–DDT	4.02E-02	4.94E-02	5.44E-11	2.33E-12	6.91E-10	8.88E-11	1.09E-07	1.38E-06	0.1%	liver; lesions	100	7.93E-13	3.02E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.24E-11	2.25E-12	6.99E-10	8.99E-11	1.05E-06	1.40E-05	0.9%	liver; lesions	100	3.59E-11	1.44E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.24E-11	2.24E-12	6.99E-10	8.99E-11	1.75E-07	2.33E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.82E-02	2.34E-02	2.46E-11	1.05E-12	3.28E-10	4.21E-11	8.20E-08	1.09E-06	0.1%	liver, kidney; toxicity	1000	1.37E-12	5.47E-11	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.92E-11	1.25E-12	3.49E-10	4.49E-11	2.25E-06	2.69E-05	1.8%	liver; inc. relative weight	1000	1.14E-11	4.09E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.66E-09	2.42E-10	6.76E-08	8.70E-09	5.66E-07	6.76E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		2.76E-01		9.66E+00						4.41E-12	1.55E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		3.10E-01		1.19E+01						8.67E-12	3.35E-10	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.55E-05	1.46E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.16E-11	3.10E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E-11	4.89E-10	100.0%	

Table M.183. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – open) – Area S5–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA W(t)
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.00E-09	7.71E-10	1.04E-07	4.47E-08	8.57E-08	1.49E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.60E+00	1.32E+01	5.91E-10	7.60E-11	1.31E-08	5.62E-09	5.91E-10	1.31E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.40E-09	1.80E-10	2.18E-08	9.33E-09	3.79E-08	5.88E-07	0.0%	Gastrointestinal system; irritation	--				
Manganese (water)	2.69E+02	4.13E+02	2.04E-08	2.62E-09	4.10E-07	1.76E-07	4.07E-06	8.21E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.03E-10	2.61E-11	3.91E-09	1.68E-09	6.76E-07	1.30E-05	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.36E-10	8.18E-11	1.40E-08	6.03E-09	9.09E-08	2.00E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.21E-09	6.69E-10	9.01E-08	3.87E-08	1.74E-08	3.01E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.94E-09	3.78E-10	4.78E-08	2.05E-08	2.94E-08	4.78E-07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.76E-11	2.26E-12	2.46E-10	1.06E-10	5.87E-07	8.28E-06	0.7%	liver; lesions, toxicity	1000	3.85E-11	1.81E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.48E-07	1.91E-08	2.84E-06	1.22E-06	7.42E-06	1.42E-04	12.0%	liver; weight inc.	1000	2.67E-10	1.70E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.72E-08	2.21E-09	2.59E-07	1.11E-07	1.72E-06	2.59E-05	2.2%	liver; lesions, fattycyst formation	1000	1.35E-11	6.77E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.16E-09	1.05E-09	1.32E-07	5.65E-08	1.64E-05	2.64E-04	22.3%	liver; lesions	100	3.58E-10	1.92E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	5.87E-06	9.94E-05	8.4%	liver; lesions	100	6.04E-10	3.41E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	9.77E-07	1.66E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.62E-02	2.34E-02	1.21E-10	1.55E-11	2.04E-09	8.73E-10	4.02E-07	6.79E-06	0.6%	liver, kidney; toxicity	1000	2.01E-11	1.14E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.23E-10	4.15E-11	4.91E-09	2.10E-09	2.49E-05	3.77E-04	31.9%	liver; inc. relative weight	1000	3.78E-10	1.91E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.50E-08	1.22E-08	1.44E-06	6.18E-07	9.50E-06	1.44E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.27E-05	1.18E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.68E-09	9.31E-08	100.0%	

Table M.184. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – open) – Area S5–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.18E-09	2.65E-10	1.12E-07	1.44E-08	8.83E-08	1.60E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	6.09E-10	2.61E-11	1.41E-08	1.82E-09	6.09E-10	1.41E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.15E+01	1.44E-09	6.19E-11	2.34E-08	3.01E-09	3.90E-08	6.33E-07	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.10E-08	8.99E-10	4.42E-07	5.68E-08	4.20E-06	8.84E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.09E-10	8.95E-12	4.21E-09	5.41E-10	6.98E-07	1.40E-05	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.56E-10	2.81E-11	1.51E-08	1.94E-09	9.37E-08	2.16E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.37E-09	2.30E-10	9.72E-08	1.25E-08	1.79E-08	3.24E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	3.03E-09	1.30E-10	5.15E-08	6.62E-09	3.03E-08	5.15E-07	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.81E-11	7.77E-13	2.67E-10	3.44E-11	6.03E-07	8.92E-06	0.7%	liver; lesions, toxicity	1000	1.32E-11	5.85E-10	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.53E-07	6.56E-09	3.06E-06	3.93E-07	7.65E-06	1.53E-04	12.0%	liver; weight inc.	1000	9.18E-11	5.50E-09	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.77E-08	7.58E-10	2.79E-07	3.59E-08	1.77E-06	2.79E-05	2.2%	liver; lesions, fatty cyst formation	1000	4.67E-12	2.19E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.43E-09	3.61E-10	1.42E-07	1.83E-08	1.69E-05	2.84E-04	22.3%	liver; lesions	100	1.23E-10	6.21E-09	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.02E-10	1.30E-11	5.35E-09	6.88E-10	6.05E-06	1.07E-04	8.4%	liver; lesions	100	2.07E-10	1.10E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	3.02E-10	1.29E-11	5.35E-09	6.88E-10	1.01E-06	1.78E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.24E-10	5.32E-12	2.19E-09	2.82E-10	4.14E-07	7.31E-06	0.6%	liver, kidney; toxicity	1000	6.92E-12	3.67E-10	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.33E-10	1.43E-11	5.28E-09	6.79E-10	2.56E-05	4.06E-04	31.9%	liver; inc. relative weight	1000	1.30E-10	6.18E-09	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.79E-08	4.20E-09	1.55E-06	2.00E-07	9.79E-06	1.55E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.49E-05	1.28E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.77E-10	3.01E-08	100.0%	

Table M.185. Risk characterization for sediments: adults – dermal exposure (current land use – open) – Area S5–C1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDx UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.07E-10	1.37E-11	4.51E-09	1.93E-09	3.56E-07	1.50E-05	16.3%	skin; keratosis, hyperpigmentation	3	2.41E-11	3.38E-09	8.7%	[A]
Barium	78.13	88.46	1.83E-09	2.36E-10	7.56E-08	3.24E-08	2.62E-08	1.08E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.15E-11	2.76E-12	8.77E-10	3.76E-10	4.30E-09	1.75E-07	0.2%	no observed effects	100	1.19E-11	1.62E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.33E-11	4.28E-12	1.46E-09	6.27E-10	3.33E-08	1.46E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.12E-09	1.44E-10	4.71E-08	2.02E-08	1.12E-09	4.71E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.63E-10	7.24E-11	2.55E-08	1.09E-08	1.52E-08	6.90E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.24E-09	1.60E-10	8.51E-08	3.65E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.08E-08	2.68E-09	8.86E-07	3.80E-07	1.49E-07	6.33E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.51E-10	4.51E-11	1.75E-08	7.50E-09	1.17E-06	5.83E-05	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.43E-10	6.99E-11	2.37E-08	1.02E-08	2.72E-08	1.18E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.82E-10	8.77E-11	2.89E-08	1.24E-08	9.74E-08	4.12E-06	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.28E-09	2.93E-10	1.03E-07	4.43E-08	7.60E-09	3.44E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.42E-11	3.11E-12	1.40E-09	5.99E-10				--	--	2.40E-11	4.61E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.90E-11	2.44E-12	1.19E-09	5.08E-10				--	--	1.88E-11	3.91E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.64E-11	9.82E-12	4.42E-09	1.90E-09	2.55E-09	1.47E-07	0.2%	--	--	7.17E-12	1.38E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.40E-11	9.52E-12	4.15E-09	1.78E-09	2.47E-09	1.38E-07	0.2%	--	--	6.95E-11	1.30E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.80E-11	1.13E-11	4.97E-09	2.13E-09	2.93E-09	1.66E-07	0.2%	--	--	8.26E-12	1.55E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.21E-11	9.27E-12	3.39E-09	1.45E-09	2.40E-09	1.13E-07	0.1%	--	--	6.77E-12	1.06E-09	2.7%	[B2]
Chrysene	0.31	0.49	7.26E-11	9.34E-12	4.20E-09	1.80E-09	2.42E-09	1.40E-07	0.2%	--	--	6.82E-13	1.31E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.15E-11	6.63E-12	2.06E-09	8.85E-10	1.72E-09	6.88E-08	0.1%	--	--	4.84E-11	6.46E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.80E-12	2.32E-13	1.16E-10	4.95E-11	3.61E-08	2.31E-06	2.5%	liver; lesions	100	3.71E-12	7.92E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.47E-11	8.32E-12	3.24E-09	1.39E-09	2.16E-09	1.08E-07	0.1%	--	--	6.07E-12	1.01E-09	2.6%	[B2]
Chemical Hazard: Hazard Index (HI): Combined Exposure (d)							1.94E-06	9.19E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.29E-10	3.84E-08	100.0%	

Table M.186. Risk characterization for sediments: children – dermal exposure (current land use – open) – Area S5–C1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.1E-10	4.7E-12	4.8E-09	6.2E-10	3.6E-07	1.6E-05	16.3%	skin; keratosis, hyperpigmentation	3	8.2E-12	1.0E-09	8.7%	[A]
Barium	78.13	88.46	1.8E-09	8.1E-11	8.1E-08	1.0E-08	2.7E-08	1.1E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.2E-11	9.4E-13	9.4E-10	1.2E-10	4.4E-09	1.8E-07	0.2%	no observed effects	100	4.0E-12	5.2E-10	4.2%	[B2]
Cadmium	1.42	1.71	3.4E-11	1.4E-12	1.5E-09	2.0E-10	3.4E-08	1.5E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.1E-09	4.9E-11	5.0E-08	6.5E-09	1.1E-09	5.0E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.8E-10	2.4E-11	2.7E-08	3.5E-09	1.5E-08	7.4E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.2E-09	5.4E-11	9.1E-08	1.1E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.1E-08	9.1E-10	9.5E-07	1.2E-07	1.5E-07	6.8E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.6E-10	1.5E-11	1.8E-08	2.4E-09	1.2E-06	6.2E-05	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.6E-10	2.4E-11	2.5E-08	3.2E-09	2.8E-08	1.2E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	7.0E-10	3.0E-11	3.1E-08	3.9E-09	1.0E-07	4.4E-06	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.3E-09	1.0E-10	1.1E-07	1.4E-08	7.8E-09	3.7E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.5E-11	1.0E-12	1.5E-09	1.9E-10				--	--	8.2E-12	1.4E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.9E-11	8.3E-13	1.2E-09	1.6E-10				--	--	6.4E-12	1.2E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.6E-11	3.3E-12	4.7E-09	6.1E-10	2.6E-09	1.5E-07	0.2%	--	--	2.4E-12	4.4E-10	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.6E-11	3.2E-12	4.4E-09	5.7E-10	2.5E-09	1.4E-07	0.2%	--	--	2.3E-11	4.1E-09	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	9.0E-11	3.8E-12	5.3E-09	6.8E-10	3.0E-09	1.7E-07	0.2%	--	--	2.8E-12	5.0E-10	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.4E-11	3.1E-12	3.6E-09	4.6E-10	2.4E-09	1.2E-07	0.1%	--	--	2.3E-12	3.4E-10	2.7%	[B2]
Chrysene	0.31	0.49	7.4E-11	3.2E-12	4.5E-09	5.8E-10	2.4E-09	1.5E-07	0.2%	--	--	2.3E-13	4.2E-11	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.3E-11	2.2E-12	2.2E-09	2.8E-10	1.7E-09	7.4E-08	0.1%	--	--	1.6E-11	2.0E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.8E-12	7.9E-14	1.2E-10	1.6E-11	3.7E-08	2.4E-06	2.5%	liver; lesions	100	1.2E-12	2.5E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.6E-11	2.8E-12	3.4E-09	4.4E-10	2.2E-09	1.1E-07	0.1%	--	--	2.0E-12	3.2E-10	2.6%	[B2]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	2.0E-06	9.9E-05	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	7.8E-11	1.2E-08	100.0%

Table M.187. Risk characterization summary for EFPC Segment 5: RME risk estimates for future land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	9.89E+00 *B*	NA	7.61E−05 W	NA	7.00E−06 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	9.9E+00 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	8E−05 W		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	7E−06 W

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	1.23E+00 *B*	3.45E−01 B	1.99E−05 W	1.85E−05 W	1.17E−07 B	2.93E−07 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	4.92E−02 B	3.76E−02 B	4.15E−06 W	1.06E−05 W	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	3.28E+01 *B*	2.77E+01 *B*	9.08E−05 W	2.56E−04 *B*	3.10E−06 W	2.35E−05 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	7.30E−04 B	1.61E−04 B	1.33E−07 B	9.78E−08 B	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	9.87E+01 *B*	4.76E+01 *B*	2.50E−04 *B*	4.02E−04 *B*	2.28E−07 B	9.85E−07 B
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					1.3E+02 *B*	7.6E+01 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					4E−04 *B*	8E−04 *B*		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					3E−06 W	2E−05 W

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.188. Human health risk characterization summary for EFPC residential scenario: future land use, Area S5–F1–R adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	8.23E–02	3.45E–01	1.31E–06	1.85E–05
Dermal Contact	2.98E–03	3.76E–02	2.02E–07	1.06E–05
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion	1.58E+01	2.77E+01	3.84E–05	2.56E–04
Inhalation (VOCs)	4.01E–05	1.61E–04	7.30E–09	9.78E–08
FOOD CHAIN				
Produce	7.88E+00	4.76E+01	2.42E–05	4.02E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.22E–08	2.93E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion			3.59E–06	2.35E–05
FOOD CHAIN				
Produce			4.21E–08	9.85E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.4E+01	7.6E+01		
Excess Lifetime Cancer Risk: Combined Exposure			7E–05	8E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			4E–06	2E–05

Table M.189. Human health risk characterization summary for EFPC residential scenario: future land use, Area S5–F1–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	2.88E–01	1.23E+00	1.52E–06	1.99E–05
Dermal Contact	3.89E–03	4.92E–02	8.78E–08	4.15E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion	1.65E+01	3.28E+01	1.33E–05	9.08E–05
Inhalation (VOCs)	2.34E–04	7.30E–04	1.42E–08	1.33E–07
FOOD CHAIN				
Produce	1.76E+01	9.87E+01	1.80E–05	2.50E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			9.24E–09	1.17E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion			4.45E–07	3.10E–06
FOOD CHAIN				
Produce			1.12E–08	2.28E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	3.4E+01	1.3E+02		
Excess Lifetime Cancer Risk: Combined Exposure			3E–05	4E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–07	3E–06

Table M.190. Human health risk characterization summary: EFPC commercial scenario: future land use, Area S5–F2–C adults long term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion				
Dermal Contact				
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion	5.66E+00	9.89E+00	1.37E−05	7.61E−05
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion				
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion			1.28E−06	7.00E−06
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.66E+00	9.89E+00		
Excess Lifetime Cancer Risk: Combined Exposure			1.37E−05	7.61E−05
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1.28E−06	7.00E−06

Table M.191. Risk characterization for soils: adults – ingestion exposure (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration (ug/kg)	RME Concentration (ug/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS **(mg/kg)**															
Antimony	0.87	1.01	3.67E-07	4.71E-08	1.38E-06	5.92E-07	9.16E-04	3.45E-03	1.0%	whole body, blood; inc. mortality	1000				
Arsenic	8.70	9.42	3.68E-06	4.73E-07	1.29E-05	5.53E-06	1.23E-02	4.30E-02	12.5%	skin; keratosis, hyperpigmentation	3	8.28E-07	9.68E-06	52.3%	(A)
Barium	104.30	119.50	4.41E-05	5.67E-06	1.64E-04	7.02E-05	6.30E-04	2.34E-03	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Cadmium	4.27	7.01	1.83E-06	2.32E-07	9.61E-06	4.12E-06	1.83E-03	9.61E-03	2.8%	kidney; proteinuria	10				
Chromium (III)	71.11	75.19	3.01E-05	3.86E-06	1.03E-04	4.41E-05	3.01E-05	1.03E-04	0.0%	no observed effects	100				
Copper	87.90	147.40	3.72E-05	4.78E-06	2.02E-04	8.65E-05	1.00E-03	5.46E-03	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	58.83	72.20	2.49E-05	3.20E-06	9.85E-05	4.24E-05				CNS, blood	--				[B2]
Manganese	1054.00	1248.00	4.46E-04	5.73E-05	1.71E-03	7.33E-04	3.18E-03	1.22E-02	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	43.50	57.59	1.84E-05	2.36E-06	7.85E-05	3.38E-05	6.13E-02	2.63E-01	76.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	35.98	50.54	1.52E-05	1.95E-06	6.92E-05	2.97E-05	7.60E-04	3.46E-03	1.0%	dec. body and organ weight	300				
Selenium	9.66	10.86	4.08E-06	5.25E-07	1.45E-05	6.38E-06	8.17E-04	2.98E-03	0.9%	whole body; clinical selenosis	3				[D]
Silver	3.87	6.48	1.63E-06	2.10E-07	8.87E-06	3.80E-06	3.27E-04	1.77E-03	0.5%	skin; argyria	3				[D]
Zinc	81.86	95.78	3.46E-05	4.45E-06	1.31E-04	5.62E-05	1.15E-04	4.37E-04	0.1%	blood; anemia	3				
ORGANICS **(mg/kg)**															
Aroclor-1260	0.22	0.37	9.30E-08	1.20E-08	5.07E-07	2.17E-07				--	--	9.21E-08	1.67E-06	9.0%	[B2]
Benzo(a)anthracene	0.46	0.82	1.93E-07	2.49E-08	1.12E-06	4.81E-07	6.45E-06	3.74E-05	0.0%	--	--	1.82E-08	3.51E-07	1.9%	[B2]
Benzo(a)pyrene	0.50	0.94	2.10E-07	2.70E-08	1.29E-06	5.52E-07	7.01E-06	4.29E-05	0.0%	--	--	1.97E-07	4.03E-06	21.8%	[B2]
Benzo(b)fluoranthene	0.98	1.80	4.14E-07	5.33E-08	2.47E-06	1.06E-06	1.38E-05	8.22E-05	0.0%	--	--	3.89E-08	7.71E-07	4.2%	[B2]
Benzo(k)fluoranthene	0.98	1.80	4.14E-07	5.33E-08	2.47E-06	1.06E-06	1.38E-05	8.22E-05	0.0%	--	--	3.89E-08	7.71E-07	4.2%	[B2]
Chrysene	0.59	1.10	2.50E-07	3.22E-08	1.51E-06	6.46E-07	8.35E-06	5.02E-05	0.0%	--	--	2.35E-09	4.71E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	8.14E-08	1.05E-08	2.90E-07	1.24E-07	2.71E-06	9.68E-06	0.0%	--	--	7.64E-08	9.09E-07	4.9%	[B2]
Indeno(1,2,3-cd)pyrene	0.36	0.64	1.51E-07	1.95E-08	8.77E-07	3.76E-07	5.05E-06	2.92E-05	0.0%	--	--	1.42E-08	2.74E-07	1.5%	[B2]
RADIONUCLIDES **(pCi/g)**															
Cesium 137+D	0.72	0.99		6.97E+01		1.04E+03									
Cobalt 60		0.01				1.55E+01						1.95E-09	2.90E-08	9.9%	[A]
Neptunium 237+D	0.02	0.06		2.11E+00		6.30E+01							2.32E-10	0.1%	[A]
Uranium 234	4.45	5.29		4.33E+02		5.56E+03						4.63E-10	1.39E-08	4.7%	[A]
Uranium 235+D	0.20	0.24		1.97E+01		2.54E+02						6.93E-09	8.89E-08	30.4%	[A]
Uranium 238+D	4.61	5.33		4.48E+02		5.60E+03						3.10E-10	4.06E-09	1.4%	[A]
												1.25E-08	1.57E-07	53.5%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	8.23E-02	3.45E-01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.31E-06	1.85E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.22E-08	2.93E-07	100.0%

Table M.192. Risk characterization for soils: children – ingestion exposure (future land use – residential) – Area S5–F1–R

Chemical	MLB Concentration (mg/kg)	RMB Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.87	1.01	1.28E-06	5.50E-08	4.94E-06	6.36E-07	3.21E-03	1.24E-02	1.0%	whole body, blood; inc. mortality	1000				
Arsenic	8.70	9.42	1.29E-05	5.52E-07	4.62E-05	5.94E-06	4.29E-02	1.54E-01	12.5%	skin; keratosis, hyperpigmentation	3	9.66E-07	1.04E-05	52.3%	[A]
Barium	104.30	119.50	1.54E-04	6.61E-06	5.86E-04	7.54E-05	2.20E-03	8.37E-03	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Cadmium	4.27	7.01	6.31E-06	2.71E-07	3.44E-05	4.42E-06	6.31E-03	3.44E-02	2.8%	kidney; proteinuria	10				
Chromium (III)	71.11	75.19	1.05E-04	4.51E-06	3.69E-04	4.74E-05	1.05E-04	3.69E-04	0.0%	no observed effects	100				
Copper	87.90	147.40	1.30E-04	5.57E-06	7.23E-04	9.30E-05	3.51E-03	1.95E-02	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	58.83	72.20	8.70E-05	3.73E-06	3.54E-04	4.55E-05				CNS, blood	--				[B2]
Manganese	1054.00	1248.00	1.56E-03	6.68E-05	6.12E-03	7.87E-04	1.11E-02	4.37E-02	3.5%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	43.50	57.59	6.44E-05	2.76E-06	2.82E-04	3.63E-05	2.15E-01	9.42E-01	76.3%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	35.98	50.54	5.32E-05	2.28E-06	2.48E-04	3.19E-05	2.66E-03	1.24E-02	1.0%	dec. body and organ weight	300				
Selenium	9.66	10.86	1.43E-05	6.13E-07	5.33E-05	6.85E-06	2.86E-03	1.07E-02	0.9%	whole body; clinical selenosis	3				[D]
Silver	3.87	6.48	5.72E-06	2.45E-07	3.18E-05	4.08E-06	1.14E-03	6.35E-03	0.5%	skin; argyria	3				[D]
Zinc	81.86	95.78	1.21E-04	5.19E-06	4.70E-04	6.04E-05	4.04E-04	1.57E-03	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.22	0.37	3.25E-07	1.39E-08	1.81E-06	2.33E-07				--	--	1.07E-07	1.80E-06	9.0%	[B2]
Benzo(a)anthracene	0.46	0.82	6.77E-07	2.90E-08	4.02E-06	5.17E-07	2.26E-05	1.34E-04	0.0%	--	--	2.12E-08	3.78E-07	1.9%	[B2]
Benzo(a)pyrene	0.50	0.94	7.36E-07	3.15E-08	4.61E-06	5.93E-07	2.45E-05	1.54E-04	0.0%	--	--	2.30E-07	4.33E-06	21.8%	[B2]
Benzo(b)fluoranthene	0.98	1.80	1.45E-06	6.21E-08	8.83E-06	1.14E-06	4.83E-05	2.94E-04	0.0%	--	--	4.54E-08	8.29E-07	4.2%	[B2]
Benzo(k)fluoranthene	0.98	1.80	1.45E-06	6.21E-08	8.83E-06	1.14E-06	4.83E-05	2.94E-04	0.0%	--	--	4.54E-08	8.29E-07	4.2%	[B2]
Chrysene	0.59	1.10	8.77E-07	3.76E-08	5.40E-06	6.94E-07	2.92E-05	1.80E-04	0.0%	--	--	2.74E-09	5.06E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	2.85E-07	1.22E-08	1.04E-06	1.34E-07	9.49E-06	3.47E-05	0.0%	--	--	8.91E-08	9.76E-07	4.9%	[B2]
Indeno(1,2,3-cd)pyrene	0.36	0.64	5.30E-07	2.27E-08	3.14E-06	4.04E-07	1.77E-05	1.05E-04	0.0%	--	--	1.66E-08	2.95E-07	1.5%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.72	0.99		2.90E+01		4.14E+02						8.13E-10	1.16E-08	9.9%	[A]
Cobalt 60		0.01				6.17E+00							9.25E-11	0.1%	[A]
Neptunium 237+D	0.02	0.06		8.76E-01		2.51E+01						1.93E-10	5.53E-09	4.7%	[A]
Uranium 234	4.45	5.29		1.60E+02		2.22E+03						2.89E-09	3.55E-08	30.4%	[A]
Uranium 235+D	0.20	0.24		8.22E+00		1.01E+02						1.32E-10	1.67E-09	1.4%	[A]
Uranium 238+D	4.61	5.33		1.87E+02		2.23E+03						5.22E-09	6.26E-08	53.5%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.68E-01	1.23E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.32E-06	1.94E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												9.24E-09	1.17E-07	100.0%	

Table M.193. Risk characterization for soils: adults – dermal exposure (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.87	1.01	1.32E-08	1.70E-09	1.49E-07	6.40E-08	3.30E-05	3.73E-04	1.0%	whole body, blood; inc. mortality	1000				
Arsenic	8.70	9.42	1.32E-07	1.70E-08	1.39E-06	5.98E-07	4.42E-04	4.65E-03	12.4%	skin; keratosis, hyperpigmentation	3	2.98E-08	1.05E-06	9.9%	[A]
Barium	104.30	119.50	1.59E-06	2.04E-07	1.77E-05	7.58E-06	2.27E-05	2.53E-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Cadmium	4.27	7.01	6.49E-08	8.35E-09	1.04E-06	4.45E-07	6.49E-05	1.04E-03	2.8%	kidney; proteinuria	10				
Chromium (III)	71.11	75.19	1.08E-06	1.39E-07	1.11E-05	4.77E-06	1.08E-06	1.11E-05	0.0%	no observed effects	100				
Copper	87.90	147.40	1.34E-06	1.72E-07	2.18E-05	9.35E-06	3.62E-05	5.90E-04	1.6%	Gastrointestinal system; irritation	– –				[D]
Lead	58.83	72.20	8.95E-07	1.15E-07	1.07E-05	4.58E-06				CNS, blood	– –				[D]
Manganese	1054.00	1248.00	1.60E-05	2.06E-06	1.85E-04	7.92E-05	1.15E-04	1.32E-03	3.5%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D2]
Mercury	43.50	57.59	6.62E-07	8.51E-08	8.53E-06	3.65E-06	2.21E-03	2.84E-02	75.6%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	35.98	50.54	5.48E-07	7.04E-08	7.48E-06	3.21E-06	2.74E-05	3.74E-04	1.0%	dec. body and organ weight	300				[D]
Selenium	9.66	10.86	1.47E-07	1.89E-08	1.61E-06	6.89E-07	2.94E-05	3.22E-04	0.9%	whole body; clinical selenosis	3				
Silver	3.87	6.48	5.88E-08	7.57E-09	9.59E-07	4.11E-07	1.18E-05	1.92E-04	0.5%	skin; argyria	3				[D]
Zinc	81.86	95.78	1.25E-06	1.60E-07	1.42E-05	6.08E-06	4.15E-06	4.73E-05	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.22	0.37	3.35E-08	4.30E-09	5.48E-07	2.35E-07									
Benzo(a)anthracene	0.46	0.82	6.96E-08	8.93E-09	1.21E-06	5.20E-07	2.32E-06	4.05E-05	0.1%		BRR BRR	3.31E-08	1.81E-06	17.1%	[B2]
Benzo(a)pyrene	0.50	0.94	7.57E-08	9.72E-09	1.39E-06	5.97E-07	2.52E-06	4.64E-05	0.1%		BRR BRR	6.53E-09	3.80E-07	3.6%	[B2]
Benzo(b)fluoranthene	0.98	1.60	1.49E-07	1.92E-08	2.67E-06	1.14E-06	4.97E-06	8.88E-05	0.2%		BRR BRR	7.11E-08	4.35E-06	41.1%	[B2]
Benzo(k)fluoranthene	0.98	1.80	1.49E-07	1.92E-08	2.67E-06	1.14E-06	4.97E-06	8.88E-05	0.2%		BRR BRR	1.40E-08	8.34E-07	7.9%	[B2]
Chrysene	0.59	1.10	9.02E-08	1.16E-08	1.63E-06	6.98E-07	3.01E-06	5.43E-05	0.1%		BRR BRR	1.40E-08	8.34E-07	7.9%	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	2.93E-08	3.77E-09	3.14E-07	1.35E-07	9.76E-07	1.05E-05	0.0%		BRR BRR	8.46E-10	5.10E-08	0.5%	[B2]
Indeno(1,2,3-cd)pyrene	0.36	0.64	5.45E-08	7.01E-09	9.48E-07	4.06E-07	1.82E-06	3.16E-05	0.1%		BRR BRR	2.75E-08	9.87E-07	9.3%	[B2]
											BRR BRR	5.12E-09	2.97E-07	2.8%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.98E-03	3.76E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.02E-07	1.08E-05	100.0%	

Table M.194. Risk characterization for soils: children – dermal exposure (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Antimony	0.87	1.01	1.72E-08	7.37E-10	1.95E-07	2.51E-08	4.30E-05	4.88E-04	1.0%	whole body, blood; inc. mortality	1000				
Arsenic	8.70	9.42	1.73E-07	7.40E-09	1.82E-06	2.34E-07	5.75E-04	6.08E-03	12.4%	skin; keratosis, hyperpigmentation	3	1.29E-08	4.10E-07	9.9%	[A]
Barium	104.30	119.50	2.07E-06	8.87E-08	2.31E-05	2.98E-06	2.96E-05	3.31E-04	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Cadmium	4.27	7.01	8.46E-08	3.63E-09	1.36E-06	1.75E-07	8.46E-05	1.36E-03	2.8%	kidney; proteinuria	10				
Chromium (III)	71.11	75.19	1.41E-06	6.04E-08	1.46E-05	1.87E-06	1.41E-06	1.46E-05	0.0%	no observed effects	100				
Copper	87.90	147.40	1.74E-06	7.47E-08	2.85E-05	3.67E-06	4.71E-05	7.72E-04	1.6%	Gastrointestinal system; irritation	– –				[D]
Lead	58.83	72.20	1.17E-06	5.00E-08	1.40E-05	1.80E-06				CNS, blood	– –				[D2]
Manganese	1054.00	1248.00	2.09E-05	8.96E-07	2.42E-04	3.11E-05	1.49E-04	1.73E-03	3.5%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	43.50	57.59	8.63E-07	3.70E-08	1.12E-05	1.43E-06	2.88E-03	3.72E-02	75.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	35.98	50.54	7.14E-07	3.06E-08	9.75E-06	1.26E-06	3.57E-05	4.89E-04	1.0%	dec. body and organ weight	300				
Selenium	9.66	10.86	1.92E-07	8.21E-09	2.10E-06	2.70E-07	3.86E-05	4.21E-04	0.9%	whole body; clinical selenosis	3				[D]
Silver	3.87	6.48	7.67E-08	3.29E-09	1.25E-06	1.61E-07	1.53E-05	2.51E-04	0.5%	skin; argyria	3				[D]
Zinc	81.86	95.78	1.62E-06	6.96E-08	1.86E-05	2.39E-06	5.41E-06	6.18E-05	0.1%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.22	0.37	4.36E-08	1.87E-09	7.17E-07	9.21E-08					BRR BRR	1.44E-08	7.09E-07	17.1%	[B2]
Benzo(a)anthracene	0.46	0.82	9.07E-08	3.89E-09	1.59E-06	2.04E-07	3.02E-06	5.29E-05	0.1%		BRR BRR	2.84E-09	1.49E-07	3.6%	[B2]
Benzo(a)pyrene	0.50	0.94	9.87E-08	4.23E-09	1.82E-06	2.34E-07	3.29E-06	6.07E-05	0.1%		BRR BRR	3.09E-08	1.71E-06	41.1%	[B2]
Benzo(b)fluoranthene	0.98	1.80	1.94E-07	8.33E-09	3.49E-06	4.48E-07	6.48E-06	1.16E-04	0.2%		BRR BRR	6.08E-09	3.27E-07	7.9%	[B2]
Benzo(k)fluoranthene	0.98	1.80	1.94E-07	8.33E-09	3.49E-06	4.48E-07	6.48E-06	1.16E-04	0.2%		BRR BRR	6.08E-09	3.27E-07	7.9%	[B2]
Chrysene	0.59	1.10	1.16E-07	5.04E-09	2.13E-06	2.74E-07	3.92E-06	7.10E-05	0.1%		BRR BRR	3.68E-10	2.00E-08	0.5%	[B2]
Dibenzo(a,h)anthracene	0.19	0.21	3.82E-08	1.64E-09	4.11E-07	5.28E-08	1.27E-06	1.37E-05	0.0%		BRR BRR	1.19E-08	3.85E-07	9.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.36	0.64	7.10E-08	3.04E-09	1.24E-06	1.59E-07	2.37E-06	4.13E-05	0.1%		BRR BRR	2.22E-09	1.16E-07	2.8%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.89E-03	4.92E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.78E-08	4.15E-06	100.0%	

Table M.195. Risk characterization for surface water: adults – ingestion exposure (swimming) (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	Risk Estimates: HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	RfDA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation	--				
Manganese (water)	2.69E+02	4.13E+02	3.69E-06	4.73E-07	3.31E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.71E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.46E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.51E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	0.4%	liver; lesions, fatty cyst formation	1000	4.37E-11	9.97E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.86E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.05E-09	2.79E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity	1000	4.16E-11	1.06E-09	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	1.8%	liver; inc. relative weight	1000	3.46E-10	7.94E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.86E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	[A]
Chemical Hazards:															
Hazard Index (HI):							9.67E-04	8.62E-03	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												2.48E-09	6.00E-08	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												3.49E-10	1.36E-08	100.0%	

Table M.196. Risk characterization for surface water: children – ingestion exposure (swimming) (future land use – residential) – Area S5–F1–R

Chemical	Chronic Daily Intake (CDI) MLB Concentration µg/SW	Chronic Daily Intake (CDI) RMB Concentration µg/SW	CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E-06	1.30E-07	2.30E-05	2.96E-06	4.34E-05	3.29E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.86E+00	1.32E+01	2.99E-07	1.28E-08	2.85E-06	3.72E-07	2.99E-07	2.85E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E-07	3.04E-08	4.86E-06	6.17E-07	1.92E-05	1.30E-04	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E-05	4.42E-07	9.05E-05	1.16E-05	2.06E-03	1.81E-02	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E-07	4.40E-09	8.62E-07	1.11E-07	3.42E-04	2.87E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E-07	1.38E-08	3.09E-06	3.97E-07	4.60E-05	4.41E-04	1.9%	no observed effects	100				
Zinc	6.67E+01	9.09E+01	2.64E-06	1.13E-07	1.99E-05	2.56E-06	8.79E-06	6.64E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E-07	1.02E-08	1.69E-06	2.17E-07	2.38E-06	1.69E-05	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	8.91E-10	3.82E-11	5.48E-09	7.05E-10	2.97E-05	1.83E-04	0.6%	liver; lesions, toxicity	1000	6.49E-10	1.20E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.35E+01	3.64E-07	1.56E-08	3.04E-06	3.90E-07	1.82E-05	1.52E-04	0.7%	liver; weight inc.	1000	2.19E-10	5.46E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E-07	6.69E-09	1.03E-06	1.32E-07	1.56E-05	1.03E-04	0.4%	liver; lesions, fattycyst formation	1000	4.08E-11	8.06E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.54E-09	6.61E-11	1.08E-08	1.39E-09	3.08E-06	2.17E-05	0.1%	liver; lesions	100	2.25E-11	4.73E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	1.48E-09	6.37E-11	1.10E-08	1.41E-09	2.97E-05	2.19E-04	0.9%	liver; lesions	100	1.02E-09	2.25E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	1.48E-09	6.36E-11	1.10E-08	1.41E-09	4.95E-06	3.65E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	6.97E-10	2.99E-11	5.14E-09	6.60E-10	2.32E-06	1.71E-05	0.1%	liver, kidney; toxicity	1000	3.89E-11	8.58E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	8.28E-10	3.55E-11	5.48E-09	7.05E-10	6.37E-05	4.21E-04	1.8%	liver; inc. relative weight	1000	3.23E-10	6.41E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E-07	6.87E-09	1.06E-06	1.36E-07	1.60E-05	1.06E-04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.25E+00		3.86E+00		8.04E+01						6.18E-11	1.29E-09	31.6%	[A]
Uranium 238+D,	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E-10	2.78E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.71E-03	2.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E-09	4.85E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E-10	4.07E-09	100.0%	

Table M.197. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target/Thing	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.58E-06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.66E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.21E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[D2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[D2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fattycyst formation	1000	1.88E-10	7.57E-09	0.7%	[D2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[D2]
Dieldrin	3.87E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[D2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.65E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity	1000	2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.46E-04	4.22E-03	31.9%	liver; inc. relative weight	1000	5.29E-09	2.14E-07	20.6%	[D2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				

Chemical Hazards:			
Hazard Index (HI):	1.02E-03	1.32E-02	100.0%
Combined Exposure (d)			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.35E-08	1.04E-06	100.0%

Table M.198. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E-07	4.69E-09	1.53E-06	1.96E-07	1.56E-06	2.18E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	3.18E-07	4.09E-08	6.91E-07	8.60E-06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	7.43E-05	1.20E-03	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E-09	1.59E-10	5.72E-08	7.35E-09	1.23E-05	1.91E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E-08	4.98E-10	2.05E-07	2.64E-08	1.66E-06	2.93E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.21E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.21E-04	0.7%	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	12.0%	liver; weight inc.	1000	1.63E-09	7.47E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E-07	1.34E-08	3.79E-06	4.87E-07	3.13E-05	3.79E-04	2.2%	liver; lesions, fatty cyst formation	1000	8.19E-11	2.97E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.99E-04	3.86E-03	22.3%	liver; lesions	100	2.18E-09	8.44E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.49E-03	8.4%	liver; lesions	100	3.67E-09	1.50E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	0.6%	liver, kidney; toxicity	1000	1.23E-10	4.98E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	31.9%	liver; inc. relative weight	1000	2.30E-09	8.40E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.71E-06	1.73E-04	2.11E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.33E-03	1.73E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-08	4.08E-07	100.0%	

Table M.199. Risk characterization for sediments: adults – dermal exposure (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.46E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%	--	--	5.02E-11	9.90E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.36E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-09	2.80E-07	100.0%	

Table M.200. Risk characterization for sediments: children – dermal exposure (future land use – residential) – Area S5–F1–R

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.7E-10	4.1E-11	4.2E-08	5.4E-09	3.2E-06	1.4E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.3E-11	9.5E-09	8.7%	[A]
Barium	78.13	88.46	1.6E-08	7.1E-10	7.1E-07	9.1E-08	2.3E-07	1.0E-05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.9E-10	8.4E-12	8.2E-09	1.0E-09	3.9E-08	1.6E-06	0.2%	no observed effects	100	3.6E-11	4.5E-09	4.2%	[D2]
Cadmium	1.42	1.71	3.0E-10	1.3E-11	1.3E-08	1.7E-09	3.0E-07	1.3E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.0E-08	4.3E-10	4.4E-07	5.7E-08	1.0E-08	4.4E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.1E-09	2.2E-10	2.4E-07	3.0E-08	1.3E-07	6.5E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.1E-08	4.6E-10	8.0E-07	1.0E-07				CNS, blood	--				[D2]
Manganese	886.40	1036.00	1.9E-07	8.1E-09	8.3E-06	1.0E-06	1.3E-06	5.9E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.2E-09	1.3E-10	1.6E-07	2.1E-08	1.0E-05	5.4E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.9E-09	2.1E-10	2.2E-07	2.8E-08	2.4E-07	1.1E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.2E-09	2.6E-10	2.7E-07	3.4E-08	8.8E-07	3.8E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.0E-08	8.9E-10	9.7E-07	1.2E-07	6.9E-08	3.2E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.2E-10	9.4E-12	1.3E-08	1.6E-09				--	--	7.2E-11	1.3E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.7E-10	7.4E-12	1.1E-08	1.4E-09				--	--	5.7E-11	1.1E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.9E-10	2.9E-11	4.1E-08	5.3E-09	2.3E-08	1.3E-06	0.2%	--	--	2.1E-11	3.9E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.7E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.1E-10	3.6E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.0E-10	3.4E-11	4.6E-08	6.0E-09	2.6E-08	1.5E-06	0.2%	--	--	2.5E-11	4.3E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.5E-10	2.8E-11	3.1E-08	4.1E-09	2.1E-08	1.0E-06	0.1%	--	--	2.0E-11	2.9E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.6E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.0E-12	3.7E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.7E-10	2.0E-11	1.9E-08	2.5E-09	1.5E-08	6.4E-07	0.1%	--	--	1.4E-10	1.8E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.6E-11	7.0E-13	1.0E-09	1.4E-10	3.2E-07	2.1E-05	2.5%	liver; lesions	100	1.1E-11	2.2E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.26	0.38	5.9E-10	2.5E-11	3.0E-08	3.9E-09	1.9E-08	1.0E-06	0.1%	--	--	1.8E-11	2.8E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.7E-05	8.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.9E-10	1.1E-07	100.0%	

Table M.201. Risk characterization for groundwater: adults – ingestion exposure (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.61E-05	9.78E-06	1.53E-04	6.55E-05	2.54E-01	5.09E-01	1.8%	skin; keratosis, hyperpigmentation	3	1.7E-05	1.15E-04	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.58E-03	9.74E-04	1.33E-02	5.70E-03	1.08E-01	1.90E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.68E+00	2.56E+00	3.61E-05	4.64E-06	7.01E-05	3.00E-05	7.22E-03	1.40E-02	0.1%	no observed effects	100	2.0E-05	1.29E-04	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.33E-04	8.14E-05	1.12E-03	4.86E-04	6.33E-04	1.12E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.20E-04	4.12E-05	8.87E-03	3.86E-03	8.66E-03	2.40E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.13E-04	6.60E-05	9.68E-04	4.15E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E-02	9.22E-03	1.21E-01	5.19E-02	1.43E+01	2.42E+01	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.66E-04	3.42E-05	5.99E-04	2.57E-04	8.86E-01	2.00E+00	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.60E+01	6.43E+01	9.21E-04	1.18E-04	1.76E-03	7.55E-04	4.61E-02	8.81E-02	0.3%	dec. body and organ weight	300				[D]
Vanadium	3.91E+01	4.90E+01	7.49E-04	9.64E-05	1.34E-03	5.76E-04	1.07E-01	1.92E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.55E+02	6.82E+02	6.89E-03	8.86E-04	1.87E-02	8.01E-03	6.89E-02	1.87E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E-03	1.72E-04	3.69E-03	1.58E-03	2.23E-02	6.15E-02	0.2%	*oral and inhal.*–liver; toxicity	100	1.2E-06	1.19E-05	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.44E+04		8.54E+04						1.4E-06	8.54E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05						8.9E-07	6.1E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05						1.2E-06	8.86E-06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.38E+01	2.77E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.8E-05	2.36E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.5E-06	2.35E-05	100.0%	

Table M.202. Risk characterization for groundwater: children – ingestion exposure (future land use – residential) – Area S5–F1–R

Chemical	MLB Conc. (µg/L)	RMB Conc. (µg/L)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	IRIS UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.9E-05	3.3E-06	1.8E-04	2.3E-05	2.6E-01	6.0E-01	1.8%	skin; keratosis, hyperpigmentation	3	5.9E-06	4.0E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.8E-03	3.3E-04	1.5E-02	2.0E-03	1.1E-01	2.2E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.8E+00	2.5E+00	3.7E-05	1.6E-06	8.3E-05	1.0E-05	7.5E-03	1.6E-02	0.1%	no observed effects	100	6.9E-06	4.5E-05	50.5%	[B2]
Chromium (III)	3.3E+01	4.1E+01	6.5E-04	2.8E-05	1.3E-03	1.7E-04	6.5E-04	1.3E-03	0.0%	no observed effects	100				
Copper	1.6E+01	3.2E+02	3.3E-04	1.4E-05	1.0E-02	1.3E-03	9.0E-03	2.8E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.6E+01	3.5E+01	5.3E-04	2.2E-05	1.1E-03	1.4E-04				CNS, blood	--				[B2]
Manganese (water)	3.7E+03	4.4E+03	7.4E-02	3.2E-03	1.4E-01	1.8E-02	1.4E+01	2.8E+01	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.3E+01	2.1E+01	2.7E-04	1.1E-05	7.0E-04	9.1E-05	9.2E-01	2.3E+00	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.8E+01	6.4E+01	9.5E-04	4.1E-05	2.0E-03	2.6E-04	4.7E-02	1.0E-01	0.3%	dec. body and organ weight	300				
Vanadium	3.9E+01	4.9E+01	7.7E-04	3.3E-05	1.5E-03	2.0E-04	1.1E-01	2.2E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	7.1E-03	3.0E-04	2.2E-02	2.8E-03	7.1E-02	2.2E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.9E+01	1.3E+02	1.3E-03	5.9E-05	4.3E-03	5.6E-04	2.3E-02	7.2E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.4E-07	4.2E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.2E+00	4.0E+00		1.7E+03		1.1E+04						1.7E-07	1.1E-06	36.4%	[A]
Uranium 234	1.2E+01	1.8E+01		6.9E+03		5.0E+04						1.1E-07	8.0E-07	26.0%	[A]
Uranium 238+D	1.0E+01	1.5E+01		5.5E+03		4.1E+04						1.5E-07	1.1E-06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.6E+01	3.2E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.3E-05	9.0E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.4E-07	3.1E-06	100.0%	

Table M.203. Risk characterization for groundwater: adults – inhalation exposure (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.7E-04	2.2E-05	7.0E-04	3.0E-04				Inc. liver, kidney weights, nephrotoxicity	--				
Methylene Chloride	6.9E+01	1.3E+02	3.4E-05	4.4E-06	1.3E-04	5.9E-05	4.0E-05	1.6E-04	100.0%	*oral and inhal.*–liver; toxicity	100	7.3E-09	9.7E-08	100.0%	B2
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.0E-05	1.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.3E-09	9.7E-08	100.0%	

Table M.204. Risk characterization for groundwater: children – inhalation exposure (future land use – residential) – Area S5–F1–R

Chemical	MLB Concentration in GW	RMB Concentration in GW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDs WOE
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.0E-03	4.4E-05	3.1E-03	4.0E-04				Inc. liver, kidney weights, nephrotoxicity	--				
Methylene Chloride	6.9E+01	1.3E+02	2.0E-04	8.6E-06	6.2E-04	8.0E-05	2.3E-04	7.3E-04	100.0%	*oral and inhal.*–liver; toxicity	100	1.4E-08	1.3E-07	100.0%	[B2]
Chemical Hazards:															
Hazard Index (HI):							2.3E-04	7.3E-04	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:												1.4E-08	1.3E-07	100.0%	
Combined Exposure (d)															

Table M.205. Risk characterization for produce: adults – ingestion exposure (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	8.67E-03	1.0E-02	1.32E-06	1.7E-07	7.04E-06	3.0E-06	3.3E-03	1.7E-02	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	6.94E-01	7.5E-01	1.06E-04	1.3E-05	5.26E-04	2.2E-04	3.5E-01	1.7E+00	3.7%	skin; keratosis, hyperpigmentation	3	2.3E-05	3.9E-04	98.2%	[A]
Barium	1.04E+00	1.2E+00	1.59E-04	2.0E-05	8.35E-04	3.5E-04	2.2E-03	1.1E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Cadmium	2.13E+00	3.5E+00	3.26E-04	4.1E-05	2.45E-03	1.0E-03	3.2E-01	2.4E+00	5.1%	kidney; proteinuria	10				
Chromium (III)	7.1E-01	7.5E-01	1.09E-04	1.4E-05	5.25E-04	2.2E-04	1.0E-04	5.2E-04	0.0%	no observed effects	100				
Copper	4.40E+00	7.3E+00	6.7E-04	8.6E-05	5.15E-03	2.2E-03	1.8E-02	1.3E-01	0.3%	Gastrointestinal system; irritation	--				[D]
Lead	5.88E-01	7.2E-01	8.98E-05	1.1E-05	5.04E-04	2.1E-04				CNS, blood	--				[B2]
Manganese	4.22E+02	4.9E+02	6.43E-02	8.2E-03	3.49E-01	1.4E-01	4.5E-01	2.4E+00	5.2%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.3E+01	1.7E+01	1.9E-03	2.5E-04	1.2E-02	5.1E-03	6.6E+00	4.0E+01	84.5%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	1.8E+00	2.5E+00	2.7E-04	3.5E-05	1.7E-03	7.5E-04	1.3E-02	8.8E-02	0.2%	dec. body and organ weight	300				
Selenium	9.6E-01	1.0E+00	1.4E-04	1.9E-05	7.5E-04	3.2E-04	2.9E-02	1.5E-01	0.3%	whole body; clinical selenosis	3				[D]
Silver	7.7E-01	1.3E+00	1.1E-04	1.5E-05	9.0E-04	3.6E-04	2.3E-02	1.8E-01	0.4%	skin; argyria	3				[D]
Zinc	3.27E+01	3.8E+01	5.0E-03	6.4E-04	2.6E-02	1.1E-02	1.6E-02	8.9E-02	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor–1260	2.16E-04	3.6E-04	3.3E-08	4.2E-09	2.5E-07	1.0E-07				--	--	3.2E-08	8.3E-07	0.2%	[B2]
Benzo(a)anthracene	1.7E-03	3.0E-03	2.5E-07	3.3E-08	2.1E-06	9.1E-07	8.6E-06	7.0E-05	0.0%	--	--	2.4E-08	6.6E-07	0.2%	[B2]
Benzo(a)pyrene	9.3E-04	1.7E-03	1.4E-07	1.8E-08	1.2E-06	5.3E-07	4.7E-06	4.1E-05	0.0%	--	--	1.3E-07	3.8E-06	1.0%	[B2]
Benzo(b)fluoranthene	1.4E-03	2.6E-03	2.2E-07	2.8E-08	1.8E-06	7.9E-07	7.3E-06	6.2E-05	0.0%	--	--	2.0E-08	5.8E-07	0.1%	[B2]
Benzo(k)fluoranthene	1.0E-03	1.9E-03	1.5E-07	2.0E-08	1.3E-06	5.7E-07	5.3E-06	4.6E-05	0.0%	--	--	1.4E-08	4.1E-07	0.1%	[B2]
Chrysene	2.5E-03	4.7E-03	3.9E-07	5.0E-08	3.3E-06	1.4E-06	1.3E-05	1.1E-04	0.0%	--	--	3.7E-09	1.0E-07	0.0%	[B2]
Dibenzo(a,h)anthracene	3.2E-04	3.5E-04	4.9E-08	6.4E-09	2.5E-07	1.0E-07	1.6E-06	8.3E-06	0.0%	--	--	4.6E-08	7.8E-07	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	1.3E-04	2.3E-04	1.9E-08	2.5E-09	1.6E-07	6.9E-08	6.5E-07	5.3E-06	0.0%	--	--	1.8E-09	5.0E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	2.15E-02	2.9E-02		7.5E+02		1.5E+04						2.1E-08	4.4E-07	45.1%	[A]
Cobalt 60		4.4E-04				2.3E+02							3.5E-09	0.4%	[A]
Neptunium 237+D	8.67E-04	2.4E-03		3.0E+01		1.2E+03						6.6E-09	2.8E-07	28.7%	[A]
Uranium 234	8.91E-03	1.0E-02		3.1E+02		5.6E+03						5.0E-09	9.0E-08	9.2%	[A]
Uranium 235+D	4.0E-04	4.8E-04		1.4E+01		2.5E+02						2.2E-10	4.1E-09	0.4%	[A]
Uranium 238+D	9.2E-03	1.0E-02		3.2E+02		5.7E+03						9.0E-09	1.6E-07	16.2%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	7.8E+00	4.7E+01	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.4E-05	4.0E-04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	4.2E-08	9.8E-07	100.0%

Table M.206. Risk characterization for produce: children – ingestion exposure (future land use – residential) – Area S5–F1–R

Chemical	MLB Concentration from Mean Concentration in Soil	RMB Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	8.67E-03	1.0E-02	2.9E-06	1.2E-07	1.4E-05	1.8E-06	7.3E-03	3.6E-02	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	6.9E-01	7.5E-01	2.3E-04	1.0E-05	1.0E-03	1.4E-04	7.9E-01	3.6E+00	3.7%	skin; keratosis, hyperpigmentation	3	1.7E-05	2.4E-04	98.2%	[A]
Barium	1.0E+00	1.2E+00	3.5E-04	1.5E-05	1.7E-03	2.2E-04	5.0E-03	2.4E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Cadmium	2.1E+00	3.5E+00	7.2E-04	3.1E-05	5.0E-03	6.5E-04	7.2E-01	5.0E+00	5.1%	kidney; proteinuria	10				
Chromium (III)	7.1E-01	7.5E-01	2.4E-04	1.0E-05	1.0E-03	1.4E-04	2.4E-04	1.0E-03	0.0%	no observed effects	100				
Copper	4.4E+00	7.3E+00	1.5E-03	6.4E-05	1.0E-02	1.3E-03	4.0E-02	2.8E-01	0.3%	Gastrointestinal system; irritation	--				[D]
Lead	5.8E-01	7.2E-01	2.0E-04	8.6E-06	1.0E-03	1.3E-04				CNS, blood	--				[B2]
Manganese	4.2E+02	4.9E+02	1.4E-01	6.1E-03	7.2E-01	9.3E-02	1.0E+00	5.1E+00	5.2%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.3E+01	1.7E+01	4.4E-03	1.9E-04	2.5E-02	3.2E-03	1.4E+01	8.3E+01	84.5%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.8E+00	2.5E+00	6.1E-04	2.6E-05	3.6E-03	4.7E-04	3.0E-02	1.8E-01	0.2%	dec. body and organ weight	300				
Selenium	9.6E-01	1.0E+00	3.3E-04	1.4E-05	1.5E-03	2.0E-04	6.5E-02	3.1E-01	0.3%	whole body; clinical selenosis	3				[D]
Silver	7.7E-01	1.3E+00	2.6E-04	1.1E-05	1.8E-03	2.4E-04	5.2E-02	3.7E-01	0.4%	skin; argyria	3				[D]
Zinc	3.2E+01	3.8E+01	1.1E-02	4.7E-04	5.5E-02	7.1E-03	3.7E-02	1.8E-01	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	2.1E-04	3.6E-04	7.3E-08	3.1E-09	5.2E-07	6.7E-08				--	--	2.4E-08	5.2E-07	0.2%	[B2]
Benzo(a)anthracene	1.7E-03	3.0E-03	5.8E-07	2.4E-08	4.4E-06	5.6E-07	1.9E-05	1.4E-04	0.0%	--	--	1.8E-08	4.1E-07	0.2%	[B2]
Benzo(a)pyrene	9.3E-04	1.7E-03	3.2E-07	1.3E-08	2.5E-06	3.3E-07	1.0E-05	8.5E-05	0.0%	--	--	1.0E-07	2.4E-06	1.0%	[B2]
Benzo(b)fluoranthene	1.4E-03	2.6E-03	4.9E-07	2.1E-08	3.8E-06	4.9E-07	1.6E-05	1.2E-04	0.0%	--	--	1.5E-08	3.6E-07	0.1%	[B2]
Benzo(k)fluoranthene	1.0E-03	1.9E-03	3.5E-07	1.5E-08	2.7E-06	3.5E-07	1.1E-05	9.2E-05	0.0%	--	--	1.1E-08	2.6E-07	0.1%	[B2]
Chrysene	2.5E-03	4.7E-03	8.8E-07	3.7E-08	6.9E-06	8.9E-07	2.9E-05	2.3E-04	0.0%	--	--	2.7E-09	6.5E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	3.2E-04	5.5E-04	1.1E-07	4.7E-09	5.2E-07	6.6E-08	3.7E-06	1.7E-05	0.0%	--	--	3.4E-08	4.8E-07	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	1.3E-04	2.3E-04	4.4E-08	1.8E-09	3.3E-07	4.3E-08	1.4E-06	1.1E-05	0.0%	--	--	1.3E-09	3.1E-08	0.0%	[B2]
RADIONUCLIDES (pCi/g PLANT TISSUE)															
Cesium 137+D	2.1E-02	2.9E-02		2.0E+02		3.6E+03						5.6E-09	1.0E-07	45.1%	[A]
Cobalt 60		4.4E-04				5.4E+01							8.2E-10	0.4%	[A]
Neptunium 237+D	8.6E-04	2.4E-03		8.0E+00		2.9E+02						1.7E-09	6.5E-08	28.7%	[A]
Uranium 234	8.9E-03	1.0E-02		8.3E+01		1.3E+03						1.3E-09	2.1E-08	9.2%	[A]
Uranium 235+D	4.0E-04	4.8E-04		3.7E+00		5.9E+01						6.0E-11	9.5E-10	0.4%	[A]
Uranium 238+D	9.2E-03	1.0E-02		8.6E+01		1.3E+03						2.4E-09	3.7E-08	16.2%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.7E+01	9.8E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.8E-05	2.5E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.1E-08	2.2E-07	100.0%	

Table M.207. Risk characterization for fish: adults – ingestion exposure (future land use – residential) – Area S5–F1–R

Chemical	MLE Concentration in Fish Tissue	RME Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS															
Mercury	0.76	0.78	2.38E-06	3.06E-07	2.89E-05	1.24E-05	7.94E-03	9.63E-02	100.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	6.43E-07	8.27E-08	8.21E-06	3.52E-06						6.37E-07	2.71E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.13E-06	1.45E-07	1.44E-05	6.18E-06						1.12E-06	4.70E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E-03	9.63E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.75E-06	7.47E-05	100.0%	

Table M.208. Risk characterization for fish: children – ingestion exposure (future land use – residential) – Area S5–F1–R

Chemical	MLB Concentration in Fish Tissue	RMB Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	UPA WOE
INORGANICS															
Mercury	0.76	0.78	4.1E-06	1.7E-07	6.0E-05	7.7E-06	1.3E-02	2.0E-01	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	1.1E-06	4.8E-08	1.7E-05	2.2E-06						3.7E-07	1.7E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.9E-06	8.4E-08	3.0E-05	3.8E-06						6.5E-07	2.9E-05	63.7%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.3E-02	2.0E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-06	4.6E-05	100.0%	

Table M.209. Risk characterization for groundwater: adults – ingestion exposure (future land use – commercial) – Area S5–F2–C

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	2.72E-05	3.49E-06	5.45E-05	1.95E-05	9.05E-02	1.82E-01	1.8%	skin; keratosis, hyperpigmentation	3	6.11E-06	3.41E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	2.71E-03	3.48E-04	4.75E-03	1.70E-03	3.87E-02	6.78E-02	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	1.29E-05	1.66E-06	2.50E-05	8.94E-06	2.58E-03	5.01E-03	0.1%	no observed effects	100	7.13E-06	3.85E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	2.26E-04	2.91E-05	4.00E-04	1.43E-04	2.26E-04	4.00E-04	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	1.14E-04	1.47E-05	3.17E-03	1.13E-03	3.09E-03	8.56E-02	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	1.83E-04	2.36E-05	3.46E-04	1.23E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	2.56E-02	3.29E-03	4.32E-02	1.54E-02	5.12E+00	8.64E+00	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	9.49E-05	1.22E-05	2.14E-04	7.64E-05	3.16E-01	7.13E-01	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	3.29E-04	4.23E-05	6.29E-04	2.25E-04	1.65E-02	3.14E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	2.68E-04	3.44E-05	4.80E-04	1.71E-04	3.82E-02	6.85E-02	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.35E+02	6.82E+02	2.46E-03	3.16E-04	6.67E-03	2.38E-03	2.46E-02	6.67E-02	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	4.78E-04	6.14E-05	1.32E-03	4.70E-04	7.96E-03	2.20E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.61E-07	3.53E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		5.14E+03		2.54E+04						5.14E-07	2.54E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		1.99E+04		1.14E+05						3.18E-07	1.82E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		1.61E+04		9.41E+04						4.51E-07	2.64E-06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							5.66E+00	9.89E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.37E-05	7.61E-05	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.28E-06	7.00E-06	100.0%	

SEGMENT 6 RISK CHARACTERIZATION TABLES

Table M.210. Risk characterization summary for EFPC Segment 6: RME estimates for current land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	6.69E−01 B	1.87E−01 B	1.32E−05 W	1.23E−05 W	2.30E−07 B	5.76E−07 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	2.65E−02 B	2.03E−02 B	1.65E−06 W	4.21E−06 W	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	5.05E+01 *B*	2.44E+01 *B*	1.97E−04 *B*	3.16E−04 *B*	1.76E−07 B	7.60E−07 B
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					5.1E+01 *B*	2.5E+01 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					3E−04 *B*	4E−04 *B*		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					4E−07 B	1E−06 W

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.211. Human health risk characterization summary for EFPC residential scenario: current land use, Area S6–C1–R adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	4.29E–02	1.87E–01	9.77E–07	1.23E–05
Dermal Contact	1.55E–03	2.03E–02	1.03E–07	4.21E–06
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce	3.76E+00	2.44E+01	1.92E–05	3.16E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			4.19E–08	5.76E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce			3.12E–08	7.60E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	3.8E+00	2.5E+01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–05	4E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			7E–08	1E–06

Table M.212. Human health risk characterization summary for EFPC residential scenario: current land use, Area S6–C1–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.50E–01	6.69E–01	1.14E–06	1.32E–05
Dermal Contact	2.02E–03	2.65E–02	4.47E–08	1.65E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce	8.41E+00	5.05E+01	1.43E–05	1.97E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.75E–08	2.30E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce			8.31E–09	1.76E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	8.6E+00	5.1E+01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–05	3E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			3E–08	4E–07

Table M.213. Risk characterization for soils: adults – ingestion exposure (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	0.97	1.27	4.12E-07	5.30E-08	1.73E-06	7.43E-07	1.03E-03	4.33E-03	2.3%	whole body, blood; inc. mortality	1000				
Arsenic	6.89	7.40	2.91E-06	3.74E-07	1.01E-05	4.34E-06	9.70E-03	3.38E-02	18.1%	skin; keratosis, hyperpigmentation	3	6.55E-07	7.60E-06	61.9%	[A]
Barium	62.90	80.29	2.66E-05	3.42E-06	1.10E-04	4.71E-05	3.80E-04	1.57E-03	0.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.49	0.68	2.05E-07	2.64E-08	9.26E-07	3.97E-07	4.11E-05	1.85E-04	0.1%	no observed effects	100	1.14E-07	1.71E-06	13.9%	[B2]
Cadmium	1.56	2.79	6.58E-07	8.46E-08	3.82E-06	1.64E-06	6.58E-04	3.62E-03	2.0%	kidney; proteinuria	10				
Chromium (III)	64.30	68.82	2.72E-05	3.49E-06	9.43E-05	4.04E-05	2.72E-05	9.43E-05	0.1%	no observed effects	100				
Copper	25.02	44.48	1.00E-05	1.30E-06	6.09E-05	2.61E-05	2.86E-04	1.65E-03	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	23.76	32.27	1.00E-05	1.29E-06	4.42E-05	1.89E-05				CNS, blood	--				[B2]
Manganese	733.00	1226.00	3.10E-04	3.98E-05	1.68E-03	7.20E-04	2.21E-03	1.20E-02	6.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	19.26	27.14	8.14E-06	1.05E-06	3.72E-05	1.59E-05	2.71E-02	1.24E-01	66.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	16.26	25.35	6.87E-06	8.84E-07	3.47E-05	1.49E-05	3.44E-04	1.74E-03	0.9%	dec. body and organ weight	300				
Selenium	22.02	26.23	9.31E-06	1.20E-06	3.59E-05	1.54E-05	1.86E-03	7.19E-03	3.8%	whole body; clinical selenosis	3				[D]
Silver	1.29	1.83	5.47E-07	7.03E-08	2.51E-06	1.08E-06	1.09E-04	5.02E-04	0.3%	skin; argyria	3				[D]
Zinc	80.24	96.10	3.39E-05	4.36E-06	1.32E-04	5.64E-05	1.13E-04	4.39E-04	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.14	3.81E-08	4.89E-09	1.92E-07	8.23E-08				--	--	3.77E-08	6.33E-07	5.2%	[B2]
Benzo(a)anthracene	0.20	0.26	8.61E-08	1.11E-08	3.61E-07	1.55E-07	2.87E-06	1.20E-05	0.0%	--	--	8.08E-09	1.13E-07	0.9%	[B2]
Benzo(a)pyrene	0.18	0.23	7.73E-08	9.94E-09	3.12E-07	1.34E-07	2.58E-06	1.04E-05	0.0%	--	--	7.26E-08	9.75E-07	7.9%	[B2]
Benzo(b)fluoranthene	0.25	0.34	1.04E-07	1.34E-08	4.69E-07	2.01E-07	3.47E-06	1.56E-05	0.0%	--	--	9.78E-09	1.47E-07	1.2%	[B2]
Benzo(k)fluoranthene	0.17	0.22	7.11E-08	9.15E-09	3.05E-07	1.31E-07	2.37E-06	1.02E-05	0.0%	--	--	6.68E-09	9.54E-08	0.8%	[B2]
Chrysene	0.20	0.26	8.62E-08	1.11E-08	3.56E-07	1.53E-07	2.87E-06	1.19E-05	0.0%	--	--	8.09E-10	1.11E-08	0.1%	[B2]
Dibenzo(a,h)anthracene	0.16	0.21	6.84E-08	8.79E-09	2.81E-07	1.20E-07	2.28E-06	9.36E-06	0.0%	--	--	6.42E-08	8.79E-07	7.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.22	0.26	9.48E-08	1.22E-08	3.50E-07	1.50E-07	3.16E-06	1.17E-05	0.0%	--	--	8.90E-09	1.10E-07	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.50	0.99		4.85E+01		1.04E+03						1.36E-09	2.92E-08	5.1%	[A]
Cobalt 60	0.01	0.05		1.43E+00		5.15E+01						2.14E-11	7.72E-10	0.1%	[A]
Protactinium 233		0.02				1.71E+01							1.71E-11	0.0%	[A]
Thorium 228+D	2.23	3.26		2.16E+02		3.43E+03						1.19E-08	1.88E-07	32.7%	[A]
Thorium 230	7.91	7.91		7.69E+02		8.31E+03						1.00E-08	1.08E-07	18.7%	[A]
Thorium 232	1.80	2.98		1.75E+02		3.13E+03						2.10E-09	3.75E-08	6.5%	[A]
Uranium 234	3.69	4.46		3.59E+02		4.68E+03						5.74E-09	7.49E-08	13.0%	[A]
Uranium 235+D	0.17	0.21		1.68E+01		2.21E+02						2.69E-10	3.54E-09	0.6%	[A]
Uranium 238+D	3.87	4.55		3.76E+02		4.78E+03						1.05E-08	1.34E-07	23.2%	[A]

Chemical Hazards:			
Hazard Index (HI):	4.29E-02	1.67E-01	100.0%
Combined Exposure (d)			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	9.77E-07	1.23E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	4.19E-08	5.76E-07	100.0%

Table M.214. Risk characterization for soils: children – ingestion exposure (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Antimony	0.97	1.27	1.4E-06	6.1E-08	6.2E-06	7.9E-07	3.6E-03	1.5E-02	2.3%	whole body, blood; inc. mortality	1000				
Arsenic	6.89	7.40	1.0E-05	4.3E-07	3.6E-05	4.6E-06	3.4E-02	1.2E-01	18.1%	skin; keratosis, hyperpigmentation	3	7.6E-07	8.1E-06	61.9%	[A]
Barium	62.90	80.29	9.3E-05	3.9E-06	3.9E-04	5.0E-05	1.3E-03	5.6E-03	0.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.49	0.68	7.1E-07	3.0E-08	3.3E-06	4.2E-07	1.4E-04	6.6E-04	0.1%	no observed effects	100	1.3E-07	1.8E-06	13.9%	[B2]
Cadmium	1.56	2.79	2.3E-06	9.8E-08	1.3E-05	1.7E-06	2.3E-03	1.3E-02	2.0%	kidney; proteinuria	10				
Chromium (III)	64.30	68.82	9.5E-05	4.0E-06	3.3E-04	4.3E-05	9.5E-05	3.3E-04	0.1%	no observed effects	100				
Copper	25.02	44.48	3.7E-05	1.5E-06	2.1E-04	2.8E-05	1.0E-03	5.9E-03	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	23.76	32.27	3.5E-05	1.5E-06	1.5E-04	2.0E-05				CNS, blood	--				[B2]
Manganese	733.00	1226.00	1.0E-03	4.6E-05	6.0E-03	7.7E-04	7.7E-03	4.3E-02	6.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	19.26	27.14	2.8E-05	1.2E-06	1.3E-04	1.7E-05	9.5E-02	4.4E-01	66.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	16.26	25.35	2.4E-05	1.0E-06	1.2E-04	1.6E-05	1.2E-03	6.2E-03	0.9%	dec. body and organ weight	300				
Selenium	22.02	26.23	3.2E-05	1.4E-06	1.2E-04	1.6E-05	6.5E-03	2.5E-02	3.8%	whole body; clinical selenosis	3				[D]
Silver	1.29	1.83	1.9E-06	8.2E-08	8.9E-06	1.1E-06	3.8E-04	1.8E-03	0.3%	skin; argyria	3				[D]
Zinc	80.24	96.10	1.1E-04	5.0E-06	4.7E-04	6.0E-05	3.9E-04	1.5E-03	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.14	1.3E-07	5.7E-09	6.8E-07	8.8E-08				--	--	4.4E-08	6.8E-07	5.2%	[B2]
Benzo(a)anthracene	0.20	0.26	3.0E-07	1.2E-08	1.2E-06	1.6E-07	1.0E-05	4.3E-05	0.0%	--	--	9.4E-09	1.2E-07	0.9%	[B2]
Benzo(a)pyrene	0.18	0.23	2.7E-07	1.1E-08	1.1E-06	1.4E-07	9.0E-06	3.7E-05	0.0%	--	--	8.4E-08	1.0E-06	7.9%	[B2]
Benzo(b)fluoranthene	0.25	0.34	3.6E-07	1.5E-08	1.6E-06	2.1E-07	1.2E-05	5.5E-05	0.0%	--	--	1.1E-08	1.5E-07	1.2%	[B2]
Benzo(k)fluoranthene	0.17	0.22	2.4E-07	1.0E-08	1.0E-06	1.4E-07	8.3E-06	3.6E-05	0.0%	--	--	7.7E-09	1.0E-07	0.8%	[B2]
Chrysene	0.20	0.26	3.0E-07	1.2E-08	1.2E-06	1.6E-07	1.0E-05	4.2E-05	0.0%	--	--	9.4E-10	1.2E-08	0.1%	[B2]
Dibenzo(a,h)anthracene	0.16	0.21	2.3E-07	1.0E-08	1.0E-06	1.2E-07	7.9E-06	3.3E-05	0.0%	--	--	7.4E-08	9.4E-07	7.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.22	0.26	3.3E-07	1.4E-08	1.2E-06	1.6E-07	1.1E-05	4.1E-05	0.0%	--	--	1.0E-08	1.1E-07	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.50	0.99		2.0E+01		4.1E+02						5.6E-10	1.1E-08	5.1%	[A]
Cobalt 60	0.01	0.05		5.9E-01		2.0E+01						8.9E-12	3.0E-10	0.1%	[A]
Protactinium 233		0.02				6.8E+00							6.8E-12	0.0%	[A]
Thorium 228+D	2.23	3.26		9.0E+01		1.3E+03						4.9E-09	7.5E-08	32.7%	[A]
Thorium 230	7.91	7.91		3.2E+02		3.3E+03						4.1E-09	4.3E-08	18.7%	[A]
Thorium 232	1.80	2.98		7.2E+01		1.2E+03						8.7E-10	1.5E-08	6.5%	[A]
Uranium 234	3.69	4.46		1.5E+02		1.8E+03						2.3E-09	2.9E-08	13.0%	[A]
Uranium 235+D	0.17	0.21		6.9E+00		8.8E+01						1.1E-10	1.4E-09	0.6%	[A]
Uranium 238+D	3.87	4.55		1.5E+02		1.9E+03						4.3E-09	5.3E-08	23.2%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-01	6.6E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.1E-06	1.3E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.7E-08	2.3E-07	100.0%	

Table M.215. Risk characterization for soils: adults – dermal exposure (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	UPA UP	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (mg/kg)															
Antimony	0.97	1.27	1.4E-08	1.9E-09	1.8E-07	8.0E-08	3.7E-05	4.6E-04	2.3%	whole body, blood; inc. mortality	1000				
Arsenic	6.89	7.40	1.0E-07	1.3E-08	1.1E-06	4.6E-07	3.4E-04	3.6E-03	18.0%	skin; keratosis, hyperpigmentation	3	2.3E-08	8.2E-07	19.5%	[A]
Barium	62.90	80.29	9.5E-07	1.2E-07	1.1E-05	5.1E-06	1.3E-05	1.7E-04	0.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.49	0.68	7.3E-09	9.5E-10	1.0E-07	4.2E-08	1.4E-06	2.0E-05	0.1%	no observed effects	100	4.0E-09	1.8E-07	4.4%	[B2]
Cadmium	1.56	2.79	2.3E-08	3.0E-09	4.1E-07	1.7E-07	2.3E-05	4.1E-04	2.0%	kidney; proteinuria	10				
Chromium (III)	64.30	68.82	9.7E-07	1.2E-07	1.0E-05	4.3E-06	9.7E-07	1.0E-05	0.1%	no observed effects	100				
Copper	25.02	44.48	3.8E-07	4.9E-08	6.5E-06	2.8E-06	1.0E-05	1.7E-04	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	23.76	32.27	3.6E-07	4.6E-08	4.7E-06	2.0E-06				CNS, blood	--				[B2]
Manganese	733.00	1226.00	1.1E-05	1.4E-06	1.8E-04	7.7E-05	7.9E-05	1.3E-03	6.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	19.26	27.14	2.9E-07	3.7E-08	4.0E-06	1.7E-06	9.7E-04	1.3E-02	66.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	16.26	25.35	2.4E-07	3.1E-08	3.7E-06	1.6E-06	1.2E-05	1.8E-04	0.9%	dec. body and organ weight	300				
Selenium	22.02	26.23	3.3E-07	4.3E-08	3.8E-06	1.6E-06	6.7E-05	7.7E-04	3.8%	whole body; clinical selenosis	3				[D]
Silver	1.29	1.83	1.9E-08	2.5E-09	2.7E-07	1.1E-07	3.9E-06	5.4E-05	0.3%	skin; argyria	3				[D]
Zinc	80.24	96.10	1.2E-06	1.5E-07	1.4E-05	6.1E-06	4.0E-06	4.7E-05	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.14	1.3E-08	1.7E-09	2.0E-07	8.6E-08						1.3E-08	6.8E-07	16.3%	[B2]
Benzo(a)anthracene	0.20	0.26	3.1E-08	3.9E-09	3.9E-07	1.6E-07	1.0E-06	1.3E-05	0.1%	--	--	2.9E-09	1.2E-07	2.9%	[B2]
Benzo(a)pyrene	0.18	0.23	2.7E-08	3.5E-09	3.3E-07	1.4E-07	9.2E-07	1.1E-05	0.1%	--	--	2.6E-08	1.0E-06	25.0%	[B2]
Benzo(b)fluoranthene	0.25	0.34	3.7E-08	4.8E-09	5.0E-07	2.1E-07	1.2E-06	1.6E-05	0.1%	--	--	3.5E-09	1.5E-07	3.8%	[B2]
Benzo(k)fluoranthene	0.17	0.22	2.5E-08	3.2E-09	3.3E-07	1.4E-07	8.5E-07	1.1E-05	0.1%	--	--	2.4E-09	1.0E-07	2.5%	[B2]
Chrysene	0.20	0.26	3.1E-08	3.9E-09	3.8E-07	1.6E-07	1.0E-06	1.2E-05	0.1%	--	--	2.9E-10	1.2E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.16	0.21	2.4E-08	3.1E-09	3.0E-07	1.3E-07	8.2E-07	1.0E-05	0.0%	--	--	2.3E-08	9.5E-07	22.6%	[B2]
Indeno(1,2,3-cd)pyrene	0.22	0.26	3.4E-08	4.3E-09	3.7E-07	1.6E-07	1.1E-06	1.2E-05	0.1%	--	--	3.2E-09	1.1E-07	2.8%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-03	2.0E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-07	4.2E-06	100.0%	

Table M.216. Risk characterization for soils: children – dermal exposure (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	Risk Estimates: RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.97	1.27	1.9E-08	8.2E-10	2.4E-07	3.1E-08	4.8E-05	6.1E-04	2.3%	whole body, blood; inc. mortality	1000				
Arsenic	6.89	7.40	1.3E-07	5.8E-09	1.4E-06	1.8E-07	4.5E-04	4.7E-03	18.0%	skin; keratosis, hyperpigmentation	3	1.0E-08	3.2E-07	19.5%	[A]
Barium	62.90	80.29	1.2E-06	5.3E-08	1.5E-05	2.0E-06	1.7E-05	2.2E-04	0.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.49	0.68	9.6E-09	4.1E-10	1.3E-07	1.6E-08	1.9E-06	2.6E-05	0.1%	no observed effects	100	1.7E-09	7.2E-08	4.4%	[B2]
Cadmium	1.56	2.79	3.0E-08	1.3E-09	5.4E-07	6.9E-08	3.0E-05	5.4E-04	2.0%	kidney; proteinuria	10				
Chromium (III)	64.30	68.82	1.2E-06	5.4E-08	1.3E-05	1.7E-06	1.2E-06	1.3E-05	0.1%	no observed effects	100				
Copper	25.02	44.48	4.9E-07	2.1E-08	8.6E-06	1.1E-06	1.3E-05	2.3E-04	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	23.76	32.27	4.7E-07	2.0E-08	6.2E-06	8.0E-07				CNS, blood	--				[B2]
Manganese	733.00	1226.00	1.4E-05	6.2E-07	2.3E-04	3.0E-05	1.0E-04	1.7E-03	6.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	19.26	27.14	3.8E-07	1.6E-08	5.2E-06	6.7E-07	1.2E-03	1.7E-02	66.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	16.26	25.35	3.2E-07	1.3E-08	4.9E-06	6.3E-07	1.6E-05	2.4E-04	0.9%	dec. body and organ weight	300				
Selenium	22.02	26.23	4.3E-07	1.8E-08	5.0E-06	6.5E-07	8.7E-05	1.0E-03	3.8%	whole body; clinical selenosis	3				[D]
Silver	1.29	1.83	2.5E-08	1.1E-09	3.5E-07	4.5E-08	5.1E-06	7.1E-05	0.3%	skin; argyria	3				[D]
Zinc	80.24	96.10	1.5E-06	6.8E-08	1.8E-05	2.3E-06	5.3E-06	6.2E-05	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.14	1.7E-08	7.6E-10	2.7E-07	3.4E-08						5.8E-09	2.6E-07	16.3%	[B2]
Benzo(a)anthracene	0.20	0.26	4.0E-08	1.7E-09	5.1E-07	6.5E-08	1.3E-06	1.7E-05	0.1%	--	--	1.2E-09	4.7E-08	2.9%	[B2]
Benzo(a)pyrene	0.18	0.23	3.6E-08	1.5E-09	4.4E-07	5.6E-08	1.2E-06	1.4E-05	0.1%	--	--	1.1E-08	4.1E-07	25.0%	[B2]
Benzo(b)fluoranthene	0.25	0.34	4.8E-08	2.1E-09	6.6E-07	8.5E-08	1.6E-06	2.2E-05	0.1%	--	--	1.5E-09	6.2E-08	3.8%	[B2]
Benzo(k)fluoranthene	0.17	0.22	3.3E-08	1.4E-09	4.3E-07	5.5E-08	1.1E-06	1.4E-05	0.1%	--	--	1.0E-09	4.0E-08	2.5%	[B2]
Chrysene	0.20	0.26	4.0E-08	1.7E-09	5.0E-07	6.4E-08	1.3E-06	1.6E-05	0.1%	--	--	1.2E-10	4.7E-09	0.3%	[B2]
Dibenzo(a,h)anthracene	0.16	0.21	3.2E-08	1.3E-09	3.9E-07	5.1E-08	1.0E-06	1.3E-05	0.0%	--	--	1.0E-08	3.7E-07	22.6%	[B2]
Indeno(1,2,3-cd)pyrene	0.22	0.26	4.4E-08	1.9E-09	4.9E-07	6.3E-08	1.4E-06	1.6E-05	0.1%	--	--	1.3E-09	4.6E-08	2.8%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.0E-03	2.6E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												4.4E-08	1.6E-06	100.0%	

Table M.217. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern, Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI) x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.87E-05	0.6%	Gastrointestinal system; irritation	– –				
Manganese (water)	2.69E+02	4.13E+02	3.68E-06	4.73E-07	3.36E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.71E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.41E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	0.4%	liver; lesions, fattycyst formation	1000	4.37E-11	9.97E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.05E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.82E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.09E-09	2.79E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.31E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity	1000	4.16E-11	1.06E-09	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	1.8%	liver; inc. relative weight	1000	3.46E-10	7.94E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							9.67E-04	8.62E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.48E-09	6.01E-08	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.49E-10	1.31E-08	100.0%	

Table M.218. Risk characterization for surface water: children – ingestion exposure (swimming) (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E–06	1.30E–07	2.30E–05	2.96E–06	4.34E–05	3.29E–04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E–07	1.28E–08	2.89E–06	3.72E–07	2.99E–07	2.89E–06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E–07	3.04E–08	4.80E–06	6.17E–07	1.92E–05	1.30E–04	0.6%	Gastrointestinal system; irritation	– –				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E–05	4.42E–07	9.09E–05	1.16E–05	2.06E–03	1.81E–02	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E–07	4.40E–09	8.62E–07	1.11E–07	3.42E–04	2.87E–03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E–07	1.38E–08	3.09E–06	3.97E–07	4.60E–05	4.41E–04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E–06	1.13E–07	1.99E–05	2.56E–06	8.79E–06	6.64E–05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E–07	1.02E–08	1.69E–06	2.17E–07	2.38E–06	1.69E–05	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E–02	2.50E–02	8.91E–10	3.82E–11	5.48E–09	7.05E–10	2.97E–05	1.83E–04	0.8%	liver; lesions, toxicity	1000	6.49E–10	1.20E–08	24.7%	[B2]
Bis(2–ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E–07	1.56E–08	3.04E–06	3.90E–07	1.82E–05	1.52E–04	0.7%	liver; weight inc.	1000	2.19E–10	5.46E–09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E–07	6.69E–09	1.03E–06	1.32E–07	1.56E–05	1.03E–04	0.4%	liver; lesions, fatty cyst formation	1000	4.08E–11	8.06E–10	1.7%	[B2]
4,4'–DDT	4.02E–02	4.94E–02	1.54E–09	6.61E–11	1.08E–08	1.39E–09	3.08E–06	2.17E–05	0.1%	liver; lesions	100	2.25E–11	4.73E–10	1.0%	[B2]
Dieldrin	3.87E–02	5.00E–02	1.49E–09	6.37E–11	1.10E–08	1.41E–09	2.97E–05	2.19E–04	0.9%	liver; lesions	100	1.02E–09	2.25E–08	46.5%	[B2]
Endrin	3.87E–02	5.00E–02	1.48E–09	6.36E–11	1.10E–08	1.41E–09	4.95E–06	3.65E–05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.82E–02	2.34E–02	6.97E–10	2.99E–11	5.14E–09	6.60E–10	2.32E–06	1.71E–05	0.1%	liver, kidney; toxicity	1000	3.89E–11	8.58E–10	1.8%	[C]
Heptachlor Epoxide	2.16E–02	2.50E–02	8.28E–10	3.55E–11	5.48E–09	7.05E–10	6.37E–05	4.21E–04	1.8%	liver; inc. relative weight	1000	3.22E–10	6.41E–09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E–07	6.87E–09	1.06E–06	1.36E–07	1.60E–05	1.06E–04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E–11	1.29E–09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E–10	2.78E–09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.71E–03	2.32E–02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E–09	4.85E–08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E–10	4.07E–09	100.0%	

Table M.219. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.58E-06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.40E-04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.05E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.21E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fatty cyst formation	1000	1.88E-10	7.57E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity	1000	2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; inc. relative weight	1000	5.29E-09	2.14E-07	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.02E-03	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.35E-08	1.04E-06	100.0%	

Table M.220. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – residential) – Area S6–C1–R

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E-07	4.69E-09	1.53E-06	1.96E-07	1.56E-06	2.18E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	3.18E-07	4.09E-08	6.91E-07	8.60E-06	0.1%	Gastrointestinal system; irritation	- -				[D]
Manganese	2.69E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	2.65E-06	4.29E-05	0.3%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E-09	1.59E-10	5.72E-08	7.35E-09	1.23E-05	1.91E-04	1.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E-08	4.98E-10	2.05E-07	2.64E-08	1.66E-06	2.93E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.20E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.21E-04	0.7%	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.59E+01	2.71E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	12.8%	liver; weight inc.	1000	1.63E-09	7.47E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E-07	1.34E-08	3.79E-06	4.87E-07	3.13E-05	3.79E-04	2.3%	liver; lesions, fatty cyst formation	1000	8.19E-11	2.97E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.99E-04	3.86E-03	23.9%	liver; lesions	100	2.18E-09	8.44E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.45E-03	9.0%	liver; lesions	100	3.67E-09	1.50E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	1.5%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	0.6%	liver, kidney; toxicity	1000	1.23E-10	4.98E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	34.1%	liver; inc. relative weight	1000	2.30E-09	8.40E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.70E-06	1.73E-04	2.11E-03	13.1%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.28E-03	1.62E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-08	4.08E-07	100.0%	

Table M.221. Risk characterization for sediments: adults – dermal exposure (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration (in sediment)	RME Concentration (in sediment)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (RME)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.65E-09	1.01E-09	3.39E-07	1.45E-07	7.65E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.60	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%	--	--	5.02E-11	9.91E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.36E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-09	2.80E-07	100.0%	

Table M.222. Risk characterization for sediments: children – dermal exposure (current land use – residential) – Area S6–C1–R

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.76E-10	4.18E-11	4.24E-08	5.45E-09	3.25E-06	1.41E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.32E-11	9.55E-09	8.7%	[A]
Barium	78.13	88.46	1.67E-08	7.17E-10	7.12E-07	9.16E-08	2.39E-07	1.02E-05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.96E-10	8.40E-12	8.25E-09	1.06E-09	3.92E-08	1.65E-06	0.2%	no observed effects	100	3.66E-11	4.58E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.04E-10	1.30E-11	1.38E-08	1.77E-09	3.04E-07	1.38E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.02E-08	4.38E-10	4.43E-07	5.70E-08	1.02E-08	4.43E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.14E-09	2.20E-10	2.41E-07	3.09E-08	1.39E-07	6.50E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.13E-08	4.86E-10	8.08E-07	1.03E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.90E-07	8.14E-09	8.34E-06	1.07E-06	1.36E-06	5.96E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.20E-09	1.37E-10	1.65E-07	2.12E-08	1.07E-05	5.49E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.96E-09	2.12E-10	2.23E-07	2.87E-08	2.48E-07	1.12E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.22E-09	2.67E-10	2.72E-07	3.49E-08	8.86E-07	3.88E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.08E-08	8.91E-10	9.73E-07	1.25E-07	6.93E-08	3.24E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.10	0.16	2.21E-10	9.47E-12	1.32E-08	1.69E-09				--	--	7.29E-11	1.30E-08	11.9%	[B2]
Aroclor–1260	0.08	0.14	1.75E-10	7.42E-12	1.12E-08	1.44E-09				--	--	5.71E-11	1.11E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.97E-10	2.99E-11	4.16E-08	5.33E-09	2.32E-08	1.39E-06	0.2%	--	--	2.18E-11	3.91E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.75E-10	2.89E-11	3.91E-08	5.02E-09	2.25E-08	1.30E-06	0.2%	--	--	2.11E-10	3.67E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.03E-10	3.44E-11	4.68E-08	6.01E-09	2.68E-08	1.56E-06	0.2%	--	--	2.51E-11	4.39E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.58E-10	2.82E-11	3.19E-08	4.10E-09	2.19E-08	1.06E-06	0.1%	--	--	2.06E-11	2.99E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.62E-10	2.84E-11	3.96E-08	5.05E-09	2.21E-08	1.32E-06	0.2%	--	--	2.07E-12	3.71E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.70E-10	2.02E-11	1.94E-08	2.50E-09	1.57E-08	6.48E-07	0.1%	--	--	1.47E-10	1.82E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.64E-11	7.03E-13	1.09E-09	1.40E-10	3.29E-07	2.18E-05	2.5%	liver; lesions	100	1.13E-11	2.24E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.90E-10	2.53E-11	3.05E-08	3.92E-09	1.97E-08	1.02E-06	0.1%	--	--	1.85E-11	2.86E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.77E-03	8.66E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.97E-10	1.10E-07	100.0%	

Table M.223. Risk characterization for produce: adults – ingestion exposure (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	EPA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	9.75E-03	1.27E-02	1.49E-06	1.91E-07	8.84E-06	3.79E-06	3.72E-03	2.21E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	5.51E-01	5.92E-01	8.40E-05	1.08E-05	4.13E-04	1.77E-04	2.80E-01	1.38E+00	5.7%	skin; keratosis, hyperpigmentation	3	1.89E-05	3.10E-04	98.1%	[A]
Barium	6.29E-01	8.03E-01	9.60E-05	1.23E-05	5.61E-04	2.40E-04	1.37E-03	8.01E-03	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.94E-03	2.70E-03	2.96E-07	3.81E-08	1.89E-06	8.10E-07	5.93E-05	3.78E-04	0.0%	no observed effects	100	1.64E-07	3.48E-06	1.1%	[B2]
Cadmium	7.79E-01	1.39E+00	1.19E-04	1.53E-05	9.74E-04	4.16E-04	1.19E-01	9.74E-01	4.0%	kidney; proteinuria	10				
Chromium (III)	6.43E-01	6.88E-01	9.81E-05	1.26E-05	4.81E-04	2.06E-04	9.81E-05	4.81E-04	0.0%	no observed effects	100				
Copper	1.25E+00	2.22E+00	1.91E-04	2.45E-05	1.55E-03	6.66E-04	5.16E-03	4.20E-02	0.2%	Gastrointestinal system; irritation	--				[D]
Lead	2.38E-01	3.23E-01	3.63E-05	4.65E-06	2.25E-04	9.66E-05				CNS, blood	--				[D2]
Manganese	2.93E+02	4.90E+02	4.47E-02	5.75E-03	3.43E-01	1.47E-01	3.20E-01	2.45E+00	10.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	5.78E+00	8.14E+00	8.82E-04	1.13E-04	5.69E-03	2.44E-03	2.94E+00	1.90E+01	77.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	8.13E-01	1.27E+00	1.24E-04	1.59E-05	8.86E-04	3.80E-04	6.20E-03	4.43E-02	0.2%	dec. body and organ weight	300				
Selenium	2.20E+00	2.62E+00	3.36E-04	4.32E-05	1.83E-03	7.85E-04	6.72E-02	3.67E-01	1.5%	whole body; clinical selenosis	3				[D]
Silver	2.59E-01	3.66E-01	3.95E-05	5.07E-06	2.56E-04	1.10E-04	7.89E-03	5.12E-02	0.2%	skin; argyria	3				[D]
Zinc	3.21E+01	3.84E+01	4.90E-03	6.30E-04	2.69E-02	1.15E-02	1.63E-02	8.95E-02	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	8.84E-05	1.38E-04	1.35E-08	1.73E-09	9.61E-08	4.12E-08				--	--	1.34E-08	3.17E-07	0.1%	[B2]
Benzo(a)anthracene	7.57E-04	9.80E-04	1.15E-07	1.48E-08	6.84E-07	2.93E-07	3.85E-06	2.28E-05	0.0%	--	--	1.08E-08	2.14E-07	0.1%	[B2]
Benzo(a)pyrene	3.45E-04	4.29E-04	5.26E-08	6.76E-09	3.00E-07	1.28E-07	1.75E-06	9.98E-06	0.0%	--	--	4.94E-08	9.37E-07	0.3%	[B2]
Benzo(b)fluoranthene	3.66E-04	5.07E-04	5.58E-08	7.17E-09	3.54E-07	1.52E-07	1.86E-06	1.18E-05	0.0%	--	--	5.24E-09	1.11E-07	0.0%	[B2]
Benzo(k)fluoranthene	1.79E-04	2.37E-04	2.73E-08	3.51E-09	1.65E-07	7.09E-08	9.10E-07	5.51E-06	0.0%	--	--	2.56E-09	5.18E-08	0.0%	[B2]
Chrysene	8.89E-04	1.13E-03	1.36E-07	1.74E-08	7.91E-07	3.39E-07	4.52E-06	2.64E-05	0.0%	--	--	1.27E-09	2.47E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	2.74E-04	3.47E-04	4.18E-08	5.37E-09	2.43E-07	1.04E-07	1.39E-06	8.09E-06	0.0%	--	--	3.92E-08	7.59E-07	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	8.12E-05	9.24E-05	1.24E-08	1.59E-09	6.46E-08	2.77E-08	4.13E-07	2.15E-06	0.0%	--	--	1.16E-09	2.02E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	1.50E-02	2.98E-02		5.25E+02		1.59E+04						1.47E-08	4.40E-07	58.7%	[A]
Cobalt 60	4.40E-04	1.47E-03		1.55E+01		7.87E+02						2.32E-10	1.16E-08	1.6%	[A]
Protactinium 233		1.63E-04				8.73E+01							8.73E-11	0.0%	[A]
Thorium 228+D	1.11E-03	1.63E-03		3.91E+01		8.74E+02						2.15E-09	4.81E-08	6.3%	[A]
Thorium 230	3.96E-03	3.96E-03		1.39E+02		2.12E+03						1.86E-09	2.75E-08	3.6%	[A]
Thorium 232	9.00E-04	1.49E-03		3.16E+01		7.97E+02						3.79E-10	9.57E-09	1.3%	[A]
Uranium 234	7.39E-03	8.91E-03		2.59E+02		4.77E+03						4.15E-09	7.64E-08	10.1%	[A]
Uranium 235+D	3.45E-04	4.21E-04		1.21E+01		2.25E+02						1.94E-10	3.61E-09	0.5%	[A]
Uranium 238+D	7.75E-03	9.11E-03		2.72E+02		4.88E+03						7.61E-09	1.37E-07	18.0%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	3.78E+00	2.44E+01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.92E-05	3.16E-04	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	3.12E-08	7.60E-07	100.0%

Table M.224. Risk characterization for produce: children – ingestion exposure (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI: Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	RfDs WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	9.7E3-03	1.2E3-02	3.3E3-06	1.4E3-07	1.8E3-05	2.3E3-06	8.3E3-03	4.5E3-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	5.5E3-01	5.9E3-01	1.8E3-04	8.0E3-06	8.5E3-04	1.1E3-04	6.2E3-01	2.8E3+00	5.7%	skin; keratosis, hyperpigmentation	3	1.4E3-05	1.9E3-04	98.1%	[A]
Barium	6.2E3-01	8.0E3-01	2.1E3-04	9.1E3-06	1.1E3-03	1.5E3-04	3.0E3-03	1.6E3-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.9E3-03	2.7E3-03	6.6E3-07	2.8E3-08	3.9E3-06	5.0E3-07	1.3E3-04	7.8E3-04	0.0%	no observed effects	100	1.2E3-07	2.1E3-06	1.1%	[B2]
Cadmium	7.7E3-01	1.3E3+00	2.6E3-04	1.1E3-05	2.0E3-03	2.6E3-04	2.6E3-01	2.0E3+00	4.0%	kidney; proteinuria	10				
Chromium (III)	6.4E3-01	6.8E3-01	2.1E3-04	9.4E3-06	9.9E3-04	1.2E3-04	2.1E3-04	9.9E3-04	0.0%	no observed effects	100				
Copper	1.2E3+00	2.2E3+00	4.2E3-04	1.8E3-05	3.2E3-03	4.1E3-04	1.1E3-02	8.7E3-02	0.2%	Gastrointestinal system; irritation	--				[D]
Lead	2.3E3-01	3.2E3-01	8.1E3-05	3.4E3-06	4.6E3-04	6.0E3-05				CNS, blood	--				[B2]
Manganese	2.9E3+02	4.9E3+02	1.0E3-01	4.2E3-03	7.1E3-01	9.1E3-02	7.1E3-01	5.0E3+00	10.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	5.7E3+00	8.1E3+00	1.9E3-03	8.4E3-05	1.1E3-02	1.5E3-03	6.5E3+00	3.9E3+01	77.8%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	8.1E3-01	1.2E3+00	2.7E3-04	1.1E3-05	1.8E3-03	2.3E3-04	1.3E3-02	9.1E3-02	0.2%	dec. body and organ weight	300				
Selenium	2.2E3+00	2.6E3+00	7.5E3-04	3.2E3-05	3.8E3-03	4.8E3-04	1.5E3-01	7.6E3-01	1.5%	whole body; clinical selenosis	3				[D]
Silver	2.5E3-01	3.6E3-01	8.8E3-05	3.7E3-06	5.3E3-04	6.8E3-05	1.7E3-02	1.0E3-01	0.2%	skin; argyria	3				[D]
Zinc	3.2E3+01	3.8E3+01	1.0E3-02	4.6E3-04	5.5E3-02	7.1E3-03	3.6E3-02	1.8E3-01	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	8.8E3-05	1.3E3-04	3.0E3-08	1.2E3-09	1.9E3-07	2.5E3-08				--	--	9.9E3-09	1.9E3-07	0.1%	[B2]
Benzo(a)anthracene	7.5E3-04	9.8E3-04	2.5E3-07	1.1E3-08	1.4E3-06	1.8E3-07	8.6E3-06	4.7E3-05	0.0%	--	--	8.0E3-09	1.3E3-07	0.1%	[B2]
Benzo(a)pyrene	3.4E3-04	4.2E3-04	1.1E3-07	5.0E3-09	6.2E3-07	7.9E3-08	3.9E3-06	2.0E3-05	0.0%	--	--	3.6E3-08	5.8E3-07	0.3%	[B2]
Benzo(b)fluoranthene	3.6E3-04	5.0E3-04	1.2E3-07	5.3E3-09	7.3E3-07	9.4E3-08	4.1E3-06	2.4E3-05	0.0%	--	--	3.9E3-09	6.9E3-08	0.0%	[B2]
Benzo(k)fluoranthene	1.7E3-04	2.3E3-04	6.1E3-08	2.6E3-09	3.4E3-07	4.4E3-08	2.0E3-06	1.1E3-05	0.0%	--	--	1.9E3-09	3.2E3-08	0.0%	[B2]
Chrysene	8.8E3-04	1.1E3-03	3.0E3-07	1.3E3-08	1.6E3-06	2.1E3-07	1.0E3-05	5.4E3-05	0.0%	--	--	9.4E3-10	1.5E3-08	0.0%	[B2]
Dibenzo(a,h)anthracene	2.7E3-04	3.4E3-04	9.3E3-08	4.0E3-09	5.0E3-07	6.4E3-08	3.1E3-06	1.6E3-05	0.0%	--	--	2.9E3-08	4.7E3-07	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	8.1E3-05	9.2E3-05	2.7E3-08	1.1E3-09	1.3E3-07	1.7E3-08	9.2E3-07	4.4E3-06	0.0%	--	--	8.6E3-10	1.2E3-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	1.5E3-02	2.9E3-02		1.4E3+02		3.6E3+03						3.9E3-09	1.0E3-07	58.7%	[A]
Cobalt 60	4.4E3-04	1.4E3-03		4.1E3+00		1.8E3+02						6.1E3-11	2.7E3-09	1.6%	[A]
Protactinium 233		1.6E3-04				2.0E3+01							2.0E3-11	0.0%	[A]
Thorium 228+D	1.1E3-03	1.6E3-03		1.0E3+01		2.0E3+02						5.7E3-10	1.1E3-08	6.3%	[A]
Thorium 230	3.9E3-03	3.9E3-03		3.6E3+01		4.9E3+02						4.8E3-10	6.3E3-09	3.6%	[A]
Thorium 232	9.0E3-04	1.4E3-03		8.4E3+00		1.8E3+02						1.0E3-10	2.2E3-09	1.3%	[A]
Uranium 234	7.3E3-03	8.9E3-03		6.9E3+01		1.1E3+03						1.1E3-09	1.7E3-08	10.1%	[A]
Uranium 235+D	3.4E3-04	4.2E3-04		3.2E3+00		5.2E3+01						5.1E3-11	8.3E3-10	0.5%	[A]
Uranium 238+D	7.7E3-03	9.1E3-03		7.2E3+01		1.1E3+03						2.0E3-09	3.1E3-08	18.0%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	8.4E3+00	5.0E3+01	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.4E3-05	1.9E3-04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	8.3E3-09	1.7E3-07	100.0%

Table M.225. Risk characterization for fish: adults – ingestion exposure (current land use – residential) – Area S6–C1–R

Chemical	MLB Concentration in Fish (mg/kg)	RMB Concentration in Fish (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	UPA WOE
INORGANICS															
Mercury	0.76	0.78	2.38E-06	3.06E-07	2.89E-05	1.24E-05	7.94E-03	9.63E-02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	6.43E-07	8.27E-08	8.21E-06	3.52E-06						6.37E-07	2.71E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.13E-06	1.45E-07	1.44E-05	6.18E-06						1.12E-06	4.76E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E-03	9.63E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.75E-06	7.47E-05	100.0%	

Table M.226. Risk characterization for fish: children – ingestion exposure (current land use – residential) – Area S6–C1–R

Chemical	MLE Concentration in Fish Tissue	RME Concentration in Fish Tissue	Chronic Daily Intake (CDI) Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS															
Mercury	0.76	0.78	4.1E-06	1.7E-07	6.0E-05	7.7E-06	1.3E-02	2.0E-01	100.0%	*oral*-CNS; neurotoxicity. *inhal*-kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	1.1E-06	4.8E-08	1.7E-05	2.2E-06						3.7E-07	1.7E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.9E-06	8.4E-08	3.0E-05	3.8E-06						6.5E-07	2.9E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-02	2.0E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-06	4.6E-05	100.0%	

Table M.227. Risk characterization summary for EFPC Segment 6: RME estimates for future land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	6.69E−01 B	1.87E−01 B	1.32E−05 W	1.23E−05 W	2.30E−07 B	5.76E−07 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	2.65E−02 B	2.03E−02 B	1.65E−06 W	4.21E−06 W	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	3.28E+01 *B*	2.77E+01 *B*	9.08E−05 W	2.56E−04 *B*	3.10E−06 W	2.35E−05 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	7.30E−04 B	1.61E−04 B	1.33E−07 B	9.78E−08 B	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	5.05E+01 *B*	2.44E+01 *B*	1.97E−04 *B*	3.16E−04 *B*	1.76E−07 B	7.60E−07 B
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					8.4E+01 *B*	52E+01 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					3E−04 *B*	7E−04 *B*		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					4E−06 W	2E−05 W

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (BLCR<=1 x 10^{-6})
W – within EPA target cancer risk range (BLCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (BLCR>1 x 10^{-4})

Table M.228. Human health risk characterization summary for EFPC residential scenario: future land use, Area S6–F1–R adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	4.29E–02	1.87E–01	9.77E–07	1.23E–05
Dermal Contact	1.55E–03	2.03E–02	1.03E–07	4.21E–06
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion	1.58E+01	2.77E+01	3.84E–05	2.56E–04
Inhalation (VOCs)	4.01E–05	1.61E–04	7.30E–09	9.78E–08
FOOD CHAIN				
Produce	3.76E+00	2.44E+01	1.92E–05	3.16E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			4.19E–08	5.76E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion			3.59E–06	2.35E–05
FOOD CHAIN				
Produce			3.12E–08	7.60E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.0E+01	5.2E+01		
Excess Lifetime Cancer Risk: Combined Exposure			6E–05	7E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			4E–06	2E–05

Table M.229. Human health risk characterization summary for EFPC residential scenario: future land use, Area S6–F1–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.50E–01	6.69E–01	1.14E–06	1.32E–05
Dermal Contact	2.02E–03	2.65E–02	4.47E–08	1.65E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion	1.65E+01	3.28E+01	1.33E–05	9.08E–05
Inhalation (VOCs)	2.34E–04	7.30E–04	1.42E–08	1.33E–07
FOOD CHAIN				
Produce	8.41E+00	5.05E+01	1.43E–05	1.97E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.75E–08	2.30E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion			4.45E–07	3.10E–06
FOOD CHAIN				
Produce			8.31E–09	1.76E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.5E+01	8.4E+01		
Excess Lifetime Cancer Risk: Combined Exposure			3E–05	3E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–07	4E–06

Table M.230. Risk characterization for soils: adults – ingestion exposure (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.97	1.27	4.12E-07	5.30E-08	1.73E-06	7.43E-07	1.03E-03	4.33E-03	2.3%	whole body, blood; inc. mortality	1000				
Arsenic	6.89	7.40	2.96E-06	3.74E-07	1.01E-05	4.34E-06	9.70E-03	3.33E-02	18.1%	skin; keratosis, hyperpigmentation	3	6.55E-07	7.60E-06	61.9%	[A]
Barium	62.90	80.29	2.66E-05	3.42E-06	1.10E-04	4.71E-05	3.86E-04	1.57E-03	0.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.49	0.68	2.09E-07	2.64E-08	9.26E-07	3.97E-07	4.18E-05	1.85E-04	0.1%	no observed effects	100	1.14E-07	1.71E-06	13.9%	[B2]
Cadmium	1.56	2.79	6.58E-07	8.46E-08	3.82E-06	1.64E-06	6.58E-04	3.82E-03	2.0%	kidney; proteinuria	10				
Chromium (III)	64.30	68.82	2.72E-05	3.49E-06	9.43E-05	4.04E-05	2.72E-05	9.43E-05	0.1%	no observed effects	100				
Copper	25.02	44.48	1.06E-05	1.36E-06	6.09E-05	2.61E-05	2.86E-04	1.65E-03	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	23.76	32.27	1.00E-05	1.29E-06	4.42E-05	1.89E-05				CNS, blood	--				[B2]
Manganese	733.00	1226.00	3.10E-04	3.98E-05	1.68E-03	7.20E-04	2.21E-03	1.20E-02	6.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	19.26	27.14	8.14E-06	1.05E-06	3.72E-05	1.59E-05	2.71E-02	1.24E-01	66.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	16.26	25.35	6.87E-06	8.84E-07	3.47E-05	1.49E-05	3.44E-04	1.74E-03	0.9%	dec. body and organ weight	300				
Selenium	22.02	26.23	9.31E-06	1.20E-06	3.59E-05	1.54E-05	1.86E-03	7.19E-03	3.8%	whole body; clinical selenosis	3				[D]
Silver	1.29	1.83	5.47E-07	7.03E-08	2.51E-06	1.08E-06	1.09E-04	5.02E-04	0.3%	skin; argyria	3				[D]
Zinc	80.24	96.10	3.39E-05	4.36E-06	1.32E-04	5.64E-05	1.13E-04	4.39E-04	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.14	3.86E-08	4.89E-09	1.92E-07	8.23E-08				--	--	3.77E-08	6.33E-07	5.2%	[B2]
Benzo(a)anthracene	0.20	0.26	8.66E-08	1.11E-08	3.66E-07	1.55E-07	2.87E-06	1.20E-05	0.0%	--	--	8.08E-09	1.13E-07	0.9%	[B2]
Benzo(a)pyrene	0.18	0.23	7.73E-08	9.94E-09	3.12E-07	1.34E-07	2.58E-06	1.04E-05	0.0%	--	--	7.26E-08	9.75E-07	7.9%	[B2]
Benzo(b)fluoranthene	0.25	0.34	1.04E-07	1.34E-08	4.69E-07	2.01E-07	3.47E-06	1.56E-05	0.0%	--	--	9.78E-09	1.47E-07	1.2%	[B2]
Benzo(k)fluoranthene	0.17	0.22	7.11E-08	9.15E-09	3.05E-07	1.31E-07	2.37E-06	1.02E-05	0.0%	--	--	6.68E-09	9.54E-08	0.8%	[B2]
Chrysene	0.20	0.26	8.62E-08	1.11E-08	3.56E-07	1.53E-07	2.87E-06	1.19E-05	0.0%	--	--	8.09E-10	1.11E-08	0.1%	[B2]
Dibenzo(a,h)anthracene	0.16	0.21	6.84E-08	8.79E-09	2.81E-07	1.20E-07	2.28E-06	9.36E-06	0.0%	--	--	6.42E-08	8.79E-07	7.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.22	0.26	9.46E-08	1.22E-08	3.50E-07	1.50E-07	3.16E-06	1.17E-05	0.0%	--	--	8.90E-09	1.10E-07	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.50	0.99		4.85E+01		1.04E+03						1.36E-09	2.92E-08	5.1%	[A]
Cobalt 60	0.01	0.05		1.43E+00		5.15E+01						2.14E-11	7.72E-10	0.1%	[A]
Protactinium 233		0.02				1.71E+01							1.71E-11	0.0%	[A]
Thorium 228+D	2.23	3.26		2.16E+02		3.43E+03						1.19E-08	1.88E-07	32.7%	[A]
Thorium 230	7.91	7.91		7.69E+02		8.31E+03						1.00E-08	1.08E-07	18.7%	[A]
Thorium 232	1.80	2.98		1.75E+02		3.18E+03						2.10E-09	3.75E-08	6.5%	[A]
Uranium 234	3.69	4.46		3.55E+02		4.68E+03						5.74E-09	7.49E-08	13.0%	[A]
Uranium 235+D	0.17	0.21		1.68E+01		2.21E+02						2.69E-10	3.54E-09	0.6%	[A]
Uranium 238+D	3.87	4.55		3.76E+02		4.78E+03						1.05E-08	1.34E-07	23.2%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.29E-02	1.87E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.77E-07	1.23E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.19E-08	3.72E-07	100.0%	

Table M.231. Risk characterization for soils: children – ingestion exposure (future land use – residential) – Area S6–F1–R

Chemical	MLB Concentration (ppm)	RMB Concentration (ppm)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates: HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Antimony	0.97	1.27	1.44E-06	6.18E-08	6.21E-06	7.98E-07	3.61E-03	1.59E-02	2.3%	whole body, blood; inc. mortality	1000				
Arsenic	6.89	7.40	1.02E-05	4.37E-07	3.63E-05	4.67E-06	3.40E-02	1.21E-01	18.1%	skin; keratosis, hyperpigmentation	3	7.64E-07	8.18E-06	61.9%	[A]
Barium	62.90	80.29	9.31E-05	3.99E-06	3.94E-04	5.06E-05	1.33E-03	5.63E-03	0.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.49	0.68	7.19E-07	3.08E-08	3.32E-06	4.26E-07	1.44E-04	6.63E-04	0.1%	no observed effects	100	1.32E-07	1.83E-06	13.9%	[B2]
Cadmium	1.56	2.79	2.30E-06	9.87E-08	1.37E-05	1.76E-06	2.30E-03	1.37E-02	2.0%	kidney; proteinuria	10				
Chromium (III)	64.30	68.82	9.51E-05	4.08E-06	3.38E-04	4.34E-05	9.51E-05	3.38E-04	0.1%	no observed effects	100				
Copper	25.02	44.48	3.70E-05	1.59E-06	2.16E-04	2.81E-05	1.00E-03	5.90E-03	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	23.76	32.27	3.52E-05	1.51E-06	1.58E-04	2.04E-05				CNS, blood	--				[B2]
Manganese	733.00	1226.00	1.08E-03	4.65E-05	6.01E-03	7.73E-04	7.75E-03	4.30E-02	6.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	19.26	27.14	2.85E-05	1.22E-06	1.33E-04	1.71E-05	9.51E-02	4.44E-01	66.3%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	16.26	25.35	2.41E-05	1.03E-06	1.24E-04	1.60E-05	1.20E-03	6.22E-03	0.9%	dec. body and organ weight	300				
Selenium	22.02	26.23	3.26E-05	1.40E-06	1.29E-04	1.65E-05	6.52E-03	2.57E-02	3.8%	whole body; clinical selenosis	3				[D]
Silver	1.29	1.83	1.91E-06	8.20E-08	8.99E-06	1.16E-06	3.83E-04	1.80E-03	0.3%	skin; argyria	3				[D]
Zinc	80.24	96.10	1.19E-04	5.09E-06	4.71E-04	6.06E-05	3.96E-04	1.57E-03	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.14	1.33E-07	5.71E-09	6.87E-07	8.84E-08			--		--	4.40E-08	6.80E-07	5.2%	[B2]
Benzo(a)anthracene	0.20	0.26	3.01E-07	1.29E-08	1.29E-06	1.66E-07	1.00E-05	4.31E-05	0.0%	--	--	9.43E-09	1.21E-07	0.9%	[B2]
Benzo(a)pyrene	0.18	0.23	2.71E-07	1.16E-08	1.12E-06	1.43E-07	9.02E-06	3.72E-05	0.0%	--	--	8.47E-08	1.05E-06	7.9%	[B2]
Benzo(b)fluoranthene	0.25	0.34	3.65E-07	1.56E-08	1.68E-06	2.16E-07	1.22E-05	5.59E-05	0.0%	--	--	1.14E-08	1.57E-07	1.2%	[B2]
Benzo(k)fluoranthene	0.17	0.22	2.49E-07	1.07E-08	1.09E-06	1.40E-07	8.30E-06	3.64E-05	0.0%	--	--	7.79E-09	1.03E-07	0.8%	[B2]
Chrysene	0.20	0.26	3.02E-07	1.29E-08	1.27E-06	1.64E-07	1.01E-05	4.25E-05	0.0%	--	--	9.44E-10	1.20E-08	0.1%	[B2]
Dibenzo(a,h)anthracene	0.16	0.21	2.39E-07	1.03E-08	1.01E-06	1.29E-07	7.97E-06	3.35E-05	0.0%	--	--	7.48E-08	9.44E-07	7.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.22	0.26	3.32E-07	1.42E-08	1.25E-06	1.61E-07	1.11E-05	4.18E-05	0.0%	--	--	1.04E-08	1.18E-07	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.50	0.99		2.02E+01		4.16E+02									
Cobalt 60	0.01	0.05		5.95E-01		2.05E+01						5.66E-10	1.16E-08	5.1%	[A]
Protactinium 233		0.02				6.83E+00						8.92E-12	3.08E-10	0.1%	[A]
Thorium 228+D	2.23	3.26		9.02E+01		1.37E+03							6.83E-12	0.0%	[A]
Thorium 230	7.91	7.91		3.20E+02		3.32E+03						4.96E-09	7.52E-08	32.7%	[A]
Thorium 232	1.80	2.98		7.25E+01		1.25E+03						4.17E-09	4.31E-08	18.7%	[A]
Uranium 234	3.69	4.46		1.50E+02		1.87E+03						8.75E-10	1.50E-08	6.5%	[A]
Uranium 235+D	0.17	0.21		6.99E+00		8.82E+01						2.39E-09	2.99E-08	13.0%	[A]
Uranium 238+D	3.87	4.55		1.57E+02		1.91E+03						1.12E-10	1.41E-09	0.6%	[A]
												4.39E-09	5.34E-08	23.2%	[A]

Chemical Hazards:			
Hazard Index (HI):	1.50E-01	6.69E-01	100.0%
Combined Exposure (d)			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.14E-06	1.32E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.75E-08	2.30E-07	100.0%

Table M.232. Risk characterization for soils: adults — dermal exposure (future land use — residential) — Area S6—F1—R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS **(mg/kg)**															
Antimony	0.97	1.27	1.48E-08	1.91E-09	1.87E-07	8.03E-08	3.7E-05	4.6E-04	2.3%	whole body, blood; inc. mortality	1000				
Arsenic	6.89	7.40	1.05E-07	1.35E-08	1.10E-06	4.69E-07	3.4E-04	3.6E-03	18.0%	skin; keratosis, hyperpigmentation	3	2.36E-08	8.22E-07	19.5%	[A]
Barium	62.90	80.29	9.57E-07	1.23E-07	1.19E-05	5.10E-06	1.3E-05	1.7E-04	0.8%	*oral*—cardiovasc. sys.; inc. blood pressure. *Inhal.*—fetotoxicity	3				
Beryllium	0.49	0.68	7.35E-09	9.50E-10	1.00E-07	4.29E-08	1.4E-06	2.0E-05	0.1%	no observed effects	100	4.09E-09	1.85E-07	4.4%	[B2]
Cadmium	1.56	2.79	2.37E-08	3.05E-09	4.13E-07	1.77E-07	2.3E-05	4.1E-04	2.0%	kidney; proteinuria	10				
Chromium (III)	64.30	68.82	9.78E-07	1.26E-07	1.02E-05	4.37E-06	9.7E-07	1.0E-05	0.1%	no observed effects	100				
Copper	25.02	44.48	3.81E-07	4.90E-08	6.59E-06	2.82E-06	1.0E-05	1.7E-04	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	23.76	32.27	3.62E-07	4.65E-08	4.78E-06	2.05E-06				CNS, blood	--				[B2]
Manganese	733.00	1226.00	1.12E-05	1.43E-06	1.82E-04	7.78E-05	7.9E-05	1.3E-03	6.4%	*oral*—CNS effects. *Inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	19.26	27.14	2.93E-07	3.77E-08	4.02E-06	1.72E-06	9.7E-04	1.3E-02	66.0%	*oral*—CNS; neurotoxicity. *Inhal.*—kidney effects	1000				[D]
Nickel	16.26	25.35	2.47E-07	3.18E-08	3.75E-06	1.61E-06	1.2E-05	1.8E-04	0.9%	dec. body and organ weight	300				
Selenium	22.02	26.23	3.35E-07	4.31E-08	3.88E-06	1.66E-06	6.7E-05	7.7E-04	3.8%	whole body; clinical selenosis	3				[D]
Silver	1.29	1.83	1.97E-08	2.53E-09	2.71E-07	1.16E-07	3.9E-06	5.4E-05	0.3%	skin; argyria	3				[D]
Zinc	80.24	96.10	1.22E-06	1.57E-07	1.42E-05	6.10E-06	4.0E-06	4.7E-05	0.2%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor-1260	0.09	0.14	1.37E-08	1.76E-09	2.07E-07	8.88E-08						1.36E-08	6.85E-07	16.3%	[B2]
Benzo(a)anthracene	0.20	0.26	3.10E-08	3.99E-09	3.90E-07	1.67E-07	1.0E-06	1.3E-05	0.1%	--	--	2.9E-09	1.27E-07	2.9%	[B2]
Benzo(a)pyrene	0.18	0.23	2.78E-08	3.58E-09	3.37E-07	1.44E-07	9.2E-07	1.1E-05	0.1%	--	--	2.6E-08	1.05E-06	25.0%	[B2]
Benzo(b)fluoranthene	0.25	0.34	3.75E-08	4.82E-09	5.07E-07	2.17E-07	1.2E-06	1.6E-05	0.1%	--	--	3.52E-09	1.58E-07	3.8%	[B2]
Benzo(k)fluoranthene	0.17	0.22	2.56E-08	3.29E-09	3.30E-07	1.41E-07	8.5E-07	1.1E-05	0.1%	--	--	2.40E-09	1.03E-07	2.5%	[B2]
Chrysene	0.20	0.26	3.10E-08	3.99E-09	3.85E-07	1.65E-07	1.0E-06	1.2E-05	0.1%	--	--	2.9E-10	1.20E-08	0.3%	[B2]
Dibenzo(a,h)anthracene	0.16	0.21	2.46E-08	3.16E-09	3.04E-07	1.30E-07	8.2E-07	1.0E-05	0.0%	--	--	2.3E-08	9.50E-07	22.6%	[B2]
Indeno(1,2,3-cd)pyrene	0.22	0.26	3.41E-08	4.39E-09	3.78E-07	1.62E-07	1.1E-06	1.2E-05	0.1%	--	--	3.20E-09	1.18E-07	2.8%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.59E-03	2.03E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.03E-07	4.21E-06	100.0%	

Table M.233. Risk characterization for soils: children – dermal exposure (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.97	1.27	1.9E-08	8.2E-10	2.4E-07	3.1E-08	4.8E-05	6.1E-04	2.3%	whole body, blood; inc. mortality	1000				
Arsenic	6.89	7.40	1.3E-07	5.8E-09	1.4E-06	1.8E-07	4.5E-04	4.7E-03	18.0%	skin; keratosis, hyperpigmentation	3	1.0E-08	3.2E-07	19.5%	[A]
Barium	62.90	80.29	1.2E-06	5.3E-08	1.5E-05	2.0E-06	1.7E-05	2.2E-04	0.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.49	0.68	9.6E-09	4.1E-10	1.3E-07	1.6E-08	1.9E-06	2.6E-05	0.1%	no observed effects	100	1.7E-09	7.2E-08	4.4%	[B2]
Cadmium	1.56	2.79	3.0E-08	1.3E-09	5.4E-07	6.9E-08	3.0E-05	5.4E-04	2.0%	kidney; proteinuria	10				
Chromium (III)	64.30	68.82	1.2E-06	5.4E-08	1.3E-05	1.7E-06	1.2E-06	1.3E-05	0.1%	no observed effects	100				
Copper	25.02	44.48	4.9E-07	2.1E-08	8.6E-06	1.1E-06	1.3E-05	2.3E-04	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	23.76	32.27	4.7E-07	2.0E-08	6.2E-06	8.0E-07				CNS, blood	--				[B2]
Manganese	733.00	1226.00	1.4E-05	6.2E-07	2.3E-04	3.0E-05	1.0E-04	1.7E-03	6.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	19.26	27.14	3.8E-07	1.6E-08	5.2E-06	6.7E-07	1.2E-03	1.7E-02	66.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	16.26	25.35	3.2E-07	1.3E-08	4.9E-06	6.3E-07	1.6E-05	2.4E-04	0.9%	dec. body and organ weight	300				
Selenium	22.02	26.23	4.3E-07	1.8E-08	5.0E-06	6.5E-07	8.7E-05	1.0E-03	3.8%	whole body; clinical selenosis	3				[D]
Silver	1.29	1.83	2.5E-08	1.1E-09	3.5E-07	4.5E-08	5.1E-06	7.1E-05	0.3%	skin; argyria	3				[D]
Zinc	80.24	96.10	1.5E-06	6.8E-08	1.8E-05	2.3E-06	5.3E-06	6.2E-05	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.14	1.7E-08	7.6E-10	2.7E-07	3.4E-08						5.8E-09	2.6E-07	16.3%	[B2]
Benzo(a)anthracene	0.20	0.26	4.0E-08	1.7E-09	5.1E-07	6.5E-08	1.3E-06	1.7E-05	0.1%	--	--	1.2E-09	4.7E-08	2.9%	[B2]
Benzo(a)pyrene	0.18	0.23	3.6E-08	1.5E-09	4.4E-07	5.6E-08	1.2E-06	1.4E-05	0.1%	--	--	1.1E-08	4.1E-07	25.0%	[B2]
Benzo(b)fluoranthene	0.25	0.34	4.8E-08	2.1E-09	6.6E-07	8.5E-08	1.6E-06	2.2E-05	0.1%	--	--	1.5E-09	6.2E-08	3.8%	[B2]
Benzo(k)fluoranthene	0.17	0.22	3.3E-08	1.4E-09	4.3E-07	5.5E-08	1.1E-06	1.4E-05	0.1%	--	--	1.0E-09	4.0E-08	2.5%	[B2]
Chrysene	0.20	0.26	4.0E-08	1.7E-09	5.0E-07	6.4E-08	1.3E-06	1.6E-05	0.1%	--	--	1.2E-10	4.7E-09	0.3%	[B2]
Dibenzo(a,h)anthracene	0.16	0.21	3.2E-08	1.3E-09	3.9E-07	5.1E-08	1.0E-06	1.3E-05	0.0%	--	--	1.0E-08	3.7E-07	22.6%	[B2]
Indeno(1,2,3-cd)pyrene	0.22	0.26	4.4E-08	1.9E-09	4.9E-07	6.3E-08	1.4E-06	1.6E-05	0.1%	--	--	1.3E-09	4.6E-08	2.8%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							2.0E-03	2.6E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												4.4E-08	1.6E-06	100.0%	

Table M.234. Risk characterization for surface water: adults – ingestion exposure (swimming) (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS *(µg/L)*															
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.88E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation	--				(D)
Manganese (water)	2.65E+02	4.13E+02	3.65E-06	4.73E-07	3.31E-05	1.44E-05	7.31E-04	6.72E-03	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				(D)
Mercury	2.68E+00	3.93E+00	3.68E-08	4.77E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				(D)
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				(D)
ORGANICS *(µg/L)*															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				(D)
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	(B2)
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.66E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	(B2)
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	0.4%	liver; lesions, fatty cyst formation	1000	4.37E-11	9.97E-10	1.7%	(B2)
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.86E-10	1.0%	(B2)
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.09E-09	2.79E-08	46.5%	(B2)
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				(D)
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity	1000	4.16E-11	1.06E-09	1.8%	(C)
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	1.8%	liver; inc. relative weight	1000	3.46E-10	7.94E-09	13.2%	(B2)
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.66E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES *(pCi/L)*															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	(A)
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	(A)
Chemical Hazards:															
Hazard Index (HI):							9.67E-04	8.62E-03	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:												2.48E-09	6.01E-08	100.0%	
Combined Exposure (d)															
Radiological Hazards:															
Excess Lifetime Cancer Risk:												5.49E-10	1.32E-08	100.0%	
Combined Exposure (d)															

Table M.235. Risk characterization for surface water: children – ingestion exposure (swimming) (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E-06	1.30E-07	2.30E-05	2.96E-06	4.34E-05	3.29E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E-07	1.28E-08	2.89E-06	3.72E-07	2.99E-07	2.89E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E-07	3.04E-08	4.80E-06	6.17E-07	1.92E-05	1.30E-04	0.6%	Gastrointestinal system; irritation	--				
Manganese (water)	2.69E+02	4.13E+02	1.03E-05	4.42E-07	9.05E-05	1.16E-05	2.06E-03	1.80E-02	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E-07	4.40E-09	8.62E-07	1.10E-07	3.42E-04	2.87E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.40E+01	3.22E-07	1.38E-08	3.09E-06	3.97E-07	4.60E-05	4.41E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E-06	1.13E-07	1.99E-05	2.56E-06	8.79E-06	6.64E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E-07	1.02E-08	1.69E-06	2.17E-07	2.38E-06	1.69E-05	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	8.91E-10	3.82E-11	5.46E-09	7.05E-10	2.97E-05	1.83E-04	0.8%	liver; lesions, toxicity	1000	6.49E-10	1.20E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E-07	1.56E-08	3.04E-06	3.90E-07	1.82E-05	1.52E-04	0.7%	liver; weight inc.	1000	2.19E-10	5.40E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E-07	6.69E-09	1.03E-06	1.32E-07	1.56E-05	1.03E-04	0.4%	liver; lesions, fattycyst formation	1000	4.08E-11	8.06E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.54E-09	6.61E-11	1.08E-08	1.39E-09	3.08E-06	2.17E-05	0.1%	liver; lesions	100	2.25E-11	4.73E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	1.49E-09	6.37E-11	1.10E-08	1.41E-09	2.97E-05	2.19E-04	0.9%	liver; lesions	100	1.07E-09	2.25E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	1.48E-09	6.36E-11	1.10E-08	1.41E-09	4.95E-06	3.65E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	6.97E-10	2.99E-11	5.14E-09	6.60E-10	2.32E-06	1.71E-05	0.1%	liver, kidney; toxicity	1000	3.89E-11	8.58E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	8.28E-10	3.55E-11	5.48E-09	7.05E-10	6.37E-05	4.21E-04	1.8%	liver; inc. relative weight	1000	3.23E-10	6.41E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E-07	6.87E-09	1.06E-06	1.36E-07	1.60E-05	1.06E-04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E-11	1.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E-10	2.78E-09	68.4%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	2.71E-03	2.32E-02	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.31E-09	4.85E-08	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.83E-10	4.07E-09	100.0%

Table M.236. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.55E-06	0.0%	Gastrointestinal system; irritation	- -				[D]
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.21E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fatty cyst formation	1000	1.88E-10	7.57E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.26E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity	1000	2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; inc. relative weight	1000	5.29E-09	2.14E-07	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.02E-03	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.35E-08	1.04E-06	100.0%	

Table M.237. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E-07	4.69E-09	1.53E-06	1.96E-07	1.56E-06	2.18E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	3.18E-07	4.09E-08	6.91E-07	8.60E-06	0.0%	Gastrointestinal system; irritation	--				
Manganese (water)	2.69E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	7.43E-05	1.20E-03	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E-09	1.59E-10	5.72E-08	7.35E-09	1.23E-05	1.91E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E-08	4.98E-10	2.05E-07	2.64E-08	1.66E-06	2.93E-05	0.2%	no observed effects	100				[D]
Zinc	6.67E+01	9.09E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	0.0%	blood; anemia	3				
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.21E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.21E-04	0.7%	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	12.0%	liver; weight inc.	1000	1.63E-09	7.47E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E-07	1.34E-08	3.79E-06	4.87E-07	3.13E-05	3.79E-04	2.2%	liver; lesions, fattycyst formation	1000	8.19E-11	2.97E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.99E-04	3.86E-03	22.3%	liver; lesions	100	2.18E-09	8.44E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.45E-03	8.4%	liver; lesions	100	3.67E-09	1.50E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	0.6%	liver, kidney; toxicity	1000	1.23E-10	4.98E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	31.9%	liver; inc. relative weight	1000	2.30E-09	8.40E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.71E-06	1.73E-04	2.11E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.33E-03	1.73E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-08	4.08E-07	100.0%	

Table M.238. Risk characterization for sediments: adults – dermal exposure (future land use – residential) – Area S6–F1–R

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.01	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%	--	--	5.02E-11	9.96E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.98E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.55E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-09	2.8E-07	100.0%	

Table M.239. Risk characterization for sediments: children – dermal exposure (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (RME)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.76E-10	4.18E-11	4.24E-08	5.45E-09	3.25E-06	1.41E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.32E-11	9.55E-09	8.7%	[A]
Barium	78.13	88.46	1.67E-08	7.17E-10	7.12E-07	9.16E-08	2.39E-07	1.02E-05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.96E-10	8.40E-12	8.25E-09	1.06E-09	3.92E-08	1.65E-06	0.2%	no observed effects	100	3.61E-11	4.56E-09	4.2%	[D2]
Cadmium	1.42	1.71	3.04E-10	1.30E-11	1.38E-08	1.77E-09	3.04E-07	1.38E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.02E-08	4.38E-10	4.43E-07	5.70E-08	1.02E-08	4.43E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.14E-09	2.20E-10	2.41E-07	3.09E-08	1.39E-07	6.50E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.13E-08	4.86E-10	8.01E-07	1.03E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.90E-07	8.14E-09	8.34E-06	1.07E-06	1.36E-06	5.96E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.20E-09	1.37E-10	1.65E-07	2.12E-08	1.07E-05	5.49E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.95E-09	2.12E-10	2.23E-07	2.87E-08	2.48E-07	1.12E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.22E-09	2.67E-10	2.72E-07	3.49E-08	8.89E-07	3.88E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.08E-08	8.91E-10	9.73E-07	1.25E-07	6.93E-08	3.24E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.21E-10	9.47E-12	1.32E-08	1.69E-09				--	--	7.29E-11	1.30E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.73E-10	7.42E-12	1.12E-08	1.44E-09				--	--	5.71E-11	1.11E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.97E-10	2.99E-11	4.16E-08	5.35E-09	2.32E-08	1.39E-06	0.2%	--	--	2.18E-11	3.91E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.75E-10	2.89E-11	3.91E-08	5.02E-09	2.25E-08	1.30E-06	0.2%	--	--	2.11E-10	3.67E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.03E-10	3.44E-11	4.68E-08	6.01E-09	2.68E-08	1.56E-06	0.2%	--	--	2.51E-11	4.39E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.58E-10	2.82E-11	3.19E-08	4.10E-09	2.19E-08	1.06E-06	0.1%	--	--	2.06E-11	2.99E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.62E-10	2.84E-11	3.96E-08	5.09E-09	2.21E-08	1.32E-06	0.2%	--	--	2.07E-12	3.71E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.70E-10	2.02E-11	1.94E-08	2.50E-09	1.57E-08	6.48E-07	0.1%	--	--	1.47E-10	1.82E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.64E-11	7.05E-13	1.09E-09	1.40E-10	3.29E-07	2.18E-05	2.5%	liver; lesions	100	1.13E-11	2.24E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.90E-10	2.53E-11	3.05E-08	3.92E-09	1.97E-08	1.02E-06	0.1%	--	--	1.85E-11	2.86E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.77E-05	8.66E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.97E-10	1.10E-07	100.0%	

Table M.240. Risk characterization for groundwater: adults – ingestion exposure (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration In GW	RME Concentration In GW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.61E-05	9.78E-06	1.53E-04	6.55E-05	2.54E-01	5.09E-01	1.8%	skin; keratosis, hyperpigmentation	3	1.71E-05	1.15E-04	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.56E-03	9.74E-04	1.33E-02	5.70E-03	1.08E-01	1.90E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.68E+00	2.56E+00	3.61E-05	4.64E-06	7.01E-05	3.00E-05	7.22E-03	1.40E-02	0.1%	no observed effects	100	2.00E-05	1.29E-04	50.5%	[D2]
Chromium (III)	3.30E+01	4.10E+01	6.33E-04	8.14E-05	1.12E-03	4.81E-04	6.33E-04	1.12E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.20E-04	4.12E-05	8.87E-03	3.80E-03	8.66E-03	2.40E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.13E-04	6.60E-05	9.68E-04	4.15E-04				CNS, blood	--				[D2]
Manganese (water)	3.74E+03	4.42E+03	7.17E-02	9.22E-03	1.21E-01	5.19E-02	1.43E+01	2.42E+01	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.66E-04	3.42E-05	5.99E-04	2.57E-04	8.86E-01	2.00E+00	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.86E+01	6.43E+01	9.21E-04	1.18E-04	1.76E-03	7.55E-04	4.61E-02	8.81E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.49E-04	9.64E-05	1.34E-03	5.76E-04	1.07E-01	1.92E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	6.89E-03	8.86E-04	1.87E-02	8.01E-03	6.89E-02	1.87E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E-03	1.72E-04	3.69E-03	1.58E-03	2.23E-02	6.15E-02	0.2%	*oral and inhal.*–liver; toxicity	100	1.29E-06	1.19E-05	4.6%	[D2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.44E+04		8.54E+04						1.44E-06	8.54E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05						8.91E-07	6.11E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05						1.26E-06	8.86E-06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.58E+01	2.77E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.84E-05	2.38E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.59E-06	2.35E-05	100.0%	

Table M.241. Risk characterization for groundwater: children – ingestion exposure (future land use – residential) – Area S6–F1–R

Chemical	Chronic Daily Intake (CDI) MLE Concentration (µg/L)	Chronic Daily Intake (CDI) RME Concentration (µg/L)	CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.91E−05	3.39E−06	1.81E−04	2.33E−05	2.64E−01	6.03E−01	1.8%	skin; keratosis, hyperpigmentation	3	5.93E−06	4.07E−05	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.86E−03	3.36E−04	1.57E−02	2.02E−03	1.13E−01	2.25E−01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.76E−05	1.61E−06	8.31E−05	1.07E−05	7.51E−03	1.66E−02	0.1%	no observed effects	100	6.92E−06	4.59E−05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.59E−04	2.82E−05	1.33E−03	1.71E−04	6.59E−04	1.33E−03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.33E−04	1.43E−05	1.05E−02	1.35E−03	9.01E−03	2.84E−01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.55E+01	5.34E−04	2.29E−05	1.15E−03	1.47E−04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E−02	3.20E−03	1.43E−01	1.84E−02	1.49E+01	2.87E+01	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.76E−04	1.18E−05	7.09E−04	9.12E−05	9.21E−01	2.36E+00	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.58E−04	4.11E−05	2.09E−03	2.68E−04	4.79E−02	1.04E−01	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.79E−04	3.34E−05	1.59E−03	2.05E−04	1.11E−01	2.27E−01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	7.16E−03	3.07E−04	2.21E−02	2.85E−03	7.16E−02	2.21E−01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E−03	5.96E−05	4.37E−03	5.62E−04	2.32E−02	7.28E−02	0.2%	*oral and inhal.*–liver; toxicity	100	4.47E−07	4.21E−06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.78E+03		1.13E+04						1.78E−07	1.13E−06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		6.90E+03		5.04E+04						1.10E−07	8.04E−07	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.59E+03		4.17E+04						1.56E−07	1.17E−06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.65E+01	3.28E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.33E−05	9.08E−05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.45E−07	3.10E−06	100.0%	

Table M.242. Risk characterization for groundwater: adults – inhalation exposure (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	UPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA WOE
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.7E-04	2.2E-05	7.0E-04	3.0E-04				Inc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.9E+01	1.3E+02	3.4E-05	4.4E-06	1.3E-04	5.9E-05	4.0E-05	1.6E-04	100.0%	*oral and inhal.*–liver; toxicity	100	7.3E-09	9.7E-08	100.0%	[D2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							4.0E-05	1.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.3E-09	9.7E-08	100.0%	

Table M.243. Risk characterization for groundwater: children – inhalation exposure (future land use – residential) – Area S6–F1–R

Chemical	Chronic Daily Intake (CDI)						Risk Estimates								
	MLE Concentration in GW	RME Concentration in GW	CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	1.03E-03	4.43E-05	3.17E-03	4.07E-04				inc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.97E+01	1.35E+02	2.00E-04	8.60E-06	6.25E-04	8.04E-05	2.34E-04	7.30E-04	100.0%	*oral and inhal.*–liver; toxicity	100	1.42E-08	1.33E-07	100.0%	[D2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							2.34E-04	7.30E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.42E-08	1.33E-07	100.0%	

Table M.244. Risk characterization for produce: adults — ingestion exposure (future land use — residential) — Area S6—F1—R

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	9.75E-03	1.27E-02	1.45E-06	1.91E-07	8.84E-06	3.79E-06	3.72E-03	2.21E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	5.51E-01	5.92E-01	8.41E-05	1.08E-05	4.13E-04	1.77E-04	2.86E-01	1.38E+00	5.7%	skin; keratosis, hyperpigmentation	3	1.89E-05	3.10E-04	98.1%	[A]
Barium	6.29E-01	8.03E-01	9.66E-05	1.23E-05	5.61E-04	2.40E-04	1.37E-03	8.01E-03	0.0%	*oral*—cardiovasc. sys.; inc. blood pressure. *inhal.*—fetotoxicity	3				
Beryllium	1.94E-03	2.70E-03	2.96E-07	3.81E-08	1.85E-06	8.10E-07	5.93E-05	3.78E-04	0.0%	no observed effects	100	1.64E-07	3.48E-06	1.1%	[D2]
Cadmium	7.79E-01	1.39E+00	1.19E-04	1.53E-05	9.74E-04	4.18E-04	1.19E-01	9.74E-01	4.0%	kidney; proteinuria	10				
Chromium (III)	6.43E-01	6.88E-01	9.81E-05	1.26E-05	4.81E-04	2.06E-04	9.81E-05	4.81E-04	0.0%	no observed effects	100				
Copper	1.25E+00	2.22E+00	1.91E-04	2.45E-05	1.55E-03	6.66E-04	5.16E-03	4.20E-02	0.2%	Gastrointestinal system; irritation	--				[D]
Lead	2.38E-01	3.23E-01	3.63E-05	4.66E-06	2.25E-04	9.66E-05				CNS, blood	--				[B2]
Manganese	2.93E+02	4.90E+02	4.47E-02	5.75E-03	3.43E-01	1.47E-01	3.20E-01	2.45E+00	10.0%	*oral*—CNS effects. *inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	5.78E+00	8.14E+00	8.82E-04	1.13E-04	5.69E-03	2.44E-03	2.94E+00	1.90E+01	77.8%	*oral*—CNS; neurotoxicity. *inhal.*—kidney effects	1000				[D]
Nickel	8.13E-01	1.27E+00	1.24E-04	1.59E-05	8.86E-04	3.80E-04	6.20E-03	4.43E-02	0.2%	dec. body and organ weight	300				
Selenium	2.20E+00	2.62E+00	3.36E-04	4.32E-05	1.83E-03	7.85E-04	6.72E-02	3.67E-01	1.5%	whole body; clinical selenosis	3				[D]
Silver	2.59E-01	3.66E-01	3.95E-05	5.07E-06	2.56E-04	1.10E-04	7.89E-03	5.12E-02	0.2%	skin; argyria	3				[D]
Zinc	3.21E+01	3.84E+01	4.90E-03	6.30E-04	2.69E-02	1.15E-02	1.63E-02	8.95E-02	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	8.84E-05	1.38E-04	1.35E-08	1.73E-09	9.61E-08	4.12E-08				--	--	1.34E-08	3.17E-07	0.1%	[B2]
Benzo(a)anthracene	7.57E-04	9.80E-04	1.15E-07	1.48E-08	6.84E-07	2.93E-07	3.85E-06	2.28E-05	0.0%	--	--	1.08E-08	2.14E-07	0.1%	[B2]
Benzo(a)pyrene	3.45E-04	4.25E-04	5.26E-08	6.76E-09	3.00E-07	1.28E-07	1.75E-06	9.98E-06	0.0%	--	--	4.94E-08	9.37E-07	0.3%	[B2]
Benzo(b)fluoranthene	3.66E-04	5.07E-04	5.58E-08	7.17E-09	3.54E-07	1.52E-07	1.86E-06	1.18E-05	0.0%	--	--	5.24E-09	1.11E-07	0.0%	[B2]
Benzo(k)fluoranthene	1.79E-04	2.37E-04	2.73E-08	3.51E-09	1.65E-07	7.09E-08	9.10E-07	5.58E-06	0.0%	--	--	2.56E-09	5.18E-08	0.0%	[B2]
Chrysene	8.89E-04	1.13E-03	1.36E-07	1.74E-08	7.91E-07	3.39E-07	4.52E-06	2.64E-05	0.0%	--	--	1.27E-09	2.47E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	2.74E-04	3.47E-04	4.18E-08	5.37E-09	2.43E-07	1.04E-07	1.39E-06	8.09E-06	0.0%	--	--	3.92E-08	7.59E-07	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	8.12E-05	9.24E-05	1.24E-08	1.59E-09	6.46E-08	2.77E-08	4.13E-07	2.15E-06	0.0%	--	--	1.16E-09	2.02E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	1.50E-02	2.98E-02		5.25E+02		1.59E+04						1.47E-08	4.46E-07	58.7%	[A]
Cobalt 60	4.40E-04	1.47E-03		1.55E+01		7.87E+02						2.32E-10	1.18E-08	1.6%	[A]
Protactinium 233		1.63E-04				8.73E+01							8.73E-11	0.0%	[A]
Thorium 228+D	1.11E-03	1.63E-03		3.91E+01		8.74E+02						2.15E-09	4.81E-08	6.3%	[A]
Thorium 230	3.96E-03	3.96E-03		1.35E+02		2.12E+03						1.80E-09	2.75E-08	3.6%	[A]
Thorium 232	9.00E-04	1.49E-03		3.16E+01		7.97E+02						3.79E-10	9.57E-09	1.3%	[A]
Uranium 234	7.39E-03	8.91E-03		2.59E+02		4.77E+03						4.15E-09	7.64E-08	10.1%	[A]
Uranium 235+D	3.45E-04	4.21E-04		1.21E+01		2.25E+02						1.94E-10	3.61E-09	0.5%	[A]
Uranium 238+D	7.75E-03	9.11E-03		2.72E+02		4.88E+03						7.61E-09	1.37E-07	18.0%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.78E+00	2.44E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.92E-05	3.16E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.12E-08	7.68E-07	100.0%	

Table M.245. Risk characterization for produce: children – ingestion exposure (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration from Main Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	9.75E-03	1.27E-02	3.32E-06	1.42E-07	1.83E-05	2.36E-06	8.3E-03	4.5E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	5.5E-01	5.92E-01	1.88E-04	8.03E-06	8.58E-04	1.10E-04	6.2E-01	2.8E+00	5.7%	skin; keratosis, hyperpigmentation	3	1.4E-05	1.93E-04	98.1%	[A]
Barium	6.29E-01	8.03E-01	2.15E-04	9.19E-06	1.16E-03	1.50E-04	3.0E-03	1.6E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.94E-03	2.70E-03	6.63E-07	2.84E-08	3.92E-06	5.04E-07	1.3E-04	7.8E-04	0.0%	no observed effects	100	1.22E-07	2.17E-06	1.1%	[B2]
Cadmium	7.79E-01	1.39E+00	2.66E-04	1.14E-05	2.02E-03	2.60E-04	2.6E-01	2.0E+00	4.0%	kidney; proteinuria	10				
Chromium (III)	6.43E-01	6.88E-01	2.19E-04	9.40E-06	9.97E-04	1.28E-04	2.1E-04	9.9E-04	0.0%	no observed effects	100				
Copper	1.25E+00	2.22E+00	4.27E-04	1.83E-05	3.22E-03	4.14E-04	1.1E-02	8.7E-02	0.2%	Gastrointestinal system; irritation	--				[D]
Lead	2.38E-01	3.22E-01	8.10E-05	3.47E-06	4.68E-04	6.01E-05				CNS, blood	--				[B2]
Manganese	2.93E+02	4.90E+02	1.00E-01	4.29E-03	7.11E-01	9.14E-02	7.1E-01	5.0E+00	10.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	5.78E+00	8.14E+00	1.97E-03	8.45E-05	1.18E-02	1.52E-03	6.5E+00	3.9E+01	77.8%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	8.13E-01	1.27E+00	2.77E-04	1.19E-05	1.84E-03	2.36E-04	1.3E-02	9.1E-02	0.2%	dec. body and organ weight	300				
Selenium	2.20E+00	2.62E+00	7.51E-04	3.22E-05	3.80E-03	4.88E-04	1.5E-01	7.6E-01	1.5%	whole body; clinical selenosis	3				[D]
Silver	2.59E-01	3.66E-01	8.82E-05	3.78E-06	5.31E-04	6.83E-05	1.7E-02	1.0E-01	0.2%	skin; argyria	3				[D]
Zinc	3.21E+01	3.84E+01	1.09E-02	4.69E-04	5.57E-02	7.16E-03	3.6E-02	1.8E-01	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	8.84E-05	1.38E-04	3.01E-08	1.29E-09	1.99E-07	2.56E-08			--		--	9.95E-09	1.97E-07	0.1%	[B2]
Benzo(a)anthracene	7.57E-04	9.84E-04	2.58E-07	1.11E-08	1.42E-06	1.83E-07	8.6E-06	4.7E-05	0.0%	--	--	8.07E-09	1.33E-07	0.1%	[B2]
Benzo(a)pyrene	3.45E-04	4.29E-04	1.18E-07	5.04E-09	6.21E-07	7.99E-08	3.9E-06	2.0E-05	0.0%	--	--	3.68E-08	5.85E-07	0.3%	[B2]
Benzo(b)fluoranthene	3.66E-04	5.07E-04	1.25E-07	5.35E-09	7.35E-07	9.45E-08	4.1E-06	2.4E-05	0.0%	--	--	3.90E-09	6.90E-08	0.0%	[B2]
Benzo(k)fluoranthene	1.79E-04	2.37E-04	6.10E-08	2.62E-09	3.43E-07	4.41E-08	2.0E-06	1.1E-05	0.0%	--	--	1.91E-09	3.22E-08	0.0%	[B2]
Chrysene	8.85E-04	1.13E-03	3.03E-07	1.30E-08	1.64E-06	2.11E-07	1.0E-05	5.4E-05	0.0%	--	--	9.49E-10	1.54E-08	0.0%	[B2]
Dibenzo(a,h)anthracene	2.74E-04	3.47E-04	9.34E-08	4.00E-09	5.03E-07	6.47E-08	3.1E-06	1.6E-05	0.0%	--	--	2.92E-08	4.72E-07	0.2%	[B2]
Indeno(1,2,3-cd)pyrene	8.12E-05	9.24E-05	2.77E-08	1.19E-09	1.34E-07	1.72E-08	9.2E-07	4.4E-06	0.0%	--	--	8.66E-10	1.26E-08	0.0%	[B2]
RADIONUCLIDES (pCi/g PLANT TISSUE)															
Cesium 137+D	1.50E-02	2.98E-02		1.40E+02		3.68E+03						3.92E-09	1.03E-07	58.7%	[A]
Cobalt 60	4.40E-04	1.47E-03		4.11E+00		1.82E+02						6.17E-11	2.73E-09	1.6%	[A]
Protactinium 233		1.63E-04				2.02E+01							2.02E-11	0.0%	[A]
Thorium 228+D	1.11E-03	1.63E-03		1.04E+01		2.02E+02						5.72E-10	1.11E-08	6.3%	[A]
Thorium 230	3.96E-03	3.96E-03		3.69E+01		4.90E+02						4.80E-10	6.37E-09	3.6%	[A]
Thorium 232	9.00E-04	1.49E-03		8.40E+00		1.84E+02						1.01E-10	2.21E-09	1.3%	[A]
Uranium 234	7.39E-03	8.99E-03		6.90E+01		1.10E+03						1.10E-09	1.77E-08	10.1%	[A]
Uranium 235+D	3.45E-04	4.21E-04		3.22E+00		5.21E+01						5.16E-11	8.34E-10	0.5%	[A]
Uranium 238+D	7.75E-03	9.11E-03		7.23E+01		1.13E+03						2.03E-09	3.16E-08	18.0%	[A]
Chemical Hazards:															
Hazard Index (HI):							8.4E+00	5.0E+01	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												1.4E-05	1.97E-04	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												8.3E-09	1.7E-07	100.0%	

Table M.246. Risk characterization for fish: adults – ingestion exposure (future land use – residential) – Area S6–F1–R

Chemical	MLB Concentration in Fish Tissue	RMB Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfD WOE
INORGANICS															
Mercury	0.76	0.78	2.3E-06	3.0E-07	2.8E-05	1.2E-05	7.9E-03	9.6E-02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	6.4E-07	8.2E-08	8.2E-06	3.5E-06						6.3E-07	2.7E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.1E-06	1.4E-07	1.4E-05	6.1E-06						1.1E-06	4.7E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.9E-03	9.6E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.7E-06	7.4E-05	100.0%	

Table M.247. Risk characterization for fish: children – ingestion exposure (future land use – residential) – Area S6–F1–R

Chemical	MLE Concentration in Fish (mg/kg)	RME Concentration in Fish (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern/ Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS															
Mercury	0.76	0.78	4.1E-06	1.7E-07	6.0E-05	7.7E-06	1.3E-02	2.0E-01	100.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	1.1E-06	4.8E-08	1.7E-05	2.2E-06						3.7E-07	1.7E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.9E-06	8.4E-08	3.0E-05	3.8E-06						6.5E-07	2.9E-05	63.7%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.3E-02	2.0E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-06	4.6E-05	100.0%	

SEGMENT 7 RISK CHARACTERIZATION TABLES

Table M.248. Risk characterization summary for EFPC Segment 7: RME risk estimates for current land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	5.34E−01 B	1.49E−01 B	1.41E−05 W	1.32E−05 W	2.17E−07 B	5.43E−07 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	2.12E−02 B	1.62E−02 B	1.64E−06 W	4.19E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	9.04E+01 *B*	4.36E+01 *B*	4.92E−04 *B*	7.91E−04 *B*	7.16E−07 B	3.10E−06 W	NA	NA	NA	NA	NA	NA
Beef	Ingestion	2.01E+01 *B*	1.01E+01 *B*	1.66E−04 *B*	2.79E−04 *B*	2.21E−06 W	9.99E−06 W	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	2.34E−01	NA	2.55E−06	NA	8.96E−06	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		1.1E+02 *B*	5.4E+01 *B*					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				7E−04 *B*	1E−03 *B*					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						3E−06 W	2E−05 W					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	1.21E−01 B	6.39E−02 B	3.21E−06 W	5.64E−06 W	9.29E−08 B	2.33E−07 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	7.49E−03 B	6.96E−03 B	5.80E−07 B	1.80E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	1.48E−03 B	1.04E−03 B	3.10E−09 B	7.22E−09 B	4.89E−10 B	1.63E−09 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.28E−03 B	1.18E−03 B	3.01E−08 B	9.31E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	9.90E−05 B	9.19E−05 B	1.26E−08 B	3.89E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		1.3E−01 B	7.3E−02 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				4E−06 W	8E−06 W					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						9E−08 B	2E−07 B					NA	NA

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.249. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S7–C1–O adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	5.53E–03	6.39E–02	1.62E–07	5.64E–06
Dermal Contact	2.00E–04	6.96E–03	1.51E–08	1.80E–06
SURFACE WATER				
Ingestion	6.90E–05	1.04E–03	1.77E–10	7.22E–09
Dermal Contact	7.27E–05	1.18E–03	1.68E–09	9.31E–08
SEDIMENT				
Dermal Contact	1.94E–06	9.19E–05	2.29E–10	3.89E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			5.30E–09	2.33E–07
SURFACE WATER				
Ingestion			3.92E–11	1.63E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.9E–03	7.3E–02		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	8E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–09	2E–07

Table M.250. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S7–C1–O children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	9.56E–03	1.21E–01	9.37E–08	3.21E–06
Dermal Contact	2.06E–04	7.49E–03	5.18E–09	5.80E–07
SURFACE WATER				
Ingestion	9.55E–05	1.48E–03	8.16E–11	3.10E–09
Dermal Contact	7.49E–05	1.28E–03	5.77E–10	3.01E–08
SEDIMENT				
Dermal Contact	2.00E–06	9.90E–05	7.87E–11	1.26E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.21E–09	9.29E–08
SURFACE WATER				
Ingestion			1.31E–11	4.89E–10
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	9.9E–03	1.3E–01		
Excess Lifetime Cancer Risk: Combined Exposure			1E–07	4E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–09	9E–08

Table M.251. Human health risk characterization summary for EFPC agricultural/homesteader scenario: current land use, Area S7–C2–A adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	3.73E–02	1.49E–01	1.10E–06	1.32E–05
Dermal Contact	1.35E–03	1.62E–02	1.02E–07	4.19E–06
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce	3.14E+00	4.36E+01	2.14E–05	7.91E–04
Beef	1.78E+00	1.01E+01	1.65E–05	2.79E–04
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting	1.60E–01	2.34E–01	7.15E–07	2.55E–06
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.58E–08	5.43E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce			4.91E–08	3.10E–06
Beef			3.28E–07	9.99E–06
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting			1.93E–06	8.96E–06
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.1E+00	5.4E+01		
Excess Lifetime Cancer Risk: Combined Exposure			4E–05	1E–03
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–06	2E–05

Table M.252. Human health risk characterization summary for EFPC agricultural/homesteader scenario: current land use, Area S7–C2–A children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.31E–01	5.34E–01	1.28E–06	1.41E–05
Dermal Contact	1.76E–03	2.12E–02	4.42E–08	1.64E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce	7.01E+00	9.04E+01	1.60E–05	4.92E–04
Beef	3.73E+00	2.01E+01	1.15E–05	1.66E–04
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.49E–08	2.17E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce			1.31E–08	7.16E–07
Beef			8.18E–08	2.21E–06
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.1E+01	1.1E+02		
Excess Lifetime Cancer Risk: Combined Exposure			3E–05	7E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1E–07	3E–06

Table M.253. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Area S7–C1–O

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (RME)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	4.5E-08	5.8E-09	4.5E-07	1.9E-07	1.1E-04	1.1E-03	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	4.8E-07	6.1E-08	4.6E-06	1.9E-06	1.6E-03	1.5E-02	24.3%	skin; keratosis, hyperpigmentation	3	1.0E-07	3.4E-06	61.9%	[A]
Barium	105.70	140.50	6.6E-06	8.5E-07	8.2E-05	3.5E-05	9.4E-05	1.1E-03	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	4.6E-08	6.0E-09	5.0E-07	2.1E-07	9.3E-06	1.0E-04	0.2%	no observed effects	100	2.5E-08	9.2E-07	16.5%	[B2]
Cadmium	3.10	5.43	1.9E-07	2.5E-08	3.1E-06	1.3E-06	1.9E-04	3.1E-03	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	4.1E-06	5.3E-07	4.0E-05	1.7E-05	4.1E-06	4.0E-05	0.1%	no observed effects	100				
Copper	68.59	116.30	4.3E-06	5.5E-07	6.8E-05	2.9E-05	1.1E-04	1.8E-03	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	2.1E-06	2.8E-07	2.5E-05	1.1E-05				CNS, blood	--				[B2]
Manganese	1253.00	1848.00	7.8E-05	1.0E-05	1.0E-03	4.6E-04	5.6E-04	7.7E-03	12.1%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	7.9E-07	1.0E-07	9.2E-06	3.9E-06	2.6E-03	3.0E-02	48.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	1.5E-06	2.0E-07	2.3E-05	9.8E-06	7.8E-05	1.1E-03	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	8.2E-07	1.0E-07	8.4E-06	3.6E-06	1.6E-04	1.6E-03	2.7%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	1.2E-07	1.5E-08	1.6E-06	7.0E-07	2.4E-05	3.3E-04	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	8.6E-06	1.1E-06	1.0E-04	4.4E-05	2.8E-05	3.4E-04	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.09	0.17	5.7E-09	7.3E-10	9.9E-08	4.2E-08				--	--	5.6E-09	3.2E-07	5.8%	[B2]
Benzo(a)anthracene	0.26	0.32	1.6E-08	2.1E-09	1.8E-07	7.9E-08	5.5E-07	6.2E-06	0.0%	--	--	1.5E-09	5.8E-08	1.0%	[B2]
Benzo(a)pyrene	0.25	0.30	1.5E-08	2.0E-09	1.7E-07	7.5E-08	5.2E-07	5.8E-06	0.0%	--	--	1.4E-08	5.4E-07	9.7%	[B2]
Benzo(b)fluoranthene	0.41	0.61	2.5E-08	3.2E-09	3.6E-07	1.5E-07	8.4E-07	1.2E-05	0.0%	--	--	2.3E-09	1.1E-07	2.0%	[B2]
Benzo(k)fluoranthene	0.44	0.62	2.7E-08	3.5E-09	3.6E-07	1.5E-07	9.2E-07	1.2E-05	0.0%	--	--	2.6E-09	1.1E-07	2.0%	[B2]
Chrysene	0.26	0.30	1.6E-08	2.0E-09	1.7E-07	7.5E-08	5.3E-07	5.9E-06	0.0%	--	--	1.5E-10	5.5E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	1.4E-08	1.8E-09	1.6E-07	6.8E-08	4.8E-07	5.3E-06	0.0%	--	--	1.3E-09	4.9E-08	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.69	1.22		9.9E+00		5.5E+02						2.7E-10	1.5E-08	6.6%	[A]
Cobalt 60	0.02	0.04		2.9E-01		1.6E+01						4.3E-12	2.4E-10	0.1%	[A]
Neptunium 237+D	0.05	0.11		6.9E-01		4.9E+01						1.5E-10	1.0E-08	4.7%	[A]
Protactinium 233		0.05				2.1E+01							2.1E-11	0.0%	[A]
Thorium 228+D	1.54	2.00		2.2E+01		9.0E+02						1.2E-09	4.9E-08	21.3%	[A]
Thorium 230	7.38	12.98		1.0E+02		5.8E+03						1.3E-09	7.5E-08	32.6%	[A]
Thorium 232	1.01	1.67		1.4E+01		7.5E+02						1.7E-10	9.0E-09	3.9%	[A]
Uranium 234	3.19	3.53		4.5E+01		1.5E+03						7.3E-10	2.5E-08	10.9%	[A]
Uranium 235+D	0.15	0.17		2.1E+00		7.4E+01						3.4E-11	1.2E-09	0.5%	[A]
Uranium 238+D	3.29	3.58		4.7E+01		1.6E+03						1.3E-09	4.5E-08	19.4%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							5.5E-03	6.3E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-07	5.6E-06	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.3E-09	2.3E-07	100.0%	

Table M.254. Risk characterization for soils: children – ingestion exposure (current land use – open) – Area S7–C1–O

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	7.8E-08	3.3E-09	8.5E-07	1.1E-07	1.9E-04	2.1E-03	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	8.3E-07	3.5E-08	8.8E-06	1.1E-06	2.7E-03	2.9E-02	24.3%	skin; keratosis, hyperpigmentation	3	6.2E-08	1.9E-06	61.9%	[A]
Barium	105.70	140.50	1.1E-05	4.9E-07	1.5E-04	2.0E-05	1.6E-04	2.2E-03	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	8.0E-08	3.4E-09	9.5E-07	1.2E-07	1.6E-05	1.9E-04	0.2%	no observed effects	100	1.4E-08	5.3E-07	16.5%	[D2]
Cadmium	3.10	5.43	3.3E-07	1.4E-08	6.0E-06	7.7E-07	3.3E-04	6.0E-03	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	7.2E-06	3.1E-07	7.6E-05	9.8E-06	7.2E-06	7.6E-05	0.1%	no observed effects	100				
Copper	68.59	116.30	7.4E-06	3.1E-07	1.3E-04	1.6E-05	2.0E-04	3.5E-03	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	3.7E-06	1.6E-07	4.8E-05	6.2E-06				CNS, blood	--				[D2]
Manganese	1253.00	1848.00	1.3E-04	5.8E-06	2.0E-03	2.6E-04	9.6E-04	1.4E-02	12.1%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	1.3E-06	5.8E-08	1.7E-05	2.2E-06	4.5E-03	5.8E-02	48.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	2.7E-06	1.1E-07	4.3E-05	5.6E-06	1.3E-04	2.1E-03	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	1.4E-06	6.1E-08	1.6E-05	2.0E-06	2.8E-04	3.2E-03	2.7%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	2.0E-07	8.9E-09	3.1E-06	4.0E-07	4.1E-05	6.2E-04	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	1.4E-05	6.3E-07	1.9E-04	2.5E-05	4.9E-05	6.5E-04	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.09	0.17	9.8E-09	4.2E-10	1.8E-07	2.4E-08				--	--	3.2E-09	1.8E-07	5.8%	[D2]
Benzo(a)anthracene	0.26	0.32	2.8E-08	1.2E-09	3.5E-07	4.5E-08	9.5E-07	1.1E-05	0.0%	--	--	8.9E-10	3.3E-08	1.0%	[D2]
Benzo(a)pyrene	0.25	0.30	2.7E-08	1.1E-09	3.3E-07	4.2E-08	9.0E-07	1.1E-05	0.0%	--	--	8.5E-09	3.1E-07	9.7%	[D2]
Benzo(b)fluoranthene	0.41	0.61	4.4E-08	1.8E-09	6.8E-07	8.8E-08	1.4E-06	2.2E-05	0.0%	--	--	1.3E-09	6.4E-08	2.0%	[D2]
Benzo(k)fluoranthene	0.44	0.62	4.8E-08	2.0E-09	6.9E-07	8.9E-08	1.6E-06	2.3E-05	0.0%	--	--	1.5E-09	6.5E-08	2.0%	[D2]
Chrysene	0.26	0.30	2.7E-08	1.1E-09	3.3E-07	4.3E-08	9.2E-07	1.1E-05	0.0%	--	--	8.6E-11	3.1E-09	0.1%	[D2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	2.4E-08	1.0E-09	3.0E-07	3.9E-08	8.3E-07	1.0E-05	0.0%	--	--	7.7E-10	2.8E-08	0.9%	[D2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.69	1.22		4.1E+00		2.1E+02						1.1E-10	6.1E-09	6.6%	[A]
Cobalt 60	0.02	0.04		1.2E-01		6.4E+00						1.8E-12	9.6E-11	0.1%	[A]
Neptunium 237+D	0.05	0.11		2.9E-01		1.9E+01						6.3E-11	4.3E-09	4.7%	[A]
Protactinium 233		0.05				8.7E+00							8.7E-12	0.0%	[A]
Thorium 228+D	1.54	2.00		9.2E+00		3.6E+02						5.0E-10	1.9E-08	21.3%	[A]
Thorium 230	7.38	12.98		4.4E+01		2.3E+03						5.7E-10	3.0E-08	32.6%	[A]
Thorium 232	1.01	1.67		6.0E+00		2.9E+02						7.2E-11	3.5E-09	3.9%	[A]
Uranium 234	3.19	3.53		1.9E+01		6.3E+02						3.0E-10	1.0E-08	10.9%	[A]
Uranium 235+D	0.15	0.17		9.0E-01		2.9E+01						1.4E-11	4.7E-10	0.5%	[A]
Uranium 238+D	3.29	3.58		1.9E+01		6.4E+02						5.5E-10	1.8E-08	19.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.5E-03	1.2E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.3E-08	3.2E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												2.2E-09	9.2E-08	100.0%	

Table M.255. Risk characterization for soils: adults – dermal exposure (current land use – open) – Area S7–C1–O

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	1.6E-09	2.1E-10	4.8E-08	2.0E-08	4.0E-06	1.2E-04	1.7%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	1.7E-08	2.2E-09	5.0E-07	2.1E-07	5.7E-05	1.6E-03	24.1%	skin; keratosis, hyperpigmentation	3	3.8E-09	3.7E-07	21.0%	[A],
Barium	105.70	140.50	2.3E-07	3.0E-08	8.9E-06	3.6E-06	3.4E-06	1.2E-04	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	1.6E-09	2.1E-10	5.4E-08	2.3E-08	3.3E-07	1.0E-05	0.2%	no observed effects	100	9.3E-10	1.0E-07	5.6%	[B2]
Cadmium	3.10	5.43	6.9E-09	8.9E-10	3.4E-07	1.4E-07	6.9E-06	3.4E-04	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	1.5E-07	1.9E-08	4.3E-06	1.8E-06	1.5E-07	4.3E-06	0.1%	no observed effects	100				
Copper	68.59	116.30	1.5E-07	1.9E-08	7.3E-06	3.1E-06	4.1E-06	1.9E-04	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	7.8E-08	1.0E-08	2.7E-06	1.1E-06				CNS, blood	--				[D2]
Manganese	1253.00	1848.00	2.8E-06	3.6E-07	1.1E-04	5.0E-05	2.0E-05	8.3E-04	12.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	2.8E-08	3.6E-09	9.9E-07	4.2E-07	9.5E-05	3.3E-03	47.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	5.6E-08	7.3E-09	2.4E-06	1.0E-06	2.8E-06	1.2E-04	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	2.9E-08	3.8E-09	9.1E-07	3.9E-07	5.9E-06	1.8E-04	2.6%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	4.3E-09	5.5E-10	1.7E-07	7.6E-08	8.6E-07	3.5E-05	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	3.1E-07	3.9E-08	1.1E-05	4.8E-06	1.0E-06	3.7E-05	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.09	0.17	2.0E-09	2.6E-10	1.0E-07	4.6E-08				--	--	2.0E-09	3.5E-07	19.8%	[B2]
Benzo(a)anthracene	0.26	0.32	5.9E-09	7.6E-10	2.0E-07	8.6E-08	1.9E-07	6.7E-06	0.1%	--	--	5.5E-10	6.2E-08	3.5%	[B2]
Benzo(a)pyrene	0.25	0.30	5.6E-09	7.2E-10	1.9E-07	8.1E-08	1.8E-07	6.3E-06	0.1%	--	--	5.3E-09	5.9E-07	33.1%	[B2]
Benzo(b)fluoranthene	0.41	0.61	9.1E-09	1.1E-09	3.9E-07	1.6E-07	3.0E-07	1.3E-05	0.2%	--	--	8.5E-10	1.2E-07	6.8%	[B2]
Benzo(k)fluoranthene	0.44	0.62	1.0E-08	1.2E-09	3.9E-07	1.6E-07	3.3E-07	1.3E-05	0.2%	--	--	9.3E-10	1.2E-07	6.9%	[B2]
Chrysene	0.26	0.30	5.7E-09	7.3E-10	1.9E-07	8.2E-08	1.9E-07	6.3E-06	0.1%	--	--	5.4E-11	5.9E-09	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	5.1E-09	6.6E-10	1.7E-07	7.3E-08	1.7E-07	5.7E-06	0.1%	--	--	4.8E-10	5.4E-08	3.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.0E-04	6.9E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.5E-08	1.8E-06	100.0%	

Table M.256. Risk characterization for soils: children – dermal exposure (current land use – open) – Area S7–C1–O

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	Risk Estimates: EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS **(mg/kg)**															
Antimony	0.72	0.77	1.6E3-09	7.2E3-11	5.2E3-08	6.7E3-09	4.2E3-06	1.3E3-04	1.7%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	1.7E3-08	7.6E3-10	5.4E3-07	6.9E3-08	5.9E3-05	1.8E3-03	24.1%	skin; keratosis, hyperpigmentation	3	1.3E3-09	1.2E3-07	21.0%	[A]
Barium	105.70	140.50	2.4E3-07	1.0E3-08	9.6E3-06	1.2E3-06	3.5E3-06	1.3E3-04	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	1.7E3-09	7.4E3-11	5.8E3-08	7.5E3-09	3.4E3-07	1.1E3-05	0.2%	no observed effects	100	3.2E3-10	3.2E3-08	5.6%	[B2]
Cadmium	3.10	5.43	7.2E3-09	3.0E3-10	3.7E3-07	4.7E3-08	7.2E3-06	3.7E3-04	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	1.5E3-07	6.6E3-09	4.7E3-06	6.0E3-07	1.5E3-07	4.7E3-06	0.1%	no observed effects	100				
Copper	68.59	116.30	1.5E3-07	6.8E3-09	7.9E3-06	1.0E3-06	4.3E3-06	2.1E3-04	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	8.1E3-08	3.4E3-09	2.9E3-06	3.8E3-07				CNS, blood	--				[B2]
Manganese	1253.00	1848.00	2.9E3-06	1.2E3-07	1.2E3-04	1.6E3-05	2.0E3-05	9.0E3-04	12.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	2.9E3-08	1.2E3-09	1.0E3-06	1.3E3-07	9.8E3-05	3.5E3-03	47.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	5.8E3-08	2.5E3-09	2.6E3-06	3.4E3-07	2.9E3-06	1.3E3-04	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	3.0E3-08	1.3E3-09	9.8E3-07	1.2E3-07	6.1E3-06	1.9E3-04	2.6%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	4.4E3-09	1.9E3-10	1.9E3-07	2.4E3-08	8.9E3-07	3.8E3-05	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	3.1E3-07	1.3E3-08	1.2E3-05	1.5E3-06	1.0E3-06	4.0E3-05	0.5%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor-1260	0.09	0.17	2.1E3-09	9.0E3-11	1.1E3-07	1.4E3-08				--	--	6.9E3-10	1.1E3-07	19.8%	[B2]
Benzo(a)anthracene	0.26	0.32	6.1E3-09	2.6E3-10	2.1E3-07	2.7E3-08	2.0E3-07	7.2E3-06	0.1%	--	--	1.9E3-10	2.0E3-08	3.5%	[B2]
Benzo(a)pyrene	0.25	0.30	5.8E3-09	2.5E3-10	2.0E3-07	2.6E3-08	1.9E3-07	6.8E3-06	0.1%	--	--	1.8E3-09	1.9E3-07	33.1%	[B2]
Benzo(b)fluoranthene	0.41	0.61	9.4E3-09	4.0E3-10	4.2E3-07	5.4E3-08	3.1E3-07	1.4E3-05	0.2%	--	--	2.9E3-10	3.9E3-08	6.8%	[B2]
Benzo(k)fluoranthene	0.44	0.62	1.0E3-08	4.4E3-10	4.2E3-07	5.4E3-08	3.4E3-07	1.4E3-05	0.2%	--	--	3.2E3-10	3.9E3-08	6.9%	[B2]
Chrysene	0.26	0.30	5.9E3-09	2.5E3-10	2.0E3-07	2.6E3-08	1.9E3-07	6.8E3-06	0.1%	--	--	1.8E3-11	1.9E3-09	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	5.3E3-09	2.2E3-10	1.8E3-07	2.3E3-08	1.7E3-07	6.1E3-06	0.1%	--	--	1.6E3-10	1.7E3-08	3.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.0E3-04	7.4E3-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.1E3-09	5.8E3-07	100.0%	

Table M.257. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – open) – Area S7–C1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS *(µg/L)*															
Barium	7.92E+01	1.05E+02	7.75E-08	9.96E-09	1.03E-06	4.40E-07	1.11E-06	1.47E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	7.63E-09	9.81E-10	1.29E-07	5.54E-08	7.63E-09	1.29E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.81E-08	2.33E-09	2.14E-07	9.18E-08	4.89E-07	5.79E-06	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.15E+02	2.65E-07	3.38E-08	4.04E-06	1.73E-06	5.26E-05	8.08E-04	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.62E-09	3.37E-10	3.85E-08	1.65E-08	8.72E-06	1.28E-04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.22E-09	1.06E-09	1.38E-07	5.91E-08	1.17E-06	1.97E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	6.72E-08	8.65E-09	8.89E-07	3.81E-07	2.24E-07	2.96E-06	0.3%	blood; anemia	3				[D]
ORGANICS *(µg/L)*															
Acetone	6.21E+00	7.70E+00	6.08E-09	7.82E-10	7.54E-08	3.23E-08	6.08E-08	7.54E-07	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.27E-11	2.92E-12	2.45E-10	1.05E-10	7.58E-07	8.15E-06	0.8%	liver; lesions, toxicity	1000	4.97E-11	1.78E-09	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.35E+01	9.30E-09	1.20E-09	1.36E-07	5.81E-08	4.65E-07	6.78E-06	0.7%	liver; weight inc.	1000	1.67E-11	8.13E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.98E-09	5.12E-10	4.59E-08	1.97E-08	3.98E-07	4.59E-06	0.4%	liver; lesions, fattycyst formation	1000	3.12E-12	1.20E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	3.93E-11	5.06E-12	4.83E-10	2.07E-10	7.86E-08	9.67E-07	0.1%	liver; lesions	100	1.72E-12	7.04E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.79E-11	4.87E-12	4.89E-10	2.10E-10	7.58E-07	9.78E-06	0.9%	liver; lesions	100	7.80E-11	3.35E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	3.78E-11	4.87E-12	4.89E-10	2.10E-10	1.26E-07	1.63E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.78E-11	2.29E-12	2.29E-10	9.83E-11	5.93E-08	7.64E-07	0.1%	liver, kidney; toxicity	1000	2.97E-12	1.28E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.11E-11	2.72E-12	2.45E-10	1.05E-10	1.63E-06	1.88E-05	1.8%	liver; inc. relative weight	1000	2.47E-11	9.54E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	4.09E-09	5.26E-10	4.73E-08	2.03E-08	4.09E-07	4.73E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES *(pCi/L)*															
Uranium 234	3.68E+00	4.29E+00		8.27E-01		3.22E+01						1.32E-11	5.15E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		9.29E-01		3.98E+01						2.60E-11	1.12E-09	68.4%	[A]
Chemical Hazards:															
Hazard Index (HI):															
Combined Exposure (d)							6.90E-05	1.04E-03	100.0%						
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												1.77E-10	7.22E-09	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												3.92E-11	1.63E-09	100.0%	

Table M.258. Risk characterization for surface water: children — ingestion exposure (swimming)(current land use — open) — Area S7–C1–O

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	Risk Estimates HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	RfDA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.07E−07	4.59E−09	1.47E−06	1.89E−07	1.53E−06	2.10E−05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.06E−08	4.52E−10	1.85E−07	2.37E−08	1.06E−08	1.85E−07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.50E−08	1.07E−09	3.06E−07	3.94E−08	6.77E−07	8.27E−06	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.64E−07	1.56E−08	5.77E−06	7.42E−07	7.27E−05	1.15E−03	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.62E−09	1.55E−10	5.50E−08	7.07E−09	1.21E−05	1.85E−04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.14E−08	4.87E−10	1.97E−07	2.53E−08	1.62E−06	2.82E−05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.30E−08	3.99E−09	1.27E−06	1.63E−07	3.10E−07	4.23E−06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.41E−09	3.60E−10	1.08E−07	1.38E−08	8.41E−08	1.08E−06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E−02	2.50E−02	3.14E−11	1.35E−12	3.49E−10	4.49E−11	1.05E−06	1.16E−05	0.8%	liver; lesions, toxicity	1000	2.29E−11	7.64E−10	24.7%	[B2]
Bis(2–ethylhexyl)phthalate	9.50E+00	1.39E+01	1.29E−08	5.51E−10	1.94E−07	2.49E−08	6.43E−07	9.68E−06	0.7%	liver; weight inc.	1000	7.72E−12	3.48E−10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.51E−09	2.36E−10	6.55E−08	8.42E−09	5.51E−07	6.55E−06	0.4%	liver; lesions, fattycyst formation	1000	1.46E−12	5.14E−11	1.7%	[B2]
4,4'–DDT	4.02E−02	4.94E−02	5.44E−11	2.33E−12	6.91E−10	8.88E−11	1.05E−07	1.38E−06	0.1%	liver; lesions	100	7.93E−13	3.02E−11	1.0%	[B2]
Dieldrin	3.87E−02	5.00E−02	5.24E−11	2.25E−12	6.99E−10	8.99E−11	1.05E−06	1.40E−05	0.9%	liver; lesions	100	3.59E−11	1.44E−09	46.5%	[B2]
Endrin	3.87E−02	5.00E−02	5.24E−11	2.24E−12	6.99E−10	8.99E−11	1.75E−07	2.33E−06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.82E−02	2.34E−02	2.46E−11	1.05E−12	3.28E−10	4.21E−11	8.20E−08	1.09E−06	0.1%	liver, kidney; toxicity	1000	1.37E−12	5.47E−11	1.8%	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	2.92E−11	1.25E−12	3.49E−10	4.49E−11	2.25E−06	2.69E−05	1.8%	liver; inc. relative weight	1000	1.14E−11	4.09E−10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.66E−09	2.42E−10	6.76E−08	8.70E−09	5.66E−07	6.76E−06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		2.76E−01		9.66E+00						4.41E−12	1.55E−10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		3.10E−01		1.19E+01						8.67E−12	3.35E−10	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.55E−05	1.48E−03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.16E−11	3.10E−09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E−11	4.89E−10	100.0%	

Table M.259. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – open) – Area S7–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.00E-09	7.71E-10	1.04E-07	4.47E-08	8.57E-08	1.49E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	5.91E-10	7.60E-11	1.31E-08	5.62E-09	5.91E-10	1.31E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.40E-09	1.80E-10	2.18E-08	9.33E-09	3.79E-08	5.88E-07	0.0%	Gastrointestinal system; irritation	--				
Manganese (water)	2.69E+02	4.13E+02	2.04E-08	2.62E-09	4.10E-07	1.76E-07	4.07E-06	8.21E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.99E+00	2.03E-10	2.61E-11	3.99E-09	1.68E-09	6.76E-07	1.30E-05	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.36E-10	8.18E-11	1.40E-08	6.01E-09	9.09E-08	2.00E-06	0.2%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	5.21E-09	6.69E-10	9.03E-08	3.87E-08	1.74E-08	3.01E-07	0.0%	blood; anemia	3				
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.94E-09	3.78E-10	4.78E-08	2.05E-08	2.94E-08	4.78E-07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.76E-11	2.26E-12	2.48E-10	1.06E-10	5.87E-07	8.28E-06	0.7%	liver; lesions, toxicity	1000	3.85E-11	1.81E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.48E-07	1.90E-08	2.84E-06	1.22E-06	7.42E-06	1.42E-04	12.0%	liver; weight inc.	1000	2.67E-10	1.70E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.72E-08	2.21E-09	2.59E-07	1.11E-07	1.72E-06	2.59E-05	2.2%	liver; lesions, fattycyst formation	1000	1.35E-11	6.77E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.18E-09	1.05E-09	1.32E-07	5.65E-08	1.64E-05	2.64E-04	22.3%	liver; lesions	100	3.58E-10	1.92E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	5.87E-06	9.94E-05	8.4%	liver; lesions	100	6.04E-10	3.41E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	9.77E-07	1.66E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.21E-10	1.55E-11	2.04E-09	8.73E-10	4.02E-07	6.79E-06	0.6%	liver, kidney; toxicity	1000	2.01E-11	1.14E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.23E-10	4.15E-11	4.91E-09	2.10E-09	2.49E-05	3.77E-04	31.9%	liver; inc. relative weight	1000	3.78E-10	1.91E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.50E-08	1.22E-08	1.44E-06	6.18E-07	9.50E-06	1.44E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.27E-05	1.18E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.68E-09	9.31E-08	100.0%	

Table M.260. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – open) – Area S7–C1–O

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.18E-09	2.65E-10	1.12E-07	1.44E-08	8.83E-08	1.60E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	6.09E-10	2.61E-11	1.41E-08	1.82E-09	6.09E-10	1.41E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.44E-09	6.19E-11	2.34E-08	3.01E-09	3.90E-08	6.33E-07	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.10E-08	8.99E-10	4.42E-07	5.68E-08	4.20E-06	8.84E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.09E-10	8.95E-12	4.21E-09	5.41E-10	6.98E-07	1.40E-05	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.56E-10	2.81E-11	1.51E-08	1.94E-09	9.37E-08	2.16E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.37E-09	2.30E-10	9.72E-08	1.25E-08	1.79E-08	3.24E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	3.03E-09	1.30E-10	5.15E-08	6.62E-09	3.03E-08	5.15E-07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.81E-11	7.77E-13	2.67E-10	3.44E-11	6.05E-07	8.92E-06	0.7%	liver; lesions, toxicity	1000	1.32E-11	5.85E-10	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.55E-07	6.56E-09	3.00E-06	3.93E-07	7.65E-06	1.53E-04	12.0%	liver; weight inc.	1000	9.18E-11	5.50E-09	18.3%	[B2]
Chloroform	4.07E+00	4.65E+00	1.77E-08	7.58E-10	2.79E-07	3.59E-08	1.77E-06	2.79E-05	2.2%	liver; lesions, fatty cyst formation	1000	4.62E-12	2.19E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.43E-09	3.61E-10	1.42E-07	1.83E-08	1.69E-05	2.84E-04	22.3%	liver; lesions	100	1.23E-10	6.21E-09	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.02E-10	1.30E-11	5.35E-09	6.88E-10	6.05E-06	1.07E-04	8.4%	liver; lesions	100	2.07E-10	1.10E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	3.02E-10	1.29E-11	5.35E-09	6.88E-10	1.01E-06	1.78E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.24E-10	5.32E-12	2.19E-09	2.82E-10	4.14E-07	7.31E-06	0.6%	liver, kidney; toxicity	1000	6.92E-12	3.67E-10	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.33E-10	1.43E-11	5.28E-09	6.79E-10	2.56E-05	4.06E-04	31.9%	liver; inc. relative weight	1000	1.30E-10	6.18E-09	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.79E-08	4.20E-09	1.55E-06	2.00E-07	9.79E-06	1.55E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.49E-05	1.28E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.77E-10	3.00E-08	100.0%	

Table M.261. Risk characterization for sediments: adults – dermal exposure (current land use – open) – Area S7–C1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.07E-10	1.37E-11	4.51E-09	1.93E-09	3.56E-07	1.50E-05	16.3%	skin; keratosis, hyperpigmentation	3	2.41E-11	3.38E-09	8.7%	[A]
Barium	78.13	88.46	1.83E-09	2.36E-10	7.56E-08	3.24E-08	2.62E-08	1.08E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.15E-11	2.76E-12	8.77E-10	3.76E-10	4.30E-09	1.75E-07	0.2%	no observed effects	100	1.19E-11	1.62E-09	4.2%	[D2]
Cadmium	1.42	1.71	3.33E-11	4.28E-12	1.46E-09	6.27E-10	3.33E-08	1.46E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.12E-09	1.44E-10	4.71E-08	2.02E-08	1.12E-09	4.71E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.63E-10	7.24E-11	2.55E-08	1.09E-08	1.52E-08	6.90E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.24E-09	1.60E-10	8.51E-08	3.65E-08				CNS, blood	--				[D2]
Manganese	886.40	1036.00	2.08E-08	2.68E-09	8.86E-07	3.80E-07	1.49E-07	6.33E-06	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.51E-10	4.51E-11	1.75E-08	7.50E-09	1.17E-06	5.83E-05	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.43E-10	6.99E-11	2.37E-08	1.02E-08	2.72E-08	1.18E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.82E-10	8.77E-11	2.89E-08	1.24E-08	9.74E-08	4.12E-06	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.28E-09	2.93E-10	1.03E-07	4.43E-08	7.60E-09	3.44E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.42E-11	3.11E-12	1.40E-09	5.99E-10				--	--	2.40E-11	4.61E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.90E-11	2.44E-12	1.19E-09	5.08E-10				--	--	1.88E-11	3.91E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.64E-11	9.82E-12	4.42E-09	1.90E-09	2.55E-09	1.47E-07	0.2%	--	--	7.17E-12	1.38E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.40E-11	9.52E-12	4.15E-09	1.78E-09	2.47E-09	1.38E-07	0.2%	--	--	6.95E-11	1.30E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.60E-11	1.13E-11	4.97E-09	2.13E-09	2.93E-09	1.66E-07	0.2%	--	--	8.26E-12	1.55E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.21E-11	9.27E-12	3.39E-09	1.45E-09	2.40E-09	1.13E-07	0.1%	--	--	6.77E-12	1.06E-09	2.7%	[B2]
Chrysene	0.31	0.49	7.26E-11	9.34E-12	4.20E-09	1.80E-09	2.42E-09	1.40E-07	0.2%	--	--	6.82E-13	1.31E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.15E-11	6.63E-12	2.06E-09	8.85E-10	1.72E-09	6.88E-08	0.1%	--	--	4.84E-11	6.46E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.80E-12	2.32E-13	1.16E-10	4.95E-11	3.61E-08	2.31E-06	2.5%	liver; lesions	100	3.71E-12	7.92E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.47E-11	8.32E-12	3.24E-09	1.39E-09	2.16E-09	1.08E-07	0.1%	--	--	6.07E-12	1.01E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.94E-06	9.19E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.29E-10	3.89E-08	100.0%	

Table M.262. Risk characterization for sediments: children – dermal exposure (current land use – open) – Area S7–C1–O

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS **(mg/kg)**															
Arsenic	4.55	5.27	1.1E-10	4.7E-12	4.8E-09	6.2E-10	3.6E-07	1.6E-05	16.3%	skin; keratosis, hyperpigmentation	3	8.2E-12	1.0E-09	8.7%	[A]
Barium	78.13	88.46	1.8E-09	8.1E-11	8.1E-08	1.0E-08	2.7E-08	1.1E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.2E-11	9.4E-13	9.4E-10	1.2E-10	4.4E-09	1.8E-07	0.2%	no observed effects	100	4.0E-12	5.2E-10	4.2%	[D2]
Cadmium	1.42	1.71	3.4E-11	1.4E-12	1.5E-09	2.0E-10	3.4E-08	1.5E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.1E-09	4.9E-11	5.0E-08	6.5E-09	1.1E-09	5.0E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.8E-10	2.4E-11	2.7E-08	3.5E-09	1.5E-08	7.4E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.2E-09	5.4E-11	9.1E-08	1.1E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.1E-08	9.1E-10	9.5E-07	1.2E-07	1.5E-07	6.8E-06	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.6E-10	1.5E-11	1.8E-08	2.4E-09	1.2E-06	6.2E-05	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.6E-10	2.4E-11	2.5E-08	3.2E-09	2.8E-08	1.2E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	7.0E-10	3.0E-11	3.1E-08	3.9E-09	1.0E-07	4.4E-06	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.3E-09	1.0E-10	1.1E-07	1.4E-08	7.6E-09	3.7E-07	0.4%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor-1254	0.10	0.16	2.5E-11	1.0E-12	1.5E-09	1.9E-10				--	--	8.2E-12	1.4E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.9E-11	8.3E-13	1.2E-09	1.6E-10				--	--	6.4E-12	1.2E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.8E-11	3.3E-12	4.7E-09	6.1E-10	2.6E-09	1.5E-07	0.2%	--	--	2.4E-12	4.4E-10	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.6E-11	3.2E-12	4.4E-09	5.7E-10	2.5E-09	1.4E-07	0.2%	--	--	2.3E-11	4.1E-09	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	9.0E-11	3.8E-12	5.3E-09	6.8E-10	3.0E-09	1.7E-07	0.2%	--	--	2.8E-12	5.0E-10	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.4E-11	3.1E-12	3.6E-09	4.6E-10	2.4E-09	1.2E-07	0.1%	--	--	2.3E-12	3.4E-10	2.7%	[B2]
Chrysene	0.31	0.49	7.4E-11	3.2E-12	4.5E-09	5.8E-10	2.4E-09	1.5E-07	0.2%	--	--	2.3E-13	4.2E-11	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.3E-11	2.2E-12	2.2E-09	2.8E-10	1.7E-09	7.4E-08	0.1%	--	--	1.6E-11	2.0E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.8E-12	7.9E-14	1.2E-10	1.6E-11	3.7E-08	2.4E-06	2.5%	liver; lesions	100	1.2E-12	2.5E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.6E-11	2.8E-12	3.4E-09	4.4E-10	2.2E-09	1.1E-07	0.1%	--	--	2.0E-12	3.2E-10	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.0E-06	9.9E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.6E-11	1.2E-08	100.0%	

Table M.263. Risk characterization for soils: adults – ingestion exposure (current land use – agricultural/homesteader) – Area S7–C2–A

Chemical	MLB Concentration (s Soil)	RMB Concentration (s Soil)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Car. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Car. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Car. Risk	WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	3.06E-07	3.93E-08	1.05E-06	4.50E-07	7.65E-04	2.62E-03	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	3.24E-06	4.17E-07	1.09E-05	4.65E-06	1.08E-02	3.62E-02	24.3%	skin; keratosis, hyperpigmentation	3	7.30E-07	8.15E-06	61.9%	[A]
Barium	105.70	140.50	4.47E-05	5.74E-06	1.92E-04	8.25E-05	6.38E-04	2.75E-03	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	3.16E-07	4.06E-08	1.18E-06	5.04E-07	6.32E-05	2.35E-04	0.2%	no observed effects	100	1.75E-07	2.17E-06	16.5%	[B2]
Cadmium	3.10	5.43	1.31E-06	1.68E-07	7.44E-06	3.19E-06	1.31E-03	7.44E-03	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	2.83E-05	3.64E-06	9.45E-05	4.05E-05	2.83E-05	9.45E-05	0.1%	no observed effects	100				
Copper	68.59	116.30	2.90E-05	3.73E-06	1.59E-04	6.83E-05	7.84E-04	4.31E-03	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	1.48E-05	1.90E-06	5.99E-05	2.57E-05				CNS, blood	--				[B2]
Manganese	1253.00	1848.00	5.30E-04	6.81E-05	2.53E-03	1.08E-03	3.78E-03	1.81E-02	12.1%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	5.36E-06	6.90E-07	2.15E-05	9.22E-06	1.79E-02	7.17E-02	48.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	1.06E-05	1.37E-06	5.37E-05	2.30E-05	5.32E-04	2.69E-03	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	5.56E-06	7.15E-07	1.98E-05	8.47E-06	1.11E-03	3.95E-03	2.7%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	8.11E-07	1.04E-07	3.85E-06	1.65E-06	1.62E-04	7.70E-04	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	5.81E-05	7.47E-06	2.42E-04	1.04E-04	1.94E-04	8.08E-04	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.09	0.17	3.85E-08	4.95E-09	2.32E-07	9.96E-08				--	--	3.81E-08	7.67E-07	5.8%	[B2]
Benzo(a)anthracene	0.26	0.32	1.12E-07	1.43E-08	4.34E-07	1.86E-07	3.72E-06	1.45E-05	0.0%	--	--	1.05E-08	1.36E-07	1.0%	[B2]
Benzo(a)pyrene	0.25	0.30	1.06E-07	1.37E-08	4.10E-07	1.76E-07	3.54E-06	1.37E-05	0.0%	--	--	9.97E-08	1.28E-06	9.7%	[B2]
Benzo(b)fluoranthene	0.41	0.61	1.72E-07	2.21E-08	8.42E-07	3.61E-07	5.72E-06	2.81E-05	0.0%	--	--	1.61E-08	2.63E-07	2.0%	[B2]
Benzo(k)fluoranthene	0.44	0.62	1.88E-07	2.41E-08	8.51E-07	3.65E-07	6.25E-06	2.84E-05	0.0%	--	--	1.76E-08	2.66E-07	2.0%	[B2]
Chrysene	0.26	0.30	1.08E-07	1.39E-08	4.13E-07	1.77E-07	3.59E-06	1.38E-05	0.0%	--	--	1.01E-09	1.29E-08	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	9.72E-08	1.25E-08	3.72E-07	1.60E-07	3.24E-06	1.24E-05	0.0%	--	--	9.12E-09	1.16E-07	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.69	1.22		6.65E+01		1.28E+03						1.87E-09	3.59E-08	6.6%	[A]
Cobalt 60	0.02	0.04		1.97E+00		3.77E+01						2.95E-11	5.65E-10	0.1%	[A]
Neptunium 237+D	0.05	0.11		4.70E+00		1.16E+02						1.03E-09	2.54E-08	4.7%	[A]
Protactinium 233		0.05				5.09E+01							5.09E-11	0.0%	[A]
Thorium 228+D	1.54	2.00		1.50E+02		2.10E+03						8.23E-09	1.16E-07	21.3%	[A]
Thorium 230	7.38	12.99		7.17E+02		1.36E+04						9.32E-09	1.77E-07	32.6%	[A]
Thorium 232	1.01	1.67		9.82E+01		1.75E+03						1.18E-09	2.10E-08	3.9%	[A]
Uranium 234	3.19	3.53		3.10E+02		3.71E+03						4.96E-09	5.93E-08	10.9%	[A]
Uranium 235+D	0.15	0.17		1.46E+01		1.75E+02						2.34E-10	2.79E-09	0.5%	[A]
Uranium 238+D	3.29	3.58		3.19E+02		3.76E+03						8.95E-09	1.05E-07	19.4%	[A]

Chemical Hazards:			
Hazard Index (HI):	3.73E-02	1.49E-01	100.0%
Combined Exposure (d)			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.10E-06	1.32E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	3.58E-08	5.43E-07	100.0%

Table M.264. Risk characterization for soils: children — ingestion exposure (current land use — agricultural/homesteader) — Area S7–C2–A

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Cancer Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Cancer Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Cancer Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	1.07E-06	4.59E-08	3.76E-06	4.83E-07	2.68E-03	9.39E-03	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	1.14E-05	4.87E-07	3.89E-05	5.00E-06	3.78E-02	1.30E-01	24.3%	skin; keratosis, hyperpigmentation	3	8.51E-07	8.75E-06	61.9%	[A]
Barium	105.70	140.50	1.56E-04	6.70E-06	6.89E-04	8.86E-05	2.22E-03	9.85E-03	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	1.11E-06	4.74E-08	4.21E-06	5.42E-07	2.21E-04	8.42E-04	0.2%	no observed effects	100	2.04E-07	2.33E-06	16.5%	[B2]
Cadmium	3.10	5.43	4.59E-06	1.97E-07	2.66E-05	3.43E-06	4.59E-03	2.66E-02	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	9.90E-05	4.24E-06	3.38E-04	4.35E-05	9.90E-05	3.38E-04	0.1%	no observed effects	100				
Copper	68.59	116.30	1.01E-04	4.35E-06	5.70E-04	7.33E-05	2.74E-03	1.54E-02	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	5.18E-05	2.22E-06	2.14E-04	2.76E-05				CNS, blood	--				[B2]
Manganese	1253.00	1848.00	1.85E-03	7.94E-05	9.06E-03	1.17E-03	1.32E-02	6.47E-02	12.1%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	1.88E-05	8.05E-07	7.71E-05	9.91E-06	6.26E-02	2.57E-01	48.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	3.73E-05	1.60E-06	1.92E-04	2.47E-05	1.86E-03	9.62E-03	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	1.95E-05	8.34E-07	7.08E-05	9.10E-06	3.89E-03	1.42E-02	2.7%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	2.84E-06	1.22E-07	1.38E-05	1.77E-06	5.68E-04	2.76E-03	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	2.03E-04	8.71E-06	8.68E-04	1.12E-04	6.78E-04	2.89E-03	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.17	1.35E-07	5.78E-09	8.32E-07	1.07E-07				--	--	4.45E-08	8.24E-07	5.8%	[B2]
Benzo(a)anthracene	0.26	0.32	3.90E-07	1.67E-08	1.55E-06	2.00E-07	1.30E-05	5.16E-05	0.0%	--	--	1.22E-08	1.46E-07	1.0%	[B2]
Benzo(a)pyrene	0.25	0.30	3.72E-07	1.59E-08	1.47E-06	1.89E-07	1.24E-05	4.89E-05	0.0%	--	--	1.16E-07	1.38E-06	9.7%	[B2]
Benzo(b)fluoranthene	0.41	0.61	6.01E-07	2.57E-08	3.01E-06	3.87E-07	2.00E-05	1.00E-04	0.0%	--	--	1.88E-08	2.63E-07	2.0%	[B2]
Benzo(k)fluoranthene	0.44	0.62	6.57E-07	2.81E-08	3.05E-06	3.92E-07	2.19E-05	1.02E-04	0.0%	--	--	2.05E-08	2.86E-07	2.0%	[B2]
Chrysene	0.26	0.30	3.77E-07	1.62E-08	1.48E-06	1.90E-07	1.26E-05	4.93E-05	0.0%	--	--	1.18E-09	1.39E-08	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	3.40E-07	1.46E-08	1.33E-06	1.71E-07	1.13E-05	4.44E-05	0.0%	--	--	1.06E-08	1.25E-07	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.69	1.22		2.79E+01		5.12E+02						7.86E-10	1.43E-08	6.6%	[A]
Cobalt 60	0.02	0.04		8.21E-01		1.50E+01						1.23E-11	2.26E-10	0.1%	[A]
Neptunium 237+D	0.05	0.11		1.96E+00		4.61E+01						4.31E-10	1.01E-08	4.7%	[A]
Protactinium 233		0.05				2.03E+01							2.03E-11	0.0%	[A]
Thorium 228+D	1.54	2.00		6.24E+01		8.40E+02						3.43E-09	4.62E-08	21.3%	[A]
Thorium 230	7.38	12.98		2.99E+02		5.44E+03						3.88E-09	7.07E-08	32.6%	[A]
Thorium 232	1.01	1.67		4.09E+01		6.98E+02						4.91E-10	8.38E-09	3.9%	[A]
Uranium 234	3.19	3.53		1.29E+02		1.46E+03						2.07E-09	2.37E-08	10.9%	[A]
Uranium 235+D	0.15	0.17		6.08E+00		6.96E+01						9.73E-11	1.11E-09	0.5%	[A]
Uranium 238+D	3.29	3.58		1.33E+02		1.50E+03						3.73E-09	4.20E-08	19.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.31E-01	5.34E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.26E-06	1.41E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.49E-08	2.17E-07	100.0%	

Table M.265. Risk characterization for soils: adults – dermal exposure (current land use – agricultural/homesteader) – Area S7–C2–A

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	1.10E-08	1.42E-09	1.13E-07	4.86E-08	2.75E-05	2.84E-04	1.7%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	1.17E-07	1.50E-08	1.17E-06	5.03E-07	3.89E-04	3.91E-03	24.1%	skin; keratosis, hyperpigmentation	3	2.63E-08	8.88E-07	21.0%	[A]
Barium	105.70	140.50	1.61E-06	2.07E-07	2.08E-05	8.92E-06	2.30E-05	2.97E-04	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	1.14E-08	1.46E-09	1.27E-07	5.45E-08	2.27E-06	2.54E-05	0.2%	no observed effects	100	6.29E-09	2.34E-07	5.6%	[B2]
Cadmium	3.10	5.43	4.72E-08	6.07E-09	8.04E-07	3.45E-07	4.72E-05	8.04E-04	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	1.02E-06	1.31E-07	1.02E-05	4.38E-06	1.02E-06	1.02E-05	0.1%	no observed effects	100				
Copper	68.59	116.30	1.04E-06	1.34E-07	1.72E-05	7.38E-06	2.82E-05	4.65E-04	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	5.33E-07	6.85E-08	6.47E-06	2.77E-06				CNS, blood	--				[B2]
Manganese	1253.00	1848.00	1.91E-05	2.45E-06	2.74E-04	1.17E-04	1.36E-04	1.95E-03	12.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	1.93E-07	2.48E-08	2.33E-06	9.97E-07	6.44E-04	7.75E-03	47.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	3.83E-07	4.93E-08	5.81E-06	2.49E-06	1.92E-05	2.90E-04	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	2.00E-07	2.57E-08	2.14E-06	9.16E-07	4.01E-05	4.27E-04	2.6%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	2.92E-08	3.75E-09	4.16E-07	1.78E-07	5.84E-06	8.32E-05	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	2.09E-06	2.69E-07	2.62E-05	1.12E-05	6.97E-06	8.74E-05	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.17	1.39E-08	1.78E-09	2.51E-07	1.08E-07				--					
Benzo(a)anthracene	0.26	0.32	4.01E-08	5.16E-09	4.69E-07	2.01E-07	1.34E-06	1.56E-05	0.1%	--	--	1.37E-08	8.29E-07	19.8%	[B2]
Benzo(a)pyrene	0.25	0.30	3.82E-08	4.92E-09	4.43E-07	1.90E-07	1.27E-06	1.48E-05	0.1%	--	--	3.77E-09	1.47E-07	3.5%	[B2]
Benzo(b)fluoranthene	0.41	0.61	6.18E-08	7.95E-09	9.10E-07	3.90E-07	2.06E-06	3.03E-05	0.2%	--	--	3.59E-08	1.39E-06	33.1%	[B2]
Benzo(k)fluoranthene	0.44	0.62	6.75E-08	8.68E-09	9.20E-07	3.94E-07	2.25E-06	3.07E-05	0.2%	--	--	5.80E-09	2.85E-07	6.8%	[B2]
Chrysene	0.26	0.30	3.88E-08	4.99E-09	4.47E-07	1.91E-07	1.29E-06	1.49E-05	0.1%	--	--	6.34E-09	2.88E-07	6.9%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	3.50E-08	4.50E-09	4.02E-07	1.72E-07	1.17E-06	1.34E-05	0.1%	--	--	3.64E-10	1.40E-08	0.3%	[B2]
											--	3.28E-09	1.26E-07	3.0%	[B2]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	1.39E-03	1.62E-02	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.02E-07	4.19E-06	100.0%

Table M.266. Risk characterization for soils: children – dermal exposure (current land use – agricultural/homesteader) – Area S7–C2–A

Chemical	MLE Concentration In Soils	RME Concentration In Soils	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Card. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Card. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total: Card. Risk	RfDA WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	1.4E-08	6.1E-10	1.4E-07	1.9E-08	3.5E-05	3.7E-04	1.7%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	1.5E-07	6.5E-09	1.5E-06	1.9E-07	5.0E-04	5.1E-03	24.1%	skin; keratosis, hyperpigmentation	3	1.1E-08	3.4E-07	21.0%	[A]
Barium	105.70	140.50	2.1E-06	8.9E-08	2.7E-05	3.5E-06	2.9E-05	3.8E-04	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	1.4E-08	6.3E-10	1.6E-07	2.1E-08	2.9E-06	3.3E-05	0.2%	no observed effects	100	2.7E-09	9.1E-08	5.6%	[D2]
Cadmium	3.10	5.43	6.1E-08	2.6E-09	1.0E-06	1.3E-07	6.1E-05	1.0E-03	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	1.3E-06	5.6E-08	1.3E-05	1.7E-06	1.3E-06	1.3E-05	0.1%	no observed effects	100				
Copper	68.59	116.30	1.3E-06	5.8E-08	2.2E-05	2.9E-06	3.6E-05	6.0E-04	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	6.9E-07	2.9E-08	8.4E-06	1.0E-06				CNS, blood	--				[D2]
Manganese	1253.00	1848.00	2.4E-05	1.0E-06	3.5E-04	4.6E-05	1.7E-04	2.5E-03	12.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	2.5E-07	1.0E-08	3.0E-06	3.9E-07	8.3E-04	1.0E-02	47.8%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	4.9E-07	2.1E-08	7.6E-06	9.7E-07	2.5E-05	3.8E-04	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	2.6E-07	1.1E-08	2.7E-06	3.5E-07	5.2E-05	5.5E-04	2.6%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	3.8E-08	1.6E-09	5.4E-07	6.9E-08	7.6E-06	1.0E-04	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	2.7E-06	1.1E-07	3.4E-05	4.4E-06	9.0E-06	1.1E-04	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.17	1.8E-08	7.7E-10	3.2E-07	4.2E-08				--	--	5.9E-09	3.2E-07	19.8%	[D2]
Benzo(a)anthracene	0.26	0.32	5.2E-08	2.2E-09	6.1E-07	7.8E-08	1.7E-06	2.0E-05	0.1%	--	--	1.6E-09	5.7E-08	3.5%	[D2]
Benzo(a)pyrene	0.25	0.30	4.9E-08	2.1E-09	5.7E-07	7.4E-08	1.6E-06	1.9E-05	0.1%	--	--	1.5E-08	5.4E-07	33.1%	[D2]
Benzo(b)fluoranthene	0.41	0.61	8.0E-08	3.4E-09	1.1E-06	1.5E-07	2.6E-06	3.9E-05	0.2%	--	--	2.5E-09	1.1E-07	6.8%	[D2]
Benzo(k)fluoranthene	0.44	0.62	8.8E-08	3.7E-09	1.2E-06	1.5E-07	2.9E-06	4.0E-05	0.2%	--	--	2.7E-09	1.1E-07	6.9%	[D2]
Chrysene	0.26	0.30	5.0E-08	2.1E-09	5.8E-07	7.5E-08	1.6E-06	1.9E-05	0.1%	--	--	1.5E-10	5.4E-09	0.3%	[D2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	4.5E-08	1.9E-09	5.2E-07	6.7E-08	1.5E-06	1.7E-05	0.1%	--	--	1.4E-09	4.9E-08	3.0%	[D2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.7E-03	2.1E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												4.4E-08	1.6E-06	100.0%	

Table M.267. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – agricultural/homesteader) – Area S7–C2–A

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.68E-06	4.73E-07	3.36E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.71E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.86E-07	1.65E-07	5.58E-06	3.86E-05	0.4%	liver; lesions, fatty cyst formation	1000	4.37E-11	9.97E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.86E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.09E-09	2.79E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity	1000	4.16E-11	1.04E-09	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	1.8%	liver; inc. relative weight	1000	3.46E-10	7.94E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	9.67E-04	8.62E-03	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.48E-09	6.01E-08	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	5.49E-10	1.31E-08	100.0%

Table M.268. Risk characterization for surface water; children — ingestion exposure (swimming) (current land use — agricultural/homesteader) — Area S7—C2—A

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E-06	1.30E-07	2.30E-05	2.96E-06	4.34E-05	3.29E-04	1.4%	*oral*—cardiovasc. sys.; inc. blood pressure. *inhal.*—fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E-07	1.28E-08	2.89E-06	3.72E-07	2.99E-07	2.89E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E-07	3.04E-08	4.80E-06	6.17E-07	1.92E-05	1.30E-04	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E-05	4.42E-07	9.05E-05	1.16E-05	2.06E-03	1.81E-02	78.0%	*oral*—CNS effects. *inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E-07	4.40E-09	8.62E-07	1.11E-07	3.42E-04	2.87E-03	12.4%	*oral*—CNS; neurotoxicity. *inhal.*—kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E-07	1.38E-08	3.09E-06	3.97E-07	4.60E-05	4.41E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E-06	1.13E-07	1.99E-05	2.56E-06	8.79E-06	6.64E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E-07	1.02E-08	1.69E-06	2.17E-07	2.38E-06	1.69E-05	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	8.91E-10	3.82E-11	5.48E-09	7.05E-10	2.97E-05	1.83E-04	0.8%	liver; lesions, toxicity	1000	6.49E-10	1.20E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E-07	1.56E-08	3.04E-06	3.90E-07	1.82E-05	1.52E-04	0.7%	liver; weight inc.	1000	2.19E-10	5.40E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E-07	6.69E-09	1.03E-06	1.32E-07	1.56E-05	1.03E-04	0.4%	liver; lesions, fatty cyst formation	1000	4.08E-11	8.06E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.54E-09	6.61E-11	1.08E-08	1.39E-09	3.08E-06	2.17E-05	0.1%	liver; lesions	100	2.25E-11	4.73E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	1.49E-09	6.37E-11	1.10E-08	1.41E-09	2.97E-05	2.19E-04	0.9%	liver; lesions	100	1.07E-09	2.25E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	1.46E-09	6.36E-11	1.10E-08	1.41E-09	4.95E-06	3.65E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	6.97E-10	2.99E-11	5.14E-09	6.60E-10	2.32E-06	1.71E-05	0.1%	liver, kidney; toxicity	1000	3.88E-11	8.58E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	8.28E-10	3.55E-11	5.48E-09	7.05E-10	6.37E-05	4.21E-04	1.8%	liver; inc. relative weight	1000	3.23E-10	6.41E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E-07	6.87E-09	1.06E-06	1.36E-07	1.60E-05	1.06E-04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E-11	1.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E-10	2.78E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.71E-03	2.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E-09	4.85E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E-10	4.07E-09	100.0%	

Table M.269. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – agricultural/homesteader) – Area S7–C2–A

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.58E-06	0.0%	Gastrointestinal system; irritation	--				
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.21E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fatty cyst formation	1000	1.88E-10	7.57E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[B2]
Dieldrin	3.67E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.66E-05	0.6%	liver, kidney; toxicity	1000	2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; inc. relative weight	1000	5.29E-09	2.14E-07	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.02E-03	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.35E-08	1.04E-06	100.0%	

Table M.270. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – agricultural/homesteader) – Area S7–C2–A

Chemical	MLB Concentration (µg/L)	RMB Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncanc/organic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E-07	4.69E-09	1.53E-06	1.96E-07	1.56E-06	2.18E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	3.18E-07	4.09E-08	6.91E-07	8.66E-06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	7.43E-05	1.20E-03	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E-09	1.59E-10	5.72E-08	7.35E-09	1.23E-05	1.91E-04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E-08	4.98E-10	2.05E-07	2.64E-08	1.66E-06	2.93E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.21E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.21E-04	0.7%	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	12.0%	liver; weight inc.	1000	1.63E-09	7.47E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E-07	1.34E-08	3.79E-06	4.87E-07	3.13E-05	3.79E-04	2.2%	liver; lesions, fatty cyst formation	1000	8.19E-11	2.97E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.99E-04	3.86E-03	22.3%	liver; lesions	100	2.18E-09	8.44E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.45E-03	8.4%	liver; lesions	100	3.67E-09	1.50E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	0.6%	liver, kidney; toxicity	1000	1.23E-10	4.98E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	31.9%	liver; inc. relative weight	1000	2.30E-09	8.40E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.71E-06	1.73E-04	2.11E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.33E-03	1.73E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-08	4.08E-07	100.0%	

Table M.271. Risk characterization for sediments: adults – dermal exposure (current land use – agricultural/homesteader) – Area S7–C2–A

Chemical	Chronic Daily Intake (CDI) MLB Concentration in Sediment	RMB Concentration in Sediment	CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[D2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[D2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.88E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.60	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				-- --	--	1.68E-10	3.32E-08	11.9%	[D2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				-- --	--	1.32E-10	2.82E-08	10.1%	[D2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%	-- --	--	5.02E-11	9.96E-09	3.6%	[D2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	-- --	--	4.86E-10	9.34E-08	33.4%	[D2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	-- --	--	5.78E-11	1.12E-08	4.0%	[D2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	-- --	--	4.74E-11	7.63E-09	2.7%	[D2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	-- --	--	4.77E-12	9.46E-10	0.3%	[D2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	-- --	--	3.39E-10	4.65E-08	16.6%	[D2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[D2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	-- --	--	4.25E-11	7.30E-09	2.6%	[D2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-09	2.8E-07	100.0%	

Table M.272. Risk characterization for sediments: children – dermal exposure (current land use – agricultural/homesteader) – Area S7–C2–A

Chemical	MLE Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	BPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.7E-10	4.1E-11	4.2E-08	5.4E-09	3.2E-06	1.4E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.3E-11	9.5E-09	8.7%	[A]
Barium	78.13	88.46	1.6E-08	7.1E-10	7.1E-07	9.1E-08	2.3E-07	1.0E-05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.9E-10	8.4E-12	8.2E-09	1.0E-09	3.9E-08	1.6E-06	0.2%	no observed effects	100	3.6E-11	4.5E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.0E-10	1.3E-11	1.3E-08	1.7E-09	3.0E-07	1.3E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.0E-08	4.3E-10	4.4E-07	5.7E-08	1.0E-08	4.4E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.1E-09	2.2E-10	2.4E-07	3.0E-08	1.3E-07	6.5E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.1E-08	4.6E-10	8.0E-07	1.0E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.9E-07	8.1E-09	8.3E-06	1.0E-06	1.3E-06	5.9E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.43	3.2E-09	1.3E-10	1.6E-07	2.1E-08	1.0E-05	5.4E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.9E-09	2.1E-10	2.2E-07	2.8E-08	2.4E-07	1.1E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.2E-09	2.6E-10	2.7E-07	3.4E-08	8.8E-07	3.8E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.0E-08	8.9E-10	9.7E-07	1.2E-07	6.9E-08	3.2E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.2E-10	9.4E-12	1.3E-08	1.6E-09				--	--	7.2E-11	1.3E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.7E-10	7.4E-12	1.1E-08	1.4E-09				--	--	5.7E-11	1.1E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.9E-10	2.9E-11	4.1E-08	5.3E-09	2.3E-08	1.3E-06	0.2%	--	--	2.1E-11	3.9E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.7E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.1E-10	3.6E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.0E-10	3.4E-11	4.6E-08	6.0E-09	2.6E-08	1.5E-06	0.2%	--	--	2.5E-11	4.3E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.5E-10	2.8E-11	3.1E-08	4.1E-09	2.1E-08	1.0E-06	0.1%	--	--	2.0E-11	2.9E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.6E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.0E-12	3.7E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.7E-10	2.0E-11	1.9E-08	2.5E-09	1.5E-08	6.4E-07	0.1%	--	--	1.4E-10	1.8E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.6E-11	7.0E-13	1.0E-09	1.4E-10	3.2E-07	2.1E-05	2.5%	liver; lesions	100	1.1E-11	2.2E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.9E-10	2.5E-11	3.0E-08	3.9E-09	1.9E-08	1.0E-06	0.1%	--	--	1.8E-11	2.8E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.7E-05	6.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.9E-10	1.1E-07	100.0%	

Table M.273. Risk characterization for produce: adults – ingestion exposure (current land use – agricultural/homesteader) – Area S7–C2–A

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Nonca. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Nonca. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	EPA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	7.24E-03	7.66E-03	1.10E-06	1.42E-07	1.25E-05	5.35E-06	2.76E-03	3.12E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	6.14E-01	6.34E-01	9.37E-05	1.20E-05	1.03E-03	4.43E-04	3.12E-01	3.45E+00	7.9%	skin; keratosis, hyperpigmentation	3	2.1E-05	7.75E-04	98.0%	[A]
Barium	1.06E+00	1.41E+00	1.61E-04	2.07E-05	2.29E-03	9.82E-04	2.30E-03	3.27E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.99E-03	3.43E-03	4.56E-07	5.87E-08	5.60E-06	2.40E-06	9.12E-05	1.12E-03	0.0%	no observed effects	100	2.52E-07	1.03E-05	1.3%	[B2]
Cadmium	1.55E+00	2.72E+00	2.37E-04	3.04E-05	4.43E-03	1.90E-03	2.37E-01	4.43E+00	10.2%	kidney; proteinuria	10				
Chromium (III)	6.70E-01	6.90E-01	1.02E-04	1.31E-05	1.12E-03	4.82E-04	1.02E-04	1.12E-03	0.0%	no observed effects	100				
Copper	3.43E+00	5.82E+00	5.23E-04	6.72E-05	9.48E-03	4.06E-03	1.41E-02	2.56E-01	0.6%	Gastrointestinal system; irritation	--				[D]
Lead	3.50E-01	4.37E-01	5.34E-05	6.87E-06	7.12E-04	3.05E-04				CNS, blood	--				[B2]
Manganese	5.01E+02	7.35E+02	7.65E-02	9.83E-03	1.20E+00	5.16E-01	5.46E-01	8.61E+00	19.8%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	3.81E+00	4.71E+00	5.81E-04	7.47E-05	7.68E-03	3.29E-03	1.94E+00	2.56E+01	58.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.26E+00	1.96E+00	1.92E-04	2.47E-05	3.20E-03	1.37E-03	9.61E-03	1.60E-01	0.4%	dec. body and organ weight	300				
Selenium	1.32E+00	1.44E+00	2.01E-04	2.58E-05	2.35E-03	1.01E-03	4.02E-02	4.70E-01	1.1%	whole body; clinical selenosis	3				[D]
Silver	3.84E-01	5.62E-01	5.86E-05	7.53E-06	9.16E-04	3.92E-04	1.17E-02	1.83E-01	0.4%	skin; argyria	3				[D]
Zinc	5.50E+01	7.08E+01	8.39E-03	1.08E-03	1.15E-01	4.95E-02	2.86E-02	3.85E-01	0.9%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor–1260	8.95E-05	1.66E-04	1.37E-08	1.76E-09	2.71E-07	1.16E-07				--	--	1.35E-08	8.98E-07	0.1%	[B2]
Benzo(a)anthracene	9.80E-04	1.18E-03	1.50E-07	1.92E-08	1.92E-06	8.22E-07	4.98E-06	6.39E-05	0.0%	--	--	1.40E-08	6.00E-07	0.1%	[B2]
Benzo(a)pyrene	4.74E-04	5.64E-04	7.23E-08	9.25E-09	9.19E-07	3.94E-07	2.41E-06	3.06E-05	0.0%	--	--	6.78E-08	2.87E-06	0.4%	[B2]
Benzo(b)fluoranthene	6.02E-04	9.11E-04	9.19E-08	1.18E-08	1.49E-06	6.37E-07	3.06E-06	4.95E-05	0.0%	--	--	8.62E-09	4.65E-07	0.1%	[B2]
Benzo(k)fluoranthene	4.72E-04	6.61E-04	7.20E-08	9.26E-09	1.08E-06	4.62E-07	2.40E-06	3.59E-05	0.0%	--	--	6.76E-09	3.37E-07	0.0%	[B2]
Chrysene	1.11E-03	1.31E-03	1.70E-07	2.18E-08	2.14E-06	9.19E-07	5.65E-06	7.14E-05	0.0%	--	--	1.59E-09	6.71E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	8.32E-05	9.83E-05	1.27E-08	1.63E-09	1.60E-07	6.87E-08	4.23E-07	5.34E-06	0.0%	--	--	1.19E-09	5.02E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	2.06E-02	3.67E-02		7.24E+02		4.58E+04						2.03E-08	1.28E-06	41.4%	[A]
Cobalt 60	6.08E-04	1.08E-03		2.13E+01		1.35E+03						3.20E-10	2.02E-08	0.7%	[A]
Neptunium 237+D	1.93E-03	4.40E-03		6.78E+01		5.50E+03						1.49E-08	1.21E-06	39.0%	[A]
Protactinium 233		4.85E-04				6.06E+02							6.06E-10	0.0%	[A]
Thorium 228+D	7.70E-04	1.00E-03		2.70E+01		1.25E+03						1.49E-09	6.89E-08	2.2%	[A]
Thorium 230	3.69E-03	6.49E-03		1.29E+02		8.11E+03						1.68E-09	1.05E-07	3.4%	[A]
Thorium 232	5.05E-04	8.33E-04		1.77E+01		1.04E+03						2.13E-10	1.25E-08	0.4%	[A]
Uranium 234	6.38E-03	7.06E-03		2.24E+02		8.83E+03						3.58E-09	1.41E-07	4.6%	[A]
Uranium 235+D	3.00E-04	3.32E-04		1.05E+01		4.15E+02						1.69E-10	6.65E-09	0.2%	[A]
Uranium 238+D	6.57E-03	7.16E-03		2.31E+02		8.94E+03						6.46E-09	2.50E-07	8.1%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	3.14E+00	4.38E+01	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.14E-05	7.91E-04	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	4.91E-08	3.11E-06	100.0%

Table M.274. Risk characterization for produce: children — ingestion exposure (current land use — agricultural/homesteader) — Area S7–C2–A

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	EPA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	7.24E-03	7.66E-03	2.47E-06	1.06E-07	2.59E-05	3.33E-06	6.17E-03	6.48E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	6.14E-01	6.34E-01	2.09E-04	8.97E-06	2.14E-03	2.76E-04	6.98E-01	7.15E+00	7.9%	skin; keratosis, hyperpigmentation	3	1.57E-05	4.83E-04	98.0%	[A]
Barium	1.06E+00	1.41E+00	3.61E-04	1.55E-05	4.75E-03	6.11E-04	5.15E-03	6.79E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.99E-03	3.43E-03	1.02E-06	4.37E-08	1.16E-05	1.49E-06	2.04E-04	2.32E-03	0.0%	no observed effects	100	1.88E-07	6.42E-06	1.3%	[B2]
Cadmium	1.55E+00	2.72E+00	5.29E-04	2.27E-05	9.18E-03	1.18E-03	5.29E-01	9.18E+00	10.2%	kidney; proteinuria	10				
Chromium (III)	6.70E-01	6.99E-01	2.28E-04	9.79E-06	2.33E-03	3.00E-04	2.28E-04	2.33E-03	0.0%	no observed effects	100				
Copper	3.43E+00	5.82E+00	1.17E-03	5.01E-05	1.97E-02	2.53E-03	3.16E-02	5.32E-01	0.6%	Gastrointestinal system; irritation	--				[D]
Lead	3.50E-01	4.37E-01	1.19E-04	5.12E-06	1.48E-03	1.90E-04				CNS, blood	--				[D2]
Manganese	5.01E+02	7.39E+02	1.71E-01	7.33E-03	2.50E+00	3.21E-01	1.22E+00	1.79E+01	19.8%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	3.81E+00	4.71E+00	1.30E-03	5.56E-05	1.59E-02	2.05E-03	4.33E+00	5.31E+01	58.8%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	1.26E+00	1.96E+00	4.29E-04	1.84E-05	6.63E-03	8.53E-04	2.15E-02	3.32E-01	0.4%	dec. body and organ weight	300				
Selenium	1.32E+00	1.44E+00	4.49E-04	1.92E-05	4.88E-03	6.27E-04	8.98E-02	9.76E-01	1.1%	whole body; clinical selenosis	3				[D]
Silver	3.84E-01	5.62E-01	1.31E-04	5.61E-06	1.90E-03	2.44E-04	2.62E-02	3.80E-01	0.4%	skin; argyria	3				[D]
Zinc	5.50E+01	7.08E+01	1.87E-02	8.03E-04	2.39E-01	3.08E-02	6.25E-02	7.98E-01	0.9%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	8.95E-05	1.66E-04	3.05E-08	1.31E-09	5.63E-07	7.24E-08				--	--	1.01E-08	5.57E-07	0.1%	[D2]
Benzo(a)anthracene	9.80E-04	1.18E-03	3.34E-07	1.43E-08	3.98E-06	5.12E-07	1.11E-03	1.33E-04	0.0%	--	--	1.03E-08	3.73E-07	0.1%	[D2]
Benzo(a)pyrene	4.74E-04	5.64E-04	1.62E-07	6.92E-09	1.91E-06	2.45E-07	5.38E-06	6.35E-05	0.0%	--	--	5.05E-08	1.79E-06	0.4%	[D2]
Benzo(b)fluoranthene	6.02E-04	9.11E-04	2.05E-07	8.80E-09	3.08E-06	3.96E-07	6.85E-06	1.03E-04	0.0%	--	--	6.43E-09	2.89E-07	0.1%	[D2]
Benzo(k)fluoranthene	4.72E-04	6.61E-04	1.61E-07	6.90E-09	2.23E-06	2.87E-07	5.36E-06	7.45E-05	0.0%	--	--	5.04E-09	2.10E-07	0.0%	[D2]
Chrysene	1.11E-03	1.31E-03	3.79E-07	1.62E-08	4.45E-06	5.72E-07	1.26E-05	1.48E-04	0.0%	--	--	1.19E-09	4.17E-08	0.0%	[D2]
Indeno(1,2,3-cd)pyrene	8.32E-05	9.83E-05	2.84E-08	1.22E-09	3.33E-07	4.28E-08	9.46E-07	1.11E-05	0.0%	--	--	8.88E-10	3.12E-08	0.0%	[D2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	2.06E-02	3.67E-02		1.93E+02		1.06E+04						5.40E-09	2.97E-07	41.4%	[A]
Cobalt 60	6.08E-04	1.08E-03		5.67E+00		3.11E+02						8.51E-11	4.67E-09	0.7%	[A]
Neptunium 237+D	1.93E-03	4.40E-03		1.80E+01		1.27E+03						3.97E-09	2.80E-07	39.0%	[A]
Protactinium 233		4.85E-04				1.40E+02							1.40E-10	0.0%	[A]
Thorium 228+D	7.70E-04	1.00E-03		7.19E+00		2.89E+02						3.95E-10	1.59E-08	2.2%	[A]
Thorium 230	3.69E-03	6.49E-03		3.44E+01		1.87E+03						4.48E-10	2.44E-08	3.4%	[A]
Thorium 232	5.05E-04	8.33E-04		4.72E+00		2.41E+02						5.66E-11	2.89E-09	0.4%	[A]
Uranium 234	6.38E-03	7.06E-03		5.96E+01		2.04E+03						9.53E-10	3.26E-08	4.6%	[A]
Uranium 235+D	3.00E-04	3.32E-04		2.80E+00		9.60E+01						4.49E-11	1.54E-09	0.2%	[A]
Uranium 238+D	6.57E-03	7.16E-03		6.14E+01		2.07E+03						1.72E-09	5.79E-08	8.1%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.01E+00	9.04E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-05	4.92E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E-08	7.16E-07	100.0%	

Table M.275. Risk characterization for beef: adults – ingestion exposure (current land use – agricultural) – Area S7–F2–A

Chemical	MLE Concentration from Mean Concentration in Soil/SW	RME Concentration from UCL Concentration in Soil/SW	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	RfDA WOE
INORGANICS (mg/kg BBBF TISSUE)															
Antimony	4.12E-04	4.37E-04	9.94E-08	1.26E-08	4.49E-07	1.92E-07	2.49E-04	1.12E-03	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	1.70E-01	1.76E-01	4.10E-05	5.26E-06	1.86E-04	7.75E-05	1.37E-01	6.03E-01	6.0%	skin; keratosis, hyperpigmentation	3	9.24E-06	1.36E-04	48.6%	(A)
Barium	5.72E-01	7.56E-01	1.38E-04	1.77E-05	7.79E-04	3.34E-04	1.97E-03	1.11E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.86E-03	3.22E-03	6.76E-07	8.66E-08	3.31E-06	1.42E-06	1.35E-04	6.62E-04	0.0%	no observed effects	100	3.74E-07	6.10E-06	2.2%	(D2)
Cadmium	1.24E-02	2.17E-02	2.98E-06	3.83E-07	2.23E-05	9.54E-06	2.98E-03	2.23E-02	0.2%	kidney; proteinuria	10				
Chromium (III)	9.29E+00	1.50E+01	2.24E-03	2.88E-04	1.54E-02	6.61E-03	2.24E-03	1.54E-02	0.2%	no observed effects	100				
Copper	8.74E+00	1.15E+01	2.11E-03	2.71E-04	1.18E-02	5.06E-03	5.69E-02	3.19E-01	3.2%	Gastrointestinal system; irritation	--				(D)
Lead	2.00E-02	2.50E-02	4.82E-06	6.20E-07	2.56E-05	1.10E-05				CNS, blood	--				(B2)
Manganese	2.35E+01	3.52E+01	5.65E-03	7.27E-04	3.61E-02	1.55E-02	4.04E-02	2.58E-01	2.6%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				(D)
Mercury	1.45E+00	2.01E+00	3.48E-04	4.48E-05	2.06E-03	8.84E-04	1.16E+00	6.87E+00	68.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				(D)
Nickel	5.59E-02	8.71E-02	1.35E-05	1.73E-06	8.95E-05	3.83E-05	6.74E-04	4.47E-03	0.0%	dec. body and organ weight	300				
Selenium	2.88E+00	3.16E+00	6.95E-04	8.93E-05	3.25E-03	1.39E-03	1.39E-01	6.49E-01	6.4%	whole body; clinical selenosis	3				(D)
Silver	3.63E-02	5.60E-02	9.23E-06	1.19E-06	5.76E-05	2.47E-05	1.85E-03	1.15E-02	0.1%	skin; argyria	3				(D)
Zinc	2.96E+02	3.90E+02	7.14E-02	9.18E-03	4.00E-01	1.72E-01	2.38E-01	1.33E+00	13.2%	blood; anemia	3				(D)
ORGANICS (mg/kg BBBF TISSUE)															
Aroclor-1260	7.52E-03	1.40E-02	1.88E-06	2.33E-07	1.44E-05	6.16E-06				--	--	1.79E-06	4.74E-05	17.0%	(B2)
Benzo(a)anthracene	2.39E-03	2.87E-03	5.76E-07	7.40E-08	2.95E-06	1.26E-06	1.92E-05	9.82E-05	0.0%	--	--	5.41E-08	9.22E-07	0.3%	(B2)
Benzo(a)pyrene	6.93E-03	8.24E-03	1.67E-06	2.15E-07	8.47E-06	3.63E-06	5.57E-05	2.82E-04	0.0%	--	--	1.57E-06	2.65E-05	9.5%	(B2)
Benzo(b)fluoranthene	1.67E-02	2.53E-02	4.03E-06	5.18E-07	2.60E-05	1.11E-05	1.34E-04	8.66E-04	0.0%	--	--	3.78E-07	8.12E-06	2.9%	(B2)
Benzo(k)fluoranthene	3.20E-02	4.48E-02	7.71E-06	9.92E-07	4.60E-05	1.97E-05	2.57E-04	1.53E-03	0.0%	--	--	7.24E-07	1.44E-05	5.2%	(B2)
Chrysene	1.79E-03	2.12E-03	4.31E-07	5.54E-08	2.17E-06	9.32E-07	1.44E-05	7.25E-05	0.0%	--	--	4.05E-09	6.80E-08	0.0%	(B2)
Indeno(1,2,3-cd)pyrene	1.04E-01	1.23E-01	2.52E-05	3.24E-06	1.27E-04	5.43E-05	8.39E-04	4.22E-03	0.0%	--	--	2.36E-06	3.96E-05	14.2%	(B2)
RADIONUCLIDES (pCi/kg BBBF TISSUE)															
Cesium 137+D	1.92E+01	3.93E+01		1.06E+03		3.10E+04						2.98E-08	8.67E-07	8.7%	(A)
Cobalt 60	1.11E+00	7.89E+00		6.17E+01		6.21E+03						9.25E-10	9.32E-08	0.9%	(A)
Neptunium 237+D	1.09E+01	3.26E+01		6.07E+02		2.57E+04						1.34E-07	5.65E-06	56.6%	(A)
Protactinium 233		1.09E+00				8.59E+02							8.59E-10	0.0%	(A)
Thorium 228+D	1.82E+01	2.37E+01		1.01E+03		1.86E+04						5.54E-08	1.02E-06	10.3%	(A)
Thorium 230	8.71E+01	1.53E+02		4.83E+03		1.21E+05						6.28E-08	1.57E-06	15.7%	(A)
Thorium 232	1.15E+01	1.97E+01		6.61E+02		1.55E+04						7.93E-09	1.86E-07	1.9%	(A)
Uranium 234	1.45E+01	1.66E+01		8.25E+02		1.30E+04						1.32E-08	2.09E-07	2.1%	(A)
Uranium 235+D	7.16E-01	8.11E-01		3.97E+01		6.39E+02						6.35E-10	1.02E-08	0.1%	(A)
Uranium 238+D	1.55E+01	1.71E+01		8.57E+02		1.35E+04						2.40E-08	3.77E-07	3.8%	(A)

Chemical Hazards:			
Hazard Index (HI):	1.78E+00	1.01E+01	100.0%
Excess Lifetime Cancer Risk:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.65E-05	2.79E-04	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	3.28E-07	9.99E-06	100.0%

Table M.276. Risk characterization for beef: children – ingestion exposure (current land use – agricultural) – Area S7–F2–A

Chemical	MLB Concentration from Media: Concentration in Soil/SW	RMB Concentration from UCL: Concentration in Soil/SW	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	Risk Estimates: HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	BPA WOE
INORGANICS (mg/kg BBBF TISSUE)															
Antimony	4.12E-04	4.37E-04	2.08E-07	8.92E-09	8.90E-07	1.14E-07	5.20E-04	2.23E-03	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	1.70E-01	1.76E-01	8.66E-05	3.68E-06	3.59E-04	4.60E-05	2.87E-01	1.20E+00	6.0%	skin; keratosis, hyperpigmentation	3	6.45E-06	8.07E-05	48.6%	[A]
Barium	5.72E-01	7.58E-01	2.88E-04	1.24E-05	1.53E-03	1.99E-04	4.12E-03	2.21E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.80E-03	3.22E-03	1.41E-06	6.06E-08	6.56E-06	8.44E-07	2.83E-04	1.31E-03	0.0%	no observed effects	100	2.61E-07	3.63E-06	2.2%	[B2]
Cadmium	1.24E-02	2.17E-02	6.24E-06	2.67E-07	4.42E-05	5.68E-06	6.24E-03	4.42E-02	0.2%	kidney; proteinuria	10				
Chromium (III)	9.29E+00	1.50E+01	4.69E-03	2.01E-04	3.06E-02	3.93E-03	4.69E-03	3.06E-02	0.2%	no observed effects	100				
Copper	8.74E+00	1.15E+01	4.41E-03	1.89E-04	2.34E-02	3.01E-03	1.19E-01	6.33E-01	3.2%	Gastrointestinal system; irritation	--				[D]
Lead	2.00E-02	2.50E-02	1.01E-05	4.32E-07	3.09E-05	6.54E-06				CNS, blood	--				[B2]
Manganese	2.39E+01	3.52E+01	1.18E-02	5.07E-04	7.17E-02	9.22E-03	8.45E-02	5.12E-01	2.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.45E+00	2.01E+00	7.29E-04	3.13E-05	4.09E-03	5.26E-04	2.43E+00	1.36E+01	68.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	5.59E-02	8.71E-02	2.82E-05	1.21E-06	1.78E-04	2.28E-05	1.41E-03	8.88E-03	0.0%	dec. body and organ weight	300				
Selenium	2.88E+00	3.16E+00	1.45E-03	6.23E-05	6.44E-03	8.28E-04	2.91E-01	1.29E+00	6.4%	whole body; clinical selenosis	3				[D]
Silver	3.83E-02	5.60E-02	1.93E-05	8.28E-07	1.14E-04	1.47E-05	3.86E-03	2.28E-02	0.1%	skin; argyria	3				[D]
Zinc	2.96E+02	3.90E+02	1.49E-01	6.40E-03	7.94E-01	1.02E-01	4.98E-01	2.65E+00	13.2%	blood; anemia	3				[D]
ORGANICS (mg/kg BBBF TISSUE)															
Aroclor-1260	7.52E-03	1.40E-02	3.79E-06	1.63E-07	2.85E-05	3.67E-06				--	--	1.25E-06	2.82E-05	17.0%	[B2]
Benzo(a)anthracene	2.39E-03	2.87E-03	1.20E-06	5.17E-08	5.85E-06	7.52E-07	4.02E-05	1.95E-04	0.0%	--	--	3.77E-08	5.49E-07	0.3%	[B2]
Benzo(a)pyrene	6.93E-03	8.24E-03	3.49E-06	1.50E-07	1.68E-05	2.16E-06	1.16E-04	5.60E-04	0.0%	--	--	1.09E-06	1.58E-05	9.5%	[B2]
Benzo(b)fluoranthene	1.67E-02	2.53E-02	8.43E-06	3.63E-07	5.15E-05	6.62E-06	2.81E-04	1.72E-03	0.0%	--	--	2.64E-07	4.84E-06	2.9%	[B2]
Benzo(k)fluoranthene	3.20E-02	4.48E-02	1.61E-05	6.92E-07	9.13E-05	1.17E-05	5.38E-04	3.04E-03	0.0%	--	--	5.05E-07	8.57E-06	5.2%	[B2]
Chrysene	1.79E-03	2.12E-03	9.02E-07	3.87E-08	4.31E-06	5.55E-07	3.01E-05	1.44E-04	0.0%	--	--	2.82E-09	4.05E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	1.04E-01	1.23E-01	5.27E-05	2.26E-06	2.51E-04	3.23E-05	1.76E-03	8.38E-03	0.0%	--	--	1.65E-06	2.36E-05	14.2%	[B2]
RADIONUCLIDES (pCi/kg BBBF TISSUE)															
Cesium 137+D	1.92E+01	3.93E+01		2.65E+02		6.84E+03						7.42E-09	1.92E-07	8.7%	[A]
Cobalt 60	1.11E+00	7.85E+00		1.54E+01		1.37E+03						2.30E-10	2.00E-08	0.9%	[A]
Neptunium 237+D	1.09E+01	3.26E+01		1.51E+02		5.68E+03						3.33E-08	1.25E-06	56.6%	[A]
Protactinium 233		1.09E+00				1.90E+02							1.90E-10	0.0%	[A]
Thorium 228+D	1.82E+01	2.37E+01		2.51E+02		4.12E+03						1.38E-08	2.27E-07	10.3%	[A]
Thorium 230	8.71E+01	1.53E+02		1.20E+03		2.67E+04						1.56E-08	3.47E-07	15.7%	[A]
Thorium 232	1.19E+01	1.97E+01		1.65E+02		3.43E+03						1.98E-09	4.11E-08	1.9%	[A]
Uranium 234	1.49E+01	1.66E+01		2.00E+02		2.88E+03						3.29E-09	4.61E-08	2.1%	[A]
Uranium 235+D	7.16E-01	8.11E-01		9.89E+00		1.41E+02						1.58E-10	2.26E-09	0.1%	[A]
Uranium 238+D	1.55E+01	1.71E+01		2.13E+02		2.98E+03						5.98E-09	8.34E-08	3.8%	[A]

Chemical Hazards: Hazard Index (HI):	3.73E+00	2.01E+01	100.0%		
Excess Lifetime Cancer Risk: Combined Exposure (d)				1.15E-05	1.60E-04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)				8.18E-08	2.22E-06	100.0%

Table M.277. Risk characterization for fish: adults – ingestion exposure (current land use – agricultural/homesteader) – Area S7–C2–A

Chemical	MLE Concentration in Fish Tissue	RME Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS															
Mercury	0.76	0.78	2.38E-06	3.06E-07	2.89E-05	1.24E-05	7.94E-03	9.63E-02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	6.43E-07	8.27E-08	8.21E-06	3.52E-06						6.37E-07	2.71E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.13E-06	1.45E-07	1.44E-05	6.18E-06						1.12E-06	4.76E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E-03	9.63E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.75E-06	7.47E-05	100.0%	

Table M.278. Risk characterization for fish: children — ingestion exposure (current land use — agricultural/homesteader) — Area S7–C2–A

Chemical	MLB Concentration in Fish Tissue	RMB Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS															
Mercury	0.76	0.78	4.16E-06	1.78E-07	6.04E-05	7.76E-06	1.39E-02	2.01E-01	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	1.12E-06	4.81E-08	1.72E-05	2.21E-06						3.70E-07	1.70E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.97E-06	8.44E-08	3.01E-05	3.88E-06						6.50E-07	2.98E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.39E-02	2.01E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-06	4.68E-05	100.0%	

Table M.279. Risk characterization for air: adults – inhalation exposure during mowing activities (current land use – agricultural) – Area S7–C2–A

Chemical	Chronic Daily Intake (CDI): MLE Concentration (µg/L)	RME Concentration (µg/L)	CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/m³)															
Antimony	9.4E-06	9.9E-06	9.7E-09	1.2E-09	1.0E-08	4.4E-09				whole body, blood; inc. mortality	--				
Arsenic	9.9E-05	1.0E-04	1.0E-07	1.3E-08	1.0E-07	4.5E-08				skin; keratosis, hyperpigmentation	--	6.6E-07	2.3E-06	90.2%	[A]
Barium	1.3E-03	1.8E-03	1.4E-06	1.8E-07	1.9E-06	8.1E-07	1.0E-02	1.3E-02	5.7%	*oral*–cardiovasc. sys.; loc. blood pressure. *inhal.*–fetotoxicity	1000				
Beryllium	9.7E-06	1.1E-05	1.0E-08	1.3E-09	1.1E-08	4.9E-09				no observed effects	--	1.0E-08	4.1E-08	1.6%	[B2]
Cadmium	4.0E-05	7.0E-05	4.1E-08	5.3E-09	7.3E-08	3.1E-08				kidney; proteinuria	--	3.2E-08	1.9E-07	7.5%	[B1]
Chromium (III)	8.7E-04	8.9E-04	9.0E-07	1.1E-07	9.3E-07	3.9E-07				no observed effects	--				
Copper	8.9E-04	1.5E-03	9.2E-07	1.1E-07	1.5E-06	6.7E-07				Gastrointestinal system; irritation	--				
Lead	4.5E-04	5.6E-04	4.7E-07	6.0E-08	5.9E-07	2.5E-07				CNS, blood	--				
Manganese	1.6E-02	2.4E-02	1.6E-05	2.1E-06	2.5E-05	1.0E-05	1.4E-01	2.1E-01	93.3%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	300				
Mercury	1.6E-04	2.0E-04	1.7E-07	2.2E-08	2.1E-07	9.1E-08	2.0E-03	2.4E-03	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	30				
Nickel	3.2E-04	5.1E-04	3.4E-07	4.3E-08	5.3E-07	2.2E-07				dec. body and organ weight	--				
Selenium	1.7E-04	1.8E-04	1.7E-07	2.2E-08	1.9E-07	8.3E-08				whole body; clinical selenosis	--				
Silver	2.4E-05	3.6E-05	2.5E-08	3.3E-09	3.8E-08	1.6E-08				skin; argyria	--				
Zinc	1.7E-03	2.3E-03	1.8E-06	2.3E-07	2.3E-06	1.0E-06				blood; anemia	--				
ORGANICS (mg/m³)															
Aroclor-1260	1.1E-06	2.2E-06	1.2E-09	1.5E-10	2.2E-09	9.8E-10				--	--				
Benzo(a)anthracene	3.4E-06	4.1E-06	3.5E-09	4.5E-10	4.2E-09	1.8E-09				--	--	2.8E-10	1.1E-09	0.0%	[B2]
Benzo(a)pyrene	3.2E-06	3.8E-06	3.4E-09	4.3E-10	4.0E-09	1.7E-09				--	--	2.6E-09	1.0E-08	0.4%	[B2]
Benzo(b)fluoranthene	5.2E-06	7.9E-06	5.4E-09	7.0E-10	8.3E-09	3.5E-09				--	--	4.3E-10	2.1E-09	0.1%	[B2]
Benzo(k)fluoranthene	5.7E-06	8.0E-06	6.0E-09	7.7E-10	8.4E-09	3.6E-09				--	--	4.7E-10	2.2E-09	0.1%	[B2]
Chrysene	3.3E-06	3.9E-06	3.4E-09	4.4E-10	4.0E-09	1.7E-09				--	--	2.7E-11	1.0E-10	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	2.9E-06	3.5E-06	3.1E-09	4.0E-10	3.6E-09	1.5E-09				--	--	2.4E-10	9.6E-10	0.0%	[B2]
RADIONUCLIDES (pCi/m³)															
Cesium 137+D	8.9E-03	1.5E-02		2.1E+00		1.2E+01									
Cobalt 60	2.6E-04	4.6E-04		6.3E-02		3.7E-01						4.0E-11	2.4E-10	0.0%	[A]
Neptunium 237+D	6.2E-04	1.4E-03		1.5E-01		1.1E+00						9.4E-12	5.5E-11	0.0%	[A]
Protactinium 233		6.3E-04				5.0E-01						4.3E-09	3.3E-08	0.4%	[A]
Thorium 228+D	2.0E-02	2.6E-02		4.7E+00		2.0E+01							4.3E-12	0.0%	[A]
Thorium 230	9.5E-02	1.6E-01		2.2E+01		1.3E+02						3.7E-07	1.6E-06	18.1%	[A]
Thorium 232	1.3E-02	2.1E-02		3.1E+00		1.7E+01						6.6E-07	3.9E-06	43.5%	[A]
Uranium 234	4.1E-02	4.5E-02		9.9E+00		3.6E+01						8.7E-08	4.8E-07	5.4%	[A]
Uranium 235+D	1.9E-03	2.1E-03		4.6E-01		1.7E+00						2.5E-07	9.5E-07	10.6%	[A]
Uranium 238+D	4.2E-02	4.6E-02		1.0E+01		3.7E+01						1.1E-08	4.3E-08	0.5%	[A]
												5.3E-07	1.9E-06	21.5%	[A]
Chemical Hazards:															
Hazard Index:							1.6E-01	2.3E-01	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												7.1E-07	2.5E-06	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												1.9E-06	8.9E-06	100.0%	

Table M.280. Risk characterization summary for EFPC Segment 7: RME risk estimates for future land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	5.34E−01 B	1.49E−01 B	1.41E−05 W	1.32E−05 W	2.17E−07 B	5.43E−07 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	2.12E−02 B	1.62E−02 B	1.64E−06 W	4.19E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	3.28E+01 *B*	2.77E+01 *B*	9.08E−05 W	2.56E−04 *B*	3.10E−06 W	2.35E−05 W	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	7.30E−04 B	1.61E−04 B	1.33E−07 B	9.78E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	9.04E+01 *B*	4.36E+01 *B*	4.92E−04 *B*	7.91E−04 *B*	7.16E−07 B	3.10E−06 W	NA	NA	NA	NA	NA	NA
Beef	Ingestion	2.01E+01 *B*	1.01E+01 *B*	1.66E−04 *B*	2.79E−04 *B*	2.21E−06 W	9.99E−06 W	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	3.68E+01 *B*	8.89E+00 *B*	2.48E−04 *B*	2.00E−04 *B*	3.46E−06 W	7.51E−06 W	NA	NA	NA	NA	NA	NA
Fish	Ingestion	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	2.34E−01	NA	2.55E−06	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		1.8E+02 *B*	9.1E+01 *B*					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				1E−03 *B*	2E−03 *B*					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						1E−05 W	4E−05 W					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	1.21E−01 B	6.39E−02 B	3.21E−06 W	5.64E−06 W	4.93E−08 B	2.33E−07 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	7.49E−03 B	6.96E−03 B	5.80E−07 B	1.80E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	1.48E−03 B	1.04E−03 B	3.10E−09 B	7.22E−09 B	4.89E−10 B	1.63E−09 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.28E−03 B	1.18E−03 B	3.01E−08 B	9.31E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	9.90E−05 B	9.19E−05 B	1.26E−08 B	3.89E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		1.3E−01 B	7.3E−02 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				4E−06 W	8E−06 W					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						5E−08 B	2E−07 B					NA	NA

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (BLCR<=1 x 10^{-6})
W – within EPA target cancer risk range (BLCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (BLCR>1 x 10^{-4})

Table M.281. Human health risk characterization summary for EFPC open land use scenario: future land use, Area S7–F1–O adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	5.53E–03	6.39E–02	1.62E–07	5.64E–06
Dermal Contact	2.00E–04	6.96E–03	1.51E–08	1.80E–06
SURFACE WATER				
Ingestion	6.90E–05	1.04E–03	1.77E–10	7.22E–09
Dermal Contact	7.27E–05	1.18E–03	1.68E–09	9.31E–08
SEDIMENT				
Dermal Contact	1.94E–06	9.19E–05	2.29E–10	3.89E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			5.30E–09	2.33E–07
SURFACE WATER				
Ingestion			3.92E–11	1.63E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.9E–03	7.3E–02		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	8E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–09	2E–07

Table M.282. Human health risk characterization summary for EFPC open land use scenario: future land use, Area S7–F1–O children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	9.56E–03	1.21E–01	9.37E–08	3.21E–06
Dermal Contact	2.06E–04	7.49E–03	5.18E–09	5.80E–07
SURFACE WATER				
Ingestion	9.55E–05	1.48E–03	8.16E–11	3.10E–09
Dermal Contact	7.49E–05	1.28E–03	5.77E–10	3.01E–08
SEDIMENT				
Dermal Contact	2.00E–06	9.90E–05	7.87E–11	1.26E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.09E–09	4.93E–08
SURFACE WATER				
Ingestion			1.31E–11	4.89E–10
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	9.9E–03	1.3E–01		
Excess Lifetime Cancer Risk: Combined Exposure			1E–07	4E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1E–09	5E–08

Table M.283. Human health risk characterization summary for EFPC agricultural/homesteader scenario: future land use, Area S7–F2–A adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	3.73E–02	1.49E–01	1.10E–06	1.32E–05
Dermal Contact	1.35E–03	1.62E–02	1.02E–07	4.19E–06
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion	1.58E+01	2.77E+01	3.84E–05	2.56E–04
Inhalation (VOCs)	4.01E–05	1.61E–04	7.30E–09	9.78E–08
FOOD CHAIN				
Produce	3.14E+00	4.36E+01	2.14E–05	7.91E–04
Beef	1.78E+00	1.01E+01	1.65E–05	2.79E–04
Dairy	1.53E+00	8.89E+00	1.01E–05	2.00E–04
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting	1.60E–01	2.34E–01	7.15E–07	2.55E–06
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.58E–08	5.43E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion			3.59E–06	2.35E–05
FOOD CHAIN				
Produce			4.91E–08	3.10E–06
Beef			3.28E–07	9.99E–06
Dairy			2.19E–07	7.51E–06
Fish				
AIR PATHWAY				
Particulates: Harvesting			1.93E–06	8.96E–06
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.3E+01	9.1E+01		
Excess Lifetime Cancer Risk: Combined Exposure			9E–05	2E–03
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			6E–06	5E–05

Table M.284. Human health risk characterization summary for EFPC agricultural/homesteader scenario: future land use, Area S7–F2–A children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.31E–01	5.34E–01	1.28E–06	1.41E–05
Dermal Contact	1.76E–03	2.12E–02	4.42E–08	1.64E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion	1.65E+01	3.28E+01	1.33E–05	9.08E–05
Inhalation (VOCs)	2.34E–04	7.30E–04	1.42E–08	1.33E–07
FOOD CHAIN				
Produce	7.01E+00	9.04E+01	1.60E–05	4.92E–04
Beef	3.73E+00	2.01E+01	1.15E–05	1.66E–04
Dairy	6.83E+00	3.68E+01	1.52E–05	2.48E–04
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.49E–08	2.17E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion			4.45E–07	3.10E–06
FOOD CHAIN				
Produce			1.31E–08	7.16E–07
Beef			8.18E–08	2.21E–06
Dairy			1.17E–07	3.46E–06
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	3.4E+01	1.8E+02		
Excess Lifetime Cancer Risk: Combined Exposure			6E–05	1E–03
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			7E–07	1E–05

Table M.285. Risk characterization for soils: adults – ingestion exposure (future land use – open) – Area S7–F1–O

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HI Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	BPA WOE
INORGANICS **(mg/kg)**															
Antimony	0.72	0.77	4.5E-08	5.8E-09	4.5E-07	1.9E-07	1.1E-04	1.1E-03	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	4.8E-07	6.1E-08	4.6E-06	1.9E-06	1.6E-03	1.5E-02	24.3%	skin; keratosis, hyperpigmentation	3	1.0E-07	3.4E-06	61.9%	[A]
Barium	105.70	140.50	6.6E-06	8.5E-07	8.2E-05	3.5E-05	9.4E-05	1.1E-03	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	4.6E-08	6.0E-09	5.0E-07	2.1E-07	9.3E-06	1.0E-04	0.2%	no observed effects	100	2.5E-08	9.2E-07	16.5%	[D2]
Cadmium	3.10	5.43	1.9E-07	2.5E-08	3.1E-06	1.3E-06	1.9E-04	3.1E-03	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	4.1E-06	5.3E-07	4.0E-05	1.7E-05	4.1E-06	4.0E-05	0.1%	no observed effects	100				
Copper	68.59	116.30	4.3E-06	5.5E-07	6.8E-05	2.9E-05	1.1E-04	1.8E-03	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	2.1E-06	2.8E-07	2.5E-05	1.1E-05				CNS, blood	--				[D2]
Manganese	1253.00	1848.00	7.8E-05	1.0E-05	1.0E-03	4.6E-04	5.6E-04	7.7E-03	12.1%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	7.9E-07	1.0E-07	9.2E-06	3.9E-06	2.6E-03	3.0E-02	48.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	1.5E-06	2.0E-07	2.3E-05	9.8E-06	7.8E-05	1.1E-03	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	6.2E-07	1.0E-07	6.4E-06	3.6E-06	1.6E-04	1.6E-03	2.7%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	1.2E-07	1.5E-08	1.6E-06	7.0E-07	2.4E-05	3.3E-04	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	8.6E-06	1.1E-06	1.0E-04	4.4E-05	2.8E-05	3.4E-04	0.5%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor–1260	0.09	0.17	5.7E-09	7.3E-10	9.9E-08	4.2E-08				--	--	5.6E-09	3.2E-07	5.8%	[D2]
Benzo(a)anthracene	0.26	0.32	1.6E-08	2.1E-09	1.8E-07	7.9E-08	5.5E-07	6.2E-06	0.0%	--	--	1.5E-09	5.8E-08	1.0%	[D2]
Benzo(a)pyrene	0.25	0.30	1.5E-08	2.0E-09	1.7E-07	7.5E-08	5.2E-07	5.8E-06	0.0%	--	--	1.4E-08	5.4E-07	9.7%	[D2]
Benzo(b)fluoranthene	0.41	0.61	2.5E-08	3.2E-09	3.6E-07	1.5E-07	8.4E-07	1.2E-05	0.0%	--	--	2.3E-09	1.1E-07	2.0%	[D2]
Benzo(k)fluoranthene	0.44	0.62	2.7E-08	3.5E-09	3.6E-07	1.5E-07	9.2E-07	1.2E-05	0.0%	--	--	2.6E-09	1.1E-07	2.0%	[D2]
Chrysene	0.26	0.30	1.6E-08	2.0E-09	1.7E-07	7.5E-08	5.3E-07	5.9E-06	0.0%	--	--	1.5E-10	5.5E-09	0.1%	[D2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	1.4E-08	1.8E-09	1.6E-07	6.8E-08	4.8E-07	5.3E-06	0.0%	--	--	1.3E-09	4.9E-08	0.9%	[D2]
RADIONUCLIDES **(pCi/g)**															
Cesium 137+D	0.69	1.22		9.9E+00		5.5E+02						2.7E-10	1.5E-08	6.6%	[A]
Cobalt 60	0.02	0.04		2.9E-01		1.6E+01						4.3E-12	2.4E-10	0.1%	[A]
Neptunium 237+D	0.05	0.11		6.9E-01		4.9E+01						1.5E-10	1.0E-08	4.7%	[A]
Protactinium 233		0.05				2.1E+01							2.1E-11	0.0%	[A]
Thorium 228+D	1.54	2.00		2.2E+01		9.0E+02						1.2E-09	4.9E-08	21.3%	[A]
Thorium 230	7.38	12.98		1.0E+02		5.8E+03						1.3E-09	7.5E-08	32.6%	[A]
Thorium 232	1.01	1.67		1.4E+01		7.5E+02						1.7E-10	9.0E-09	3.9%	[A]
Uranium 234	3.19	3.53		4.5E+01		1.5E+03						7.3E-10	2.5E-08	10.9%	[A]
Uranium 235+D	0.15	0.17		2.1E+00		7.4E+01						3.4E-11	1.2E-09	0.5%	[A]
Uranium 238+D	3.29	3.58		4.7E+01		1.6E+03						1.3E-09	4.5E-08	19.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							5.5E-03	6.3E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-07	5.6E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												5.3E-09	2.3E-07	100.0%	

Table M.286. Risk characterization for soils; children – ingestion exposure (future land use – open) – Area S7–F1–O

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Risk Estimates: Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS **(mg/kg)**															
Antimony	0.72	0.77	7.8E-08	3.3E-09	8.5E-07	1.1E-07	1.9E-04	2.1E-03	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	8.3E-07	3.5E-08	8.8E-06	1.1E-06	2.7E-03	2.9E-02	24.3%	skin; keratosis, hyperpigmentation	3	6.2E-08	1.9E-06	61.9%	[A]
Barium	105.70	140.50	1.1E-05	4.9E-07	1.5E-04	2.0E-05	1.6E-04	2.2E-03	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	8.0E-08	3.4E-09	9.5E-07	1.2E-07	1.6E-05	1.9E-04	0.2%	no observed effects	100	1.4E-08	5.3E-07	16.5%	[B2]
Cadmium	3.10	5.43	3.3E-07	1.4E-08	6.0E-06	7.7E-07	3.3E-04	6.0E-03	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	7.2E-06	3.1E-07	7.6E-05	9.8E-06	7.2E-06	7.6E-05	0.1%	no observed effects	100				
Copper	68.59	116.30	7.4E-06	3.1E-07	1.3E-04	1.6E-05	2.0E-04	3.5E-03	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	3.7E-06	1.6E-07	4.8E-05	6.2E-06				CNS, blood	--				[B2]
Manganese	1253.00	1848.00	1.3E-04	5.8E-06	2.0E-03	2.6E-04	9.6E-04	1.4E-02	12.1%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	1.3E-06	5.8E-08	1.7E-05	2.2E-06	4.5E-03	5.8E-02	48.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	2.7E-06	1.1E-07	4.3E-05	5.6E-06	1.3E-04	2.1E-03	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	1.4E-06	6.1E-08	1.6E-05	2.0E-06	2.8E-04	3.2E-03	2.7%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	2.0E-07	8.9E-09	3.1E-06	4.0E-07	4.1E-05	6.2E-04	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	1.4E-05	6.3E-07	1.9E-04	2.5E-05	4.9E-05	6.5E-04	0.5%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor–1260	0.09	0.17	9.8E-09	4.2E-10	1.8E-07	2.4E-08				--	--	3.2E-09	1.8E-07	5.8%	[B2]
Benzo(a)anthracene	0.26	0.32	2.8E-08	1.2E-09	3.3E-07	4.5E-08	9.5E-07	1.1E-05	0.0%	--	--	8.9E-10	3.3E-08	1.0%	[B2]
Benzo(a)pyrene	0.25	0.30	2.7E-08	1.1E-09	3.3E-07	4.2E-08	9.0E-07	1.1E-05	0.0%	--	--	8.5E-09	3.1E-07	9.7%	[B2]
Benzo(b)fluoranthene	0.41	0.61	4.4E-08	1.8E-09	6.8E-07	8.8E-08	1.4E-06	2.2E-05	0.0%	--	--	1.3E-09	6.4E-08	2.0%	[B2]
Benzo(k)fluoranthene	0.44	0.62	4.8E-08	2.0E-09	6.9E-07	8.9E-08	1.6E-06	2.3E-05	0.0%	--	--	1.5E-09	6.5E-08	2.0%	[B2]
Chrysene	0.26	0.30	2.7E-08	1.1E-09	3.3E-07	4.3E-08	9.2E-07	1.1E-05	0.0%	--	--	8.6E-11	3.1E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	2.4E-08	1.0E-09	3.0E-07	3.9E-08	8.3E-07	1.0E-05	0.0%	--	--	7.7E-10	2.8E-08	0.9%	[B2]
RADIONUCLIDES **(pCi/g)**															
Cesium 137+D	0.69	1.22		2.0E+00		1.1E+02						5.7E-11	3.2E-09	6.6%	[A]
Cobalt 60	0.02	0.04		6.0E-02		3.4E+00						9.0E-13	5.1E-11	0.1%	[A]
Neptunium 237+D	0.05	0.11		1.4E-01		1.0E+01						3.1E-11	2.3E-09	4.7%	[A]
Protactinium 233		0.05				4.6E+00							4.6E-12	0.0%	[A]
Thorium 228+D	1.54	2.00		4.5E+00		1.9E+02						2.5E-10	1.0E-08	21.3%	[A]
Thorium 230	7.38	12.98		2.1E+01		1.2E+03						2.8E-10	1.6E-08	32.6%	[A]
Thorium 232	1.01	1.67		2.9E+00		1.5E+02						3.5E-11	1.9E-09	3.9%	[A]
Uranium 234	3.19	3.53		9.4E+00		3.3E+02						1.5E-10	5.3E-09	10.9%	[A]
Uranium 235+D	0.15	0.17		4.4E-01		1.5E+01						7.1E-12	2.5E-10	0.5%	[A]
Uranium 238+D	3.29	3.58		9.7E+00		3.4E+02						2.7E-10	9.5E-09	19.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.3E-03	1.2E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.3E-08	3.2E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-09	4.9E-08	100.0%	

Table M.287. Risk characterization for soils: adults – dermal exposure (future land use – open) – Area S7–F1–O

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	1.6E-09	2.1E-10	4.8E-08	2.0E-08	4.0E-06	1.2E-04	1.7%	whole body, blood; loc. mortality	1000				
Arsenic	7.67	7.93	1.7E-08	2.2E-09	5.0E-07	2.1E-07	5.7E-05	1.6E-03	24.1%	skin; keratosis, hyperpigmentation	3	3.8E-09	3.7E-07	21.0%	[A]
Barium	105.70	140.50	2.3E-07	3.0E-08	8.9E-06	3.8E-06	3.4E-06	1.2E-04	1.8%	*oral*–cardiovasc. sys.; loc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	1.6E-09	2.1E-10	5.4E-08	2.3E-08	3.3E-07	1.0E-05	0.2%	no observed effects	100	9.3E-10	1.0E-07	5.6%	[B2]
Cadmium	3.10	3.43	6.9E-09	8.9E-10	3.4E-07	1.4E-07	6.9E-06	3.4E-04	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	1.5E-07	1.9E-08	4.3E-06	1.8E-06	1.5E-07	4.3E-06	0.1%	no observed effects	100				
Copper	68.59	116.30	1.5E-07	1.9E-08	7.3E-06	3.1E-06	4.1E-06	1.9E-04	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	7.8E-08	1.0E-08	2.7E-06	1.1E-06				CNS, blood	--				[D2]
Manganese	1253.00	1848.00	2.8E-06	3.6E-07	1.1E-04	5.0E-05	2.0E-05	8.3E-04	12.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	2.8E-08	3.6E-09	9.9E-07	4.2E-07	9.5E-05	3.3E-03	47.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	5.6E-08	7.3E-09	2.4E-06	1.0E-06	2.8E-06	1.2E-04	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	2.9E-08	3.8E-09	9.1E-07	3.9E-07	3.9E-06	1.8E-04	2.6%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	4.3E-09	5.5E-10	1.7E-07	7.6E-08	8.6E-07	3.5E-05	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	3.1E-07	3.9E-08	1.1E-05	4.8E-06	1.0E-06	3.7E-05	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.17	2.0E-09	2.6E-10	1.0E-07	4.6E-08				--	--	2.0E-09	3.5E-07	19.8%	[B2]
Benzo(a)anthracene	0.26	0.32	5.9E-09	7.6E-10	2.0E-07	8.6E-08	1.9E-07	6.7E-06	0.1%	--	--	5.5E-10	6.2E-08	3.5%	[B2]
Benzo(a)pyrene	0.25	0.30	5.6E-09	7.2E-10	1.9E-07	8.1E-08	1.8E-07	6.3E-06	0.1%	--	--	5.3E-09	5.9E-07	33.1%	[B2]
Benzo(b)fluoranthene	0.41	0.61	9.1E-09	1.1E-09	3.9E-07	1.6E-07	3.0E-07	1.3E-05	0.2%	--	--	8.5E-10	1.2E-07	6.8%	[B2]
Benzo(k)fluoranthene	0.44	0.62	1.0E-08	1.2E-09	3.9E-07	1.6E-07	3.3E-07	1.3E-05	0.2%	--	--	9.3E-10	1.2E-07	6.9%	[B2]
Chrysene	0.26	0.30	5.7E-09	7.3E-10	1.9E-07	8.2E-08	1.9E-07	6.3E-06	0.1%	--	--	5.4E-11	5.9E-09	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	5.1E-09	6.6E-10	1.7E-07	7.3E-08	1.7E-07	5.7E-06	0.1%	--	--	4.6E-10	5.4E-08	3.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.0E-04	6.9E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.5E-08	1.8E-06	100.0%	

Table M.288. Risk characterization for soils: children – dermal exposure (future land use – open) – Area S7–F1–O

Chemical	MLB Concentration in Soil	RMB Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	1.6E-09	7.2E-11	5.2E-08	6.7E-09	4.2E-06	1.3E-04	1.7%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	1.7E-08	7.6E-10	5.4E-07	6.9E-08	5.9E-05	1.8E-03	24.1%	skin; keratosis, hyperpigmentation	3	1.3E-09	1.2E-07	21.0%	[A]
Barium	105.70	140.50	2.4E-07	1.0E-08	9.6E-06	1.2E-06	3.5E-06	1.3E-04	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	1.7E-09	7.4E-11	5.8E-08	7.5E-09	3.4E-07	1.1E-05	0.2%	no observed effects	100	3.2E-10	3.2E-08	5.6%	[B2]
Cadmium	3.10	5.43	7.2E-09	3.0E-10	3.7E-07	4.7E-08	7.2E-06	3.7E-04	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	1.5E-07	6.6E-09	4.7E-06	6.0E-07	1.5E-07	4.7E-06	0.1%	no observed effects	100				
Copper	68.59	116.30	1.5E-07	6.8E-09	7.9E-06	1.0E-06	4.3E-06	2.1E-04	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	8.1E-08	3.4E-09	2.9E-06	3.8E-07				CNS, blood	--				[B2]
Manganese	1253.00	1848.00	2.9E-06	1.2E-07	1.2E-04	1.6E-05	2.0E-05	9.0E-04	12.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	2.9E-08	1.2E-09	1.0E-06	1.3E-07	9.8E-05	3.5E-03	47.8%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	5.8E-08	2.5E-09	2.6E-06	3.4E-07	2.9E-06	1.3E-04	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	3.0E-08	1.3E-09	9.8E-07	1.2E-07	6.1E-06	1.9E-04	2.6%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	4.4E-09	1.9E-10	1.9E-07	2.4E-08	8.9E-07	3.8E-05	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	3.1E-07	1.3E-08	1.2E-05	1.5E-06	1.0E-06	4.0E-05	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.17	2.1E-09	9.0E-11	1.1E-07	1.4E-08				--	--	6.9E-10	1.1E-07	19.8%	[B2]
Benzo(a)anthracene	0.26	0.32	6.1E-09	2.6E-10	2.1E-07	2.7E-08	2.0E-07	7.2E-06	0.1%	--	--	1.9E-10	2.0E-08	3.5%	[B2]
Benzo(a)pyrene	0.25	0.30	5.8E-09	2.5E-10	2.0E-07	2.6E-08	1.9E-07	6.8E-06	0.1%	--	--	1.8E-09	1.9E-07	33.1%	[B2]
Benzo(b)fluoranthene	0.41	0.61	9.4E-09	4.0E-10	4.2E-07	5.4E-08	3.1E-07	1.4E-05	0.2%	--	--	2.9E-10	3.9E-08	6.8%	[B2]
Benzo(k)fluoranthene	0.44	0.62	1.0E-08	4.4E-10	4.2E-07	5.4E-08	3.4E-07	1.4E-05	0.2%	--	--	3.2E-10	3.9E-08	6.9%	[B2]
Chrysene	0.26	0.30	5.9E-09	2.5E-10	2.0E-07	2.6E-08	1.9E-07	6.8E-06	0.1%	--	--	1.8E-11	1.9E-09	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	5.3E-09	2.2E-10	1.8E-07	2.3E-08	1.7E-07	6.1E-06	0.1%	--	--	1.6E-10	1.7E-08	3.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.0E-04	7.4E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.1E-09	5.8E-07	100.0%	

Table M.289. Risk characterization for surface water: adults – ingestion exposure (swimming)(future land use – open) – Area S7–F1–O

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDo Uncertainty	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	BPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	7.75E-08	9.96E-09	1.03E-06	4.40E-07	1.1E-06	1.47E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	7.63E-09	9.81E-10	1.29E-07	5.54E-08	7.63E-09	1.29E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.81E-08	2.33E-09	2.14E-07	9.18E-08	4.89E-07	5.79E-06	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.63E-07	3.38E-08	4.04E-06	1.73E-06	5.26E-05	8.08E-04	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.66E+00	3.93E+00	2.62E-09	3.37E-10	3.85E-08	1.65E-08	8.72E-06	1.28E-04	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.22E-09	1.06E-09	1.38E-07	5.91E-08	1.17E-06	1.97E-05	1.9%	no observed effects	100				
Zinc	6.67E+01	9.09E+01	6.72E-08	8.65E-09	8.86E-07	3.81E-07	2.24E-07	2.96E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	6.08E-09	7.82E-10	7.54E-08	3.23E-08	6.08E-08	7.54E-07	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.27E-11	2.92E-12	2.45E-10	1.05E-10	7.58E-07	8.15E-06	0.8%	liver; lesions, toxicity	1000	4.97E-11	1.78E-09	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	9.30E-09	1.20E-09	1.36E-07	5.81E-08	4.65E-07	6.78E-06	0.7%	liver; weight inc.	1000	1.67E-11	8.13E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.98E-09	5.12E-10	4.59E-08	1.97E-08	3.98E-07	4.59E-06	0.4%	liver; lesions, fattycyst formation	1000	3.12E-12	1.20E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	3.93E-11	5.06E-12	4.83E-10	2.07E-10	7.86E-08	9.67E-07	0.1%	liver; lesions	100	1.72E-12	7.04E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.79E-11	4.87E-12	4.89E-10	2.10E-10	7.58E-07	9.78E-06	0.9%	liver; lesions	100	7.80E-11	3.35E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	3.78E-11	4.87E-12	4.89E-10	2.10E-10	1.26E-07	1.63E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.78E-11	2.29E-12	2.29E-10	9.83E-11	5.93E-08	7.64E-07	0.1%	liver, kidney; toxicity	1000	2.97E-12	1.28E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.11E-11	2.72E-12	2.45E-10	1.05E-10	1.63E-06	1.88E-05	1.8%	liver; inc. relative weight	1000	2.47E-11	9.54E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	4.09E-09	5.26E-10	4.73E-08	2.03E-08	4.09E-07	4.73E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		8.27E-01		3.22E+01						1.32E-11	5.15E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		9.29E-01		3.98E+01						2.60E-11	1.12E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.90E-05	1.04E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.71E-10	7.22E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.92E-11	1.63E-09	100.0%	

Table M.290. Risk characterization for surface water: children – ingestion exposure (swimming)(future land use – open) – Area S7–F1–O

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.07E-07	4.59E-09	1.47E-06	1.89E-07	1.53E-06	2.10E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.60E+00	1.32E+01	1.06E-08	4.52E-10	1.85E-07	2.37E-08	1.06E-08	1.85E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.50E-08	1.07E-09	3.06E-07	3.94E-08	6.77E-07	8.27E-06	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.64E-07	1.56E-08	5.77E-06	7.42E-07	7.27E-05	1.15E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.62E-09	1.55E-10	5.50E-08	7.07E-09	1.21E-05	1.83E-04	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.14E-08	4.87E-10	1.97E-07	2.53E-08	1.62E-06	2.82E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.30E-08	3.99E-09	1.27E-06	1.63E-07	3.10E-07	4.23E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.41E-09	3.60E-10	1.08E-07	1.38E-08	8.41E-08	1.08E-06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.14E-11	1.35E-12	3.49E-10	4.49E-11	1.05E-06	1.16E-05	0.8%	liver; lesions, toxicity	1000	2.29E-11	7.64E-10	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.35E+01	1.29E-08	5.51E-10	1.94E-07	2.49E-08	6.43E-07	9.68E-06	0.7%	liver; weight inc.	1000	7.72E-12	3.48E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.51E-09	2.36E-10	6.55E-08	8.42E-09	5.51E-07	6.55E-06	0.4%	liver; lesions, fattycyst formation	1000	1.44E-12	5.14E-11	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.44E-11	2.33E-12	6.91E-10	8.88E-11	1.09E-07	1.38E-06	0.1%	liver; lesions	100	7.93E-13	3.02E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.24E-11	2.25E-12	6.99E-10	8.95E-11	1.05E-06	1.40E-05	0.9%	liver; lesions	100	3.59E-11	1.44E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.24E-11	2.24E-12	6.99E-10	8.99E-11	1.75E-07	2.33E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.46E-11	1.05E-12	3.28E-10	4.21E-11	8.20E-08	1.09E-06	0.1%	liver, kidney; toxicity	1000	1.37E-12	5.47E-11	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.92E-11	1.25E-12	3.49E-10	4.49E-11	2.25E-06	2.69E-05	1.8%	liver; inc. relative weight	1000	1.14E-11	4.09E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.66E-09	2.42E-10	6.76E-08	8.70E-09	5.66E-07	6.76E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		2.76E-01		9.66E+00						4.41E-12	1.55E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		3.10E-01		1.19E+01						8.67E-12	3.35E-10	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.35E-05	1.48E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.16E-11	3.16E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E-11	4.89E-10	100.0%	

Table M.291. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (future land use – open) – Area S7–F1–O

Chemical	Chronic Daily Intake (CDI): MLE Concentration in SW	RME Concentration in SW	CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.00E-09	7.71E-10	1.04E-07	4.47E-08	8.57E-08	1.49E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	5.91E-10	7.60E-11	1.31E-08	5.62E-09	5.91E-10	1.31E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.40E-09	1.80E-10	2.18E-08	9.33E-09	3.79E-08	5.88E-07	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.04E-08	2.62E-09	4.10E-07	1.76E-07	4.07E-06	8.21E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.03E-10	2.61E-11	3.91E-09	1.68E-09	6.76E-07	1.30E-05	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.36E-10	8.18E-11	1.40E-08	6.01E-09	9.09E-08	2.00E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.21E-09	6.69E-10	9.03E-08	3.87E-08	1.74E-08	3.01E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.94E-09	3.78E-10	4.78E-08	2.05E-08	2.94E-08	4.78E-07	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.76E-11	2.26E-12	2.48E-10	1.06E-10	5.87E-07	8.28E-06	0.7%	liver; lesions, toxicity	1000	3.85E-11	1.81E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.46E-07	1.91E-08	2.84E-06	1.22E-06	7.42E-06	1.42E-04	12.0%	liver; weight inc.	1000	2.67E-10	1.70E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.72E-08	2.21E-09	2.59E-07	1.11E-07	1.72E-06	2.59E-05	2.2%	liver; lesions, fatty cyst formation	1000	1.35E-11	6.77E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.18E-09	1.05E-09	1.32E-07	5.65E-08	1.64E-05	2.64E-04	22.3%	liver; lesions	100	3.58E-10	1.92E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	5.87E-06	9.94E-05	8.4%	liver; lesions	100	6.04E-10	3.41E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	9.77E-07	1.66E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.21E-10	1.55E-11	2.04E-09	8.73E-10	4.02E-07	6.79E-06	0.6%	liver, kidney; toxicity	1000	2.01E-11	1.14E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.23E-10	4.15E-11	4.91E-09	2.10E-09	2.49E-05	3.77E-04	31.9%	liver; inc. relative weight	1000	3.78E-10	1.91E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.50E-08	1.22E-08	1.44E-06	6.18E-07	9.50E-06	1.44E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.27E-05	1.18E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.68E-09	9.31E-08	100.0%	

Table M.292. Risk characterization for surface waters: children — dermal exposure (swimming and wading) (future land use — open) — Area S7—F1—O

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Car. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Car. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.18E-09	2.65E-10	1.12E-07	1.44E-08	8.83E-08	1.60E-06	0.1%	*oral*—cardiovasc. sys.; inc. blood pressure. *inhal.*—fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	6.09E-10	2.61E-11	1.41E-08	1.82E-09	6.09E-10	1.41E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.44E-09	6.19E-11	2.34E-08	3.01E-09	3.90E-08	6.33E-07	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.10E-08	8.99E-10	4.42E-07	5.68E-08	4.20E-06	8.84E-05	6.9%	*oral*—CNS effects. *inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.09E-10	8.95E-12	4.21E-09	5.41E-10	6.96E-07	1.40E-05	1.1%	*oral*—CNS; neurotoxicity. *inhal.*—kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.56E-10	2.81E-11	1.51E-08	1.94E-09	9.37E-08	2.16E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.37E-09	2.30E-10	9.72E-08	1.25E-08	1.79E-08	3.24E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	3.03E-09	1.30E-10	5.15E-08	6.62E-09	3.03E-08	5.15E-07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.81E-11	7.77E-13	2.67E-10	3.44E-11	6.05E-07	8.92E-06	0.7%	liver; lesions, toxicity	1000	1.32E-11	5.85E-10	1.9%	[D2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.53E-07	6.56E-09	3.06E-06	3.93E-07	7.65E-06	1.53E-04	12.0%	liver; weight inc.	1000	9.18E-11	5.50E-09	18.3%	[D2]
Chloroform	4.07E+00	4.65E+00	1.77E-08	7.58E-10	2.79E-07	3.59E-08	1.77E-06	2.79E-05	2.2%	liver; lesions, fattycyst formation	1000	4.62E-12	2.19E-10	0.7%	[D2]
4,4'-DDT	4.02E-02	4.94E-02	8.43E-09	3.61E-10	1.42E-07	1.83E-08	1.69E-05	2.84E-04	22.3%	liver; lesions	100	1.23E-10	6.21E-09	20.7%	[D2]
Dieldrin	3.87E-02	5.00E-02	3.02E-10	1.30E-11	5.33E-09	6.88E-10	6.05E-06	1.07E-04	8.4%	liver; lesions	100	2.07E-10	1.10E-08	36.6%	[D2]
Endrin	3.87E-02	5.00E-02	3.02E-10	1.29E-11	5.33E-09	6.88E-10	1.01E-06	1.78E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.24E-10	5.32E-12	2.19E-09	2.82E-10	4.14E-07	7.31E-06	0.6%	liver, kidney; toxicity	1000	6.92E-12	3.67E-10	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.33E-10	1.43E-11	5.28E-09	6.79E-10	2.56E-05	4.06E-04	31.9%	liver; inc. relative weight	1000	1.30E-10	6.18E-09	20.6%	[D2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.79E-08	4.20E-09	1.55E-06	2.00E-07	9.79E-06	1.55E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.49E-05	1.28E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.77E-10	3.00E-08	100.0%	

Table M.293. Risk characterization for sediments: adults – dermal exposure (future land use – open) – Area S7–F1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.07E-10	1.37E-11	4.51E-09	1.93E-09	3.56E-07	1.50E-05	16.3%	skin; keratosis, hyperpigmentation	3	2.41E-11	3.38E-09	8.7%	[A]
Barium	78.13	88.46	1.83E-09	2.36E-10	7.56E-08	3.24E-08	2.62E-08	1.08E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.15E-11	2.76E-12	8.77E-10	3.76E-10	4.30E-09	1.75E-07	0.2%	no observed effects	100	1.19E-11	1.62E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.33E-11	4.28E-12	1.46E-09	6.27E-10	3.33E-08	1.46E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.12E-09	1.44E-10	4.77E-08	2.02E-08	1.12E-09	4.71E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.63E-10	7.24E-11	2.55E-08	1.09E-08	1.52E-08	6.90E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.24E-09	1.60E-10	8.51E-08	3.65E-08				CNS, blood	--				[D2]
Manganese	886.40	1036.00	2.08E-08	2.68E-09	8.86E-07	3.80E-07	1.49E-07	6.33E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.51E-10	4.51E-11	1.75E-08	7.50E-09	1.17E-06	5.83E-05	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.43E-10	6.99E-11	2.37E-08	1.02E-08	2.72E-08	1.16E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.82E-10	8.77E-11	2.85E-08	1.24E-08	9.74E-08	4.12E-06	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.28E-09	2.93E-10	1.03E-07	4.43E-08	7.60E-09	3.44E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.42E-11	3.10E-12	1.40E-09	5.99E-10				--	--	2.40E-11	4.63E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.90E-11	2.44E-12	1.19E-09	5.08E-10				--	--	1.88E-11	3.91E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.64E-11	9.82E-12	4.42E-09	1.90E-09	2.55E-09	1.47E-07	0.2%	--	--	7.17E-12	1.38E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.40E-11	9.52E-12	4.15E-09	1.78E-09	2.47E-09	1.38E-07	0.2%	--	--	6.95E-11	1.30E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.80E-11	1.13E-11	4.97E-09	2.13E-09	2.93E-09	1.66E-07	0.2%	--	--	8.26E-12	1.55E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.21E-11	9.27E-12	3.39E-09	1.45E-09	2.40E-09	1.13E-07	0.1%	--	--	6.77E-12	1.06E-09	2.7%	[B2]
Chrysene	0.31	0.49	7.26E-11	9.34E-12	4.20E-09	1.80E-09	2.42E-09	1.40E-07	0.2%	--	--	6.82E-13	1.31E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.15E-11	6.63E-12	2.06E-09	8.85E-10	1.72E-09	6.88E-08	0.1%	--	--	4.84E-11	6.46E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.86E-12	2.32E-13	1.16E-10	4.95E-11	3.61E-08	2.31E-06	2.5%	liver; lesions	100	3.71E-12	7.92E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.47E-11	8.32E-12	3.24E-09	1.39E-09	2.16E-09	1.08E-07	0.1%	--	--	6.07E-12	1.01E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.94E-06	9.19E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.29E-10	3.89E-08	100.0%	

Table M.294. Risk characterization for sediments: children – dermal exposure (future land use – open) – Area S7–F1–O

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.1E-10	4.7E-12	4.8E-09	6.2E-10	3.6E-07	1.6E-05	16.3%	skin; keratosis, hyperpigmentation	3	8.2E-12	1.0E-09	8.7%	[A]
Barium	78.13	88.46	1.8E-09	8.1E-11	8.1E-08	1.0E-08	2.7E-08	1.1E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.2E-11	9.4E-13	9.4E-10	1.2E-10	4.4E-09	1.8E-07	0.2%	no observed effects	100	4.0E-12	5.2E-10	4.2%	[B2]
Cadmium	1.42	1.71	3.4E-11	1.4E-12	1.5E-09	2.0E-10	3.4E-08	1.5E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.1E-09	4.9E-11	5.0E-08	6.5E-09	1.1E-09	5.0E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.8E-10	2.4E-11	2.7E-08	3.5E-09	1.5E-08	7.4E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.2E-09	5.4E-11	9.1E-08	1.1E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.1E-08	9.1E-10	9.5E-07	1.2E-07	1.5E-07	6.8E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.6E-10	1.5E-11	1.8E-08	2.4E-09	1.2E-06	6.2E-05	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.6E-10	2.4E-11	2.5E-08	3.2E-09	2.8E-08	1.2E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	7.0E-10	3.0E-11	3.1E-08	3.9E-09	1.0E-07	4.4E-06	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.3E-09	1.0E-10	1.1E-07	1.4E-08	7.8E-09	3.7E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.5E-11	1.0E-12	1.5E-09	1.9E-10				--	--	8.2E-12	1.4E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.9E-11	8.3E-13	1.2E-09	1.6E-10				--	--	6.4E-12	1.2E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.8E-11	3.3E-12	4.7E-09	6.1E-10	2.6E-09	1.5E-07	0.2%	--	--	2.4E-12	4.4E-10	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.6E-11	3.2E-12	4.4E-09	5.7E-10	2.5E-09	1.4E-07	0.2%	--	--	2.3E-11	4.1E-09	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	9.0E-11	3.8E-12	5.3E-09	6.8E-10	3.0E-09	1.7E-07	0.2%	--	--	2.8E-12	5.0E-10	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.4E-11	3.1E-12	3.6E-09	4.6E-10	2.4E-09	1.2E-07	0.1%	--	--	2.3E-12	3.4E-10	2.7%	[B2]
Chrysene	0.31	0.49	7.4E-11	3.2E-12	4.5E-09	5.8E-10	2.4E-09	1.5E-07	0.2%	--	--	2.3E-13	4.2E-11	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.3E-11	2.2E-12	2.2E-09	2.8E-10	1.7E-09	7.4E-08	0.1%	--	--	1.6E-11	2.0E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.8E-12	7.9E-14	1.2E-10	1.6E-11	3.7E-08	2.4E-06	2.5%	liver; lesions	100	1.2E-12	2.5E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.6E-11	2.8E-12	3.4E-09	4.4E-10	2.2E-09	1.1E-07	0.1%	--	--	2.0E-12	3.2E-10	2.6%	[B2]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	2.0E-06	9.9E-05	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	7.8E-11	1.2E-08	100.0%

Table M.295. Risk characterization for soils: adults – ingestion exposure (future land use – agricultural/homesteader) – Area S7–P2–A

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	3.06E-07	3.93E-08	1.05E-06	4.50E-07	7.65E-04	2.62E-03	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	3.24E-06	4.17E-07	1.09E-05	4.65E-06	1.08E-02	3.62E-02	24.3%	skin; keratosis, hyperpigmentation	3	7.30E-07	8.15E-06	61.9%	[A]
Barium	103.70	140.50	4.47E-05	5.74E-06	1.92E-04	8.25E-05	6.38E-04	2.75E-03	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	3.16E-07	4.06E-08	1.18E-06	5.04E-07	6.32E-05	2.35E-04	0.2%	no observed effects	100	1.75E-07	2.17E-06	16.5%	[B2]
Cadmium	3.10	5.43	1.30E-06	1.68E-07	7.44E-06	3.19E-06	1.30E-03	7.44E-03	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	2.83E-05	3.64E-06	9.45E-05	4.05E-05	2.83E-05	9.45E-05	0.1%	no observed effects	100				
Copper	68.59	116.30	2.90E-05	3.73E-06	1.59E-04	6.83E-05	7.84E-04	4.31E-03	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	1.48E-05	1.90E-06	5.99E-05	2.57E-05				CNS, blood	--				[B2]
Manganese	1253.00	1848.00	5.30E-04	6.81E-05	2.53E-03	1.08E-03	3.78E-03	1.81E-02	12.1%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	5.36E-06	6.90E-07	2.15E-05	9.22E-06	1.79E-02	7.17E-02	48.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	1.06E-05	1.37E-06	5.37E-05	2.30E-05	5.32E-04	2.69E-03	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	5.56E-06	7.15E-07	1.98E-05	8.47E-06	1.11E-03	3.95E-03	2.7%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	8.11E-07	1.04E-07	3.85E-06	1.65E-06	1.62E-04	7.70E-04	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	5.81E-05	7.47E-06	2.42E-04	1.04E-04	1.94E-04	8.08E-04	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.09	0.17	3.85E-08	4.95E-09	2.32E-07	9.96E-08				--	--	3.81E-08	7.67E-07	5.8%	[B2]
Benzo(a)anthracene	0.26	0.32	1.12E-07	1.43E-08	4.34E-07	1.86E-07	3.72E-06	1.45E-05	0.0%	--	--	1.05E-08	1.36E-07	1.0%	[B2]
Benzo(a)pyrene	0.25	0.30	1.06E-07	1.37E-08	4.10E-07	1.76E-07	3.54E-06	1.37E-05	0.0%	--	--	9.97E-08	1.28E-06	9.7%	[B2]
Benzo(b)fluoranthene	0.41	0.61	1.72E-07	2.21E-08	8.42E-07	3.61E-07	5.72E-06	2.81E-05	0.0%	--	--	1.61E-08	2.63E-07	2.0%	[B2]
Benzo(k)fluoranthene	0.44	0.62	1.88E-07	2.41E-08	8.51E-07	3.65E-07	6.25E-06	2.84E-05	0.0%	--	--	1.76E-08	2.68E-07	2.0%	[B2]
Chrysene	0.26	0.30	1.08E-07	1.39E-08	4.13E-07	1.77E-07	3.59E-06	1.38E-05	0.0%	--	--	1.01E-09	1.29E-08	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	9.72E-08	1.25E-08	3.72E-07	1.60E-07	3.24E-06	1.24E-05	0.0%	--	--	9.12E-09	1.16E-07	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.69	1.22		6.69E+01		1.28E+03						1.87E-09	3.59E-08	6.6%	[A]
Cobalt 60	0.02	0.04		1.97E+00		3.77E+01						2.95E-11	5.65E-10	0.1%	[A]
Neptunium 237+D	0.05	0.11		4.70E+00		1.16E+02						1.03E-09	2.54E-08	4.7%	[A]
Protactinium 233		0.05				5.09E+01							5.09E-11	0.0%	[A]
Thorium 228+D	1.54	2.00		1.50E+02		2.10E+03						8.23E-09	1.16E-07	21.3%	[A]
Thorium 230	7.38	12.98		7.17E+02		1.36E+04						9.32E-09	1.77E-07	32.6%	[A]
Thorium 232	1.01	1.67		9.82E+01		1.75E+03						1.18E-09	2.10E-08	3.9%	[A]
Uranium 234	3.19	3.53		3.10E+02		3.71E+03						4.94E-09	5.93E-08	10.9%	[A]
Uranium 235+D	0.15	0.17		1.46E+01		1.75E+02						2.34E-10	2.79E-09	0.5%	[A]
Uranium 238+D	3.29	3.58		3.19E+02		3.76E+03						8.95E-09	1.05E-07	19.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.73E-02	1.49E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.10E-06	1.32E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)							–					3.58E-08	5.43E-07	100.0%	

Table M.296. Risk characterization for soils: children – ingestion exposure (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration in Soil	RME Concentration in Soil	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	1.07E-06	4.59E-08	3.76E-06	4.83E-07	2.68E-03	9.39E-03	1.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	1.14E-05	4.87E-07	3.89E-05	5.00E-06	3.78E-02	1.30E-01	24.3%	skin; keratosis, hyperpigmentation	3	8.51E-07	8.75E-06	61.9%	[A]
Barium	105.70	140.50	1.56E-04	6.70E-06	5.89E-04	8.86E-05	2.23E-03	9.85E-03	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	1.11E-06	4.74E-08	4.21E-06	5.42E-07	2.21E-04	8.42E-04	0.2%	no observed effects	100	2.04E-07	2.33E-06	16.5%	[B2]
Cadmium	3.10	5.43	4.59E-06	1.97E-07	2.66E-05	3.43E-06	4.59E-03	2.66E-02	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	9.90E-05	4.24E-06	3.38E-04	4.35E-05	9.90E-05	3.38E-04	0.1%	no observed effects	100				
Copper	68.59	116.30	1.01E-04	4.35E-06	5.70E-04	7.33E-05	2.74E-03	1.54E-02	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	5.18E-05	2.22E-06	2.14E-04	2.76E-05				CNS, blood	--				[B2]
Manganese	1253.00	1848.00	1.85E-03	7.94E-05	9.06E-03	1.17E-03	1.32E-02	6.47E-02	12.1%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	1.88E-05	8.05E-07	7.71E-05	9.91E-06	6.26E-02	2.57E-01	48.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	3.73E-05	1.60E-06	1.92E-04	2.47E-05	1.66E-03	9.62E-03	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	1.95E-05	8.34E-07	7.08E-05	9.10E-06	3.89E-03	1.42E-02	2.7%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	2.84E-06	1.22E-07	1.38E-05	1.77E-06	5.68E-04	2.76E-03	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	2.03E-04	8.71E-06	8.66E-04	1.12E-04	6.78E-04	2.88E-03	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.09	0.17	1.35E-07	5.78E-09	8.32E-07	1.07E-07				--	--	4.45E-08	8.24E-07	5.8%	[B2]
Benzo(a)anthracene	0.26	0.32	3.90E-07	1.67E-08	1.55E-06	2.00E-07	1.30E-05	5.18E-05	0.0%	--	--	1.22E-08	1.46E-07	1.0%	[B2]
Benzo(a)pyrene	0.25	0.30	3.72E-07	1.59E-08	1.47E-06	1.89E-07	1.24E-05	4.89E-05	0.0%	--	--	1.16E-07	1.38E-06	9.7%	[B2]
Benzo(b)fluoranthene	0.41	0.61	6.01E-07	2.57E-08	3.01E-06	3.87E-07	2.00E-05	1.00E-04	0.0%	--	--	1.88E-08	2.83E-07	2.0%	[B2]
Benzo(k)fluoranthene	0.44	0.62	6.57E-07	2.81E-08	3.05E-06	3.92E-07	2.19E-05	1.02E-04	0.0%	--	--	2.05E-08	2.86E-07	2.0%	[B2]
Chrysene	0.26	0.30	3.77E-07	1.62E-08	1.48E-06	1.90E-07	1.26E-05	4.93E-05	0.0%	--	--	1.18E-09	1.39E-08	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	3.40E-07	1.46E-08	1.33E-06	1.71E-07	1.13E-05	4.46E-05	0.0%	--	--	1.06E-08	1.25E-07	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.69	1.22		2.79E+01		5.12E+02						7.80E-10	1.43E-08	6.6%	[A]
Cobalt 60	0.02	0.04		8.21E-01		1.50E+01						1.23E-11	2.26E-10	0.1%	[A]
Neptunium 237+D	0.05	0.11		1.96E+00		4.61E+01						4.31E-10	1.01E-08	4.7%	[A]
Protactinium 233		0.05				2.03E+01							2.03E-11	0.0%	[A]
Thorium 228+D	1.54	2.00		6.24E+01		8.40E+02						3.43E-09	4.62E-08	21.3%	[A]
Thorium 230	7.38	12.98		2.99E+02		5.44E+03						3.88E-09	7.07E-08	32.6%	[A]
Thorium 232	1.01	1.67		4.09E+01		6.98E+02						4.91E-10	8.38E-09	3.9%	[A]
Uranium 234	3.19	3.53		1.29E+02		1.48E+03						2.07E-09	2.37E-08	10.9%	[A]
Uranium 235+D	0.15	0.17		6.08E+00		6.96E+01						9.73E-11	1.11E-09	0.5%	[A]
Uranium 238+D	3.29	3.58		1.33E+02		1.50E+03						3.73E-09	4.20E-08	19.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.31E-01	5.34E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.28E-06	1.41E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.49E-08	2.17E-07	100.0%	

Table M.297. Risk characterization for soils: adults – dermal exposure (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	1.10E-08	1.42E-09	1.13E-07	4.86E-08	2.75E-05	2.84E-04	1.7%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	1.17E-07	1.50E-08	1.17E-06	5.00E-07	3.89E-04	3.90E-03	24.1%	skin; keratosis, hyperpigmentation	3	2.63E-08	8.86E-07	21.0%	[A]
Barium	105.70	140.50	1.61E-06	2.07E-07	2.08E-05	8.92E-06	2.30E-03	2.97E-04	1.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.75	0.86	1.14E-08	1.46E-09	1.27E-07	5.45E-08	2.27E-06	2.54E-05	0.2%	no observed effects	100	6.29E-09	2.34E-07	5.6%	[B2]
Cadmium	3.10	5.43	4.72E-08	6.07E-09	8.04E-07	3.45E-07	4.72E-05	8.04E-04	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	1.02E-06	1.31E-07	1.02E-05	4.38E-06	1.02E-06	1.02E-05	0.1%	no observed effects	100				
Copper	68.59	116.30	1.04E-06	1.34E-07	1.72E-05	7.38E-06	2.82E-05	4.65E-04	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	5.33E-07	6.85E-08	6.47E-06	2.77E-06				CNS, blood	--				[D2]
Manganese	1253.00	1848.00	1.91E-05	2.45E-06	2.74E-04	1.17E-04	1.36E-04	1.95E-03	12.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	[illegible]	15.71	1.93E-07	2.48E-08	2.33E-06	9.97E-07	6.44E-04	7.75E-03	47.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	25.18	39.23	3.83E-07	4.93E-08	5.81E-06	2.49[illegible]	1.92E-05	2.90E-04	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	2.00E-07	2.57E-08	2.14E-06	9.16[illegible]	4.01E-05	4.27E-04	2.6%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	2.92E-08	3.75E-09	4.16E-07	1.78E-07	5.84E-06	8.32E-05	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	2.09E-06	2.69E-07	2.62E-05	1.12E-05	6.97E-06	8.74E-05	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.17	1.39E-08	1.78E-09	2.51E-07	1.08E-07			--	--	--	1.37E-08	8.29E-07	19.8%	[B2]
Benzo(a)anthracene	0.26	0.32	4.01E-08	5.16E-09	4.69E-07	2.01E-07	1.34E-06	1.56E-05	0.1%	--	--	3.77E-09	1.47E-07	3.5%	[B2]
Benzo(a)pyrene	0.25	0.30	3.82E-08	4.92E-09	4.43E-07	1.90E-07	1.27E-06	1.48E-05	0.1%	--	--	3.59E-08	1.39E-06	33.1%	[B2]
Benzo(b)fluoranthene	0.41	0.61	6.18E-08	7.95E-09	9.10E-07	3.90E-07	2.06E-06	3.03E-05	0.2%	--	--	5.80E-09	2.85E-07	6.8%	[B2]
Benzo(k)fluoranthene	0.44	0.62	6.75E-08	8.68E-09	9.20E-07	3.94E-07	2.25E-06	3.07E-05	0.2%	--	--	6.34E-09	2.88E-07	6.9%	[B2]
Chrysene	0.26	0.30	3.88E-08	4.99E-09	4.47E-07	1.91E-07	1.29E-06	1.49E-05	0.1%	--	--	3.64E-10	1.40E-08	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	3.50E-08	4.50E-09	4.02E-07	1.72E-07	1.17E-06	1.34E-05	0.1%	--	--	3.28E-09	1.26E-07	3.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.35E-03	1.62E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-07	4.19E-06	100.0%	

Table M.298. Risk characterization for soils: children — dermal exposure (future land use — agricultural/homesteader) — Area S7—F2—A

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Antimony	0.72	0.77	1.4E-08	6.1E-10	1.4E-07	1.9E-08	3.5E-05	3.7E-04	1.7%	whole body, blood; inc. mortality	1000				
Arsenic	7.67	7.93	1.5E-07	6.5E-09	1.5E-06	1.9E-07	5.0E-04	5.1E-03	24.1%	skin; keratosis, hyperpigmentation	3	1.1E-08	3.4E-07	21.0%	[A]
Barium	105.70	140.50	2.1E-06	8.9E-08	2.7E-05	3.5E-06	2.9E-05	3.8E-04	1.8%	*oral*—cardiovasc. sys.; inc. blood pressure. *Inhal.*—fetotoxicity	3				
Beryllium	0.75	0.86	1.4E-08	6.3E-10	1.6E-07	2.1E-08	2.9E-06	3.3E-05	0.2%	no observed effects	100	2.7E-09	9.1E-08	5.6%	[B2]
Cadmium	3.10	5.43	6.1E-08	2.6E-09	1.0E-06	1.3E-07	6.1E-05	1.0E-03	5.0%	kidney; proteinuria	10				
Chromium (III)	66.95	68.97	1.3E-06	5.6E-08	1.3E-05	1.7E-06	1.3E-06	1.3E-05	0.1%	no observed effects	100				
Copper	68.59	116.30	1.3E-06	5.8E-08	2.2E-05	2.9E-06	3.6E-05	6.0E-04	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	35.00	43.70	6.9E-07	2.9E-08	8.4E-06	1.0E-06				CNS, blood	--				[B2]
Manganese	1253.00	1848.00	2.4E-05	1.0E-06	3.5E-04	4.6E-05	1.7E-04	2.5E-03	12.0%	*oral*—CNS effects. *Inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	12.69	15.71	2.5E-07	1.0E-08	3.0E-06	3.9E-07	8.3E-04	1.0E-02	47.8%	*oral*—CNS; neurotoxicity. *Inhal.*—kidney effects	1000				[D]
Nickel	25.18	39.23	4.9E-07	2.1E-08	7.6E-06	9.7E-07	2.5E-05	3.8E-04	1.8%	dec. body and organ weight	300				
Selenium	13.16	14.43	2.6E-07	1.1E-08	2.7E-06	3.5E-07	5.2E-05	5.5E-04	2.6%	whole body; clinical selenosis	3				[D]
Silver	1.92	2.81	3.8E-08	1.6E-09	5.4E-07	6.9E-08	7.6E-06	1.0E-04	0.5%	skin; argyria	3				[D]
Zinc	137.40	177.00	2.7E-06	1.1E-07	3.4E-05	4.4E-06	9.0E-06	1.1E-04	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.09	0.17	1.8E-08	7.7E-10	3.2E-07	4.2E-08				--	--	5.9E-09	3.2E-07	19.8%	[B2]
Benzo(a)anthracene	0.26	0.32	5.2E-08	2.2E-09	6.1E-07	7.8E-08	1.7E-06	2.0E-05	0.1%	--	--	1.6E-09	5.7E-08	3.5%	[B2]
Benzo(a)pyrene	0.25	0.30	4.9E-08	2.1E-09	5.7E-07	7.4E-08	1.6E-06	1.9E-05	0.1%	--	--	1.5E-08	5.4E-07	33.1%	[B2]
Benzo(b)fluoranthene	0.41	0.61	8.0E-08	3.4E-09	1.1E-06	1.5E-07	2.6E-06	3.9E-05	0.2%	--	--	2.5E-09	1.1E-07	6.8%	[B2]
Benzo(k)fluoranthene	0.44	0.62	8.6E-08	3.7E-09	1.2E-06	1.5E-07	2.9E-06	4.0E-05	0.2%	--	--	2.7E-09	1.1E-07	6.9%	[B2]
Chrysene	0.26	0.30	5.0E-08	2.1E-09	5.8E-07	7.5E-08	1.6E-06	1.9E-05	0.1%	--	--	1.5E-10	5.4E-09	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.23	0.27	4.5E-08	1.9E-09	5.2E-07	6.7E-08	1.5E-06	1.7E-05	0.1%	--	--	1.4E-09	4.9E-08	3.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.7E-03	2.1E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												4.4E-08	1.6E-06	100.0%	

Table M.299. Risk characterization for surface water: adults – ingestion exposure (swimming) (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	Risk Estimates: HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	BPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.68E-06	4.73E-07	3.36E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.70E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.86E-07	1.65E-07	5.58E-06	3.86E-05	0.4%	liver; lesions, fatty cyst formation	1000	4.37E-11	9.97E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.86E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.09E-09	2.79E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity	1000	4.16E-11	1.06E-09	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.26E-05	1.57E-04	1.8%	liver; inc. relative weight	1000	3.46E-10	7.94E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.33E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.67E-04	8.62E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.48E-09	6.01E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												5.49E-10	1.3E-08	100.0%	

Table M.300. Risk characterization for surface water: children — ingestion exposure (swimming) (future land use — agricultural/homesteader) — Area S7–F2–A

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Car. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Car. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Car. Risk	EPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E−06	1.30E−07	2.30E−05	2.96E−06	4.34E−05	3.29E−04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E−07	1.28E−08	2.89E−06	3.72E−07	2.99E−07	2.89E−06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E−07	3.04E−08	4.80E−06	6.17E−07	1.92E−05	1.30E−04	0.6%	Gastrointestinal system; irritation	– –				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E−05	4.42E−07	9.05E−05	1.16E−05	2.06E−03	1.81E−02	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E−07	4.40E−09	8.62E−07	1.11E−07	3.42E−04	2.87E−03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E−07	1.38E−08	3.09E−06	3.97E−07	4.60E−05	4.41E−04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E−06	1.13E−07	1.99E−05	2.56E−06	8.79E−06	6.64E−05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E−07	1.02E−08	1.69E−06	2.17E−07	2.38E−06	1.69E−05	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E−02	2.50E−02	8.91E−10	3.82E−11	5.48E−09	7.05E−10	2.97E−05	1.83E−04	0.8%	liver; lesions, toxicity	1000	6.49E−10	1.20E−08	24.7%	[D2]
Bis(2–ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E−07	1.56E−08	3.04E−06	3.99E−07	1.82E−05	1.52E−04	0.7%	liver; weight inc.	1000	2.19E−10	5.46E−09	11.3%	[D2]
Chloroform	4.07E+00	4.69E+00	1.56E−07	6.69E−09	1.03E−06	1.32E−07	1.56E−05	1.03E−04	0.4%	liver; lesions, fattycyst formation	1000	4.08E−11	8.06E−10	1.7%	[D2]
4,4'–DDT	4.02E−02	4.94E−02	1.54E−09	6.61E−11	1.08E−08	1.39E−09	3.08E−06	2.17E−05	0.1%	liver; lesions	100	2.25E−11	4.73E−10	1.0%	[D2]
Dieldrin	3.87E−02	5.00E−02	1.49E−09	6.37E−11	1.10E−08	1.41E−09	2.97E−05	2.19E−04	0.9%	liver; lesions	100	1.02E−09	2.25E−08	46.5%	[D2]
Endrin	3.87E−02	5.00E−02	1.48E−09	6.36E−11	1.10E−08	1.41E−09	4.95E−06	3.65E−05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.82E−02	2.34E−02	6.97E−10	2.99E−11	5.14E−09	6.60E−10	2.32E−06	1.71E−05	0.1%	liver, kidney; toxicity	1000	3.89E−11	8.58E−10	1.8%	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	8.28E−10	3.55E−11	5.48E−09	7.05E−10	6.37E−05	4.21E−04	1.8%	liver; inc. relative weight	1000	3.23E−10	6.41E−09	13.2%	[D2]
Tetrachloroethylene	4.18E+00	4.86E+00	1.60E−07	6.87E−09	1.06E−06	1.36E−07	1.60E−05	1.06E−04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E−11	1.29E−09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E−10	2.78E−09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.71E−05	2.32E−02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E−09	4.85E−08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E−10	4.07E−09	100.0%	

Table M.301. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDo OF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	RfDo WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.56E-06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.21E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.52E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fattycyst formation	1000	1.88E-10	7.57E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	4.15E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity	1000	2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; inc. relative weight	1000	5.29E-09	2.14E-07	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	1.02E-03	1.32E-02	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.35E-08	1.04E-06	100.0%

Table M.302. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E−07	4.69E−09	1.53E−06	1.96E−07	1.56E−06	2.18E−05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E−08	4.62E−10	1.92E−07	2.47E−08	1.08E−08	1.92E−07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E−08	1.10E−09	3.18E−07	4.09E−08	6.91E−07	8.60E−06	0.0%	Gastrointestinal system; irritation	– –				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E−07	1.59E−08	6.00E−06	7.72E−07	7.43E−05	1.20E−03	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E−09	1.59E−10	5.72E−08	7.35E−09	1.23E−05	1.91E−04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E−08	4.98E−10	2.05E−07	2.64E−08	1.66E−06	2.93E−05	0.2%	no observed effects	100				
Zinc	6.67E+01	9.09E+01	9.56E−08	4.07E−09	1.32E−06	1.70E−07	3.17E−07	4.40E−06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E−08	2.30E−09	7.00E−07	9.00E−08	5.37E−07	7.00E−06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E−02	2.50E−02	3.21E−10	1.38E−11	3.63E−09	4.67E−10	1.07E−05	1.21E−04	0.7%	liver; lesions, toxicity	1000	2.34E−10	7.94E−09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E−06	1.16E−07	4.15E−05	5.34E−06	1.35E−04	2.08E−03	12.0%	liver; weight inc.	1000	1.63E−09	7.47E−08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E−07	1.34E−08	3.75E−06	4.87E−07	3.13E−05	3.79E−04	2.2%	liver; lesions, fatty cyst formation	1000	8.19E−11	2.97E−09	0.7%	[B2]
4,4'–DDT	4.02E−02	4.94E−02	1.49E−07	6.40E−09	1.93E−06	2.48E−07	2.99E−04	3.68E−03	22.3%	liver; lesions	100	2.18E−09	8.44E−08	20.7%	[B2]
Dieldrin	3.87E−02	5.00E−02	5.36E−09	2.30E−10	7.27E−08	9.34E−09	1.07E−04	1.45E−03	8.4%	liver; lesions	100	3.67E−09	1.50E−07	36.6%	[B2]
Endrin	3.87E−02	5.00E−02	5.35E−09	2.29E−10	7.27E−08	9.34E−09	1.78E−05	2.42E−04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.02E−02	2.34E−02	2.20E−09	9.43E−11	2.98E−08	3.83E−09	7.33E−06	9.99E−05	0.6%	liver, kidney; toxicity	1000	1.23E−10	4.98E−09	1.2%	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	5.90E−09	2.53E−10	7.18E−08	9.23E−09	4.54E−04	5.52E−03	31.9%	liver; inc. relative weight	1000	2.30E−09	8.40E−08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E−06	7.43E−08	2.11E−05	2.71E−06	1.73E−04	2.11E−03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.33E−03	1.73E−02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E−08	4.08E−07	100.0%	

Table M.303. Risk characterization for sediments: adults – dermal exposure (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration In Sediment	RME Concentration In Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	Risk Estimates: RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.28E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.59E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.86E-09	4.89E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.46E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.65E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%	--	--	5.02E-11	9.96E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-09	2.8E-07	100.0%	

Table M.304. Risk characterization for sediments: children – dermal exposure (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.76E-10	4.18E-11	4.24E-08	5.45E-09	3.25E-06	1.41E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.32E-11	9.55E-09	8.7%	[A]
Barium	78.13	88.46	1.67E-08	7.17E-10	7.12E-07	9.16E-08	2.39E-07	1.02E-05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.96E-10	8.40E-12	8.25E-09	1.06E-09	3.92E-08	1.65E-06	0.2%	no observed effects	100	3.61E-11	4.56E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.04E-10	1.30E-11	1.38E-08	1.77E-09	3.04E-07	1.38E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.02E-08	4.38E-10	4.43E-07	5.70E-08	1.02E-08	4.43E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.14E-09	2.20E-10	2.41E-07	3.09E-08	1.39E-07	6.50E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.13E-08	4.86E-10	8.01E-07	1.03E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.90E-07	8.14E-09	8.34E-06	1.07E-06	1.36E-06	5.96E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.20E-09	1.37E-10	1.65E-07	2.12E-08	1.07E-05	5.49E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.96E-09	2.12E-10	2.23E-07	2.87E-08	2.48E-07	1.12E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.22E-09	2.67E-10	2.72E-07	3.49E-08	8.89E-07	3.88E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.08E-08	8.91E-10	9.75E-07	1.25E-07	6.93E-08	3.24E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.10	0.16	2.21E-10	9.47E-12	1.32E-08	1.69E-09				--	--	7.29E-11	1.30E-08	11.9%	[B2]
Aroclor–1260	0.08	0.14	1.73E-10	7.42E-12	1.12E-08	1.44E-09				--	--	5.71E-11	1.11E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.97E-10	2.99E-11	4.16E-08	5.35E-09	2.32E-08	1.39E-06	0.2%	--	--	2.18E-11	3.91E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.75E-10	2.89E-11	3.91E-08	5.02E-09	2.25E-08	1.30E-06	0.2%	--	--	2.11E-10	3.67E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.03E-10	3.44E-11	4.68E-08	6.01E-09	2.68E-08	1.56E-06	0.2%	--	--	2.51E-11	4.39E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.58E-10	2.82E-11	3.19E-08	4.10E-09	2.19E-08	1.06E-06	0.1%	--	--	2.06E-11	2.99E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.62E-10	2.84E-11	3.96E-08	5.09E-09	2.21E-08	1.32E-06	0.2%	--	--	2.07E-12	3.71E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.70E-10	2.02E-11	1.94E-08	2.50E-09	1.57E-08	6.48E-07	0.1%	--	--	1.47E-10	1.82E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.64E-11	7.05E-13	1.09E-09	1.40E-10	3.29E-07	2.18E-05	2.5%	liver; lesions	100	1.13E-11	2.24E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.90E-10	2.53E-11	3.05E-08	3.92E-09	1.97E-08	1.02E-06	0.1%	--	--	1.85E-11	2.86E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.27E-05	8.66E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.97E-10	1.10E-07	100.0%	

Table M.305. Risk characterization for groundwater: adults – ingestion exposure (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLB Concentration in GW	RMB Concentration in GW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern / Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.61E-05	9.78E-06	1.53E-04	6.55E-05	2.54E-01	5.09E-01	1.8%	skin; keratosis, hyperpigmentation	3	1.7E-05	1.1E-04	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.58E-03	9.74E-04	1.33E-02	5.70E-03	1.08E-01	1.90E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.50E+00	3.60E-05	4.64E-06	7.00E-05	3.00E-05	7.22E-03	1.40E-02	0.1%	no observed effects	100	2.0E-05	1.2E-04	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.33E-04	8.14E-05	1.12E-03	4.80E-04	6.33E-04	1.12E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.20E-04	4.12E-05	8.87E-03	3.60E-03	8.66E-03	2.40E-01	0.9%	Gastrointestinal system; irritation	– –				[D]
Lead	2.68E+01	3.55E+01	5.13E-04	6.60E-05	9.68E-04	4.15E-04				CNS, blood	– –				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E-02	9.22E-03	1.21E-01	5.19E-02	1.43E+01	2.42E+01	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.66E-04	3.42E-05	5.99E-04	2.57E-04	8.86E-01	2.00E+00	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.21E-04	1.18E-04	1.76E-03	7.55E-04	4.61E-02	8.81E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.49E-04	9.64E-05	1.34E-03	5.76E-04	1.07E-01	1.92E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	6.89E-03	8.86E-04	1.87E-02	8.01E-03	6.89E-02	1.87E-01	0.7%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E-03	1.72E-04	3.69E-03	1.56E-03	2.23E-02	6.15E-02	0.2%	*oral and inhal.*–liver; toxicity	100	1.2E-06	1.1E-05	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.44E+04		8.54E+04						1.4E-06	8.5E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05						8.9E-07	6.1E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05						1.2E-06	8.8E-06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI):							1.5E+01	2.7E+01	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												3.8E-05	2.5E-04	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												3.5E-06	2.3E-05	100.0%	

Table M.306. Risk characterization for groundwater: children – ingestion exposure (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.91E-05	3.39E-06	1.81E-04	2.33E-05	2.64E-01	6.03E-01	1.8%	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.88E-03	3.38E-04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.61E-06	8.31E-05	1.07E-05	7.51E-03	1.66E-02	0.1%	no observed effects	100	6.92E-06	4.59E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.58E-04	2.82E-05	1.33E-03	1.71E-04	6.58E-04	1.33E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.86E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	1.49E+01	2.87E+01	87.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.35E+01	2.15E+01	2.76E-04	1.18E-05	7.09E-04	9.12E-05	9.21E-01	2.36E+00	7.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	4.86E+01	6.43E+01	9.58E-04	4.11E-05	2.09E-03	2.68E-04	4.79E-02	1.04E-01	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.28E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.47E-07	4.21E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.78E+03		1.13E+04						1.78E-07	1.13E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		6.90E+03		5.04E+04						1.10E-07	8.06E-07	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.55E+03		4.17E+04						1.56E-07	1.17E-06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.65E+01	3.28E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.33E-05	9.08E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.45E-07	3.10E-06	100.0%	

Table M.307. Risk characterization for groundwater: adults – inhalation exposure (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	RfDA WOE
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.7E-04	2.2E-05	7.0E-04	3.0E-04									
Methylene Chloride	6.9E+01	1.3E+02	3.4E-05	4.4E-06	1.3E-04	5.9E-05	4.0E-05	1.6E-04	100.0%	Inc. liver, kidney weights, nephrotoxicity *oral and inhal.*–liver; toxicity	100	7.3E-09	9.7E-08	100.0%	(B2)
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							4.0E-05	1.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.3E-09	9.7E-08	100.0%	

Table M.308. Risk characterization for groundwater: children – inhalation exposure (future land use – agricultural/homesteader) – Area S7–F2–A

			Chronic Daily Intake (CDI)				Risk Estimates								
Chemical	MLB Concentration in GW	RMB Concentration in GW	CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDs WOE
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	1.03E-03	4.43E-05	3.17E-03	4.07E-04				loc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.97E+01	1.35E+02	2.01E-04	8.60E-06	6.25E-04	8.04E-05	2.34E-04	7.30E-04	100.0%	*oral and inhal.*–liver; toxicity	100	1.42E-08	1.33E-07	100.0%	[D2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.34E-04	7.30E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.42E-08	1.33E-07	100.0%	

Table M.309. Risk characterization for produce: adults – ingestion exposure (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	RfDs WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	7.24E-03	7.66E-03	1.10E-06	1.42E-07	1.25E-05	5.35E-06	2.76E-03	3.12E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	6.14E-01	6.34E-01	9.37E-05	1.20E-05	1.03E-03	4.43E-04	3.12E-01	3.45E+00	7.9%	skin; keratosis, hyperpigmentation	3	2.11E-05	7.75E-04	98.0%	[A]
Barium	1.06E+00	1.40E+00	1.61E-04	2.07E-05	2.29E-03	9.82E-04	2.30E-03	3.27E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.99E-03	3.43E-03	4.56E-07	5.87E-08	5.60E-06	2.40E-06	9.12E-05	1.12E-03	0.0%	no observed effects	100	2.52E-07	1.03E-05	1.3%	[B2]
Cadmium	1.55E+00	2.72E+00	2.37E-04	3.04E-05	4.43E-03	1.90E-03	2.37E-01	4.43E+00	10.2%	kidney; proteinuria	10				
Chromium (III)	6.70E-01	6.90E-01	1.02E-04	1.31E-05	1.12E-03	4.82E-04	1.02E-04	1.12E-03	0.0%	no observed effects	100				
Copper	3.43E+00	5.82E+00	5.23E-04	6.73E-05	9.48E-03	4.06E-03	1.41E-02	2.56E-01	0.6%	Gastrointestinal system; irritation	--				[D]
Lead	3.50E-01	4.37E-01	5.34E-05	6.87E-06	7.12E-04	3.05E-04				CNS, blood	--				[B2]
Manganese	5.01E+02	7.39E+02	7.65E-02	9.83E-03	1.20E+00	5.16E-01	5.46E-01	8.61E+00	19.8%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	3.81E+00	4.71E+00	5.81E-04	7.47E-05	7.68E-03	3.29E-03	1.94E+00	2.56E+01	58.8%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	1.26E+00	1.96E+00	1.92E-04	2.47E-05	3.20E-03	1.37E-03	9.61E-03	1.60E-01	0.4%	dec. body and organ weight	300				
Selenium	1.32E+00	1.44E+00	2.01E-04	2.58E-05	2.35E-03	1.01E-03	4.02E-02	4.70E-01	1.1%	whole body; clinical selenosis	3				[D]
Silver	3.84E-01	5.62E-01	5.86E-05	7.53E-06	9.16E-04	3.92E-04	1.17E-02	1.83E-01	0.4%	skin; argyria	3				[D]
Zinc	5.50E+01	7.08E+01	8.39E-03	1.08E-03	1.15E-01	4.95E-02	2.80E-02	3.85E-01	0.9%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	8.95E-05	1.66E-04	1.37E-08	1.76E-09	2.72E-07	1.16E-07				--	--	1.35E-08	8.96E-07	0.1%	[B2]
Benzo(a)anthracene	9.60E-04	1.18E-03	1.50E-07	1.92E-08	1.92E-06	8.22E-07	4.98E-06	6.39E-05	0.0%	--	--	1.40E-08	6.00E-07	0.1%	[B2]
Benzo(a)pyrene	4.74E-04	5.64E-04	7.23E-08	9.29E-09	9.19E-07	3.94E-07	2.41E-06	3.06E-05	0.0%	--	--	6.78E-08	2.87E-06	0.4%	[B2]
Benzo(b)fluoranthene	6.02E-04	9.11E-04	9.19E-08	1.18E-08	1.49E-06	6.37E-07	3.00E-06	4.95E-05	0.0%	--	--	8.62E-09	4.65E-07	0.1%	[B2]
Benzo(k)fluoranthene	4.72E-04	6.61E-04	7.20E-08	9.26E-09	1.08E-06	4.62E-07	2.40E-06	3.59E-05	0.0%	--	--	6.76E-09	3.37E-07	0.0%	[B2]
Chrysene	1.11E-03	1.31E-03	1.70E-07	2.18E-08	2.14E-06	9.19E-07	5.65E-06	7.14E-05	0.0%	--	--	1.59E-09	6.71E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	8.32E-05	9.83E-05	1.27E-08	1.63E-09	1.60E-07	6.87E-08	4.23E-07	5.34E-06	0.0%	--	--	1.19E-09	5.07E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	2.06E-02	3.67E-02		7.24E+02		4.58E+04						2.03E-08	1.28E-06	41.4%	[A]
Cobalt 60	6.08E-04	1.08E-03		2.13E+01		1.35E+03						3.20E-10	2.02E-08	0.7%	[A]
Neptunium 237+D	1.93E-03	4.40E-03		6.78E+01		5.50E+03						1.49E-08	1.21E-06	39.0%	[A]
Protactinium 233		4.85E-04				6.06E+02							6.00E-10	0.0%	[A]
Thorium 228+D	7.70E-04	1.00E-03		2.70E+01		1.25E+03						1.45E-09	6.89E-08	2.2%	[A]
Thorium 230	3.69E-03	6.49E-03		1.29E+02		8.11E+03						1.68E-09	1.05E-07	3.4%	[A]
Thorium 232	5.05E-04	8.33E-04		1.77E+01		1.04E+03						2.13E-10	1.25E-08	0.4%	[A]
Uranium 234	6.38E-03	7.06E-03		2.24E+02		6.83E+03						3.58E-09	1.41E-07	4.6%	[A]
Uranium 235+D	3.00E-04	3.32E-04		1.05E+01		4.15E+02						1.69E-10	6.65E-09	0.2%	[A]
Uranium 238+D	6.57E-03	7.16E-03		2.31E+02		8.94E+03						6.46E-09	2.50E-07	8.1%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	3.14E+00	4.36E+01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.14E-05	7.91E-04	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	4.91E-08	3.11E-06	100.0%

Table M.310. Risk characterization for produce: children – ingestion exposure (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	7.2E-03	7.6E-03	2.4E-06	1.0E-07	2.5E-05	3.3E-06	6.1E-03	6.4E-02	0.1%	whole body, blood; loc. mortality	1000				
Arsenic	6.1E-01	6.3E-01	2.0E-04	8.9E-06	2.1E-03	2.7E-04	6.9E-01	7.1E+00	7.9%	skin; keratosis, hyperpigmentation	3	1.5E-05	4.8E-04	98.0%	[A]
Barium	1.0E+00	1.4E+00	3.6E-04	1.5E-05	4.7E-03	6.1E-04	5.1E-03	6.7E-02	0.1%	*oral*–cardiovasc. sys.; loc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.9E-03	3.4E-03	1.0E-06	4.3E-08	1.1E-05	1.4E-06	2.0E-04	2.3E-03	0.0%	no observed effects	100	1.8E-07	6.4E-06	1.3%	[B2]
Cadmium	1.5E+00	2.7E+00	5.2E-04	2.2E-05	9.1E-03	1.1E-03	5.2E-01	9.1E+00	10.2%	kidney; proteinuria	10				
Chromium (III)	6.7E-01	6.9E-01	2.2E-04	9.7E-06	2.3E-03	3.0E-04	2.2E-04	2.3E-03	0.0%	no observed effects	100				
Copper	3.4E+00	5.8E+00	1.1E-03	5.0E-05	1.9E-02	2.5E-03	3.1E-02	5.3E-01	0.6%	Gastrointestinal system; irritation	--				[D]
Lead	3.5E-01	4.3E-01	1.1E-04	5.1E-06	1.4E-03	1.9E-04				CNS, blood	--				[B2]
Manganese	5.0E+02	7.3E+02	1.7E-01	7.3E-03	2.5E+00	3.2E-01	1.2E+00	1.7E+01	19.8%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	3.8E+00	4.7E+00	1.3E-03	5.5E-05	1.5E-02	2.0E-03	4.3E+00	5.3E+01	58.8%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	1.2E+00	1.9E+00	4.2E-04	1.8E-05	6.6E-03	8.5E-04	2.1E-02	3.3E-01	0.4%	dec. body and organ weight	300				
Selenium	1.3E+00	1.4E+00	4.4E-04	1.9E-05	4.8E-03	6.2E-04	8.9E-02	9.7E-01	1.1%	whole body; clinical selenosis	3				[D]
Silver	3.8E-01	5.6E-01	1.3E-04	5.6E-06	1.9E-03	2.4E-04	2.6E-02	3.8E-01	0.4%	skin; argyria	3				[D]
Zinc	5.5E+01	7.0E+01	1.8E-02	8.0E-04	2.3E-01	3.0E-02	6.2E-02	7.9E-01	0.9%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	8.9E-05	1.6E-04	3.0E-08	1.3E-09	5.6E-07	7.2E-08				--	--	1.0E-08	5.5E-07	0.1%	[B2]
Benzo(a)anthracene	9.8E-04	1.1E-03	3.3E-07	1.4E-08	3.9E-06	5.1E-07	1.1E-05	1.3E-04	0.0%	--	--	1.0E-08	3.7E-07	0.1%	[B2]
Benzo(a)pyrene	4.7E-04	5.6E-04	1.6E-07	6.9E-09	1.9E-06	2.4E-07	5.3E-06	6.3E-05	0.0%	--	--	5.0E-08	1.7E-06	0.4%	[B2]
Benzo(b)fluoranthene	6.0E-04	9.1E-04	2.0E-07	8.8E-09	3.0E-06	3.9E-07	6.8E-06	1.0E-04	0.0%	--	--	6.4E-09	2.8E-07	0.1%	[B2]
Benzo(k)fluoranthene	4.7E-04	6.6E-04	1.6E-07	6.9E-09	2.2E-06	2.8E-07	5.3E-06	7.4E-05	0.0%	--	--	5.0E-09	2.1E-07	0.0%	[B2]
Chrysene	1.1E-03	1.3E-03	3.7E-07	1.6E-08	4.4E-06	5.7E-07	1.2E-05	1.4E-04	0.0%	--	--	1.1E-09	4.1E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	8.3E-05	9.8E-05	2.8E-08	1.2E-09	3.3E-07	4.2E-08	9.4E-07	1.1E-05	0.0%	--	--	8.8E-10	3.1E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	2.0E-02	3.6E-02		1.9E+02		1.0E+04						5.4E-09	2.9E-07	41.4%	[A]
Cobalt 60	6.0E-04	1.0E-03		5.6E+00		3.1E+02						8.5E-11	4.6E-09	0.7%	[A]
Neptunium 237+D	1.9E-03	4.4E-03		1.8E+01		1.2E+03						3.9E-09	2.8E-07	39.0%	[A]
Protactinium 233		4.8E-04				1.4E+02							1.4E-10	0.0%	[A]
Thorium 228+D	7.7E-04	1.0E-03		7.1E+00		2.8E+02						3.9E-10	1.5E-08	2.2%	[A]
Thorium 230	3.6E-03	6.4E-03		3.4E+01		1.8E+03						4.4E-10	2.4E-08	3.4%	[A]
Thorium 232	5.0E-04	8.3E-04		4.7E+00		2.4E+02						5.6E-11	2.8E-09	0.4%	[A]
Uranium 234	6.3E-03	7.0E-03		5.9E+01		2.0E+03						9.5E-10	3.2E-08	4.6%	[A]
Uranium 235+D	3.0E-04	3.3E-04		2.8E+00		9.6E+01						4.4E-11	1.5E-09	0.2%	[A]
Uranium 238+D	6.5E-03	7.1E-03		6.1E+01		2.0E+03						1.7E-09	5.7E-08	8.1%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.0E+00	9.0E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-05	4.9E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.3E-08	7.1E-07	100.0%	

Table M.311. Risk characterization for beef: adults – ingestion exposure (future land use – agricultural) – Area S7–F2–A

Chemical	MLE Concentration from Meas. Concentration (mg/kg DW)	RME Concentration from UCL Concentration (mg/kg DW)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg BBBF TISSUE)															
Antimony	4.12E-04	4.37E-04	9.94E-08	1.28E-08	4.49E-07	1.92E-07	2.49E-04	1.12E-03	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	1.70E-01	1.76E-01	4.11E-05	5.28E-06	1.81E-04	7.75E-05	1.37E-01	6.03E-01	6.0%	skin; keratosis, hyperpigmentation	3	9.24E-06	1.36E-04	48.6%	[A]
Barium	5.72E-01	7.58E-01	1.38E-04	1.77E-05	7.79E-04	3.34E-04	1.97E-03	1.11E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.80E-03	3.22E-03	6.76E-07	8.69E-08	3.31E-06	1.42E-06	1.35E-04	6.62E-04	0.0%	no observed effects	100	3.74E-07	6.10E-06	2.2%	[B2]
Cadmium	1.24E-02	2.17E-02	2.98E-06	3.83E-07	2.23E-05	9.54E-06	2.98E-03	2.23E-02	0.2%	kidney; proteinuria	10				
Chromium (III)	9.29E+00	1.50E+01	2.24E-03	2.88E-04	1.54E-02	6.60E-03	2.24E-03	1.54E-02	0.2%	no observed effects	100				
Copper	8.74E+00	1.15E+01	2.11E-03	2.71E-04	1.18E-02	5.06E-03	5.69E-02	3.19E-01	3.2%	Gastrointestinal system; irritation	--				[D]
Lead	2.00E-02	2.50E-02	4.82E-06	6.20E-07	2.56E-05	1.10E-05				CNS, blood	--				[B2]
Manganese	2.35E+01	3.52E+01	5.65E-03	7.27E-04	3.61E-02	1.55E-02	4.04E-02	2.58E-01	2.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.45E+00	2.08E+00	3.48E-04	4.48E-05	2.06E-03	8.84E-04	1.16E+00	6.87E+00	68.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	5.59E-02	6.71E-02	1.35E-05	1.73E-06	8.95E-05	3.83E-05	6.74E-04	4.47E-03	0.0%	dec. body and organ weight	300				
Selenium	2.88E+00	3.16E+00	6.95E-04	8.93E-05	3.25E-03	1.39E-03	1.39E-01	6.49E-01	6.4%	whole body; clinical selenosis	3				[D]
Silver	3.83E-02	5.60E-02	9.23E-06	1.19E-06	5.76E-05	2.47E-05	1.85E-03	1.15E-02	0.1%	skin; argyria	3				[D]
Zinc	2.96E+02	3.90E+02	7.14E-02	9.16E-03	4.00E-01	1.72E-01	2.38E-01	1.33E+00	13.2%	blood; anemia	3				[D]
ORGANICS (mg/kg BBBF TISSUE)															
Aroclor-1260	7.52E-03	1.40E-02	1.81E-06	2.33E-07	1.44E-05	6.16E-06				--	--	1.79E-06	4.74E-05	17.0%	[B2]
Benzo(a)anthracene	2.39E-03	2.87E-03	5.76E-07	7.40E-08	2.95E-06	1.26E-06	1.92E-05	9.82E-05	0.0%	--	--	5.41E-08	9.22E-07	0.3%	[B2]
Benzo(a)pyrene	6.93E-03	8.24E-03	1.67E-06	2.15E-07	8.47E-06	3.63E-06	5.57E-05	2.82E-04	0.0%	--	--	1.57E-06	2.65E-05	9.5%	[B2]
Benzo(b)fluoranthene	1.67E-02	2.53E-02	4.03E-06	5.18E-07	2.60E-05	1.11E-05	1.34E-04	8.66E-04	0.0%	--	--	3.78E-07	8.12E-06	2.9%	[B2]
Benzo(k)fluoranthene	3.20E-02	4.48E-02	7.71E-06	9.92E-07	4.60E-05	1.97E-05	2.57E-04	1.53E-03	0.0%	--	--	7.24E-07	1.44E-05	5.2%	[B2]
Chrysene	1.79E-03	2.12E-03	4.31E-07	5.54E-08	2.17E-06	9.32E-07	1.44E-05	7.25E-05	0.0%	--	--	4.05E-09	6.80E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	1.04E-01	1.23E-01	2.52E-05	3.24E-06	1.27E-04	5.43E-05	8.39E-04	4.22E-03	0.0%	--	--	2.36E-06	3.96E-05	14.2%	[B2]
RADIONUCLIDES (pCi/kg BBBF TISSUE)															
Cesium 137+D	1.92E+01	3.93E+01		1.06E+03		3.10E+04									
Cobalt 60	1.11E+00	7.89E+00		6.17E+01		6.21E+03						2.98E-08	8.67E-07	8.7%	[A]
Neptunium 237+D	1.09E+01	3.26E+01		6.07E+02		2.57E+04						9.25E-10	9.32E-08	0.9%	[A]
Protactinium 233		1.09E+00				8.59E+02						1.34E-07	5.65E-06	56.6%	[A]
Thorium 228+D	1.82E+01	2.37E+01		1.01E+03		1.86E+04							8.59E-10	0.0%	[A]
Thorium 230	8.71E+01	1.53E+02		4.83E+03		1.21E+05						5.54E-08	1.02E-06	10.3%	[A]
Thorium 232	1.19E+01	1.97E+01		6.61E+02		1.35E+04						6.28E-08	1.57E-06	15.7%	[A]
Uranium 234	1.49E+01	1.66E+01		8.25E+02		1.30E+04						7.93E-09	1.86E-07	1.9%	[A]
Uranium 235+D	7.16E-01	8.11E-01		3.97E+01		6.39E+02						1.32E-08	2.09E-07	2.1%	[A]
Uranium 238+D	1.55E+01	1.71E+01		8.57E+02		1.35E+04						6.35E-10	1.02E-08	0.1%	[A]
												2.40E-08	3.77E-07	3.8%	[A]
Chemical Hazards:															
Hazard Index (HI):							1.78E+00	1.01E+01	100.0%						
Excess Lifetime Cancer Risk:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.65E-05	2.79E-04	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.28E-07	9.99E-06	100.0%	

Table M.312. Risk characterization for beef: children – ingestion exposure (future land use – agricultural) – Area S7–F2–A

Chemical	MLE Concentration from Meas. Concentration in Soil (SW)	RME Concentration from UCL Concentration in Soil (SW)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	IRIS UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (mg/kg BBBF TISSUE)															
Antimony	4.12E-04	4.37E-04	2.08E-07	8.92E-09	8.90E-07	1.14E-07	5.20E-04	2.23E-03	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	1.70E-01	1.76E-01	8.60E-05	3.68E-06	3.59E-04	4.60E-05	2.87E-01	1.20E+00	6.0%	skin; keratosis, hyperpigmentation	3	6.45E-06	8.07E-05	48.6%	[A]
Barium	5.72E-01	7.58E-01	2.88E-04	1.24E-05	1.55E-03	1.99E-04	4.12E-03	2.21E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.80E-03	3.22E-03	1.40E-06	6.06E-08	6.56E-06	8.44E-07	2.83E-04	1.31E-03	0.0%	no observed effects	100	2.61E-07	3.63E-06	2.2%	[D2]
Cadmium	1.24E-02	2.17E-02	6.24E-06	2.67E-07	4.42E-05	5.68E-06	6.24E-03	4.42E-02	0.2%	kidney; proteinuria	10				
Chromium (III)	9.29E+00	1.50E+01	4.69E-03	2.01E-04	3.06E-02	3.93E-03	4.69E-03	3.06E-02	0.2%	no observed effects	100				
Copper	8.74E+00	1.15E+01	4.40E-03	1.89E-04	2.34E-02	3.01E-03	1.19E-01	6.33E-01	3.2%	Gastrointestinal system; irritation	--				[D]
Lead	2.00E-02	2.50E-02	1.01E-05	4.32E-07	5.09E-05	6.54E-06				CNS, blood	--				[D2]
Manganese	2.35E+01	3.52E+01	1.18E-02	5.07E-04	7.17E-02	9.22E-03	8.45E-02	5.12E-01	2.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.45E+00	2.01E+00	7.29E-04	3.13E-05	4.09E-03	5.26E-04	2.43E+00	1.36E+01	68.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	5.59E-02	8.71E-02	2.02E-05	1.21E-06	1.78E-04	2.28E-05	1.41E-03	8.88E-03	0.0%	dec. body and organ weight	300				
Selenium	2.68E+00	3.16E+00	1.45E-03	6.23E-05	6.44E-03	8.28E-04	2.91E-01	1.29E+00	6.4%	whole body; clinical selenosis	3				[D]
Silver	3.83E-02	5.60E-02	1.93E-05	8.28E-07	1.14E-04	1.47E-05	3.86E-03	2.28E-02	0.1%	skin; argyria	3				[D]
Zinc	2.96E+02	3.90E+02	1.49E-01	6.40E-03	7.94E-01	1.02E-01	4.98E-01	2.65E+00	13.2%	blood; anemia	3				[D]
ORGANICS (mg/kg BBBF TISSUE)															
Aroclor-1260	7.52E-03	1.40E-02	3.79E-06	1.63E-07	2.85E-05	3.67E-06				--	--	1.25E-06	2.82E-05	17.0%	[D2]
Benzo(a)anthracene	2.39E-03	2.87E-03	1.21E-06	5.17E-08	5.85E-06	7.52E-07	4.02E-05	1.95E-04	0.0%	--	--	3.77E-08	5.49E-07	0.3%	[D2]
Benzo(a)pyrene	6.93E-03	8.24E-03	3.49E-06	1.50E-07	1.68E-05	2.16E-06	1.16E-04	5.60E-04	0.0%	--	--	1.09E-06	1.58E-05	9.5%	[D2]
Benzo(b)fluoranthene	1.67E-02	2.55E-02	8.43E-06	3.61E-07	5.15E-05	6.62E-06	2.81E-04	1.72E-03	0.0%	--	--	2.64E-07	4.84E-06	2.9%	[D2]
Benzo(k)fluoranthene	3.20E-02	4.48E-02	1.61E-05	6.92E-07	9.13E-05	1.17E-05	5.38E-04	3.04E-03	0.0%	--	--	5.05E-07	8.57E-06	5.2%	[D2]
Chrysene	1.79E-03	2.12E-03	9.02E-07	3.87E-08	4.31E-06	5.55E-07	3.01E-05	1.44E-04	0.0%	--	--	2.82E-09	4.05E-08	0.0%	[D2]
Indeno(1,2,3-cd)pyrene	1.04E-01	1.23E-01	5.27E-05	2.26E-06	2.51E-04	3.23E-05	1.76E-03	8.38E-03	0.0%	--	--	1.65E-06	2.36E-05	14.2%	[D2]
RADIONUCLIDES (pCi/kg BBBF TISSUE)															
Cesium 137+D	1.92E+01	3.93E+01		2.65E+02		6.84E+03						7.42E-09	1.92E-07	8.7%	[A]
Cobalt 60	1.11E+00	7.85E+00		1.54E+01		1.37E+03						2.30E-10	2.06E-08	0.9%	[A]
Neptunium 237+D	1.09E+01	3.26E+01		1.51E+02		5.68E+03						3.33E-08	1.25E-06	56.6%	[A]
Protactinium 233		1.09E+00				1.90E+02							1.90E-10	0.0%	[A]
Thorium 228+D	1.82E+01	2.37E+01		2.51E+02		4.12E+03						1.38E-08	2.27E-07	10.3%	[A]
Thorium 230	8.71E+01	1.53E+02		1.20E+03		2.67E+04						1.56E-08	3.47E-07	15.7%	[A]
Thorium 232	1.19E+01	1.97E+01		1.65E+02		3.43E+03						1.98E-09	4.11E-08	1.9%	[A]
Uranium 234	1.49E+01	1.66E+01		2.06E+02		2.88E+03						3.29E-09	4.61E-08	2.1%	[A]
Uranium 235+D	7.16E-01	8.11E-01		9.89E+00		1.41E+02						1.58E-10	2.26E-09	0.1%	[A]
Uranium 238+D	1.55E+01	1.71E+01		2.13E+02		2.98E+03						5.98E-09	8.34E-08	3.8%	[A]
Chemical Hazards:															
Hazard Index (HI):							3.73E+00	2.01E+01	100.0%						
Excess Lifetime Cancer Risk:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.15E-05	1.66E-04	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.18E-08	2.21E-06	100.0%	

Table M.313. Risk characterization for milk: adults – ingestion exposure (future land use – agricultural) – Area S7–F2–A

Chemical	MLE Concentration from Mean Concentration (mg/kg/BW)	RME Concentration from UCL Concentration (mg/kg/BW)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	RfDA WOE
INORGANICS															
Antimony	6.72E-05	7.1E-05	6.4E-08	8.3E-09	2.9E-07	1.2E-07	1.6E-04	7.3E-04	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	1.9E-03	1.9E-03	1.8E-06	2.3E-07	8.0E-06	3.4E-06	6.1E-03	2.7E-02	0.3%	skin; keratosis, hyperpigmentation	3	4.1E-07	6.0E-06	3.0%	[A]
Barium	3.37E+00	4.47E+00	3.2E-03	4.1E-04	1.8E-02	7.8E-03	4.6E-02	2.6E-01	3.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.1E-06	2.4E-06	2.0E-09	2.6E-10	1.0E-08	4.3E-09	4.1E-07	2.0E-06	0.0%	no observed effects	100	1.1E-09	1.8E-08	0.0%	[D2]
Cadmium	6.6E-02	1.1E-01	6.4E-05	8.2E-06	4.8E-04	2.0E-04	6.4E-02	4.8E-01	5.4%	kidney; proteinuria	10				
Chromium (III)	1.7E+00	2.8E+00	1.6E-03	2.1E-04	1.1E-02	5.0E-03	1.6E-03	1.1E-02	0.1%	no observed effects	100				
Copper	5.0E+00	6.6E+00	4.8E-03	6.2E-04	2.7E-02	1.1E-02	1.3E-01	7.3E-01	8.3%	Gastrointestinal system; irritation	--				
Lead	1.4E-02	1.7E-02	1.3E-05	1.7E-06	7.2E-05	3.1E-05				CNS, blood	--				[D]
Manganese	2.03E+01	3.0E+01	1.9E-02	2.5E-03	1.2E-01	5.3E-02	1.4E-01	8.9E-01	10.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D2]
Mercury	2.0E-01	2.9E-01	2.0E-04	2.5E-05	1.1E-03	5.1E-04	6.7E-01	3.9E+00	44.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	6.2E-02	9.7E-02	6.0E-05	7.7E-06	4.0E-04	1.7E-04	3.0E-03	2.0E-02	0.2%	dec. body and organ weight	300				[D]
Selenium	7.3E-01	8.0E-01	7.1E-04	9.1E-05	3.3E-03	1.4E-03	1.4E-01	6.6E-01	7.5%	whole body; clinical selenosis	3				
Silver	2.0E-01	3.0E-01	2.0E-04	2.5E-05	1.2E-03	5.3E-04	3.9E-02	2.4E-01	2.6%	skin; argyria	3				[D]
Zinc	8.67E+01	1.1E+02	8.3E-02	1.0E-02	4.6E-01	2.0E-01	2.7E-01	1.5E+00	17.6%	blood; anemia	3				[D]
ORGANICS															
Aroclor-1260	2.6E-03	4.9E-03	2.5E-06	3.2E-07	2.0E-05	8.6E-06				--	--	2.5E-06	6.6E-05	33.5%	[D2]
Benzo(a)anthracene	9.6E-04	1.1E-03	9.2E-07	1.1E-07	4.7E-06	2.0E-06	3.0E-05	1.5E-04	0.0%	--	--	8.7E-08	1.4E-06	0.7%	[D2]
Benzo(a)pyrene	2.5E-03	3.0E-03	2.4E-06	3.1E-07	1.2E-05	5.3E-06	8.2E-05	4.1E-04	0.0%	--	--	2.3E-06	3.9E-05	19.6%	[D2]
Benzo(b)fluoranthene	6.0E-03	9.1E-03	5.6E-06	7.5E-07	3.7E-05	1.6E-05	1.9E-04	1.2E-03	0.0%	--	--	5.4E-07	1.1E-05	5.9%	[D2]
Benzo(k)fluoranthene	1.1E-02	1.5E-02	1.0E-05	1.4E-06	6.5E-05	2.8E-05	3.6E-04	2.1E-03	0.0%	--	--	1.0E-06	2.0E-05	10.2%	[D2]
Chrysene	7.3E-04	8.7E-04	7.1E-07	9.1E-08	3.5E-06	1.5E-06	2.3E-05	1.2E-04	0.0%	--	--	6.6E-09	1.1E-07	0.1%	[D2]
Indeno(1,2,3-cd)pyrene	3.5E-02	4.1E-02	3.4E-05	4.4E-06	1.7E-04	7.3E-05	1.1E-03	5.7E-03	0.1%	--	--	3.2E-06	5.3E-05	27.0%	[D2]
RADIONUCLIDES															
Cesium 137+D	1.0E+01	2.3E+01		2.4E+03		7.4E+04						6.7E-08	2.0E-06	27.6%	[A]
Cobalt 60	1.8E-01	1.5E+00		4.1E+01		4.7E+03						6.1E-10	7.1E-08	0.9%	[A]
Neptunium 237+D	2.1E+00	6.3E+00		4.6E+02		1.9E+04						1.0E-07	4.3E-06	58.2%	[A]
Protactinium 233		1.4E-01				4.4E+02							4.4E-10	0.0%	[A]
Thorium 228+D	1.2E+00	1.6E+00		2.6E+02		5.3E+03						1.5E-08	2.9E-07	3.9%	[A]
Thorium 230	6.2E+00	1.0E+01		1.3E+03		3.4E+04						1.7E-08	4.4E-07	6.0%	[A]
Thorium 232	8.4E-01	1.4E+00		1.6E+02		4.4E+03						2.2E-09	5.2E-08	0.7%	[A]
Uranium 234	1.2E+00	1.3E+00		2.6E+02		4.2E+03						4.3E-09	6.8E-08	0.9%	[A]
Uranium 235+D	5.9E-02	6.9E-02		1.3E+01		2.2E+02						2.1E-10	3.5E-09	0.0%	[A]
Uranium 238+D	1.2E+00	1.4E+00		2.8E+02		4.5E+03						7.9E-09	1.2E-07	1.7%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	1.3E+00	8.8E+00	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.0E-05	2.0E-04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	2.1E-07	7.5E-06	100.0%

Table M.314. Risk characterization for milk: children – ingestion exposure (future land use – agricultural) – Area S7–F2–A

Chemical	MLE Concentration from Mean Concentration in Soil/SW	RME Concentration from UCL Concentration in Soil/SW	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS															
Antimony	6.72E-05	7.11E-05	2.90E-07	1.24E-08	1.28E-06	1.55E-07	7.26E-04	3.02E-03	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	1.91E-03	1.97E-03	8.24E-06	3.53E-07	3.34E-05	4.30E-06	2.75E-02	1.11E-01	0.3%	skin; keratosis, hyperpigmentation	3	6.18E-07	7.53E-06	3.0%	[A]
Barium	3.37E+00	4.47E+00	1.46E-02	6.25E-04	7.60E-02	9.77E-03	2.08E-01	1.09E+00	3.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.16E-06	2.49E-06	9.35E-09	4.01E-10	4.22E-08	5.43E-09	1.87E-06	8.44E-06	0.0%	no observed effects	100	1.72E-09	2.33E-08	0.0%	[B2]
Cadmium	6.68E-02	1.17E-01	2.89E-04	1.24E-05	1.99E-03	2.56E-04	2.89E-01	1.99E+00	5.4%	kidney; proteinuria	10				
Chromium (III)	1.74E+00	2.88E+00	7.53E-03	3.23E-04	4.88E-02	6.28E-03	7.53E-03	4.88E-02	0.1%	no observed effects	100				
Copper	5.06E+00	6.61E+00	2.19E-02	9.38E-04	1.12E-01	1.44E-02	5.91E-01	3.03E+00	8.3%	Gastrointestinal system; irritation	--				[D]
Lead	1.41E-02	1.76E-02	6.09E-05	2.61E-06	2.99E-04	3.85E-05				CNS, blood	--				[B2]
Manganese	2.03E+01	3.04E+01	8.76E-02	3.76E-03	5.17E-01	6.65E-02	6.26E-01	3.69E+00	10.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.08E-01	2.90E-01	9.00E-04	3.86E-05	4.93E-03	6.34E-04	3.00E+00	1.64E+01	44.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	6.25E-02	9.74E-02	2.70E-04	1.16E-05	1.66E-03	2.13E-04	1.35E-02	8.28E-02	0.2%	dec. body and organ weight	300				
Selenium	7.36E-01	8.07E-01	3.18E-03	1.36E-04	1.37E-02	1.76E-03	6.36E-01	2.74E+00	7.5%	whole body; clinical selenosis	3				[D]
Silver	2.07E-01	3.03E-01	8.94E-04	3.83E-05	5.14E-03	6.61E-04	1.79E-01	1.03E+00	2.8%	skin; argyria	3				[D]
Zinc	8.67E+01	1.14E+02	3.75E-01	1.61E-02	1.94E+00	2.49E-01	1.25E+00	6.46E+00	17.6%	blood; anemia	3				[D]
ORGANICS															
Aroclor-1260	2.65E-03	4.94E-03	1.15E-05	4.91E-07	8.38E-05	1.08E-05				--	--	3.78E-06	8.30E-05	33.5%	[B2]
Benzo(a)anthracene	9.61E-04	1.15E-03	4.15E-06	1.78E-07	1.96E-05	2.52E-06	1.38E-04	6.53E-04	0.0%	--	--	1.30E-07	1.84E-06	0.7%	[B2]
Benzo(a)pyrene	2.56E-03	3.05E-03	1.11E-05	4.75E-07	5.18E-05	6.66E-06	3.69E-04	1.73E-03	0.0%	--	--	3.46E-06	4.88E-05	19.6%	[B2]
Benzo(b)fluoranthene	6.06E-03	9.16E-03	2.62E-05	1.12E-06	1.56E-04	2.00E-05	8.72E-04	5.19E-03	0.0%	--	--	8.18E-07	1.46E-05	5.9%	[B2]
Benzo(k)fluoranthene	1.13E-02	1.59E-02	4.90E-05	2.10E-06	2.70E-04	3.47E-05	1.63E-03	8.98E-03	0.0%	--	--	1.53E-06	2.53E-05	10.2%	[B2]
Chrysene	7.38E-04	8.73E-04	3.19E-06	1.37E-07	1.48E-05	1.91E-06	1.06E-04	4.94E-04	0.0%	--	--	9.97E-09	1.39E-07	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	3.55E-02	4.19E-02	1.53E-04	6.57E-06	7.12E-04	9.16E-05	5.11E-03	2.37E-02	0.1%	--	--	4.80E-06	6.69E-05	27.0%	[B2]
RADIONUCLIDES															
Cesium 137+D	1.09E+01	2.35E+01		1.29E+03		3.41E+04						3.61E-08	9.56E-07	27.6%	[A]
Cobalt 60	1.85E-01	1.50E+00		2.18E+01		2.18E+03						3.28E-10	3.27E-08	0.9%	[A]
Neptunium 237+D	2.10E+00	6.31E+00		2.48E+02		9.15E+03						5.46E-08	2.01E-06	58.2%	[A]
Protactinium 233		1.40E-01				2.03E+02							2.03E-10	0.0%	[A]
Thorium 228+D	1.29E+00	1.68E+00		1.53E+02		2.44E+03						8.42E-09	1.34E-07	3.9%	[A]
Thorium 230	6.20E+00	1.09E+01		7.33E+02		1.56E+04						9.53E-09	2.06E-07	6.0%	[A]
Thorium 232	8.49E-01	1.40E+00		1.00E+02		2.03E+03						1.21E-09	2.44E-08	0.7%	[A]
Uranium 234	1.21E+00	1.36E+00		1.44E+02		1.97E+03						2.30E-09	3.15E-08	0.9%	[A]
Uranium 235+D	5.98E-02	6.97E-02		7.08E+00		1.01E+02						1.13E-10	1.62E-09	0.0%	[A]
Uranium 238+D	1.27E+00	1.44E+00		1.50E+02		2.08E+03						4.21E-09	5.83E-08	1.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.83E+00	3.68E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.52E-05	2.48E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.17E-07	3.46E-06	100.0%	

Table M.315. Risk characterization for fish: adults – ingestion exposure (future land use – agricultural/homesteader) – Area S7–F2–A

Chemical	MLE Concentration in Fish Tissue	RME Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	BPA WOE
INORGANICS															
Mercury	0.76	0.78	2.38E-06	3.06E-07	2.89E-05	1.24E-05	7.94E-03	9.63E-02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	6.43E-07	8.27E-08	8.21E-06	3.52E-06						6.37E-07	2.71E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.13E-06	1.45E-07	1.44E-05	6.18E-06						1.12E-06	4.76E-05	63.7%	[B2]
Chemical Hazards:															
Hazard Index (HI):															
Combined Exposure (d)							7.94E-03	9.63E-02	100.0%						
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												1.75E-06	7.47E-05	100.0%	

Table M.316. Risk characterization for fish: children — ingestion exposure (future land use — agricultural/homesteader) — Area S7—F2—A

Chemical	MLB Concentration to Fish Tissue	RMB Concentration to Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS															
Mercury	0.76	0.78	4.16E-06	1.78E-07	6.04E-05	7.76E-06	1.39E-02	2.01E-01	100.0%	*oral*-CNS; neurotoxicity. *inhal.*-kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	1.12E-06	4.81E-08	1.72E-05	2.21E-06						3.70E-07	1.70E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.97E-06	8.44E-08	3.01E-05	3.88E-06						6.50E-07	2.98E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.39E-02	2.01E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-06	4.68E-05	100.0%	

Table M.317. Risk characterization for air: adults – inhalation exposure during mowing activities (future land use – agricultural) – Area S7–F2–A

Chemical	Chronic Daily Intake (CDI): MLE Concentration in Air	RME Concentration in Air	CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/m³)															
Antimony	9.4E-06	9.9E-06	9.7E-09	1.2E-09	1.0E-08	4.4E-09				whole body, blood; inc. mortality	--				
Arsenic	9.9E-05	1.0E-04	1.0E-07	1.3E-08	1.0E-07	4.5E-08				skin; keratosis, hyperpigmentation	--	6.6E-07	2.3E-06	90.2%	[A]
Barium	1.3E-03	1.8E-03	1.4E-06	1.8E-07	1.9E-06	8.1E-07	1.0E-02	1.3E-02	5.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	1000				
Beryllium	9.7E-06	1.1E-05	1.0E-08	1.3E-09	1.1E-08	4.9E-09				no observed effects	--	1.0E-08	4.1E-08	1.6%	[B2]
Cadmium	4.0E-05	7.0E-05	4.1E-08	5.3E-09	7.3E-08	3.1E-08				kidney; proteinuria	--	3.2E-08	1.9E-07	7.5%	[B1]
Chromium (III)	8.7E-04	8.9E-04	9.0E-07	1.1E-07	9.3E-07	3.9E-07				no observed effects	--				
Copper	8.9E-04	1.5E-03	9.2E-07	1.1E-07	1.5E-06	6.7E-07				Gastrointestinal system; irritation	--				
Lead	4.5E-04	5.6E-04	4.7E-07	6.0E-08	5.9E-07	2.5E-07				CNS, blood	--				
Manganese	1.6E-02	2.4E-02	1.6E-05	2.1E-06	2.5E-05	1.0E-05	1.4E-01	2.1E-01	93.3%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	300				
Mercury	1.6E-04	2.0E-04	1.7E-07	2.2E-08	2.1E-07	9.1E-08	2.0E-03	2.4E-03	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	30				
Nickel	3.2E-04	5.1E-04	3.4E-07	4.3E-08	5.3E-07	2.2E-07				dec. body and organ weight	--				
Selenium	1.7E-04	1.8E-04	1.7E-07	2.2E-08	1.9E-07	8.3E-08				whole body; clinical selenosis	--				
Silver	2.4E-05	3.6E-05	2.5E-08	3.3E-09	3.8E-08	1.6E-08				skin; argyria	--				
Zinc	1.7E-03	2.3E-03	1.8E-06	2.3E-07	2.3E-06	1.0E-06				blood; anemia	--				
ORGANICS (mg/m³)															
Aroclor-1260	1.1E-06	2.2E-06	1.2E-09	1.5E-10	2.2E-09	9.8E-10				--	--				
Benzo(a)anthracene	3.4E-06	4.1E-06	3.5E-09	4.5E-10	4.2E-09	1.8E-09				--	--	2.8E-10	1.1E-09	0.0%	[B2]
Benzo(a)pyrene	3.2E-06	3.8E-06	3.4E-09	4.3E-10	4.0E-09	1.7E-09				--	--	2.6E-09	1.0E-08	0.4%	[B2]
Benzo(b)fluoranthene	5.2E-06	7.9E-06	5.4E-09	7.0E-10	8.3E-09	3.5E-09				--	--	4.3E-10	2.1E-09	0.1%	[B2]
Benzo(k)fluoranthene	5.7E-06	8.0E-06	6.0E-09	7.7E-10	8.4E-09	3.6E-09				--	--	4.7E-10	2.2E-09	0.1%	[B2]
Chrysene	3.3E-06	3.9E-06	3.4E-09	4.4E-10	4.0E-09	1.7E-09				--	--	2.7E-11	1.0E-10	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	2.9E-06	3.5E-06	3.1E-09	4.0E-10	3.6E-09	1.5E-09				--	--	2.4E-10	9.6E-10	0.0%	[B2]
RADIONUCLIDES (pCi/m³)															
Cesium 137+D	8.9E-03	1.5E-02		2.1E+00		1.2E+01						4.0E-11	2.4E-10	0.0%	[A]
Cobalt 60	2.6E-04	4.6E-04		6.3E-02		3.7E-01						9.4E-12	5.5E-11	0.0%	[A]
Neptunium 237+D	6.2E-04	1.4E-03		1.5E-01		1.1E+00						4.3E-09	3.3E-08	0.4%	[A]
Protactinium 233		6.3E-04				5.0E-01							4.3E-12	0.0%	[A]
Thorium 228+D	2.0E-02	2.6E-02		4.7E+00		2.0E+01						3.7E-07	1.6E-06	18.1%	[A]
Thorium 230	9.5E-02	1.6E-01		2.2E+01		1.3E+02						6.6E-07	3.9E-06	43.5%	[A]
Thorium 232	1.3E-02	2.1E-02		3.1E+00		1.7E+01						8.7E-08	4.8E-07	5.4%	[A]
Uranium 234	4.1E-02	4.5E-02		9.9E+00		3.6E+01						2.5E-07	9.5E-07	10.6%	[A]
Uranium 235+D	1.9E-03	2.1E-03		4.6E-01		1.7E+00						1.1E-08	4.3E-08	0.5%	[A]
Uranium 238+D	4.2E-02	4.6E-02		1.0E+01		3.7E+01						5.3E-07	1.9E-06	21.5%	[A]
Chemical Hazards: Hazard Index Combined Exposure (d)							1.6E-01	2.3E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.1E-07	2.5E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.9E-06	8.9E-06	100.0%	

SEGMENT 8 RISK CHARACTERIZATION TABLES

Table M.318. Risk characterization summary for EFPC Segment 8: RME estimates for current land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	2.41E−01 B	1.27E−01 B	2.80E−06 W	4.90E−06 W	1.02E−07 B	2.56E−07 B	1.06E+00 *B*	2.95E−01 B	1.23E−05 W	1.14E−05 W	2.39E−07 B	5.98E−07 B
	Dermal Contact	1.48E−02 B	1.37E−02 B	3.51E−07 B	1.09E−06 W	NA	NA	4.18E−02 B	3.20E−02 B	9.96E−07 B	2.54E−06 W	NA	NA
Surface Water	Ingestion	1.48E−03 B	1.04E−03 B	3.10E−09 B	7.22E−09 B	4.89E−10 B	1.63E−09 B	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	1.28E−03 B	1.18E−03 B	3.01E−08 B	9.31E−08 B	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	9.90E−05 B	9.19E−05 B	1.26E−08 B	3.89E−08 B	NA	NA	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	8.40E+01 *B*	4.05E+01 *B*	2.02E−04 *B*	3.25E−04 *B*	6.98E−07 B	3.02E−06 W
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		2.6E−01 B	1.4E−01 B					8.5E+01 *B*	4.1E+01 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				3E−06 W	6E−06 W					3E−04 *B*	4E−04 *B*		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						1E−07 B	3E−07 B					9E−07 B	4E−06 W

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.323. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Area S8–C1–O

	MLB Concentration in Soil	RMB Concentration in Soil	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern TARGET TISSUE	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDA WOE
NICS (mg/kg)															
	0.65	0.70	4.0E3–08	5.2E3–09	4.1E3–07	1.7E3–07	1.0E3–04	1.0E3–03	0.8%	whole body, blood; inc. mortality	1000				
	7.20	7.62	4.5E3–07	5.7E3–08	4.4E3–06	1.9E3–06	1.5E3–03	1.4E3–02	11.8%	skin; keratosis, hyperpigmentation	3	1.0E3–07	3.3E3–06	68.4%	[A]
	115.90	140.80	7.2E3–06	9.3E3–07	8.2E3–05	3.5E3–05	1.0E3–04	1.1E3–03	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
	0.81	0.90	5.0E3–08	6.4E3–09	5.2E3–07	2.2E3–07	1.0E3–05	1.0E3–04	0.1%	no observed effects	100	2.7E3–08	9.7E3–07	19.9%	[D2]
	3.29	5.33	2.0E3–07	2.6E3–08	3.1E3–06	1.3E3–06	2.0E3–04	3.1E3–03	2.5%	kidney; proteinuria	10				
n (III)	70.62	75.59	4.4E3–06	5.6E3–07	4.4E3–05	1.9E3–05	4.4E3–06	4.4E3–05	0.0%	no observed effects	100				
	115.30	199.90	7.2E3–06	9.2E3–07	1.1E3–04	5.0E3–05	1.9E3–04	3.1E3–03	2.5%	Gastrointestinal system; irritation	– –				[D]
	52.40	77.84	3.2E3–06	4.2E3–07	4.5E3–05	1.9E3–05				CNS, blood	– –				[B2]
e	857.50	1076.00	5.3E3–05	6.9E3–06	6.3E3–04	2.7E3–04	3.8E3–04	4.5E3–03	3.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
	35.68	49.11	2.2E3–06	2.8E3–07	2.8E3–05	1.2E3–05	7.4E3–03	9.6E3–02	75.9%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
	33.49	48.33	2.1E3–06	2.7E3–07	2.8E3–05	1.2E3–05	1.0E3–04	1.4E3–03	1.1%	dec. body and organ weight	300				
	6.44	6.94	4.0E3–07	5.1E3–08	4.0E3–06	1.7E3–06	8.0E3–05	8.1E3–04	0.6%	whole body; clinical selenosis	3				[D]
	4.31	6.96	2.7E3–07	3.4E3–08	4.0E3–06	1.7E3–06	5.4E3–05	8.1E3–04	0.6%	skin; argyria	3				[D]
	124.40	205.10	7.7E3–06	1.0E3–06	1.2E3–04	5.1E3–05	2.6E3–05	4.0E3–04	0.3%	blood; anemia	3				[D]
CS (mg/kg)															
1260	0.01	0.02	8.4E3–10	1.0E3–10	1.2E3–08	5.2E3–09				– –	– –	8.4E3–10	4.0E3–08	0.8%	[B2]
nthracene	0.14	0.19	9.0E3–09	1.1E3–09	1.1E3–07	4.7E3–08	3.0E3–07	3.7E3–06	0.0%	– –	– –	8.4E3–10	3.4E2–08	0.7%	[B2]
pyrene	0.16	0.20	1.0E3–08	1.3E3–09	1.1E3–07	5.0E3–08	3.4E3–07	3.9E3–06	0.0%	– –	– –	9.6E3–09	3.7E3–07	7.6%	[B2]
fluoranthene	0.17	0.22	1.0E3–08	1.3E3–09	1.2E3–07	5.5E3–08	3.5E3–07	4.3E3–06	0.0%	– –	– –	9.8E3–10	4.0E3–08	0.8%	[B2]
fluoranthene	0.18	0.23	1.1E3–08	1.4E3–09	1.3E3–07	5.8E3–08	3.7E3–07	4.5E3–06	0.0%	– –	– –	1.0E3–09	4.2E3–08	0.9%	[B2]
	0.15	0.20	9.5E3–09	1.2E3–09	1.1E3–07	4.9E3–08	3.1E3–07	3.8E3–06	0.0%	– –	– –	8.9E3–11	3.5E3–09	0.1%	[B2]
2,3–cd)pyrene	0.18	0.21	1.1E2–08	1.4E3–09	1.2E3–07	5.3E3–08	3.7E3–07	4.2E3–06	0.0%	– –	– –	1.0E3–09	3.9E2–08	0.8%	[B2]
NUCLIDES (pCi/g)															
37+D	1.36	2.29		1.9E3+01		1.0E3+03						5.4E3–10	2.8E3–08	11.2%	[A]
	0.04	0.06		6.0E3–01		2.4E3+01						8.9E3–12	3.7E3–10	0.1%	[A]
m 237+D	0.12	0.35		1.7E3+00		1.5E3+02						3.8E3–10	3.4E3–08	13.4%	[A]
lum 233	0.05	0.16		7.7E3–01		7.2E3+01						7.7E3–13	7.2E3–11	0.0%	[A]
228+D	1.74	2.30		2.5E3+01		1.0E3+03						1.3E3–09	5.6E3–08	22.2%	[A]
232	1.09	1.61		1.5E3+01		7.2E3+02						1.8E3–10	8.6E3–09	3.4%	[A]
234	5.51	6.77		7.9E3+01		3.0E3+03						1.2E3–09	4.8E3–08	19.0%	[A]
235+D	0.24	0.29		3.4E3+00		1.3E3+02						5.4E3–11	2.1E3–09	0.8%	[A]
238+D	5.08	6.05		7.5E3+01		2.7E3+03						2.0E3–09	7.6E3–08	29.8%	[A]
Hazards:							1.0E3–02	1.2E3–01	100.0%						
Index (HI):															
ned Exposure (d)															
Lifetime Cancer Risk:												1.4E3–07	4.9E3–06	100.0%	
ned Exposure (d)															
cal Hazards:															
Lifetime Cancer Risk:												5.8E3–09	2.5E3–07	100.0%	
ned Exposure (d)															

Table M.320. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S8–C1–O children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.75E–02	2.41E–01	8.29E–08	2.80E–06
Dermal Contact	3.76E–04	1.48E–02	3.39E–09	3.51E–07
SURFACE WATER				
Ingestion	9.55E–05	1.48E–03	8.16E–11	3.10E–09
Dermal Contact	7.49E–05	1.28E–03	5.77E–10	3.01E–08
SEDIMENT				
Dermal Contact	2.00E–06	9.90E–05	7.87E–11	1.26E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.45E–09	1.02E–07
SURFACE WATER				
Ingestion			1.31E–11	4.89E–10
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.8E–02	2.6E–01		
Excess Lifetime Cancer Risk: Combined Exposure			9E–08	3E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–09	1E–07

Table M.321. Human health risk characterization summary for EFPC residential scenario: current land use, Area Area S8–C2–R adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	6.83E–02	2.95E–01	9.71E–07	1.14E–05
Dermal Contact	2.46E–03	3.20E–02	6.66E–08	2.54E–06
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce	6.47E+00	4.05E+01	2.01E–05	3.25E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.97E–08	5.98E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce			9.68E–08	3.02E–06
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	6.6E+00	4.1E+01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–05	4E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1E–07	4E–06

Table M.322. Human health risk characterization summary for EFPC residential scenario: current land use, Area S8–C2–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	2.39E–01	1.06E+00	1.13E–06	1.23E–05
Dermal Contact	3.21E–03	4.18E–02	2.89E–08	9.96E–07
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce	1.45E+01	8.40E+01	1.50E–05	2.02E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.66E–08	2.39E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce			2.58E–08	6.98E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.5E+01	8.5E+01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–05	3E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			4E–08	9E–07

Table M.323. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Area S8–C1–O

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS **(mg/kg)**															
Antimony	0.65	0.70	4.08E–08	5.25E–09	4.11E–07	1.76E–07	1.02E–04	1.03E–03	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	4.51E–07	5.79E–08	4.47E–06	1.92E–06	1.50E–03	1.49E–02	11.8%	skin; keratosis, hyperpigmentation	3	1.01E–07	3.36E–06	68.4%	[A]
Barium	115.90	140.80	7.26E–06	9.33E–07	8.27E–05	3.54E–05	1.04E–04	1.18E–03	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	5.05E–08	6.49E–09	5.29E–07	2.27E–07	1.01E–05	1.06E–04	0.1%	no observed effects	100	2.79E–08	9.76E–07	19.9%	[B2]
Cadmium	3.29	5.33	2.06E–07	2.65E–08	3.13E–06	1.34E–06	2.06E–04	3.13E–03	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	4.42E–06	5.69E–07	4.44E–05	1.90E–05	4.42E–06	4.44E–05	0.0%	no observed effects	100				
Copper	115.30	199.90	7.22E–06	9.28E–07	1.17E–04	5.03E–05	1.95E–04	3.17E–03	2.5%	Gastrointestinal system; irritation	--				[D]
Lead	52.40	77.84	3.28E–06	4.22E–07	4.57E–05	1.96E–05				CNS, blood	--				[B2]
Manganese	857.50	1076.00	5.37E–05	6.90E–06	6.32E–04	2.71E–04	3.84E–04	4.51E–03	3.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	35.68	49.11	2.23E–06	2.87E–07	2.88E–05	1.24E–05	7.45E–03	9.61E–02	75.9%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	2.10E–06	2.70E–07	2.84E–05	1.22E–05	1.05E–04	1.42E–03	1.1%	dec. body and organ weight	300				
Selenium	6.44	6.94	4.03E–07	5.19E–08	4.07E–06	1.75E–06	8.07E–05	8.15E–04	0.6%	whole body; clinical selenosis	3				[D]
Silver	4.31	6.96	2.70E–07	3.47E–08	4.08E–06	1.75E–06	5.40E–05	8.17E–04	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	7.79E–06	1.00E–06	1.20E–04	5.16E–05	2.60E–05	4.01E–04	0.3%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor–1260	0.01	0.02	8.44E–10	1.09E–10	1.23E–08	5.28E–09				--	--	8.40E–10	4.07E–08	0.8%	[B2]
Benzo(a)anthracene	0.14	0.19	9.02E–09	1.16E–09	1.11E–07	4.77E–08	3.01E–07	3.71E–06	0.0%	--	--	8.47E–10	3.48E–08	0.7%	[B2]
Benzo(a)pyrene	0.16	0.20	1.03E–08	1.32E–09	1.19E–07	5.09E–08	3.42E–07	3.96E–06	0.0%	--	--	9.62E–09	3.71E–07	7.6%	[B2]
Benzo(b)fluoranthene	0.17	0.22	1.05E–08	1.35E–09	1.29E–07	5.55E–08	3.50E–07	4.31E–06	0.0%	--	--	9.85E–10	4.05E–08	0.8%	[B2]
Benzo(k)fluoranthene	0.18	0.23	1.12E–08	1.44E–09	1.36E–07	5.83E–08	3.73E–07	4.54E–06	0.0%	--	--	1.03E–09	4.26E–08	0.9%	[B2]
Chrysene	0.15	0.20	9.56E–09	1.23E–09	1.14E–07	4.91E–08	3.19E–07	3.82E–06	0.0%	--	--	8.97E–11	3.58E–09	0.1%	[B2]
Indeno(1,2,3--cd)pyrene	0.18	0.21	1.12E–08	1.44E–09	1.26E–07	5.39E–08	3.72E–07	4.20E–06	0.0%	--	--	1.05E–09	3.94E–08	0.8%	[B2]
RADIONUCLIDES **(pCi/g)**															
Cesium 137+D	1.36	2.29		1.95E+01		1.03E+03						5.47E–10	2.88E–08	11.2%	[A]
Cobalt 60	0.04	0.06		6.00E–01		2.49E+01						8.95E–12	3.74E–10	0.1%	[A]
Neptunium 237+D	0.12	0.35		1.76E+00		1.56E+02						3.88E–10	3.43E–08	13.4%	[A]
Protactinium 233	0.05	0.16		7.72E–01		7.23E+01						7.72E–13	7.23E–11	0.0%	[A]
Thorium 228+D	1.74	2.30		2.51E+01		1.04E+03						1.38E–09	5.69E–08	22.2%	[A]
Thorium 232	1.09	1.61		1.57E+01		7.24E+02						1.08E–10	8.69E–09	3.4%	[A]
Uranium 234	5.51	6.77		7.94E+01		3.05E+03						1.27E–09	4.87E–08	19.0%	[A]
Uranium 235+D	0.24	0.29		3.42E+00		1.31E+02						5.48E–11	2.10E–09	0.8%	[A]
Uranium 238+D	5.08	6.05		7.31E+01		2.72E+03						2.05E–09	7.63E–08	29.8%	[A]
Chemical Hazards:															
Hazard Index (HI):							1.01E–02	1.27E–01	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:												1.44E–07	4.90E–06	100.0%	
Combined Exposure (d)															
Radiological Hazards:															
Excess Lifetime Cancer Risk:												5.84E–09	2.56E–07	100.0%	
Combined Exposure (d)															

Table M.324. Risk characterization for soils: children – ingestion exposure (current land use – open) – Area S8–C1–O

Chemical	MLE Concentration in Soil	RME Concentration in Soil	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Antimony	0.65	0.70	7.06E-08	3.03E-09	7.80E-07	1.00E-07	1.77E-04	1.95E-03	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	7.79E-07	3.34E-08	8.50E-06	1.09E-06	2.60E-03	2.83E-02	11.8%	skin; keratosis, hyperpigmentation	3	5.85E-08	1.91E-06	68.4%	[A]
Barium	115.90	140.80	1.26E-05	5.38E-07	1.57E-04	2.02E-05	1.79E-04	2.24E-03	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	8.73E-08	3.74E-09	1.01E-06	1.29E-07	1.75E-05	2.01E-04	0.1%	no observed effects	100	1.6E-08	5.5E-07	19.9%	[B2]
Cadmium	3.29	5.33	3.56E-07	1.53E-08	5.94E-06	7.64E-07	3.56E-04	5.94E-03	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	7.65E-06	3.28E-07	8.43E-05	1.08E-05	7.65E-06	8.43E-05	0.0%	no observed effects	100				
Copper	115.30	199.90	1.25E-05	5.35E-07	2.23E-04	2.87E-05	3.37E-04	6.03E-03	2.5%	Gastrointestinal system; irritation	--				[D]
Lead	52.40	77.84	5.67E-06	2.43E-07	8.68E-05	1.12E-05				CNS, blood	--				[B2]
Manganese	857.50	1076.00	9.29E-05	3.98E-06	1.20E-03	1.54E-04	6.63E-04	8.57E-03	3.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	35.68	49.11	3.86E-06	1.66E-07	5.48E-05	7.04E-06	1.29E-02	1.83E-01	75.9%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	3.63E-06	1.55E-07	5.33E-05	6.93E-06	1.81E-04	2.70E-03	1.1%	dec. body and organ weight	300				
Selenium	6.44	6.94	6.97E-07	2.99E-08	7.74E-06	9.95E-07	1.39E-04	1.55E-03	0.6%	whole body; clinical selenosis	3				[D]
Silver	4.31	6.96	4.67E-07	2.00E-08	7.76E-06	9.98E-07	9.34E-05	1.55E-03	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	1.35E-05	5.77E-07	2.29E-04	2.94E-05	4.49E-05	7.63E-04	0.3%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.01	0.02	1.47E-09	6.29E-11	2.34E-08	3.01E-09				--	--	4.84E-10	2.32E-08	0.8%	[B2]
Benzo(a)anthracene	0.14	0.19	1.56E-08	6.69E-10	2.11E-07	2.72E-08	5.20E-07	7.03E-06	0.0%	--	--	4.88E-10	1.98E-08	0.7%	[B2]
Benzo(a)pyrene	0.16	0.20	1.77E-08	7.60E-10	2.26E-07	2.90E-08	5.91E-07	7.52E-06	0.0%	--	--	5.55E-09	2.12E-07	7.6%	[B2]
Benzo(b)fluoranthene	0.17	0.22	1.81E-08	7.78E-10	2.46E-07	3.16E-08	6.03E-07	8.19E-06	0.0%	--	--	5.68E-10	2.31E-08	0.8%	[B2]
Benzo(k)fluoranthene	0.18	0.23	1.94E-08	8.30E-10	2.59E-07	3.32E-08	6.44E-07	8.62E-06	0.0%	--	--	6.06E-10	2.43E-08	0.9%	[B2]
Chrysene	0.15	0.20	1.65E-08	7.08E-10	2.18E-07	2.80E-08	5.51E-07	7.25E-06	0.0%	--	--	5.17E-11	2.04E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	1.93E-08	8.28E-10	2.39E-07	3.07E-08	6.44E-07	7.97E-06	0.0%	--	--	6.04E-10	2.24E-08	0.8%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.36	2.29		8.14E+00		4.11E+02						2.28E-10	1.15E-08	11.2%	[A]
Cobalt 60	0.04	0.06		2.50E-01		9.95E+00						3.75E-12	1.49E-10	0.1%	[A]
Neptunium 237+D	0.12	0.35		7.35E-01		6.23E+01						1.62E-10	1.37E-08	13.4%	[A]
Protactinium 233	0.05	0.16		3.22E-01		2.88E+01						3.22E-13	2.88E-11	0.0%	[A]
Thorium 228+D	1.74	2.30		1.05E+01		4.13E+02						5.75E-10	2.27E-08	22.2%	[A]
Thorium 232	1.09	1.61		6.55E+00		2.85E+02						7.84E-11	3.47E-09	3.4%	[A]
Uranium 234	5.51	6.77		3.31E+01		1.22E+03						5.29E-10	1.94E-08	19.0%	[A]
Uranium 235+D	0.24	0.29		1.43E+00		5.24E+01						2.28E-11	8.38E-10	0.8%	[A]
Uranium 238+D	5.08	6.05		3.05E+01		1.09E+03						8.53E-10	3.04E-08	29.8%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.75E-02	2.41E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.29E-08	2.86E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												2.45E-09	1.02E-07	100.0%	

Table M.325. Risk characterization for soils: adults – dermal exposure (current land use – open) – Area S8–C1–O

Chemical	MLE Concentration In Soils	RME Concentration In Soils	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	IRIS Wt of Evid
INORGANICS (mg/kg)															
Antimony	0.65	0.70	1.47E-09	1.89E-10	4.44E-08	1.90E-08	3.68E-06	1.11E-04	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	1.62E-08	2.09E-09	4.84E-07	2.07E-07	5.41E-05	1.61E-03	11.8%	skin; keratosis, hyperpigmentation	3	3.65E-09	3.63E-07	33.4%	[A]
Barium	115.90	140.80	2.61E-07	3.36E-08	6.94E-06	3.83E-06	3.73E-06	1.28E-04	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	1.82E-09	2.34E-10	5.72E-08	2.45E-08	3.63E-07	1.14E-05	0.1%	no observed effects	100	1.00E-09	1.05E-07	9.7%	[B2]
Cadmium	3.29	5.33	7.41E-09	9.53E-10	3.38E-07	1.45E-07	7.41E-06	3.38E-04	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	1.59E-07	2.05E-08	4.86E-06	2.06E-06	1.59E-07	4.86E-06	0.0%	no observed effects	100				
Copper	115.30	199.90	2.60E-07	3.34E-08	1.27E-05	5.44E-06	7.03E-06	3.43E-04	2.5%	Gastrointestinal system; irritation	--				[D]
Lead	52.40	77.84	1.18E-07	1.52E-08	4.94E-06	2.12E-06				CNS, blood	--				[B2]
Manganese	857.50	1076.00	1.93E-06	2.49E-07	6.83E-05	2.93E-05	1.38E-05	4.88E-04	3.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	35.68	49.11	8.04E-08	1.03E-08	3.12E-06	1.34E-06	2.68E-04	1.04E-02	75.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	7.55E-08	9.71E-09	3.07E-06	1.31E-06	3.77E-06	1.53E-04	1.1%	dec. body and organ weight	300				
Selenium	6.44	6.94	1.45E-08	1.87E-09	4.40E-07	1.89E-07	2.90E-06	8.81E-05	0.6%	whole body; clinical selenosis	3				[D]
Silver	4.31	6.96	9.72E-09	1.25E-09	4.42E-07	1.89E-07	1.94E-06	8.83E-05	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	2.80E-07	3.61E-08	1.30E-05	5.58E-06	9.35E-07	4.34E-05	0.3%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.01	0.02	3.05E-10	3.93E-11	1.33E-08	5.71E-09				--	--	3.02E-10	4.41E-08	4.0%	[B2]
Benzo(a)anthracene	0.14	0.19	3.25E-09	4.18E-10	1.20E-07	5.15E-08	1.08E-07	4.01E-06	0.0%	--	--	3.05E-10	3.76E-08	3.5%	[B2]
Benzo(a)pyrene	0.16	0.20	3.65E-09	4.74E-10	1.28E-07	5.50E-08	1.23E-07	4.28E-06	0.0%	--	--	3.46E-09	4.01E-07	36.9%	[B2]
Benzo(b)fluoranthene	0.17	0.22	3.78E-09	4.86E-10	1.40E-07	5.99E-08	1.26E-07	4.66E-06	0.0%	--	--	3.55E-10	4.38E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.18	0.23	4.03E-09	5.19E-10	1.47E-07	6.30E-08	1.34E-07	4.90E-06	0.0%	--	--	3.79E-10	4.60E-08	4.2%	[B2]
Chrysene	0.15	0.20	3.44E-09	4.42E-10	1.24E-07	5.30E-08	1.15E-07	4.13E-06	0.0%	--	--	3.23E-11	3.87E-09	0.4%	[B2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	4.02E-09	5.17E-10	1.36E-07	5.83E-08	1.34E-07	4.54E-06	0.0%	--	--	3.77E-10	4.26E-08	3.9%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.65E-04	1.37E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.87E-09	1.09E-06	100.0%	

Table M.326. Risk characterization for soils: children – dermal exposure (current land use – open) – Area S8–C1–O

Chemical	MLB Concentration in Soil	RMB Concentration in Soil	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.65	0.70	1.5E-09	6.4E-11	4.7E-08	6.1E-09	3.7E-06	1.1E-04	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	1.6E-08	7.1E-10	5.2E-07	6.7E-08	5.5E-05	1.7E-03	11.8%	skin; keratosis, hyperpigmentation	3	1.2E-09	1.1E-07	33.4%	[A]
Barium	115.90	140.80	2.6E-07	1.1E-08	9.6E-06	1.2E-06	3.8E-06	1.3E-04	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	1.8E-09	8.0E-11	6.1E-08	7.9E-09	3.7E-07	1.2E-05	0.1%	no observed effects	100	3.4E-10	3.4E-08	9.7%	[B2]
Cadmium	3.29	5.33	7.6E-09	3.2E-10	3.6E-07	4.6E-08	7.6E-06	3.6E-04	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	1.6E-07	7.0E-09	5.1E-06	6.6E-07	1.6E-07	5.1E-06	0.0%	no observed effects	100				
Copper	115.30	199.90	2.6E-07	1.1E-08	1.3E-05	1.7E-06	7.2E-06	3.6E-04	2.5%	Gastrointestinal system; irritation	--				[D]
Lead	52.40	77.84	1.2E-07	5.2E-09	5.3E-06	6.8E-07				CNS, blood	--				[B2]
Manganese	857.50	1076.00	1.9E-06	8.5E-08	7.3E-05	9.4E-06	1.4E-05	5.2E-04	3.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	35.68	49.11	8.2E-08	3.5E-09	3.3E-06	4.3E-07	2.7E-04	1.1E-02	75.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	7.7E-08	3.3E-09	3.3E-06	4.2E-07	3.8E-06	1.6E-04	1.1%	dec. body and organ weight	300				
Selenium	6.44	6.94	1.5E-08	6.4E-10	4.7E-07	6.1E-08	2.9E-06	9.4E-05	0.6%	whole body; clinical selenosis	3				[D]
Silver	4.31	6.96	1.0E-08	4.2E-10	4.7E-07	6.1E-08	2.0E-06	9.5E-05	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	2.8E-07	1.2E-08	1.4E-05	1.8E-06	9.6E-07	4.6E-05	0.3%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.01	0.02	3.1E-10	1.3E-11	1.4E-08	1.8E-09				--	--	1.0E-10	1.4E-08	4.0%	[B2]
Benzo(a)anthracene	0.14	0.19	3.3E-09	1.4E-10	1.2E-07	1.6E-08	1.1E-07	4.3E-06	0.0%	--	--	1.0E-10	1.2E-08	3.5%	[B2]
Benzo(a)pyrene	0.16	0.20	3.8E-09	1.6E-10	1.3E-07	1.7E-08	1.2E-07	4.6E-06	0.0%	--	--	1.1E-09	1.3E-07	36.9%	[B2]
Benzo(b)fluoranthene	0.17	0.22	3.8E-09	1.6E-10	1.5E-07	1.9E-08	1.3E-07	5.0E-06	0.0%	--	--	1.2E-10	1.4E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.18	0.23	4.1E-09	1.7E-10	1.5E-07	2.0E-08	1.3E-07	5.2E-06	0.0%	--	--	1.3E-10	1.4E-08	4.2%	[B2]
Chrysene	0.15	0.20	3.5E-09	1.5E-10	1.3E-07	1.7E-08	1.1E-07	4.4E-06	0.0%	--	--	1.1E-11	1.2E-09	0.4%	[B2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	4.1E-09	1.7E-10	1.4E-07	1.8E-08	1.3E-07	4.8E-06	0.0%	--	--	1.3E-10	1.3E-08	3.9%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.7E-04	1.4E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.3E-09	3.5E-07	100.0%	

Table M.327. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – open) – Area S8–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	7.75E-08	9.99E-09	1.03E-06	4.40E-07	1.11E-06	1.47E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	7.63E-09	9.81E-10	1.29E-07	5.54E-08	7.63E-09	1.29E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.81E-08	2.33E-09	2.14E-07	9.18E-08	4.87E-07	5.79E-06	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.63E-07	3.38E-08	4.04E-06	1.73E-06	5.26E-05	8.08E-04	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.62E-09	3.37E-10	3.85E-08	1.65E-08	8.72E-06	1.28E-04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.22E-09	1.06E-09	1.38E-07	5.91E-08	1.17E-06	1.97E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	6.72E-08	8.65E-09	8.89E-07	3.81E-07	2.24E-07	2.96E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.28E+00	7.70E+00	6.08E-09	7.82E-10	7.54E-08	3.23E-08	6.08E-08	7.54E-07	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.27E-11	2.92E-12	2.45E-10	1.05E-10	7.58E-07	8.15E-06	0.8%	liver; lesions, toxicity	1000	4.97E-11	1.78E-09	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	9.30E-09	1.20E-09	1.36E-07	5.81E-08	4.65E-07	6.78E-06	0.7%	liver; weight inc.	1000	1.67E-11	8.13E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.98E-09	5.12E-10	4.59E-08	1.97E-08	3.98E-07	4.59E-06	0.4%	liver; lesions, fatty cyst formation	1000	3.12E-12	1.20E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	3.93E-11	5.06E-12	4.83E-10	2.07E-10	7.86E-08	9.67E-07	0.1%	liver; lesions	100	1.72E-12	7.04E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.79E-11	4.87E-12	4.69E-10	2.10E-10	7.58E-07	9.78E-06	0.9%	liver; lesions	100	7.80E-11	3.32E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	3.78E-11	4.87E-12	4.69E-10	2.10E-10	1.26E-07	1.63E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.78E-11	2.29E-12	2.29E-10	9.83E-11	5.93E-08	7.64E-07	0.1%	liver, kidney; toxicity	1000	2.97E-12	1.28E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.11E-11	2.72E-12	2.45E-10	1.05E-10	1.63E-06	1.88E-05	1.8%	liver; inc. relative weight	1000	2.47E-11	9.54E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	4.09E-09	5.26E-10	4.73E-08	2.03E-08	4.09E-07	4.73E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		8.27E-01		3.27E+01						1.32E-11	5.15E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		9.29E-01		3.98E+01						2.60E-11	1.12E-09	68.4%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	6.90E-05	1.04E-03	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.77E-10	7.22E-09	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	3.92E-11	1.63E-09	100.0%

Table M.328. Risk characterization for surface water: children – ingestion exposure (swimming)(current land use – open) – Area S8–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BFA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.07E–07	4.59E–09	1.47E–06	1.89E–07	1.53E–06	2.10E–05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.06E–08	4.52E–10	1.85E–07	2.37E–08	1.06E–08	1.85E–07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.50E–08	1.07E–09	3.06E–07	3.94E–08	6.77E–07	8.27E–06	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.66E–07	1.56E–08	5.77E–06	7.42E–07	7.27E–05	1.15E–03	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.62E–09	1.55E–10	5.50E–08	7.07E–09	1.21E–05	1.83E–04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.14E–08	4.87E–10	1.97E–07	2.53E–08	1.62E–06	2.82E–05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.30E–08	3.99E–09	1.27E–06	1.63E–07	3.10E–07	4.23E–06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.41E–09	3.60E–10	1.08E–07	1.38E–08	8.41E–08	1.08E–06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.37E–02	2.50E–02	3.14E–11	1.35E–12	3.49E–10	4.49E–11	1.05E–06	1.16E–05	0.8%	liver; lesions, toxicity	1000	2.29E–11	7.64E–10	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.29E–08	5.53E–10	1.94E–07	2.49E–08	6.43E–07	9.68E–06	0.7%	liver; weight inc.	1000	7.72E–12	3.48E–10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.51E–09	2.36E–10	6.55E–08	8.42E–09	5.51E–07	6.55E–06	0.4%	liver; lesions, fatty cyst formation	1000	1.44E–12	5.14E–11	1.7%	[B2]
4,4'–DDT	4.02E–02	4.94E–02	5.44E–11	2.33E–12	6.91E–10	8.88E–11	1.09E–07	1.38E–06	0.1%	liver; lesions	100	7.93E–13	3.02E–11	1.0%	[B2]
Dieldrin	3.87E–02	5.00E–02	5.24E–11	2.25E–12	6.99E–10	8.99E–11	1.05E–06	1.40E–05	0.9%	liver; lesions	100	3.59E–11	1.44E–09	46.5%	[B2]
Endrin	3.87E–02	5.00E–02	5.24E–11	2.24E–12	6.99E–10	8.99E–11	1.75E–07	2.33E–06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.82E–02	2.34E–02	2.46E–11	1.05E–12	3.28E–10	4.21E–11	8.20E–08	1.09E–06	0.1%	liver, kidney; toxicity	1000	1.37E–12	5.47E–11	1.8%	[C]
Heptachlor Epoxide	2.16E–02	2.50E–02	2.92E–11	1.25E–12	3.49E–10	4.49E–11	2.25E–06	2.69E–05	1.8%	liver; inc. relative weight	1000	1.14E–11	4.09E–10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.66E–09	2.42E–10	6.76E–08	8.70E–09	5.66E–07	6.76E–06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		2.76E–01		9.66E+00						4.41E–12	1.55E–10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		3.10E–01		1.19E+01						8.67E–12	3.35E–10	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.55E–05	1.48E–03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.16E–11	3.10E–09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E–11	4.89E–10	100.0%	

Table M.329. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – open) – Area S8–C1–O

Chemical	MLB Concentration (GAW)	RMB Concentration (GAW)	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	BPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.00E-09	7.70E-10	1.04E-07	4.47E-08	8.57E-08	1.49E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.60E+00	1.32E+01	5.91E-10	7.60E-11	1.31E-08	5.62E-09	5.91E-10	1.31E-08	0.0%	no observed effects	100				
Copper	1.65E+01	2.19E+01	1.40E-09	1.80E-10	2.18E-08	9.33E-09	3.79E-08	5.88E-07	0.0%	Gastrointestinal system; irritation	– –				[D]
Manganese (water)	2.69E+02	4.13E+02	2.04E-08	2.62E-09	4.10E-07	1.76E-07	4.07E-06	8.21E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.03E-10	2.61E-11	3.91E-09	1.68E-09	6.76E-07	1.30E-05	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.36E-10	8.18E-11	1.40E-08	6.01E-09	9.09E-08	2.00E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.21E-09	6.69E-10	9.09E-08	3.87E-08	1.74E-08	3.01E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.94E-09	3.78E-10	4.78E-08	2.05E-08	2.94E-08	4.78E-07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.76E-11	2.26E-12	2.48E-10'	1.06E-10	5.87E-07	8.28E-06	0.7%	liver; lesions, toxicity	1000	3.85E-11	1.81E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.48E-07	1.91E-08	2.84E-06	1.22E-06	7.42E-06	1.42E-04	12.0%	liver; weight inc.	1000	2.67E-10	1.70E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.72E-08	2.21E-09	2.59E-07	1.11E-07	1.72E-06	2.59E-05	2.2%	liver; lesions, fattycyst formation	1000	1.35E-11	6.77E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.18E-09	1.05E-09	1.32E-07	5.65E-08	1.64E-05	2.64E-04	22.3%	liver; lesions	100	3.58E-10	1.92E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	5.87E-06	9.94E-05	8.4%	liver; lesions	100	6.04E-10	3.41E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	9.77E-07	1.66E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.87E-02	2.34E-02	1.21E-10	1.55E-11	2.04E-09	8.73E-10	4.02E-07	6.79E-06	0.6%	liver, kidney; toxicity	1000	2.01E-11	1.14E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.23E-10	4.15E-11	4.91E-09	2.10E-09	2.49E-05	3.77E-04	31.9%	liver; inc. relative weight	1000	3.78E-10	1.91E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.50E-08	1.22E-08	1.44E-06	6.18E-07	9.50E-06	1.44E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.27E-05	1.18E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.68E-09	9.31E-08	100.0%	

Table M.330. Risk characterization for surface waters: children — dermal exposure (swimming and wading) (current land use — open) — Area S8—C1—O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.16E-09	2.65E-10	1.12E-07	1.44E-08	8.83E-08	1.60E-06	0.1%	*oral*—cardiovasc. sys.; inc. blood pressure. *inhal.*—fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	6.06E-10	2.60E-11	1.41E-08	1.82E-09	6.06E-10	1.41E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.44E-09	6.19E-11	2.34E-08	3.01E-09	3.96E-08	6.33E-07	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.10E-08	8.99E-10	4.42E-07	5.68E-08	4.20E-06	8.84E-05	6.9%	*oral*—CNS effects. *inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.09E-10	8.95E-12	4.21E-09	5.41E-10	6.96E-07	1.40E-05	1.1%	*oral*—CNS; neurotoxicity. *inhal.*—kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.56E-10	2.81E-11	1.51E-08	1.94E-09	9.37E-08	2.16E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.37E-09	2.30E-10	9.72E-08	1.25E-08	1.79E-08	3.24E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	3.03E-09	1.30E-10	5.15E-08	6.62E-09	3.03E-08	5.15E-07	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.68E-11	7.77E-13	2.67E-10	3.44E-11	6.05E-07	8.92E-06	0.7%	liver; lesions, toxicity	1000	1.32E-11	5.85E-10	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.53E-07	6.56E-09	3.06E-06	3.93E-07	7.65E-06	1.53E-04	12.0%	liver; weight inc.	1000	9.18E-11	5.50E-09	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.77E-08	7.58E-10	2.79E-07	3.59E-08	1.77E-06	2.79E-05	2.2%	liver; lesions, fatty cyst formation	1000	4.62E-12	2.19E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.43E-09	3.61E-10	1.42E-07	1.83E-08	1.69E-05	2.84E-04	22.3%	liver; lesions	100	1.23E-10	6.21E-09	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.02E-10	1.30E-11	5.35E-09	6.88E-10	6.05E-06	1.07E-04	8.4%	liver; lesions	100	2.07E-10	1.10E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	3.02E-10	1.29E-11	5.35E-09	6.88E-10	1.01E-06	1.78E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.24E-10	5.32E-12	2.19E-09	2.82E-10	4.14E-07	7.31E-06	0.6%	liver, kidney; toxicity	1000	6.92E-12	3.67E-10	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.33E-10	1.43E-11	5.28E-09	6.79E-10	2.56E-05	4.06E-04	31.9%	liver; inc. relative weight	1000	1.30E-10	6.18E-09	20.6%	[B2]
Tetrachloroethylene	4.16E+00	4.84E+00	9.79E-08	4.20E-09	1.55E-06	2.00E-07	9.79E-06	1.55E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.49E-05	1.28E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.77E-10	3.01E-08	100.0%	

Table M.331. Risk characterization for sediments: adults – dermal exposure (current land use – open) – Area S8–C1–O

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.07E-10	1.37E-11	4.51E-09	1.93E-09	3.56E-07	1.50E-05	16.3%	skin; keratosis, hyperpigmentation	3	2.41E-11	3.38E-09	8.7%	[A]
Barium	78.13	88.46	1.83E-09	2.36E-10	7.56E-08	3.24E-08	2.62E-08	1.08E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.15E-11	2.76E-12	8.77E-10	3.76E-10	4.30E-09	1.75E-07	0.2%	no observed effects	100	1.19E-11	1.62E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.33E-11	4.28E-12	1.46E-09	6.27E-10	3.33E-08	1.46E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.12E-09	1.44E-10	4.71E-08	2.02E-08	1.12E-09	4.71E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.63E-10	7.24E-11	2.55E-08	1.09E-08	1.52E-08	6.90E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.24E-09	1.60E-10	8.51E-08	3.65E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.08E-08	2.68E-09	8.86E-07	3.80E-07	1.49E-07	6.33E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.51E-10	4.51E-11	1.75E-08	7.50E-09	1.17E-06	5.83E-05	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.43E-10	6.99E-11	2.37E-08	1.02E-08	2.72E-08	1.18E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.01	33.74	6.82E-10	8.77E-11	2.86E-08	1.24E-08	9.74E-08	4.12E-06	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.28E-09	2.93E-10	1.03E-07	4.43E-08	7.60E-09	3.44E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.42E-11	3.11E-12	1.40E-09	5.95E-10				--	--	2.40E-11	4.61E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.90E-11	2.44E-12	1.19E-09	5.08E-10				--	--	1.88E-11	3.91E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.64E-11	9.82E-12	4.42E-09	1.90E-09	2.55E-09	1.47E-07	0.2%	--	--	7.17E-12	1.38E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.40E-11	9.52E-12	4.15E-09	1.78E-09	2.47E-09	1.38E-07	0.2%	--	--	6.95E-11	1.30E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.60E-11	1.13E-11	4.97E-09	2.13E-09	2.93E-09	1.66E-07	0.2%	--	--	8.20E-12	1.55E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.21E-11	9.27E-12	3.35E-09	1.45E-09	2.40E-09	1.13E-07	0.1%	--	--	6.77E-12	1.06E-09	2.7%	[B2]
Chrysene	0.31	0.49	7.26E-11	9.34E-12	4.20E-09	1.80E-09	2.42E-09	1.40E-07	0.2%	--	--	6.82E-13	1.31E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.15E-11	6.63E-12	2.06E-09	8.85E-10	1.72E-09	6.88E-08	0.1%	--	--	4.84E-11	6.46E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.80E-12	2.32E-13	1.16E-10	4.95E-11	3.61E-08	2.31E-06	2.5%	liver; lesions	100	3.71E-12	7.92E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.47E-11	8.32E-12	3.24E-09	1.39E-09	2.16E-09	1.08E-07	0.1%	--	--	6.07E-12	1.01E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.94E-06	9.19E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.29E-10	3.86E-08	100.0%	

Table M.322. Risk characterization for sediments: children – dermal exposure (current land use – open) – Area S8–C1–O

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	IRPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	IRPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.1E-10	4.7E-12	4.8E-09	6.2E-10	3.6E-07	1.6E-05	16.3%	skin; keratosis, hyperpigmentation	3	8.2E-12	1.0E-09	8.7%	[A]
Barium	78.13	88.46	1.8E-09	8.1E-11	8.1E-08	1.0E-08	2.7E-08	1.1E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.2E-11	9.4E-13	9.4E-10	1.2E-10	4.4E-09	1.8E-07	0.2%	no observed effects	100	4.0E-12	5.2E-10	4.2%	[B2]
Cadmium	1.42	1.71	3.4E-11	1.4E-12	1.5E-09	2.0E-10	3.4E-08	1.5E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.1E-09	4.9E-11	5.0E-08	6.5E-09	1.1E-09	5.0E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.8E-10	2.4E-11	2.7E-08	3.5E-09	1.5E-08	7.4E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.2E-09	5.4E-11	9.1E-08	1.1E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.1E-08	9.1E-10	9.5E-07	1.2E-07	1.5E-07	6.8E-06	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.6E-10	1.5E-11	1.8E-08	2.4E-09	1.2E-06	6.2E-05	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.6E-10	2.4E-11	2.5E-08	3.2E-09	2.8E-08	1.2E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	35.74	7.0E-10	3.0E-11	3.1E-08	3.9E-09	1.0E-07	4.4E-06	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.3E-09	1.0E-10	1.1E-07	1.4E-08	7.8E-09	3.7E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.5E-11	1.0E-12	1.5E-09	1.9E-10				--	--	8.2E-12	1.4E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.9E-11	8.3E-13	1.2E-09	1.6E-10				--	--	6.4E-12	1.2E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.8E-11	3.3E-12	4.7E-09	6.1E-10	2.6E-09	1.5E-07	0.2%	--	--	2.4E-12	4.4E-10	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.6E-11	3.2E-12	4.4E-09	5.7E-10	2.5E-09	1.4E-07	0.2%	--	--	2.3E-11	4.1E-09	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	9.0E-11	3.8E-12	5.3E-09	6.8E-10	3.0E-09	1.7E-07	0.2%	--	--	2.8E-12	5.0E-10	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.4E-11	3.1E-12	3.6E-09	4.6E-10	2.4E-09	1.2E-07	0.1%	--	--	2.3E-12	3.4E-10	2.7%	[B2]
Chrysene	0.31	0.49	7.4E-11	3.2E-12	4.5E-09	5.8E-10	2.4E-09	1.5E-07	0.2%	--	--	2.3E-13	4.2E-11	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.3E-11	2.2E-12	2.2E-09	2.8E-10	1.7E-09	7.4E-08	0.1%	--	--	1.6E-11	2.0E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.8E-12	7.9E-14	1.2E-10	1.6E-11	3.7E-08	2.4E-06	2.5%	liver; lesions	100	1.2E-12	2.5E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.6E-11	2.8E-12	3.4E-09	4.4E-10	2.2E-09	1.1E-07	0.1%	--	--	2.0E-12	3.2E-10	2.6%	[B2]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	2.0E-06	9.9E-05	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	7.8E-11	1.2E-08	100.0%

Table M.333. Risk characterization for soils: adults – ingestion exposure (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	0.65	0.70	2.76E-07	3.54E-08	9.58E-07	4.11E-07	6.89E-04	2.40E-03	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	3.04E-06	3.91E-07	1.04E-05	4.47E-06	1.01E-02	3.48E-02	11.8%	skin; keratosis, hyperpigmentation	3	6.84E-07	7.83E-06	68.4%	[A]
Barium	115.90	140.80	4.90E-05	6.30E-06	1.93E-04	8.27E-05	7.00E-04	2.76E-03	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	3.41E-07	4.38E-08	1.24E-06	5.29E-07	6.82E-05	2.47E-04	0.1%	no observed effects	100	1.88E-07	2.28E-06	19.9%	[B2]
Cadmium	3.29	5.33	1.39E-06	1.79E-07	7.29E-06	3.13E-06	1.39E-03	7.29E-03	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	2.99E-05	3.84E-06	1.04E-04	4.44E-05	2.99E-05	1.04E-04	0.0%	no observed effects	100				
Copper	115.30	199.90	4.87E-05	6.27E-06	2.74E-04	1.17E-04	1.32E-03	7.40E-03	2.5%	Gastrointestinal system; irritation	--				[D]
Lead	52.40	77.84	2.21E-05	2.85E-06	1.07E-04	4.57E-05				CNS, blood	--				[B2]
Manganese	857.50	1076.00	3.62E-04	4.66E-05	1.47E-03	6.32E-04	2.59E-03	1.05E-02	3.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	35.68	49.11	1.51E-05	1.94E-06	6.73E-05	2.88E-05	5.03E-02	2.24E-01	75.9%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	1.42E-05	1.82E-06	6.62E-05	2.84E-05	7.08E-04	3.31E-03	1.1%	dec. body and organ weight	300				
Selenium	6.44	6.94	2.72E-06	3.50E-07	9.51E-06	4.07E-06	5.44E-04	1.90E-03	0.6%	whole body; clinical selenosis	3				[D]
Silver	4.31	6.96	1.82E-06	2.34E-07	9.53E-06	4.08E-06	3.65E-04	1.91E-03	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	5.26E-05	6.76E-06	2.81E-04	1.20E-04	1.75E-04	9.37E-04	0.3%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.01	0.02	5.73E-09	7.36E-10	2.88E-08	1.23E-08				--	--	5.67E-09	9.49E-08	0.8%	[B2]
Benzo(a)anthracene	0.14	0.19	6.04E-08	7.83E-09	2.60E-07	1.11E-07	2.03E-06	8.65E-06	0.0%	--	--	5.72E-09	8.12E-08	0.7%	[B2]
Benzo(a)pyrene	0.16	0.20	6.92E-08	8.90E-09	2.77E-07	1.19E-07	2.31E-06	9.23E-06	0.0%	--	--	6.49E-08	8.67E-07	7.6%	[B2]
Benzo(b)fluoranthene	0.17	0.22	7.08E-08	9.11E-09	3.02E-07	1.29E-07	2.36E-06	1.01E-05	0.0%	--	--	6.65E-09	9.45E-08	0.8%	[B2]
Benzo(k)fluoranthene	0.18	0.23	7.56E-08	9.72E-09	3.18E-07	1.36E-07	2.52E-06	1.06E-05	0.0%	--	--	7.10E-09	9.93E-08	0.9%	[B2]
Chrysene	0.15	0.20	6.45E-08	8.29E-09	2.67E-07	1.14E-07	2.15E-06	8.90E-06	0.0%	--	--	6.05E-10	8.36E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	7.54E-08	9.70E-09	2.94E-07	1.26E-07	2.51E-06	9.79E-06	0.0%	--	--	7.08E-09	9.19E-08	0.8%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.36	2.29		1.32E+02		2.40E+03									
Cobalt 60	0.04	0.06		4.05E+00		5.82E+01						3.69E-09	6.73E-08	11.2%	[A]
Neptunium 237+D	0.12	0.35		1.19E+01		3.64E+02						6.07E-11	8.73E-10	0.1%	[A]
Protactinium 233	0.05	0.16		5.21E+00		1.69E+02						2.62E-09	8.01E-08	13.4%	[A]
Thorium 228+D	1.74	2.30		1.69E+02		2.42E+03						5.21E-12	1.69E-10	0.0%	[A]
Thorium 232	1.09	1.61		1.06E+02		1.69E+03						9.31E-09	1.33E-07	22.2%	[A]
Uranium 234	5.51	6.77		5.36E+02		7.11E+03						1.27E-09	2.03E-08	3.4%	[A]
Uranium 235+D	0.24	0.29		2.31E+01		3.06E+02						8.58E-09	1.14E-07	19.0%	[A]
Uranium 238+D	5.08	6.05		4.94E+02		6.36E+03						3.70E-10	4.90E-09	0.8%	[A]
												1.38E-08	1.78E-07	29.8%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	6.83E-02	2.93E-01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	9.70E-07	1.14E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	3.97E-08	5.98E-07	100.0%

Table M.334. Risk characterization for soils: children – ingestion exposure (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Antimony	0.65	0.70	9.65E-07	4.13E-08	3.43E-06	4.41E-07	2.41E-03	8.58E-03	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	1.06E-05	4.56E-07	3.74E-05	4.81E-06	3.55E-02	1.25E-01	11.8%	skin; keratosis, hyperpigmentation	3	7.99E-07	8.41E-06	68.4%	[A]
Barium	115.90	140.80	1.71E-04	7.35E-06	6.91E-04	8.88E-05	2.45E-03	9.87E-03	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	1.19E-06	5.11E-08	4.42E-06	5.69E-07	2.35E-04	8.85E-04	0.1%	no observed effects	100	2.20E-07	2.45E-06	19.9%	[B2]
Cadmium	3.29	5.33	4.86E-06	2.08E-07	2.61E-05	3.36E-06	4.86E-03	2.61E-02	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	1.04E-04	4.46E-06	3.71E-04	4.77E-05	1.04E-04	3.71E-04	0.0%	no observed effects	100				
Copper	115.30	199.90	1.71E-04	7.31E-06	9.81E-04	1.26E-04	4.61E-03	2.65E-02	2.5%	Gastrointestinal system; irritation	--				[D]
Lead	52.40	77.84	7.75E-05	3.32E-06	3.82E-04	4.91E-05				CNS, blood	--				[B2]
Manganese	857.50	1076.00	1.27E-03	5.44E-05	5.26E-03	6.75E-04	9.06E-03	3.77E-02	3.6%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	35.68	49.11	5.28E-05	2.26E-06	2.41E-04	3.10E-05	1.76E-01	8.03E-01	75.9%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	4.95E-05	2.12E-06	2.37E-04	3.05E-05	2.48E-03	1.19E-02	1.1%	dec. body and organ weight	300				
Selenium	6.44	6.94	9.53E-06	4.08E-07	3.40E-05	4.38E-06	1.91E-03	6.81E-03	0.6%	whole body; clinical selenosis	3				[D]
Silver	4.31	6.96	6.38E-06	2.73E-07	3.41E-05	4.39E-06	1.28E-03	6.83E-03	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	1.84E-04	7.89E-06	1.01E-03	1.29E-04	6.13E-04	3.35E-03	0.3%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.01	0.02	2.00E-08	8.59E-10	1.03E-07	1.32E-08				--	--	6.62E-09	1.02E-07	0.8%	[B2]
Benzo(a)anthracene	0.14	0.19	2.13E-07	9.14E-09	9.30E-07	1.20E-07	7.11E-06	3.10E-05	0.0%	--	--	6.67E-09	8.72E-08	0.7%	[B2]
Benzo(a)pyrene	0.16	0.20	2.42E-07	1.04E-08	9.92E-07	1.28E-07	8.07E-06	3.31E-05	0.0%	--	--	7.58E-08	9.31E-07	7.6%	[B2]
Benzo(b)fluoranthene	0.17	0.22	2.48E-07	1.06E-08	1.08E-06	1.39E-07	8.27E-06	3.60E-05	0.0%	--	--	7.76E-09	1.01E-07	0.8%	[B2]
Benzo(k)fluoranthene	0.18	0.23	2.65E-07	1.13E-08	1.14E-06	1.46E-07	8.82E-06	3.79E-05	0.0%	--	--	8.28E-09	1.07E-07	0.9%	[B2]
Chrysene	0.15	0.20	2.26E-07	9.68E-09	9.57E-07	1.23E-07	7.53E-06	3.19E-05	0.0%	--	--	7.06E-10	8.98E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	2.64E-07	1.13E-08	1.05E-06	1.35E-07	8.80E-06	3.51E-05	0.0%	--	--	8.26E-09	9.87E-08	0.8%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.36	2.29		5.50E+01		9.59E+02						1.54E-09	2.68E-08	11.2%	[A]
Cobalt 60	0.04	0.06		1.69E+00		2.32E+01						2.53E-11	3.48E-10	0.1%	[A]
Neptunium 237+D	0.12	0.35		4.96E+00		1.45E+02						1.09E-09	3.20E-08	13.4%	[A]
Protactinium 233	0.05	0.16		2.17E+00		6.73E+01						2.17E-12	6.73E-11	0.0%	[A]
Thorium 228+D	1.74	2.30		7.06E+01		9.64E+02						3.88E-09	5.30E-08	22.2%	[A]
Thorium 232	1.09	1.61		4.41E+01		6.74E+02						5.29E-10	8.09E-09	3.4%	[A]
Uranium 234	5.51	6.77		2.23E+02		2.84E+03						3.57E-09	4.54E-08	19.0%	[A]
Uranium 235+D	0.24	0.29		9.63E+00		1.22E+02						1.54E-10	1.96E-09	0.8%	[A]
Uranium 238+D	5.08	6.05		2.06E+02		2.54E+03						5.76E-09	7.10E-08	29.8%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.39E-01	1.06E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.13E-06	1.23E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.66E-08	2.39E-07	100.0%	

Table M.335. Risk characterization for soils: adults – dermal exposure (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration in Soils	BMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (BMB)	CDI Carc. Effects (BMB)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (BMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern. Target Tissue	IRIS UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (BMB)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS **(mg/kg)**															
Antimony	0.65	0.70	9.92E-09	1.28E-09	1.04E-07	4.44E-08	2.48E-05	2.59E-04	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	1.10E-07	1.41E-08	1.13E-06	4.84E-07	3.65E-04	3.76E-03	11.8%	skin; keratosis, hyperpigmentation	3	2.46E-08	8.47E-07	33.4%	[A]
Barium	115.90	140.80	1.76E-06	2.27E-07	2.08E-05	8.94E-06	2.52E-05	2.98E-04	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	1.23E-08	1.58E-09	1.34E-07	5.72E-08	2.45E-06	2.67E-05	0.1%	no observed effects	100	6.78E-09	2.46E-07	9.7%	[D2]
Cadmium	3.29	5.33	5.00E-08	6.43E-09	7.85E-07	3.38E-07	5.00E-05	7.85E-04	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	1.07E-06	1.38E-07	1.12E-05	4.80E-06	1.07E-06	1.12E-05	0.0%	no observed effects	100				
Copper	115.30	199.90	1.75E-06	2.26E-07	2.96E-05	1.27E-05	4.74E-05	8.00E-04	2.5%	Gastrointestinal system; irritation	--				
Lead	52.40	77.84	7.97E-07	1.03E-07	1.15E-05	4.94E-06				CNS, blood	--				[D]
Manganese	857.50	1076.00	1.30E-05	1.68E-06	1.59E-04	6.83E-05	9.32E-05	1.14E-03	3.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D2]
Mercury	35.68	49.11	5.43E-07	6.98E-08	7.27E-06	3.12E-06	1.81E-03	2.42E-02	75.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	5.10E-07	6.55E-08	7.16E-06	3.07E-06	2.55E-05	3.58E-04	1.1%	dec. body and organ weight	300				[D]
Selenium	6.44	6.94	9.80E-08	1.26E-08	1.03E-06	4.40E-07	1.96E-05	2.06E-04	0.6%	whole body; clinical selenosis	3				
Silver	4.31	6.96	6.56E-08	8.44E-09	1.03E-06	4.42E-07	1.31E-05	2.06E-04	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	1.89E-06	2.43E-07	3.04E-05	1.30E-05	6.31E-06	1.01E-04	0.3%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor–1260	0.01	0.02	2.06E-09	2.65E-10	3.11E-08	1.33E-08				--	--	2.04E-09	1.03E-07	4.0%	[D2]
Benzo(a)anthracene	0.14	0.19	2.19E-08	2.82E-09	2.86E-07	1.20E-07	7.31E-07	9.35E-06	0.0%	--	--	2.06E-09	8.78E-08	3.5%	[D2]
Benzo(a)pyrene	0.16	0.20	2.49E-08	3.20E-09	2.95E-07	1.28E-07	8.30E-07	9.98E-06	0.0%	--	--	2.34E-08	9.37E-07	36.9%	[D2]
Benzo(b)fluoranthene	0.17	0.22	2.55E-08	3.28E-09	3.26E-07	1.40E-07	8.50E-07	1.09E-05	0.0%	--	--	2.39E-09	1.02E-07	4.0%	[D2]
Benzo(k)fluoranthene	0.18	0.23	2.72E-08	3.50E-09	3.43E-07	1.47E-07	9.07E-07	1.14E-05	0.0%	--	--	2.56E-09	1.07E-07	4.2%	[D2]
Chrysene	0.15	0.20	2.32E-08	2.99E-09	2.89E-07	1.24E-07	7.74E-07	9.63E-06	0.0%	--	--	2.18E-10	9.03E-09	0.4%	[D2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	2.71E-08	3.49E-09	3.17E-07	1.36E-07	9.05E-07	1.06E-05	0.0%	--	--	2.55E-09	9.93E-08	3.9%	[D2]
Chemical Hazards:															
Hazard Index (HI):							2.46E-05	3.20E-02	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												6.66E-08	2.54E-06	100.0%	

Table M.336. Risk characterization for soils: children – dermal exposure (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	Risk Estimates: RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Antimony	0.65	0.70	1.2E-08	5.5E-10	1.3E-07	1.7E-08	3.2E-05	3.3E-04	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	1.4E-07	6.1E-09	1.4E-06	1.9E-07	4.7E-04	4.9E-03	11.8%	skin; keratosis, hyperpigmentation	3	1.0E-08	3.3E-07	33.4%	[A]
Barium	115.90	140.80	2.3E-06	9.8E-08	2.7E-05	3.5E-06	3.2E-05	3.9E-04	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	1.6E-08	6.8E-10	1.7E-07	2.2E-08	3.2E-06	3.4E-05	0.1%	no observed effects	100	2.9E-09	9.6E-08	9.7%	[B2]
Cadmium	3.29	5.33	6.5E-08	2.7E-09	1.0E-06	1.3E-07	6.5E-05	1.0E-03	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	1.4E-06	6.0E-08	1.4E-05	1.8E-06	1.4E-06	1.4E-05	0.0%	no observed effects	100				
Copper	115.30	199.90	2.2E-06	9.8E-08	3.8E-05	4.9E-06	6.1E-05	1.0E-03	2.5%	Gastrointestinal system; irritation	--				[D]
Lead	52.40	77.84	1.0E-06	4.4E-08	1.5E-05	1.9E-06				CNS, blood	--				[B2]
Manganese	857.50	1076.00	1.7E-05	7.2E-07	2.0E-04	2.6E-05	1.2E-04	1.4E-03	3.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	35.68	49.11	7.0E-07	3.0E-08	9.5E-06	1.2E-06	2.3E-03	3.1E-02	75.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	6.6E-07	2.8E-08	9.3E-06	1.2E-06	3.3E-05	4.6E-04	1.1%	dec. body and organ weight	300				
Selenium	6.44	6.94	1.2E-07	5.4E-09	1.3E-06	1.7E-07	2.5E-05	2.6E-04	0.6%	whole body; clinical selenosis	3				[D]
Silver	4.31	6.96	8.5E-08	3.6E-09	1.3E-06	1.7E-07	1.7E-05	2.6E-04	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	2.4E-06	1.0E-07	3.9E-05	5.1E-06	8.2E-06	1.3E-04	0.3%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.01	0.02	2.6E-09	1.1E-10	4.0E-08	5.2E-09				--	--	8.8E-10	4.0E-08	4.0%	[B2]
Benzo(a)anthracene	0.14	0.19	2.8E-08	1.2E-09	3.6E-07	4.7E-08	9.5E-07	1.2E-05	0.0%	--	--	8.9E-10	3.4E-08	3.5%	[B2]
Benzo(a)pyrene	0.16	0.20	3.2E-08	1.3E-09	3.9E-07	5.0E-08	1.0E-06	1.3E-05	0.0%	--	--	1.0E-08	3.6E-07	36.9%	[B2]
Benzo(b)fluoranthene	0.17	0.22	3.3E-08	1.4E-09	4.2E-07	5.4E-08	1.1E-06	1.4E-05	0.0%	--	--	1.0E-09	4.0E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.18	0.23	3.5E-08	1.5E-09	4.4E-07	5.7E-08	1.1E-06	1.5E-05	0.0%	--	--	1.1E-09	4.2E-08	4.2%	[B2]
Chrysene	0.15	0.20	3.0E-08	1.3E-09	3.7E-07	4.8E-08	1.0E-06	1.2E-05	0.0%	--	--	9.4E-11	3.5E-09	0.4%	[B2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	3.5E-08	1.5E-09	4.1E-07	5.3E-08	1.1E-06	1.3E-05	0.0%	--	--	1.1E-09	3.9E-08	3.9%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.2E-03	4.1E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.8E-08	9.9E-07	100.0%	

Table M.337. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	UF/A UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UF/A WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation	-- -				[D]
Manganese (water)	2.69E+02	4.13E+02	3.69E-06	4.75E-07	3.36E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.68E-08	4.72E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	0.4%	liver; lesions, fatty cyst formation	1000	4.37E-11	9.97E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.05E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.86E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.09E-09	2.79E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity	1000	4.16E-11	1.06E-09	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	1.8%	liver; inc. relative weight	1000	3.46E-10	7.94E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	9.67E-04	8.62E-03	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.48E-09	6.00E-08	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	5.49E-10	1.30E-08	100.0%

Table M.338. Risk characterization for surface water: children – ingestion exposure (swimming) (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	Risk Estimates: RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E–06	1.30E–07	2.30E–05	2.96E–06	4.34E–05	3.29E–04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E–07	1.28E–08	2.89E–06	3.72E–07	2.99E–07	2.89E–06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E–07	3.04E–08	4.88E–06	6.17E–07	1.92E–05	1.30E–04	0.6%	Gastrointestinal system; irritation	– –				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E–05	4.42E–07	9.05E–05	1.16E–05	2.06E–03	1.61E–02	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E–07	4.40E–09	8.62E–07	1.11E–07	3.42E–04	2.87E–03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E–07	1.38E–08	3.09E–06	3.97E–07	4.60E–05	4.41E–04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E–06	1.13E–07	1.99E–05	2.56E–06	8.79E–06	6.64E–05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E–07	1.02E–08	1.69E–06	2.17E–07	2.38E–06	1.69E–05	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E–02	2.50E–02	8.91E–10	3.82E–11	5.48E–09	7.05E–10	2.97E–05	1.83E–04	0.8%	liver; lesions, toxicity	1000	6.49E–10	1.20E–08	24.7%	[B2]
Bis(2–ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E–07	1.56E–08	3.04E–06	3.90E–07	1.82E–05	1.52E–04	0.7%	liver; weight inc.	1000	2.19E–10	5.46E–09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E–07	6.69E–09	1.03E–06	1.32E–07	1.56E–05	1.03E–04	0.4%	liver; lesions, fatty cyst formation	1000	4.08E–11	8.06E–10	1.7%	[B2]
4,4'–DDT	4.02E–02	4.94E–02	1.54E–09	6.60E–11	1.05E–08	1.39E–09	3.08E–06	2.17E–05	0.1%	liver; lesions	100	2.25E–11	4.73E–10	1.0%	[B2]
Dieldrin	3.87E–02	5.00E–02	1.49E–09	6.37E–11	1.10E–08	1.41E–09	2.97E–05	2.19E–04	0.9%	liver; lesions	100	1.02E–09	2.25E–08	46.5%	[B2]
Endrin	3.87E–02	5.00E–02	1.49E–09	6.36E–11	1.10E–08	1.41E–09	4.95E–06	3.65E–05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.87E–02	2.34E–02	6.97E–10	2.99E–11	5.14E–09	6.60E–10	2.32E–06	1.71E–05	0.1%	liver, kidney; toxicity	1000	3.89E–11	8.58E–10	1.8%	[C]
Heptachlor Epoxide	2.16E–02	2.30E–02	8.28E–10	3.55E–11	5.48E–09	7.05E–10	6.37E–05	4.21E–04	1.8%	liver; inc. relative weight	1000	3.23E–10	6.41E–09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E–07	6.87E–09	1.06E–06	1.36E–07	1.60E–05	1.06E–04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E–11	1.29E–09	31.6%	[A]
Uranium 238+D	4.15E+00	5.51E+00		4.35E+00		9.94E+01						1.21E–10	2.78E–09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.7E–03	2.32E–02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E–09	4.85E–08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E–10	4.07E–09	100.0%	

Table M.339. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.56E-06	0.0%	Gastrointestinal system; irritation	--				
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.20E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fatty cyst formation	1000	1.88E-10	7.57E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity	1000	2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; inc. relative weight	1000	5.29E-09	2.14E-07	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.02E-03	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.35E-08	1.04E-06	100.0%	

Table M.340. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – residential) – Area S8–C2–R

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E−07	4.65E−09	1.55E−06	1.96E−07	1.56E−06	2.18E−05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E−08	4.62E−10	1.92E−07	2.47E−08	1.08E−08	1.92E−07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E−08	1.10E−09	3.18E−07	4.09E−08	6.91E−07	8.60E−06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E−07	1.59E−08	6.00E−06	7.72E−07	7.43E−05	1.20E−03	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E−09	1.59E−10	5.72E−08	7.35E−09	1.23E−05	1.91E−04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E−08	4.98E−10	2.05E−07	2.64E−08	1.66E−06	2.93E−05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.50E−08	4.07E−09	1.32E−06	1.70E−07	3.17E−07	4.40E−06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E−08	2.30E−09	7.00E−07	9.00E−08	5.37E−07	7.00E−06	0.0%	loc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E−02	2.50E−02	3.22E−10	1.38E−11	3.63E−09	4.67E−10	1.07E−05	1.21E−04	0.7%	liver; lesions, toxicity	1000	2.34E−10	7.94E−09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.70E−06	1.16E−07	4.15E−05	5.34E−06	1.35E−04	2.08E−03	12.0%	liver; weight inc.	1000	1.63E−09	7.47E−08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E−07	1.34E−08	3.75E−06	4.87E−07	3.13E−05	3.79E−04	2.2%	liver; lesions, fattycyst formation	1000	8.19E−11	2.97E−09	0.7%	[B2]
4,4'–DDT	4.02E−02	4.94E−02	1.49E−07	6.40E−09	1.93E−06	2.48E−07	2.99E−04	3.86E−03	22.3%	liver; lesions	100	2.18E−09	8.44E−08	20.7%	[B2]
Dieldrin	3.87E−02	5.00E−02	5.36E−09	2.30E−10	7.27E−08	9.34E−09	1.07E−04	1.45E−03	8.4%	liver; lesions	100	3.67E−09	1.50E−07	36.6%	[B2]
Endrin	3.87E−02	5.00E−02	5.35E−09	2.29E−10	7.27E−08	9.34E−09	1.78E−05	2.42E−04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.82E−02	2.34E−02	2.20E−09	9.43E−11	2.98E−08	3.83E−09	7.33E−06	9.93E−05	0.6%	liver, kidney; toxicity	1000	1.23E−10	4.98E−09	1.2%	[C]
Heptachlor Epoxide	2.16E−02	2.50E−02	5.90E−09	2.53E−10	7.18E−08	9.23E−09	4.54E−04	5.52E−03	31.9%	liver; inc. relative weight	1000	2.30E−09	8.41E−08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E−06	7.43E−08	2.11E−05	2.71E−06	1.73E−04	2.11E−03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.35E−03	1.73E−02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E−08	4.08E−07	100.0%	

Table M.341. Risk characterization for sediments: adults – dermal exposure (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[B2]
Manganese	866.40	1036.00	1.42E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.04E-06	0.2%	--	--	5.02E-11	9.98E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.98E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.69E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-05	6.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-09	2.8E-07	100.0%	

Table M.342. Risk characterization for sediments: children – dermal exposure (current land use – residential) – Area S8–C2–R

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	IRPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	IRPA WOE
INORGANICS **(mg/kg)**															
Arsenic	4.55	5.27	9.76E−10	4.18E−11	4.24E−08	5.45E−09	3.25E−06	1.41E−04	16.3%	skin; keratosis, hyperpigmentation	3	7.32E−11	9.55E−09	8.7%	[A]
Barium	78.13	88.46	1.67E−08	7.17E−10	7.12E−07	9.16E−08	2.39E−07	1.02E−05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.96E−10	8.40E−12	8.25E−09	1.06E−09	3.92E−08	1.65E−06	0.2%	no observed effects	100	3.61E−11	4.56E−09	4.2%	[B2]
Cadmium	1.42	1.71	3.04E−10	1.30E−11	1.38E−08	1.77E−09	3.04E−07	1.38E−05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.02E−08	4.38E−10	4.43E−07	5.70E−08	1.02E−08	4.43E−07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.14E−09	2.20E−10	2.41E−07	3.09E−08	1.39E−07	6.50E−06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.13E−08	4.86E−10	8.01E−07	1.03E−07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.90E−07	8.14E−09	8.34E−06	1.07E−06	1.36E−06	5.96E−05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.20E−09	1.37E−10	1.65E−07	2.12E−08	1.07E−05	5.49E−04	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.96E−09	2.12E−10	2.23E−07	2.87E−08	2.48E−07	1.12E−05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.22E−09	2.67E−10	2.72E−07	3.49E−08	8.69E−07	3.88E−05	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.08E−08	8.91E−10	9.73E−07	1.25E−07	6.93E−08	3.24E−06	0.4%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor–1254	0.10	0.16	2.21E−10	9.47E−12	1.32E−08	1.69E−09				--	--	7.29E−11	1.30E−08	11.9%	[B2]
Aroclor–1260	0.08	0.14	1.73E−10	7.42E−12	1.12E−08	1.44E−09				--	--	5.71E−11	1.11E−08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.97E−10	2.99E−11	4.16E−08	5.35E−09	2.32E−08	1.39E−06	0.2%	--	--	2.18E−11	3.90E−09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.75E−10	2.89E−11	3.91E−08	5.02E−09	2.25E−08	1.30E−06	0.2%	--	--	2.11E−10	3.67E−08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.03E−10	3.44E−11	4.68E−08	6.01E−09	2.68E−08	1.56E−06	0.2%	--	--	2.51E−11	4.39E−09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.58E−10	2.82E−11	3.19E−08	4.10E−09	2.19E−08	1.06E−06	0.1%	--	--	2.06E−11	2.99E−09	2.7%	[B2]
Chrysene	0.31	0.49	6.62E−10	2.84E−11	3.96E−08	5.09E−09	2.21E−08	1.32E−06	0.2%	--	--	2.07E−12	3.71E−10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.70E−10	2.02E−11	1.94E−08	2.50E−09	1.57E−08	6.48E−07	0.1%	--	--	1.47E−10	1.82E−08	16.6%	[B2]
Dieldrin	0.01	0.01	1.64E−11	7.03E−13	1.05E−09	1.40E−10	3.29E−07	2.18E−05	2.5%	liver; lesions	100	1.13E−11	2.24E−09	2.0%	[B2]
Indeno(1,2,3–cd)pyrene	0.28	0.38	5.90E−10	2.53E−11	3.05E−08	3.92E−09	1.97E−08	1.02E−06	0.1%	--	--	1.85E−11	2.86E−09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.77E−05	8.66E−04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.97E−10	1.11E−07	100.0%	

Table M.343. Risk characterization for produce: adults – ingestion exposure (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration from Meso Concentration (mg/kg)	RME Concentration from UCL Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern (Target Tissue)	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	6.52E-03	7.00E-03	9.95E-07	1.28E-07	4.89E-06	2.09E-06	2.49E-03	1.22E-02	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	5.76E-01	6.10E-01	8.79E-05	1.13E-05	4.26E-04	1.83E-04	2.93E-01	1.42E+00	3.5%	skin; keratosis, hyperpigmentation	3	1.98E-05	3.19E-04	98.2%	[A]
Barium	1.16E+00	1.41E+00	1.77E-04	2.27E-05	9.84E-04	4.22E-04	2.53E-03	1.41E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	3.22E-03	3.61E-03	4.92E-07	6.33E-08	2.52E-06	1.08E-06	9.84E-05	5.04E-04	0.0%	no observed effects	100	2.72E-07	4.64E-06	1.4%	[B2]
Cadmium	1.64E+00	2.66E+00	2.51E-04	3.23E-05	1.86E-03	7.97E-04	2.51E-01	1.86E+00	4.6%	kidney; proteinuria	10				
Chromium (III)	7.06E-01	7.56E-01	1.08E-04	1.39E-05	5.28E-04	2.26E-04	1.08E-04	5.28E-04	0.0%	no observed effects	100				
Copper	5.77E+00	1.00E+01	8.86E-04	1.13E-04	6.98E-03	2.99E-03	2.38E-02	1.89E-01	0.5%	Gastrointestinal system; irritation	--				[D]
Lead	5.24E-01	7.78E-01	8.00E-05	1.03E-05	5.44E-04	2.33E-04				CNS, blood	--				[D2]
Manganese	3.43E+02	4.30E+02	5.23E-02	6.73E-03	3.00E-01	1.29E-01	3.74E-01	2.15E+00	5.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.07E+01	1.47E+01	1.63E-03	2.10E-04	1.03E-02	4.41E-03	5.44E+00	3.43E+01	84.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.67E+00	2.42E+00	2.56E-04	3.29E-05	1.69E-03	7.24E-04	1.28E-02	8.44E-02	0.2%	dec. body and organ weight	300				[D]
Selenium	6.44E-01	6.94E-01	9.85E-05	1.26E-05	4.85E-04	2.08E-04	1.97E-02	9.70E-02	0.2%	whole body; clinical selenosis	3				[D]
Silver	8.63E-01	1.39E+00	1.32E-04	1.69E-05	9.72E-04	4.17E-04	2.63E-02	1.94E-01	0.5%	skin; argyria	3				[D]
Zinc	4.98E+01	8.20E+01	7.59E-03	9.76E-04	5.73E-02	2.46E-02	2.53E-02	1.91E-01	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor–1260	1.33E-05	2.06E-05	2.03E-09	2.61E-10	1.44E-08	6.17E-09				--	--	2.01E-09	4.75E-08	0.0%	[B2]
Benzo(a)anthracene	5.35E-04	7.04E-04	8.17E-08	1.05E-08	4.92E-07	2.11E-07	2.72E-06	1.64E-05	0.0%	--	--	7.67E-09	1.54E-07	0.0%	[B2]
Benzo(a)pyrene	3.08E-04	3.81E-04	4.71E-08	6.05E-09	2.66E-07	1.14E-07	1.57E-06	8.87E-06	0.0%	--	--	4.42E-08	8.33E-07	0.3%	[B2]
Benzo(b)fluoranthene	2.49E-04	3.27E-04	3.79E-08	4.86E-09	2.28E-07	9.79E-08	1.26E-06	7.61E-06	0.0%	--	--	3.56E-09	7.14E-08	0.0%	[B2]
Benzo(k)fluoranthene	1.90E-04	2.46E-04	2.90E-08	3.73E-09	1.72E-07	7.38E-08	9.67E-07	5.74E-06	0.0%	--	--	2.72E-09	5.39E-08	0.0%	[B2]
Chrysene	6.65E-04	8.50E-04	1.00E-07	1.30E-08	5.94E-07	2.54E-07	3.38E-06	1.98E-05	0.0%	--	--	9.52E-10	1.86E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	6.45E-05	7.76E-05	9.85E-09	1.27E-09	5.42E-08	2.32E-08	3.28E-07	1.81E-06	0.0%	--	--	9.24E-10	1.70E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	4.07E-02	6.86E-02		1.43E+03		3.66E+04						4.00E-08	1.03E-06	34.1%	[A]
Cobalt 60	1.25E-03	1.66E-03		4.38E+01		8.90E+02						6.57E-10	1.34E-08	0.4%	[A]
Neptunium 237+D	4.90E-03	1.39E-02		1.72E+02		7.43E+03						3.76E-08	1.63E-06	54.1%	[A]
Protactinium 233	5.36E-04	1.61E-03		1.88E+01		8.60E+02						1.88E-11	8.60E-10	0.0%	[A]
Thorium 228+D	8.71E-04	1.15E-03		3.06E+01		6.16E+02						1.68E-09	3.39E-08	1.1%	[A]
Thorium 232	5.45E-04	8.05E-04		1.91E+01		4.31E+02						2.29E-10	5.17E-09	0.2%	[A]
Uranium 234	1.10E-02	1.35E-02		3.87E+02		7.25E+03						6.19E-09	1.16E-07	3.8%	[A]
Uranium 235+D	4.76E-04	5.83E-04		1.67E+01		3.12E+02						2.67E-10	5.00E-09	0.2%	[A]
Uranium 238+D	1.02E-02	1.21E-02		3.56E+02		6.48E+03						9.98E-09	1.87E-07	6.0%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	6.47E+00	4.05E+01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	2.01E-05	3.29E-04	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	9.68E-08	3.02E-06	100.0%

Table M.344. Risk characterization for produce: children – ingestion exposure (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration from Media Concentration (mg/kg)	RME Concentration from UCL Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	BPA Wgt
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	6.52E-03	7.00E-03	2.22E-06	9.55E-08	1.01E-05	1.30E-06	5.56E-03	2.53E-02	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	5.76E-01	6.10E-01	1.96E-04	8.42E-06	8.86E-04	1.14E-04	6.55E-01	2.95E+00	3.5%	skin; keratosis, hyperpigmentation	3	1.47E-05	1.99E-04	98.2%	[A]
Barium	1.16E+00	1.41E+00	3.95E-04	1.69E-05	2.04E-03	2.62E-04	5.65E-03	2.92E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	3.22E-03	3.61E-03	1.10E-06	4.71E-08	5.23E-06	6.72E-07	2.20E-04	1.05E-03	0.0%	no observed effects	100	2.03E-07	2.89E-06	1.4%	[B2]
Cadmium	1.64E+00	2.66E+00	5.61E-04	2.40E-05	3.86E-03	4.96E-04	5.61E-01	3.86E+00	4.6%	kidney; proteinuria	10				
Chromium (III)	7.06E-01	7.56E-01	2.41E-04	1.03E-05	1.10E-03	1.41E-04	2.41E-04	1.10E-03	0.0%	no observed effects	100				
Copper	5.77E+00	1.00E+01	1.97E-03	8.43E-05	1.45E-02	1.86E-03	5.31E-02	3.92E-01	0.5%	Gastrointestinal system; irritation	--				[D]
Lead	5.24E-01	7.78E-01	1.79E-04	7.66E-06	1.13E-03	1.45E-04				CNS, blood	--				[B2]
Manganese	3.43E+02	4.30E+02	1.17E-01	5.01E-03	6.24E-01	8.02E-02	8.36E-01	4.46E+00	5.3%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.07E+01	1.47E+01	3.65E-03	1.56E-04	2.14E-02	2.75E-03	1.22E+01	7.12E+01	84.7%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	1.67E+00	2.42E+00	5.71E-04	2.45E-05	3.50E-03	4.50E-04	2.86E-02	1.75E-01	0.2%	dec. body and organ weight	300				
Selenium	6.44E-01	6.94E-01	2.20E-04	9.41E-06	1.01E-03	1.29E-04	4.39E-02	2.01E-01	0.2%	whole body; clinical selenosis	3				[D]
Silver	8.65E-01	1.39E+00	2.94E-04	1.26E-05	2.02E-03	2.59E-04	5.88E-02	4.03E-01	0.5%	skin; argyria	3				[D]
Zinc	4.98E+01	8.20E+01	1.70E-02	7.27E-04	1.19E-01	1.53E-02	5.66E-02	3.96E-01	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	1.33E-05	2.06E-05	4.54E-09	1.94E-10	2.99E-08	3.84E-09				--	--	1.50E-09	2.96E-08	0.0%	[B2]
Benzo(a)anthracene	3.55E-04	7.04E-04	1.83E-07	7.83E-09	1.02E-06	1.31E-07	6.09E-06	3.40E-05	0.0%	--	--	5.71E-09	9.58E-08	0.0%	[B2]
Benzo(a)pyrene	3.08E-04	3.81E-04	1.05E-07	4.51E-09	5.52E-07	7.10E-08	3.51E-06	1.84E-05	0.0%	--	--	3.29E-08	5.18E-07	0.3%	[B2]
Benzo(b)fluoranthene	2.49E-04	3.27E-04	8.48E-08	3.63E-09	4.74E-07	6.09E-08	2.83E-06	1.58E-05	0.0%	--	--	2.65E-09	4.45E-08	0.0%	[B2]
Benzo(k)fluoranthene	1.90E-04	2.46E-04	6.49E-08	2.78E-09	3.57E-07	4.59E-08	2.16E-06	1.19E-05	0.0%	--	--	2.03E-09	3.35E-08	0.0%	[B2]
Chrysene	6.65E-04	8.50E-04	2.27E-07	9.72E-09	1.23E-06	1.58E-07	7.56E-06	4.11E-05	0.0%	--	--	7.10E-10	1.16E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	6.45E-05	7.76E-05	2.20E-08	9.43E-10	1.12E-07	1.45E-08	7.34E-07	3.75E-06	0.0%	--	--	6.89E-10	1.06E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	4.07E-02	6.86E-02		3.80E+02		8.50E+03						1.06E-08	2.38E-07	34.1%	[A]
Cobalt 60	1.25E-03	1.66E-03		1.17E+01		2.06E+02						1.75E-10	3.09E-09	0.4%	[A]
Neptunium 237+D	4.90E-03	1.35E-02		4.58E+01		1.72E+03						1.01E-08	3.78E-07	54.1%	[A]
Protactinium 233	5.36E-04	1.61E-03		5.01E+00		1.99E+02						5.01E-12	1.99E-10	0.0%	[A]
Thorium 228+D	8.71E-04	1.15E-03		8.13E+00		1.42E+02						4.47E-10	7.83E-09	1.1%	[A]
Thorium 232	5.45E-04	8.05E-04		5.08E+00		9.96E+01						6.10E-11	1.20E-09	0.2%	[A]
Uranium 234	1.10E-02	1.35E-02		1.03E+02		1.68E+03						1.65E-09	2.68E-08	3.8%	[A]
Uranium 235+D	4.76E-04	5.83E-04		4.44E+00		7.22E+01						7.10E-11	1.16E-09	0.2%	[A]
Uranium 238+D	1.02E-02	1.21E-02		9.48E+01		1.50E+03						2.66E-09	4.20E-08	6.0%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	1.45E+01	6.40E+01	100.0%		
Excess Lifetime Cancer Risk: Combined Exposure (d)				1.50E-05	2.02E-04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)				2.38E-08	6.98E-07	100.0%

Table M.345. Risk characterization for fish: adults – ingestion exposure (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration in Fish Tissue	RME Concentration in Fish Tissue	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS															
Mercury	0.76	0.78	2.38E-06	3.06E-07	2.89E-05	1.24E-05	7.94E-03	9.63E-02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	6.43E-07	8.27E-08	8.21E-06	3.52E-06						6.37E-07	2.71E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.13E-06	1.45E-07	1.44E-05	6.18E-06						1.12E-06	4.76E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E-03	9.63E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.75E-06	7.47E-05	100.0%	

Table M.346. Risk characterization for fish: children – ingestion exposure (current land use – residential) – Area S8–C2–R

Chemical	MLE Concentration in Fish (mg/kg)	RME Concentration in Fish (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS															
Mercury	0.76	0.78	4.1E-06	1.7E-07	6.0E-05	7.7E-06	1.3E-02	2.0E-01	100.0%	*oral*-CNS; neurotoxicity. *Inhal.*-kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	1.1E-06	4.8E-08	1.7E-05	2.2E-06						3.7E-07	1.7E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.9E-06	8.4E-08	3.0E-05	3.8E-06						6.5E-07	2.9E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-02	2.0E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-06	4.6E-05	100.0%	

Table M.347. Risk characterization summary for EFPC Segment 8: RME estimates for future land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	1.06E+00 *B*	2.95E−01 B	1.23E−05 W	1.14E−05 W	2.39E−07 B	5.98E−07 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	4.18E−02 B	3.20E−02 B	9.96E−07 B	2.54E−06 W	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	3.28E+01 *B*	2.77E+01 *B*	9.08E−05 W	2.56E−04 *B*	3.10E−06 W	2.35E−05 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	7.30E−04 B	1.61E−04 B	1.33E−07 B	9.78E−08 B	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	8.40E+01 *B*	4.05E+01 *B*	2.02E−04 *B*	3.25E−04 *B*	6.98E−07 B	3.02E−06 W
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					1.2E+02 *B*	6.9E+01 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					4E−04 *B*	7E−04 *B*		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					4E−06 W	3E−05 W

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1×10^{-6})
W – within EPA target cancer risk range (ELCR>1×10^{-6} and <1×10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1×10^{-4})

Table M.348 Human health risk characterization summary for EFPC residential scenario: future land use, Area S8–F1–R adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	6.83E–02	2.95E–01	9.71E–07	1.14E–05
Dermal Contact	2.46E–03	3.20E–02	6.66E–08	2.54E–06
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion	1.58E+01	2.77E+01	3.84E–05	2.56E–04
Inhalation (VOCs)	4.01E–05	1.61E–04	7.30E–09	9.78E–08
FOOD CHAIN				
Produce	6.47E+00	4.05E+01	2.01E–05	3.25E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.97E–08	5.98E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion			3.59E–06	2.35E–05
FOOD CHAIN				
Produce			9.68E–08	3.02E–06
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.2E+01	6.9E+01		
Excess Lifetime Cancer Risk: Combined Exposure			6E–05	7E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			4E–06	3E–05

Table M.349. Human health risk characterization summary for EFPC residential scenario: future land use, Area S8–F1–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	2.39E–01	1.06E+00	1.13E–06	1.23E–05
Dermal Contact	3.21E–03	4.18E–02	2.89E–08	9.96E–07
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion	1.65E+01	3.28E+01	1.33E–05	9.08E–05
Inhalation (VOCs)	2.34E–04	7.30E–04	1.42E–08	1.33E–07
FOOD CHAIN				
Produce	1.45E+01	8.40E+01	1.50E–05	2.02E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.66E–08	2.39E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion			4.45E–07	3.10E–06
FOOD CHAIN				
Produce			2.58E–08	6.98E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	3.1E+01	1.2E+02		
Excess Lifetime Cancer Risk: Combined Exposure			3E–05	4E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–07	4E–06

Table M.350. Risk characterization for soils: adults — ingestion exposure (future land use — residential) — Area S8—F1—R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.65	0.70	2.7E-07	3.5E-08	9.5E-07	4.1E-07	6.8E-04	2.4E-03	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	3.0E-06	3.9E-07	1.0E-05	4.7E-06	1.0E-02	3.4E-02	11.6%	skin; keratosis, hyperpigmentation	3	6.8E-07	7.8E-06	68.4%	[A]
Barium	115.90	140.80	4.9E-05	6.3E-06	1.9E-04	8.2E-05	7.0E-04	2.7E-03	0.9%	*oral*—cardiovasc. sys.; inc. blood pressure. *inhal.*—fetotoxicity	3				
Beryllium	0.81	0.90	3.4E-07	4.3E-08	1.2E-06	5.2E-07	6.8E-05	2.4E-04	0.1%	no observed effects	100	1.8E-07	2.2E-06	19.9%	[B2]
Cadmium	3.29	3.33	1.3E-06	1.7E-07	7.2E-06	3.1E-06	1.3E-03	7.2E-03	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	2.9E-05	3.8E-06	1.0E-04	4.4E-05	2.9E-05	1.0E-04	0.0%	no observed effects	100				
Copper	115.30	199.90	4.8E-05	6.2E-06	2.7E-04	1.1E-04	1.3E-03	7.4E-03	2.5%	Gastrointestinal system; irritation	--				[D]
Lead	52.40	77.84	2.2E-05	2.8E-06	1.0E-04	4.5E-05				CNS, blood	--				[B2]
Manganese	857.50	1076.00	3.6E-04	4.6E-05	1.4E-03	6.3E-04	2.5E-03	1.0E-02	3.6%	*oral*—CNS effects. *inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	35.68	49.11	1.5E-05	1.9E-06	6.7E-05	2.8E-05	5.0E-02	2.2E-01	75.9%	*oral*—CNS; neurotoxicity. *inhal.*—kidney effects	1000				[D]
Nickel	33.49	48.33	1.4E-05	1.8E-06	6.6E-05	2.8E-05	7.0E-04	3.3E-03	1.1%	dec. body and organ weight	300				
Selenium	6.44	6.94	2.7E-06	3.5E-07	9.5E-06	4.0E-06	5.4E-04	1.9E-03	0.6%	whole body; clinical selenosis	3				[D]
Silver	4.31	6.96	1.8E-06	2.3E-07	9.5E-06	4.0E-06	3.6E-04	1.9E-03	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	5.2E-05	6.7E-06	2.8E-04	1.2E-04	1.7E-04	9.3E-04	0.3%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.01	0.02	5.7E-09	7.3E-10	2.8E-08	1.2E-08				--	--	5.6E-09	9.4E-08	0.8%	[B2]
Benzo(a)anthracene	0.14	0.19	6.0E-08	7.8E-09	2.6E-07	1.1E-07	2.0E-06	8.6E-06	0.0%	--	--	5.7E-09	8.1E-08	0.7%	[B2]
Benzo(a)pyrene	0.16	0.20	6.9E-08	8.9E-09	2.7E-07	1.1E-07	2.3E-06	9.2E-06	0.0%	--	--	6.4E-08	8.6E-07	7.6%	[B2]
Benzo(b)fluoranthene	0.17	0.22	7.0E-08	9.1E-09	3.0E-07	1.2E-07	2.3E-06	1.0E-05	0.0%	--	--	6.6E-09	9.4E-08	0.8%	[B2]
Benzo(k)fluoranthene	0.18	0.23	7.5E-08	9.7E-09	3.1E-07	1.3E-07	2.5E-06	1.0E-05	0.0%	--	--	7.1E-09	9.9E-08	0.9%	[B2]
Chrysene	0.15	0.20	6.4E-08	8.2E-09	2.6E-07	1.1E-07	2.1E-06	8.9E-06	0.0%	--	--	6.0E-10	8.3E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	7.5E-08	9.7E-09	2.9E-07	1.2E-07	2.5E-06	9.7E-06	0.0%	--	--	7.0E-09	9.1E-08	0.8%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.36	2.29		1.3E+02		2.4E+03						3.6E-09	6.7E-08	11.2%	[A]
Cobalt 60	0.04	0.06		4.0E+00		5.8E+01						6.0E-11	8.7E-10	0.1%	[A]
Neptunium 237+D	0.12	0.35		1.1E+01		3.6E+02						2.6E-09	8.0E-08	13.4%	[A]
Protactinium 233	0.05	0.16		5.2E+00		1.6E+02						5.2E-12	1.6E-10	0.0%	[A]
Thorium 228+D	1.74	2.30		1.6E+02		2.4E+03						9.3E-09	1.3E-07	22.2%	[A]
Thorium 232	1.09	1.61		1.0E+02		1.6E+03						1.2E-09	2.0E-08	3.4%	[A]
Uranium 234	5.51	6.77		5.3E+02		7.1E+03						8.5E-09	1.1E-07	19.0%	[A]
Uranium 235+D	0.24	0.29		2.3E+01		3.0E+02						3.7E-10	4.9E-09	0.8%	[A]
Uranium 238+D	5.08	6.05		4.9E+02		6.3E+03						1.3E-08	1.7E-07	29.8%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.8E-02	2.9E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.7E-07	1.1E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.9E-08	5.9E-07	100.0%	

Table M.351. Risk characterization for soils: children – ingestion exposure (future land use – residential) – Area S8–F1–R

Chemical	MLE Concentration (mg/kg)	RME Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Antimony	0.65	0.70	9.6E-07	4.1E-08	3.4E-06	4.4E-07	2.4E-03	8.5E-03	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	1.0E-05	4.5E-07	3.7E-05	4.8E-06	3.5E-02	1.2E-01	11.6%	skin; keratosis, hyperpigmentation	3	7.9E-07	8.4E-06	68.4%	[A]
Barium	115.90	140.80	1.7E-04	7.3E-06	6.9E-04	8.8E-05	2.4E-03	9.8E-03	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	1.1E-06	5.1E-08	4.4E-06	5.6E-07	2.3E-04	8.8E-04	0.1%	no observed effects	100	2.2E-07	2.4E-06	19.9%	[B2]
Cadmium	3.29	5.33	4.6E-06	2.0E-07	2.6E-05	3.3E-06	4.6E-03	2.6E-02	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	1.0E-04	4.4E-06	3.7E-04	4.7E-05	1.0E-04	3.7E-04	0.0%	no observed effects	100				
Copper	115.30	199.90	1.7E-04	7.3E-06	9.8E-04	1.2E-04	4.6E-03	2.6E-02	2.5%	Gastrointestinal system; irritation	--				
Lead	52.40	77.84	7.7E-05	3.3E-06	3.8E-04	4.9E-05				CNS, blood	--				[D]
Manganese	857.50	1076.00	1.2E-03	5.4E-05	5.2E-03	6.7E-04	9.0E-03	3.7E-02	3.6%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[B2]
Mercury	35.68	49.11	5.2E-05	2.2E-06	2.4E-04	3.1E-05	1.7E-01	8.0E-01	75.9%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	4.9E-05	2.1E-06	2.3E-04	3.0E-05	2.4E-03	1.1E-02	1.1%	dec. body and organ weight	300				[D]
Selenium	6.44	6.94	9.5E-06	4.0E-07	3.4E-05	4.3E-06	1.9E-03	6.8E-03	0.6%	whole body; clinical selenosis	3				
Silver	4.31	6.96	6.3E-06	2.7E-07	3.4E-05	4.3E-06	1.2E-03	6.8E-03	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	1.8E-04	7.8E-06	1.0E-03	1.2E-04	6.1E-04	3.3E-03	0.3%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1260	0.01	0.02	2.0E-08	8.5E-10	1.0E-07	1.3E-08				--	--	6.6E-09	1.0E-07	0.8%	[B2]
Benzo(a)anthracene	0.14	0.19	2.1E-07	9.1E-09	9.3E-07	1.2E-07	7.1E-06	3.1E-05	0.0%	--	--	6.6E-09	8.7E-08	0.7%	[B2]
Benzo(a)pyrene	0.16	0.20	2.4E-07	1.0E-08	9.9E-07	1.2E-07	8.0E-06	3.3E-05	0.0%	--	--	7.5E-08	9.3E-07	7.6%	[B2]
Benzo(b)fluoranthene	0.17	0.22	2.4E-07	1.0E-08	1.0E-06	1.3E-07	8.2E-06	3.6E-05	0.0%	--	--	7.7E-09	1.0E-07	0.8%	[B2]
Benzo(k)fluoranthene	0.18	0.23	2.6E-07	1.1E-08	1.1E-06	1.4E-07	8.8E-06	3.7E-05	0.0%	--	--	8.2E-09	1.0E-07	0.9%	[B2]
Chrysene	0.15	0.20	2.2E-07	9.6E-09	9.5E-07	1.2E-07	7.5E-06	3.1E-05	0.0%	--	--	7.0E-10	8.9E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	2.6E-07	1.1E-08	1.0E-06	1.3E-07	8.8E-06	3.5E-05	0.0%	--	--	8.2E-09	9.8E-08	0.8%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	1.36	2.29		5.5E+01		9.5E+02						1.5E-09	2.6E-08	11.2%	[A]
Cobalt 60	0.04	0.06		1.6E+00		2.3E+01						2.5E-11	3.4E-10	0.1%	[A]
Neptunium 237+D	0.12	0.35		4.9E+00		1.4E+02						1.0E-09	3.2E-08	13.4%	[A]
Protactinium 233	0.05	0.16		2.1E+00		6.7E+01						2.1E-12	6.7E-11	0.0%	[A]
Thorium 228+D	1.74	2.30		7.0E+01		9.6E+02						3.8E-09	5.3E-08	22.2%	[A]
Thorium 232	1.09	1.61		4.4E+01		6.7E+02						5.2E-10	8.0E-09	3.4%	[A]
Uranium 234	5.51	6.77		2.2E+02		2.8E+03						3.5E-09	4.5E-08	19.0%	[A]
Uranium 235+D	0.24	0.29		9.6E+00		1.2E+02						1.5E-10	1.9E-09	0.8%	[A]
Uranium 238+D	5.08	6.05		2.0E+02		2.5E+03						5.7E-09	7.1E-08	29.8%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							2.3E-01	1.0E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.1E-06	1.2E-05	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-08	2.3E-07	100.0%	

Table M.352. Risk characterization for soils: adults – dermal exposure (future land use – residential) – Area S8–F1–R

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Care. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Care. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Care. Risk	IRIS WOE
INORGANICS **(mg/kg)**															
Antimony	0.65	0.70	9.92E-09	1.28E-09	1.04E-07	4.44E-08	2.48E-05	2.59E-04	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	1.10E-07	1.41E-08	1.13E-06	4.84E-07	3.65E-04	3.76E-03	11.8%	skin; keratosis, hyperpigmentation	3	2.46E-08	8.47E-07	33.4%	[A]
Barium	115.90	140.80	1.76E-06	2.27E-07	2.08E-05	8.94E-06	2.52E-05	2.98E-04	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	1.23E-08	1.58E-09	1.34E-07	5.72E-08	2.45E-06	2.67E-05	0.1%	no observed effects	100	6.78E-09	2.46E-07	9.7%	[B2]
Cadmium	3.29	5.33	5.00E-08	6.43E-09	7.85E-07	3.38E-07	5.00E-05	7.85E-04	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	1.07E-06	1.38E-07	1.12E-05	4.80E-06	1.07E-06	1.12E-05	0.0%	no observed effects	100				
Copper	115.30	199.90	1.75E-06	2.26E-07	2.96E-05	1.27E-05	4.74E-05	8.00E-04	2.5%	Gastrointestinal system; irritation	--				[D]
Lead	52.40	77.84	7.97E-07	1.03E-07	1.15E-05	4.94E-06				CNS, blood	--				[B2]
Manganese	857.50	1076.00	1.30E-05	1.68E-06	1.59E-04	6.83E-05	9.32E-05	1.14E-03	3.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	35.68	49.11	5.43E-07	6.98E-08	7.27E-06	3.12E-06	1.81E-03	2.42E-02	75.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	5.10E-07	6.55E-08	7.16E-06	3.07E-06	2.55E-05	3.58E-04	1.1%	dec. body and organ weight	300				
Selenium	6.44	6.94	9.80E-08	1.26E-08	1.03E-06	4.40E-07	1.96E-05	2.06E-04	0.6%	whole body; clinical selenosis	3				[D]
Silver	4.31	6.96	6.56E-08	8.44E-09	1.03E-06	4.42E-07	1.31E-05	2.06E-04	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	1.89E-06	2.43E-07	3.04E-05	1.30E-05	6.31E-06	1.01E-04	0.3%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor–1260	0.01	0.02	2.06E-09	2.65E-10	3.11E-08	1.33E-08				--	--	2.04E-09	1.03E-07	4.0%	[B2]
Benzo(a)anthracene	0.14	0.19	2.19E-08	2.82E-09	2.81E-07	1.20E-07	7.31E-07	9.35E-06	0.0%	--	--	2.06E-09	8.78E-08	3.5%	[B2]
Benzo(a)pyrene	0.16	0.20	2.49E-08	3.20E-09	2.99E-07	1.28E-07	8.30E-07	9.98E-06	0.0%	--	--	2.34E-08	9.37E-07	36.9%	[B2]
Benzo(b)fluoranthene	0.17	0.22	2.55E-08	3.28E-09	3.26E-07	1.40E-07	8.50E-07	1.09E-05	0.0%	--	--	2.39E-09	1.02E-07	4.0%	[B2]
Benzo(k)fluoranthene	0.18	0.23	2.72E-08	3.50E-09	3.43E-07	1.47E-07	9.07E-07	1.14E-05	0.0%	--	--	2.56E-09	1.07E-07	4.2%	[B2]
Chrysene	0.15	0.20	2.32E-08	2.99E-09	2.89E-07	1.24E-07	7.74E-07	9.63E-06	0.0%	--	--	2.18E-10	9.03E-09	0.4%	[B2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	2.71E-08	3.49E-09	3.17E-07	1.36E-07	9.05E-07	1.06E-05	0.0%	--	--	2.55E-09	9.93E-08	3.9%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.46E-03	3.20E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.60E-08	2.54E-06	100.0%	

Table M.353. Risk characterization for soils: children – dermal exposure (future land use – residential) – Area S8–F1–R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Antimony	0.65	0.70	1.29E-08	5.54E-10	1.35E-07	1.74E-08	3.23E-05	3.39E-04	0.8%	whole body, blood; inc. mortality	1000				
Arsenic	7.20	7.62	1.43E-07	6.12E-09	1.48E-06	1.90E-07	4.76E-04	4.92E-03	11.6%	skin; keratosis, hyperpigmentation	3	1.07E-08	3.32E-07	33.4%	[A]
Barium	115.90	140.80	2.30E-06	9.85E-08	2.73E-05	3.51E-06	3.28E-05	3.90E-04	0.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.81	0.90	1.60E-08	6.85E-10	1.75E-07	2.25E-08	3.20E-06	3.49E-05	0.1%	no observed effects	100	2.95E-09	9.66E-08	9.7%	[B2]
Cadmium	3.29	5.33	6.52E-08	2.79E-09	1.03E-06	1.33E-07	6.52E-05	1.03E-03	2.5%	kidney; proteinuria	10				
Chromium (III)	70.62	75.59	1.40E-06	6.00E-08	1.46E-05	1.88E-06	1.40E-06	1.46E-05	0.0%	no observed effects	100				
Copper	115.30	199.90	2.29E-06	9.80E-08	3.87E-05	4.98E-06	6.16E-05	1.05E-03	2.5%	Gastrointestinal system; irritation	--				[D]
Lead	52.40	77.84	1.04E-06	4.45E-08	1.51E-05	1.94E-06				CNS, blood	--				[D2]
Manganese	857.50	1076.00	1.70E-05	7.29E-07	2.08E-04	2.68E-05	1.21E-04	1.49E-03	3.6%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	35.68	49.11	7.08E-07	3.03E-08	9.51E-06	1.22E-06	2.36E-03	3.17E-02	75.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	33.49	48.33	6.66E-07	2.85E-08	9.36E-06,	1.20E-06	3.32E-05	4.68E-04	1.1%	dec. body and organ weight	300				
Selenium	6.44	6.94	1.28E-07	5.47E-09	1.34E-06	1.73E-07	2.55E-05	2.69E-04	0.6%	whole body; clinical selenosis	3				[D]
Silver	4.31	6.96	8.55E-08	3.67E-09	1.35E-06	1.73E-07	1.71E-05	2.69E-04	0.6%	skin; argyria	3				[D]
Zinc	124.40	205.10	2.47E-06	1.06E-07	3.97E-05	5.11E-06	8.22E-06	1.32E-04	0.3%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1260	0.01	0.02	2.69E-09	1.15E-10	4.07E-08	5.23E-09				--					
Benzo(a)anthracene	0.14	0.19	2.86E-08	1.22E-09	3.67E-07	4.72E-08	9.53E-07	1.22E-05	0.0%	--	--	8.87E-10	4.03E-08	4.0%	[B2]
Benzo(a)pyrene	0.16	0.20	3.25E-08	1.39E-09	3.92E-07	5.03E-08	1.08E-06	1.31E-05	0.0%	--	--	8.94E-10	3.44E-08	3.5%	[B2]
Benzo(b)fluoranthene	0.17	0.22	3.32E-08	1.42E-09	4.27E-07	5.49E-08	1.11E-06	1.42E-05	0.0%	--	--	1.02E-08	3.68E-07	36.9%	[B2]
Benzo(k)fluoranthene	0.18	0.23	3.55E-08	1.52E-09	4.49E-07	5.77E-08	1.18E-06	1.50E-05	0.0%	--	--	1.04E-09	4.01E-08	4.0%	[B2]
Chrysene	0.15	0.20	3.03E-08	1.30E-09	3.78E-07	4.86E-08	1.01E-06	1.26E-05	0.0%	--	--	1.11E-09	4.21E-08	4.2%	[B2]
Indeno(1,2,3-cd)pyrene	0.18	0.21	3.54E-08	1.52E-09	4.15E-07	5.34E-08	1.18E-06	1.38E-05	0.0%	--	--	9.47E-11	3.54E-09	0.4%	[B2]
											--	1.11E-09	3.90E-08	3.9%	[B2]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	3.21E-03	4.18E-02	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	2.89E-08	9.96E-07	100.0%

Table M.354. Risk characterization for surface water: adults — ingestion exposure (swimming) (future land use — residential) — Area S8—F1—R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	RfDo WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.39E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*—cardiovasc. sys.; inc. blood pressure. *Inhal.*—fetotoxicity	3				
Chromium (III)	7.60E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.60E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.65E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.68E-06	4.73E-07	3.36E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*—CNS effects. *Inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.70E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*—CNS; neurotoxicity. *Inhal.*—kidney effects	1000				[D]
Vanadium	8.40E+00	1.40E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	0.4%	liver; lesions, fattycyst formation	1000	4.37E-11	9.97E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.86E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.09E-09	2.79E-08	46.5%	[B2]
Endrin	3.67E-02	5.00E-02	5.30E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.62E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity	1000	4.16E-11	1.06E-09	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	1.8%	liver; inc. relative weight	1000	3.46E-10	7.94E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.67E-04	8.62E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.48E-09	6.01E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												5.49E-10	1.32E-08	100.0%	

Table M.355. Risk characterization for surface water: children – ingestion exposure (swimming) (future land use – residential) – Area S8–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	Risk Estimates: RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	HPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E-06	1.30E-07	2.30E-05	2.96E-06	4.34E-05	3.29E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E-07	1.28E-08	2.89E-06	3.72E-07	2.99E-07	2.89E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E-07	3.04E-08	4.80E-06	6.17E-07	1.92E-05	1.30E-04	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E-05	4.42E-07	9.05E-05	1.16E-05	2.06E-03	1.81E-02	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E-07	4.40E-09	8.62E-07	1.11E-07	3.42E-04	2.87E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E-07	1.38E-08	3.09E-06	3.97E-07	4.60E-05	4.41E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E-06	1.13E-07	1.99E-05	2.56E-06	8.79E-06	6.64E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E-07	1.02E-08	1.69E-06	2.17E-07	2.38E-06	1.69E-05	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	8.91E-10	3.82E-11	5.48E-09	7.05E-10	2.97E-05	1.83E-04	0.8%	liver; lesions, toxicity	1000	6.49E-10	1.20E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E-07	1.56E-08	3.04E-06	3.90E-07	1.82E-05	1.52E-04	0.7%	liver; weight inc.	1000	2.19E-10	5.46E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E-07	6.66E-09	1.03E-06	1.32E-07	1.56E-05	1.03E-04	0.4%	liver; lesions, fatty cyst formation	1000	4.08E-11	8.00E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.54E-09	6.61E-11	1.08E-08	1.39E-09	3.08E-06	2.17E-05	0.1%	liver; lesions	100	2.25E-11	4.73E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	1.49E-09	6.37E-11	1.10E-08	1.41E-09	2.97E-05	2.19E-04	0.9%	liver; lesions	100	1.02E-09	2.25E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	1.48E-09	6.36E-11	1.10E-08	1.41E-09	4.95E-06	3.65E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.62E-02	2.34E-02	6.97E-10	2.99E-11	5.14E-09	6.60E-10	2.32E-06	1.71E-05	0.1%	liver, kidney; toxicity	1000	3.89E-11	8.58E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	8.28E-10	3.55E-11	5.48E-09	7.05E-10	6.37E-05	4.21E-04	1.8%	liver; inc. relative weight	1000	3.23E-10	6.41E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E-07	6.87E-09	1.06E-06	1.36E-07	1.60E-05	1.06E-04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E-11	1.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E-10	2.78E-09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.71E-03	2.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E-09	4.85E-08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E-10	4.07E-09	100.0%	

Table M.356. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (future land use – residential) – Area S8–F1–R

Chemical	MLB Concentration (µg/L)	RMB Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	IRPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	IRPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.41E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.05E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.58E-06	0.0%	Gastrointestinal system; irritation	– –				[D]
Manganese (water)	2.65E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.40E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.20E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.59E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[B2]
Chloroform	4.07E+00	4.65E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fatty cyst formation	1000	1.88E-10	7.57E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity	1000	2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; inc. relative weight	1000	5.29E-09	2.14E-07	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.02E-05	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.35E-08	1.04E-06	100.0%	

Table M.357. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (future land use – residential) – Area S8–F1–R

Chemical	Chronic Daily Intake (CDI) MLE Concentration (µg/L)	RME Concentration (µg/L)	CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	RfDA OR	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E-07	4.69E-09	1.53E-06	1.96E-07	1.56E-06	2.16E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.60E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	3.18E-07	4.09E-08	6.91E-07	8.60E-06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	7.43E-05	1.20E-03	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.66E+00	3.93E+00	3.70E-09	1.59E-10	5.72E-08	7.35E-09	1.23E-05	1.91E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E-08	4.98E-10	2.05E-07	2.64E-08	1.66E-06	2.93E-05	0.2%	no observed effects	100				
Zinc	6.67E+01	9.09E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.22E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.21E-04	0.7%	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.72E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	12.0%	liver; weight inc.	1000	1.63E-09	7.47E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E-07	1.34E-08	3.79E-06	4.87E-07	3.13E-05	3.79E-04	2.2%	liver; lesions, fatty cyst formation	1000	8.19E-11	2.97E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.99E-04	3.86E-03	22.3%	liver; lesions	100	2.16E-09	8.44E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.45E-03	8.4%	liver; lesions	100	3.67E-09	1.50E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	0.6%	liver, kidney; toxicity	1000	1.23E-10	4.98E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	31.9%	liver; inc. relative weight	1000	2.30E-09	8.40E-08	20.6%	[B2]
Tetrachloroethylene	4.16E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.71E-06	1.73E-04	2.11E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.33E-03	1.73E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-08	4.08E-07	100.0%	

Table M.358. Risk characterization for sediments: adults – dermal exposure (future land use – residential) – Area S8–F1–R

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.88E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.35E-07	1.45E-07	7.85E-09	3.35E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.05E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.46E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.06E-06	0.2%	--	--	5.02E-11	9.94E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.36E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-09	2.80E-07	100.0%	

Table M.359. Risk characterization for sediments: children – dermal exposure (future land use – residential) – Area S8–F1–R

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.7E-10	4.1E-11	4.2E-08	5.4E-09	3.2E-06	1.4E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.3E-11	9.5E-09	8.7%	[A]
Barium	78.13	88.46	1.6E-08	7.1E-10	7.1E-07	9.1E-08	2.3E-07	1.0E-05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.9E-10	8.4E-12	8.2E-09	1.0E-09	3.9E-08	1.6E-06	0.2%	no observed effects	100	3.6E-11	4.5E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.0E-10	1.3E-11	1.3E-08	1.7E-09	3.0E-07	1.3E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.0E-08	4.3E-10	4.4E-07	5.7E-08	1.0E-08	4.4E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.1E-09	2.2E-10	2.4E-07	3.0E-08	1.3E-07	6.5E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.1E-08	4.8E-10	8.0E-07	1.0E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.9E-07	8.1E-09	8.3E-06	1.0E-06	1.3E-06	5.9E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.2E-09	1.3E-10	1.6E-07	2.1E-08	1.0E-05	5.4E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.9E-09	2.1E-10	2.2E-07	2.8E-08	2.4E-07	1.1E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.2E-09	2.6E-10	2.7E-07	3.4E-08	8.8E-07	3.8E-05	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.0E-08	8.9E-10	9.7E-07	1.2E-07	6.9E-08	3.2E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.2E-10	9.4E-12	1.3E-08	1.6E-09				--	--	7.2E-11	1.3E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.7E-10	7.4E-12	1.1E-08	1.4E-09				--	--	5.7E-11	1.1E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.9E-10	2.9E-11	4.1E-08	5.3E-09	2.3E-08	1.3E-06	0.2%	--	--	2.1E-11	3.9E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.7E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.1E-10	3.6E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.0E-10	3.4E-11	4.6E-08	6.0E-09	2.6E-08	1.5E-06	0.2%	--	--	2.5E-11	4.3E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.5E-10	2.8E-11	3.1E-08	4.1E-09	2.1E-08	1.0E-06	0.1%	--	--	2.0E-11	2.9E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.6E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.0E-12	3.7E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.7E-10	2.0E-11	1.9E-08	2.5E-09	1.5E-08	6.4E-07	0.1%	--	--	1.4E-10	1.8E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.6E-11	7.0E-13	1.0E-09	1.4E-10	3.2E-07	2.1E-05	2.5%	liver; lesions	100	1.1E-11	2.2E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.9E-10	2.5E-11	3.0E-08	3.9E-09	1.9E-08	1.0E-06	0.1%	--	--	1.8E-11	2.8E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.7E-05	6.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.9E-10	1.1E-07	100.0%	

Table M.360. Risk characterization for groundwater: adults — ingestion exposure (future land use — residential) — Area S8—F1—R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	RfDs UR	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.61E−05	9.78E−06	1.53E−04	6.55E−05	2.54E−01	5.09E−01	1.8%	skin; keratosis, hyperpigmentation	3	1.71E−05	1.15E−04	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.58E−03	9.74E−04	1.33E−02	5.70E−03	1.08E−01	1.90E−01	0.7%	*oral*—cardiovasc. sys.; inc. blood pressure. *Inhal.*—fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.61E−05	4.64E−06	7.01E−05	3.00E−05	7.22E−03	1.40E−02	0.1%	no observed effects	100	2.00E−05	1.29E−04	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.33E−04	8.14E−05	1.12E−03	4.81E−04	6.33E−04	1.12E−03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.20E−04	4.12E−05	8.87E−03	3.86E−03	8.66E−03	2.40E−01	0.9%	Gastrointestinal system; irritation	– –				[D]
Lead	2.68E+01	3.53E+01	5.13E−04	6.60E−05	9.68E−04	4.15E−04				CNS, blood	– –				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E−02	9.22E−03	1.21E−01	5.19E−02	1.43E+01	2.42E+01	87.4%	*oral*—CNS effects. *Inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.66E−04	3.42E−05	5.99E−04	2.57E−04	8.86E−01	2.00E+00	7.2%	*oral*—CNS; neurotoxicity. *Inhal.*—kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.21E−04	1.18E−04	1.76E−03	7.55E−04	4.61E−02	8.81E−02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.49E−04	9.64E−05	1.34E−03	5.76E−04	1.07E−01	1.92E−01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	6.89E−03	8.86E−04	1.87E−02	8.01E−03	6.89E−02	1.87E−01	0.7%	liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E−03	1.72E−04	3.69E−03	1.58E−03	2.23E−02	6.15E−02	0.2%	*oral and inhal.*—liver; toxicity	100	1.29E−06	1.19E−05	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D[1]	3.27E+00	4.07E+00		1.44E+04		8.54E+04						1.44E−06	8.54E−06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05						8.91E−07	6.11E−06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05						1.20E−06	8.86E−06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI):							1.58E+01	2.77E+01	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:												3.84E−05	2.56E−04	100.0%	
Combined Exposure (d)															
Radiological Hazards:															
Excess Lifetime Cancer Risk:												3.59E−06	2.35E−05	100.0%	
Combined Exposure (d)															

Table M.361. Risk characterization for groundwater: children – ingestion exposure (future land use – residential) – Area S8–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.56E+00	7.91E-05	3.39E-06	1.8E-04	2.33E-05	2.64E-01	6.03E-01	1.8%	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.88E-03	9.38E-04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.6E-06	8.3E-05	1.07E-05	7.51E-03	1.66E-02	0.1%	no observed effects	100	6.92E-06	4.59E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.59E-04	2.82E-05	1.33E-03	1.7E-04	6.59E-04	1.33E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.84E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	1.49E+01	2.87E+01	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.76E-04	1.18E-05	7.09E-04	9.12E-05	9.21E-01	2.36E+00	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.58E-04	4.1E-05	2.09E-03	2.68E-04	4.79E-02	1.04E-01	0.3%	dec. body and organ weight	300				[D]
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.28E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.47E-07	4.21E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.76E+03		1.13E+04						1.7E-07	1.13E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		6.99E+03		5.04E+04						1.10E-07	8.06E-07	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.59E+03		4.17E+04						1.56E-07	1.17E-06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.65E+01	3.26E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.33E-05	9.08E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.45E-07	3.10E-06	100.0%	

Table M.362. Risk characterization for groundwater: adults – inhalation exposure (future land use – residential) – Area S8–F1–R

Chemical	MLB Concentration in GW	RMB Concentration in GW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfD WOE
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.7E–04	2.2E–05	7.0E–04	3.0E–04				Inc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.9E+01	1.3E+02	3.4E–05	4.4E–06	1.3E–04	5.9E–05	4.0E–05	1.6E–04	100.0%	*oral and inhal.*–liver; toxicity	100	7.3E–09	9.7E–08	100.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.0E–05	1.6E–04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.3E–09	9.7E–08	100.0%	

Table M.363. Risk characterization for groundwater: children – inhalation exposure (future land use – residential) – Area S8–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD Ref	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	1.03E-03	4.43E-05	3.17E-03	4.07E-04				inc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.97E+01	1.35E+02	2.01E-04	8.60E-06	6.25E-04	8.04E-05	2.34E-04	7.30E-04	100.0%	*oral and inhal.*–liver; toxicity	100	1.42E-08	1.33E-07	100.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.34E-04	7.30E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.42E-08	1.33E-07	100.0%	

Table M.364. Risk characterization for produce: adults — ingestion exposure (future land use — residential) — Area S8–F1–R

Chem(d)	MLB Concentration from Mean Concentration (mg/kg)	RMB Concentration from UCL Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	6.52E-03	7.00E-03	9.95E-07	1.28E-07	4.85E-06	2.09E-06	2.49E-03	1.22E-02	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	5.76E-01	6.10E-01	8.79E-05	1.13E-05	4.26E-04	1.83E-04	2.93E-01	1.42E+00	3.5%	skin; keratosis, hyperpigmentation	3	1.98E-05	3.19E-04	98.2%	A
Barium	1.16E+00	1.41E+00	1.77E-04	2.27E-05	9.84E-04	4.22E-04	2.53E-03	1.41E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	3.22E-03	3.61E-03	4.92E-07	6.33E-08	2.52E-06	1.08E-06	9.84E-05	5.04E-04	0.0%	no observed effects	100	2.72E-07	4.64E-06	1.4%	D2
Cadmium	1.64E+00	2.66E+00	2.51E-04	3.23E-05	1.86E-03	7.97E-04	2.51E-01	1.86E+00	4.6%	kidney; proteinuria	10				
Chromium (III)	7.06E-01	7.56E-01	1.08E-04	1.39E-05	5.28E-04	2.26E-04	1.08E-04	5.28E-04	0.0%	no observed effects	100				
Copper	5.77E+00	1.00E+01	8.86E-04	1.13E-04	6.98E-03	2.99E-03	2.38E-02	1.89E-01	0.5%	Gastrointestinal system; irritation	--				D
Lead	5.24E-01	7.78E-01	8.00E-05	1.03E-05	5.44E-04	2.33E-04				CNS, blood	--				D2
Manganese	3.43E+02	4.30E+02	5.28E-02	6.73E-03	3.00E-01	1.29E-01	3.74E-01	2.15E+00	5.3%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				D
Mercury	1.07E+01	1.47E+01	1.63E-03	2.10E-04	1.03E-02	4.41E-03	5.44E+00	3.43E+01	84.7%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				D
Nickel	1.67E+00	2.42E+00	2.56E-04	3.29E-05	1.69E-03	7.24E-04	1.28E-02	8.44E-02	0.2%	dec. body and organ weight	300				
Selenium	6.44E-01	6.94E-01	9.83E-05	1.26E-05	4.85E-04	2.08E-04	1.97E-02	9.70E-02	0.2%	whole body; clinical selenosis	3				D
Silver	8.63E-01	1.39E+00	1.32E-04	1.69E-05	9.72E-04	4.17E-04	2.63E-02	1.94E-01	0.5%	skin; argyria	3				D
Zinc	4.98E+01	8.20E+01	7.59E-03	9.76E-04	5.73E-02	2.46E-02	2.53E-02	1.91E-01	0.5%	blood; anemia	3				D
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1260	1.33E-05	2.06E-05	2.03E-09	2.61E-10	1.44E-08	6.17E-09				--	--	2.01E-09	4.75E-08	0.0%	D2
Benzo(a)anthracene	5.35E-04	7.04E-04	8.17E-08	1.05E-08	4.92E-07	2.11E-07	2.72E-06	1.64E-05	0.0%	--	--	7.67E-09	1.54E-07	0.0%	D2
Benzo(a)pyrene	3.08E-04	3.88E-04	4.71E-08	6.05E-09	2.66E-07	1.14E-07	1.57E-06	8.87E-06	0.0%	--	--	4.42E-08	8.33E-07	0.3%	D2
Benzo(b)fluoranthene	2.49E-04	3.27E-04	3.79E-08	4.86E-09	2.28E-07	9.79E-08	1.26E-06	7.61E-06	0.0%	--	--	3.56E-09	7.14E-08	0.0%	D2
Benzo(k)fluoranthene	1.90E-04	2.46E-04	2.90E-08	3.73E-09	1.72E-07	7.38E-08	9.67E-07	5.74E-06	0.0%	--	--	2.72E-09	5.39E-08	0.0%	D2
Chrysene	6.65E-04	8.50E-04	1.01E-07	1.30E-08	5.94E-07	2.54E-07	3.38E-06	1.98E-05	0.0%	--	--	9.52E-10	1.86E-08	0.0%	D2
Indeno(1,2,3-cd)pyrene	6.45E-05	7.76E-05	9.85E-09	1.27E-09	5.42E-08	2.32E-08	3.28E-07	1.81E-06	0.0%	--	--	9.24E-10	1.70E-08	0.0%	D2
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	4.07E-02	6.86E-02		1.43E+03		3.66E+04						4.00E-08	1.03E-06	34.1%	A
Cobalt 60	1.25E-03	1.66E-03		4.38E+01		8.90E+02						6.57E-10	1.34E-08	0.4%	A
Neptunium 237+D	4.90E-03	1.39E-02		1.72E+02		7.43E+03						3.78E-08	1.63E-06	54.1%	A
Protactinium 233	5.36E-04	1.61E-03		1.88E+01		8.60E+02						1.88E-11	8.60E-10	0.0%	A
Thorium 228+D	8.71E-04	1.15E-03		3.06E+01		6.16E+02						1.68E-09	3.39E-08	1.1%	A
Thorium 232	5.45E-04	8.05E-04		1.91E+01		4.31E+02						2.29E-10	5.17E-09	0.2%	A
Uranium 234	1.10E-02	1.35E-02		3.87E+02		7.25E+03						6.19E-09	1.16E-07	3.8%	A
Uranium 235+D	4.76E-04	5.83E-04		1.67E+01		3.12E+02						2.67E-10	5.00E-09	0.2%	A
Uranium 238+D	1.02E-02	1.21E-02		3.56E+02		6.48E+03						9.98E-09	1.82E-07	6.0%	A
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.47E+00	4.05E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.01E-05	3.25E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												9.68E-08	3.02E-06	100.0%	

Table M.365. Risk characterization for produce: children – ingestion exposure (future land use – residential) – Area S8–F1–R

Chemical	MLE Concentration from Mean Concentration (mg/kg)	RME Concentration from UCL Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	BPA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	6.52E-03	7.00E-03	2.22E-06	9.53E-08	1.00E-05	1.30E-06	5.56E-03	2.53E-02	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	5.70E-01	6.10E-01	1.94E-04	8.42E-06	8.84E-04	1.14E-04	6.55E-01	2.95E+00	3.5%	skin; keratosis, hyperpigmentation	3	1.47E-05	1.99E-04	98.2%	[A]
Barium	1.10E+00	1.41E+00	3.95E-04	1.69E-05	2.04E-03	2.62E-04	5.65E-03	2.92E-02	0.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	3.22E-03	3.66E-03	1.10E-06	4.71E-08	5.23E-06	6.72E-07	2.20E-04	1.05E-03	0.0%	no observed effects	100	2.03E-07	2.89E-06	1.4%	[B2]
Cadmium	1.64E+00	2.66E+00	5.61E-04	2.40E-05	3.86E-03	4.96E-04	5.61E-01	3.86E+00	4.6%	kidney; proteinuria	10				
Chromium (III)	7.06E-01	7.56E-01	2.41E-04	1.03E-05	1.10E-03	1.41E-04	2.41E-04	1.10E-03	0.0%	no observed effects	100				
Copper	5.77E+00	1.00E+01	1.97E-03	8.43E-05	1.45E-02	1.86E-03	5.31E-02	3.92E-01	0.5%	Gastrointestinal system; irritation	--				[D]
Lead	5.24E-01	7.78E-01	1.79E-04	7.66E-06	1.13E-03	1.45E-04				CNS, blood	--				[B2]
Manganese	3.43E+02	4.30E+02	1.17E-01	5.01E-03	6.24E-01	8.02E-02	8.36E-01	4.46E+00	5.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.07E+01	1.47E+01	3.65E-03	1.56E-04	2.14E-02	2.75E-03	1.22E+01	7.12E+01	84.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.67E+00	2.42E+00	5.71E-04	2.45E-05	3.50E-03	4.50E-04	2.86E-02	1.75E-01	0.2%	dec. body and organ weight	300				
Selenium	6.44E-01	6.94E-01	2.20E-04	9.41E-06	1.00E-03	1.29E-04	4.39E-02	2.01E-01	0.2%	whole body; clinical selenosis	3				[D]
Silver	8.63E-01	1.39E+00	2.94E-04	1.26E-05	2.02E-03	2.59E-04	5.88E-02	4.03E-01	0.5%	skin; argyria	3				[D]
Zinc	4.98E+01	8.20E+01	1.70E-02	7.27E-04	1.19E-01	1.53E-02	5.66E-02	3.96E-01	0.5%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor–1260	1.33E-05	2.06E-05	4.54E-09	1.94E-10	2.99E-08	3.84E-09				--	--	1.50E-09	2.99E-08	0.0%	[B2]
Benzo(a)anthracene	5.35E-04	7.04E-04	1.83E-07	7.83E-09	1.02E-06	1.31E-07	6.09E-06	3.40E-05	0.0%	--	--	5.71E-09	9.58E-08	0.0%	[B2]
Benzo(a)pyrene	3.08E-04	3.81E-04	1.05E-07	4.51E-09	5.52E-07	7.10E-08	3.51E-06	1.84E-05	0.0%	--	--	3.29E-08	5.18E-07	0.3%	[B2]
Benzo(b)fluoranthene	2.49E-04	3.27E-04	8.48E-08	3.63E-09	4.74E-07	6.09E-08	2.83E-06	1.58E-05	0.0%	--	--	2.65E-09	4.45E-08	0.0%	[B2]
Benzo(k)fluoranthene	1.90E-04	2.46E-04	6.49E-08	2.78E-09	3.57E-07	4.59E-08	2.16E-06	1.19E-05	0.0%	--	--	2.03E-09	3.35E-08	0.0%	[B2]
Chrysene	6.65E-04	8.50E-04	2.27E-07	9.72E-09	1.23E-06	1.58E-07	7.56E-06	4.11E-05	0.0%	--	--	7.10E-10	1.16E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	6.45E-05	7.76E-05	2.20E-08	9.43E-10	1.12E-07	1.45E-08	7.34E-07	3.75E-06	0.0%	--	--	6.89E-10	1.06E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	4.07E-02	6.86E-02		3.86E+02		8.50E+03						1.06E-08	2.38E-07	34.1%	[A]
Cobalt 60	1.29E-03	1.66E-03		1.17E+01		2.06E+02						1.75E-10	3.09E-09	0.4%	[A]
Neptunium 237+D	4.90E-03	1.39E-02		4.59E+01		1.72E+03						1.01E-08	3.78E-07	54.1%	[A]
Protactinium 233	5.36E-04	1.61E-03		5.01E+00		1.99E+02						5.01E-12	1.99E-10	0.0%	[A]
Thorium 228+D	8.71E-04	1.15E-03		8.13E+00		1.42E+02						4.47E-10	7.83E-09	1.1%	[A]
Thorium 232	5.45E-04	8.05E-04		5.08E+00		9.99E+01						6.10E-11	1.20E-09	0.2%	[A]
Uranium 234	1.10E-02	1.35E-02		1.03E+02		1.68E+03						1.65E-09	2.68E-08	3.8%	[A]
Uranium 235+D	4.76E-04	5.83E-04		4.44E+00		7.22E+01						7.10E-11	1.16E-09	0.2%	[A]
Uranium 238+D	1.02E-02	1.21E-02		9.46E+01		1.50E+03						2.66E-09	4.20E-08	6.0%	[A]
Chemical Hazards: Hazard Index (HI):							1.45E+01	8.40E+01	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.30E-05	2.02E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												2.36E-08	6.98E-07	100.0%	

Table M.366. Risk characterization for fish: adults – ingestion exposure (future land use – residential) – Area S8–F1–R

Chemical	MLB Concentration in Fish (mg/kg)	RME Concentration in Fish (mg/kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD Wgt
INORGANICS															
Mercury	0.76	0.78	2.3E-06	3.0E-07	2.8E-05	1.2E-05	7.9E-03	9.6E-02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	6.4E-07	8.2E-08	8.2E-06	3.5E-06						6.3E-07	2.7E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.1E-06	1.4E-07	1.4E-05	6.1E-06						1.1E-06	4.7E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.9E-03	9.6E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.7E-06	7.4E-05	100.0%	

Table M.367. Risk characterization for fish: children – ingestion exposure (future land use – residential) – Area S8–F1–R

Chemical	MLB Concentration in Fish 7/1/04	RMB Concentration in Fish 7/1/04	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	RfD WOE
INORGANICS															
Mercury	0.76	0.78	4.16E-06	1.78E-07	6.04E-05	7.76E-06	1.39E-02	2.01E-01	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	1.12E-06	4.81E-08	1.72E-05	2.21E-06						3.70E-07	1.70E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.97E-06	8.44E-08	3.01E-05	3.88E-06						6.51E-07	2.98E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.39E-02	2.01E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-06	4.68E-05	100.0%	

SEGMENT 9 RISK CHARACTERIZATION TABLES

Table M.368. Risk characterization summary for EFPC Segment 9: RME estimates for current land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards:													
Hazard Index (HI):		NA	NA					NA	NA				
Combined Exposure													
Excess Lifetime Cancer Risk:				NA	NA					NA	NA		
Combined Exposure													
Radiological Hazards:													
Excess Lifetime Cancer Risk:						NA	NA					NA	NA
Combined Exposure													

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	8.9E−02 B	4.7E−02 B	2.66E−06 W	4.67E−06 W	7.22E−08 B	1.81E−07 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	5.5E−03 B	5.1E−03 B	4.03E−07 B	1.25E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	1.5E−03 B	1.0E−03 B	3.10E−09 B	7.22E−09 B	4.89E−10 B	1.63E−09 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.3E−03 B	1.2E−03 B	3.01E−08 B	9.31E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	9.9E−05 B	92E−05 B	1.26E−08 B	3.89E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards:													
Hazard Index (HI):		9.8E−02 B	5.4E−02 B					NA	NA				
Combined Exposure													
Excess Lifetime Cancer Risk:				3E−06 W	6E−06 W					NA	NA		
Combined Exposure													
Radiological Hazards:													
Excess Lifetime Cancer Risk:						7E−08 B	2E−07 B					NA	NA
Combined Exposure													

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.369. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S9–C1–O adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	4.55E–03	4.70E–02	1.39E–07	4.67E–06
Dermal Contact	1.65E–04	5.10E–03	1.13E–08	1.25E–06
SURFACE WATER				
Ingestion	6.90E–05	1.04E–03	1.77E–10	7.22E–09
Dermal Contact	7.27E–05	1.18E–03	1.68E–09	9.31E–08
SEDIMENT				
Dermal Contact	1.94E–06	9.19E–05	2.29E–10	3.89E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			4.63E–09	1.81E–07
SURFACE WATER				
Ingestion			3.92E–11	1.63E–09
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	4.9E–03	5.4E–02		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	6E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–09	2E–07

Table M.370. Human health risk characterization summary for EFPC open land use scenario: current land use, Area S9–C1–O children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	7.87E–03	8.92E–02	8.01E–08	2.66E–06
Dermal Contact	1.70E–04	5.49E–03	3.90E–09	4.03E–07
SURFACE WATER				
Ingestion	9.55E–05	1.48E–03	8.16E–11	3.10E–09
Dermal Contact	7.49E–05	1.28E–03	5.77E–10	3.01E–08
SEDIMENT				
Dermal Contact	2.00E–06	9.90E–05	7.87E–11	1.26E–08
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.93E–09	7.22E–08
SURFACE WATER				
Ingestion			1.31E–11	4.89E–10
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	8.2E–03	9.8E–02		
Excess Lifetime Cancer Risk: Combined Exposure			8E–08	3E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–09	7E–08

Table M.371. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Area S9–C1–O

Chemical	MLE Concentration (µg/g)	RME Concentration (µg/g)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs Weight
INORGANICS (mg/kg)															
Antimony	0.67	0.71	4.1E-08	5.3E-09	4.1E-07	1.7E-07	1.0E-04	1.0E-03	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	4.1E-07	5.3E-08	4.0E-06	1.7E-06	1.4E-03	1.3E-02	28.9%	skin; keratosis, hyperpigmentation	3	9.4E-08	3.0E-06	65.3%	[A]
Barium	100.70	105.90	6.3E-06	8.1E-07	6.2E-05	2.6E-05	9.0E-05	8.8E-04	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	4.5E-08	5.8E-09	4.6E-07	1.9E-07	9.0E-06	9.2E-05	0.2%	no observed effects	100	2.5E-08	8.5E-07	18.3%	[B2]
Cadmium	2.09	2.49	1.3E-07	1.6E-08	1.4E-06	6.2E-07	1.3E-04	1.4E-03	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	3.7E-06	4.8E-07	3.5E-05	1.5E-05	3.7E-06	3.5E-05	0.1%	no observed effects	100				
Copper	41.96	47.73	2.6E-06	3.3E-07	2.8E-05	1.2E-05	7.1E-05	7.5E-04	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	2.2E-06	2.8E-07	2.3E-05	1.0E-05				CNS, blood	--				[B2]
Manganese	940.60	995.30	5.8E-05	7.5E-06	5.8E-04	2.5E-04	4.2E-04	4.1E-03	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	6.6E-07	8.6E-08	7.1E-06	3.0E-06	2.2E-03	2.4E-02	51.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	1.5E-06	1.9E-07	1.5E-05	6.7E-06	7.6E-05	7.8E-04	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	4.4E-07	5.7E-08	4.4E-06	1.8E-06	8.8E-05	8.8E-04	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	9.9E-08	1.2E-08	1.0E-06	4.6E-07	2.0E-05	2.1E-04	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	3.5E-06	4.5E-07	3.4E-05	1.4E-05	1.1E-05	1.1E-04	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.02	0.02	1.4E-09	1.8E-10	1.4E-08	6.1E-09				--	--	1.4E-09	4.7E-08	1.0%	[B2]
Aroclor-1260	0.09	0.13	5.5E-09	7.0E-10	7.5E-08	3.2E-08				--	--	5.4E-09	2.4E-07	5.3%	[B2]
Benzo(a)anthracene	0.14	0.17	8.9E-09	1.1E-09	1.0E-07	4.3E-08	2.9E-07	3.3E-06	0.0%	--	--	8.3E-10	3.1E-08	0.7%	[B2]
Benzo(a)pyrene	0.15	0.18	9.3E-09	1.2E-09	1.0E-07	4.5E-08	3.1E-07	3.5E-06	0.0%	--	--	8.8E-09	3.3E-07	7.1%	[B2]
Benzo(b)fluoranthene	0.14	0.17	9.0E-09	1.1E-09	9.8E-08	4.2E-08	3.0E-07	3.3E-06	0.0%	--	--	8.4E-10	3.0E-08	0.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	1.0E-08	1.2E-09	1.0E-07	4.6E-08	3.3E-07	3.6E-06	0.0%	--	--	9.4E-10	3.3E-08	0.7%	[B2]
Chrysene	0.15	0.17	9.1E-09	1.1E-09	1.0E-07	4.3E-08	3.0E-07	3.4E-06	0.0%	--	--	8.5E-11	3.2E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.20	0.22	1.2E-08	1.6E-09	1.3E-07	5.5E-08	4.2E-07	4.3E-06	0.0%	--	--	1.2E-09	4.0E-08	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.99	1.23		1.4E+01		5.5E+02						3.9E-10	1.5E-08	8.6%	[A]
Cobalt 60	0.06	0.08		8.1E-01		3.5E+01						1.2E-11	5.2E-10	0.3%	[A]
Neptunium 237+D	0.10	0.26		1.5E+00		1.1E+02						3.3E-10	2.5E-08	14.0%	[A]
Protactinium 233	0.01	0.06		1.3E-01		2.7E+01						1.3E-13	2.7E-11	0.0%	[A]
Thorium 228+D	1.59	1.91		2.2E+01		8.6E+02						1.2E-09	4.7E-08	26.2%	[A]
Thorium 230	2.72	3.50		3.9E+01		1.5E+03						5.0E-10	2.0E-08	11.3%	[A]
Thorium 232	1.01	1.27		1.4E+01		5.7E+02						1.7E-10	6.8E-09	3.8%	[A]
Uranium 234	2.88	3.09		4.1E+01		1.3E+03						6.6E-10	2.2E-08	12.3%	[A]
Uranium 235+D	0.13	0.14		1.9E+00		6.4E+01						3.1E-11	1.0E-09	0.6%	[A]
Uranium 238+D	3.11	3.30		4.4E+01		1.4E+03						1.2E-09	4.1E-08	23.0%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	4.5E-03	4.7E-02	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.3E-07	4.6E-06	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	4.6E-09	1.8E-07	100.0%

Table M.372. Risk characterization for soils: children – ingestion exposure (current land use – open) – Area S9–C1–O

Chemical	MLE Concentration In Soils	RME Concentration In Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	IRPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRPA WOE
INORGANICS **(mg/kg)**															
Antimony	0.67	0.71	7.2E-08	3.1E-09	7.9E-07	1.0E-07	1.8E-04	1.9E-03	2.2%	whole body, blood; loc. mortality	1000				
Arsenic	6.69	6.92	7.2E-07	3.1E-08	7.7E-06	9.9E-07	2.4E-03	2.5E-02	28.9%	skin; keratosis, hyperpigmentation	3	5.4E-08	1.7E-06	65.3%	[A]
Barium	100.70	105.90	1.0E-05	4.6E-07	1.1E-04	1.5E-05	1.5E-04	1.6E-03	1.9%	*oral*–cardiovasc. sys.; loc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	7.8E-08	3.3E-09	8.8E-07	1.1E-07	1.5E-05	1.7E-04	0.2%	no observed effects	100	1.4E-08	4.8E-07	18.3%	[B2]
Cadmium	2.09	2.49	2.2E-07	9.6E-09	2.7E-06	3.5E-07	2.2E-04	2.7E-03	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	6.4E-06	2.7E-07	6.7E-05	8.7E-06	6.4E-06	6.7E-05	0.1%	no observed effects	100				
Copper	41.96	47.73	4.5E-06	1.9E-07	5.3E-05	6.8E-06	1.2E-04	1.4E-03	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	3.8E-06	1.6E-07	4.4E-05	5.7E-06				CNS, blood	--				[B2]
Manganese	940.60	995.30	1.0E-04	4.3E-06	1.1E-03	1.4E-04	7.2E-04	7.9E-03	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	1.1E-06	4.9E-08	1.3E-05	1.7E-06	3.8E-03	4.5E-02	51.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	2.6E-06	1.1E-07	3.0E-05	3.8E-06	1.3E-04	1.5E-03	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	7.6E-07	3.2E-08	8.3E-06	1.0E-06	1.5E-04	1.6E-03	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	1.7E-07	7.4E-09	2.0E-06	2.6E-07	3.4E-05	4.1E-04	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	6.1E-06	2.6E-07	6.5E-05	8.4E-06	2.0E-05	2.1E-04	0.2%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor–1254	0.02	0.02	2.4E-09	1.0E-10	2.7E-08	3.5E-09				--	--	8.1E-10	2.7E-08	1.0%	[B2]
Aroclor–1260	0.09	0.13	9.5E-09	4.0E-10	1.4E-07	1.8E-08				--	--	3.1E-09	1.4E-07	5.3%	[B2]
Benzo(a)anthracene	0.14	0.17	1.5E-08	6.6E-10	1.9E-07	2.4E-08	5.1E-07	6.3E-06	0.0%	--	--	4.8E-10	1.8E-08	0.7%	[B2]
Benzo(a)pyrene	0.15	0.18	1.6E-08	6.9E-10	2.0E-07	2.5E-08	5.4E-07	6.6E-06	0.0%	--	--	5.0E-09	1.8E-07	7.1%	[B2]
Benzo(b)fluoranthene	0.14	0.17	1.5E-08	6.7E-10	1.8E-07	2.4E-08	5.2E-07	6.2E-06	0.0%	--	--	4.8E-10	1.7E-08	0.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	1.7E-08	7.4E-10	2.0E-07	2.6E-08	5.7E-07	6.8E-06	0.0%	--	--	5.4E-10	1.9E-08	0.7%	[B2]
Chrysene	0.15	0.17	1.5E-08	6.7E-10	1.9E-07	2.5E-08	5.2E-07	6.4E-06	0.0%	--	--	4.9E-11	1.6E-09	0.1%	[B2]
Indeno(1,2,3–cd)pyrene	0.20	0.22	2.2E-08	9.4E-10	2.4E-07	3.1E-08	7.3E-07	8.2E-06	0.0%	--	--	6.8E-10	2.3E-08	0.9%	[B2]
RADIONUCLIDES **(pCi/g)**															
Cesium 137+D	0.99	1.23		5.9E+00		2.2E+02						1.6E-10	6.2E-09	8.6%	[A]
Cobalt 60	0.06	0.08		3.4E-01		1.4E+01						5.1E-12	2.1E-10	0.3%	[A]
Neptunium 237+D	0.10	0.26		6.2E-01		4.5E+01						1.3E-10	1.0E-08	14.0%	[A]
Protactinium 233	0.01	0.06		5.5E-02		1.1E+01						5.5E-14	1.1E-11	0.0%	[A]
Thorium 228+D	1.59	1.91		9.5E+00		3.4E+02						5.2E-10	1.8E-08	26.2%	[A]
Thorium 230	2.72	3.50		1.6E+01		6.2E+02						2.1E-10	8.1E-09	11.3%	[A]
Thorium 232	1.01	1.27		6.0E+00		2.2E+02						7.3E-11	2.7E-09	3.8%	[A]
Uranium 234	2.88	3.09		1.7E+01		5.5E+02						2.7E-10	8.8E-09	12.3%	[A]
Uranium 235+D	0.13	0.14		8.0E-01		2.5E+01						1.2E-11	4.1E-10	0.6%	[A]
Uranium 238+D	3.11	3.30		1.8E+01		5.9E+02						5.2E-10	1.6E-08	23.0%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.8E-03	8.9E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.0E-08	2.6E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.9E-09	7.2E-08	100.0%	

Table M.373. Risk characterization for soils: adults – dermal exposure (current land use – open) – Area S9–C1–O

Chemical	MLE Concentration In Soils	RME Concentration In Soils	Chronic Daily Intake (CDI) CDI Noncan. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncan. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncan. Effects (CDI/RfD) (MLE)	HQ Noncan. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.67	0.71	1.50E-09	1.93E-10	4.51E-08	1.93E-08	3.76E-06	1.13E-04	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	1.51E-08	1.94E-09	4.39E-07	1.88E-07	5.03E-05	1.46E-03	28.7%	skin; keratosis, hyperpigmentation	3	3.39E-09	3.31E-07	26.4%	[A]
Barium	100.70	105.90	2.27E-07	2.92E-08	6.72E-06	2.88E-06	3.24E-06	9.60E-05	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	1.63E-09	2.10E-10	5.02E-08	2.15E-08	3.27E-07	1.00E-05	0.2%	no observed effects	100	9.04E-10	9.25E-08	7.4%	[B2]
Cadmium	2.09	2.49	4.70E-09	6.05E-10	1.58E-07	6.78E-08	4.70E-06	1.58E-04	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	1.35E-07	1.73E-08	3.86E-06	1.66E-06	1.35E-07	3.86E-06	0.1%	no observed effects	100				
Copper	41.96	47.73	9.46E-08	1.22E-08	3.03E-06	1.30E-06	2.56E-06	8.19E-05	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	7.99E-08	1.03E-08	2.55E-06	1.09E-06				CNS, blood	--				[B2]
Manganese	940.60	995.30	2.12E-06	2.73E-07	6.32E-05	2.71E-05	1.51E-05	4.51E-04	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	2.41E-08	3.10E-09	7.77E-07	3.33E-07	8.03E-05	2.59E-03	50.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	5.54E-08	7.12E-09	1.70E-06	7.30E-07	2.77E-06	8.52E-05	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	1.59E-08	2.05E-09	4.76E-07	2.04E-07	3.19E-06	9.52E-05	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	3.59E-09	4.62E-10	1.18E-07	5.06E-08	7.19E-07	2.36E-05	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	1.28E-07	1.64E-08	3.74E-06	1.60E-06	4.26E-07	1.25E-05	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.02	0.02	5.12E-10	6.59E-11	1.55E-08	6.66E-09				--	--	5.07E-10	5.13E-08	4.1%	[B2]
Aroclor-1260	0.09	0.13	1.98E-09	2.55E-10	8.12E-08	3.48E-08				--	--	1.96E-09	2.66E-07	21.4%	[B2]
Benzo(a)anthracene	0.14	0.17	3.21E-09	4.12E-10	1.09E-07	4.67E-08	1.07E-07	3.63E-06	0.1%	--	--	3.01E-10	3.41E-08	2.7%	[B2]
Benzo(a)pyrene	0.15	0.18	3.37E-09	4.34E-10	1.14E-07	4.88E-08	1.12E-07	3.80E-06	0.1%	--	--	3.17E-09	3.56E-07	28.5%	[B2]
Benzo(b)fluoranthene	0.14	0.17	3.25E-09	4.18E-10	1.07E-07	4.58E-08	1.08E-07	3.56E-06	0.1%	--	--	3.05E-10	3.34E-08	2.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	3.66E-09	4.64E-10	1.17E-07	5.02E-08	1.20E-07	3.91E-06	0.1%	--	--	3.39E-10	3.67E-08	2.9%	[B2]
Chrysene	0.15	0.17	3.28E-09	4.22E-10	1.10E-07	4.74E-08	1.09E-07	3.65E-06	0.1%	--	--	3.08E-11	3.46E-09	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.20	0.22	4.59E-09	5.90E-10	1.41E-07	6.02E-08	1.53E-07	4.69E-06	0.1%	--	--	4.30E-10	4.40E-08	3.5%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.65E-04	5.10E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.13E-08	1.25E-06	100.0%	

Table M.374. Risk characterization for soils: children – dermal exposure (current land use – open) – Area S9–C1–O

Chemical	MLB Concentration In Soils	RMB Concentration In Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs / UR	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDs / WOE
INORGANICS (mg/kg)															
Antimony	0.67	0.71	1.55E-09	6.66E-11	4.85E-08	6.24E-09	3.88E-06	1.21E-04	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	1.56E-08	6.66E-10	4.73E-07	6.08E-08	5.18E-05	1.58E-03	28.7%	skin; keratosis, hyperpigmentation	3	1.17E-09	1.06E-07	26.4%	[A]
Barium	100.70	105.90	2.34E-07	1.00E-08	7.24E-06	9.30E-07	3.34E-06	1.03E-04	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	1.69E-09	7.22E-11	5.40E-08	6.95E-09	3.37E-07	1.08E-05	0.2%	no observed effects	100	3.10E-10	2.99E-08	7.4%	[B2]
Cadmium	2.09	2.49	4.85E-09	2.08E-10	1.70E-07	2.19E-08	4.85E-06	1.70E-04	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	1.39E-07	5.95E-09	4.16E-06	5.35E-07	1.39E-07	4.16E-06	0.1%	no observed effects	100				
Copper	41.96	47.73	9.75E-08	4.18E-09	3.26E-06	4.19E-07	2.63E-06	8.81E-05	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	8.23E-08	3.53E-09	2.75E-06	3.54E-07				CNS, blood	--				[B2]
Manganese	940.60	995.30	2.19E-06	9.37E-08	6.81E-05	8.74E-06	1.56E-05	4.86E-04	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	2.48E-08	1.06E-09	8.37E-07	1.08E-07	8.28E-05	2.79E-03	50.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	5.71E-08	2.45E-09	1.83E-06	2.36E-07	2.85E-06	9.17E-05	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	1.64E-08	7.03E-10	5.12E-07	6.59E-08	3.29E-06	1.02E-04	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	3.70E-09	1.59E-10	1.27E-07	1.63E-08	7.41E-07	2.54E-05	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	1.32E-07	5.66E-09	4.02E-06	5.17E-07	4.39E-07	1.34E-05	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.02	0.02	5.28E-10	2.26E-11	1.67E-08	2.15E-09				--	--	1.74E-10	1.66E-08	4.1%	[B2]
Aroclor-1260	0.09	0.13	2.05E-09	8.77E-11	8.74E-08	1.12E-08				--	--	6.75E-10	8.65E-08	21.4%	[B2]
Benzo(a)anthracene	0.14	0.17	3.31E-09	1.42E-10	1.17E-07	1.51E-08	1.10E-07	3.91E-06	0.1%	--	--	1.03E-10	1.10E-08	2.7%	[B2]
Benzo(a)pyrene	0.15	0.18	3.48E-09	1.49E-10	1.23E-07	1.58E-08	1.16E-07	4.09E-06	0.1%	--	--	1.09E-09	1.15E-07	28.5%	[B2]
Benzo(b)fluoranthene	0.14	0.17	3.35E-09	1.44E-10	1.15E-07	1.48E-08	1.12E-07	3.84E-06	0.1%	--	--	1.05E-10	1.08E-08	2.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	3.72E-09	1.59E-10	1.28E-07	1.62E-08	1.24E-07	4.20E-06	0.1%	--	--	1.16E-10	1.18E-08	2.9%	[B2]
Chrysene	0.15	0.17	3.38E-09	1.45E-10	1.19E-07	1.53E-08	1.13E-07	3.97E-06	0.1%	--	--	1.06E-11	1.12E-09	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.20	0.22	4.73E-09	2.03E-10	1.51E-07	1.95E-08	1.58E-07	5.04E-06	0.1%	--	--	1.48E-10	1.42E-08	3.5%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.7E-04	3.49E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.98E-09	4.03E-07	100.0%	

Table M.375. Risk characterization for surface water: adults – ingestion exposure (swimming) (current land use – open) – Area S9–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WoE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	7.75E-08	9.96E-09	1.03E-06	4.40E-07	1.1E-06	1.47E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	7.63E-09	9.81E-10	1.29E-07	5.54E-08	7.63E-09	1.29E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.15E+01	1.81E-08	2.33E-09	2.14E-07	9.18E-08	4.89E-07	5.79E-06	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.63E-07	3.38E-08	4.04E-06	1.73E-06	5.26E-05	8.08E-04	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.62E-09	3.37E-10	3.85E-08	1.65E-08	8.72E-06	1.28E-04	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.40E+01	8.22E-09	1.06E-09	1.38E-07	5.91E-08	1.17E-06	1.97E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	6.72E-08	8.65E-09	8.86E-07	3.86E-07	2.24E-07	2.96E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	6.08E-09	7.82E-10	7.54E-08	3.23E-08	6.08E-08	7.54E-07	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.27E-11	2.92E-12	2.45E-10	1.05E-10	7.58E-07	8.15E-06	0.8%	liver; lesions, toxicity	1000	4.97E-11	1.78E-09	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.35E+01	9.30E-09	1.20E-09	1.36E-07	5.81E-08	4.65E-07	6.78E-06	0.7%	liver; weight inc.	1000	1.67E-11	8.13E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.98E-09	5.12E-10	4.59E-08	1.97E-08	3.98E-07	4.59E-06	0.4%	liver; lesions, fatty cyst formation	1000	3.12E-12	1.20E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	3.93E-11	5.06E-12	4.83E-10	2.07E-10	7.86E-08	9.67E-07	0.1%	liver; lesions	100	1.72E-12	7.04E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.79E-11	4.87E-12	4.85E-10	2.10E-10	7.58E-07	9.78E-06	0.9%	liver; lesions	100	7.80E-11	3.35E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	3.78E-11	4.87E-12	4.85E-10	2.10E-10	1.26E-07	1.63E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.78E-11	2.29E-12	2.28E-10	9.83E-11	5.93E-08	7.64E-07	0.1%	liver, kidney; toxicity	1000	2.97E-12	1.28E-10	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.11E-11	2.72E-12	2.45E-10	1.05E-10	1.63E-06	1.88E-05	1.8%	liver; inc. relative weight	1000	2.47E-11	9.54E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	4.09E-09	5.26E-10	4.73E-08	2.03E-08	4.09E-07	4.73E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		8.27E-01		3.22E+01						1.32E-11	5.15E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		9.29E-01		3.98E+01						2.60E-11	1.12E-09	68.4%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							6.90E-05	1.04E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.77E-10	7.22E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.92E-11	1.63E-09	100.0%	

Table M.376. Risk characterization for surface water: children – ingestion exposure (swimming)(current land use – open) – Area S9–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.07E-07	4.59E-09	1.47E-06	1.89E-07	1.53E-06	2.10E-05	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.06E-08	4.52E-10	1.85E-07	2.37E-08	1.06E-08	1.85E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.50E-08	1.07E-09	3.06E-07	3.94E-08	6.77E-07	8.27E-06	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.66E-07	1.56E-08	5.77E-06	7.42E-07	7.27E-05	1.15E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.62E-09	1.55E-10	5.50E-08	7.07E-09	1.21E-05	1.83E-04	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.14E-08	4.87E-10	1.97E-07	2.53E-08	1.62E-06	2.82E-05	1.9%	no observed effects	100				
Zinc	6.87E+01	9.04E+01	9.30E-08	3.99E-09	1.27E-06	1.63E-07	3.10E-07	4.23E-06	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.41E-09	3.60E-10	1.08E-07	1.38E-08	8.41E-08	1.08E-06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.14E-11	1.35E-12	3.49E-10	4.49E-11	1.05E-06	1.16E-05	0.8%	liver; lesions, toxicity	1000	2.29E-11	7.64E-10	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.29E-08	5.51E-10	1.94E-07	2.49E-08	6.43E-07	9.68E-06	0.7%	liver; weight inc.	1000	7.72E-12	3.48E-10	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.51E-09	2.36E-10	6.55E-08	8.42E-09	5.51E-07	6.55E-06	0.4%	liver; lesions, fattycyst formation	1000	1.44E-12	5.14E-11	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.44E-11	2.33E-12	6.91E-10	8.88E-11	1.09E-07	1.38E-06	0.1%	liver; lesions	100	7.93E-13	3.02E-11	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.24E-11	2.25E-12	6.99E-10	8.99E-11	1.05E-06	1.40E-05	0.9%	liver; lesions	100	3.59E-11	1.44E-09	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.24E-11	2.24E-12	6.99E-10	8.99E-11	1.75E-07	2.33E-06	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.46E-11	1.05E-12	3.28E-10	4.21E-11	8.20E-08	1.09E-06	0.1%	liver, kidney; toxicity	1000	1.37E-12	5.47E-11	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.92E-11	1.25E-12	3.49E-10	4.49E-11	2.25E-06	2.69E-05	1.8%	liver; inc. relative weight	1000	1.14E-11	4.09E-10	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.66E-09	2.42E-10	6.76E-08	8.70E-09	5.66E-07	6.76E-06	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		2.76E-01		9.66E+00						4.41E-12	1.55E-10	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		3.10E-01		1.19E+01						8.67E-12	3.35E-10	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.35E-05	1.48E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												8.16E-11	3.10E-09	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.31E-11	4.89E-10	100.0%	

Table M.377. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (current land use – open) – Area S9–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	BPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.00E-09	7.71E-10	1.04E-07	4.47E-08	8.57E-08	1.49E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	5.91E-10	7.60E-11	1.31E-08	5.62E-09	5.91E-10	1.31E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.40E-09	1.80E-10	2.18E-08	9.33E-09	3.79E-08	5.88E-07	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.04E-08	2.62E-09	4.10E-07	1.76E-07	4.07E-06	8.21E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.03E-10	2.61E-11	3.91E-09	1.68E-09	6.76E-07	1.30E-05	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.36E-10	8.18E-11	1.40E-08	6.01E-09	9.09E-08	2.00E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.21E-09	6.69E-10	9.03E-08	3.87E-08	1.74E-08	3.01E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.94E-09	3.78E-10	4.76E-08	2.05E-08	2.94E-08	4.76E-07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.76E-11	2.26E-12	2.48E-10	1.06E-10	5.87E-07	8.28E-06	0.7%	liver; lesions, toxicity	1000	3.85E-11	1.81E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.48E-07	1.91E-08	2.84E-06	1.22E-06	7.42E-06	1.42E-04	12.0%	liver; weight inc.	1000	2.67E-10	1.70E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.72E-08	2.21E-09	2.59E-07	1.11E-07	1.72E-06	2.59E-05	2.2%	liver; lesions, fatty cyst formation	1000	1.35E-11	6.77E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.18E-09	1.05E-09	1.32E-07	5.65E-08	1.64E-05	2.64E-04	22.3%	liver; lesions	100	3.58E-10	1.92E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	5.87E-06	9.94E-05	8.4%	liver; lesions	100	6.04E-10	3.41E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	2.93E-10	3.77E-11	4.97E-09	2.13E-09	9.77E-07	1.66E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.21E-10	1.55E-11	2.04E-09	8.73E-10	4.02E-07	6.79E-06	0.6%	liver, kidney; toxicity	1000	2.01E-11	1.14E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	3.23E-10	4.15E-11	4.91E-09	2.10E-09	2.49E-05	3.77E-04	31.9%	liver; inc. relative weight	1000	3.78E-10	1.91E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.50E-08	1.22E-08	1.44E-06	6.18E-07	9.50E-06	1.44E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.27E-05	1.18E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.68E-09	9.31E-08	100.0%	

Table M.378. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (current land use – open) – Area S9–C1–O

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	IRIS UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	IRIS WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	6.18E-09	2.65E-10	1.12E-07	1.44E-08	8.83E-08	1.60E-06	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	6.09E-10	2.61E-11	1.40E-08	1.82E-09	6.09E-10	1.40E-08	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.44E-09	6.19E-11	2.34E-08	3.01E-09	3.90E-08	6.33E-07	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.10E-08	8.99E-10	4.42E-07	5.68E-08	4.20E-06	8.84E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.09E-10	8.95E-12	4.21E-09	5.41E-10	6.98E-07	1.40E-05	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	6.56E-10	2.81E-11	1.51E-08	1.94E-09	9.37E-08	2.16E-06	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	5.37E-09	2.30E-10	9.72E-08	1.25E-08	1.79E-08	3.24E-07	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	3.03E-09	1.30E-10	5.15E-08	6.62E-09	3.03E-08	5.15E-07	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	1.88E-11	7.77E-13	2.67E-10	3.44E-11	6.09E-07	8.92E-06	0.7%	liver; lesions, toxicity	1000	1.32E-11	5.85E-10	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.53E-07	6.56E-09	3.06E-06	3.93E-07	7.65E-06	1.53E-04	12.0%	liver; weight inc.	1000	9.18E-11	5.50E-09	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.77E-08	7.58E-10	2.79E-07	3.59E-08	1.77E-06	2.79E-05	2.2%	liver; lesions, fatty cyst formation	1000	4.62E-12	2.19E-10	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	8.43E-09	3.61E-10	1.42E-07	1.83E-08	1.69E-05	2.84E-04	22.3%	liver; lesions	100	1.23E-10	6.21E-09	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	3.02E-10	1.30E-11	5.35E-09	6.88E-10	6.05E-06	1.07E-04	8.4%	liver; lesions	100	2.07E-10	1.10E-08	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	3.02E-10	1.29E-11	5.35E-09	6.88E-10	1.01E-06	1.78E-05	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.24E-10	5.32E-12	2.19E-09	2.82E-10	4.14E-07	7.31E-06	0.6%	liver, kidney; toxicity	1000	6.92E-12	3.67E-10	1.2%	[C]
Heptachlor Epoxide	2.10E-02	2.50E-02	3.33E-10	1.43E-11	5.28E-09	6.79E-10	2.56E-05	4.06E-04	31.9%	liver; inc. relative weight	1000	1.30E-10	6.18E-09	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	9.79E-08	4.20E-09	1.55E-06	2.00E-07	9.79E-06	1.55E-04	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.49E-05	1.28E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.77E-10	3.01E-08	100.0%	

Table M.379. Risk characterization for sediments: adults – dermal exposure (current land use – open) – Area S9–C1–O

Chemical	MLE Concentration In Sediment	RME Concentration In Sediment	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	Risk Estimates: RfDs OF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.07E-10	1.37E-11	4.51E-09	1.93E-09	3.56E-07	1.50E-05	16.3%	skin; keratosis, hyperpigmentation	3	2.41E-11	3.38E-09	8.7%	[A]
Barium	78.13	88.46	1.83E-09	2.36E-10	7.56E-08	3.24E-08	2.62E-08	1.08E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.15E-11	2.76E-12	8.77E-10	3.76E-10	4.30E-09	1.75E-07	0.2%	no observed effects	100	1.19E-11	1.62E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.33E-11	4.28E-12	1.46E-09	6.27E-10	3.33E-08	1.46E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.12E-09	1.44E-10	4.71E-08	2.02E-08	1.12E-09	4.71E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.63E-10	7.24E-11	2.35E-08	1.09E-08	1.52E-08	6.90E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.24E-09	1.60E-10	8.51E-08	3.65E-08				CNS, blood	--				[D2]
Manganese	886.40	1036.00	2.08E-08	2.68E-09	8.86E-07	3.80E-07	1.49E-07	6.33E-06	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.51E-10	4.51E-11	1.75E-08	7.50E-09	1.17E-06	5.83E-05	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.43E-10	6.99E-11	2.37E-08	1.02E-08	2.72E-08	1.16E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.82E-10	8.77E-11	2.69E-08	1.24E-08	9.74E-08	4.12E-06	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.28E-09	2.93E-10	1.03E-07	4.43E-08	7.60E-09	3.44E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.42E-11	3.11E-12	1.40E-09	5.99E-10				--	--	2.40E-11	4.62E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.90E-11	2.44E-12	1.19E-09	5.08E-10				--	--	1.88E-11	3.91E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.64E-11	9.82E-12	4.42E-09	1.90E-09	2.55E-09	1.47E-07	0.2%	--	--	7.17E-12	1.38E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.40E-11	9.52E-12	4.15E-09	1.78E-09	2.47E-09	1.38E-07	0.2%	--	--	6.95E-11	1.30E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.60E-11	1.13E-11	4.97E-09	2.13E-09	2.93E-09	1.66E-07	0.2%	--	--	8.26E-12	1.55E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.21E-11	9.27E-12	3.39E-09	1.45E-09	2.40E-09	1.13E-07	0.1%	--	--	6.77E-12	1.06E-09	2.7%	[B2]
Chrysene	0.31	0.49	7.26E-11	9.34E-12	4.20E-09	1.80E-09	2.42E-09	1.40E-07	0.2%	--	--	6.82E-13	1.31E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.15E-11	6.63E-12	2.06E-09	8.85E-10	1.72E-09	6.88E-08	0.1%	--	--	4.84E-11	6.46E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.80E-12	2.32E-13	1.16E-10	4.95E-11	3.60E-08	2.31E-06	2.5%	liver; lesions	100	3.71E-12	7.92E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.47E-11	8.32E-12	3.24E-09	1.39E-09	2.16E-09	1.08E-07	0.1%	--	--	6.07E-12	1.00E-09	2.6%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.94E-06	9.19E-05	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.29E-10	3.89E-08	100.0%	

Table M.380. Risk characterization for sediments: children – dermal exposure (current land use – open) – Area S9–C1–O

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	IRPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	IRPA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	1.1E-10	4.7E-12	4.8E-09	6.2E-10	3.6E-07	1.6E-05	16.3%	skin; keratosis, hyperpigmentation	3	8.2E-12	1.0E-09	8.7%	[A]
Barium	78.13	88.46	1.8E-09	8.1E-11	8.1E-08	1.0E-08	2.7E-08	1.1E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	2.2E-11	9.4E-13	9.4E-10	1.2E-10	4.4E-09	1.8E-07	0.2%	no observed effects	100	4.0E-12	5.2E-10	4.2%	[B2]
Cadmium	1.42	1.71	3.4E-11	1.4E-12	1.5E-09	2.0E-10	3.4E-08	1.5E-06	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.1E-09	4.9E-11	5.0E-08	6.5E-09	1.1E-09	5.0E-08	0.1%	no observed effects	100				
Copper	23.99	29.87	5.8E-10	2.4E-11	2.7E-08	3.5E-09	1.5E-08	7.4E-07	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.2E-09	5.4E-11	9.1E-08	1.1E-08				CNS, blood	--				[B2]
Manganese	886.40	1036.00	2.1E-08	9.1E-10	9.5E-07	1.2E-07	1.5E-07	6.8E-06	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.6E-10	1.5E-11	1.8E-08	2.4E-09	1.2E-06	6.2E-05	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	5.6E-10	2.4E-11	2.5E-08	3.2E-09	2.6E-08	1.2E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	7.0E-10	3.0E-11	3.1E-08	3.9E-09	1.0E-07	4.4E-06	4.5%	no observed effects	100				
Zinc	97.07	120.60	2.3E-09	1.0E-10	1.1E-07	1.4E-08	7.8E-09	3.7E-07	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.5E-11	1.0E-12	1.5E-09	1.9E-10				--	--	8.2E-12	1.4E-09	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.9E-11	8.3E-13	1.2E-09	1.6E-10				--	--	6.4E-12	1.2E-09	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	7.8E-11	3.3E-12	4.7E-09	6.1E-10	2.6E-09	1.5E-07	0.2%	--	--	2.4E-12	4.4E-10	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	7.6E-11	3.2E-12	4.4E-09	5.7E-10	2.5E-09	1.4E-07	0.2%	--	--	2.3E-11	4.1E-09	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	9.0E-11	3.8E-12	5.3E-09	6.8E-10	3.0E-09	1.7E-07	0.2%	--	--	2.8E-12	5.0E-10	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	7.4E-11	3.1E-12	3.6E-09	4.6E-10	2.4E-09	1.2E-07	0.1%	--	--	2.3E-12	3.4E-10	2.7%	[B2]
Chrysene	0.31	0.49	7.4E-11	3.2E-12	4.5E-09	5.8E-10	2.4E-09	1.5E-07	0.2%	--	--	2.3E-13	4.2E-11	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	5.3E-11	2.2E-12	2.2E-09	2.8E-10	1.7E-09	7.4E-08	0.1%	--	--	1.6E-11	2.0E-09	16.6%	[B2]
Dieldrin	0.01	0.01	1.8E-12	7.9E-14	1.2E-10	1.6E-11	3.7E-08	2.4E-06	2.5%	liver; lesions	100	1.2E-12	2.5E-10	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	6.6E-11	2.8E-12	3.4E-09	4.4E-10	2.2E-09	1.1E-07	0.1%	--	--	2.0E-12	3.2E-10	2.6%	[B2]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	2.0E-06	9.9E-05	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	7.8E-11	1.2E-08	100.0%

Table M.381. Risk characterization summary for East Fork Poplar Creek Segment 9: RME estimates for future land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	3.92E−01 B	1.10E−01 B	1.17E−05 W	1.09E−05 W	1.68E−07 B	4.22E−07 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.56E−02 B	1.19E−02 B	1.14E−06 W	2.91E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	3.28E+01 *B*	2.77E+01 *B*	9.08E−05 W	2.56E−04 *B*	3.10E−06 W	2.35E−05 W	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	7.30E−04 B	1.61E−04 B	1.33E−07 B	9.78E−08 B	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	6.30E+01 *B*	3.04E+01 *B*	429E−04 *B*	6.90E−04 *B*	1.07E−06 W	4.61E−06 W	NA	NA	NA	NA	NA	NA
Beef	Ingestion	1.77E+01 *B*	8.94E+00 *B*	1.30E−04 *B*	2.18E−04 *B*	2.06E−06 W	9.30E−06 W	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	3.06E+01 *B*	7.42E+00 *B*	1.70E−04 *B*	1.37E−04 *B*	3.44E−06 W	7.47E−06 W	NA	NA	NA	NA	NA	NA
Fish	Ingestion	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	1.30E−01	NA	2.14E−06	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		1.4E+02 *B*	7.5E+01 *B*					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				9E−04 *B*	1E−03 *B*					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						1E−05 W	5E−05 W					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	3.92E−01 B	1.10E−01 B	1.17E−05 W	1.09E−05 W	1.68E−07 B	4.22E−07 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.56E−02 B	1.19E−02 B	1.14E−06 W	2.91E−06 W	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	2.32E−02 B	8.62E−03 B	4.85E−08 B	6.01E−08 B	4.07E−09 B	1.36E−08 B
	Dermal Contact	NA	NA	NA	NA	NA	NA	1.73E−02 B	1.32E−02 B	4.08E−07 B	1.04E−06 W	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	8.66E−04 B	6.62E−04 B	1.10E−07 B	2.80E−07 B	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	3.28E+01 *B*	2.77E+01 *B*	9.08E−05 W	2.56E−04 *B*	3.10E−06 W	2.35E−05 W
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	7.30E−04 B	1.61E−04 B	1.33E−07 B	9.78E−08 B	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	2.70E+01 *B*	1.30E+01 *B*	1.84E−04 *B*	2.96E−04 *B*	4.57E−07 B	1.98E−06 W
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	2.01E−01 B	9.63E−02 B	4.68E−05 W	7.47E−05 W	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					6.0E+01 *B*	4.1E+01 *B*				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					3E−04 *B*	6E−04 *B*		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					4E−06 W	3E−05 W

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.382. Human health risk characterization summary for EFPC residential scenario: future land use, Area S9–F1–R adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	3.07E–02	1.10E–01	9.38E–07	1.09E–05
Dermal Contact	1.11E–03	1.19E–02	7.66E–08	2.91E–06
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion	1.58E+01	2.77E+01	3.84E–05	2.56E–04
Inhalation (VOCs)	4.01E–05	1.61E–04	7.30E–09	9.78E–08
FOOD CHAIN				
Produce	2.54E+00	1.30E+01	1.87E–05	2.96E–04
Beef				
Dairy				
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.13E–08	4.22E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion			3.59E–06	2.35E–05
FOOD CHAIN				
Produce			7.40E–08	1.98E–06
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.8E+01	4.1E+01		
Excess Lifetime Cancer Risk: Combined Exposure			6E–05	6E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			4E–06	3E–05

Table M.383. Human health risk characterization summary for EFPC residential scenario: future land use, Area S9–F1–R children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.08E–01	3.92E–01	1.09E–06	1.17E–05
Dermal Contact	1.45E–03	1.56E–02	3.33E–08	1.14E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion	1.65E+01	3.28E+01	1.33E–05	9.08E–05
Inhalation (VOCs)	2.34E–04	7.30E–04	1.42E–08	1.33E–07
FOOD CHAIN				
Produce	5.67E+00	2.70E+01	1.39E–05	1.84E–04
Beef				
Dairy				
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.30E–08	1.68E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion			4.45E–07	3.10E–06
FOOD CHAIN				
Produce			1.97E–08	4.57E–07
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.2E+01	6.0E+01		
Excess Lifetime Cancer Risk: Combined Exposure			3E–05	3E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–07	4E–06

Table M.384. Human health risk characterization summary for EFPC agricultural/homesteader scenario: future land use, Area S9–F2–A adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	3.07E–02	1.10E–01	9.38E–07	1.09E–05
Dermal Contact	1.11E–03	1.19E–02	7.66E–08	2.91E–06
SURFACE WATER				
Ingestion	9.67E–04	8.62E–03	2.48E–09	6.01E–08
Dermal Contact	1.02E–03	1.32E–02	2.35E–08	1.04E–06
SEDIMENT				
Dermal Contact	1.36E–05	6.62E–04	1.60E–09	2.80E–07
GROUNDWATER				
Ingestion	1.58E+01	2.77E+01	3.84E–05	2.56E–04
Inhalation (VOCs)	4.01E–05	1.61E–04	7.30E–09	9.78E–08
FOOD CHAIN				
Produce	2.54E+00	3.04E+01	1.87E–05	6.90E–04
Beef	1.60E+00	8.94E+00	1.38E–05	2.18E–04
Dairy	1.34E+00	7.42E+00	7.90E–06	1.37E–04
Fish	7.94E–03	9.63E–02	1.75E–06	7.47E–05
AIR PATHWAY				
Particulates: Harvesting	1.22E–01	1.30E–01	6.16E–07	2.14E–06
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			3.13E–08	4.22E–07
SURFACE WATER				
Ingestion			5.49E–10	1.36E–08
GROUNDWATER				
Ingestion			3.59E–06	2.35E–05
FOOD CHAIN				
Produce			7.40E–08	4.61E–06
Beef			3.16E–07	9.30E–06
Dairy			2.38E–07	7.47E–06
Fish				
AIR PATHWAY				
Particulates: Harvesting			1.47E–06	5.69E–06
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.1E+01	7.5E+01		
Excess Lifetime Cancer Risk: Combined Exposure			8E–05	1E–03
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			6E–06	5E–05

Table M.385. Human health risk characterization summary for EFPC agricultural/homesteader scenario: future land use, Area S9–F2–A children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.08E–01	3.92E–01	1.09E–06	1.17E–05
Dermal Contact	1.45E–03	1.56E–02	3.33E–08	1.14E–06
SURFACE WATER				
Ingestion	2.71E–03	2.32E–02	2.31E–09	4.85E–08
Dermal Contact	1.33E–03	1.73E–02	1.02E–08	4.08E–07
SEDIMENT				
Dermal Contact	1.77E–05	8.66E–04	6.97E–10	1.10E–07
GROUNDWATER				
Ingestion	1.65E+01	3.28E+01	1.33E–05	9.08E–05
Inhalation (VOCs)	2.34E–04	7.30E–04	1.42E–08	1.33E–07
FOOD CHAIN				
Produce	5.67E+00	6.30E+01	1.39E–05	4.29E–04
Beef	3.35E+00	1.77E+01	9.61E–06	1.30E–04
Dairy	5.98E+00	3.06E+01	1.18E–05	1.70E–04
Fish	1.39E–02	2.01E–01	1.02E–06	4.68E–05
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.30E–08	1.68E–07
SURFACE WATER				
Ingestion			1.83E–10	4.07E–09
GROUNDWATER				
Ingestion			4.45E–07	3.10E–06
FOOD CHAIN				
Produce			1.97E–08	1.07E–06
Beef			7.86E–08	2.06E–06
Dairy			1.27E–07	3.44E–06
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	3.2E+01	1.4E+02		
Excess Lifetime Cancer Risk: Combined Exposure			5E–05	9E–04
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			7E–07	1E–05

Table M.386. Risk characterization for soils: adults – ingestion exposure (future land use – residential) – Area S9–F1–R

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.67	0.71	2.8E-07	3.6E-08	9.7E-07	4.1E-07	7.0E-04	2.4E-03	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	2.8E-06	3.6E-07	9.4E-06	4.0E-06	9.4E-03	3.1E-02	28.9%	skin; keratosis, hyperpigmentation	3	6.3E-07	7.1E-06	65.3%	[A]
Barium	100.70	105.90	4.2E-05	5.4E-06	1.4E-04	6.2E-05	6.0E-04	2.0E-03	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	3.0E-07	3.9E-08	1.0E-06	4.6E-07	6.1E-05	2.1E-04	0.2%	no observed effects	100	1.6E-07	2.0E-06	18.3%	[B2]
Cadmium	2.09	2.49	8.8E-07	1.1E-07	3.4E-06	1.4E-06	8.8E-04	3.4E-03	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	2.5E-05	3.2E-06	8.3E-05	3.5E-05	2.5E-05	8.3E-05	0.1%	no observed effects	100				
Copper	41.96	47.73	1.7E-05	2.2E-06	6.5E-05	2.8E-05	4.7E-04	1.7E-03	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	1.5E-05	1.9E-06	5.5E-05	2.3E-05				CNS, blood	--				[B2]
Manganese	940.60	995.30	3.9E-04	5.1E-05	1.3E-03	5.8E-04	2.8E-03	9.7E-03	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	4.5E-06	5.6E-07	1.6E-05	7.1E-06	1.5E-02	5.5E-02	51.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	1.0E-05	1.3E-06	3.6E-05	1.5E-05	5.1E-04	1.8E-03	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	2.9E-06	3.8E-07	1.0E-05	4.4E-06	5.9E-04	2.0E-03	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	6.7E-07	8.6E-08	2.5E-06	1.0E-06	1.3E-04	5.1E-04	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	2.3E-05	3.0E-06	8.0E-05	3.4E-05	7.9E-05	2.6E-04	0.2%	blood; anemia	3				
ORGANICS (mg/kg)															
Aroclor–1254	0.02	0.02	9.6E-09	1.2E-09	3.3E-08	1.4E-08				--	--	9.5E-09	1.1E-07	1.0%	[B2]
Aroclor–1260	0.09	0.13	3.7E-08	4.7E-09	1.7E-07	7.5E-08				--	--	3.6E-08	5.7E-07	5.3%	[B2]
Benzo(a)anthracene	0.14	0.17	6.0E-08	7.7E-09	2.3E-07	1.0E-07	2.0E-06	7.8E-06	0.0%	--	--	5.6E-09	7.3E-08	0.7%	[B2]
Benzo(a)pyrene	0.15	0.18	6.3E-08	8.1E-09	2.4E-07	1.0E-07	2.1E-06	8.2E-06	0.0%	--	--	5.9E-08	7.6E-07	7.1%	[B2]
Benzo(b)fluoranthene	0.14	0.17	6.1E-08	7.8E-09	2.3E-07	9.8E-08	2.0E-06	7.6E-06	0.0%	--	--	5.7E-09	7.2E-08	0.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	6.7E-08	8.7E-09	2.5E-07	1.0E-07	2.2E-06	8.4E-06	0.0%	--	--	6.3E-09	7.9E-08	0.7%	[B2]
Chrysene	0.15	0.17	6.1E-08	7.9E-09	2.3E-07	1.0E-07	2.0E-06	7.9E-06	0.0%	--	--	5.7E-10	7.4E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.20	0.22	8.6E-08	1.1E-08	3.0E-07	1.3E-07	2.8E-06	1.0E-05	0.0%	--	--	8.0E-09	9.4E-08	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.99	1.23		9.6E+01		1.3E+03						2.6E-09	3.6E-08	8.6%	[A]
Cobalt 60	0.06	0.08		5.5E+00		8.2E+01						8.2E-11	1.2E-09	0.3%	[A]
Neptunium 237+D	0.10	0.26		1.0E+01		2.6E+02						2.2E-09	5.9E-08	14.0%	[A]
Protactinium 233	0.01	0.06		9.0E-01		6.4E+01						9.0E-13	6.4E-11	0.0%	[A]
Thorium 228+D	1.59	1.91		1.5E+02		2.0E+03						8.5E-09	1.1E-07	26.2%	[A]
Thorium 230	2.72	3.50		2.6E+02		3.6E+03						3.4E-09	4.7E-08	11.3%	[A]
Thorium 232	1.01	1.27		9.8E+01		1.3E+03						1.1E-09	1.6E-08	3.8%	[A]
Uranium 234	2.88	3.09		2.8E+02		3.2E+03						4.4E-09	5.2E-08	12.3%	[A]
Uranium 235+D	0.13	0.14		1.3E+01		1.5E+02						2.0E-10	2.4E-09	0.6%	[A]
Uranium 238+D	3.11	3.30		3.0E+02		3.4E+03						8.4E-09	9.6E-08	23.0%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.0E-02	1.1E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.3E-07	1.0E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.1E-08	4.2E-07	100.0%	

Table M.387. Risk characterization for soils: children – ingestion exposure (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	Risk Estimates: HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	RfDo WOE
INORGANICS **(mg/kg)**															
Antimony	0.67	0.71	9.87E-07	4.23E-08	3.46E-06	4.46E-07	2.47E-03	8.71E-03	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	9.90E-06	4.24E-07	3.40E-05	4.37E-06	3.30E-02	1.13E-01	28.9%	skin; keratosis, hyperpigmentation	3	7.43E-07	7.64E-06	65.3%	[A]
Barium	100.70	105.90	1.49E-04	6.38E-06	5.19E-04	6.66E-05	2.13E-03	7.42E-03	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	1.07E-06	4.60E-08	3.88E-06	4.99E-07	2.15E-04	7.76E-04	0.2%	no observed effects	100	1.98E-07	2.14E-06	18.3%	[B2]
Cadmium	2.09	2.49	3.09E-06	1.32E-07	1.22E-05	1.57E-06	3.09E-03	1.22E-02	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	8.84E-05	3.79E-06	2.98E-04	3.84E-05	8.84E-05	2.98E-04	0.1%	no observed effects	100				
Copper	41.96	47.73	6.21E-05	2.66E-06	2.34E-04	3.01E-05	1.68E-03	6.33E-03	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	5.24E-05	2.25E-06	1.97E-04	2.54E-05				CNS, blood	--				[B2]
Manganese	940.60	995.30	1.39E-03	5.96E-05	4.88E-03	6.28E-04	9.94E-03	3.49E-02	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	1.58E-05	6.78E-07	6.01E-05	7.73E-06	5.27E-02	2.00E-01	51.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	3.64E-05	1.56E-06	1.32E-04	1.69E-05	1.82E-03	6.59E-03	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	1.05E-05	4.49E-07	3.68E-05	4.73E-06	2.09E-03	7.36E-03	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	2.36E-06	1.01E-07	9.12E-06	1.17E-06	4.72E-04	1.82E-03	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	8.38E-05	3.59E-06	2.89E-04	3.71E-05	2.79E-04	9.63E-04	0.2%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor–1254	0.02	0.02	3.36E-08	1.44E-09	1.20E-07	1.55E-08			--	--	--	1.11E-08	1.19E-07	1.0%	[B2]
Aroclor–1260	0.09	0.13	1.30E-07	5.58E-09	6.27E-07	8.07E-08			--	--	--	4.30E-08	6.21E-07	5.3%	[B2]
Benzo(a)anthracene	0.14	0.17	2.11E-07	9.02E-09	8.43E-07	1.08E-07	7.02E-06	2.81E-05	0.0%	--	--	6.59E-09	7.91E-08	0.7%	[B2]
Benzo(a)pyrene	0.15	0.18	2.22E-07	9.49E-09	8.86E-07	1.13E-07	7.38E-06	2.93E-05	0.0%	--	--	6.93E-08	8.26E-07	7.1%	[B2]
Benzo(b)fluoranthene	0.14	0.17	2.13E-07	9.15E-09	8.26E-07	1.06E-07	7.12E-06	2.75E-05	0.0%	--	--	6.68E-09	7.75E-08	0.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	2.37E-07	1.02E-08	9.05E-07	1.16E-07	7.90E-06	3.02E-05	0.0%	--	--	7.41E-09	8.51E-08	0.7%	[B2]
Chrysene	0.15	0.17	2.15E-07	9.23E-09	8.55E-07	1.10E-07	7.18E-06	2.85E-05	0.0%	--	--	6.74E-10	8.02E-09	0.1%	[B2]
Indeno(1,2,3-cd)pyrene	0.20	0.22	3.03E-07	1.29E-08	1.09E-06	1.40E-07	1.00E-05	3.62E-05	0.0%	--	--	9.41E-09	1.02E-07	0.9%	[B2]
RADIONUCLIDES **(pCi/g)**															
Cesium 137+D	0.99	1.23		4.00E+01		5.17E+02						1.12E-09	1.45E-08	8.6%	[A]
Cobalt 60	0.06	0.08		2.29E+00		3.28E+01						3.44E-11	4.92E-10	0.3%	[A]
Neptunium 237+D	0.10	0.26		4.22E+00		1.07E+02						9.28E-10	2.36E-08	14.0%	[A]
Protactinium 233	0.01	0.06		3.77E-01		2.58E+01						3.77E-13	2.58E-11	0.0%	[A]
Thorium 228+D	1.59	1.91		6.45E+01		8.02E+02						3.55E-09	4.41E-08	26.2%	[A]
Thorium 230	2.72	3.50		1.10E+02		1.46E+03						1.43E-09	1.90E-08	11.3%	[A]
Thorium 232	1.01	1.27		4.11E+01		5.32E+02						4.93E-10	6.38E-09	3.8%	[A]
Uranium 234	2.88	3.09		1.17E+02		1.30E+03						1.87E-09	2.07E-08	12.3%	[A]
Uranium 235+D	0.13	0.14		5.45E+00		6.04E+01						8.72E-11	9.66E-10	0.6%	[A]
Uranium 238+D	3.11	3.30		1.26E+02		1.38E+03						3.52E-09	3.87E-08	23.0%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	1.08E-01	3.92E-01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.09E-06	1.17E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.30E-08	1.68E-07	100.0%

Table M.388. Risk characterization for soils: adults – dermal exposure (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration in Soil	RME Concentration in Soil	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS **(mg/kg)**															
Antimony	0.67	0.71	1.02E-08	1.3E-09	1.05E-07	4.5E-08	2.54E-05	2.63E-04	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	1.02E-07	1.3E-08	1.03E-06	4.39E-07	3.39E-04	3.42E-03	28.7%	skin; keratosis, hyperpigmentation	3	2.29E-08	7.69E-07	26.4%	[A]
Barium	100.70	105.90	1.53E-06	1.97E-07	1.57E-05	6.72E-06	2.19E-05	2.24E-04	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	1.10E-08	1.42E-09	1.17E-07	5.02E-08	2.2E-06	2.34E-05	0.2%	no observed effects	100	6.10E-09	2.16E-07	7.4%	[B2]
Cadmium	2.09	2.49	3.17E-08	4.08E-09	3.69E-07	1.58E-07	3.17E-05	3.69E-04	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	9.09E-07	1.17E-07	9.01E-06	3.86E-06	9.09E-07	9.01E-06	0.1%	no observed effects	100				
Copper	41.96	47.73	6.39E-07	8.21E-08	7.07E-06	3.03E-06	1.73E-05	1.91E-04	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	5.39E-07	6.93E-08	5.96E-06	2.55E-06				CNS, blood	--				[B2]
Manganese	940.60	995.30	1.43E-05	1.84E-06	1.47E-04	6.32E-05	1.02E-04	1.05E-03	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	1.63E-07	2.09E-08	1.81E-06	7.77E-07	5.42E-04	6.05E-03	50.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	3.74E-07	4.81E-08	3.98E-06	1.70E-06	1.87E-05	1.99E-04	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	1.08E-07	1.38E-08	1.11E-06	4.76E-07	2.15E-05	2.22E-04	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	2.43E-08	3.12E-09	2.75E-07	1.18E-07	4.85E-06	5.51E-05	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	8.62E-07	1.1E-07	8.72E-06	3.74E-06	2.87E-06	2.91E-05	0.2%	blood; anemia	3				[D]
ORGANICS **(mg/kg)**															
Aroclor-1254	0.02	0.02	3.46E-09	4.45E-10	3.63E-08	1.55E-08				--	--	3.42E-09	1.20E-07	4.1%	[B2]
Aroclor-1260	0.09	0.13	1.34E-08	1.72E-09	1.89E-07	8.12E-08				--	--	1.33E-08	6.25E-07	21.4%	[B2]
Benzo(a)anthracene	0.14	0.17	2.17E-08	2.78E-09	2.54E-07	1.09E-07	7.22E-07	8.46E-06	0.1%	--	--	2.03E-09	7.96E-08	2.7%	[B2]
Benzo(a)pyrene	0.15	0.18	2.28E-08	2.93E-09	2.66E-07	1.14E-07	7.59E-07	8.88E-06	0.1%	--	--	2.14E-08	8.32E-07	28.5%	[B2]
Benzo(b)fluoranthene	0.14	0.17	2.20E-08	2.82E-09	2.49E-07	1.07E-07	7.32E-07	8.31E-06	0.1%	--	--	2.06E-09	7.88E-08	2.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	2.44E-08	3.13E-09	2.73E-07	1.17E-07	8.12E-07	9.11E-06	0.1%	--	--	2.29E-09	8.55E-08	2.9%	[B2]
Chrysene	0.15	0.17	2.22E-08	2.85E-09	2.58E-07	1.11E-07	7.39E-07	8.66E-06	0.1%	--	--	2.08E-10	8.08E-09	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.20	0.22	3.10E-08	3.98E-09	3.28E-07	1.41E-07	1.03E-06	1.09E-05	0.1%	--	--	2.91E-09	1.03E-07	3.5%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.1E-03	1.19E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.6E-08	2.9E-06	100.0%	

Table M.389. Risk characterization for soils: children – dermal exposure (future land use – residential) – Area S9–F1–R

Chemical	MLB Concentration (mg/kg)	RMB Concentration (mg/kg)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD Ref.	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Antimony	0.67	0.71	1.3E-08	5.6E-10	1.3E-07	1.7E-08	3.3E-05	3.4E-04	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	1.3E-07	5.6E-09	1.3E-06	1.7E-07	4.4E-04	4.4E-03	28.7%	skin; keratosis, hyperpigmentation	3	9.9E-09	3.0E-07	26.4%	[A]
Barium	100.70	105.90	2.0E-06	8.5E-08	2.0E-05	2.6E-06	2.8E-05	2.9E-04	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	1.4E-08	6.1E-10	1.5E-07	1.9E-08	2.8E-06	3.0E-05	0.2%	no observed effects	100	2.6E-09	8.4E-08	7.4%	[B2]
Cadmium	2.09	2.49	4.1E-08	1.7E-09	4.0E-07	6.2E-08	4.1E-05	4.8E-04	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	1.1E-06	5.0E-08	1.1E-05	1.5E-06	1.1E-06	1.1E-05	0.1%	no observed effects	100				
Copper	41.96	47.73	8.3E-07	3.5E-08	9.2E-06	1.1E-06	2.2E-05	2.5E-04	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	7.0E-07	3.0E-08	7.8E-06	1.0E-06				CNS, blood	--				[B2]
Manganese	940.60	995.30	1.8E-05	8.0E-07	1.9E-04	2.4E-05	1.3E-04	1.3E-03	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	2.1E-07	9.0E-09	2.3E-06	3.0E-07	7.0E-04	7.9E-03	50.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	4.8E-07	2.0E-08	5.2E-06	6.6E-07	2.4E-05	2.6E-04	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	1.4E-07	6.0E-09	1.4E-06	1.8E-07	2.8E-05	2.9E-04	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	3.1E-08	1.3E-09	3.6E-07	4.6E-08	6.3E-06	7.2E-05	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	1.1E-06	4.8E-08	1.1E-05	1.4E-06	3.7E-06	3.8E-05	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.02	0.02	4.5E-09	1.9E-10	4.7E-08	6.1E-09				--	--	1.4E-09	4.7E-08	4.1%	[B2]
Aroclor–1260	0.09	0.13	1.7E-08	7.4E-10	2.4E-07	3.1E-08				--	--	5.7E-09	2.4E-07	21.4%	[B2]
Benzo(a)anthracene	0.14	0.17	2.8E-08	1.2E-09	3.3E-07	4.2E-08	9.4E-07	1.1E-05	0.1%	--	--	8.8E-10	3.1E-08	2.7%	[B2]
Benzo(a)pyrene	0.15	0.18	2.9E-08	1.2E-09	3.4E-07	4.4E-08	9.9E-07	1.1E-05	0.1%	--	--	9.2E-09	3.2E-07	28.5%	[B2]
Benzo(b)fluoranthene	0.14	0.17	2.8E-08	1.2E-09	3.2E-07	4.1E-08	9.5E-07	1.0E-05	0.1%	--	--	8.9E-10	3.0E-08	2.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	3.1E-08	1.3E-09	3.5E-07	4.6E-08	1.0E-06	1.1E-05	0.1%	--	--	9.9E-10	3.3E-08	2.9%	[B2]
Chrysene	0.15	0.17	2.8E-08	1.2E-09	3.3E-07	4.3E-08	9.6E-07	1.1E-05	0.1%	--	--	9.0E-11	3.1E-09	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.20	0.22	4.0E-08	1.7E-09	4.2E-07	5.5E-08	1.3E-06	1.4E-05	0.1%	--	--	1.2E-09	4.0E-08	3.5%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.4E-03	1.5E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.3E-08	1.1E-06	100.0%	

Table M.390. Risk characterization for surface water: adults – ingestion exposure (swimming) (future land use – residential) – Area S9–F1–R

Chemical	MLB Concentration in SW	RMB Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E–06	1.39E–07	8.55E–06	3.66E–06	1.55E–05	1.22E–04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.60E+00	1.32E+01	1.07E–07	1.37E–08	1.07E–06	4.61E–07	1.07E–07	1.07E–06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E–07	3.26E–08	1.78E–06	7.66E–07	6.85E–06	4.82E–05	0.6%	Gastrointestinal system; irritation	– –				[D]
Manganese (water)	2.69E+02	4.13E+02	3.68E–06	4.73E–07	3.36E–05	1.44E–05	7.36E–04	6.72E–03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E–08	4.71E–09	3.20E–07	1.37E–07	1.22E–04	1.07E–03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E–07	1.48E–08	1.15E–06	4.92E–07	1.64E–05	1.64E–04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E–07	1.21E–07	7.40E–06	3.17E–06	3.14E–06	2.47E–05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E–08	1.09E–08	6.27E–07	2.69E–07	8.51E–07	6.27E–06	0.1%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E–02	2.50E–02	3.18E–10	4.09E–11	2.04E–09	8.72E–10	1.06E–05	6.78E–05	0.8%	liver; lesions, toxicity	1000	6.96E–10	1.48E–08	24.7%	[B2]
Bis(2–ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E–07	1.67E–08	1.13E–06	4.83E–07	6.51E–06	5.64E–05	0.7%	liver; weight inc.	1000	2.34E–10	6.77E–09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E–08	7.17E–09	3.81E–07	1.63E–07	5.58E–06	3.81E–05	0.4%	liver; lesions, fatty cyst formation	1000	4.37E–11	9.97E–10	1.7%	[B2]
4,4'–DDT	4.02E–02	4.94E–02	5.51E–10	7.08E–11	4.02E–09	1.72E–09	1.10E–06	8.04E–06	0.1%	liver; lesions	100	2.41E–11	5.86E–10	1.0%	[B2]
Dieldrin	3.87E–02	5.00E–02	5.31E–10	6.82E–11	4.07E–09	1.74E–09	1.06E–05	8.14E–05	0.9%	liver; lesions	100	1.09E–09	2.79E–08	46.5%	[B2]
Endrin	3.87E–02	5.00E–02	5.30E–10	6.81E–11	4.07E–09	1.74E–09	1.77E–06	1.36E–05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.82E–02	2.34E–02	2.49E–10	3.20E–11	1.91E–09	8.17E–10	8.30E–07	6.36E–06	0.1%	liver, kidney; toxicity	1000	4.16E–11	1.06E–09	1.6%	[C]
Heptachlor Epoxide	2.16E–02	2.50E–02	2.96E–10	3.80E–11	2.04E–09	8.72E–10	2.28E–05	1.57E–04	1.8%	liver; inc. relative weight	1000	3.46E–10	7.94E–09	13.2%	[B2]
Tetrachloroethylene	4.16E+00	4.84E+00	5.72E–08	7.36E–09	3.94E–07	1.69E–07	5.72E–06	3.94E–05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E–10	4.29E–09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E–10	9.28E–09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.67E–04	8.62E–03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.48E–09	6.01E–08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.49E–10	1.30E–08	100.0%	

Table M.391. Risk characterization for surface water: children – ingestion exposure (swimming) (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration (GAW)	RME Concentration (GAW)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E–06	1.30E–07	2.30E–05	2.96E–06	4.34E–05	3.29E–04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E–07	1.28E–08	2.89E–06	3.72E–07	2.99E–07	2.89E–06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E–07	3.04E–08	4.80E–06	6.17E–07	1.92E–05	1.30E–04	0.6%	Gastrointestinal system; irritation	– –				[D]'
Manganese (water)	2.69E+02	4.13E+02	1.03E–05	4.42E–07	9.05E–05	1.16E–05	2.06E–03	1.81E–02	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	1.03E–07	4.40E–09	8.62E–07	1.11E–07	3.42E–04	2.87E–03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.40E+01	3.22E–07	1.38E–08	3.09E–06	3.97E–07	4.60E–05	4.41E–04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E–06	1.13E–07	1.99E–05	2.56E–06	8.79E–06	6.64E–05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E–07	1.02E–08	1.69E–06	2.17E–07	2.38E–06	1.69E–05	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E–02	2.50E–02	8.91E–10	3.82E–11	5.48E–09	7.05E–10	2.97E–05	1.83E–04	0.8%	liver; lesions, toxicity	1000	6.49E–10	1.20E–08	24.7%	[B2]
Bis(2–ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E–07	1.56E–08	3.04E–06	3.90E–07	1.82E–05	1.52E–04	0.7%	liver; weight inc.	1000	2.19E–10	5.44E–09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E–07	6.69E–09	1.03E–06	1.32E–07	1.56E–05	1.03E–04	0.4%	liver; lesions, fatty cyst formation	1000	4.08E–11	8.06E–10	1.7%	[B2]
4,4'–DDT	4.02E–02	4.94E–02	1.54E–09	6.61E–11	1.08E–08	1.39E–09	3.08E–06	2.17E–05	0.1%	liver; lesions	100	2.25E–11	4.73E–10	1.0%	[B2]
Dieldrin	3.87E–02	5.00E–02	1.49E–09	6.37E–11	1.10E–08	1.41E–09	2.97E–05	2.19E–04	0.9%	liver; lesions	100	1.02E–09	2.25E–08	46.5%	[B2]
Endrin	3.87E–02	5.00E–02	1.49E–09	6.36E–11	1.10E–08	1.41E–09	4.95E–06	3.65E–05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.82E–02	2.34E–02	6.97E–10	2.99E–11	5.14E–09	6.60E–10	2.32E–06	1.71E–05	0.1%	liver, kidney; toxicity	1000	3.89E–11	8.58E–10	1.8%	[C]
Heptachlor Epoxide	2.16E–02	2.50E–02	8.28E–10	3.55E–11	5.48E–09	7.05E–10	6.37E–05	4.21E–04	1.8%	liver; inc. relative weight	1000	3.23E–10	6.41E–09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E–07	6.87E–09	1.06E–06	1.36E–07	1.60E–05	1.06E–04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E–11	1.29E–09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E–10	2.78E–09	68.4%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							2.71E–03	2.32E–02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E–09	4.85E–08	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E–10	4.07E–09	100.0%	

Table M.392. Risk characterization for surface waters: adults – dermal exposure (swimming and wading) (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.08E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.58E-06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	2.85E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.05E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.20E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.35E-10	2.02E-08	1.9%	[D2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[D2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.99E-06	1.24E-06	2.40E-05	2.99E-04	2.2%	liver; lesions, fatty cyst formation	1000	1.88E-10	7.57E-09	0.7%	[D2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[D2]
Dieldrin	3.87E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[B2]
Endrin	3.67E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity	1000	2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.46E-04	4.22E-03	31.9%	liver; inc. relative weight	1000	5.29E-09	2.14E-07	20.6%	[D2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.02E-03	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.35E-08	1.04E-06	100.0%	

Table M.393. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E-07	4.69E-09	1.53E-06	1.96E-07	1.56E-06	2.18E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	3.18E-07	4.09E-08	6.91E-07	8.60E-06	0.0%	Gastrointestinal system; irritation	--				
Manganese (water)	2.69E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	7.43E-05	1.20E-03	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E-09	1.59E-10	5.72E-08	7.35E-09	1.23E-05	1.91E-04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E-08	4.98E-10	2.05E-07	2.64E-08	1.66E-06	2.93E-05	0.2%	no observed effects	100				[D]
Zinc	6.87E+01	9.09E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.20E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.20E-04	0.7%	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	1.9%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.70E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	12.0%	liver; weight inc.	1000	1.63E-09	7.47E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E-07	1.34E-08	3.79E-06	4.87E-07	3.13E-05	3.79E-04	2.2%	liver; lesions, fattycyst formation	1000	8.19E-11	2.97E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.98E-04	3.86E-03	22.3%	liver; lesions	100	2.18E-09	8.44E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.45E-03	8.4%	liver; lesions	100	3.67E-09	1.50E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	0.6%	liver, kidney; toxicity	1000	1.23E-10	4.98E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	31.9%	liver; inc. relative weight	1000	2.30E-09	8.40E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.71E-06	1.73E-04	2.11E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.33E-03	1.73E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-08	4.08E-07	100.0%	

Table M.394. Risk characterization for sediments: adults – dermal exposure (future land use – residential) – Area S9–F1–R

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfD WoE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; loc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.50E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.16E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.71E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.00E-06	0.2%	--	--	5.02E-11	9.90E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.16E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.65E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.36E-05	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-09	2.80E-07	100.0%	

Table M.395. Risk characterization for sediments: children – dermal exposure (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.7E-10	4.1E-11	4.2E-08	5.4E-09	3.2E-06	1.4E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.3E-11	9.5E-09	8.7%	[A]
Barium	78.13	88.46	1.6E-08	7.1E-10	7.1E-07	9.1E-08	2.3E-07	1.0E-05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.9E-10	8.4E-12	8.2E-09	1.0E-09	3.9E-08	1.6E-06	0.2%	no observed effects	100	3.6E-11	4.5E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.0E-10	1.3E-11	1.3E-08	1.7E-09	3.0E-07	1.3E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.0E-08	4.3E-10	4.4E-07	5.7E-08	1.0E-08	4.4E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.1E-09	2.2E-10	2.4E-07	3.0E-08	1.3E-07	6.5E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.1E-08	4.8E-10	8.0E-07	1.0E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.9E-07	8.1E-09	8.3E-06	1.0E-06	1.3E-06	5.9E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.2E-09	1.3E-10	1.6E-07	2.1E-08	1.0E-05	5.4E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.9E-09	2.1E-10	2.2E-07	2.8E-08	2.4E-07	1.1E-05	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	6.2E-09	2.6E-10	2.7E-07	3.4E-08	8.8E-07	3.8E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.0E-08	8.9E-10	9.7E-07	1.2E-07	6.9E-08	3.2E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.2E-10	9.4E-12	1.3E-08	1.6E-09				--	--	7.2E-11	1.3E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.7E-10	7.4E-12	1.1E-08	1.4E-09				--	--	5.7E-11	1.1E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.9E-10	2.9E-11	4.1E-08	5.3E-09	2.3E-08	1.3E-06	0.2%	--	--	2.1E-11	3.9E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.7E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.1E-10	3.6E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.0E-10	3.4E-11	4.6E-08	6.0E-09	2.6E-08	1.5E-06	0.2%	--	--	2.5E-11	4.3E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.5E-10	2.8E-11	3.1E-08	4.1E-09	2.1E-08	1.0E-06	0.1%	--	--	2.0E-11	2.9E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.6E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.0E-12	3.7E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.7E-10	2.0E-11	1.9E-08	2.5E-09	1.5E-08	6.4E-07	0.1%	--	--	1.4E-10	1.8E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.6E-11	7.0E-13	1.0E-09	1.4E-10	3.2E-07	2.1E-05	2.5%	liver; lesions	100	1.1E-11	2.2E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.9E-10	2.5E-11	3.0E-08	3.9E-09	1.9E-08	1.0E-06	0.1%	--	--	1.8E-11	2.8E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.7E-05	8.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.9E-10	1.1E-07	100.0%	

Table M.396. Risk characterization for groundwater: adults — ingestion exposure (future land use — residential) — Area S9–F1–R

Chemical	MLE Concentration in GW	RME Concentration in GW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (RME)	Noncarcinogenic Effect of Concern: Target Tissue	IRPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.61E−05	9.78E−06	1.53E−04	6.55E−05	2.54E−01	5.09E−01	1.8%	skin; keratosis, hyperpigmentation	3	1.71E−05	1.15E−04	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.58E−03	9.74E−04	1.33E−02	5.70E−03	1.08E−01	1.90E−01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.61E−05	4.64E−06	7.01E−05	3.00E−05	7.22E−03	1.40E−02	0.1%	no observed effects	100	2.00E−05	1.29E−04	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.33E−04	8.14E−05	1.12E−03	4.81E−04	6.33E−04	1.12E−03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.20E−04	4.12E−05	6.87E−03	3.80E−03	8.60E−03	2.40E−01	0.9%	Gastrointestinal system; irritation	– –				[D]
Lead	2.68E+01	3.53E+01	5.13E−04	6.60E−05	9.69E−04	4.15E−04				CNS, blood	– –				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E−02	9.22E−03	1.21E−01	5.19E−02	1.43E+01	2.42E+01	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.66E−04	3.42E−05	5.99E−04	2.57E−04	8.86E−01	2.00E+00	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.21E−04	1.18E−04	1.76E−03	7.55E−04	4.61E−02	8.81E−02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.49E−04	9.64E−05	1.34E−03	5.76E−04	1.07E−01	1.92E−01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.62E+02	6.89E−03	8.86E−04	1.87E−02	8.01E−03	6.89E−02	1.87E−01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E−03	1.72E−04	3.69E−03	1.58E−03	2.23E−02	6.15E−02	0.2%	*oral and inhal.*–liver; toxicity	100	1.29E−06	1.19E−05	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D[f]	3.27E+00	4.07E+00		1.44E+04		8.54E+04						1.44E−06	8.54E−06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05						8.91E−07	6.11E−06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05						1.26E−06	8.86E−06	37.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.58E+01	2.77E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.84E−05	2.56E−04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.59E−06	2.35E−05	100.0%	

Table M.397. Risk characterization for groundwater: children – ingestion exposure (future land use – residential) – Area S9–F1–R

Chemical	MLB Concentration (µg/L)	RMB Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	Risk Estimates: HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	IRPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	IRPA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.91E-05	3.39E-06	1.81E-04	2.33E-05	2.64E-01	6.03E-01	1.8%	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.88E-03	3.38E-04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.61E-06	8.31E-05	1.07E-05	7.51E-03	1.66E-02	0.1%	no observed effects	100	6.92E-06	4.59E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.59E-04	2.82E-05	1.33E-03	1.71E-04	6.59E-04	1.33E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.64E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	1.49E+01	2.87E+01	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.76E-04	1.18E-05	7.09E-04	9.12E-05	9.21E-01	2.36E+00	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.58E-04	4.11E-05	2.05E-03	2.66E-04	4.79E-02	1.04E-01	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.28E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.47E-07	4.21E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.78E+03		1.13E+04						1.78E-07	1.13E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		6.90E+03		5.04E+04						1.10E-07	8.06E-07	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.59E+03		4.17E+04						1.56E-07	1.17E-06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.65E+01	3.28E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.33E-05	9.08E-05	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												4.45E-07	3.10E-06	100.0%	

Table M.398. Risk characterization for groundwater: adults – inhalation exposure (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA Wgt
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.7E-04	2.2E-05	7.0E-04	3.0E-04				loc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.9E+01	1.3E+02	3.4E-05	4.4E-06	1.3E-04	5.9E-05	4.0E-05	1.6E-04	100.0%	*oral and inhal.*–liver; toxicity	100	7.3E-09	9.7E-08	100.0%	[B2]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							4.0E-05	1.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.3E-09	9.7E-08	100.0%	

Table M.399. Risk characterization for groundwater: children – inhalation exposure (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	1.03E–03	4.43E–05	3.17E–03	4.07E–04				loc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.97E+01	1.35E+02	2.00E–04	8.60E–06	6.25E–04	8.04E–05	2.34E–04	7.30E–04	100.0%	*oral and inhal.*–liver; toxicity	100	1.42E–08	1.33E–07	100.0%	(B2)
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.34E–04	7.30E–04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.42E–08	1.33E–07	100.0%	

Table M.400. Risk characterization for produce: adults – ingestion exposure (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration from Mean Concentration (mg/kg)	RME Concentration from UCL Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	6.67E-03	7.10E-03	1.02E-06	1.31E-07	4.99E-06	2.13E-06	2.55E-03	1.24E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	5.35E-01	5.54E-01	8.17E-05	1.05E-05	3.87E-04	1.66E-04	2.72E-01	1.29E+00	9.9%	skin; keratosis, hyperpigmentation	3	1.84E-05	2.90E-04	98.1%	[A]
Barium	1.01E+00	1.06E+00	1.54E-04	1.98E-05	7.40E-04	3.17E-04	2.20E-03	1.06E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.90E-03	3.16E-03	4.42E-07	5.69E-08	2.21E-06	9.47E-07	8.85E-05	4.42E-04	0.0%	no observed effects	100	2.45E-07	4.07E-06	1.4%	[B2]
Cadmium	1.06E+00	1.25E+00	1.59E-04	2.05E-05	8.70E-04	3.73E-04	1.59E-01	8.70E-01	6.7%	kidney; proteinuria	10				
Chromium (III)	5.97E-01	6.09E-01	9.12E-05	1.17E-05	4.25E-04	1.82E-04	9.12E-05	4.25E-04	0.0%	no observed effects	100				
Copper	2.10E+00	2.39E+00	3.20E-04	4.12E-05	1.67E-03	7.15E-04	8.65E-03	4.51E-02	0.3%	Gastrointestinal system; irritation	--				[D]
Lead	3.54E-01	4.03E-01	5.41E-05	6.95E-06	2.81E-04	1.21E-04				CNS, blood	--				[B2]
Manganese	3.76E+02	3.98E+02	5.74E-02	7.38E-03	2.78E-01	1.19E-01	4.10E-01	1.99E+00	15.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	3.21E+00	3.66E+00	4.89E-04	6.29E-05	2.57E-03	1.10E-03	1.63E+00	8.56E+00	65.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.23E+00	1.34E+00	1.87E-04	2.41E-05	9.38E-04	4.02E-04	9.37E-03	4.69E-02	0.4%	dec. body and organ weight	300				
Selenium	7.08E-01	7.56E-01	1.08E-04	1.39E-05	5.24E-04	2.24E-04	2.16E-02	1.05E-01	0.8%	whole body; clinical selenosis	3				[D]
Silver	3.19E-01	3.72E-01	4.86E-05	6.25E-06	2.60E-04	1.11E-04	9.73E-03	5.20E-02	0.4%	skin; argyria	3				[D]
Zinc	2.27E+01	2.36E+01	3.46E-03	4.44E-04	1.65E-02	7.05E-03	1.15E-02	5.49E-02	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1254	3.95E-05	4.26E-05	6.03E-09	7.76E-10	2.98E-08	1.28E-08			--		--	5.97E-09	9.83E-08	0.0%	[D2]
Aroclor-1260	8.64E-05	1.26E-04	1.32E-08	1.70E-09	6.77E-08	3.76E-08			--		--	1.31E-08	2.85E-07	0.1%	[D2]
Benzo(a)anthracene	5.29E-04	6.38E-04	8.07E-08	1.04E-08	4.46E-07	1.91E-07	2.69E-06	1.49E-05	0.0%	--	--	7.57E-09	1.40E-07	0.0%	[D2]
Benzo(a)pyrene	2.82E-04	3.38E-04	4.30E-08	5.53E-09	2.36E-07	1.01E-07	1.43E-06	7.88E-06	0.0%	--	--	4.04E-08	7.39E-07	0.3%	[D2]
Benzo(b)fluoranthene	2.14E-04	2.56E-04	3.27E-08	4.20E-09	1.79E-07	7.48E-08	1.09E-06	5.82E-06	0.0%	--	--	3.06E-09	5.46E-08	0.0%	[D2]
Benzo(k)fluoranthene	1.70E-04	1.96E-04	2.60E-08	3.34E-09	1.37E-07	5.68E-08	8.66E-07	4.57E-06	0.0%	--	--	2.46E-09	4.29E-08	0.0%	[D2]
Chrysene	6.35E-04	7.60E-04	9.68E-08	1.24E-08	5.31E-07	2.27E-07	3.23E-06	1.77E-05	0.0%	--	--	9.09E-10	1.66E-08	0.0%	[D2]
Indeno(1,2,3-cd)pyrene	7.36E-05	8.01E-05	1.12E-08	1.44E-09	5.60E-08	2.40E-08	3.74E-07	1.87E-06	0.0%	--	--	1.05E-09	1.75E-08	0.0%	[D2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	2.97E-02	3.70E-02		1.04E+03		1.98E+04						2.91E-08	5.55E-07	28.1%	[A]
Cobalt 60	1.70E-03	2.35E-03		5.96E+01		1.26E+03						8.94E-10	1.89E-08	1.0%	[A]
Neptunium 237+D	4.16E-03	1.02E-02		1.46E+02		5.47E+03						3.21E-08	1.20E-06	60.9%	[A]
Protactinium 233	9.31E-05	6.17E-04		3.27E+00		3.30E+02						3.27E-12	3.30E-10	0.0%	[A]
Thorium 228+D	7.96E-04	9.57E-04		2.79E+01		5.12E+02						1.54E-09	2.82E-08	1.4%	[A]
Thorium 230	1.36E-03	1.75E-03		4.76E+01		9.36E+02						6.19E-10	1.22E-08	0.6%	[A]
Thorium 232	5.07E-04	6.35E-04		1.78E+01		3.40E+02						2.13E-10	4.08E-09	0.2%	[A]
Uranium 234	5.76E-03	6.19E-03		2.02E+02		3.31E+03						3.24E-09	5.30E-08	2.7%	[A]
Uranium 235+D	2.69E-04	2.88E-04		9.44E+00		1.54E+02						1.51E-10	2.47E-09	0.1%	[A]
Uranium 238+D	6.21E-03	6.59E-03		2.18E+02		3.53E+03						6.10E-09	9.89E-08	5.0%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	2.54E+00	1.30E+01	100.0%		
Excess Lifetime Cancer Risk: Combined Exposure (d)				1.87E-05	2.98E-04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)				7.40E-08	1.98E-06	100.0%

Table M.401. Risk characterization for produce: children – ingestion exposure (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration from Meas Concentration (ug/g)	RME Concentration from UCL Concentration (ug/g)	Chronic Daily Intake (CDI) CDI Noncarc Effects (MLE)	CDI Carc Effects (MLE)	CDI Noncarc Effects (RME)	CDI Carc Effects (RME)	HQ Noncarc Effects (CDI/RfD) (MLE)	HQ Noncarc Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg PLANT TISSUB)															
Antimony	6.67E-03	7.10E-03	2.28E-06	9.75E-08	1.03E-05	1.32E-06	5.69E-03	2.57E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	5.35E-01	5.54E-01	1.83E-04	7.83E-06	8.03E-04	1.03E-04	6.09E-01	2.68E+00	9.9%	skin; keratosis, hyperpigmentation	3	1.37E-05	1.81E-04	98.1%	[A]
Barium	1.01E+00	1.06E+00	3.43E-04	1.47E-05	1.53E-03	1.97E-04	4.91E-03	2.19E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.90E-03	3.16E-03	9.85E-07	4.24E-08	4.58E-06	5.89E-07	1.98E-04	9.17E-04	0.0%	no observed effects	100	1.82E-07	2.53E-06	1.4%	[B2]
Cadmium	1.04E+00	1.25E+00	3.56E-04	1.52E-05	1.18E-03	2.32E-04	3.56E-01	1.81E+00	6.7%	kidney; proteinuria	10				
Chromium (III)	5.97E-01	6.09E-01	2.04E-04	8.73E-06	8.82E-04	1.13E-04	2.04E-04	8.82E-04	0.0%	no observed effects	100				
Copper	2.10E+00	2.39E+00	7.16E-04	3.07E-05	3.46E-03	4.45E-04	1.93E-02	9.35E-02	0.3%	Gastrointestinal system; irritation	--				[D]
Lead	3.54E-01	4.03E-01	1.21E-04	5.18E-06	5.83E-04	7.50E-05				CNS, blood	--				[B2]
Manganese	3.76E+02	3.98E+02	1.28E-01	5.50E-03	5.77E-01	7.42E-02	9.17E-01	4.12E+00	15.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	3.21E+00	3.68E+00	1.09E-03	4.69E-05	5.33E-03	6.85E-04	3.65E+00	1.78E+01	65.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.23E+00	1.34E+00	4.19E-04	1.80E-05	1.95E-03	2.50E-04	2.10E-02	9.73E-02	0.4%	dec. body and organ weight	300				
Selenium	7.08E-01	7.50E-01	2.41E-04	1.03E-05	1.09E-03	1.40E-04	4.83E-02	2.17E-01	0.8%	whole body; clinical selenosis	3				[D]
Silver	3.19E-01	3.72E-01	1.09E-04	4.66E-06	5.39E-04	6.93E-05	2.17E-02	1.08E-01	0.4%	skin; argyria	3				[D]
Zinc	2.27E+01	2.36E+01	7.73E-03	3.31E-04	3.41E-02	4.39E-03	2.58E-02	1.14E-01	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUB)															
Aroclor-1254	3.95E-05	4.26E-05	1.35E-08	5.78E-10	6.18E-08	7.94E-09				--	--	4.45E-09	6.12E-08	0.0%	[B2]
Aroclor-1260	8.64E-05	1.26E-04	2.95E-08	1.26E-09	1.82E-07	2.34E-08				--	--	9.73E-09	1.80E-07	0.1%	[B2]
Benzo(a)anthracene	5.29E-04	6.38E-04	1.68E-07	7.73E-09	9.25E-07	1.19E-07	6.01E-06	3.08E-05	0.0%	--	--	5.64E-09	8.68E-08	0.0%	[B2]
Benzo(a)pyrene	2.82E-04	3.38E-04	9.62E-08	4.12E-09	4.90E-07	6.30E-08	3.21E-06	1.63E-05	0.0%	--	--	3.01E-08	4.60E-07	0.3%	[B2]
Benzo(b)fluoranthene	2.14E-04	2.50E-04	7.30E-08	3.13E-09	3.62E-07	4.65E-08	2.43E-06	1.21E-05	0.0%	--	--	2.28E-09	3.40E-08	0.0%	[B2]
Benzo(k)fluoranthene	1.70E-04	1.96E-04	5.81E-08	2.49E-09	2.84E-07	3.66E-08	1.94E-06	9.48E-06	0.0%	--	--	1.82E-09	2.67E-08	0.0%	[B2]
Chrysene	6.35E-04	7.60E-04	2.16E-07	9.28E-09	1.10E-06	1.42E-07	7.21E-06	3.67E-05	0.0%	--	--	6.77E-10	1.03E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	7.36E-05	8.01E-05	2.51E-08	1.08E-09	1.16E-07	1.49E-08	8.37E-07	3.87E-06	0.0%	--	--	7.85E-10	1.09E-08	0.0%	[B2]
RADIONUCLIDES (pCi/g PLANT TISSUB)															
Cesium 137+D	2.97E-02	3.70E-02		2.77E+02		4.58E+03									
Cobalt 60	1.70E-03	2.35E-03		1.59E+01		2.91E+02						7.75E-09	1.28E-07	28.1%	[A]
Neptunium 237+D	4.16E-03	1.02E-02		3.85E+01		1.27E+03						2.38E-10	4.36E-09	1.0%	[A]
Protactinium 233	9.31E-05	6.17E-04		8.69E-01		7.63E+01						8.55E-09	2.78E-07	60.9%	[A]
Thorium 228+D	7.96E-04	9.57E-04		7.43E+00		1.18E+02						8.69E-13	7.63E-11	0.0%	[A]
Thorium 230	1.36E-03	1.75E-03		1.27E+01		2.16E+02						4.09E-10	6.52E-09	1.4%	[A]
Thorium 232	5.07E-04	6.35E-04		4.73E+00		7.85E+01						1.65E-10	2.81E-09	0.6%	[A]
Uranium 234	5.76E-03	6.19E-03		5.38E+01		7.66E+02						5.68E-11	9.43E-10	0.2%	[A]
Uranium 235+D	2.69E-04	2.88E-04		2.51E+00		3.57E+01						8.61E-10	1.23E-08	2.7%	[A]
Uranium 238+D	6.21E-03	6.59E-03		5.80E+01		8.16E+02						4.02E-11	5.71E-10	0.1%	[A]
												1.62E-09	2.29E-08	5.0%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							5.67E+00	2.70E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.35E-05	1.84E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.97E-08	4.37E-07	100.0%	

Table M.402. Risk characterization for fish: adults – ingestion exposure (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration in Fish Tissue	RME Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS															
Mercury	0.76	0.78	2.38E-06	3.06E-07	2.89E-05	1.24E-05	7.94E-03	9.63E-02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	6.43E-07	8.27E-08	8.28E-06	3.52E-06						6.37E-07	2.71E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.13E-06	1.45E-07	1.44E-05	6.18E-06						1.12E-06	4.76E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E-03	9.63E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.75E-06	7.47E-05	100.0%	

Table M.403. Risk characterization for fish: children – ingestion exposure (future land use – residential) – Area S9–F1–R

Chemical	MLE Concentration in Fish (mg/kg)	RME Concentration in Fish (mg/kg)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS															
Mercury	0.76	0.78	4.1E-06	1.7E-07	6.0E-05	7.7E-06	1.3E-02	2.0E-01	100.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.20	0.22	1.1E-06	4.8E-08	1.7E-05	2.2E-06						3.7E-07	1.7E-05	36.3%	[B2]
Aroclor-1260	0.36	0.39	1.9E-06	8.4E-08	3.0E-05	3.8E-06						6.5E-07	2.9E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-02	2.0E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-06	4.6E-05	100.0%	

Table M.404. Risk characterization for soils: adults – ingestion exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDA Uncertainty	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Antimony	0.67	0.71	2.82E-07	3.63E-08	9.73E-07	4.17E-07	7.05E-04	2.43E-03	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	2.83E-06	3.64E-07	9.48E-06	4.06E-06	9.43E-03	3.16E-02	28.9%	skin; keratosis, hyperpigmentation	3	6.37E-07	7.11E-06	65.3%	[A]
Barium	100.70	105.90	4.26E-05	5.47E-06	1.45E-04	6.22E-05	6.08E-04	2.07E-03	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	3.06E-07	3.94E-08	1.08E-06	4.64E-07	6.13E-05	2.17E-04	0.2%	no observed effects	100	1.69E-07	2.00E-06	18.3%	[D2]
Cadmium	2.09	2.49	8.82E-07	1.13E-07	3.41E-06	1.46E-06	8.82E-04	3.41E-03	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	2.53E-05	3.25E-06	8.34E-05	3.57E-05	2.53E-05	8.34E-05	0.1%	no observed effects	100				
Copper	41.95	47.73	1.77E-05	2.28E-06	6.54E-05	2.80E-05	4.79E-04	1.77E-03	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	1.50E-05	1.93E-06	5.51E-05	2.36E-05				CNS, blood	--				[D2]
Manganese	940.60	995.30	3.98E-04	5.11E-05	1.36E-03	5.84E-04	2.84E-03	9.74E-03	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	4.52E-06	5.81E-07	1.68E-05	7.19E-06	1.51E-02	5.59E-02	51.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.65	1.04E-05	1.34E-06	3.68E-05	1.58E-05	5.19E-04	1.84E-03	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	2.99E-06	3.85E-07	1.03E-05	4.40E-06	5.98E-04	2.05E-03	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	6.74E-07	8.66E-08	2.55E-06	1.09E-06	1.35E-04	5.10E-04	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	2.39E-05	3.08E-06	8.07E-05	3.46E-05	7.98E-05	2.69E-04	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.02	0.02	9.61E-09	1.24E-09	3.36E-08	1.44E-08			--	--	--	9.51E-09	1.11E-07	1.0%	[D2]
Aroclor–1260	0.09	0.13	3.72E-08	4.78E-09	1.75E-07	7.51E-08			--	--	--	3.68E-08	5.78E-07	5.3%	[D2]
Benzo(a)anthracene	0.14	0.17	6.02E-08	7.73E-09	2.35E-07	1.01E-07	2.01E-06	7.84E-06	0.0%	--	--	5.65E-09	7.36E-08	0.7%	[B2]
Benzo(a)pyrene	0.15	0.18	6.33E-08	8.14E-09	2.46E-07	1.05E-07	2.11E-06	8.20E-06	0.0%	--	--	5.94E-08	7.65E-07	7.1%	[B2]
Benzo(b)fluoranthene	0.14	0.17	6.10E-08	7.84E-09	2.31E-07	9.89E-08	2.03E-06	7.69E-06	0.0%	--	--	5.72E-09	7.22E-08	0.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	6.77E-08	8.70E-09	2.55E-07	1.08E-07	2.26E-06	8.43E-06	0.0%	--	--	6.35E-09	7.91E-08	0.7%	[B2]
Chrysene	0.15	0.17	6.15E-08	7.91E-09	2.33E-07	1.02E-07	2.05E-06	7.96E-06	0.0%	--	--	5.78E-10	7.47E-09	0.1%	[B2]
Indeno(1,2,3–cd)pyrene	0.20	0.22	8.60E-08	1.11E-08	3.03E-07	1.30E-07	2.87E-06	1.01E-05	0.0%	--	--	8.07E-09	9.49E-08	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.99	1.23		9.61E+01		1.30E+03						2.69E-09	3.63E-08	8.6%	[A]
Cobalt 60	0.06	0.08		5.51E+00		8.22E+01						8.26E-11	1.23E-09	0.3%	[A]
Neptunium 237+D	0.10	0.26		1.01E+01		2.68E+02						2.23E-09	5.90E-08	14.0%	[A]
Protactinium 233	0.01	0.06		9.05E-01		6.47E+01						9.05E-13	6.47E-11	0.0%	[A]
Thorium 228+D	1.59	1.91		1.55E+02		2.01E+03						8.51E-09	1.11E-07	26.2%	[A]
Thorium 230	2.72	3.50		2.64E+02		3.67E+03						3.45E-09	4.77E-08	11.3%	[A]
Thorium 232	1.01	1.27		9.66E+01		1.33E+03						1.18E-09	1.60E-08	3.8%	[A]
Uranium 234	2.88	3.09		2.80E+02		3.25E+03						4.48E-09	5.20E-08	12.3%	[A]
Uranium 235+D	0.13	0.14		1.31E+01		1.51E+02						2.09E-10	2.42E-09	0.6%	[A]
Uranium 238+D	3.11	3.30		3.02E+02		3.46E+03						8.46E-09	9.69E-08	23.0%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.07E-02	1.10E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.38E-07	1.09E-05	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.13E-08	4.22E-07	100.0%	

Table M.405. Risk characterization for soils: children – ingestion exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Antimony	0.67	0.71	9.87E-07	4.23E-08	3.48E-06	4.48E-07	2.47E-03	8.70E-03	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	9.90E-06	4.24E-07	3.40E-05	4.37E-06	3.30E-02	1.13E-01	28.9%	skin; keratosis, hyperpigmentation	3	7.43E-07	7.64E-06	65.3%	[A]
Barium	100.70	105.90	1.49E-04	6.38E-06	5.19E-04	6.68E-05	2.13E-03	7.42E-03	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	1.07E-06	4.60E-08	3.88E-06	4.99E-07	2.15E-04	7.70E-04	0.2%	no observed effects	100	1.98E-07	2.14E-06	18.3%	[B2]
Cadmium	2.09	2.49	3.09E-06	1.32E-07	1.22E-05	1.57E-06	3.09E-03	1.22E-02	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	8.84E-05	3.79E-06	2.98E-04	3.84E-05	8.84E-05	2.98E-04	0.1%	no observed effects	100				
Copper	41.96	47.73	6.21E-05	2.66E-06	2.34E-04	3.01E-05	1.68E-03	6.33E-03	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	5.24E-05	2.25E-06	1.97E-04	2.54E-05				CNS, blood	--				[D]
Manganese	940.60	995.30	1.39E-03	5.96E-05	4.88E-03	6.28E-04	9.94E-03	3.49E-02	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[B2]
Mercury	10.69	12.25	1.58E-05	6.78E-07	6.01E-05	7.73E-06	5.27E-02	2.00E-01	51.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	3.64E-05	1.56E-06	1.32E-04	1.69E-05	1.82E-03	6.59E-03	1.7%	dec. body and organ weight	300				[D]
Selenium	7.08	7.50	1.05E-05	4.49E-07	3.68E-05	4.73E-06	2.09E-03	7.36E-03	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	2.36E-06	1.01E-07	9.12E-06	1.17E-06	4.72E-04	1.82E-03	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	8.38E-05	3.59E-06	2.89E-04	3.71E-05	2.79E-04	9.63E-04	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.02	0.02	3.36E-08	1.44E-09	1.20E-07	1.55E-08			--		--	1.10E-08	1.19E-07	1.0%	[B2]
Aroclor–1260	0.09	0.13	1.30E-07	5.58E-09	6.27E-07	8.07E-08			--		--	4.30E-08	6.21E-07	5.3%	[B2]
Benzo(a)anthracene	0.14	0.17	2.11E-07	9.02E-09	8.43E-07	1.08E-07	7.02E-06	2.81E-05	0.0%	--	--	6.59E-09	7.91E-08	0.7%	[B2]
Benzo(a)pyrene	0.15	0.18	2.21E-07	9.49E-09	8.86E-07	1.13E-07	7.36E-06	2.93E-05	0.0%	--	--	6.93E-08	8.26E-07	7.1%	[B2]
Benzo(b)fluoranthene	0.14	0.17	2.13E-07	9.15E-09	8.26E-07	1.06E-07	7.12E-06	2.75E-05	0.0%	--	--	6.68E-09	7.75E-08	0.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	2.37E-07	1.02E-08	9.03E-07	1.16E-07	7.90E-06	3.02E-05	0.0%	--	--	7.41E-09	8.50E-08	0.7%	[B2]
Chrysene	0.15	0.17	2.15E-07	9.23E-09	8.55E-07	1.10E-07	7.18E-06	2.85E-05	0.0%	--	--	6.74E-10	8.02E-09	0.1%	[B2]
Indeno(1,2,3–cd)pyrene	0.20	0.22	3.01E-07	1.29E-08	1.09E-06	1.40E-07	1.00E-05	3.62E-05	0.0%	--	--	9.41E-09	1.02E-07	0.9%	[B2]
RADIONUCLIDES (pCi/g)															
Cesium 137+D	0.99	1.23		4.00E+01		5.17E+02						1.12E-09	1.45E-08	8.6%	[A]
Cobalt 60	0.06	0.08		2.29E+00		3.28E+01						3.44E-11	4.92E-10	0.3%	[A]
Neptunium 237+D	0.10	0.26		4.22E+00		1.07E+02						9.28E-10	2.36E-08	14.0%	[A]
Protactinium 233	0.01	0.06		3.77E-01		2.58E+01						3.77E-13	2.58E-11	0.0%	[A]
Thorium 228+D	1.59	1.91		6.45E+01		8.02E+02						3.55E-09	4.41E-08	26.2%	[A]
Thorium 230	2.72	3.50		1.10E+02		1.46E+03						1.43E-09	1.90E-08	11.3%	[A]
Thorium 232	1.01	1.27		4.11E+01		5.32E+02						4.93E-10	6.38E-09	3.8%	[A]
Uranium 234	2.88	3.09		1.17E+02		1.30E+03						1.87E-09	2.07E-08	12.3%	[A]
Uranium 235+D	0.13	0.14		5.45E+00		6.04E+01						8.72E-11	9.66E-10	0.6%	[A]
Uranium 238+D	3.11	3.30		1.26E+02		1.38E+03						3.52E-09	3.87E-08	23.0%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	1.08E-01	3.92E-01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.09E-06	1.17E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.30E-08	1.68E-07	100.0%

Table M.406. Risk characterization for soils: adults – dermal exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLE Concentration (µg/kg)	RME Concentration (µg/kg)	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Antimony	0.67	0.71	1.02E-08	1.31E-09	1.05E-07	4.51E-08	2.54E-05	2.63E-04	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	1.02E-07	1.31E-08	1.03E-06	4.39E-07	3.39E-04	3.42E-03	28.7%	skin; keratosis, hyperpigmentation	3	2.29E-08	7.69E-07	26.4%	[A]
Barium	100.70	105.90	1.53E-06	1.97E-07	1.57E-05	6.72E-06	2.19E-05	2.24E-04	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	1.10E-08	1.42E-09	1.17E-07	5.02E-08	2.21E-06	2.34E-05	0.2%	no observed effects	100	6.10E-09	2.16E-07	7.4%	[B2]
Cadmium	2.09	2.49	3.17E-08	4.08E-09	3.65E-07	1.56E-07	3.17E-05	3.69E-04	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	9.09E-07	1.17E-07	9.01E-06	3.86E-06	9.09E-07	9.01E-06	0.1%	no observed effects	100				
Copper	41.96	47.73	6.39E-07	8.21E-08	7.07E-06	3.03E-06	1.73E-05	1.91E-04	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	5.39E-07	6.93E-08	5.96E-06	2.55E-06				CNS, blood	--				[B2]
Manganese	940.60	995.30	1.43E-05	1.84E-06	1.47E-04	6.32E-05	1.02E-04	1.05E-03	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	1.63E-07	2.09E-08	1.81E-06	7.77E-07	5.42E-04	6.05E-03	50.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	3.74E-07	4.81E-08	3.98E-06	1.70E-06	1.87E-05	1.99E-04	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	1.08E-07	1.38E-08	1.11E-06	4.76E-07	2.15E-05	2.22E-04	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.59	1.86	2.43E-08	3.12E-09	2.75E-07	1.18E-07	4.85E-06	5.51E-05	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	8.62E-07	1.11E-07	8.72E-06	3.74E-06	2.87E-06	2.91E-05	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.02	0.02	3.46E-09	4.45E-10	3.63E-08	1.55E-08				--	--	3.42E-09	1.20E-07	4.1%	[B2]
Aroclor-1260	0.09	0.13	1.34E-08	1.72E-09	1.89E-07	8.12E-08				--	--	1.33E-08	6.25E-07	21.4%	[B2]
Benzo(a)anthracene	0.14	0.17	2.17E-08	2.78E-09	2.54E-07	1.09E-07	7.22E-07	8.48E-06	0.1%	--	--	2.03E-09	7.96E-08	2.7%	[B2]
Benzo(a)pyrene	0.15	0.18	2.28E-08	2.93E-09	2.66E-07	1.14E-07	7.59E-07	8.86E-06	0.1%	--	--	2.14E-08	8.32E-07	28.5%	[B2]
Benzo(b)fluoranthene	0.14	0.17	2.20E-08	2.82E-09	2.49E-07	1.07E-07	7.32E-07	8.31E-06	0.1%	--	--	2.06E-09	7.80E-08	2.7%	[B2]
Benzo(k)fluoranthene	0.16	0.18	2.44E-08	3.13E-09	2.73E-07	1.17E-07	8.12E-07	9.18E-06	0.1%	--	--	2.29E-09	8.55E-08	2.9%	[B2]
Chrysene	0.15	0.17	2.22E-08	2.85E-09	2.58E-07	1.11E-07	7.39E-07	8.60E-06	0.1%	--	--	2.08E-10	8.08E-09	0.3%	[B2]
Indeno(1,2,3-cd)pyrene	0.20	0.22	3.10E-08	3.98E-09	3.28E-07	1.41E-07	1.03E-06	1.09E-05	0.1%	--	--	2.91E-09	1.03E-07	3.5%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.11E-03	1.19E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.66E-08	2.91E-06	100.0%	

Table M.407. Risk characterization for soils: children – dermal exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLE Concentration in Soil	RME Concentration in Soil	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern; Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Antimony	0.67	0.71	1.32E-08	5.67E-10	1.36E-07	1.77E-08	3.31E-05	3.44E-04	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	6.69	6.92	1.33E-07	5.69E-09	1.34E-06	1.72E-07	4.42E-04	4.47E-03	28.7%	skin; keratosis, hyperpigmentation	3	9.96E-09	3.02E-07	26.4%	[A]
Barium	100.70	103.90	2.00E-06	8.56E-08	2.05E-05	2.64E-06	2.85E-05	2.93E-04	1.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.73	0.79	1.44E-08	6.16E-10	1.53E-07	1.97E-08	2.88E-06	3.00E-05	0.2%	no observed effects	100	2.65E-09	8.47E-08	7.4%	[D2]
Cadmium	2.09	2.49	4.14E-08	1.77E-09	4.83E-07	6.21E-08	4.14E-05	4.83E-04	3.1%	kidney; proteinuria	10				
Chromium (III)	59.74	60.85	1.18E-06	5.08E-08	1.18E-05	1.52E-06	1.18E-06	1.18E-05	0.1%	no observed effects	100				
Copper	41.96	47.73	8.32E-07	3.57E-08	9.24E-06	1.19E-06	2.25E-05	2.50E-04	1.6%	Gastrointestinal system; irritation	--				[D]
Lead	35.44	40.25	7.03E-07	3.01E-08	7.80E-06	1.00E-06				CNS, blood	--				[D2]
Manganese	940.60	995.30	1.87E-05	8.00E-07	1.93E-04	2.48E-05	1.33E-04	1.38E-03	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	10.69	12.25	2.12E-07	9.09E-09	2.37E-06	3.05E-07	7.07E-04	7.91E-03	50.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	24.57	26.85	4.87E-07	2.09E-08	5.20E-06	6.69E-07	2.44E-05	2.60E-04	1.7%	dec. body and organ weight	300				
Selenium	7.08	7.50	1.40E-07	6.01E-09	1.45E-06	1.87E-07	2.81E-05	2.90E-04	1.9%	whole body; clinical selenosis	3				[D]
Silver	1.39	1.86	3.16E-08	1.35E-09	3.60E-07	4.63E-08	6.32E-06	7.20E-05	0.5%	skin; argyria	3				[D]
Zinc	56.64	58.90	1.12E-06	4.81E-08	1.14E-05	1.47E-06	3.74E-06	3.86E-05	0.2%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.02	0.02	4.51E-09	1.93E-10	4.74E-08	6.10E-09				--	--	1.49E-09	4.70E-08	4.1%	[D2]
Aroclor-1260	0.09	0.13	1.75E-08	7.48E-10	2.48E-07	3.18E-08				--	--	5.76E-09	2.45E-07	21.4%	[D2]
Benzo(a)anthracene	0.14	0.17	2.82E-08	1.21E-09	3.33E-07	4.28E-08	9.41E-07	1.11E-05	0.1%	--	--	8.83E-10	3.17E-08	2.7%	[D2]
Benzo(a)pyrene	0.15	0.18	2.97E-08	1.27E-09	3.48E-07	4.47E-08	9.90E-07	1.16E-05	0.1%	--	--	9.29E-09	3.26E-07	28.5%	[D2]
Benzo(b)fluoranthene	0.14	0.17	2.86E-08	1.23E-09	3.26E-07	4.19E-08	9.54E-07	1.09E-05	0.1%	--	--	8.95E-10	3.06E-08	2.7%	[D2]
Benzo(k)fluoranthene	0.16	0.18	3.18E-08	1.36E-09	3.58E-07	4.60E-08	1.06E-06	1.19E-05	0.1%	--	--	9.93E-10	3.36E-08	2.9%	[D2]
Chrysene	0.15	0.17	2.89E-08	1.24E-09	3.38E-07	4.34E-08	9.63E-07	1.13E-05	0.1%	--	--	9.03E-11	3.17E-09	0.3%	[D2]
Indeno(1,2,3-cd)pyrene	0.20	0.22	4.03E-08	1.73E-09	4.29E-07	5.52E-08	1.34E-06	1.43E-05	0.1%	--	--	1.26E-09	4.03E-08	3.5%	[D2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.45E-03	1.56E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.33E-08	1.14E-06	100.0%	

Table M.408. Risk characterization for surface water: adults — ingestion exposure (swimming) (future land use — agricultural/homesteader) — Area S9–F2–A

Chemical	MLE Concentration in AW	RME Concentration in AW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.08E-06	1.35E-07	8.55E-06	3.66E-06	1.55E-05	1.22E-04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.07E-07	1.37E-08	1.07E-06	4.61E-07	1.07E-07	1.07E-06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.53E-07	3.26E-08	1.78E-06	7.64E-07	6.85E-06	4.82E-05	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.68E-06	4.73E-07	3.36E-05	1.44E-05	7.36E-04	6.72E-03	78.0%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.66E-08	4.71E-09	3.20E-07	1.37E-07	1.22E-04	1.07E-03	12.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.15E-07	1.48E-08	1.15E-06	4.92E-07	1.64E-05	1.64E-04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.41E-07	1.21E-07	7.40E-06	3.17E-06	3.14E-06	2.47E-05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	8.51E-08	1.09E-08	6.27E-07	2.69E-07	8.51E-07	6.27E-06	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.18E-10	4.09E-11	2.04E-09	8.72E-10	1.06E-05	6.78E-05	0.8%	liver; lesions, toxicity	1000	6.96E-10	1.48E-08	24.7%	[B2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	1.30E-07	1.67E-08	1.13E-06	4.83E-07	6.51E-06	5.64E-05	0.7%	liver; weight inc.	1000	2.34E-10	6.77E-09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	5.58E-08	7.17E-09	3.81E-07	1.63E-07	5.58E-06	3.81E-05	0.4%	liver; lesions, fatty cyst formation	1000	4.37E-11	9.97E-10	1.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	5.51E-10	7.08E-11	4.02E-09	1.72E-09	1.10E-06	8.04E-06	0.1%	liver; lesions	100	2.41E-11	5.86E-10	1.0%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.31E-10	6.82E-11	4.07E-09	1.74E-09	1.06E-05	8.14E-05	0.9%	liver; lesions	100	1.09E-09	2.79E-08	46.5%	[B2]
Endrin	3.87E-02	5.00E-02	5.31E-10	6.81E-11	4.07E-09	1.74E-09	1.77E-06	1.36E-05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.49E-10	3.20E-11	1.91E-09	8.17E-10	8.30E-07	6.36E-06	0.1%	liver, kidney; toxicity	1000	4.16E-11	1.06E-09	1.8%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	2.96E-10	3.80E-11	2.04E-09	8.72E-10	2.28E-05	1.57E-04	1.8%	liver; inc. relative weight	1000	3.46E-10	7.94E-09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	5.72E-08	7.36E-09	3.94E-07	1.69E-07	5.72E-06	3.94E-05	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		1.16E+01		2.68E+02						1.85E-10	4.29E-09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		1.30E+01		3.31E+02						3.64E-10	9.28E-09	68.4%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	9.67E-04	8.62E-03	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)		2.48E-09	6.01E-08	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)		5.49E-10	1.31E-08	100.0%

Table M.409. Risk characterization for surface water: children – ingestion exposure (swimming) (future land use – agricultural/homesteader) – Area S9–F2–A

Chem(a)	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	3.04E–06	1.30E–07	2.30E–05	2.96E–06	4.34E–05	3.29E–04	1.4%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	2.99E–07	1.28E–08	2.89E–06	3.72E–07	2.99E–07	2.89E–06	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	7.10E–07	3.04E–08	4.80E–06	6.17E–07	1.92E–05	1.30E–04	0.6%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	1.03E–05	4.42E–07	9.09E–05	1.16E–05	2.06E–03	1.81E–02	78.0%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.66E+00	3.93E+00	1.03E–07	4.40E–09	8.62E–07	1.11E–07	3.42E–04	2.87E–03	12.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	3.22E–07	1.38E–08	3.09E–06	3.97E–07	4.60E–05	4.41E–04	1.9%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	2.64E–06	1.13E–07	1.99E–05	2.56E–06	8.79E–06	6.64E–05	0.3%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	2.38E–07	1.02E–08	1.69E–06	2.17E–07	2.38E–06	1.69E–05	0.1%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E–02	2.50E–02	8.91E–10	3.82E–11	5.48E–09	7.05E–10	2.97E–05	1.83E–04	0.8%	liver; lesions, toxicity	1000	6.49E–10	1.20E–08	24.7%	[B2]
Bis(2–ethylhexyl)phthalate	9.50E+00	1.39E+01	3.64E–07	1.56E–08	3.04E–06	3.90E–07	1.82E–05	1.52E–04	0.7%	liver; weight inc.	1000	2.19E–10	5.40E–09	11.3%	[B2]
Chloroform	4.07E+00	4.69E+00	1.56E–07	6.69E–09	1.03E–06	1.32E–07	1.56E–05	1.03E–04	0.4%	liver; lesions, fatty cyst formation	1000	4.08E–11	8.00E–10	1.7%	[B2]
4,4'–DDT	4.02E–02	4.94E–02	1.54E–09	6.61E–11	1.08E–08	1.39E–09	3.08E–06	2.17E–05	0.1%	liver; lesions	100	2.25E–11	4.73E–10	1.0%	[B2]
Dieldrin	3.87E–02	5.00E–02	1.49E–09	6.37E–11	1.10E–08	1.41E–09	2.97E–05	2.19E–04	0.9%	liver; lesions	100	1.02E–09	2.25E–08	46.5%	[B2]
Endrin	3.87E–02	5.00E–02	1.48E–09	6.36E–11	1.10E–08	1.41E–09	4.95E–06	3.65E–05	0.2%	CNS, liver; convulsions, lesions	100				[D]
gamma–BHC	1.82E–02	2.34E–02	6.97E–10	2.99E–11	5.14E–09	6.60E–10	2.32E–06	1.71E–05	0.1%	liver, kidney; toxicity	1000	3.89E–11	8.58E–10	1.8%	[C]
Heptachlor Epoxide	2.16E–02	2.50E–02	8.28E–10	3.55E–11	5.48E–09	7.05E–10	6.37E–05	4.21E–04	1.8%	liver; inc. relative weight	1000	3.23E–10	6.41E–09	13.2%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.60E–07	6.87E–09	1.06E–06	1.36E–07	1.60E–05	1.06E–04	0.5%	liver; hepatotoxicity	1000				
RADIONUCLIDES (pCi/L)															
Uranium 234	3.68E+00	4.29E+00		3.86E+00		8.04E+01						6.18E–11	1.29E–09	31.6%	[A]
Uranium 238+D	4.13E+00	5.31E+00		4.33E+00		9.94E+01						1.21E–10	2.78E–09	68.4%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.71E–03	2.32E–02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.31E–09	4.65E–08	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.83E–10	4.07E–09	100.0%	

Table M.410. Risk characterization for surface waters: adults — dermal exposure (swimming and wading) (future land use — agricultural/homesteader) — Area S9–F2–A

Chemical	MLB Concentration (µg/L)	RMB Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern, Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	RfDA WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	8.40E-08	1.09E-08	1.17E-06	5.00E-07	1.20E-06	1.67E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	8.27E-09	1.06E-09	1.47E-07	6.29E-08	8.27E-09	1.47E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	1.96E-08	2.52E-09	2.43E-07	1.04E-07	5.30E-07	6.55E-06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.65E+02	4.13E+02	2.80E-07	3.66E-08	4.59E-06	1.97E-06	5.70E-05	9.18E-04	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	2.84E-09	3.65E-10	4.37E-08	1.87E-08	9.46E-06	1.46E-04	1.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	8.91E-09	1.15E-09	1.57E-07	6.72E-08	1.27E-06	2.24E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	7.29E-08	9.37E-09	1.01E-06	4.33E-07	2.43E-07	3.37E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	4.12E-08	5.30E-09	5.35E-07	2.29E-07	4.12E-07	5.35E-06	0.0%	Inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	2.46E-10	3.17E-11	2.78E-09	1.19E-09	8.20E-06	9.26E-05	0.7%	liver; lesions, toxicity	1000	5.39E-10	2.02E-08	1.9%	[D2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.08E-06	2.67E-07	3.17E-05	1.36E-05	1.04E-04	1.59E-03	12.0%	liver; weight inc.	1000	3.74E-09	1.90E-07	18.3%	[D2]
Chloroform	4.07E+00	4.69E+00	2.40E-07	3.09E-08	2.90E-06	1.24E-06	2.40E-05	2.90E-04	2.2%	liver; lesions, fatty cyst formation	1000	1.88E-10	7.57E-09	0.7%	[D2]
4,4'-DDT	4.02E-02	4.94E-02	1.15E-07	1.47E-08	1.48E-06	6.32E-07	2.29E-04	2.95E-03	22.3%	liver; lesions	100	5.01E-09	2.15E-07	20.7%	[D2]
Dieldrin	3.87E-02	5.00E-02	4.11E-09	5.28E-10	5.56E-08	2.38E-08	8.22E-05	1.11E-03	8.4%	liver; lesions	100	8.45E-09	3.81E-07	36.6%	[D2]
Endrin	3.87E-02	5.00E-02	4.10E-09	5.28E-10	5.56E-08	2.38E-08	1.37E-05	1.85E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	1.69E-09	2.17E-10	2.28E-08	9.77E-09	5.63E-06	7.60E-05	0.6%	liver, kidney; toxicity	1000	2.82E-10	1.27E-08	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	4.52E-09	5.82E-10	5.49E-08	2.35E-08	3.48E-04	4.22E-03	31.9%	liver; inc. relative weight	1000	5.29E-09	2.14E-07	20.6%	[D2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.33E-06	1.71E-07	1.61E-05	6.92E-06	1.33E-04	1.61E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.02E-03	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.35E-08	1.04E-06	100.0%	

Table M.411. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (future land use – agricultural/homesteader) – Area S9–P2–A

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Barium	7.92E+01	1.05E+02	1.09E-07	4.69E-09	1.53E-06	1.96E-07	1.56E-06	2.18E-05	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.80E+00	1.32E+01	1.08E-08	4.62E-10	1.92E-07	2.47E-08	1.08E-08	1.92E-07	0.0%	no observed effects	100				
Copper	1.85E+01	2.19E+01	2.56E-08	1.10E-09	3.18E-07	4.09E-08	6.91E-07	8.60E-06	0.0%	Gastrointestinal system; irritation	--				[D]
Manganese (water)	2.69E+02	4.13E+02	3.72E-07	1.59E-08	6.00E-06	7.72E-07	7.43E-05	1.20E-03	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.68E+00	3.93E+00	3.70E-09	1.59E-10	5.72E-08	7.35E-09	1.23E-05	1.91E-04	1.1%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Vanadium	8.40E+00	1.41E+01	1.16E-08	4.98E-10	2.05E-07	2.64E-08	1.66E-06	2.93E-05	0.2%	no observed effects	100				
Zinc	6.87E+01	9.09E+01	9.50E-08	4.07E-09	1.32E-06	1.70E-07	3.17E-07	4.40E-06	0.0%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Acetone	6.21E+00	7.70E+00	5.37E-08	2.30E-09	7.00E-07	9.00E-08	5.37E-07	7.00E-06	0.0%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Aldrin	2.32E-02	2.50E-02	3.21E-10	1.38E-11	3.63E-09	4.67E-10	1.07E-05	1.21E-04	0.7%	liver; lesions, toxicity	1000	2.34E-10	7.94E-09	1.9%	[D2]
Bis(2-ethylhexyl)phthalate	9.50E+00	1.39E+01	2.71E-06	1.16E-07	4.15E-05	5.34E-06	1.35E-04	2.08E-03	12.0%	liver; weight inc.	1000	1.63E-09	7.47E-08	18.3%	[B2]
Chloroform	4.07E+00	4.69E+00	3.13E-07	1.34E-08	3.79E-06	4.87E-07	3.13E-05	3.79E-04	2.2%	liver; lesions, fattycyst formation	1000	8.19E-11	2.97E-09	0.7%	[B2]
4,4'-DDT	4.02E-02	4.94E-02	1.49E-07	6.40E-09	1.93E-06	2.48E-07	2.99E-04	3.86E-03	22.3%	liver; lesions	100	2.18E-09	8.44E-08	20.7%	[B2]
Dieldrin	3.87E-02	5.00E-02	5.36E-09	2.30E-10	7.27E-08	9.34E-09	1.07E-04	1.45E-03	8.4%	liver; lesions	100	3.67E-09	1.50E-07	36.6%	[B2]
Endrin	3.87E-02	5.00E-02	5.35E-09	2.29E-10	7.27E-08	9.34E-09	1.78E-05	2.42E-04	1.4%	CNS, liver; convulsions, lesions	100				[D]
gamma-BHC	1.82E-02	2.34E-02	2.20E-09	9.43E-11	2.98E-08	3.83E-09	7.33E-06	9.93E-05	0.6%	liver, kidney; toxicity	1000	1.23E-10	4.98E-09	1.2%	[C]
Heptachlor Epoxide	2.16E-02	2.50E-02	5.90E-09	2.53E-10	7.18E-08	9.23E-09	4.54E-04	5.52E-03	31.9%	liver; inc. relative weight	1000	2.30E-09	8.40E-08	20.6%	[B2]
Tetrachloroethylene	4.18E+00	4.84E+00	1.73E-06	7.43E-08	2.11E-05	2.71E-06	1.73E-04	2.11E-03	12.2%	liver; hepatotoxicity	1000				
Chemical Hazards: Hazard Index (HI):							1.35E-03	1.73E-02	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.02E-08	4.08E-07	100.0%	

Table M.412. Risk characterization for sediments: adults – dermal exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemicals	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	7.49E-10	9.62E-11	3.24E-08	1.39E-08	2.50E-06	1.08E-04	16.3%	skin; keratosis, hyperpigmentation	3	1.68E-10	2.43E-08	8.7%	[A]
Barium	78.13	88.46	1.28E-08	1.65E-09	5.45E-07	2.33E-07	1.83E-07	7.78E-06	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.51E-10	1.93E-11	6.31E-09	2.70E-09	3.01E-08	1.26E-06	0.2%	no observed effects	100	8.32E-11	1.10E-08	4.2%	[B2]
Cadmium	1.42	1.71	2.33E-10	3.00E-11	1.05E-08	4.52E-09	2.33E-07	1.05E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	7.85E-09	1.01E-09	3.39E-07	1.45E-07	7.85E-09	3.39E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	3.94E-09	5.07E-10	1.84E-07	7.88E-08	1.07E-07	4.97E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	8.71E-09	1.12E-09	6.13E-07	2.63E-07				CNS, blood	--				[B2]
Manganese	886.40	1036.00	1.46E-07	1.87E-08	6.38E-06	2.73E-06	1.04E-06	4.56E-05	6.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	2.46E-09	3.16E-10	1.26E-07	5.40E-08	8.19E-06	4.20E-04	63.4%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	3.80E-09	4.89E-10	1.73E-07	7.31E-08	1.90E-07	8.53E-06	1.3%	dec. body and organ weight	300				
Vanadium	29.04	33.74	4.77E-09	6.14E-10	2.08E-07	8.90E-08	6.82E-07	2.97E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	1.60E-08	2.05E-09	7.44E-07	3.19E-07	5.32E-08	2.48E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor–1254	0.10	0.16	1.69E-10	2.18E-11	1.01E-08	4.31E-09				--	--	1.68E-10	3.32E-08	11.9%	[B2]
Aroclor–1260	0.08	0.14	1.33E-10	1.71E-11	8.54E-09	3.66E-09				--	--	1.32E-10	2.82E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	5.35E-10	6.87E-11	3.18E-08	1.36E-08	1.78E-08	1.08E-06	0.2%	--	--	5.02E-11	9.96E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	5.18E-10	6.66E-11	2.99E-08	1.28E-08	1.73E-08	9.96E-07	0.2%	--	--	4.86E-10	9.34E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	6.16E-10	7.92E-11	3.57E-08	1.53E-08	2.05E-08	1.19E-06	0.2%	--	--	5.78E-11	1.12E-08	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	5.05E-10	6.49E-11	2.44E-08	1.04E-08	1.68E-08	8.13E-07	0.1%	--	--	4.74E-11	7.63E-09	2.7%	[B2]
Chrysene	0.31	0.49	5.08E-10	6.53E-11	3.02E-08	1.30E-08	1.69E-08	1.01E-06	0.2%	--	--	4.77E-12	9.46E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	3.61E-10	4.64E-11	1.49E-08	6.37E-09	1.20E-08	4.95E-07	0.1%	--	--	3.39E-10	4.65E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.26E-11	1.62E-12	8.32E-10	3.57E-10	2.52E-07	1.66E-05	2.5%	liver; lesions	100	2.60E-11	5.70E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	4.53E-10	5.82E-11	2.33E-08	1.00E-08	1.51E-08	7.78E-07	0.1%	--	--	4.25E-11	7.30E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-03	6.62E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-09	2.80E-07	100.0%	

Table M.413. Risk characterization for sediments: children – dermal exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLB Concentration in Sediment	RMB Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	IRFA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	IRFA WOE
INORGANICS (mg/kg)															
Arsenic	4.55	5.27	9.7E-10	4.1E-11	4.2E-08	5.4E-09	3.2E-06	1.4E-04	16.3%	skin; keratosis, hyperpigmentation	3	7.3E-11	9.5E-09	8.7%	[A]
Barium	78.13	88.46	1.6E-08	7.1E-10	7.1E-07	9.1E-08	2.3E-07	1.0E-05	1.2%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.92	1.03	1.9E-10	8.4E-12	8.2E-09	1.0E-09	3.9E-08	1.6E-06	0.2%	no observed effects	100	3.6E-11	4.5E-09	4.2%	[B2]
Cadmium	1.42	1.71	3.0E-10	1.3E-11	1.3E-08	1.7E-09	3.0E-07	1.3E-05	1.6%	kidney; proteinuria	10				
Chromium (III)	47.74	55.04	1.0E-08	4.3E-10	4.4E-07	5.7E-08	1.0E-08	4.4E-07	0.1%	no observed effects	100				
Copper	23.99	29.87	5.1E-09	2.2E-10	2.4E-07	3.0E-08	1.3E-07	6.5E-06	0.8%	Gastrointestinal system; irritation	--				[D]
Lead	52.96	99.48	1.1E-08	4.6E-10	8.0E-07	1.0E-07				CNS, blood	--				[D2]
Manganese	886.40	1036.00	1.9E-07	8.1E-09	8.3E-06	1.0E-06	1.3E-06	5.9E-05	6.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	14.95	20.45	3.2E-09	1.3E-10	1.6E-07	2.1E-08	1.0E-05	5.4E-04	63.4%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	23.14	27.71	4.9E-09	2.1E-10	2.2E-07	2.8E-08	2.4E-07	1.1E-05	1.3%	dec. body and organ weight	300				[D]
Vanadium	29.04	33.74	6.2E-09	2.6E-10	2.7E-07	3.4E-08	8.8E-07	3.8E-05	4.5%	no observed effects	100				
Zinc	97.07	120.80	2.0E-08	8.9E-10	9.7E-07	1.2E-07	6.9E-08	3.2E-06	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Aroclor-1254	0.10	0.16	2.2E-10	9.4E-12	1.3E-08	1.6E-09				--	--	7.2E-11	1.3E-08	11.9%	[B2]
Aroclor-1260	0.08	0.14	1.7E-10	7.4E-12	1.1E-08	1.4E-09				--	--	5.7E-11	1.1E-08	10.1%	[B2]
Benzo(a)anthracene	0.33	0.52	6.9E-10	2.9E-11	4.1E-08	5.3E-09	2.3E-08	1.3E-06	0.2%	--	--	2.1E-11	3.9E-09	3.6%	[B2]
Benzo(a)pyrene	0.32	0.49	6.7E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.1E-10	3.6E-08	33.4%	[B2]
Benzo(b)fluoranthene	0.37	0.58	8.0E-10	3.4E-11	4.6E-08	6.0E-09	2.6E-08	1.5E-06	0.2%	--	--	2.5E-11	4.3E-09	4.0%	[B2]
Benzo(k)fluoranthene	0.31	0.40	6.5E-10	2.8E-11	3.1E-08	4.1E-09	2.1E-08	1.0E-06	0.1%	--	--	2.0E-11	2.9E-09	2.7%	[B2]
Chrysene	0.31	0.49	6.6E-10	2.8E-11	3.9E-08	5.0E-09	2.2E-08	1.3E-06	0.2%	--	--	2.0E-12	3.7E-10	0.3%	[B2]
Dibenzo(a,h)anthracene	0.22	0.24	4.7E-10	2.0E-11	1.9E-08	2.5E-09	1.5E-08	6.4E-07	0.1%	--	--	1.4E-10	1.8E-08	16.6%	[B2]
Dieldrin	0.01	0.01	1.6E-11	7.0E-13	1.0E-09	1.4E-10	3.2E-07	2.1E-05	2.5%	liver; lesions	100	1.1E-11	2.2E-09	2.0%	[B2]
Indeno(1,2,3-cd)pyrene	0.28	0.38	5.9E-10	2.5E-11	3.0E-08	3.9E-09	1.9E-08	1.0E-06	0.1%	--	--	1.8E-11	2.8E-09	2.6%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.7E-05	8.6E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.9E-10	1.1E-07	100.0%	

Table M.414. Risk characterization for groundwater: adults — ingestion exposure (future land use — agricultural/homesteader) — Area S9—F2—A

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.61E-05	9.78E-06	1.53E-04	6.53E-05	2.54E-01	5.09E-01	1.8%	skin; keratosis, hyperpigmentation	3	1.7E-05	1.1E-04	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.58E-03	9.74E-04	1.33E-02	5.70E-03	1.08E-01	1.90E-01	0.7%	*oral*—cardiovasc. sys.; inc. blood pressure. *Inhal.*—fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.61E-05	4.64E-06	7.01E-05	3.00E-05	7.22E-03	1.40E-02	0.1%	no observed effects	100	2.0E-05	1.2E-04	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.33E-04	8.14E-05	1.12E-03	4.88E-04	6.33E-04	1.12E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.20E-04	4.12E-05	8.87E-03	3.80E-03	8.66E-03	2.40E-01	0.9%	Gastrointestinal system; irritation	- -				[D]
Lead	2.68E+01	3.53E+01	5.13E-04	6.60E-05	9.68E-04	4.15E-04				CNS, blood	- -				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.17E-02	9.22E-03	1.21E-01	5.19E-02	1.43E+01	2.42E+01	87.4%	*oral*—CNS effects. *Inhal.*—respiratory, psychomotor disturb.	1				[D]
Mercury	1.35E+01	2.19E+01	2.66E-04	3.42E-05	5.99E-04	2.57E-04	8.86E-01	2.00E+00	7.2%	*oral*—CNS; neurotoxicity. *Inhal.*—kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.21E-04	1.18E-04	1.76E-03	7.55E-04	4.61E-02	8.81E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.49E-04	9.64E-05	1.34E-03	5.76E-04	1.07E-01	1.92E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.55E+02	6.82E+02	6.85E-03	8.86E-04	1.87E-02	8.01E-03	6.85E-02	1.87E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.34E-03	1.72E-04	3.65E-03	1.58E-03	2.23E-02	6.15E-02	0.2%	*oral and inhal.*—liver; toxicity	100	1.2E-06	1.1E-05	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D[j]	3.27E+00	4.07E+00		1.44E+04		8.54E+04						1.4E-06	8.5E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		5.57E+04		3.82E+05						8.9E-07	6.1E-06	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		4.51E+04		3.16E+05						1.2E-06	8.8E-06	37.7%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.5E+01	2.7E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.8E-05	2.3E-04	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												3.5E-06	2.3E-05	100.0%	

Table M.415. Risk characterization for groundwater: children – ingestion exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLB Concentration (µg/L)	RMB Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (µg/L)															
Arsenic	3.97E+00	5.58E+00	7.91E-05	3.39E-06	1.81E-04	2.33E-05	2.64E-01	6.03E-01	1.8%	skin; keratosis, hyperpigmentation	3	5.93E-06	4.07E-05	44.8%	[A]
Barium	3.95E+02	4.85E+02	7.88E-03	3.38E-04	1.57E-02	2.02E-03	1.13E-01	2.25E-01	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	1.88E+00	2.56E+00	3.76E-05	1.61E-06	8.31E-05	1.07E-05	7.51E-03	1.66E-02	0.1%	no observed effects	100	6.92E-06	4.59E-05	50.5%	[B2]
Chromium (III)	3.30E+01	4.10E+01	6.59E-04	2.82E-05	1.33E-03	1.71E-04	6.59E-04	1.33E-03	0.0%	no observed effects	100				
Copper	1.67E+01	3.24E+02	3.33E-04	1.43E-05	1.05E-02	1.35E-03	9.01E-03	2.84E-01	0.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.68E+01	3.53E+01	5.34E-04	2.29E-05	1.15E-03	1.47E-04				CNS, blood	--				[B2]
Manganese (water)	3.74E+03	4.42E+03	7.46E-02	3.20E-03	1.43E-01	1.84E-02	1.49E+01	2.87E+01	87.4%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.39E+01	2.19E+01	2.76E-04	1.18E-05	7.09E-04	9.12E-05	9.21E-01	2.36E+00	7.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	4.80E+01	6.43E+01	9.58E-04	4.11E-05	2.09E-03	2.68E-04	4.79E-02	1.04E-01	0.3%	dec. body and organ weight	300				
Vanadium	3.91E+01	4.90E+01	7.79E-04	3.34E-05	1.59E-03	2.05E-04	1.11E-01	2.27E-01	0.7%	no observed effects	100				
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	7.16E-03	3.07E-04	2.21E-02	2.85E-03	7.16E-02	2.21E-01	0.7%	inc. liver, kidney weights, nephrotoxicity	1000				[D]
Methylene Chloride	6.97E+01	1.35E+02	1.39E-03	5.96E-05	4.37E-03	5.62E-04	2.32E-02	7.28E-02	0.2%	*oral and inhal.*–liver; toxicity	100	4.47E-07	4.21E-06	4.6%	[B2]
RADIONUCLIDES (pCi/L)															
Radium 228+D	3.27E+00	4.07E+00		1.78E+03		1.13E+04						1.78E-07	1.13E-06	36.4%	[A]
Uranium 234	1.26E+01	1.82E+01		6.90E+03		5.04E+04						1.10E-07	8.06E-07	26.0%	[A]
Uranium 238+D	1.02E+01	1.51E+01		5.59E+03		4.17E+04						1.56E-07	1.17E-06	37.7%	[A]

Chemical Hazards:			
Hazard Index (HI):			
Combined Exposure (d)	1.65E+01	3.28E+01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.33E-05	9.08E-05	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	4.45E-07	3.10E-06	100.0%

Table M.416. Risk characterization for groundwater: adults – inhalation exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLE Concentration (µg/L)	RME Concentration (µg/L)	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDA WOE
ORGANICS (µg/L)															
Acetone	3.5E+02	6.8E+02	1.7E–04	2.2E–05	7.0E–04	3.0E–04				Inc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.9E+01	1.3E+02	3.4E–05	4.4E–06	1.3E–04	5.9E–05	4.0E–05	1.6E–04	100.0%	*oral and inhal*–liver; toxicity	100	7.3E–09	9.7E–08	100.0%	(D2)
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.0E–05	1.6E–04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.3E–09	9.7E–08	100.0%	

Table M.417. Risk characterization for groundwater: children – inhalation exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLB Concentration (µg/L)	RMB Concentration (µg/L)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	BPA WoE
ORGANICS (µg/L)															
Acetone	3.59E+02	6.82E+02	1.03E-03	4.43E-05	3.17E-03	4.07E-04				Inc. liver, kidney weights, nephrotoxicity					
Methylene Chloride	6.97E+01	1.35E+02	2.01E-04	8.60E-06	6.25E-04	8.04E-05	2.34E-04	7.30E-04	100.0%	*oral and inhal.*–liver; toxicity	100	1.42E-08	1.33E-07	100.0%	(D2)
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.34E-04	7.30E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.42E-08	1.33E-07	100.0%	

Table M.418. Risk characterization for produce: adults – ingestion exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLE Concentration from Mean Concentration (µg/g)	RME Concentration from UCL Concentration (µg/g)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Care. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Care. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	IRIS UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Care. Risk	IRIS WOE
INORGANICS (mg/kg PLANT TISSUB)															
Antimony	6.67E-03	7.10E-03	1.02E-06	1.31E-07	1.16E-05	4.96E-06	2.55E-03	2.89E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	5.35E-01	5.54E-01	8.17E-05	1.05E-05	9.03E-04	3.87E-04	2.72E-01	3.01E+00	9.9%	skin; keratosis, hyperpigmentation	3	1.84E-05	6.77E-04	98.1%	[A]
Barium	1.01E+00	1.06E+00	1.54E-04	1.98E-05	1.75E-03	7.40E-04	2.20E-03	2.47E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.90E-03	3.16E-03	4.47E-07	5.69E-08	5.16E-06	2.21E-06	8.85E-05	1.03E-03	0.0%	no observed effects	100	2.45E-07	9.50E-06	1.4%	[D2]
Cadmium	1.04E+00	1.25E+00	1.59E-04	2.05E-05	2.00E-03	8.70E-04	1.59E-01	2.03E+00	6.7%	kidney; proteinuria	10				
Chromium (III)	5.97E-01	6.09E-01	9.12E-05	1.17E-05	9.92E-04	4.25E-04	9.12E-05	9.92E-04	0.0%	no observed effects	100				
Copper	2.10E+00	2.39E+00	3.20E-04	4.12E-05	3.89E-03	1.67E-03	8.65E-03	1.05E-01	0.3%	Gastrointestinal system; irritation	--				[D]
Lead	3.54E-01	4.03E-01	5.41E-05	6.95E-06	6.56E-04	2.81E-04				CNS, blood	--				[B2]
Manganese	3.76E+02	3.98E+02	5.74E-02	7.38E-03	6.49E-01	2.78E-01	4.10E-01	4.64E+00	15.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	3.21E+00	3.68E+00	4.89E-04	6.29E-05	5.99E-03	2.57E-03	1.63E+00	2.00E+01	65.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.23E+00	1.34E+00	1.87E-04	2.41E-05	2.19E-03	9.38E-04	9.37E-03	1.09E-01	0.4%	dec. body and organ weight	300				
Selenium	7.08E-01	7.50E-01	1.08E-04	1.39E-05	1.22E-03	5.24E-04	2.16E-02	2.44E-01	0.8%	whole body; clinical selenosis	3				[D]
Silver	3.19E-01	3.72E-01	4.86E-05	6.25E-06	6.06E-04	2.60E-04	9.73E-03	1.21E-01	0.4%	skin; argyria	3				[D]
Zinc	2.27E+01	2.36E+01	3.46E-03	4.44E-04	3.84E-02	1.65E-02	1.15E-02	1.28E-01	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUB)															
Aroclor–1254	3.95E-05	4.26E-05	6.03E-09	7.76E-10	6.95E-08	2.98E-08				--	--	5.97E-09	2.29E-07	0.0%	[B2]
Aroclor–1260	8.64E-05	1.26E-04	1.32E-08	1.70E-09	2.05E-07	8.77E-08				--	--	1.31E-08	6.75E-07	0.1%	[B2]
Benzo(a)anthracene	5.29E-04	6.38E-04	8.07E-08	1.04E-08	1.04E-06	4.46E-07	2.69E-06	3.47E-05	0.0%	--	--	7.57E-09	3.26E-07	0.0%	[B2]
Benzo(a)pyrene	2.82E-04	3.38E-04	4.30E-08	5.53E-09	5.51E-07	2.36E-07	1.43E-06	1.84E-05	0.0%	--	--	4.04E-08	1.73E-06	0.3%	[B2]
Benzo(b)fluoranthene	2.14E-04	2.53E-04	3.27E-08	4.20E-09	4.07E-07	1.74E-07	1.09E-06	1.30E-05	0.0%	--	--	3.06E-09	1.27E-07	0.0%	[B2]
Benzo(k)fluoranthene	1.70E-04	1.96E-04	2.60E-08	3.34E-09	3.20E-07	1.37E-07	8.66E-07	1.07E-05	0.0%	--	--	2.44E-09	1.00E-07	0.0%	[B2]
Chrysene	6.35E-04	7.60E-04	9.68E-08	1.24E-08	1.24E-06	5.31E-07	3.23E-06	4.13E-05	0.0%	--	--	9.09E-10	3.87E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	7.36E-05	8.01E-05	1.12E-08	1.44E-09	1.31E-07	5.60E-08	3.74E-07	4.35E-06	0.0%	--	--	1.05E-09	4.09E-08	0.0%	[B2]
RADIONUCLIDES (pCi/g PLANT TISSUB)															
Cesium 137+D	2.97E-02	3.70E-02		1.04E+03		4.63E+04						2.91E-08	1.31E-06	28.1%	[A]
Cobalt 60	1.70E-03	2.35E-03		5.96E+01		2.94E+03						8.94E-10	4.40E-08	1.0%	[A]
Neptunium 237+D	4.16E-03	1.02E-02		1.46E+02		1.28E+04						3.21E-08	2.81E-06	60.9%	[A]
Protactinium 233	9.31E-05	6.17E-04		3.27E+00		7.70E+02						3.27E-12	7.70E-10	0.0%	[A]
Thorium 228+D	7.96E-04	9.57E-04		2.79E+01		1.20E+03						1.54E-09	6.58E-08	1.4%	[A]
Thorium 230	1.36E-03	1.75E-03		4.76E+01		2.18E+03						6.19E-10	2.84E-08	0.6%	[A]
Thorium 232	5.07E-04	6.35E-04		1.78E+01		7.93E+02						2.13E-10	9.51E-09	0.2%	[A]
Uranium 234	5.76E-03	6.19E-03		2.02E+02		7.73E+03						3.24E-09	1.24E-07	2.7%	[A]
Uranium 235+D	2.69E-04	2.88E-04		9.44E+00		3.60E+02						1.51E-10	5.76E-09	0.1%	[A]
Uranium 238+D	6.21E-03	6.59E-03		2.18E+02		8.24E+03						6.10E-09	2.31E-07	5.0%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	2.54E+00	3.04E+01	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.87E-05	6.90E-04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	7.40E-08	4.61E-06	100.0%

Table M.419. Risk characterization for produce: children – ingestion exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLE Concentration from Mean Concentration (mg/kg)	RME Concentration from UCL Concentration (mg/kg)	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	IRIS UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	IRIS WOE
INORGANICS (mg/kg PLANT TISSUE)															
Antimony	6.67E-03	7.10E-03	2.28E-06	9.75E-08	2.40E-05	3.09E-06	5.69E-03	6.00E-02	0.1%	whole body, blood; inc. mortality	1000				
Arsenic	5.35E-01	5.54E-01	1.83E-04	7.83E-06	1.87E-03	2.41E-04	6.09E-01	6.24E+00	9.9%	skin; keratosis, hyperpigmentation	3	1.37E-05	4.21E-04	98.1%	[A]
Barium	1.01E+00	1.06E+00	3.43E-04	1.47E-05	3.58E-03	4.60E-04	4.91E-03	5.12E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.90E-03	3.16E-03	9.85E-07	4.24E-08	1.07E-05	1.38E-06	1.98E-04	2.14E-03	0.0%	no observed effects	100	1.82E-07	5.91E-06	1.4%	[B2]
Cadmium	1.04E+00	1.25E+00	3.56E-04	1.52E-05	4.21E-03	5.42E-04	3.56E-01	4.21E+00	6.7%	kidney; proteinuria	10				
Chromium (III)	5.97E-01	6.09E-01	2.04E-04	8.73E-06	2.06E-03	2.65E-04	2.04E-04	2.06E-03	0.0%	no observed effects	100				
Copper	2.10E+00	2.35E+00	7.16E-04	3.07E-05	8.07E-03	1.04E-03	1.93E-02	2.18E-01	0.3%	Gastrointestinal system; irritation	--				[D]
Lead	3.54E-01	4.03E-01	1.21E-04	5.18E-06	1.36E-03	1.75E-04				CNS, blood	--				[D]
Manganese	3.76E+02	3.98E+02	1.28E-01	5.50E-03	1.35E+00	1.73E-01	9.17E-01	9.62E+00	15.3%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D2]
Mercury	3.21E+00	3.68E+00	1.09E-03	4.69E-05	1.24E-02	1.60E-03	3.65E+00	4.14E+01	65.7%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	1.23E+00	1.34E+00	4.19E-04	1.80E-05	4.54E-03	5.84E-04	2.10E-02	2.27E-01	0.4%	dec. body and organ weight	300				[D]
Selenium	7.08E-01	7.50E-01	2.41E-04	1.03E-05	2.54E-03	3.26E-04	4.83E-02	5.07E-01	0.8%	whole body; clinical selenosis	3				[D]
Silver	3.19E-01	3.72E-01	1.09E-04	4.66E-06	1.26E-03	1.62E-04	2.17E-02	2.52E-01	0.4%	skin; argyria	3				[D]
Zinc	2.27E+01	2.36E+01	7.73E-03	3.31E-04	7.97E-02	1.02E-02	2.58E-02	2.66E-01	0.4%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Aroclor-1254	3.95E-05	4.26E-05	1.35E-08	5.78E-10	1.44E-07	1.85E-08				--	--	4.45E-09	1.43E-07	0.0%	[B2]
Aroclor-1260	8.64E-05	1.26E-04	2.95E-08	1.26E-09	4.25E-07	5.46E-08				--	--	9.73E-09	4.20E-07	0.1%	[B2]
Benzo(a)anthracene	5.29E-04	6.38E-04	1.80E-07	7.73E-09	2.16E-06	2.78E-07	6.01E-06	7.20E-05	0.0%	--	--	5.64E-09	2.03E-07	0.0%	[B2]
Benzo(a)pyrene	2.82E-04	3.38E-04	9.62E-08	4.12E-09	1.14E-06	1.47E-07	3.21E-06	3.81E-05	0.0%	--	--	3.01E-08	1.07E-06	0.3%	[B2]
Benzo(b)fluoranthene	2.14E-04	2.30E-04	7.30E-08	3.13E-09	8.45E-07	1.09E-07	2.43E-06	2.82E-05	0.0%	--	--	2.28E-09	7.95E-08	0.0%	[B2]
Benzo(k)fluoranthene	1.70E-04	1.96E-04	5.81E-08	2.49E-09	6.66E-07	8.53E-08	1.94E-06	2.21E-05	0.0%	--	--	1.82E-09	6.23E-08	0.0%	[B2]
Chrysene	6.35E-04	7.66E-04	2.16E-07	9.28E-09	2.57E-06	3.30E-07	7.21E-06	8.56E-05	0.0%	--	--	6.77E-10	2.41E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	7.36E-05	8.01E-05	2.51E-08	1.08E-09	2.71E-07	3.46E-08	8.37E-07	9.03E-06	0.0%	--	--	7.85E-10	2.54E-08	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Cesium 137+D	2.97E-02	3.70E-02		2.77E+02		1.07E+04						7.75E-09	2.99E-07	28.1%	[A]
Cobalt 60	1.70E-03	2.35E-03		1.55E+01		6.79E+02						2.38E-10	1.02E-08	1.0%	[A]
Neptunium 237+D	4.16E-03	1.02E-02		3.85E+01		2.95E+03						8.55E-09	6.50E-07	60.9%	[A]
Protactinium 233	9.31E-05	6.17E-04		8.65E-01		1.78E+02						8.65E-13	1.78E-10	0.0%	[A]
Thorium 228+D	7.96E-04	9.57E-04		7.43E+00		2.76E+02						4.05E-10	1.52E-08	1.4%	[A]
Thorium 230	1.36E-03	1.75E-03		1.27E+01		5.05E+02						1.65E-10	6.56E-09	0.6%	[A]
Thorium 232	5.07E-04	6.35E-04		4.73E+00		1.83E+02						5.68E-11	2.20E-09	0.2%	[A]
Uranium 234	5.76E-03	6.19E-03		5.38E+01		1.79E+03						8.61E-10	2.86E-08	2.7%	[A]
Uranium 235+D	2.69E-04	2.88E-04		2.51E+00		8.32E+01						4.02E-11	1.33E-09	0.1%	[A]
Uranium 238+D	6.21E-03	6.59E-03		5.80E+01		1.90E+03						1.62E-09	5.33E-08	5.0%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	5.67E+00	6.30E+01	100.0%
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.39E-05	4.29E-04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)	1.97E-08	1.07E-06	100.0%

Table M.420. Risk characterization for beef: adults — ingestion exposure (future land use — agricultural) — Area S9–F2–A

Chemical	MLE Concentration from Meso Concentration in Soil/AW	RME Concentration from UCL Concentration in Soil/AW	Chronic Daily Intake (CDI): CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncanc/noncanc Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	BPA WOE
INORGANICS (mg/kg BEEF TISSUE)															
Antimony	3.8E-04	4.0E-04	9.1E-08	1.1E-08	4.1E-07	1.7E-07	2.2E-04	1.0E-03	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	1.4E-01	1.5E-01	3.5E-05	4.6E-06	1.5E-04	6.7E-05	1.1E-01	5.2E-01	5.9%	skin; keratosis, hyperpigmentation	3	8.0E-06	1.1E-04	54.4%	[A]
Barium	5.7E-01	7.5E-01	1.3E-04	1.7E-05	7.7E-04	3.3E-04	1.9E-03	1.1E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.7E-03	2.9E-03	6.5E-07	8.4E-08	3.0E-06	1.3E-06	1.3E-04	6.0E-04	0.0%	no observed effects	100	3.6E-07	5.6E-06	2.6%	[D2]
Cadmium	8.3E-03	9.9E-03	2.0E-06	2.5E-07	1.0E-05	4.3E-06	2.0E-03	1.0E-02	0.1%	kidney; proteinuria	10				
Chromium (III)	9.1E+00	1.4E+01	2.2E-03	2.8E-04	1.5E-02	6.5E-03	2.2E-03	1.5E-02	0.2%	no observed effects	100				
Copper	7.8E+00	9.2E+00	1.9E-03	2.4E-04	9.5E-03	4.0E-03	5.1E-02	2.5E-01	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.0E-02	2.3E-02	4.8E-06	6.2E-07	2.3E-05	1.0E-05				CNS, blood	--				[D2]
Manganese	2.0E+01	2.5E+01	4.8E-03	6.1E-04	2.6E-02	1.1E-02	3.4E-02	1.8E-01	2.1%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.3E+00	1.8E+00	3.2E-04	4.2E-05	1.9E-03	8.2E-04	1.1E+00	6.4E+00	71.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	5.4E-02	5.9E-02	1.3E-05	1.6E-06	6.1E-05	2.6E-05	6.5E-04	3.0E-03	0.0%	dec. body and organ weight	300				
Selenium	1.5E+00	1.6E+00	3.7E-04	4.8E-05	1.6E-03	7.2E-04	7.4E-02	3.3E-01	3.8%	whole body; clinical selenosis	3				[D]
Silver	3.1E-02	3.7E-02	7.6E-06	9.8E-07	3.8E-05	1.6E-05	1.5E-03	7.6E-03	0.1%	skin; argyria	3				[D]
Zinc	2.6E+02	3.4E+02	6.3E-02	8.1E-03	3.5E-01	1.5E-01	2.1E-01	1.1E+00	13.1%	blood; anemia	3				[D]
ORGANICS (mg/kg BEEF TISSUE)															
Aroclor–1254	7.1E-04	7.7E-04	1.7E-07	2.2E-08	7.9E-07	3.4E-07				--	--	1.7E-07	2.6E-06	1.2%	[B2]
Aroclor–1260	7.2E-03	1.0E-02	1.7E-06	2.2E-07	1.0E-05	4.6E-06				--	--	1.7E-06	3.5E-05	16.4%	[B2]
Benzo(a)anthracene	1.2E-03	1.5E-03	3.1E-07	3.9E-08	1.6E-06	6.8E-07	1.0E-05	5.3E-05	0.0%	--	--	2.9E-08	5.0E-07	0.2%	[B2]
Benzo(a)pyrene	4.1E-03	4.9E-03	9.9E-07	1.2E-07	5.0E-06	2.1E-06	3.3E-05	1.6E-04	0.0%	--	--	9.3E-07	1.5E-05	7.3%	[B2]
Benzo(b)fluoranthene	5.9E-03	6.9E-03	1.4E-06	1.8E-07	7.1E-06	3.0E-06	4.7E-05	2.3E-04	0.0%	--	--	1.3E-07	2.2E-06	1.0%	[B2]
Benzo(k)fluoranthene	1.1E-02	1.3E-02	2.7E-06	3.5E-07	1.3E-05	5.8E-06	9.2E-05	4.5E-04	0.0%	--	--	2.6E-07	4.2E-06	2.0%	[B2]
Chrysene	1.0E-03	1.2E-03	2.4E-07	3.1E-08	1.2E-06	5.3E-07	8.2E-06	4.1E-05	0.0%	--	--	2.3E-09	3.9E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	9.2E-02	1.0E-01	2.2E-05	2.8E-06	1.0E-04	4.4E-05	7.4E-04	3.4E-03	0.0%	--	--	2.0E-06	3.2E-05	14.8%	[B2]
RADIONUCLIDES (pCi/kg BEEF TISSUE)															
Cesium 137+D	2.6E+01	3.9E+01		1.4E+03		3.1E+04						4.0E-08	8.7E-07	9.4%	[A]
Cobalt 60	3.1E+00	1.0E+01		1.7E+02		8.0E+03						2.5E-09	1.2E-07	1.3%	[A]
Neptunium 237+D	1.2E+01	3.5E+01		6.7E+02		2.8E+04						1.4E-07	6.2E-06	66.9%	[A]
Protactinium 233	2.0E-01	1.3E+00		1.1E+01		1.0E+03						1.1E-11	1.0E-09	0.0%	[A]
Thorium 228+D	1.8E+01	2.2E+01		1.0E+03		1.7E+04						5.7E-08	9.7E-07	10.5%	[A]
Thorium 230	3.2E+01	4.1E+01		1.7E+03		3.2E+04						2.3E-08	4.2E-07	4.5%	[A]
Thorium 232	1.2E+01	1.5E+01		6.6E+02		1.1E+04						7.9E-09	1.4E-07	1.5%	[A]
Uranium 234	1.3E+01	1.4E+01		7.5E+02		1.1E+04						1.2E-08	1.8E-07	2.0%	[A]
Uranium 235+D	6.4E-01	7.1E-01		3.6E+01		5.6E+02						5.7E-10	9.0E-09	0.1%	[A]
Uranium 238+D	1.4E+01	1.5E+01		8.1E+02		1.2E+04						2.2E-08	3.5E-07	3.8%	[A]
Chemical Hazards: Hazard Index (HI):							1.6E+00	8.9E+00	100.0%						
Excess Lifetime Cancer Risk: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.3E-05	2.1E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												3.1E-07	9.3E-06	100.0%	

Table M.421. Risk characterization for beef: children – ingestion exposure (future land use – agricultural) – Area S9–F2–A

Chemical	MLE Concentration from Meas. Concentration in Soil/AW	RME Concentration from UCL Concentration in Soil/AW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern/ Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg BBBF TISSUE)															
Antimony	3.8E-04	4.0E-04	1.9E-07	8.2E-09	8.2E-07	1.0E-07	4.8E-04	2.0E-03	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	1.4E-01	1.5E-01	7.5E-05	3.2E-06	3.1E-04	4.0E-05	2.5E-01	1.0E+00	5.9%	skin; keratosis, hyperpigmentation	3	5.6E-06	7.0E-05	54.4%	[A]
Barium	5.7E-01	7.5E-01	2.8E-04	1.2E-05	1.5E-03	1.9E-04	4.1E-03	2.1E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.7E-03	2.9E-03	1.3E-06	5.8E-08	6.0E-06	7.7E-07	2.7E-04	1.2E-03	0.0%	no observed effects	100	2.5E-07	3.3E-06	2.6%	[B2]
Cadmium	8.3E-03	9.9E-03	4.2E-06	1.8E-07	2.0E-05	2.6E-06	4.2E-03	2.0E-02	0.1%	kidney; proteinuria	10				
Chromium (III)	9.1E+00	1.4E+01	4.6E-03	1.9E-04	3.0E-02	3.9E-03	4.6E-03	3.0E-02	0.2%	no observed effects	100				
Copper	7.8E+00	9.2E+00	3.9E-03	1.7E-04	1.8E-02	2.4E-03	1.0E-01	5.1E-01	2.9%	Gastrointestinal system; irritation	--				[D]
Lead	2.0E-02	2.3E-02	1.0E-05	4.3E-07	4.6E-05	6.0E-06				CNS, blood	--				[B2]
Manganese	2.0E+01	2.5E+01	1.0E-02	4.3E-04	5.2E-02	6.7E-03	7.1E-02	3.7E-01	2.1%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.3E+00	1.8E+00	6.8E-04	2.9E-05	3.8E-03	4.9E-04	2.3E+00	1.2E+01	71.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	5.4E-02	5.9E-02	2.7E-05	1.1E-06	1.2E-04	1.5E-05	1.3E-03	6.0E-03	0.0%	dec. body and organ weight	300				
Selenium	1.5E+00	1.6E+00	7.8E-04	3.3E-05	3.3E-03	4.3E-04	1.5E-01	6.6E-01	3.8%	whole body; clinical selenosis	3				[D]
Silver	3.1E-02	3.7E-02	1.6E-05	6.6E-07	7.5E-05	9.7E-06	3.2E-03	1.5E-02	0.1%	skin; argyria	3				[D]
Zinc	2.6E+02	3.4E+02	1.3E-01	5.7E-03	6.9E-01	8.9E-02	4.4E-01	2.3E+00	13.1%	blood; anemia	3				[D]
ORGANICS (mg/kg BBBF TISSUE)															
Aroclor-1254	7.1E-04	7.7E-04	3.6E-07	1.5E-08	1.5E-06	2.0E-07				--	--	1.1E-07	1.5E-06	1.2%	[B2]
Aroclor-1260	7.2E-03	1.0E-02	3.6E-06	1.5E-07	2.1E-05	2.7E-06				--	--	1.2E-06	2.1E-05	16.4%	[B2]
Benzo(a)anthracene	1.2E-03	1.5E-03	6.5E-07	2.7E-08	3.1E-06	4.0E-07	2.1E-05	1.0E-04	0.0%	--	--	2.0E-08	2.9E-07	0.2%	[B2]
Benzo(a)pyrene /	4.1E-03	4.9E-03	2.0E-06	8.9E-08	1.0E-05	1.3E-06	6.9E-05	3.3E-04	0.0%	--	--	6.5E-07	9.4E-06	7.3%	[B2]
Benzo(b)fluoranthene	5.9E-03	6.9E-03	3.0E-06	1.2E-07	1.4E-05	1.8E-06	9.9E-05	4.7E-04	0.0%	--	--	9.3E-08	1.3E-06	1.0%	[B2]
Benzo(k)fluoranthene	1.1E-02	1.3E-02	5.8E-06	2.5E-07	2.7E-05	3.4E-06	1.9E-04	9.0E-04	0.0%	--	--	1.8E-07	2.5E-06	2.0%	[B2]
Chrysene	1.0E-03	1.2E-03	5.1E-07	2.2E-08	2.4E-06	3.2E-07	1.7E-05	8.3E-05	0.0%	--	--	1.6E-09	2.3E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	9.2E-02	1.0E-01	4.6E-05	2.0E-06	2.0E-04	2.6E-05	1.5E-03	6.8E-03	0.0%	--	--	1.4E-06	1.9E-05	14.8%	[B2]
RADIONUCLIDES (pCi/kg BBBF TISSUE)															
Cesium 137+D	2.6E+01	3.9E+01		3.5E+02		6.8E+03						1.0E-08	1.9E-07	9.4%	[A]
Cobalt 60	3.1E+00	1.0E+01		4.3E+01		1.7E+03						6.4E-10	2.6E-08	1.3%	[A]
Neptunium 237+D	1.2E+01	3.5E+01		1.6E+02		6.2E+03						3.7E-08	1.3E-06	66.9%	[A]
Protactinium 233	2.0E-01	1.3E+00		2.8E+00		2.4E+02						2.8E-12	2.4E-10	0.0%	[A]
Thorium 228+D	1.8E+01	2.2E+01		2.6E+02		3.9E+03						1.4E-08	2.1E-07	10.5%	[A]
Thorium 230	3.2E+01	4.1E+01		4.4E+02		7.1E+03						5.7E-09	9.3E-08	4.5%	[A]
Thorium 232	1.2E+01	1.5E+01		1.6E+02		2.6E+03						1.9E-09	3.1E-08	1.5%	[A]
Uranium 234	1.3E+01	1.4E+01		1.8E+02		2.5E+03						3.0E-09	4.0E-08	2.0%	[A]
Uranium 235+D	6.4E-01	7.1E-01		8.9E+00		1.2E+02						1.4E-10	2.0E-09	0.1%	[A]
Uranium 238+D	1.4E+01	1.5E+01		2.0E+02		2.7E+03						5.6E-09	7.7E-08	3.8%	[A]

Chemical Hazards:			
Hazard Index (HI):	3.3E+00	1.7E+01	100.0%
Excess Lifetime Cancer Risk:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	9.6E-06	1.3E-04	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	7.8E-08	2.0E-06	100.0%

Table M.422. Risk characterization for milk: adults — ingestion exposure (future land use — agricultural) — Area S9–F2–A

Chemical	MLE Concentration from Mean Concentration in Soil/SW	RME Concentration from UCL Concentration in Soil/SW	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	BPA WOE
INORGANICS															
Antimony	6.1E-05	6.5E-05	5.9E-08	7.6E-09	2.7E-07	1.1E-07	1.4E-04	6.7E-04	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	1.6E-03	1.7E-03	1.6E-06	2.0E-07	7.0E-06	3.0E-06	5.3E-03	2.3E-02	0.3%	skin; keratosis, hyperpigmentation	3	3.6E-07	5.3E-06	3.9%	[A]
Barium	3.3E+00	4.4E+00	3.2E-03	4.1E-04	1.8E-02	7.8E-03	4.6E-02	2.6E-01	3.5%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.1E-06	2.2E-06	2.0E-09	2.6E-10	9.4E-09	4.0E-09	4.0E-07	1.8E-06	0.0%	no observed effects	100	1.1E-09	1.7E-08	0.0%	[B2]
Cadmium	4.5E-02	5.3E-02	4.3E-05	5.5E-06	2.2E-04	9.4E-05	4.3E-02	2.2E-01	3.0%	kidney; proteinuria	10				
Chromium (III)	1.7E+00	2.6E+00	1.6E-03	2.1E-04	1.1E-02	5.0E-03	1.6E-03	1.1E-02	0.2%	no observed effects	100				
Copper	4.6E+00	5.4E+00	4.4E-03	5.7E-04	2.2E-02	9.5E-03	1.2E-01	6.0E-01	8.1%	Gastrointestinal system; irritation	--				[D]
Lead	1.4E-02	1.6E-02	1.3E-05	1.7E-06	6.6E-05	2.8E-05				CNS, blood	--				[B2]
Manganese	1.7E+01	2.2E+01	1.6E-02	2.1E-03	9.1E-02	3.9E-02	1.1E-01	6.5E-01	8.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.9E-01	2.7E-01	1.9E-04	2.4E-05	1.1E-03	4.7E-04	6.3E-01	3.7E+00	50.2%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	6.1E-02	6.6E-02	5.8E-05	7.5E-06	2.7E-04	1.1E-04	2.9E-03	1.3E-02	0.2%	dec. body and organ weight	300				
Selenium	3.9E-01	4.2E-01	3.8E-04	4.9E-05	1.7E-03	7.3E-04	7.6E-02	3.4E-01	4.6%	whole body; clinical selenosis	3				[D]
Silver	1.7E-01	2.0E-01	1.6E-04	2.1E-05	8.2E-04	3.5E-04	3.3E-02	1.6E-01	2.2%	skin; argyria	3				[D]
Zinc	7.8E+01	1.0E+02	7.5E-02	9.6E-03	4.1E-01	1.7E-01	2.5E-01	1.3E+00	18.7%	blood; anemia	3				[D]
ORGANICS															
Aroclor–1254	2.6E-04	2.8E-04	2.5E-07	3.2E-08	1.1E-06	4.9E-07				--	--	2.5E-07	3.8E-06	2.8%	[B2]
Aroclor–1260	2.5E-03	3.7E-03	2.4E-06	3.1E-07	1.5E-05	6.5E-06				--	--	2.4E-06	5.0E-05	36.8%	[B2]
Benzo(a)anthracene	5.1E-04	6.2E-04	5.0E-07	6.4E-08	2.5E-06	1.1E-06	1.6E-05	8.5E-05	0.0%	--	--	4.6E-08	8.0E-07	0.6%	[B2]
Benzo(a)pyrene	1.5E-03	1.8E-03	1.4E-06	1.8E-07	7.5E-06	3.2E-06	4.9E-05	2.5E-04	0.0%	--	--	1.3E-06	2.3E-05	17.1%	[B2]
Benzo(b)fluoranthene	2.1E-03	2.5E-03	2.0E-06	2.6E-07	1.0E-05	4.4E-06	6.9E-05	3.4E-04	0.0%	--	--	1.9E-07	3.2E-06	2.4%	[B2]
Benzo(k)fluoranthene	4.0E-03	4.7E-03	3.9E-06	5.0E-07	1.9E-05	8.3E-06	1.3E-04	6.4E-04	0.0%	--	--	3.7E-07	6.0E-06	4.4%	[B2]
Chrysene	4.2E-04	5.0E-04	4.0E-07	5.2E-08	2.0E-06	8.8E-07	1.3E-05	6.9E-05	0.0%	--	--	3.8E-09	6.4E-08	0.0%	[B2]
Indeno(1,2,3–cd)pyrene	3.1E-02	3.4E-02	3.0E-05	3.8E-06	1.4E-04	6.0E-05	1.0E-03	4.6E-03	0.1%	--	--	2.8E-06	4.3E-05	32.0%	[B2]
RADIONUCLIDES															
Cesium 137+D	1.4E+01	2.3E+01		3.1E+03		7.4E+04						8.9E-08	2.0E-06	28.0%	[A]
Cobalt 60	5.1E-01	1.8E+00		1.1E+02		5.9E+03						1.7E-09	8.9E-08	1.2%	[A]
Neptunium 237+D	2.2E+00	6.7E+00		5.0E+02		2.1E+04						1.1E-07	4.6E-06	62.5%	[A]
Protactinium 233	2.6E-02	1.7E-01				5.6E+02						0.0E+00	5.6E-10	0.0%	[A]
Thorium 228+D	1.3E+00	1.6E+00		2.9E+02		5.0E+03						1.6E-08	2.7E-07	3.7%	[A]
Thorium 230	2.2E+00	2.9E+00		5.0E+02		9.2E+03						6.5E-09	1.2E-07	1.6%	[A]
Thorium 232	8.5E-01	1.0E+00		1.6E+02		3.3E+03						2.2E-09	4.0E-08	0.5%	[A]
Uranium 234	1.1E+00	1.2E+00		2.4E+02		3.8E+03						3.9E-09	6.1E-08	0.8%	[A]
Uranium 235+D	5.5E-02	6.2E-02		1.2E+01		1.9E+02						1.9E-10	3.1E-09	0.0%	[A]
Uranium 238+D	1.2E+00	1.3E+00		2.7E+02		4.2E+03						7.5E-09	1.1E-07	1.6%	[A]

Chemical Hazards: Hazard Index (HI): Combined Exposure (d)	1.3E+00	7.4E+00	100.0%		
Excess Lifetime Cancer Risk: Combined Exposure (d)				7.9E-06	1.3E-04	100.0%
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)				2.3E-07	7.4E-06	100.0%

Table M.423. Risk characterization for milk: children – ingestion exposure (future land use – agricultural) – Area S9–F2–A

Chemical	MLE Concentration from Mean Concentration in Soil (µg/kg)	RME Concentration from UCL Concentration in Soil (µg/kg)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS															
Antimony	6.19E-05	6.59E-05	2.68E-07	1.15E-08	1.12E-06	1.44E-07	6.69E-04	2.80E-03	0.0%	whole body, blood; inc. mortality	1000				
Arsenic	1.66E-03	1.72E-03	7.18E-06	3.08E-07	2.92E-05	3.76E-06	2.39E-02	9.74E-02	0.3%	skin; keratosis, hyperpigmentation	3	5.39E-07	6.57E-06	3.9%	[A]
Barium	3.37E+00	4.45E+00	1.46E-02	6.24E-04	7.57E-02	9.73E-03	2.08E-01	1.08E+00	3.5%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.10E-06	2.29E-06	9.06E-09	3.88E-10	3.85E-08	5.00E-09	1.8E-06	7.77E-06	0.0%	no observed effects	100	1.67E-09	2.15E-08	0.0%	[B2]
Cadmium	4.50E-02	5.37E-02	1.94E-04	8.33E-06	9.12E-04	1.17E-04	1.94E-01	9.12E-01	3.0%	kidney; proteinuria	10				
Chromium (III)	1.73E+00	2.86E+00	7.48E-03	3.20E-04	4.86E-02	6.25E-03	7.48E-03	4.86E-02	0.2%	no observed effects	100				
Copper	4.60E+00	5.41E+00	1.95E-02	8.52E-04	9.19E-02	1.18E-02	5.37E-01	2.46E+00	8.1%	Gastrointestinal system; irritation	--				[D]
Lead	1.43E-02	1.62E-02	6.17E-05	2.64E-06	2.75E-04	3.54E-05				CNS, blood	--				[D2]
Manganese	1.73E+01	2.24E+01	7.49E-02	3.21E-03	3.80E-01	4.88E-02	5.35E-01	2.71E+00	8.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.98E-01	2.72E-01	8.53E-04	3.66E-05	4.61E-03	5.93E-04	2.84E+00	1.54E+01	50.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	6.10E-02	6.67E-02	2.64E-04	1.13E-05	1.13E-03	1.46E-04	1.32E-02	5.66E-02	0.2%	dec. body and organ weight	300				
Selenium	3.96E-01	4.20E-01	1.71E-03	7.33E-05	7.12E-03	9.16E-04	3.42E-01	1.42E+00	4.6%	whole body; clinical selenosis	3				[D]
Silver	1.72E-01	2.01E-01	7.42E-04	3.18E-05	3.41E-03	4.38E-04	1.48E-01	6.81E-01	2.2%	skin; argyria	3				[D]
Zinc	7.80E+01	1.01E+02	3.37E-01	1.44E-02	1.72E+00	2.21E-01	1.12E+00	5.74E+00	18.7%	blood; anemia	3				[D]
ORGANICS															
Aroclor-1254	2.63E-04	2.83E-04	1.14E-06	4.87E-08	4.81E-06	6.19E-07				--	--	3.75E-07	4.76E-06	2.8%	[B2]
Aroclor-1260	2.56E-03	3.72E-03	1.11E-05	4.74E-07	6.32E-05	8.13E-06				--	--	3.65E-06	6.26E-05	36.8%	[B2]
Benzo(a)anthracene	5.18E-04	6.26E-04	2.24E-06	9.60E-08	1.06E-05	1.37E-06	7.46E-05	3.54E-04	0.0%	--	--	7.01E-08	9.97E-07	0.6%	[B2]
Benzo(a)pyrene	1.53E-03	1.83E-03	6.60E-06	2.83E-07	3.11E-05	4.00E-06	2.20E-04	1.04E-03	0.0%	--	--	2.06E-06	2.92E-05	17.1%	[B2]
Benzo(b)fluoranthene	2.15E-03	2.51E-03	9.31E-06	3.98E-07	4.26E-05	5.48E-06	3.10E-04	1.42E-03	0.0%	--	--	2.91E-07	4.00E-06	2.4%	[B2]
Benzo(k)fluoranthene	4.09E-03	4.71E-03	1.77E-05	7.57E-07	8.01E-05	1.03E-05	5.89E-04	2.67E-03	0.0%	--	--	5.53E-07	7.51E-06	4.4%	[B2]
Chrysene	4.21E-04	5.04E-04	1.82E-06	7.80E-08	8.57E-06	1.10E-06	6.07E-05	2.86E-04	0.0%	--	--	5.69E-09	8.04E-08	0.0%	[B2]
Indeno(1,2,3-cd)pyrene	3.14E-02	3.42E-02	1.36E-04	5.81E-06	5.86E-04	7.46E-05	4.52E-03	1.93E-02	0.1%	--	--	4.24E-06	5.45E-05	32.0%	[B2]
RADIONUCLIDES															
Cesium 137+D	1.44E+01	2.37E+01		1.70E+03		3.43E+04						4.77E-08	9.62E-07	28.0%	[A]
Cobalt 60	5.16E-01	1.85E+00		6.11E+01		2.74E+03						9.16E-10	4.11E-08	1.2%	[A]
Neptunium 237+D	2.26E+00	6.73E+00		2.67E+02		9.76E+03						5.88E-08	2.15E-06	62.5%	[A]
Protactinium 233	2.69E-02	1.78E-01				2.59E+02						0.00E+00	2.59E-10	0.0%	[A]
Thorium 228+D	1.34E+00	1.61E+00		1.58E+02		2.33E+03						8.71E-09	1.28E-07	3.7%	[A]
Thorium 230	2.28E+00	2.94E+00		2.70E+02		4.26E+03						3.51E-09	5.54E-08	1.6%	[A]
Thorium 232	8.53E-01	1.07E+00		1.01E+02		1.55E+03						1.21E-09	1.86E-08	0.5%	[A]
Uranium 234	1.12E+00	1.22E+00		1.32E+02		1.77E+03						2.12E-09	2.84E-08	0.8%	[A]
Uranium 235+D	5.50E-02	6.29E-02		6.50E+00		9.12E+01						1.04E-10	1.46E-09	0.0%	[A]
Uranium 238+D	1.22E+00	1.35E+00		1.44E+02		1.96E+03						4.03E-09	5.48E-08	1.6%	[A]

Chemical Hazards:			
Hazard Index (HI): Combined Exposure (d)	5.98E+00	3.00E+01	100.0%
Excess Lifetime Cancer Risk:			
Combined Exposure (d)	1.18E-05	1.70E-04	100.0%
Radiological Hazards:			
Excess Lifetime Cancer Risk: Combined Exposure (d)	1.27E-07	3.44E-06	100.0%

Table M.424. Risk characterization for fish: adults – ingestion exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLB Concentration in Fish Tissue	RMB Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS															
Mercury	0.76	0.78	2.38E–06	3.08E–07	2.89E–05	1.24E–05	7.94E–03	9.63E–02	100.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	6.43E–07	8.27E–08	8.21E–06	3.52E–06						6.37E–07	2.71E–05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.13E–06	1.45E–07	1.44E–05	6.18E–06						1.12E–06	4.76E–05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E–03	9.63E–02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.75E–06	7.47E–05	100.0%	

Table M.425. Risk characterization for fish: children – ingestion exposure (future land use – agricultural/homesteader) – Area S9–F2–A

Chemical	MLB Concentration in Fish (mg/kg)	RMB Concentration in Fish (mg/kg)	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLB)	CDI Canc. Effects (MLB)	CDI Noncanc. Effects (RMB)	CDI Canc. Effects (RMB)	Risk Estimates HQ Noncanc. Effects (CDI/RfD) (MLB)	HQ Noncanc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UP	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Canc. Risk	RfD WOE
INORGANICS															
Mercury	0.76	0.78	4.1E-06	1.7E-07	6.0E-05	7.7E-06	1.3E-02	2.0E-01	100.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
ORGANICS															
Aroclor–1254	0.20	0.22	1.1E-06	4.8E-08	1.7E-05	2.2E-06						3.7E-07	1.7E-05	36.3%	[B2]
Aroclor–1260	0.36	0.39	1.9E-06	8.4E-08	3.0E-05	3.8E-06						6.5E-07	2.9E-05	63.7%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-02	2.0E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.0E-06	4.6E-05	100.0%	

Table M.426. Risk characterization for air: adults – inhalation exposure during mowing activities (future land use – agricultural) – Area S9–F2–A

Chemical	MLE Concentration in Air	RME Concentration in Air	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	UPA UR	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	UPA Wt.
INORGANICS (mg/m³)															
Antimony	8.67E-06	9.23E-06	9.02E-09	1.16E-09	9.60E-09	4.11E-09				whole body, blood; inc. mortality	--				
Arsenic	8.70E-05	9.00E-05	9.04E-08	1.16E-08	9.36E-08	4.01E-08				skin; keratosis, hyperpigmentation	--	5.81E-07	2.00E-06	93.7%	[A]
Barium	1.31E-03	1.39E-03	1.36E-06	1.75E-07	1.43E-06	6.13E-07	9.53E-03	1.00E-02	7.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	1000				
Beryllium	9.43E-06	1.03E-05	9.80E-09	1.26E-09	1.07E-08	4.58E-09				no observed effects	--	1.06E-08	3.85E-08	1.8%	[D2]
Cadmium	2.71E-05	3.24E-05	2.82E-08	3.62E-09	3.37E-08	1.44E-08				kidney; proteinuria	--	2.21E-08	8.80E-08	4.1%	[D1]
Chromium (III)	7.77E-04	7.91E-04	8.07E-07	1.04E-07	8.22E-07	3.52E-07				no observed effects	--				
Copper	5.45E-04	6.20E-04	5.67E-07	7.29E-08	6.45E-07	2.76E-07				Gastrointestinal system; irritation	--				
Lead	4.61E-04	5.22E-04	4.79E-07	6.16E-08	5.44E-07	2.33E-07				CNS, blood	--				
Manganese	1.22E-02	1.29E-02	1.27E-05	1.63E-06	1.35E-05	5.76E-06	1.1E-01	1.1E-01	90.8%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	300				
Mercury	1.39E-04	1.59E-04	1.44E-07	1.86E-08	1.66E-07	7.06E-08	1.6E-03	1.9E-03	1.5%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	30				
Nickel	3.19E-04	3.49E-04	3.32E-07	4.27E-08	3.63E-07	1.56E-07				dec. body and organ weight	--				
Selenium	9.20E-05	9.75E-05	9.56E-08	1.23E-08	1.01E-07	4.34E-08				whole body; clinical selenosis	--				
Silver	2.07E-05	2.42E-05	2.15E-08	2.77E-09	2.51E-08	1.08E-08				skin; argyria	--				
Zinc	7.36E-04	7.66E-04	7.65E-07	9.84E-08	7.96E-07	3.41E-07				blood; anemia	--				
ORGANICS (mg/m³)															
Aroclor-1254	2.95E-07	3.19E-07	3.07E-10	3.95E-11	3.30E-10	1.42E-10				--	--				
Aroclor-1260	1.14E-06	1.66E-06	1.19E-09	1.53E-10	1.73E-09	7.41E-10				--	--				
Benzo(a)anthracene	1.85E-06	2.23E-06	1.92E-09	2.47E-10	2.32E-09	9.95E-10				--	--	1.51E-10	6.07E-10	0.0%	[D2]
Benzo(a)pyrene	1.95E-06	2.33E-06	2.02E-09	2.60E-10	2.43E-09	1.04E-09				--	--	1.59E-09	6.34E-09	0.3%	[D2]
Benzo(b)fluoranthene	1.88E-06	2.19E-06	1.95E-09	2.51E-10	2.28E-09	9.75E-10				--	--	1.53E-10	5.95E-10	0.0%	[D2]
Benzo(k)fluoranthene	2.08E-06	2.40E-06	2.16E-09	2.78E-10	2.49E-09	1.07E-09				--	--	1.70E-10	6.52E-10	0.0%	[D2]
Chrysene	1.89E-06	2.27E-06	1.97E-09	2.53E-10	2.36E-09	1.01E-09				--	--	1.54E-11	6.16E-11	0.0%	[D2]
Indeno(1,2,3-cd)pyrene	2.64E-06	2.88E-06	2.75E-09	3.53E-10	2.99E-09	1.28E-09				--	--	2.16E-10	7.83E-10	0.0%	[D2]
RADIONUCLIDES (pCi/m³)															
Cesium 137+D	1.29E-02	1.60E-02		3.07E+00		1.28E+01						5.84E-11	2.43E-10	0.0%	[A]
Cobalt 60	7.36E-04	1.02E-03		1.76E-01		8.11E-01						2.64E-11	1.22E-10	0.0%	[A]
Neptunium 237+D	1.35E-03	3.32E-03		3.23E-01		2.65E+00						9.38E-09	7.68E-08	1.3%	[A]
Protactinium 233	1.21E-04	8.01E-04		2.85E-02		6.39E-01						2.49E-13	5.49E-12	0.0%	[A]
Thorium 228+D	2.07E-02	2.49E-02		4.95E+00		1.98E+01						3.86E-07	1.55E-06	27.2%	[A]
Thorium 230	3.53E-02	4.54E-02		8.44E+00		3.62E+01						2.45E-07	1.05E-06	18.5%	[A]
Thorium 232	1.32E-02	1.65E-02		3.15E+00		1.31E+01						8.82E-08	3.68E-07	6.5%	[A]
Uranium 234	3.75E-02	4.02E-02		8.96E+00		3.20E+01						2.33E-07	8.33E-07	14.6%	[A]
Uranium 235+D	1.75E-03	1.87E-03		4.18E-01		1.49E+00						1.04E-08	3.73E-08	0.7%	[A]
Uranium 238+D	4.04E-02	4.29E-02		9.66E+00		3.42E+01						5.02E-07	1.78E-06	31.2%	[A]
Chemical Hazards: Hazard Index: Combined Exposure (d)							1.2E-01	1.3E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.16E-07	2.14E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.47E-06	5.69E-06	100.0%	

SEWER LINE BELTWAY RISK CHARACTERIZATION TABLES

Table M.427. Risk characterization summary for Emory Valley Road: RME risk estimates for current land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	1.49E-01 B	7.82E-02 B	2.55E-06 W	4.48E-06 W	3.19E-08 B	8.01E-08 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	9.10E-03 B	8.45E-03 B	1.56E-07 B	4.85E-07 B	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		1.6E-01 B	8.7E-02 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				3E-06 W	5E-06 W					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						3E-08 B	8E-08 B					NA	NA

Table M.428. Human health risk characterization summary for EFPC open land use scenario: current land use, Emory Valley Road adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	6.84E–03	7.82E–02	1.35E–07	4.48E–06
Dermal Contact	2.46E–04	8.45E–03	4.85E–09	4.85E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.25E–09	8.01E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	7.1E–03	8.7E–02		
Excess Lifetime Cancer Risk: Combined Exposure			1E–07	5E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–09	8E–08

Table M.429. Human health risk characterization summary for EFPC open land use scenario: current land use, Emory Valley Road children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.18E–02	1.49E–01	7.76E–08	2.55E–06
Dermal Contact	2.54E–04	9.10E–03	1.66E–09	1.56E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			9.36E–10	3.19E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.2E–02	1.6E–01		
Excess Lifetime Cancer Risk: Combined Exposure			8E–08	3E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			9E–10	3E–08

Table M.430. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Emory Valley Road

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.80	0.86	5.0E-08	6.4E-09	5.0E-07	2.1E-07	1.2E-04	1.2E-03	1.6%	whole body, blood; inc. mortality	1000				
Arsenic	9.55	10.18	5.9E-07	7.6E-08	5.9E-06	2.5E-06	1.9E-03	1.9E-02	25.5%	skin; keratosis, hyperpigmentation	3	1.3E-07	4.4E-06	100.0%	[A]
Chromium (III)	71.87	74.55	4.5E-06	5.7E-07	4.3E-05	1.8E-05	4.5E-06	4.3E-05	0.1%	no observed effects	100				
Mercury	22.66	29.15	1.4E-06	1.8E-07	1.7E-05	7.3E-06	4.7E-03	5.7E-02	73.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Selenium	8.09	8.62	5.0E-07	6.5E-08	5.0E-06	2.1E-06	1.0E-04	1.0E-03	1.3%	whole body; clinical selenosis	3				[D]
Zinc	63.32	71.53	3.9E-06	5.1E-07	4.2E-05	1.8E-05	1.3E-05	1.4E-04	0.2%	blood; anemia	3				[D]
RADIONUCLIDES (pCi/g)															
Uranium 234	3.01	3.46		4.3E+01		1.5E+03						6.9E-10	2.4E-08	31.1%	[A]
Uranium 235+D	0.12	0.13		1.6E+00		6.0E+01						2.6E-11	9.6E-10	1.2%	[A]
Uranium 238+D	3.79	4.30		5.4E+01		1.9E+03						1.5E-09	5.4E-08	67.7%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							6.8E-03	7.8E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.3E-07	4.4E-06	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.2E-09	8.0E-08	100.0%	

Table M.431. Risk characterization for soils: children – ingestion exposure (current land use – open) – Emory Valley Road

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Car. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Car. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.80	0.86	8.6E-08	3.7E-09	9.5E-07	1.2E-07	2.1E-04	2.4E-03	1.6%	whole body; blood; inc. mortality	1000				
Arsenic	9.55	10.18	1.0E-06	4.4E-08	1.1E-05	1.4E-06	3.4E-03	3.7E-02	25.5%	skin; keratosis, hyperpigmentation	3	7.7E-08	2.5E-06	100.0%	[A]
Chromium (III)	71.67	74.55	7.7E-06	3.3E-07	8.3E-05	1.0E-05	7.7E-06	8.3E-05	0.1%	no observed effects	100				
Mercury	22.66	29.15	2.4E-06	1.0E-07	3.2E-05	4.1E-06	8.1E-03	1.0E-01	73.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Selenium	8.09	8.62	8.7E-07	3.7E-08	9.6E-06	1.2E-06	1.7E-04	1.9E-03	1.3%	whole body; clinical selenosis	3				[D]
Zinc	63.32	71.53	6.8E-06	2.9E-07	7.9E-05	1.0E-05	2.2E-05	2.6E-04	0.2%	blood; anemia	3				[D]
RADIONUCLIDES (pCi/g)															
Uranium 234	3.01	3.46		1.8E+01		6.2E+02						2.8E-10	9.9E-09	31.1%	[A]
Uranium 235+D	0.12	0.13		7.0E-01		2.4E+01						1.1E-11	3.8E-10	1.2%	[A]
Uranium 238+D	3.79	4.30		2.2E+01		7.7E+02						6.3E-10	2.1E-08	67.7%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.1E-02	1.4E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.7E-08	2.5E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												9.3E-10	3.1E-08	100.0%	

Table M.432. Risk characterization for soils: adults – dermal exposure (current land use – open) – Emory Valley Road

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	0.80	0.86	1.8E3-09	2.3E3-10	5.4E3-08	2.3E3-08	4.5E3-06	1.3E3-04	1.6%	whole body, blood; loc. mortality	1000				
Arsenic	9.55	10.18	2.1E3-08	2.7E3-09	6.4E3-07	2.7E3-07	7.1E3-05	2.1E3-03	25.5%	skin; keratosis, hyperpigmentation	3	4.8E3-09	4.8E3-07	100.0%	[A]
Chromium (III)	71.87	74.55	1.6E3-07	2.0E3-08	4.7E3-06	2.0E3-06	1.6E3-07	4.7E3-06	0.1%	no observed effects	100				
Mercury	22.66	29.15	5.1E3-08	6.5E3-09	1.8E3-06	7.9E3-07	1.7E3-04	6.1E3-03	73.0%	*oral*-CNS; neurotoxicity. *Inhal.*-kidney effects	1000				[D]
Selenium	8.09	8.62	1.8E3-08	2.3E3-09	5.4E3-07	2.3E3-07	3.6E3-06	1.0E3-04	1.3%	whole body; clinical selenosis	3				[D]
Zinc	63.32	71.53	1.4E3-07	1.8E3-08	4.5E3-06	1.9E3-06	4.7E3-07	1.5E3-05	0.2%	blood; anemia	3				[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.4E3-04	8.4E3-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												4.8E3-09	4.8E3-07	100.0%	

Table M.433. Risk characterization for soils: children – dermal exposure (current land use – open) – Emory Valley Road

Chemical	MLB Concentration In Soils	RMB Concentration In Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.80	0.86	1.8E-09	7.9E-11	5.8E-08	7.5E-09	4.6E-06	1.4E-04	1.6%	whole body, blood; inc. mortality	1000				
Arsenic	9.55	10.18	2.2E-08	9.5E-10	6.9E-07	8.9E-08	7.4E-05	2.3E-03	25.5%	skin; keratosis, hyperpigmentation	3	1.6E-09	1.5E-07	100.0%	[A]
Chromium (III)	71.87	74.55	1.6E-07	7.1E-09	5.0E-06	6.5E-07	1.6E-07	5.0E-06	0.1%	no observed effects	100				
Mercury	22.66	29.15	5.2E-08	2.2E-09	1.9E-06	2.5E-07	1.7E-04	6.6E-03	73.0%	oral–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Selenium	8.09	8.62	1.8E-08	8.0E-10	5.8E-07	7.5E-08	3.7E-06	1.1E-04	1.3%	whole body; clinical selenosis	3				[D]
Zinc	63.32	71.53	1.4E-07	6.3E-09	4.8E-06	6.2E-07	4.9E-07	1.6E-05	0.2%	blood; anemia	3				[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.5E-04	9.1E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-09	1.5E-07	100.0%	

Table M.434. Risk characterization summary for Emory Valley Road: RME risk estimates for future land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards:													
Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards:													
Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	1.5E−01 B	7.8E−02 B	2.6E−06 W	4.5E−06 W	1.7E−08 B	8.0E−08 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	9.1E−03 B	8.4E−03 B	1.6E−07 B	4.8E−07 B	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards:													
Hazard Index (HI): Combined Exposure		1.6E−01 B	8.7E−02 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				3E−06 W	5E−06 W					NA	NA		
Radiological Hazards:													
Excess Lifetime Cancer Risk: Combined Exposure						2E−08 B	8E−08 B					NA	NA

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.435. Human health risk characterization summary for EFPC open land use scenario: future land use, Emory Valley Road adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	6.84E–03	7.82E–02	1.35E–07	4.48E–06
Dermal Contact	2.46E–04	8.45E–03	4.85E–09	4.85E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.25E–09	8.01E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	7.1E–03	8.7E–02		
Excess Lifetime Cancer Risk: Combined Exposure			1E–07	5E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–09	8E–08

Table M.436. Human health risk characterization summary for EFPC open land use scenario: future land use, Emory Valley Road children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.18E–02	1.49E–01	7.76E–08	2.55E–06
Dermal Contact	2.54E–04	9.10E–03	1.66E–09	1.56E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			4.63E–10	1.69E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.2E–02	1.6E–01		
Excess Lifetime Cancer Risk: Combined Exposure			8E–08	3E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–10	2E–08

Table M.437. Risk characterization for soils: adults – ingestion exposure (future land use – open) – Emory Valley Road

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern; Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.80	0.86	5.0E-08	6.4E-09	5.0E-07	2.1E-07	1.2E-04	1.2E-03	1.6%	whole body, blood; inc. mortality	1000				
Arsenic	9.55	10.18	5.9E-07	7.6E-08	5.9E-06	2.5E-06	1.9E-03	1.9E-02	25.5%	skin; keratosis, hyperpigmentation	3	1.3E-07	4.4E-06	100.0%	[A]
Chromium (III)	71.87	74.55	4.5E-06	5.7E-07	4.3E-05	1.8E-05	4.5E-06	4.3E-05	0.1%	no observed effects	100				
Mercury	22.66	29.15	1.4E-06	1.8E-07	1.7E-05	7.3E-06	4.7E-03	5.7E-02	73.0%	*oral*–CNS; neurotoxicity, *inhal.*–kidney effects	1000				[D]
Selenium	8.09	8.62	5.0E-07	6.5E-08	5.0E-06	2.1E-06	1.0E-04	1.0E-03	1.3%	whole body; clinical selenosis	3				[D]
Zinc	63.32	71.53	3.9E-06	5.1E-07	4.2E-05	1.8E-05	1.3E-05	1.4E-04	0.2%	blood; anemia	3				[D]
RADIONUCLIDES (pCi/g)															
Uranium 234	3.01	3.46		4.3E+01		1.5E+03						6.9E-10	2.4E-08	31.1%	[A]
Uranium 235+D	0.12	0.13		1.6E+00		6.0E+01						2.6E-11	9.6E-10	1.2%	[A]
Uranium 238+D	3.79	4.30		5.4E+01		1.9E+03						1.5E-09	5.4E-08	67.7%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							6.8E-03	7.8E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.3E-07	4.4E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												2.2E-09	8.0E-08	100.0%	

Table M.438. Risk characterization for soils: children – ingestion exposure (future land use – open) – Emory Valley Road

Chemical	MLE Concentration (s Soils)	RME Concentration (s Soils)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern / Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.80	0.86	6.69E-08	3.72E-09	9.59E-07	1.23E-07	2.17E-04	2.40E-03	1.6%	whole body, blood; inc. mortality	1000				
Arsenic	9.55	10.18	1.03E-06	4.43E-08	1.14E-05	1.46E-06	3.45E-03	3.79E-02	25.5%	skin; keratosis, hyperpigmentation	3	7.76E-08	2.55E-06	100.0%	[A]
Chromium (III)	71.87	74.55	7.76E-06	3.34E-07	8.32E-05	1.07E-05	7.76E-06	8.32E-05	0.1%	no observed effects	100				
Mercury	22.66	29.15	2.45E-06	1.05E-07	3.25E-05	4.18E-06	8.16E-03	1.08E-01	73.0%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				
Selenium	8.09	8.62	8.74E-07	3.75E-08	9.62E-06	1.24E-06	1.75E-04	1.92E-03	1.3%	whole body; clinical selenosis	3				[D]
Zinc	63.32	71.53	6.86E-06	2.94E-07	7.98E-05	1.03E-05	2.29E-05	2.66E-04	0.2%	blood; anemia	3				[D]
RADIONUCLIDES (pCi/g)															
Uranium 234	3.01	3.46		8.93E+00		3.30E+02						1.43E-10	5.27E-09	31.1%	[A]
Uranium 235+D	0.12	0.13		3.47E-01		1.27E+01						5.54E-12	2.04E-10	1.2%	[A]
Uranium 238+D	3.79	4.30		1.12E+01		4.10E+02						3.14E-10	1.15E-08	67.7%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.16E-02	1.49E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.76E-08	2.55E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.63E-10	1.69E-08	100.0%	

Table M.439. Risk characterization for soils: adults – dermal exposure (future land use – open) – Emory Valley Road

Chemical	MLE Concentration In Soils	RME Concentration In Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Card. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Card. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Card. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.80	0.86	1.8E-09	2.3E-10	5.4E-08	2.3E-08	4.5E-06	1.3E-04	1.6%	whole body, blood; inc. mortality	1000				
Arsenic	9.55	10.18	2.1E-08	2.7E-09	6.4E-07	2.7E-07	7.1E-05	2.1E-03	25.5%	skin; keratosis, hyperpigmentation	3	4.8E-09	4.8E-07	100.0%	(A)
Chromium (III)	71.87	74.55	1.6E-07	2.0E-08	4.7E-06	2.0E-06	1.6E-07	4.7E-06	0.1%	no observed effects	100				
Mercury	22.66	29.15	5.1E-08	6.5E-09	1.8E-06	7.9E-07	1.7E-04	6.1E-03	73.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				(D)
Selenium	8.09	8.62	1.8E-08	2.3E-09	5.4E-07	2.3E-07	3.6E-06	1.0E-04	1.3%	whole body; clinical selenosis	3				(D)
Zinc	63.32	71.53	1.4E-07	1.8E-08	4.5E-06	1.9E-06	4.7E-07	1.5E-05	0.2%	blood; anemia	3				(D)
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.4E-04	8.4E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												4.8E-09	4.8E-07	100.0%	

Table M.440. Risk characterization for soils: children – dermal exposure (future land use – open) – Emory Valley Road

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.80	0.86	1.8E-09	7.9E-11	5.8E-08	7.5E-09	4.6E-06	1.4E-04	1.6%	whole body; blood; inc. mortality	1000				
Arsenic	9.55	10.18	2.2E-08	9.5E-10	6.9E-07	8.9E-08	7.4E-05	2.3E-03	25.5%	skin; keratosis, hyperpigmentation	3	1.6E-09	1.5E-07	100.0%	[A]
Chromium (III)	71.87	74.55	1.6E-07	7.1E-09	5.0E-06	6.5E-07	1.6E-07	5.0E-06	0.1%	no observed effects	100				
Mercury	22.66	29.15	5.2E-08	2.2E-09	1.9E-06	2.5E-07	1.7E-04	6.6E-03	73.0%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Selenium	8.09	8.62	1.8E-08	8.0E-10	5.8E-07	7.5E-08	3.7E-06	1.1E-04	1.3%	whole body; clinical selenosis	3				[D]
Zinc	63.32	71.53	1.4E-07	6.3E-09	4.8E-06	6.2E-07	4.9E-07	1.6E-05	0.2%	blood; anemia	3				[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.5E-04	9.1E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-09	1.5E-07	100.0%	

Table M.441. Risk characterization summary for Fairbanks Avenue: RME risk estimates for current land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	1.74E−01 B	9.17E−02 B	3.29E−06 W	5.77E−06 W	2.74E−08 B	6.88E−08 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.07E−02 B	9.91E−03 B	2.01E−07 B	6.24E−07 B	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		1.8E−01 B	1.0E−01 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				3E−06 W	6E−06 W					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						3E−08 B	7E−08 B					NA	NA

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.442. Human health risk characterization summary for EFPC open land use scenario: current land use, Fairbanks Avenue adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	7.91E–03	9.17E–02	1.73E–07	5.77E–06
Dermal Contact	2.85E–04	9.91E–03	6.22E–09	6.24E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.94E–09	6.88E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	8.2E–03	1.0E–01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	6E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–09	7E–08

Table M.443. Human health risk characterization summary for EFPC open land use scenario: current land use, Fairbanks Avenue children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.37E–02	1.74E–01	9.96E–08	3.29E–06
Dermal Contact	2.94E–04	1.07E–02	2.14E–09	2.01E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			8.09E–10	2.74E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.4E–02	1.8E–01		
Excess Lifetime Cancer Risk: Combined Exposure			1E–07	3E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			8E–10	3E–08

Table M.444. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Fairbanks Avenue

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.85	0.91	5.3E-08	6.8E-09	5.3E-07	2.3E-07	1.3E-04	1.3E-03	1.5%	whole body, blood; inc. mortality	1000				
Arsenic	12.26	13.10	7.6E-07	9.8E-08	7.6E-06	3.3E-06	2.5E-03	2.5E-02	28.0%	skin; keratosis, hyperpigmentation	3	1.7E-07	5.7E-06	100.0%	(A)
Chromium (III)	69.17	70.99	4.3E-06	5.5E-07	4.1E-05	1.7E-05	4.3E-06	4.1E-05	0.0%	no observed effects	100				
Mercury	25.11	33.18	1.5E-06	2.0E-07	1.9E-05	8.3E-06	5.2E-03	6.4E-02	70.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				(D)
Selenium	7.56	8.31	4.7E-07	6.0E-08	4.8E-06	2.0E-06	9.4E-05	9.7E-04	1.1%	whole body; clinical selenosis	3				(D)
Zinc	60.19	67.64	3.7E-06	4.8E-07	3.9E-05	1.7E-05	1.2E-05	1.3E-04	0.1%	blood; anemia	3				(D)
RADIONUCLIDES (pCi/g)															
Uranium 234	3.02	3.53		4.3E+01		1.5E+03						6.9E-10	2.5E-08	37.0%	(A)
Uranium 235+D	0.13	0.16		1.9E+00		7.2E+01						3.0E-11	1.1E-09	1.7%	(A)
Uranium 238+D	3.01	3.35		4.3E+01		1.5E+03						1.2E-09	4.2E-08	61.3%	(A)
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							7.9E-03	9.1E-02	100.0%						
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												1.7E-07	5.7E-06	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.9E-09	6.8E-08	100.0%	

Table M.445. Risk characterization for soils: children – ingestion exposure (current land use – open) – Fairbanks Avenue

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Car. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Car. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	Risk Estimates: RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Car. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.85	0.91	9.2E-08	3.9E-09	1.0E-06	1.3E-07	2.3E-04	2.5E-03	1.5%	whole body, blood; inc. mortality	1000				
Arsenic	12.26	13.10	1.3E-06	5.6E-08	1.4E-05	1.8E-06	4.4E-03	4.8E-02	28.0%	skin; keratosis, hyperpigmentation	3	9.9E-08	3.2E-06	100.0%	[A]
Chromium (III)	69.17	70.99	7.4E-06	3.2E-07	7.9E-05	1.0E-05	7.4E-06	7.9E-05	0.0%	no observed effects	100				
Mercury	25.11	33.18	2.7E-06	1.1E-07	3.7E-05	4.7E-06	9.0E-03	1.2E-01	70.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Selenium	7.56	8.31	8.1E-07	3.5E-08	9.2E-06	1.1E-06	1.6E-04	1.8E-03	1.1%	whole body; clinical selenosis	3				[D]
Zinc	60.19	67.64	6.5E-06	2.7E-07	7.5E-05	9.7E-06	2.1E-05	2.5E-04	0.1%	blood; anemia	3				[D]
RADIONUCLIDES (pCi/g)															
Uranium 234	3.02	3.53		1.8E+01		6.3E+02						2.9E-10	1.0E-08	37.0%	[A]
Uranium 235+D	0.13	0.16		7.9E-01		2.8E+01						1.2E-11	4.6E-10	1.7%	[A]
Uranium 238+D	3.01	3.35		1.8E+01		6.0E+02						5.0E-10	1.6E-08	61.3%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-02	1.7E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.9E-08	3.2E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												8.0E-10	2.7E-08	100.0%	

Table M.446. Risk characterization for soils: adults – dermal exposure (current land use – open) – Fairbanks Avenue

Chemical	MLE Concentration in Soils ()	RME Concentration in Soils ()	Chronic Daily Intake (CDI) () CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	Risk Estimates	Noncarcinogenic Effect of Concern	RfDA UF ()	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	RfDA WOE ()
INORGANICS (mg/kg)														
Antimony	0.85	0.91	1.92E-09	2.47E-10	5.80E-08	2.49E-08	4.79E-06	1.45E-04	1.5%	whole body, blood; inc. mortality	1000			
Arsenic	12.26	13.10	2.76E-08	3.55E-09	8.31E-07	3.56E-07	9.21E-05	2.77E-03	28.0%	skin; keratosis, hyperpigmentation	3	6.22E-09	6.24E-07	100.0% [A]
Chromium (III)	69.17	70.99	1.56E-07	2.00E-08	4.51E-06	1.93E-06	1.56E-07	4.51E-06	0.0%	no observed effects	100			
Mercury	25.11	33.18	5.66E-08	7.28E-09	2.11E-06	9.02E-07	1.89E-04	7.02E-03	70.8%	*oral*–CNS; neurotoxicity, *inhal.*–kidney effects	1000			[D]
Selenium	7.56	8.31	1.70E-08	2.19E-09	5.27E-07	2.26E-07	3.41E-06	1.05E-04	1.1%	whole body; clinical selenosis	3			[D]
Zinc	60.19	67.64	1.36E-07	1.74E-08	4.29E-06	1.84E-06	4.52E-07	1.43E-05	0.1%	blood; anemia	3			[D]
Chemical Hazards:														
Hazard Index (HI):							2.65E-04	9.91E-03	100.0%					
Combined Exposure (d)														
Excess Lifetime Cancer Risk:														
Combined Exposure (d)												6.22E-09	6.24E-07	100.0%

Table M.447. Risk characterization for soils: children – dermal exposure (current land use – open) – Fairbanks Avenue

Chemical	MLB Concentration in Soil ( )	RMB Concentration in Soil ( )	Chronic Daily Intake (CDI) ( ) CDI Noncar. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carcinogenic Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)		Risk Estimates: Noncarcinogenic Effect of Concern	RfDs UF ( )	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	EPA WOE ( )
INORGANICS (mg/kg)														
Antimony	0.85	0.91	1.9E-09	8.47E-11	6.24E-08	8.03E-09	4.94E-06	1.56E-04	1.5%	whole body, blood; inc. mortality	1000			
Arsenic	12.26	13.10	2.85E-08	1.22E-09	8.95E-07	1.15E-07	9.50E-05	2.98E-03	28.0%	skin; keratosis, hyperpigmentation	3	2.14E-09	2.01E-07	100.0% [A]
Chromium (III)	69.17	70.99	1.6E-07	6.89E-09	4.85E-06	6.24E-07	1.6E-07	4.85E-06	0.0%	no observed effects	100			
Mercury	25.11	33.18	5.83E-08	2.50E-09	2.27E-06	2.91E-07	1.94E-04	7.56E-03	70.8%	*oral*-CNS; neurotoxicity. *Inhal.*-kidney effects	1000			[D]
Selenium	7.56	8.31	1.76E-08	7.53E-10	5.67E-07	7.30E-08	3.51E-06	1.13E-04	1.1%	whole body; clinical selenosis	3			[D]
Zinc	60.19	67.64	1.40E-07	5.99E-09	4.67E-06	5.94E-07	4.66E-07	1.54E-05	0.1%	blood; anemia	3			[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.94E-04	1.07E-02	100.0%					
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.14E-09	2.01E-07	100.0%

Table M.448. Risk characterization summary for Fairbanks Avenue: RME risk estimates for future land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	1.7E−01 B	9.2E−02 B	3.3E−06 W	5.8E−06 W	1.5E−08 B	6.9E−08 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	1.1E−02 B	9.9E−03 B	2.0E−07 B	6.2E−07 B	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		1.8E−01 B	1.0E−01 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				3E−06 W	6E−06 W					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						1E−08 B	7E−08 B					NA	NA

B – below or equal [illegible] rget noncancer hazard index (HI <=1), or cancer risk (ELCR <=1 x 10^{-6})
W – within EPA [illegible] ancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target [illegible]cancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.449. Human health risk characterization summary for EFPC open land use scenario: future land use, Fairbanks Avenue adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	7.91E–03	9.17E–02	1.73E–07	5.77E–06
Dermal Contact	2.85E–04	9.91E–03	6.22E–09	6.24E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.94E–09	6.88E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	8.2E–03	1.0E–01		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	6E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			2E–09	7E–08

Table M.450. Human health risk characterization summary for EFPC open land use scenario: future land use, Fairbanks Avenue children long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	1.37E–02	1.74E–01	9.96E–08	3.29E–06
Dermal Contact	2.94E–04	1.07E–02	2.14E–09	2.01E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			4.00E–10	1.46E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	1.4E–02	1.8E–01		
Excess Lifetime Cancer Risk: Combined Exposure			1E–07	3E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			4E–10	1E–08

Table M.451. Risk characterization for soils: adults – ingestion exposure (future land use – open) – Fairbanks Avenue

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Antimony	0.85	0.91	5.33E-08	6.85E-09	5.30E-07	2.30E-07	1.33E-04	1.34E-03	1.5%	whole body, blood; inc. mortality	1000				
Arsenic	12.26	13.10	7.68E-07	9.87E-08	7.69E-06	3.30E-06	2.56E-03	2.56E-02	28.0%	skin; keratosis, hyperpigmentation	3	1.73E-07	5.77E-06	100.0%	[A]
Chromium (III)	69.17	70.99	4.33E-06	5.57E-07	4.17E-05	1.79E-05	4.33E-06	4.17E-05	0.0%	no observed effects	100				
Mercury	25.11	33.18	1.57E-06	2.02E-07	1.95E-05	8.35E-06	5.24E-03	6.49E-02	70.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Selenium	7.56	8.31	4.74E-07	6.09E-08	4.88E-06	2.09E-06	9.47E-05	9.75E-04	1.1%	whole body; clinical selenosis	3				[D]
Zinc	60.19	67.64	3.77E-06	4.85E-07	3.97E-05	1.70E-05	1.26E-05	1.32E-04	0.1%	blood; anemia	3				[D]
RADIONUCLIDES (pCi/g)															
Uranium 234	3.02	3.53		4.35E+01		1.59E+03						6.96E-10	2.54E-08	37.0%	[A]
Uranium 235+D	0.13	0.16		1.92E+00		7.23E+01						3.07E-11	1.10E-09	1.7%	[A]
Uranium 238+D	3.01	3.35		4.34E+01		1.58E+03						1.21E-09	4.22E-08	61.3%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.94E-03	9.17E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.73E-07	5.77E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.94E-09	6.88E-08	100.0%	

Table M.452. Risk characterization for soils: children – ingestion exposure (future land use – open) – Fairbanks Avenue

Chemical	MLE Concentration in soils	RME Concentration in soils	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS (mg/kg)															
Antimony	0.85	0.91	9.2E-08	3.9E-09	1.0E-06	1.3E-07	2.3E-04	2.5E-03	1.5%	whole body; blood; inc. mortality	1000				
Arsenic	12.26	13.10	1.3E-06	5.6E-08	1.4E-05	1.8E-06	4.4E-03	4.8E-02	28.0%	skin; keratosis, hyperpigmentation	3	9.9E-08	3.2E-06	100.0%	[A]
Chromium (III)	69.17	70.99	7.4E-06	3.2E-07	7.9E-05	1.0E-05	7.4E-06	7.9E-05	0.0%	no observed effects	100				
Mercury	25.11	33.18	2.7E-06	1.1E-07	3.7E-05	4.7E-06	9.0E-03	1.2E-01	70.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Selenium	7.56	8.31	8.1E-07	3.5E-08	9.2E-06	1.1E-06	1.6E-04	1.8E-03	1.1%	whole body; clinical selenosis	3				[D]
Zinc	60.19	67.64	6.5E-06	2.7E-07	7.5E-05	9.7E-06	2.1E-05	2.5E-04	0.1%	blood; anemia	3				[D]
RADIONUCLIDES (pCi/g)															
Uranium 234	3.02	3.53		8.9E+00		3.3E+02						1.4E-10	5.3E-09	37.0%	[A]
Uranium 235+D	0.13	0.16		3.9E-01		1.5E+01						6.3E-12	2.4E-10	1.7%	[A]
Uranium 238+D	3.01	3.35		8.9E+00		3.1E+02						2.5E-10	8.9E-09	61.3%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.3E-02	1.7E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.9E-08	3.2E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												4.0E-10	1.4E-08	100.0%	

Table M.453. Risk characterization for soils: adults – dermal exposure (future land use – open) – Fairbanks Avenue

Chemical	MLB Concentration in Soils ( )	RMB Concentration in Soils ( )	Chronic Daily Intake (CDI) ( ) CDI Noncarc. Effects (MLB)	CDI Carcinogenic Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carcinogenic Effects (RMB)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)		Noncarcinogenic Effect of Concern	BPA UF ( )	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	BPA WOE ( )
INORGANICS (mg/kg)														
Antimony	0.85	0.91	1.92E-09	2.47E-10	5.80E-08	2.49E-08	4.79E-06	1.45E-04	1.5%	whole body, blood; inc. mortality	1000			
Arsenic	12.26	13.10	2.76E-08	3.55E-09	8.31E-07	3.56E-07	9.21E-05	2.77E-03	28.0%	skin; keratosis, hyperpigmentation	3	6.22E-09	6.24E-07	100.0% [A]
Chromium (III)	69.17	70.99	1.56E-07	2.00E-08	4.51E-06	1.93E-06	1.50E-07	4.51E-06	0.0%	no observed effects	100			
Mercury	25.11	33.18	5.66E-08	7.28E-09	2.11E-06	9.02E-07	1.89E-04	7.02E-03	70.8%	*oral*-CNS; neurotoxicity. *Inhal.*-kidney effects	1000			[D]
Selenium	7.56	8.31	1.70E-08	2.19E-09	5.27E-07	2.26E-07	3.41E-06	1.05E-04	1.1%	whole body; clinical selenosis	3			[D]
Zinc	60.19	67.64	1.36E-07	1.74E-08	4.29E-06	1.84E-06	4.52E-07	1.43E-05	0.1%	blood; anemia	3			[D]
Chemical Hazards:														
Hazard Index (HI): Combined Exposure (d)							2.85E-04	9.91E-03	100.0%					
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.22E-09	6.24E-07	100.0%

Table M.454. Risk characterization for soils: children – dermal exposure (future land use – open) – Fairbanks Avenue

Chemical	MLE Concentration in Soils ()	RME Concentration in Soils ()	Chronic Daily Intake (CDI) () CDI Noncar. Effects (MLE)	CDI Carcinogenic Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carcinogenic Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)		Risk Estimates: Noncarcinogenic Effect of Concern	BPA UF ()	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	BPA WOE ()
INORGANICS (mg/kg)														
Antimony	0.85	0.91	1.98E-09	8.47E-11	6.24E-08	8.03E-09	4.94E-06	1.56E-04	1.5%	whole body, blood; inc. mortality	1000			
Arsenic	12.26	13.10	2.85E-08	1.22E-09	8.95E-07	1.15E-07	9.50E-05	2.98E-03	28.0%	skin; keratosis, hyperpigmentation	3	2.14E-09	2.0E-07	100.0% (A)
Chromium (III)	69.17	70.99	1.61E-07	6.89E-09	4.85E-06	6.24E-07	1.61E-07	4.85E-06	0.0%	no observed effects	100			
Mercury	25.11	33.18	5.83E-08	2.50E-09	2.27E-06	2.91E-07	1.94E-04	7.56E-03	70.8%	*oral*–CNS; neurotoxicity, *inhal.*–kidney effects	1000			(D)
Selenium	7.56	8.31	1.76E-08	7.55E-10	5.67E-07	7.30E-08	3.51E-06	1.13E-04	1.1%	whole body; clinical selenosis	3			(D)
Zinc	60.19	67.64	1.40E-07	5.99E-09	4.62E-06	5.94E-07	4.66E-07	1.54E-05	0.1%	blood; anemia	3			(D)
Chemical Hazards:														
Hazard Index (HI): Combined Exposure (d)							2.94E-04	1.07E-02	100.0%					
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.14E-09	2.0E-07	100.0%

Table M.455. Risk characterization summary for Tulane Avenue: RME risk estimates for current land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	1.52E−01 B	7.99E−02 B	3.96E−06 W	6.95E−06 W	1.86E−08 B	4.66E−08 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	9.30E−03 B	8.63E−03 B	2.43E−07 B	7.52E−07 B	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards: Hazard Index (HI): Combined Exposure		1.6E−01 B	8.9E−02 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				4E−06 W	8E−06 W					NA	NA		
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure						2E−08 B	5E−08 B					NA	NA

B – below or equal to target noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA target cancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.456. Human health risk characterization summary for EFPC open land use scenario: current land use, Tulane Avenue adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	5.30E–03	7.99E–02	1.64E–07	6.95E–06
Dermal Contact	1.91E–04	8.63E–03	5.91E–09	7.52E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.27E–09	4.66E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.5E–03	8.9E–02		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	8E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1E–09	5E–08

Table M.457. Human health risk characterization summary for EFPC open land use scenario: current land use, Tulane Avenue children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	9.17E–03	1.52E–01	9.47E–08	3.96E–06
Dermal Contact	1.97E–04	9.30E–03	2.03E–09	2.43E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			5.29E–10	1.86E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	9.4E–03	1.6E–01		
Excess Lifetime Cancer Risk: Combined Exposure			1E–07	4E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			5E–10	2E–08

Table M.458. Risk characterization for soils: adults – ingestion exposure (current land use – open) – Tulane Avenue

Chemical	MLE Concentration (µg/kg)	RME Concentration (µg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS **(mg/kg)**															
Antimony	0.77	1.18	4.79E-08	6.16E-09	6.95E-07	2.98E-07	1.20E-04	1.74E-03	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	11.66	15.79	7.30E-07	9.39E-08	9.27E-06	3.97E-06	2.43E-03	3.09E-02	38.7%	skin; keratosis, hyperpigmentation	3	1.64E-07	6.95E-06	100.0%	[A]
Chromium (III)	70.29	81.69	4.40E-06	5.66E-07	4.80E-05	2.06E-05	4.40E-06	4.80E-05	0.1%	no observed effects	100				
Mercury	13.32	24.42	8.34E-07	1.07E-07	1.43E-05	6.14E-06	2.78E-03	4.78E-02	59.8%	*oral*–CNS; neurotoxicity, *inhal.*–kidney effects	1000				[D]
Selenium	5.85	7.90	3.66E-07	4.71E-08	4.64E-06	1.99E-06	7.33E-05	9.28E-04	1.2%	whole body; clinical selenosis	3				[D]
Zinc	58.64	105.20	3.67E-06	4.72E-07	6.18E-05	2.65E-05	1.22E-05	2.06E-04	0.3%	blood; anemia	3				[D]
RADIONUCLIDES **(pCi/g)**															
Uranium 234	1.68	2.09		2.42E+01		9.40E+02						3.88E-10	1.50E-08	32.3%	[A]
Uranium 235+D	0.07	0.09		1.06E+00		4.27E+01						1.69E-11	6.83E-10	1.5%	[A]
Uranium 238+D	2.15	2.45		3.09E+01		1.10E+03						8.65E-10	3.08E-08	66.2%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							5.30E-03	7.99E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.64E-07	6.95E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.27E-09	4.66E-08	100.0%	

Table M.459. Risk characterization for soils: children – ingestion exposure (current land use – open) – Tulane Avenue

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS (mg/kg)															
Antimony	0.77	1.18	8.29E-08	3.55E-09	1.32E-06	1.70E-07	2.07E-04	3.30E-03	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	11.66	15.79	1.26E-06	5.40E-08	1.76E-05	2.26E-06	4.20E-03	5.87E-02	38.7%	skin; keratosis, hyperpigmentation	3	9.47E-08	3.96E-06	100.0%	[A]
Chromium (III)	70.29	81.69	7.60E-06	3.26E-07	9.11E-05	1.17E-05	7.60E-06	9.11E-05	0.1%	no observed effects	100				
Mercury	13.32	24.42	1.44E-06	6.18E-08	2.72E-05	3.50E-06	4.80E-03	9.08E-02	59.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Selenium	5.85	7.90	6.33E-07	2.71E-08	8.81E-06	1.13E-06	1.27E-04	1.76E-03	1.2%	whole body; clinical selenosis	3				[D]
Zinc	58.64	105.20	6.35E-06	2.72E-07	1.17E-04	1.51E-05	2.12E-05	3.91E-04	0.3%	blood; anemia	3				[D]
RADIONUCLIDES (pCi/g)															
Uranium 234	1.68	2.09		1.01E+01		3.75E+02						1.61E-10	6.00E-09	32.3%	[A]
Uranium 235+D	0.07	0.09		4.40E-01		1.70E+01						7.04E-12	2.73E-10	1.5%	[A]
Uranium 238+D	2.15	2.45		1.29E+01		4.40E+02						3.60E-10	1.23E-08	66.2%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.17E-03	1.32E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.47E-08	3.96E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												5.29E-10	1.86E-08	100.0%	

Table M.460. Risk characterization for soils: adults – dermal exposure (current land use – open) – Tulane Avenue

Chemical	MLE Concentration In Soils	RME Concentration In Soils	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	0.77	1.18	1.73E-09	2.22E-10	7.51E-08	3.22E-08	4.32E-06	1.88E-04	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	11.66	15.79	2.63E-08	3.38E-09	1.00E-06	4.29E-07	8.76E-05	3.34E-03	38.7%	skin; keratosis, hyperpigmentation	3	5.91E-09	7.52E-07	100.0%	[A]
Chromium (III)	70.29	81.69	1.58E-07	2.04E-08	5.18E-06	2.22E-06	1.58E-07	5.18E-06	0.1%	no observed effects	100				
Mercury	13.32	24.42	3.00E-08	3.86E-09	1.55E-06	6.64E-07	1.00E-04	5.17E-03	59.8%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Selenium	5.85	7.90	1.32E-08	1.70E-09	5.01E-07	2.15E-07	2.64E-06	1.00E-04	1.2%	whole body; clinical selenosis	3				[D]
Zinc	58.64	105.20	1.32E-07	1.70E-08	6.66E-06	2.86E-06	4.41E-07	2.23E-05	0.3%	blood; anemia	3				[D]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							1.91E-04	8.63E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.91E-09	7.52E-07	100.0%	

Table M.461. Risk characterization for soils: children – dermal exposure (current land use – open) – Tulane Avenue

Chemical	MLE Concentration in Soil (mg/kg)	RME Concentration in Soil (mg/kg)	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.77	1.18	1.78E-09	7.62E-11	8.08E-08	1.04E-08	4.45E-06	2.02E-04	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	11.66	15.79	2.71E-08	1.16E-09	1.08E-06	1.39E-07	9.03E-05	3.60E-03	38.7%	skin; keratosis, hyperpigmentation	3	2.03E-09	2.43E-07	100.0%	[A]
Chromium (III)	70.29	81.69	1.63E-07	7.00E-09	9.58E-06	7.18E-07	1.63E-07	5.58E-06	0.1%	no observed effects	100				
Mercury	13.32	24.42	3.09E-08	1.33E-09	1.67E-06	2.15E-07	1.03E-04	5.56E-03	59.8%	*oral*-CNS; neurotoxicity. *Inhal.*-kidney effects	1000				[D]
Selenium	5.85	7.90	1.36E-08	5.85E-10	5.40E-07	6.94E-08	2.72E-06	1.08E-04	1.2%	whole body; clinical selenosis	3				[D]
Zinc	58.64	105.20	1.36E-07	5.84E-09	7.19E-06	9.24E-07	4.54E-07	2.40E-05	0.3%	blood; anemia	3				[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.97E-04	9.30E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.03E-09	2.43E-07	100.0%	

Table M.462. Risk characterization summary for Tulane Avenue: RME risk estimates for future land uses

MEDIA	ROUTE	AGRICULTURAL LAND USE						COMMERCIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards:													
Hazard Index (HI): Combined Exposure		NA	NA					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				NA	NA					NA	NA		
Radiological Hazards:													
Excess Lifetime Cancer Risk: Combined Exposure						NA	NA					NA	NA

MEDIA	ROUTE	OPEN LAND USE						RESIDENTIAL LAND USE					
		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)		NONCANCER		CANCER		RADIONUCLIDES (CANCER ONLY)	
		CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT	CHILD	ADULT
Soil	Ingestion	1.5E−01 B	8.0E−02 B	4.0E−06 W	7.0E−06 W	9.9E−09 B	4.7E−08 B	NA	NA	NA	NA	NA	NA
	Dermal Contact	9.3E−03 B	8.6E−03 B	2.4E−07 B	7.5E−07 B	NA	NA	NA	NA	NA	NA	NA	NA
Surface Water	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sediment	Dermal Contact	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Inhalation (VOCs)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Produce	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beef	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dairy	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fish	Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Air	Particulates: Harvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chemical Hazards:													
Hazard Index (HI): Combined Exposure		1.6E−01 B	8.9E−02 B					NA	NA				
Excess Lifetime Cancer Risk: Combined Exposure				4E−06 W	8E−06 W					NA	NA		
Radiological Hazards:													
Excess Lifetime Cancer Risk: Combined Exposure						1E−08 B	5E−08 B					NA	NA

B – below or equa' rget noncancer hazard index (HI<=1), or cancer risk (ELCR<=1 x 10^{-6})
W – within EPA (ancer risk range (ELCR>1 x 10^{-6} and <1 x 10^{-4})
B – exceeds target noncancer hazard index (HI>1), or cancer risk (ELCR>1 x 10^{-4})

Table M.463. Human health risk characterization summary for EFPC open land use scenario: future land use, Tulane Avenue adults long–term exposure

Exposure Pathway	Noncarcinogenic Effects Hazard Index (HI): Based on MLE	Noncarcinogenic Effects Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	5.30E–03	7.99E–02	1.64E–07	6.95E–06
Dermal Contact	1.91E–04	8.63E–03	5.91E–09	7.52E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			1.27E–09	4.66E–08
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.5E–03	8.9E–02		
Excess Lifetime Cancer Risk: Combined Exposure			2E–07	8E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			1E–09	5E–08

Table M.464. Human health risk characterization summary for EFPC open land use scenario: future land use, Tulane Avenue children long–term exposure

Exposure Pathway	Noncarcinogenic Effects: Hazard Index (HI): Based on MLE	Noncarcinogenic Effects: Hazard Index (HI): Based on RME	Excess Lifetime Cancer Risk: Based on MLE	Excess Lifetime Cancer Risk: Based on RME
CHEMICALS				
SOIL PATHWAYS				
Ingestion	9.17E–03	1.52E–01	9.47E–08	3.96E–06
Dermal Contact	1.97E–04	9.30E–03	2.03E–09	2.43E–07
SURFACE WATER				
Ingestion				
Dermal Contact				
SEDIMENT				
Dermal Contact				
GROUNDWATER				
Ingestion				
Inhalation (VOCs)				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
RADIONUCLIDES				
SOIL PATHWAYS				
Ingestion			2.61E–10	9.86E–09
SURFACE WATER				
Ingestion				
GROUNDWATER				
Ingestion				
FOOD CHAIN				
Produce				
Beef				
Dairy				
Fish				
AIR PATHWAY				
Particulates: Harvesting				
Chemical Hazards: Hazard Index (HI): Combined Exposure	9.4E–03	1.6E–01		
Excess Lifetime Cancer Risk: Combined Exposure			1E–07	4E–06
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure			3E–10	1E–08

Table M.465. Risk characterization for soils: adults – ingestion exposure (future land use – open) – Tulane Avenue

Chemical	MLB Concentration In Soils	RMB Concentration In Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncar. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncar. Effects (CDI/RfD) (MLB)	HQ Noncar. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI X CSF) (MLB)	Excess Lifetime Cancer Risk (CDI X CSF) (RMB)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (mg/kg)															
Antimony	0.77	1.18	4.79E-08	6.16E-09	6.95E-07	2.98E-07	1.20E-04	1.74E-03	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	11.66	15.79	7.30E-07	9.39E-08	9.27E-06	3.97E-06	2.43E-03	3.09E-02	38.7%	skin; keratosis, hyperpigmentation	3	1.64E-07	6.95E-06	100.0%	[A]
Chromium (III)	70.29	81.69	4.40E-06	5.66E-07	4.80E-05	2.06E-05	4.40E-06	4.80E-05	0.1%	no observed effects	100				
Mercury	13.32	24.42	8.34E-07	1.07E-07	1.43E-05	6.14E-06	2.78E-03	4.78E-02	59.8%	*oral*-CNS; neurotoxicity. *Inhal.*-kidney effects	1000				[D]
Selenium	5.85	7.90	3.66E-07	4.71E-08	4.64E-06	1.99E-06	7.33E-05	9.28E-04	1.2%	whole body; clinical selenosis	3				[D]
Zinc	58.64	105.20	3.67E-06	4.72E-07	6.18E-05	2.65E-05	1.22E-05	2.06E-04	0.3%	blood; anemia	3				[D]
RADIONUCLIDES (pCi/g)															
Uranium 234	1.68	2.09		2.42E+01		9.40E+02						3.88E-10	1.50E-08	32.3%	[A]
Uranium 235+D	0.07	0.09		1.06E+00		4.27E+01						1.69E-11	6.83E-10	1.5%	[A]
Uranium 238+D	2.15	2.45		3.09E+01		1.10E+03						8.65E-10	3.08E-08	66.2%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							5.30E-03	7.99E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.64E-07	6.95E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.27E-09	4.60E-08	100.0%	

Table M.466. Risk characterization for soils: children – ingestion exposure (future land use – open) – Tulane Avenue

Chemical	MLE Concentration (s Soil)	RME Concentration (s Soil)	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg)															
Antimony	0.77	1.18	8.2E-08	3.5E-09	1.3E-06	1.7E-07	2.0E-04	3.3E-03	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	11.66	15.79	1.2E-06	5.4E-08	1.7E-05	2.2E-06	4.2E-03	5.8E-02	38.7%	skin; keratosis, hyperpigmentation	3	9.4E-08	3.9E-06	100.0%	[A]
Chromium (III)	70.29	81.69	7.6E-06	3.2E-07	9.1E-05	1.1E-05	7.6E-06	9.1E-05	0.1%	no observed effects	100				
Mercury	13.32	24.42	1.4E-06	6.1E-08	2.7E-05	3.5E-06	4.8E-03	9.0E-02	59.8%	*oral*–CNS; neurotoxicity. *Inhal*–kidney effects	1000				[D]
Selenium	5.85	7.90	6.3E-07	2.7E-08	8.8E-06	1.1E-06	1.2E-04	1.7E-03	1.2%	whole body; clinical selenosis	3				[D]
Zinc	58.64	105.20	6.3E-06	2.7E-07	1.1E-04	1.5E-05	2.1E-05	3.9E-04	0.3%	blood; anemia	3				[D]
RADIONUCLIDES (pCi/g)															
Uranium 234	1.68	2.09		4.9E+00		1.9E+02						7.9E-11	3.1E-09	32.3%	[A]
Uranium 235+D	0.07	0.09		2.1E-01		9.0E+00						3.4E-12	1.4E-10	1.5%	[A]
Uranium 238+D	2.15	2.45		6.3E+00		2.3E+02						1.7E-10	6.5E-09	66.2%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							9.1E-03	1.3E-01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												9.4E-08	3.9E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												2.6E-10	9.8E-09	100.0%	

Table M.467. Risk characterization for soils: adults – dermal exposure (future land use – open) – Tulane Avenue

Chemical	MLB Concentration in Soils	RMB Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Antimony	0.77	1.18	1.7E-09	2.2E-10	7.5E-08	3.2E-08	4.3E-06	1.8E-04	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	11.66	15.79	2.6E-08	3.3E-09	1.0E-06	4.2E-07	8.7E-05	3.3E-03	38.7%	skin; keratosis, hyperpigmentation	3	5.9E-09	7.5E-07	100.0%	[A]
Chromium (III)	70.29	81.69	1.5E-07	2.0E-08	5.1E-06	2.2E-06	1.5E-07	5.1E-06	0.1%	no observed effects	100				
Mercury	13.32	24.42	3.0E-08	3.8E-09	1.5E-06	6.6E-07	1.0E-04	5.1E-03	59.8%	*oral*-CNS; neurotoxicity. *Inhal.*-kidney effects	1000				[D]
Selenium	5.85	7.90	1.3E-08	1.7E-09	5.0E-07	2.1E-07	2.6E-06	1.0E-04	1.2%	whole body; clinical selenosis	3				[D]
Zinc	58.64	105.20	1.3E-07	1.7E-08	6.6E-06	2.8E-06	4.4E-07	2.2E-05	0.3%	blood; anemia	3				[D]
Chemical Hazards:															
Hazard Index (HI):							1.9E-04	8.6E-03	100.0%						
Combined Exposure (d)															
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												5.9E-09	7.5E-07	100.0%	

Table M.468. Risk characterization for soils: children – dermal exposure (future land use – open) – Tulane Avenue

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Antimony	0.77	1.18	1.7E-09	7.6E-11	8.0E-08	1.0E-08	4.4E-06	2.0E-04	2.2%	whole body, blood; inc. mortality	1000				
Arsenic	11.66	15.79	2.7E-08	1.1E-09	1.0E-06	1.3E-07	9.0E-05	3.6E-03	38.7%	skin; keratosis, hyperpigmentation	3	2.0E-09	2.4E-07	100.0%	[A],
Chromium (III)	70.29	81.69	1.6E-07	7.0E-09	5.5E-06	7.1E-07	1.6E-07	5.5E-06	0.1%	no observed effects	100				
Mercury	13.32	24.42	3.0E-08	1.3E-09	1.6E-06	2.1E-07	1.0E-04	5.5E-03	59.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Selenium	5.85	7.90	1.3E-08	5.8E-10	5.4E-07	6.9E-08	2.7E-06	1.0E-04	1.2%	whole body; clinical selenosis	3				[D]
Zinc	58.64	105.20	1.3E-07	5.8E-09	7.1E-06	9.2E-07	4.5E-07	2.4E-05	0.3%	blood; anemia	3				[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.9E-04	9.3E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.0E-09	2.4E-07	100.0%	

LEAD 0.6 UPTAKE/BIOKINETIC MODEL RESULTS

Table M.469. LEAD 0.6 Uptake/Biokinetic Model Results
Current Land Use - Segment 3
(Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	89.5	0.0
1-2	89.5	0.0
2-3	89.5	0.0
3-4	89.5	0.0
4-5	89.5	0.0
5-6	89.5	0.0
6-7	89.5	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.469. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.39	8.31	5.37
1-2:	2.45	8.33	5.37
2-3:	2.46	8.76	5.37
3-4:	2.51	8.65	5.37
4-5:	2.57	8.55	5.37
5-6:	2.58	8.74	5.37
6-7:	2.60	9.11	5.37

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.470. LEAD 0.6 Uptake/Biokinetic Model Results
Current Land Use - Segment 6
(Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	32.3	0.0
1-2	32.3	0.0
2-3	32.3	0.0
3-4	32.3	0.0
4-5	32.3	0.0
5-6	32.3	0.0
6-7	32.3	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.470. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.40	4.88	1.94
1-2:	1.44	4.90	1.94
2-3:	1.48	5.33	1.94
3-4:	1.51	5.22	1.94
4-5:	1.54	5.12	1.94
5-6:	1.55	5.31	1.94
6-7:	1.60	5.68	1.94

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.471. LEAD 0.6 Uptake/Biokinetic Model Results
Current Land Use - Segment 7
(Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	43.7	0.0
1-2	43.7	0.0
2-3	43.7	0.0
3-4	43.7	0.0
4-5	43.7	0.0
5-6	43.7	0.0
6-7	43.7	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.471. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.60	5.56	2.62
1-2:	1.64	5.58	2.62
2-3:	1.67	6.02	2.62
3-4:	1.71	5.91	2.62
4-5:	1.75	5.80	2.62
5-6:	1.76	6.00	2.62
6-7:	1.80	6.36	2.62

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.472. LEAD 0.6 Uptake/Biokinetic Model Results
Current Land Use - Segment 8
(Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	77.8	0.0
1-2	77.8	0.0
2-3	77.8	0.0
3-4	77.8	0.0
4-5	77.8	0.0
5-6	77.8	0.0
6-7	77.8	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.472. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.19	7.61	4.67
1-2:	2.24	7.63	4.67
2-3:	2.26	8.06	4.67
3-4:	2.30	7.95	4.67
4-5:	2.36	7.85	4.67
5-6:	2.37	8.04	4.67
6-7:	2.40	8.41	4.67

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.473. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 1
(Total Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 38.30 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	47.7	0.0
1-2	47.7	0.0
2-3	47.7	0.0
3-4	47.7	0.0
4-5	47.7	0.0
5-6	47.7	0.0
6-7	47.7	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.473. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.77	9.63	2.86
1-2:	3.91	15.40	2.86
2-3:	4.46	16.22	2.86
3-4:	4.66	16.30	2.86
4-5:	4.90	16.57	2.86
5-6:	5.03	17.34	2.86
6-7:	5.12	17.90	2.86

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	3.83	0.00	0.00
1-2:	2.96	9.57	0.00	0.00
2-3:	3.40	9.96	0.00	0.00
3-4:	3.29	10.15	0.00	0.00
4-5:	3.18	10.53	0.00	0.00
5-6:	3.38	11.11	0.00	0.00
6-7:	3.74	11.30	0.00	0.00

Table M.474. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 2
(Total Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 38.30 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	55.9	0.0
1-2	55.9	0.0
2-3	55.9	0.0
3-4	55.9	0.0
4-5	55.9	0.0
5-6	55.9	0.0
6-7	55.9	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.474. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.92	10.12	3.35
1-2:	4.06	15.89	3.35
2-3:	4.60	16.71	3.35
3-4:	4.80	16.79	3.35
4-5:	5.04	17.07	3.35
5-6:	5.17	17.84	3.35
6-7:	5.26	18.39	3.35

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	3.83	0.00	0.00
1-2:	2.96	9.57	0.00	0.00
2-3:	3.40	9.96	0.00	0.00
3-4:	3.29	10.15	0.00	0.00
4-5:	3.18	10.53	0.00	0.00
5-6:	3.38	11.11	0.00	0.00
6-7:	3.74	11.30	0.00	0.00

Table M.475. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 3
(Total Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 38.30 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	89.5	0.0
1-2	89.5	0.0
2-3	89.5	0.0
3-4	89.5	0.0
4-5	89.5	0.0
5-6	89.5	0.0
6-7	89.5	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.475. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	3.50	12.14	5.37
1-2:	4.65	17.90	5.37
2-3:	5.18	18.72	5.37
3-4:	5.38	18.80	5.37
4-5:	5.65	19.08	5.37
5-6:	5.77	19.85	5.37
6-7:	5.86	20.41	5.37

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	3.83	0.00	0.00
1-2:	2.96	9.57	0.00	0.00
2-3:	3.40	9.96	0.00	0.00
3-4:	3.29	10.15	0.00	0.00
4-5:	3.18	10.53	0.00	0.00
5-6:	3.38	11.11	0.00	0.00
6-7:	3.74	11.30	0.00	0.00

Table M.476. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 4
(Total Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 38.30 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	136.0	0.0
1-2	136.0	0.0
2-3	136.0	0.0
3-4	136.0	0.0
4-5	136.0	0.0
5-6	136.0	0.0
6-7	136.0	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.476. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	4.30	14.93	8.16
1-2:	5.47	20.69	8.16
2-3:	5.98	21.51	8.16
3-4:	6.19	21.59	8.16
4-5:	6.48	21.87	8.16
5-6:	6.61	22.64	8.16
6-7:	6.68	23.20	8.16

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	3.83	0.00	0.00
1-2:	2.96	9.57	0.00	0.00
2-3:	3.40	9.96	0.00	0.00
3-4:	3.29	10.15	0.00	0.00
4-5:	3.18	10.53	0.00	0.00
5-6:	3.38	11.11	0.00	0.00
6-7:	3.74	11.30	0.00	0.00

Table M.477. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 5
(Total Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 38.30 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	72.2	0.0
1-2	72.2	0.0
2-3	72.2	0.0
3-4	72.2	0.0
4-5	72.2	0.0
5-6	72.2	0.0
6-7	72.2	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.477. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	3.20	11.10	4.33
1-2:	4.34	16.87	4.33
2-3:	4.88	17.68	4.33
3-4:	5.08	17.77	4.33
4-5:	5.34	18.04	4.33
5-6:	5.46	18.81	4.33
6-7:	5.55	19.37	4.33

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	3.83	0.00	0.00
1-2:	2.96	9.57	0.00	0.00
2-3:	3.40	9.96	0.00	0.00
3-4:	3.29	10.15	0.00	0.00
4-5:	3.18	10.53	0.00	0.00
5-6:	3.38	11.11	0.00	0.00
6-7:	3.74	11.30	0.00	0.00

Table M.478. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 6
(Total Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 38.30 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	32.3	0.0
1-2	32.3	0.0
2-3	32.3	0.0
3-4	32.3	0.0
4-5	32.3	0.0
5-6	32.3	0.0
6-7	32.3	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.478. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.51	8.71	1.94
1-2:	3.64	14.47	1.94
2-3:	4.19	15.29	1.94
3-4:	4.39	15.37	1.94
4-5:	4.62	15.65	1.94
5-6:	4.75	16.42	1.94
6-7:	4.85	16.98	1.94

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	3.83	0.00	0.00
1-2:	2.96	9.57	0.00	0.00
2-3:	3.40	9.96	0.00	0.00
3-4:	3.29	10.15	0.00	0.00
4-5:	3.18	10.53	0.00	0.00
5-6:	3.38	11.11	0.00	0.00
6-7:	3.74	11.30	0.00	0.00

Table M.479. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 7
(Total Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 38.30 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	43.7	0.0
1-2	43.7	0.0
2-3	43.7	0.0
3-4	43.7	0.0
4-5	43.7	0.0
5-6	43.7	0.0
6-7	43.7	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.479. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.70	9.39	2.62
1-2:	3.84	15.16	2.62
2-3:	4.39	15.97	2.62
3-4:	4.59	16.06	2.62
4-5:	4.82	16.33	2.62
5-6:	4.95	17.10	2.62
6-7:	5.05	17.66	2.62

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	3.83	0.00	0.00
1-2:	2.96	9.57	0.00	0.00
2-3:	3.40	9.96	0.00	0.00
3-4:	3.29	10.15	0.00	0.00
4-5:	3.18	10.53	0.00	0.00
5-6:	3.38	11.11	0.00	0.00
6-7:	3.74	11.30	0.00	0.00

Table M.480. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 8
(Total Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 38.30 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	77.8	0.0
1-2	77.8	0.0
2-3	77.8	0.0
3-4	77.8	0.0
4-5	77.8	0.0
5-6	77.8	0.0
6-7	77.8	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.480. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	3.29	11.44	4.67
1-2:	4.44	17.20	4.67
2-3:	4.98	18.02	4.67
3-4:	5.18	18.10	4.67
4-5:	5.44	18.38	4.67
5-6:	5.57	19.15	4.67
6-7:	5.65	19.71	4.67

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	3.83	0.00	0.00
1-2:	2.96	9.57	0.00	0.00
2-3:	3.40	9.96	0.00	0.00
3-4:	3.29	10.15	0.00	0.00
4-5:	3.18	10.53	0.00	0.00
5-6:	3.38	11.11	0.00	0.00
6-7:	3.74	11.30	0.00	0.00

Table M.481. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 9
(Total Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 38.30 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	40.3	0.0
1-2	40.3	0.0
2-3	40.3	0.0
3-4	40.3	0.0
4-5	40.3	0.0
5-6	40.3	0.0
6-7	40.3	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.481. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.65	9.19	2.42
1-2:	3.78	14.95	2.42
2-3:	4.33	15.77	2.42
3-4:	4.53	15.85	2.42
4-5:	4.76	16.13	2.42
5-6:	4.89	16.90	2.42
6-7:	4.99	17.46	2.42

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	3.83	0.00	0.00
1-2:	2.96	9.57	0.00	0.00
2-3:	3.40	9.96	0.00	0.00
3-4:	3.29	10.15	0.00	0.00
4-5:	3.18	10.53	0.00	0.00
5-6:	3.38	11.11	0.00	0.00
6-7:	3.74	11.30	0.00	0.00

Table M.482. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 1
(Dissolved Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 1.69 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	47.7	0.0
1-2	47.7	0.0
2-3	47.7	0.0
3-4	47.7	0.0
4-5	47.7	0.0
5-6	47.7	0.0
6-7	47.7	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.482. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.72	5.97	2.86
1-2:	1.81	6.24	2.86
2-3:	1.86	6.70	2.86
3-4:	1.91	6.59	2.86
4-5:	1.96	6.51	2.86
5-6:	1.97	6.73	2.86
6-7:	2.01	7.10	2.86

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.17	0.00	0.00
1-2:	2.96	0.42	0.00	0.00
2-3:	3.40	0.44	0.00	0.00
3-4:	3.29	0.45	0.00	0.00
4-5:	3.18	0.46	0.00	0.00
5-6:	3.38	0.49	0.00	0.00
6-7:	3.74	0.50	0.00	0.00

Table M.483. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 2
(Dissolved Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 1.69 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	55.9	0.0
1-2	55.9	0.0
2-3	55.9	0.0
3-4	55.9	0.0
4-5	55.9	0.0
5-6	55.9	0.0
6-7	55.9	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.483. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.86	6.46	3.35
1-2:	1.95	6.74	3.35
2-3:	2.00	7.19	3.35
3-4:	2.05	7.09	3.35
4-5:	2.10	7.00	3.35
5-6:	2.12	7.22	3.35
6-7:	2.16	7.59	3.35

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.17	0.00	0.00
1-2:	2.96	0.42	0.00	0.00
2-3:	3.40	0.44	0.00	0.00
3-4:	3.29	0.45	0.00	0.00
4-5:	3.18	0.46	0.00	0.00
5-6:	3.38	0.49	0.00	0.00
6-7:	3.74	0.50	0.00	0.00

Table M.484. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 3
(Dissolved Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 1.69 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	89.5	0.0
1-2	89.5	0.0
2-3	89.5	0.0
3-4	89.5	0.0
4-5	89.5	0.0
5-6	89.5	0.0
6-7	89.5	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.484. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.44	8.48	5.37
1-2:	2.55	8.75	5.37
2-3:	2.58	9.20	5.37
3-4:	2.63	9.10	5.37
4-5:	2.71	9.01	5.37
5-6:	2.72	9.24	5.37
6-7:	2.75	9.61	5.37

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.17	0.00	0.00
1-2:	2.96	0.42	0.00	0.00
2-3:	3.40	0.44	0.00	0.00
3-4:	3.29	0.45	0.00	0.00
4-5:	3.18	0.46	0.00	0.00
5-6:	3.38	0.49	0.00	0.00
6-7:	3.74	0.50	0.00	0.00

Table M.485. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 4
(Dissolved Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 1.69 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc..
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	136.0	0.0
1-2	136.0	0.0
2-3	136.0	0.0
3-4	136.0	0.0
4-5	136.0	0.0
5-6	136.0	0.0
6-7	136.0	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.485. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	3.24	11.27	8.16
1-2:	3.37	11.54	8.16
2-3:	3.38	11.99	8.16
3-4:	3.44	11.89	8.16
4-5:	3.54	11.80	8.16
5-6:	3.55	12.03	8.16
6-7:	3.57	12.40	8.16

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.17	0.00	0.00
1-2:	2.96	0.42	0.00	0.00
2-3:	3.40	0.44	0.00	0.00
3-4:	3.29	0.45	0.00	0.00
4-5:	3.18	0.46	0.00	0.00
5-6:	3.38	0.49	0.00	0.00
6-7:	3.74	0.50	0.00	0.00

Table M.486. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 5
(Dissolved Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 1.69 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	72.2	0.0
1-2	72.2	0.0
2-3	72.2	0.0
3-4	72.2	0.0
4-5	72.2	0.0
5-6	72.2	0.0
6-7	72.2	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.486. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.14	7.44	4.33
1-2:	2.24	7.71	4.33
2-3:	2.28	8.17	4.33
3-4:	2.33	8.06	4.33
4-5:	2.40	7.98	4.33
5-6:	2.41	8.20	4.33
6-7:	2.44	8.57	4.33

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.17	0.00	0.00
1-2:	2.96	0.42	0.00	0.00
2-3:	3.40	0.44	0.00	0.00
3-4:	3.29	0.45	0.00	0.00
4-5:	3.18	0.46	0.00	0.00
5-6:	3.38	0.49	0.00	0.00
6-7:	3.74	0.50	0.00	0.00

Table M.487. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 6
(Dissolved Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 1.69 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	32.3	0.0
1-2	32.3	0.0
2-3	32.3	0.0
3-4	32.3	0.0
4-5	32.3	0.0
5-6	32.3	0.0
6-7	32.3	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.487. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.45	5.05	1.94
1-2:	1.54	5.32	1.94
2-3:	1.60	5.77	1.94
3-4:	1.64	5.67	1.94
4-5:	1.68	5.58	1.94
5-6:	1.69	5.80	1.94
6-7:	1.74	6.18	1.94

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.17	0.00	0.00
1-2:	2.96	0.42	0.00	0.00
2-3:	3.40	0.44	0.00	0.00
3-4:	3.29	0.45	0.00	0.00
4-5:	3.18	0.46	0.00	0.00
5-6:	3.38	0.49	0.00	0.00
6-7:	3.74	0.50	0.00	0.00

Table M.488. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 7
(Dissolved Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 1.69 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	43.7	0.0
1-2	43.7	0.0
2-3	43.7	0.0
3-4	43.7	0.0
4-5	43.7	0.0
5-6	43.7	0.0
6-7	43.7	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.488. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.65	5.73	2.62
1-2:	1.74	6.00	2.62
2-3:	1.79	6.46	2.62
3-4:	1.84	6.35	2.62
4-5:	1.88	6.27	2.62
5-6:	1.90	6.49	2.62
6-7:	1.94	6.86	2.62

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.17	0.00	0.00
1-2:	2.96	0.42	0.00	0.00
2-3:	3.40	0.44	0.00	0.00
3-4:	3.29	0.45	0.00	0.00
4-5:	3.18	0.46	0.00	0.00
5-6:	3.38	0.49	0.00	0.00
6-7:	3.74	0.50	0.00	0.00

Table M.489. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 8
(Dissolved Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 1.69 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	77.8	0.0
1-2	77.8	0.0
2-3	77.8	0.0
3-4	77.8	0.0
4-5	77.8	0.0
5-6	77.8	0.0
6-7	77.8	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.489. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.24	7.78	4.67
1-2:	2.34	8.05	4.67
2-3:	2.38	8.50	4.67
3-4:	2.43	8.40	4.67
4-5:	2.50	8.31	4.67
5-6:	2.51	8.53	4.67
6-7:	2.54	8.91	4.67

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.17	0.00	0.00
1-2:	2.96	0.42	0.00	0.00
2-3:	3.40	0.44	0.00	0.00
3-4:	3.29	0.45	0.00	0.00
4-5:	3.18	0.46	0.00	0.00
5-6:	3.38	0.49	0.00	0.00
6-7:	3.74	0.50	0.00	0.00

Table M.490. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 9
(Dissolved Pb Concentrations, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 1.69 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	40.3	0.0
1-2	40.3	0.0
2-3	40.3	0.0
3-4	40.3	0.0
4-5	40.3	0.0
5-6	40.3	0.0
6-7	40.3	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.490. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.59	5.53	2.42
1-2:	1.68	5.80	2.42
2-3:	1.73	6.25	2.42
3-4:	1.78	6.15	2.42
4-5:	1.82	6.06	2.42
5-6:	1.84	6.28	2.42
6-7:	1.88	6.66	2.42

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.17	0.00	0.00
1-2:	2.96	0.42	0.00	0.00
2-3:	3.40	0.44	0.00	0.00
3-4:	3.29	0.45	0.00	0.00
4-5:	3.18	0.46	0.00	0.00
5-6:	3.38	0.49	0.00	0.00
6-7:	3.74	0.50	0.00	0.00

Table M.491. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 1
(Excludes Drinking Water Contribution, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	47.7	0.0
1-2	47.7	0.0
2-3	47.7	0.0
3-4	47.7	0.0
4-5	47.7	0.0
5-6	47.7	0.0
6-7	47.7	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.491. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.67	5.80	2.86
1-2:	1.71	5.82	2.86
2-3:	1.74	6.26	2.86
3-4:	1.78	6.15	2.86
4-5:	1.82	6.04	2.86
5-6:	1.83	6.24	2.86
6-7:	1.87	6.60	2.86

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.492. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 2
(Excludes Drinking Water Contribution, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	55.9	0.0
1-2	55.9	0.0
2-3	55.9	0.0
3-4	55.9	0.0
4-5	55.9	0.0
5-6	55.9	0.0
6-7	55.9	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.492. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.81	6.29	3.35
1-2:	1.86	6.31	3.35
2-3:	1.88	6.75	3.35
3-4:	1.92	6.64	3.35
4-5:	1.97	6.53	3.35
5-6:	1.98	6.73	3.35
6-7:	2.01	7.09	3.35

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.493. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 3
(Excludes Drinking Water Contribution, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	89.5	0.0
1-2	89.5	0.0
2-3	89.5	0.0
3-4	89.5	0.0
4-5	89.5	0.0
5-6	89.5	0.0
6-7	89.5	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.493. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.39	8.31	5.37
1-2:	2.45	8.33	5.37
2-3:	2.46	8.76	5.37
3-4:	2.51	8.65	5.37
4-5:	2.57	8.55	5.37
5-6:	2.58	8.74	5.37
6-7:	2.60	9.11	5.37

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.494. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 4
(Excludes Drinking Water Contribution, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	136.0	0.0
1-2	136.0	0.0
2-3	136.0	0.0
3-4	136.0	0.0
4-5	136.0	0.0
5-6	136.0	0.0
6-7	136.0	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.494. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	3.20	11.10	8.16
1-2:	3.27	11.12	8.16
2-3:	3.26	11.56	8.16
3-4:	3.31	11.45	8.16
4-5:	3.41	11.34	8.16
5-6:	3.41	11.54	8.16
6-7:	3.42	11.90	8.16

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.495. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 5
(Excludes Drinking Water Contribution, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	72.2	0.0
1-2	72.2	0.0
2-3	72.2	0.0
3-4	72.2	0.0
4-5	72.2	0.0
5-6	72.2	0.0
6-7	72.2	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.495. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.09	7.27	4.33
1-2:	2.14	7.29	4.33
2-3:	2.16	7.73	4.33
3-4:	2.21	7.62	4.33
4-5:	2.26	7.51	4.33
5-6:	2.27	7.71	4.33
6-7:	2.30	8.07	4.33

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.496. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 6
(Excludes Drinking Water Contribution, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	32.3	0.0
1-2	32.3	0.0
2-3	32.3	0.0
3-4	32.3	0.0
4-5	32.3	0.0
5-6	32.3	0.0
6-7	32.3	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.496. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.40	4.88	1.94
1-2:	1.44	4.90	1.94
2-3:	1.48	5.33	1.94
3-4:	1.51	5.22	1.94
4-5:	1.54	5.12	1.94
5-6:	1.55	5.31	1.94
6-7:	1.60	5.68	1.94

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.497. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 7
(Excludes Drinking Water Contribution, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	43.7	0.0
1-2	43.7	0.0
2-3	43.7	0.0
3-4	43.7	0.0
4-5	43.7	0.0
5-6	43.7	0.0
6-7	43.7	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.497. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.60	5.56	2.62
1-2:	1.64	5.58	2.62
2-3:	1.67	6.02	2.62
3-4:	1.71	5.91	2.62
4-5:	1.75	5.80	2.62
5-6:	1.76	6.00	2.62
6-7:	1.80	6.36	2.62

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.498. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 8
(Excludes Drinking Water Contribution, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	77.8	0.0
1-2	77.8	0.0
2-3	77.8	0.0
3-4	77.8	0.0
4-5	77.8	0.0
5-6	77.8	0.0
6-7	77.8	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.498. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	2.19	7.61	4.67
1-2:	2.24	7.63	4.67
2-3:	2.26	8.06	4.67
3-4:	2.30	7.95	4.67
4-5:	2.36	7.85	4.67
5-6:	2.37	8.04	4.67
6-7:	2.40	8.41	4.67

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

Table M.499. LEAD 0.6 Uptake/Biokinetic Model Results
Future Land Use - Segment 9
(Excludes Drinking Water Contribution, Excludes Foodchain)

ABSORPTION METHODOLOGY: Non-Linear Active-Passive

AIR CONCENTRATION: 0.000 ug Pb/m3
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 0.00 ug Pb/L
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	40.3	0.0
1-2	40.3	0.0
2-3	40.3	0.0
3-4	40.3	0.0
4-5	40.3	0.0
5-6	40.3	0.0
6-7	40.3	0.0

Additional Dust Sources: None DEFAULT

PAINT Intake: 0.00 ug Pb/day DEFAULT

MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 0.00 ug Pb/dL

Table M.499. (continued)

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	1.54	5.36	2.42
1-2:	1.58	5.38	2.42
2-3:	1.61	5.81	2.42
3-4:	1.65	5.70	2.42
4-5:	1.69	5.60	2.42
5-6:	1.70	5.79	2.42
6-7:	1.74	6.16	2.42

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Paint Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.94	0.00	0.00	0.00
1-2:	2.96	0.00	0.00	0.00
2-3:	3.40	0.00	0.00	0.00
3-4:	3.29	0.00	0.00	0.00
4-5:	3.18	0.00	0.00	0.00
5-6:	3.38	0.00	0.00	0.00
6-7:	3.74	0.00	0.00	0.00

PHASE Ib MONITORING DATA

Table M.500. EFPC Phase IB chemical and radionuclide results: soil – Segment 1

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2-Methylnaphthalene	MG/KG	8	17	3.300E-01	4.800E-02	2.561E-01	6.500E-01	3.229E-01	3.229E-01	3.828E-02
4-Chloro-3-Methylphenol	MG/KG	1	17	3.300E-01	4.100E-02	2.748E-01	6.500E-01	3.306E-01	3.306E-01	3.198E-02
4,4'-DDD	MG/KG	1	14	1.600E-02	2.200E-04	1.244E-02	3.200E-02	1.592E-02	1.592E-02	1.960E-03
Acenaphthene	MG/KG	5	17	3.300E-01	6.300E-02	3.268E-01	1.700E+00	4.881E-01	4.881E-01	9.242E-02
Acenaphthylene	MG/KG	5	17	3.300E-01	4.300E-02	2.162E-01	4.600E-01	2.644E-01	2.644E-01	2.757E-02
alpha-Chlordane	MG/KG	1	14	8.000E-02	2.800E-04	5.950E-02	1.600E-01	7.820E-02	7.820E-02	1.056E-02
Aluminum	MG/KG	17	17	1.000E+01	6.640E+03	1.443E+04	2.320E+04	1.639E+04	1.639E+04	1.124E+03
Americium 241	PCI/G	9	12	9.519E-02	-1.600E-01	-2.375E-02	6.000E-02	1.316E-02	1.316E-02	2.055E-02
Anthracene	MG/KG	9	17	3.300E-01	6.300E-02	3.274E-01	2.000E+00	5.151E-01	5.151E-01	1.075E-01
Antimony	MG/KG	74	97	4.900E-01	1.650E-01	1.109E+00	9.200E+00	1.371E+00	1.371E+00	1.581E-01
Aroclor-1254	MG/KG	1	14	1.600E-01	2.550E-02	1.675E-01	8.000E-01	2.591E-01	2.591E-01	5.168E-02
Aroclor-1260	MG/KG	10	14	1.600E-01	2.550E-02	1.011E+00	2.900E+00	1.523E+00	1.523E+00	2.893E-01
Arsenic	MG/KG	97	101	3.600E+00	7.000E-01	6.308E+00	1.600E+01	6.868E+00	6.868E+00	3.373E-01
Barium	MG/KG	17	17	5.000E-01	3.600E+01	1.501E+02	3.270E+02	1.850E+02	1.850E+02	2.000E+01
Benzo(a)anthracene	MG/KG	13	17	3.300E-01	1.900E-01	7.968E-01	3.400E+00	1.163E+00	1.163E+00	2.096E-01
Benzo(a)pyrene	MG/KG	13	17	3.300E-01	1.900E-01	7.309E-01	2.700E+00	1.045E+00	1.045E+00	1.797E-01
Benzo(b)fluoranthene	MG/KG	14	17	3.300E-01	1.200E-01	1.010E+00	3.900E+00	1.418E+00	1.418E+00	2.334E-01
Benzo(g,h,i)perylene	MG/KG	12	17	3.300E-01	1.900E-01	4.826E-01	1.800E+00	6.435E-01	6.435E-01	9.214E-02
Benzo(k)fluoranthene	MG/KG	14	17	3.300E-01	1.200E-01	8.121E-01	3.200E+00	1.127E+00	1.127E+00	1.806E-01
Beryllium	MG/KG	13	17	2.000E-01	1.250E-01	1.061E+00	4.600E+00	1.502E+00	1.502E+00	2.526E-01
bis(2-Ethylhexyl)phthalate	MG/KG	5	17	3.300E-01	6.700E-02	2.332E-01	6.500E-01	2.950E-01	2.950E-01	3.537E-02
Butylbenzylphthalate	MG/KG	1	17	3.300E-01	8.200E-02	2.657E-01	6.500E-01	3.187E-01	3.187E-01	3.034E-02
Cadmium	MG/KG	12	17	1.000E+00	3.650E-01	5.231E+00	2.600E+01	7.984E+00	7.984E+00	1.577E+00
Carbazole	MG/KG	3	5	3.300E-01	9.600E-02	1.842E-01	2.600E-01	2.609E-01	2.600E-01	3.598E-02
Cesium 137+D	PCI/G	17	17	6.071E-02	1.100E-01	1.148E+00	8.240E+00	1.959E+00	1.959E+00	4.641E-01
Chromium (III)	MG/KG	89	91	1.000E+00	9.400E+00	6.393E+01	1.170E+02	6.839E+01	6.839E+01	2.689E+00
Chrysene	MG/KG	13	17	3.300E-01	1.900E-01	7.856E-01	3.100E+00	1.153E+00	1.153E+00	2.102E-01
Cobalt	MG/KG	16	17	1.000E+00	1.800E+00	1.161E+01	2.570E+01	1.414E+01	1.414E+01	1.452E+00
Cobalt 60	PCI/G	15	15	1.444E-02	-4.430E-02	5.600E-03	5.480E-02	1.825E-02	1.825E-02	7.180E-03
Copper	MG/KG	17	17	1.000E+00	4.100E+00	8.012E+01	1.760E+02	1.040E+02	1.040E+02	1.365E+01
Cyanide	MG/KG	7	12	6.000E-01	3.000E-01	6.408E-01	1.300E+00	8.046E-01	8.046E-01	9.120E-02
Dibenzofuran	MG/KG	5	17	3.300E-01	5.200E-02	2.632E-01	7.000E-01	3.415E-01	3.415E-01	4.487E-02
Dibenzo(a,h)anthracene	MG/KG	8	17	3.300E-01	5.500E-02	2.476E-01	6.500E-01	3.235E-01	3.235E-01	4.346E-02
Endosulfan II	MG/KG	1	14	1.600E-02	2.600E-04	1.245E-02	3.200E-02	1.592E-02	1.592E-02	1.959E-03
Endrin	MG/KG	1	14	1.600E-02	1.500E-04	1.244E-02	3.200E-02	1.592E-02	1.592E-02	1.963E-03
Endrin aldehyde	MG/KG	1	2		6.100E-04	4.305E-03	8.000E-03	2.763E-02	8.000E-03	3.695E-03
Fluoranthene	MG/KG	15	17	3.300E-01	5.000E-02	1.716E+00	8.200E+00	2.623E+00	2.623E+00	5.194E-01
Fluorene	MG/KG	5	17	3.300E-01	7.200E-02	2.982E-01	1.200E+00	4.132E-01	4.132E-01	6.589E-02
gamma-Chlordane	MG/KG	2	14	8.000E-02	7.100E-04	5.929E-02	1.600E-01	7.815E-02	7.815E-02	1.064E-02
Heptachlor	MG/KG	1	14	8.000E-03	1.300E-04	6.227E-03	1.600E-02	7.955E-03	7.955E-03	9.755E-04
Indeno(1,2,3-cd)pyrene	MG/KG	12	17	3.300E-01	1.800E-01	4.791E-01	1.800E+00	6.448E-01	6.448E-01	9.489E-02
Lead	MG/KG	17	17	5.000E-01	1.060E+01	4.024E+01	6.620E+01	4.767E+01	4.767E+01	4.256E+00
Manganese	MG/KG	17	17	5.000E-01	2.560E+01	7.012E+02	1.560E+03	8.995E+02	8.995E+02	1.136E+02
Mercury	MG/KG	51	94	3.400E+00	4.000E-01	1.303E+02	1.590E+03	1.834E+02	1.834E+02	3.196E+01
Naphthalene	MG/KG	6	17	3.300E-01	9.500E-02	3.329E-01	1.800E+00	5.033E-01	5.033E-01	9.761E-02
Neptunium 237+D	PCI/G	12	12	5.102E-02	-3.000E-02	5.500E-03	3.900E-02	1.573E-02	1.573E-02	5.699E-03
Nickel	MG/KG	17	17	1.000E+01	3.700E+00	4.112E+01	9.720E+01	5.424E+01	5.424E+01	7.518E+00
Pentachlorophenol	MG/KG	1	17	1.600E+00	6.700E-02	1.154E+00	3.200E+00	1.471E+00	1.471E+00	1.815E-01
Phenanthrene	MG/KG	13	17	3.300E-01	1.900E-01	1.063E+00	7.800E+00	1.837E+00	1.837E+00	4.433E-01
Protactinium 233	PCI/G	5	5	1.165E-01	-1.190E-01	-1.612E-02	9.840E-02	6.044E-02	6.044E-02	3.591E-02
Pyrene	MG/KG	15	17	3.300E-01	4.800E-02	1.266E+00	6.500E+00	1.968E+00	1.968E+00	4.024E-01
Selenium	MG/KG	11	99	1.200E+01	3.600E-01	8.246E+00	6.300E+01	9.887E+00	9.887E+00	9.879E-01
Silver	MG/KG	9	17	1.000E+00	8.500E-01	4.253E+00	1.320E+01	6.107E+00	6.107E+00	1.062E+00
Thallium	MG/KG	1	14	5.000E-01	2.400E-01	1.699E+00	1.930E+01	4.097E+00	4.097E+00	1.354E+00
Thorium 228+D	PCI/G	1	1	1.830E-01	2.542E+00	2.542E+00	2.542E+00		2.542E+00	
Thorium 230	PCI/G	1	1	2.420E-01	4.576E+00	4.576E+00	4.576E+00		4.576E+00	
Thorium 232	PCI/G	1	1	1.620E-01	1.898E+00	1.898E+00	1.898E+00		1.898E+00	
Uranium 234	PCI/G	85	88	2.924E-01	3.100E-01	6.574E+00	2.845E+01	7.723E+00	7.723E+00	6.915E-01
Uranium 235+D	PCI/G	99	99	2.641E-03	1.000E-02	3.293E-01	1.819E+00	3.908E-01	3.908E-01	3.702E-02
Uranium 238+D	PCI/G	83	86	1.579E-01	2.100E-01	7.191E+00	3.263E+01	8.353E+00	8.353E+00	6.986E-01
Vanadium	MG/KG	17	17	1.000E+00	1.350E+01	2.448E+01	3.630E+01	2.710E+01	2.710E+01	1.503E+00
Zinc	MG/KG	23	102	9.600E+01	1.250E+01	6.611E+01	3.400E+02	7.345E+01	7.345E+01	4.421E+00

Table M.501. EFPC Phase IB chemical and radionuclide results: soil – Segment 2

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2-Methylnaphthalene	MG/KG	5	6	3.300E-01	8.200E-02	1.338E-01	2.600E-01	1.912E-01	1.912E-01	2.849E-02
4,4'-DDE	MG/KG	4	6	1.600E-02	1.500E-04	1.668E-03	3.600E-03	2.670E-03	2.670E-03	4.972E-04
Acenaphthene	MG/KG	2	6	3.300E-01	4.700E-02	1.537E-01	2.250E-01	2.181E-01	2.181E-01	3.199E-02
Acenaphthylene	MG/KG	1	6	3.300E-01	1.300E-01	1.933E-01	2.250E-01	2.241E-01	2.241E-01	1.526E-02
Aldrin	MG/KG	5	6	8.000E-03	8.100E-05	3.135E-04	9.000E-04	5.601E-04	5.601E-04	1.224E-04
alpha-Chlordane	MG/KG	4	6	8.000E-02	1.100E-04	2.197E-03	6.000E-03	4.205E-03	4.205E-03	9.968E-04
Aluminum	MG/KG	6	6	1.000E+01	1.020E+04	1.370E+04	1.880E+04	1.693E+04	1.693E+04	1.603E+03
Anthracene	MG/KG	4	6	3.300E-01	5.900E-02	1.332E-01	1.950E-01	1.756E-01	1.756E-01	2.108E-02
Antimony	MG/KG	79	95	4.900E-01	1.000E-01	8.159E-01	5.950E+00	9.766E-01	9.766E-01	9.672E-02
Aroclor-1260	MG/KG	6	6	1.600E-01	3.000E-03	3.673E-01	8.600E-01	6.474E-01	6.474E-01	1.390E-01
Arsenic	MG/KG	93	98	3.600E+00	1.400E+00	8.545E+00	5.000E+01	9.772E+00	9.772E+00	7.388E-01
Barium	MG/KG	6	6	5.000E-01	6.550E+01	1.465E+02	2.540E+02	2.037E+02	2.037E+02	2.838E+01
Benzo(a)anthracene	MG/KG	6	6	3.300E-01	1.400E-01	8.467E-01	2.200E+00	1.500E+00	1.500E+00	3.244E-01
Benzo(a)pyrene	MG/KG	6	6	3.300E-01	1.400E-01	6.317E-01	1.600E+00	1.075E+00	1.075E+00	2.201E-01
Benzo(b)fluoranthene	MG/KG	6	6	3.300E-01	4.000E-01	1.233E+00	2.800E+00	1.970E+00	1.970E+00	3.658E-01
Benzo(g,h,i)perylene	MG/KG	6	6	3.300E-01	1.100E-01	4.900E-01	1.200E+00	8.177E-01	8.177E-01	1.626E-01
Benzo(k)fluoranthene	MG/KG	6	6	3.300E-01	4.000E-01	1.233E+00	2.800E+00	1.970E+00	1.970E+00	3.658E-01
Beryllium	MG/KG	6	6	2.000E-01	6.500E-01	9.033E-01	1.100E+00	1.069E+00	1.069E+00	8.237E-02
bis(2-Ethylhexyl)phthalate	MG/KG	3	6	3.300E-01	5.300E-02	1.437E-01	2.200E-01	2.107E-01	2.107E-01	3.326E-02
Cadmium	MG/KG	6	6	1.000E+00	1.500E+00	4.833E+00	8.100E+00	7.081E+00	7.081E+00	1.115E+00
Carbazole	MG/KG	4	6	3.300E-01	5.500E-02	1.325E-01	1.950E-01	1.779E-01	1.779E-01	2.254E-02
Cesium 137+D	PCI/G	6	6	6.994E-02	7.920E-02	7.615E-01	1.580E+00	1.228E+00	1.228E+00	2.313E-01
Chromium (III)	MG/KG	84	93	1.000E+00	1.500E+01	6.117E+01	9.200E+01	6.390E+01	6.390E+01	1.641E+00
Chrysene	MG/KG	6	6	3.300E-01	1.900E-01	6.183E-01	1.400E+00	1.003E+00	1.003E+00	1.908E-01
Cobalt	MG/KG	6	6	1.000E+00	8.700E+00	1.143E+01	1.410E+01	1.339E+01	1.339E+01	9.694E-01
Cobalt 60	PCI/G	6	6	4.035E-02	-1.020E-01	1.827E-02	8.850E-02	7.620E-02	7.620E-02	2.875E-02
Copper	MG/KG	6	6	1.000E+00	1.220E+01	1.523E+02	3.500E+02	2.559E+02	2.559E+02	5.143E+01
Dibenzofuran	MG/KG	2	6	3.300E-01	5.300E-02	1.520E-01	2.200E-01	2.132E-01	2.132E-01	3.039E-02
Dibenzo(a,h)anthracene	MG/KG	4	6	3.300E-01	5.000E-02	1.792E-01	3.600E-01	2.702E-01	2.702E-01	4.517E-02
Di-n-Butylphthalate	MG/KG	1	6	3.300E-01	1.100E-01	1.967E-01	2.250E-01	2.327E-01	2.250E-01	1.787E-02
Fluoranthene	MG/KG	6	6	3.300E-01	3.700E-01	1.295E+00	2.900E+00	2.096E+00	2.096E+00	3.975E-01
Fluorene	MG/KG	2	6	3.300E-01	6.600E-02	1.573E-01	2.250E-01	2.171E-01	2.171E-01	2.967E-02
gamma-Chlordane	MG/KG	3	6	8.000E-02	5.600E-04	1.252E-03	2.800E-03	1.899E-03	1.899E-03	3.213E-04
Heptachlor	MG/KG	1	6	8.000E-03	8.200E-05	9.053E-04	1.150E-03	1.246E-03	1.150E-03	1.690E-04
Indeno(1,2,3-cd)pyrene	MG/KG	6	6	3.300E-01	1.200E-01	5.283E-01	1.300E+00	8.840E-01	8.840E-01	1.765E-01
Lead	MG/KG	6	6	5.000E-01	2.360E+01	4.297E+01	6.580E+01	5.585E+01	5.585E+01	6.391E+00
Manganese	MG/KG	6	6	5.000E-01	7.210E+02	8.147E+02	8.820E+02	8.601E+02	8.601E+02	2.257E+01
Mercury	MG/KG	27	83	3.400E+00	5.500E-01	2.203E+01	4.430E+02	3.326E+01	3.326E+01	6.753E+00
Naphthalene	MG/KG	5	6	3.300E-01	5.400E-02	1.027E-01	1.800E-01	1.494E-01	1.494E-01	2.321E-02
Neptunium 237+D	PCI/G	6	6	1.226E-02	4.000E-03	1.517E-02	6.000E-02	3.346E-02	3.346E-02	9.079E-03
Nickel	MG/KG	6	6	1.000E+01	9.900E+00	3.928E+01	5.900E+01	5.675E+01	5.675E+01	8.668E+00
Phenanthrene	MG/KG	6	6	3.300E-01	1.300E-01	5.800E-01	1.200E+00	9.407E-01	9.407E-01	1.790E-01
Protactinium 233	PCI/G	6	6	8.607E-02	-9.340E-02	1.652E-02	1.500E-01	8.543E-02	8.543E-02	3.420E-02
Pyrene	MG/KG	6	6	3.300E-01	2.500E-01	1.025E+00	2.500E+00	1.757E+00	1.757E+00	3.631E-01
Selenium	MG/KG	28	98	1.200E+01	4.650E-01	1.234E+01	5.900E+01	1.457E+01	1.457E+01	1.342E+00
Silver	MG/KG	3	6	1.000E+00	1.150E+00	2.333E+00	3.800E+00	3.342E+00	3.342E+00	5.006E-01
Thorium 228+D	PCI/G	3	3	8.552E-02	1.142E+00	1.517E+00	2.110E+00	2.393E+00	2.110E+00	2.999E-01
Thorium 230	PCI/G	3	3	1.473E-01	3.402E+00	4.564E+00	6.515E+00	7.430E+00	6.515E+00	9.816E-01
Thorium 232	PCI/G	3	3	7.845E-02	9.180E-01	1.309E+00	1.742E+00	2.007E+00	1.742E+00	2.388E-01
Uranium 234	PCI/G	81	88	1.862E-01	5.827E-01	3.086E+00	1.141E+01	3.585E+00	3.585E+00	2.999E-01
Uranium 235+D	PCI/G	93	93	1.359E-03	2.568E-02	1.356E-01	5.350E-01	1.574E-01	1.574E-01	1.312E-02
Uranium 238+D	PCI/G	79	86	1.049E-01	4.662E-01	3.404E+00	1.132E+01	3.860E+00	3.860E+00	2.740E-01
Vanadium	MG/KG	6	6	1.000E+00	1.830E+01	2.272E+01	3.060E+01	2.690E+01	2.690E+01	2.076E+00
Zinc	MG/KG	21	98	9.600E+01	1.400E+01	3.074E+02	3.820E+03	4.364E+02	4.364E+02	7.773E+01

Table M.502. EFPC Phase IB chemical and radionuclide results: soil — Segment 3

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2-Methylnaphthalene	MG/KG	3	9	3.300E-01	5.900E-02	2.524E-01	7.000E-01	3.742E-01	3.742E-01	6.547E-02
4,4'-DDD	MG/KG	2	10	1.600E-02	1.600E-04	5.869E-03	1.100E-02	8.610E-03	8.610E-03	1.495E-03
4,4'-DDE	MG/KG	2	10	1.600E-02	2.000E-03	6.190E-03	1.100E-02	8.711E-03	8.711E-03	1.375E-03
Acenaphthene	MG/KG	1	9	3.300E-01	2.000E-01	3.400E-01	9.000E-01	5.046E-01	5.046E-01	8.854E-02
Acenaphthylene	MG/KG	1	9	3.300E-01	5.700E-02	2.458E-01	7.000E-01	3.559E-01	3.559E-01	5.920E-02
Aldrin	MG/KG	1	10	8.000E-03	1.100E-04	2.966E-03	5.500E-03	4.249E-03	4.249E-03	6.999E-04
alpha-Chlordane	MG/KG	4	10	8.000E-02	1.900E-04	2.615E-02	5.500E-02	4.102E-02	4.102E-02	8.112E-03
Aluminum	MG/KG	14	14	1.000E+01	8.190E+03	1.556E+04	2.710E+04	1.831E+04	1.831E+04	1.556E+03
Americium 241	PCI/G	23	23	6.520E-02	-1.500E-01	2.652E-02	2.500E-01	5.819E-02	5.819E-02	1.844E-02
Anthracene	MG/KG	4	9	3.300E-01	4.800E-02	3.157E-01	1.000E+00	5.131E-01	5.131E-01	1.062E-01
Antimony	MG/KG	56	65	4.900E-01	2.200E-01	1.482E+00	1.100E+01	1.873E+00	1.873E+00	2.342E-01
Aroclor-1254	MG/KG	5	30	1.600E-01	2.050E-02	1.406E-01	6.700E-01	1.838E-01	1.838E-01	2.540E-02
Aroclor-1260	MG/KG	13	30	1.600E-01	2.050E-02	2.323E-01	1.700E+00	3.306E-01	3.306E-01	5.788E-02
Arsenic	MG/KG	69	70	3.600E+00	1.250E+00	8.792E+00	2.400E+01	9.514E+00	9.514E+00	4.333E-01
Barium	MG/KG	14	14	5.000E-01	6.080E+01	9.986E+01	1.730E+02	1.158E+02	1.158E+02	8.995E+00
Benzo(a)anthracene	MG/KG	7	9	3.300E-01	5.500E-02	7.063E-01	2.900E+00	1.277E+00	1.277E+00	3.069E-01
Benzo(a)pyrene	MG/KG	6	9	3.300E-01	8.700E-02	6.774E-01	2.600E+00	1.201E+00	1.201E+00	2.813E-01
Benzo(b)fluoranthene	MG/KG	7	9	3.300E-01	9.100E-02	1.180E+00	5.500E+00	2.276E+00	2.276E+00	5.891E-01
Benzo(g,h,i)perylene	MG/KG	5	9	3.300E-01	1.700E-01	5.022E-01	1.500E+00	7.947E-01	7.947E-01	1.573E-01
Benzo(k)fluoranthene	MG/KG	6	9	3.300E-01	9.300E-02	1.136E+00	5.500E+00	2.245E+00	2.245E+00	5.962E-01
Beryllium	MG/KG	8	14	2.000E-01	3.850E-01	6.907E-01	9.500E-01	7.772E-01	7.772E-01	4.885E-02
bis(2-Ethylhexyl)phthalate	MG/KG	5	9	3.300E-01	6.000E-02	2.313E-01	7.000E-01	3.547E-01	3.547E-01	6.636E-02
Butylbenzylphthalate	MG/KG	4	9	3.300E-01	5.500E-02	2.224E-01	7.000E-01	3.392E-01	3.392E-01	6.280E-02
Cadmium	MG/KG	8	14	1.000E+00	4.800E-01	2.299E+00	7.400E+00	3.378E+00	3.378E+00	6.096E-01
Carbazole	MG/KG	2	7	3.300E-01	5.100E-02	1.759E-01	2.100E-01	2.192E-01	2.100E-01	2.232E-02
Cesium 137+D	PCI/G	28	28	1.689E-02	0.000E+00	6.076E-01	2.440E+00	8.189E-01	8.189E-01	1.240E-01
Chromium (III)	MG/KG	71	71	1.000E+00	1.640E+01	6.904E+01	2.170E+02	7.510E+01	7.510E+01	3.636E+00
Chrysene	MG/KG	7	9	3.300E-01	5.400E-02	7.819E-01	3.500E+00	1.471E+00	1.471E+00	3.705E-01
Cobalt	MG/KG	14	14	1.000E+00	6.600E+00	1.365E+01	2.030E+01	1.550E+01	1.550E+01	1.042E+00
Cobalt 60	PCI/G	29	29	9.587E-03	-5.410E-02	5.641E-03	1.400E-01	1.560E-02	1.560E-02	5.856E-03
Copper	MG/KG	14	14	1.000E+00	8.300E+00	4.364E+01	1.240E+02	6.090E+01	6.090E+01	9.747E+00
delta-BHC	MG/KG	1	10	8.000E-03	8.500E-05	2.963E-03	5.500E-03	4.249E-03	4.249E-03	7.010E-04
Dibenzofuran	MG/KG	1	9	3.300E-01	2.000E-01	2.922E-01	7.000E-01	4.012E-01	4.012E-01	5.859E-02
Dibenzo(a,h)anthracene	MG/KG	4	9	3.300E-01	5.300E-02	2.563E-01	7.000E-01	3.775E-01	3.775E-01	6.515E-02
Dieldrin	MG/KG	2	10	1.600E-02	2.100E-03	2.536E-02	2.000E-01	6.100E-02	6.100E-02	1.944E-02
Diethyl phthalate	MG/KG	1	9	3.300E-01	2.000E-01	1.518E+00	1.200E+01	3.955E+00	3.955E+00	1.310E+00
Di-n-Butylphthalate	MG/KG	1	9	3.300E-01	7.300E-02	2.509E-01	7.000E-01	3.594E-01	3.594E-01	5.834E-02
Endosulfan I	MG/KG	1	10	8.000E-03	1.500E-04	2.970E-03	5.500E-03	4.250E-03	4.250E-03	6.981E-04
Endosulfan II	MG/KG	1	10	1.600E-02	3.900E-04	6.039E-03	1.100E-02	8.669E-03	8.669E-03	1.435E-03
Endrin	MG/KG	1	10	1.600E-02	2.600E-04	6.026E-03	1.100E-02	8.667E-03	8.667E-03	1.441E-03
Fluoranthene	MG/KG	7	9	3.300E-01	1.300E-01	1.620E+00	7.300E+00	3.135E+00	3.135E+00	8.148E-01
Fluorene	MG/KG	2	9	3.300E-01	5.700E-02	3.097E-01	7.800E-01	4.645E-01	4.645E-01	8.328E-02
gamma-Chlordane	MG/KG	4	10	8.000E-02	1.000E-04	2.603E-02	5.500E-02	4.097E-02	4.097E-02	8.149E-03
Heptachlor	MG/KG	1	10	8.000E-03	1.400E-04	2.974E-03	5.500E-03	4.252E-03	4.252E-03	6.970E-04
Heptachlor Epoxide	MG/KG	1	10	8.000E-03	1.050E-03	3.670E-03	1.100E-02	5.554E-03	5.554E-03	1.028E-03
Indeno(1,2,3-cd)pyrene	MG/KG	6	9	3.300E-01	4.700E-02	5.030E-01	1.500E+00	8.113E-01	8.113E-01	1.658E-01
Lead	MG/KG	13	13	5.000E-01	2.650E+01	6.908E+01	1.770E+02	8.954E+01	8.954E+01	1.148E+01
Manganese	MG/KG	14	14	5.000E-01	3.980E+02	1.023E+03	1.910E+03	1.193E+03	1.193E+03	9.588E+01
Mercury	MG/KG	36	72	3.400E+00	6.500E-02	3.741E+01	8.680E+02	5.893E+01	5.893E+01	1.292E+01
Naphthalene	MG/KG	2	9	3.300E-01	4.600E-02	2.818E-01	7.000E-01	4.076E-01	4.076E-01	6.768E-02
Neptunium 237+D	PCI/G	24	24	1.504E-02	-4.000E-02	9.042E-03	1.100E-01	2.380E-02	2.380E-02	8.610E-03
Nickel	MG/KG	14	14	1.000E+01	8.900E+00	2.867E+01	6.280E+01	3.684E+01	3.684E+01	4.613E+00
Phenanthrene	MG/KG	7	9	3.300E-01	6.200E-02	9.490E-01	5.100E+00	1.947E+00	1.947E+00	5.368E-01
Protactinium 233	PCI/G	6	6	8.485E-02	-5.630E-02	5.092E-02	1.630E-01	1.235E-01	1.235E-01	3.601E-02
Pyrene	MG/KG	7	9	3.300E-01	9.500E-02	1.162E+00	5.100E+00	2.203E+00	2.203E+00	5.601E-01
p,p'-Methoxychlor	MG/KG	1	10	8.000E-02	9.800E-04	2.970E-02	5.500E-02	4.251E-02	4.251E-02	6.989E-03
Selenium	MG/KG	26	71	1.200E+01	3.600E-01	1.279E+01	6.000E+01	1.551E+01	1.551E+01	1.633E+00
Silver	MG/KG	5	14	1.000E+00	4.800E-01	2.438E+00	8.500E+00	3.714E+00	3.714E+00	7.205E-01
Thorium 228+D	PCI/G	3	3	1.161E-01	1.622E+00	2.104E+00	2.363E+00	2.808E+00	2.363E+00	2.411E-01
Thorium 230	PCI/G	3	3	1.222E-01	1.763E+00	2.370E+00	3.155E+00	3.572E+00	3.155E+00	4.115E-01
Thorium 232	PCI/G	3	3	1.016E-01	1.246E+00	1.498E+00	1.902E+00	2.094E+00	1.902E+00	2.041E-01
Uranium 234	PCI/G	76	83	1.785E-01	3.800E-01	3.121E+00	1.201E+01	3.709E+00	3.709E+00	3.539E-01
Uranium 235+D	PCI/G	92	92	2.458E-03	1.000E-02	1.490E-01	1.150E+00	1.815E-01	1.815E-01	1.954E-02
Uranium 238+D	PCI/G	76	83	8.891E-02	2.300E-01	3.097E+00	1.565E+01	3.658E+00	3.658E+00	3.369E-01
Vanadium	MG/KG	14	14	1.000E+00	1.630E+01	2.763E+01	4.280E+01	3.122E+01	3.122E+01	2.026E+00
Zinc	MG/KG	21	71	9.600E+01	1.800E+01	3.130E+02	3.415E+03	4.656E+02	4.656E+02	9.158E+01

Table M.503. EFPC Phase IB chemical and radionuclide results: soil — Segment 4

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2-Methylnaphthalene	MG/KG	5	9	3.300E-01	4.300E-02	2.028E-01	5.500E-01	3.200E-01	3.200E-01	6.303E-02
4-Chloro-3-Methylphenol	MG/KG	1	9	3.300E-01	5.200E-02	2.686E-01	5.500E-01	3.621E-01	3.621E-01	5.030E-02
4-Nitrophenol	MG/KG	1	9	1.600E+00	3.900E-01	1.321E+00	2.750E+00	1.773E+00	1.773E+00	2.431E-01
Acenaphthene	MG/KG	1	9	3.300E-01	6.000E-02	2.694E-01	5.500E-01	3.621E-01	3.621E-01	4.983E-02
Acenaphthylene	MG/KG	2	9	3.300E-01	5.200E-02	2.500E-01	5.500E-01	3.535E-01	3.535E-01	5.568E-02
Aluminum	MG/KG	9	9	1.000E+01	1.440E+04	1.939E+04	2.790E+04	2.215E+04	2.215E+04	1.485E+03
Americium 241	PCI/G	7	8	1.935E-01	-1.800E-01	4.375E-02	3.000E-01	1.503E-01	1.503E-01	5.622E-02
Anthracene	MG/KG	7	9	3.300E-01	5.300E-02	1.544E-01	4.750E-01	2.364E-01	2.364E-01	4.408E-02
Antimony	MG/KG	86	100	4.900E-01	1.900E-01	1.145E+00	4.700E+00	1.304E+00	1.304E+00	9.584E-02
Aroclor-1254	MG/KG	3	9	1.600E-01	1.000E-01	9.217E-01	3.000E+00	1.621E+00	1.621E+00	3.759E-01
Aroclor-1260	MG/KG	7	9	1.600E-01	1.050E-01	1.501E+00	3.800E+00	2.226E+00	2.226E+00	3.897E-01
Arsenic	MG/KG	100	100	3.600E+00	2.900E+00	1.005E+01	4.050E+01	1.075E+01	1.075E+01	4.247E-01
Barium	MG/KG	9	9	5.000E-01	9.900E+01	2.277E+02	4.540E+02	2.945E+02	2.945E+02	3.595E+01
Benzo(a)anthracene	MG/KG	9	9	3.300E-01	3.000E-01	5.444E-01	9.100E-01	6.834E-01	6.834E-01	7.474E-02
Benzo(a)pyrene	MG/KG	9	9	3.300E-01	3.400E-01	5.678E-01	9.400E-01	7.020E-01	7.020E-01	7.218E-02
Benzo(b)fluoranthene	MG/KG	9	9	3.300E-01	4.900E-01	9.700E-01	1.700E+00	1.237E+00	1.237E+00	1.435E-01
Benzo(g,h,i)perylene	MG/KG	3	9	3.300E-01	1.700E-01	3.000E-01	6.400E-01	3.974E-01	3.974E-01	5.240E-02
Benzo(k)fluoranthene	MG/KG	9	9	3.300E-01	1.700E-01	9.078E-01	1.700E+00	1.222E+00	1.222E+00	1.689E-01
Beryllium	MG/KG	4	9	2.000E-01	4.350E-01	1.077E+00	2.200E+00	1.516E+00	1.516E+00	2.358E-01
bis(2-Ethylhexyl)phthalate	MG/KG	6	9	3.300E-01	7.900E-02	2.236E-01	5.500E-01	3.320E-01	3.320E-01	5.830E-02
Butylbenzylphthalate	MG/KG	1	9	3.300E-01	4.900E-02	2.654E-01	5.500E-01	3.599E-01	3.599E-01	5.082E-02
Cadmium	MG/KG	8	9	1.000E+00	6.500E-01	1.315E+01	4.130E+01	2.088E+01	2.088E+01	4.156E+00
Cesium 137+D	PCI/G	8	8	3.509E-02	4.500E-01	1.462E+00	2.700E+00	1.924E+00	1.924E+00	2.438E-01
Chromium (III)	MG/KG	104	104	1.000E+00	9.800E+00	8.240E+01	1.800E+02	8.784E+01	8.784E+01	3.283E+00
Chrysene	MG/KG	9	9	3.300E-01	3.600E-01	6.522E-01	1.200E+00	8.361E-01	8.361E-01	9.889E-02
Cobalt	MG/KG	9	9	1.000E+00	1.310E+01	1.547E+01	1.840E+01	1.653E+01	1.653E+01	5.703E-01
Cobalt 60	PCI/G	7	7	1.421E-02	-1.000E-02	1.857E-02	5.000E-02	3.677E-02	3.677E-02	9.368E-03
Copper	MG/KG	9	9	1.000E+00	2.820E+01	1.838E+02	3.970E+02	2.620E+02	2.620E+02	4.207E+01
Cyanide	MG/KG	6	9	6.000E-01	3.150E-01	3.273E+00	1.710E+01	6.700E+00	6.700E+00	1.843E+00
Di-n-Butylphthalate	MG/KG	2	9	3.300E-01	5.100E-02	2.490E-01	5.500E-01	3.500E-01	3.500E-01	5.431E-02
Fluoranthene	MG/KG	9	9	3.300E-01	6.200E-01	1.226E+00	2.300E+00	1.599E+00	1.599E+00	2.008E-01
Fluorene	MG/KG	1	9	3.300E-01	7.300E-02	2.709E-01	5.500E-01	3.622E-01	3.622E-01	4.909E-02
Indeno(1,2,3-cd)pyrene	MG/KG	5	9	3.300E-01	4.900E-02	2.777E-01	6.400E-01	3.876E-01	3.876E-01	5.911E-02
Lead	MG/KG	7	7	5.000E-01	3.410E+01	1.034E+02	1.550E+02	1.355E+02	1.355E+02	1.649E+01
Manganese	MG/KG	9	9	5.000E-01	7.010E+02	1.143E+03	1.740E+03	1.323E+03	1.323E+03	9.677E+01
Mercury	MG/KG	69	109	3.400E+00	6.000E-02	1.542E+02	1.290E+03	1.932E+02	1.932E+02	2.348E+01
Naphthalene	MG/KG	3	9	3.300E-01	5.200E-02	2.316E-01	5.500E-01	3.406E-01	3.406E-01	5.865E-02
Neptunium 237+D	PCI/G	7	7	3.774E-02	-6.000E-02	2.429E-02	7.000E-02	5.870E-02	5.870E-02	1.771E-02
Nickel	MG/KG	9	9	1.000E+01	2.410E+01	8.763E+01	1.740E+02	1.168E+02	1.168E+02	1.567E+01
Pentachlorophenol	MG/KG	1	9	1.600E+00	3.000E-01	1.311E+00	2.750E+00	1.772E+00	1.772E+00	2.480E-01
Phenanthrene	MG/KG	9	9	3.300E-01	2.200E-01	5.100E-01	8.600E-01	6.604E-01	6.604E-01	8.088E-02
Pyrene	MG/KG	9	9	3.300E-01	4.900E-01	1.010E+00	2.200E+00	1.374E+00	1.374E+00	1.959E-01
Selenium	MG/KG	13	103	1.200E+01	3.700E-01	7.394E+00	1.700E+01	7.967E+00	7.967E+00	3.448E-01
Silver	MG/KG	7	9	1.000E+00	8.500E-01	1.242E+01	2.970E+01	1.795E+01	1.795E+01	2.975E+00
Uranium 234	PCI/G	84	94	3.915E-01	2.600E-01	7.824E+00	2.857E+01	9.171E+00	9.171E+00	8.106E-01
Uranium 235+D	PCI/G	95	95	1.842E-03	2.000E-02	3.668E-01	1.348E+00	4.309E-01	4.309E-01	3.858E-02
Uranium 238+D	PCI/G	84	94	2.040E-01	1.500E-01	7.585E+00	2.764E+01	8.805E+00	8.805E+00	7.346E-01
Vanadium	MG/KG	9	9	1.000E+00	2.790E+01	3.369E+01	4.490E+01	3.721E+01	3.721E+01	1.893E+00
Zinc	MG/KG	34	104	9.600E+01	1.950E+01	1.025E+02	3.920E+02	1.157E+02	1.157E+02	7.965E+00

Table M.504. EFPC Phase IB chemical and radionuclide results: soil — Segment 5

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2-Methylnaphthalene	MG/KG	2	4	3.300E-01	4.500E-02	1.275E-01	2.150E-01	2.333E-01	2.150E-01	4.498E-02
Acenaphthylene	MG/KG	1	4	3.300E-01	9.000E-02	1.787E-01	2.150E-01	2.492E-01	2.150E-01	2.996E-02
Aluminum	MG/KG	6	6	1.000E+01	1.300E+04	1.453E+04	1.620E+04	1.562E+04	1.562E+04	5.383E+02
Americium 241	PCI/G	6	6	1.076E-01	-1.000E-01	4.667E-02	3.200E-01	1.665E-01	1.665E-01	5.948E-02
Anthracene	MG/KG	2	4	3.300E-01	1.100E-01	1.800E-01	2.150E-01	2.358E-01	2.150E-01	2.372E-02
Antimony	MG/KG	61	69	4.900E-01	1.700E-01	8.672E-01	3.950E+00	1.008E+00	1.008E+00	8.469E-02
Aroclor-1260	MG/KG	2	4	1.600E-01	9.500E-02	2.200E-01	3.700E-01	3.856E-01	3.700E-01	7.039E-02
Arsenic	MG/KG	72	72	3.600E+00	3.400E+00	8.704E+00	3.300E+01	9.417E+00	9.417E+00	4.280E-01
Barium	MG/KG	6	6	5.000E-01	7.470E+01	1.043E+02	1.300E+02	1.195E+02	1.195E+02	7.525E+00
Benzoic Acid	MG/KG	2	4	1.600E+00	4.500E-02	5.613E-01	1.050E+00	1.226E+00	1.050E+00	2.824E-01
Benzo(a)anthracene	MG/KG	4	4	3.300E-01	1.200E-01	4.575E-01	8.200E-01	8.855E-01	8.200E-01	1.819E-01
Benzo(a)pyrene	MG/KG	4	4	3.300E-01	1.400E-01	4.975E-01	9.400E-01	9.621E-01	9.400E-01	1.974E-01
Benzo(b)fluoranthene	MG/KG	4	4	3.300E-01	2.900E-01	9.800E-01	1.800E+00	1.902E+00	1.800E+00	3.917E-01
Benzo(g,h,i)perylene	MG/KG	4	4	3.300E-01	1.000E-01	4.100E-01	7.300E-01	7.994E-01	7.300E-01	1.655E-01
Benzo(k)fluoranthene	MG/KG	4	4	3.300E-01	2.900E-01	9.800E-01	1.800E+00	1.902E+00	1.300E+00	3.917E-01
bis(2-Ethylhexyl)phthalate	MG/KG	2	4	3.300E-01	1.200E-01	1.700E-01	2.150E-01	2.206E-01	2.150E-01	2.151E-02
Cadmium	MG/KG	5	6	1.000E+00	4.000E-01	4.267E+00	8.400E+00	7.014E+00	7.014E+00	1.363E+00
Cesium 137+D	PCI/G	6	6	2.279E-02	2.400E-01	7.167E-01	1.200E+00	9.878E-01	9.878E-01	1.346E-01
Chromium (III)	MG/KG	72	72	1.000E+00	1.770E+01	7.111E+01	1.280E+02	7.519E+01	7.519E+01	2.451E+00
Chrysene	MG/KG	4	4	3.300E-01	1.600E-01	5.925E-01	1.100E+00	1.172E+00	1.100E+00	2.464E-01
Cobalt	MG/KG	5	6	1.000E+00	4.300E+00	1.315E+01	1.610E+01	1.682E+01	1.610E+01	1.824E+00
Cobalt 60	PCI/G	6	6	1.027E-02	-3.000E-02	2.891E-19	2.000E-02	1.472E-02	1.472E-02	7.303E-03
Copper	MG/KG	6	6	1.000E+00	1.720E+01	8.790E+01	2.200E+02	1.474E+02	1.474E+02	2.951E+01
Cyanide	MG/KG	1	6	6.000E-01	3.000E-01	1.069E+01	6.260E+01	3.161E+01	3.161E+01	1.038E+01
Dibenzo(a,h)anthracene	MG/KG	2	4	3.300E-01	1.800E-01	1.925E-01	2.150E-01	2.120E-01	2.120E-01	8.292E-03
Di-n-Butylphthalate	MG/KG	1	4	3.300E-01	2.800E-02	8.388E-02	1.950E-01	1.736E-01	1.736E-01	3.811E-02
Fluoranthene	MG/KG	4	4	3.300E-01	2.600E-01	1.067E+00	2.100E+00	2.158E+00	2.100E+00	4.633E-01
Fluorene	MG/KG	1	4	3.300E-01	5.300E-02	1.695E-01	2.150E-01	2.616E-01	2.150E-01	3.912E-02
Indeno(1,2,3-cd)pyrene	MG/KG	4	4	3.300E-01	8.300E-02	3.582E-01	6.400E-01	7.023E-01	6.400E-01	1.462E-01
Lead	MG/KG	6	6	5.000E-01	2.620E+01	5.883E+01	7.220E+01	7.358E+01	7.220E+01	7.316E+00
Manganese	MG/KG	6	6	5.000E-01	6.020E+02	1.054E+03	1.300E+03	1.248E+03	1.248E+03	9.649E+01
Mercury	MG/KG	35	72	3.400E+00	1.300E+00	4.350E+01	3.520E+02	5.759E+01	5.759E+01	8.452E+00
Neptunium 237+D	PCI/G	6	6	2.421E-02	-7.000E-02	2.167E-02	6.000E-02	6.244E-02	6.000E-02	2.023E-02
Nickel	MG/KG	6	6	1.000E+01	1.340E+01	3.598E+01	6.210E+01	5.054E+01	5.054E+01	7.225E+00
Phenanthrene	MG/KG	4	4	3.300E-01	1.100E-01	4.200E-01	8.000E-01	8.349E-01	8.000E-01	1.763E-01
Pyrene	MG/KG	4	4	3.300E-01	2.300E-01	8.250E-01	1.500E+00	1.612E+00	1.500E+00	3.346E-01
Selenium	MG/KG	20	72	1.200E+01	3.500E-01	9.663E+00	2.500E+01	1.086E+01	1.086E+01	7.151E-01
Silver	MG/KG	4	6	1.000E+00	8.000E-01	3.867E+00	9.100E+00	6.476E+00	6.476E+00	1.295E+00
Uranium 234	PCI/G	64	70	2.800E-01	6.660E-01	4.453E+00	1.974E+01	5.292E+00	5.292E+00	5.034E-01
Uranium 235+D	PCI/G	70	70	2.068E-03	4.066E-02	2.030E-01	9.630E-01	2.419E-01	2.419E-01	2.334E-02
Uranium 238+D	PCI/G	65	71	1.468E-01	5.328E-01	4.605E+00	1.632E+01	5.334E+00	5.334E+00	4.370E-01
Vanadium	MG/KG	6	6	1.000E+00	2.110E+01	2.773E+01	3.120E+01	3.100E+01	3.100E+01	1.621E+00
Zinc	MG/KG	16	72	9.600E+01	2.600E+01	8.186E+01	3.890E+02	9.578E+01	9.578E+01	8.357E+00

Table M.505. EFPC Phase IB chemical and radionuclide results: soil – Segment 6

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
4,4'-DDD	MG/KG	1	5	1.600E-02	3.400E-04	6.358E-03	1.000E-02	1.093E-02	1.000E-02	2.145E-03
alpha-Chlordane	MG/KG	1	5	8.000E-02	1.000E-03	2.976E-02	4.950E-02	5.467E-02	4.950E-02	1.168E-02
Aluminum	MG/KG	7	7	1.000E+01	4.550E+03	1.270E+04	1.820E+04	1.614E+04	1.614E+04	1.770E+03
Americium 241	PCI/G	1	1	5.800E-01	0.000E+00	0.000E+00	0.000E+00		0.000E+00	
Antimony	MG/KG	54	61	4.900E-01	2.100E-01	9.748E-01	7.650E+00	1.265E+00	1.265E+00	1.740E-01
Aroclor-1260	MG/KG	2	5	1.600E-01	5.200E-03	9.004E-02	1.500E-01	1.401E-01	1.401E-01	2.347E-02
Arsenic	MG/KG	62	62	3.600E+00	1.700E+00	6.885E+00	1.300E+01	7.397E+00	7.397E+00	3.060E-01
Barium	MG/KG	7	7	5.000E-01	3.370E+01	6.290E+01	9.450E+01	8.029E+01	8.029E+01	8.947E+00
Benzo(a)anthracene	MG/KG	3	7	3.300E-01	4.600E-02	2.037E-01	3.000E-01	2.637E-01	2.637E-01	3.089E-02
Benzo(a)pyrene	MG/KG	3	7	3.300E-01	5.000E-02	1.829E-01	2.400E-01	2.275E-01	2.275E-01	2.299E-02
Benzo(b)fluoranthene	MG/KG	3	7	3.300E-01	7.600E-02	2.466E-01	4.300E-01	3.421E-01	3.421E-01	4.917E-02
Benzo(g,h,i)perylene	MG/KG	2	7	3.300E-01	1.950E-01	2.257E-01	3.100E-01	2.591E-01	2.591E-01	1.720E-02
Benzo(k)fluoranthene	MG/KG	3	7	3.300E-01	4.900E-02	1.683E-01	2.500E-01	2.227E-01	2.227E-01	2.801E-02
Beryllium	MG/KG	4	7	2.000E-01	1.600E-01	4.857E-01	8.100E-01	6.761E-01	6.761E-01	9.795E-02
bis(2-Ethylhexyl)phthalate	MG/KG	1	7	3.300E-01	7.500E-02	1.836E-01	2.100E-01	2.189E-01	2.100E-01	1.818E-02
Cadmium	MG/KG	2	7	1.000E+00	6.000E-01	1.557E+00	4.600E+00	2.789E+00	2.789E+00	6.339E-01
Cesium 137+D	PCI/G	5	5	6.104E-02	1.220E-02	4.992E-01	1.080E+00	9.919E-01	9.919E-01	2.311E-01
Chromium (III)	MG/KG	63	63	1.000E+00	1.140E+01	6.430E+01	1.120E+02	6.882E+01	6.882E+01	2.704E+00
Chrysene	MG/KG	3	7	3.300E-01	5.800E-02	2.040E-01	2.900E-01	2.598E-01	2.598E-01	2.870E-02
Cobalt	MG/KG	5	7	1.000E+00	2.550E+00	1.074E+01	2.710E+01	1.713E+01	1.713E+01	3.289E+00
Cobalt 60	PCI/G	5	5	3.189E-02	-3.530E-02	1.468E-02	5.660E-02	4.900E-02	4.900E-02	1.610E-02
Copper	MG/KG	6	7	1.000E+00	3.350E+00	2.502E+01	7.800E+01	4.448E+01	4.448E+01	1.001E+01
Cyanide	MG/KG	2	3	6.000E-01	3.000E-01	9.667E-01	1.500E+00	1.997E+00	1.500E+00	3.528E-01
delta-BHC	MG/KG	1	5	8.000E-03	1.200E-04	3.154E-03	4.950E-03	5.432E-03	4.950E-03	1.068E-03
Dibenzo(a,h)anthracene	MG/KG	2	7	3.300E-01	5.700E-02	1.617E-01	2.050E-01	2.099E-01	2.050E-01	2.482E-02
Endosulfan I	MG/KG	1	5	8.000E-03	1.000E-04	3.150E-03	4.950E-03	5.434E-03	4.950E-03	1.071E-03
Fluoranthene	MG/KG	3	7	3.300E-01	1.100E-01	3.114E-01	6.900E-01	4.772E-01	4.772E-01	8.532E-02
gamma-Chlordane	MG/KG	1	5	8.000E-02	8.300E-04	2.967E-02	4.950E-02	5.469E-02	4.950E-02	1.174E-02
Indeno(1,2,3-cd)pyrene	MG/KG	2	7	3.300E-01	1.950E-01	2.243E-01	3.000E-01	2.555E-01	2.555E-01	1.605E-02
Lead	MG/KG	7	7	5.000E-01	1.130E+01	2.376E+01	4.120E+01	3.227E+01	3.227E+01	4.380E+00
Manganese	MG/KG	7	7	5.000E-01	6.210E+01	7.330E+02	1.990E+03	1.226E+03	1.226E+03	2.539E+02
Mercury	MG/KG	28	63	3.400E+00	2.100E-01	1.926E+01	2.070E+02	2.714E+01	2.714E+01	4.717E+00
Neptunium 237+D	PCI/G	1	1	6.000E-02	0.000E+00	0.000E+00	0.000E+00		0.000E+00	
Nickel	MG/KG	6	7	1.000E+01	4.200E+00	1.626E+01	3.810E+01	2.535E+01	2.535E+01	4.678E+00
Phenanthrene	MG/KG	2	7	3.300E-01	1.950E-01	2.143E-01	2.700E-01	2.342E-01	2.342E-01	1.026E-02
Protactinium 233	PCI/G	4	4	9.995E-02	-7.950E-02	-8.925E-03	1.630E-02	4.646E-02	1.630E-02	2.353E-02
Pyrene	MG/KG	3	7	3.300E-01	9.300E-02	2.533E-01	5.100E-01	3.557E-01	3.557E-01	5.269E-02
Selenium	MG/KG	29	63	1.200E+01	3.550E-01	2.202E+01	5.800E+01	2.623E+01	2.623E+01	2.522E+00
Silver	MG/KG	1	7	1.000E+00	8.000E-01	1.293E+00	2.900E+00	1.832E+00	1.832E+00	2.776E-01
Thorium 228+D	PCI/G	2	2	1.550E-01	1.190E+00	2.226E+00	3.263E+00	8.771E+00	3.263E+00	1.036E+00
Thorium 230	PCI/G	1	1	4.030E-01	7.913E+00	7.913E+00	7.913E+00		7.913E+00	
Thorium 232	PCI/G	2	2	1.482E-01	6.230E-01	1.800E+00	2.978E+00	9.235E+00	2.978E+00	1.178E+00
Uranium 234	PCI/G	55	60	2.775E-01	4.600E-01	3.694E+00	1.852E+01	4.457E+00	4.457E+00	4.567E-01
Uranium 235+D	PCI/G	59	59	2.413E-03	2.000E-02	1.727E-01	8.774E-01	2.105E-01	2.105E-01	2.264E-02
Uranium 238+D	PCI/G	54	59	1.434E-01	3.600E-01	3.873E+00	1.765E+01	4.554E+00	4.554E+00	4.076E-01
Vanadium	MG/KG	7	7	1.000E+00	9.600E+00	2.320E+01	3.100E+01	2.838E+01	2.838E+01	2.664E+00
Zinc	MG/KG	36	63	9.600E+01	1.350E+01	8.024E+01	3.930E+02	9.610E+01	9.610E+01	9.494E+00

Table M.506. EFPC Phase IB chemical and radionuclide results: soil – Segment 7

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
4,4'-DDE	MG/KG	6	7	1.600E-02	1.600E-04	8.543E-04	1.950E-03	1.467E-03	1.467E-03	3.153E-04
4,4'-DDT	MG/KG	2	7	1.600E-02	3.100E-04	1.751E-03	2.150E-03	2.230E-03	2.150E-03	2.465E-04
Aldrin	MG/KG	1	7	8.000E-03	8.200E-05	9.117E-04	1.100E-03	1.183E-03	1.100E-03	1.396E-04
alpha-Chlordane	MG/KG	7	7	8.000E-02	1.100E-04	8.043E-04	2.800E-03	1.572E-03	1.572E-03	3.949E-04
Aluminum	MG/KG	8	8	1.000E+01	7.490E+03	1.012E+04	1.330E+04	1.153E+04	1.153E+04	7.488E+02
Anthracene	MG/KG	2	8	3.300E-01	5.100E-02	1.695E-01	2.150E-01	2.123E-01	2.123E-01	2.257E-02
Antimony	MG/KG	256	283	4.900E-01	9.500E-02	7.235E-01	3.600E+00	7.660E-01	7.660E-01	2.577E-02
Aroclor-1260	MG/KG	5	7	1.600E-01	1.700E-02	9.114E-02	2.700E-01	1.696E-01	1.696E-01	4.037E-02
Arsenic	MG/KG	280	291	3.600E+00	9.000E-01	7.674E+00	2.100E+01	7.928E+00	7.928E+00	1.536E-01
Barium	MG/KG	8	8	5.000E-01	4.420E+01	1.057E+02	2.080E+02	1.405E+02	1.405E+02	1.839E+01
Benzo(a)anthracene	MG/KG	4	8	3.300E-01	1.950E-01	2.638E-01	3.800E-01	3.167E-01	3.167E-01	2.796E-02
Benzo(a)pyrene	MG/KG	4	8	3.300E-01	1.950E-01	2.513E-01	3.700E-01	2.991E-01	2.991E-01	2.524E-02
Benzo(b)fluoranthene	MG/KG	6	8	3.300E-01	4.100E-02	4.061E-01	7.500E-01	6.144E-01	6.144E-01	1.099E-01
Benzo(g,h,i)perylene	MG/KG	4	8	3.300E-01	1.700E-01	2.300E-01	4.000E-01	2.819E-01	2.819E-01	2.739E-02
Benzo(k)fluoranthene	MG/KG	4	8	3.300E-01	1.950E-01	4.438E-01	7.500E-01	6.215E-01	6.215E-01	9.385E-02
Beryllium	MG/KG	8	8	2.000E-01	5.100E-01	7.475E-01	1.100E+00	8.587E-01	8.587E-01	5.867E-02
bis(2-Ethylhexyl)phthalate	MG/KG	5	8	3.300E-01	7.700E-02	1.890E-01	3.700E-01	2.503E-01	2.503E-01	3.236E-02
Cadmium	MG/KG	4	8	1.000E+00	6.000E-01	3.100E+00	9.300E+00	5.431E+00	5.431E+00	1.230E+00
Carbazole	MG/KG	2	8	3.300E-01	5.000E-02	1.659E-01	2.150E-01	2.127E-01	2.127E-01	2.471E-02
Cesium 137+D	PCI/G	7	7	6.245E-02	7.930E-02	6.880E-01	2.080E+00	1.222E+00	1.222E+00	2.745E-01
Chromium (III)	MG/KG	330	330	1.000E+00	1.240E+01	6.695E+01	1.750E+02	6.897E+01	6.897E+01	1.224E+00
Chrysene	MG/KG	4	8	3.300E-01	1.950E-01	2.550E-01	3.800E-01	3.017E-01	3.017E-01	2.464E-02
Cobalt	MG/KG	8	8	1.000E+00	7.100E+00	1.360E+01	3.710E+01	2.015E+01	2.015E+01	3.458E+00
Cobalt 60	PCI/G	7	7	3.675E-02	-1.140E-02	2.026E-02	5.510E-02	3.589E-02	3.589E-02	8.046E-03
Copper	MG/KG	8	8	1.000E+00	6.000E+00	6.859E+01	1.990E+02	1.163E+02	1.163E+02	2.520E+01
Dibenzo(a,h)anthracene	MG/KG	3	8	3.300E-01	5.300E-02	1.493E-01	2.050E-01	1.957E-01	1.957E-01	2.454E-02
Dieldrin	MG/KG	2	7	1.600E-02	2.000E-04	1.570E-03	2.150E-03	2.147E-03	2.147E-03	2.971E-04
Di-n-Butylphthalate	MG/KG	3	8	3.300E-01	6.100E-02	2.558E-01	5.100E-01	3.565E-01	3.565E-01	5.320E-02
Di-n-Octyl Phthalate	MG/KG	2	8	3.300E-01	5.200E-02	1.698E-01	2.150E-01	2.140E-01	2.140E-01	2.334E-02
Endosulfan II	MG/KG	1	7	1.600E-02	3.800E-04	1.811E-03	2.150E-03	2.280E-03	2.150E-03	2.413E-04
Endosulfan Sulfate	MG/KG	1	7	1.600E-02	7.000E-04	1.836E-03	2.150E-03	2.209E-03	2.150E-03	1.920E-04
Endrin	MG/KG	2	7	1.600E-02	1.300E-04	1.579E-03	2.150E-03	2.215E-03	2.150E-03	3.275E-04
Endrin aldehyde	MG/KG	2	7		2.700E-04	1.931E-03	3.000E-03	2.531E-03	2.531E-03	3.085E-04
Fluoranthene	MG/KG	5	8	3.300E-01	6.200E-02	4.346E-01	8.300E-01	6.353E-01	6.353E-01	1.059E-01
gamma-BHC	MG/KG	1	7	8.000E-03	4.300E-04	9.543E-04	1.100E-03	1.127E-03	1.100E-03	8.901E-05
gamma-Chlordane	MG/KG	6	7	8.000E-02	8.700E-05	3.396E-04	1.000E-03	5.611E-04	5.611E-04	1.140E-04
Heptachlor	MG/KG	4	7	8.000E-03	1.000E-04	5.557E-04	1.100E-03	9.100E-04	9.100E-04	1.823E-04
Heptachlor Epoxide	MG/KG	1	7	8.000E-03	2.400E-04	9.271E-04	1.100E-03	1.152E-03	1.100E-03	1.158E-04
Indeno(1,2,3-cd)pyrene	MG/KG	4	8	3.300E-01	1.900E-01	2.300E-01	3.700E-01	2.718E-01	2.718E-01	2.204E-02
Lead	MG/KG	8	8	5.000E-01	2.130E+01	3.500E+01	5.580E+01	4.370E+01	4.370E+01	4.594E+00
Manganese	MG/KG	8	8	5.000E-01	5.370E+02	1.253E+03	3.390E+03	1.848E+03	1.848E+03	3.140E+02
Mercury	MG/KG	84	326	3.400E+00	3.900E-01	1.269E+01	2.780E+02	1.571E+01	1.571E+01	1.830E+00
Neptunium 237+D	PCI/G	3	3	1.543E-02	1.200E-02	4.833E-02	1.100E-01	1.388E-01	1.100E-01	3.100E-02
Nickel	MG/KG	7	8	1.000E+01	3.550E+00	2.518E+01	5.980E+01	3.923E+01	3.923E+01	7.418E+00
Phenanthrene	MG/KG	4	8	3.300E-01	1.950E-01	2.475E-01	4.200E-01	3.019E-01	3.019E-01	2.871E-02
Protactinium 233	PCI/G	7	7	8.258E-02	-1.105E-01	-5.257E-03	1.270E-01	4.847E-02	4.847E-02	2.765E-02
Pyrene	MG/KG	5	8	3.300E-01	4.500E-02	3.250E-01	6.400E-01	4.584E-01	4.584E-01	7.042E-02
p,p'-Methoxychlor	MG/KG	4	7	8.000E-02	3.000E-04	5.400E-03	1.100E-02	9.066E-03	9.066E-03	1.886E-03
Selenium	MG/KG	150	331	1.200E+01	4.550E-01	1.316E+01	6.800E+01	1.443E+01	1.443E+01	7.720E-01
Silver	MG/KG	2	8	1.000E+00	1.150E+00	1.919E+00	4.400E+00	2.809E+00	2.809E+00	4.699E-01
Thorium 228+D	PCI/G	2	2	9.974E-02	1.076E+00	1.540E+00	2.004E+00	4.470E+00	2.004E+00	4.640E-01
Thorium 230	PCI/G	2	2	2.086E-01	1.774E+00	7.376E+00	1.298E+01	4.274E+01	1.298E+01	5.601E+00
Thorium 232	PCI/G	2	2	8.102E-02	3.540E-01	1.010E+00	1.666E+00	5.152E+00	1.666E+00	6.560E-01
Uranium 234	PCI/G	279	308	1.192E-01	3.538E-01	3.190E+00	1.974E+01	3.532E+00	3.532E+00	2.073E-01
Uranium 235+D	PCI/G	335	335	5.684E-04	2.568E-02	1.502E-01	9.630E-01	1.662E-01	1.662E-01	9.690E-03
Uranium 238+D	PCI/G	290	319	5.923E-02	2.831E-01	3.287E+00	2.431E+01	3.578E+00	3.578E+00	1.763E-01
Vanadium	MG/KG	8	8	1.000E+00	1.580E+01	1.887E+01	2.300E+01	2.048E+01	2.048E+01	8.476E-01
Zinc	MG/KG	116	330	9.600E+01	1.800E+01	1.374E+02	3.820E+03	1.770E+02	1.770E+02	2.400E+01

Table M.507. EFPC Phase IB chemical and radionuclide results: soil – Segment 8

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
2–Methylnaphthalene	MG/KG	1	8	3.300E–01	5.300E–02	1.948E–01	2.300E–01	2.339E–01	2.300E–01	2.064E–02
4,4'–DDE	MG/KG	2	2	1.600E–02	2.500E–04	3.050E–04	3.600E–04	6.523E–04	3.600E–04	5.500E–05
4,4'–DDT	MG/KG	1	2	1.600E–02	5.600E–04	1.280E–03	2.000E–03	5.826E–03	2.000E–03	7.200E–04
alpha–Chlordane	MG/KG	1	2	8.000E–02	6.500E–04	8.500E–04	1.050E–03	2.113E–03	1.050E–03	2.000E–04
Aluminum	MG/KG	8	8	1.000E+01	9.470E+03	1.297E+04	1.860E+04	1.508E+04	1.508E+04	1.109E+03
Antimony	MG/KG	69	77	4.900E–01	1.450E–01	6.521E–01	1.300E+00	6.995E–01	6.995E–01	2.850E–02
Aroclor–1260	MG/KG	2	2	1.600E–01	6.100E–03	1.355E–02	2.100E–02	6.059E–02	2.100E–02	7.450E–03
Arsenic	MG/KG	84	85	3.600E+00	2.000E+00	7.197E+00	1.300E+01	7.622E+00	7.622E+00	2.554E–01
Barium	MG/KG	8	8	5.000E–01	7.450E+01	1.159E+02	1.860E+02	1.408E+02	1.408E+02	1.313E+01
Benzo(a)anthracene	MG/KG	5	8	3.300E–01	4.400E–02	1.441E–01	2.300E–01	1.895E–01	1.895E–01	2.395E–02
Benzo(a)pyrene	MG/KG	4	8	3.300E–01	9.200E–02	1.637E–01	2.300E–01	2.022E–01	2.022E–01	2.028E–02
Benzo(b)fluoranthene	MG/KG	7	8	3.300E–01	7.600E–02	1.676E–01	3.100E–01	2.204E–01	2.204E–01	2.784E–02
Benzo(g,h,i)perylene	MG/KG	1	8	3.300E–01	1.000E–01	1.988E–01	2.300E–01	2.268E–01	2.268E–01	1.478E–02
Benzo(k)fluoranthene	MG/KG	7	8	3.300E–01	7.600E–02	1.789E–01	3.100E–01	2.318E–01	2.318E–01	2.794E–02
Beryllium	MG/KG	8	8	2.000E–01	6.700E–01	8.062E–01	1.000E+00	9.018E–01	9.018E–01	5.042E–02
bis(2–Ethylhexyl)phthalate	MG/KG	6	8	3.300E–01	5.500E–02	1.076E–01	2.250E–01	1.524E–01	1.524E–01	2.361E–02
Cadmium	MG/KG	6	8	1.000E+00	6.000E–01	3.288E+00	9.300E+00	5.325E+00	5.325E+00	1.076E+00
Cesium 137+D	PCI/G	7	7	1.315E–01	5.190E–02	1.357E+00	3.130E+00	2.288E+00	2.288E+00	4.792E–01
Chromium (III)	MG/KG	85	85	1.000E+00	1.710E+01	7.062E+01	1.610E+02	7.559E+01	7.559E+01	2.990E+00
Chrysene	MG/KG	5	8	3.300E–01	5.400E–02	1.526E–01	2.300E–01	1.950E–01	1.950E–01	2.234E–02
Cobalt	MG/KG	8	8	1.000E+00	9.100E+00	1.179E+01	2.000E+01	1.423E+01	1.423E+01	1.291E+00
Cobalt 60	PCI/G	7	7	2.601E–02	6.700E–03	4.164E–02	6.510E–02	5.541E–02	5.541E–02	7.084E–03
Copper	MG/KG	8	8	1.000E+00	1.030E+01	1.153E+02	3.820E+02	1.999E+02	1.999E+02	4.462E+01
Dieldrin	MG/KG	1	2	1.600E–02	4.400E–04	1.220E–03	2.000E–03	6.145E–03	2.000E–03	7.800E–04
Di–n–Butylphthalate	MG/KG	1	8	3.300E–01	5.000E–02	1.944E–01	2.300E–01	2.342E–01	2.300E–01	2.101E–02
Endrin	MG/KG	2	2	1.600E–02	2.400E–04	4.600E–04	6.800E–04	1.849E–03	6.800E–04	2.200E–04
Fluoranthene	MG/KG	7	8	3.300E–01	6.400E–02	1.793E–01	3.100E–01	2.388E–01	2.388E–01	3.144E–02
gamma–Chlordane	MG/KG	1	2	8.000E–02	3.200E–04	6.850E–04	1.050E–03	2.990E–03	1.050E–03	3.650E–04
Heptachlor	MG/KG	1	2	8.000E–03	7.500E–05	6.375E–04	1.200E–03	4.189E–03	1.200E–03	5.625E–04
Heptachlor Epoxide	MG/KG	1	2	8.000E–03	1.500E–04	6.000E–04	1.050E–03	3.441E–03	1.050E–03	4.500E–04
Indeno(1,2,3–cd)pyrene	MG/KG	3	8	3.300E–01	8.200E–02	1.784E–01	2.300E–01	2.144E–01	2.144E–01	1.900E–02
Lead	MG/KG	8	8	5.000E–01	1.410E+01	5.240E+01	1.310E+02	7.784E+01	7.784E+01	1.343E+01
Manganese	MG/KG	8	8	5.000E–01	5.030E+02	8.575E+02	1.430E+03	1.076E+03	1.076E+03	1.151E+02
Mercury	MG/KG	37	85	3.400E+00	9.500E–01	3.568E+01	4.170E+02	4.911E+01	4.911E+01	8.079E+00
Neptunium 237+D	PCI/G	4	4	2.322E–02	2.000E–03	1.225E–01	4.060E–01	3.469E–01	3.469E–01	9.533E–02
Nickel	MG/KG	8	8	1.000E+01	1.180E+01	3.349E+01	7.230E+01	4.833E+01	4.833E+01	7.837E+00
Phenanthrene	MG/KG	5	8	3.300E–01	4.500E–02	1.370E–01	2.300E–01	1.847E–01	1.847E–01	2.519E–02
Protactinium 233	PCI/G	7	7	7.697E–02	–1.110E–01	5.361E–02	3.190E–01	1.606E–01	1.606E–01	5.506E–02
Pyrene	MG/KG	7	8	3.300E–01	5.000E–02	1.373E–01	2.300E–01	1.824E–01	1.824E–01	2.385E–02
Selenium	MG/KG	9	85	1.200E+01	4.150E–01	6.440E+00	1.700E+01	6.939E+00	6.939E+00	2.997E–01
Silver	MG/KG	4	8	1.000E+00	1.200E+00	4.313E+00	1.230E+01	6.957E+00	6.957E+00	1.396E+00
Thorium 228+D	PCI/G	3	3	8.178E–02	1.136E+00	1.742E+00	2.301E+00	2.726E+00	2.301E+00	3.371E–01
Thorium 232	PCI/G	3	3	6.138E–02	6.150E–01	1.089E+00	1.609E+00	1.929E+00	1.609E+00	2.879E–01
Uranium 234	PCI/G	66	74	3.106E–01	3.538E–01	5.514E+00	2.543E+01	6.768E+00	6.768E+00	7.526E–01
Uranium 235+D	PCI/G	81	81	2.276E–03	4.280E–02	2.378E–01	1.241E+00	2.917E–01	2.917E–01	3.236E–02
Uranium 238+D	PCI/G	66	74	1.583E–01	2.831E–01	5.078E+00	2.098E+01	6.054E+00	6.054E+00	5.855E–01
Vanadium	MG/KG	8	8	1.000E+00	1.710E+01	2.260E+01	3.480E+01	2.662E+01	2.662E+01	2.121E+00
Zinc	MG/KG	16	85	9.600E+01	2.250E+01	1.244E+02	4.160E+03	2.051E+02	2.051E+02	4.849E+01

Table M.508. EFPC Phase IB chemical and radionuclide results: soil – Segment 9

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
4,4'-DDD	MG/KG	1	13	1.600E-02	1.400E-04	2.018E-03	2.450E-03	2.303E-03	2.303E-03	1.598E-04
4,4'-DDE	MG/KG	5	13	1.600E-02	4.700E-04	1.686E-03	2.300E-03	2.012E-03	2.012E-03	1.831E-04
alpha-Chlordane	MG/KG	7	13	8.000E-02	3.700E-04	1.336E-03	4.600E-03	1.861E-03	1.861E-03	2.944E-04
Aluminum	MG/KG	18	18	1.000E+01	6.880E+03	1.105E+04	2.330E+04	1.268E+04	1.268E+04	9.342E+02
Antimony	MG/KG	524	651	4.900E-01	6.500E-02	6.672E-01	7.900E+00	7.102E-01	7.102E-01	2.612E-02
Aroclor-1254	MG/KG	1	13	1.600E-01	2.050E-02	2.273E-02	3.400E-02	2.450E-02	2.450E-02	9.929E-04
Aroclor-1260	MG/KG	12	13	1.600E-01	1.600E-02	8.804E-02	2.600E-01	1.279E-01	1.279E-01	2.235E-02
Arsenic	MG/KG	299	320	3.600E+00	1.200E+00	6.693E+00	1.600E+01	6.923E+00	6.923E+00	1.395E-01
Barium	MG/KG	18	18	5.000E-01	7.660E+01	1.007E+02	1.330E+02	1.059E+02	1.059E+02	3.024E+00
Benzo(a)anthracene	MG/KG	9	18	3.300E-01	4.900E-02	1.423E-01	2.200E-01	1.718E-01	1.718E-01	1.692E-02
Benzo(a)pyrene	MG/KG	8	18	3.300E-01	5.300E-02	1.497E-01	2.200E-01	1.795E-01	1.795E-01	1.713E-02
Benzo(b)fluoranthene	MG/KG	14	18	3.300E-01	5.400E-02	1.443E-01	2.200E-01	1.684E-01	1.684E-01	1.384E-02
Benzo(g,h,i)perylene	MG/KG	2	18	3.300E-01	6.100E-02	2.023E-01	2.450E-01	2.212E-01	2.212E-01	1.086E-02
Benzo(k)fluoranthene	MG/KG	11	18	3.300E-01	5.200E-02	1.601E-01	2.200E-01	1.846E-01	1.846E-01	1.411E-02
Beryllium	MG/KG	17	18	2.000E-01	2.500E-01	7.250E-01	1.100E+00	7.907E-01	7.907E-01	3.778E-02
bis(2-Ethylhexyl)phthalate	MG/KG	6	18	3.300E-01	4.500E-02	1.686E-01	2.450E-01	1.982E-01	1.982E-01	1.698E-02
Butylbenzylphthalate	MG/KG	1	18	3.300E-01	2.000E-02	1.990E-01	2.450E-01	2.228E-01	2.228E-01	1.368E-02
Cadmium	MG/KG	14	18	1.000E+00	6.000E-01	2.086E+00	3.700E+00	2.492E+00	2.492E+00	2.330E-01
Cesium 137+D	PCI/G	17	17	7.050E-02	1.690E-01	9.885E-01	2.250E+00	1.234E+00	1.234E+00	1.406E-01
Chromium (III)	MG/KG	690	690	1.000E+00	6.900E+00	5.974E+01	1.820E+02	6.085E+01	6.085E+01	6.736E-01
Chrysene	MG/KG	9	18	3.300E-01	4.400E-02	1.456E-01	2.200E-01	1.743E-01	1.743E-01	1.655E-02
Cobalt	MG/KG	18	18	1.000E+00	8.800E+00	1.095E+01	1.430E+01	1.146E+01	1.146E+01	2.946E-01
Cobalt 60	PCI/G	17	17	2.171E-02	-7.810E-02	5.665E-02	1.270E-01	7.833E-02	7.833E-02	1.242E-02
Copper	MG/KG	18	18	1.000E+00	7.400E+00	4.196E+01	6.350E+01	4.773E+01	4.773E+01	3.317E+00
delta-BHC	MG/KG	2	13	8.000E-03	6.100E-05	9.632E-04	1.250E-03	1.158E-03	1.158E-03	1.093E-04
Dieldrin	MG/KG	2	13	1.600E-02	1.500E-04	1.919E-03	2.300E-03	2.222E-03	2.222E-03	1.697E-04
Di-n-Butylphthalate	MG/KG	2	18	3.300E-01	9.800E-02	2.107E-01	2.450E-01	2.238E-01	2.238E-01	7.510E-03
Endrin	MG/KG	1	13	1.600E-02	2.050E-03	2.427E-03	5.400E-03	2.872E-03	2.872E-03	2.498E-04
Fluoranthene	MG/KG	15	18	3.300E-01	6.000E-02	1.378E-01	2.200E-01	1.620E-01	1.620E-01	1.387E-02
gamma-Chlordane	MG/KG	5	13	8.000E-02	2.600E-04	1.289E-03	4.200E-03	1.790E-03	1.790E-03	2.809E-04
Heptachlor	MG/KG	5	13	8.000E-03	8.100E-05	7.147E-04	1.150E-03	9.579E-04	9.579E-04	1.364E-04
Heptachlor Epoxide	MG/KG	1	13	8.000E-03	2.000E-04	1.038E-03	1.200E-03	1.165E-03	1.165E-03	7.120E-05
Indeno(1,2,3-cd)pyrene	MG/KG	2	18	3.300E-01	7.900E-02	2.034E-01	2.450E-01	2.215E-01	2.215E-01	1.041E-02
Lead	MG/KG	18	18	5.000E-01	2.120E+01	3.544E+01	6.680E+01	4.025E+01	4.025E+01	2.768E+00
Manganese	MG/KG	18	18	5.000E-01	6.740E+02	9.406E+02	1.180E+03	9.953E+02	9.953E+02	3.146E+01
Mercury	MG/KG	143	697	3.400E+00	4.000E-01	1.069E+01	2.160E+02	1.225E+01	1.225E+01	9.481E-01
Neptunium 237+D	PCI/G	7	7	4.701E-02	3.000E-03	1.041E-01	5.700E-01	2.556E-01	2.556E-01	7.795E-02
Nickel	MG/KG	18	18	1.000E+01	1.070E+01	2.457E+01	3.250E+01	2.685E+01	2.685E+01	1.312E+00
Phenanthrene	MG/KG	7	18	3.300E-01	4.900E-02	1.560E-01	2.450E-01	1.875E-01	1.875E-01	1.813E-02
Protactinium 233	PCI/G	15	15	5.546E-02	-1.290E-01	9.307E-03	2.920E-01	6.165E-02	6.165E-02	2.972E-02
Pyrene	MG/KG	15	18	3.300E-01	5.500E-02	1.202E-01	2.200E-01	1.451E-01	1.451E-01	1.436E-02
Selenium	MG/KG	100	699	1.200E+01	4.450E-01	7.075E+00	6.600E+01	7.498E+00	7.498E+00	2.568E-01
Silver	MG/KG	3	18	1.000E+00	1.150E+00	1.594E+00	3.200E+00	1.860E+00	1.860E+00	1.524E-01
Thorium 228+D	PCI/G	8	8	5.783E-02	7.280E-01	1.592E+00	2.352E+00	1.914E+00	1.914E+00	1.701E-01
Thorium 230	PCI/G	6	6	8.859E-02	1.278E+00	2.716E+00	3.811E+00	3.496E+00	3.496E+00	3.869E-01
Thorium 232	PCI/G	8	8	4.567E-02	6.640E-01	1.014E+00	1.681E+00	1.269E+00	1.269E+00	1.348E-01
Uranium 234	PCI/G	514	682	9.119E-02	3.954E-01	2.882E+00	2.130E+01	3.094E+00	3.094E+00	1.286E-01
Uranium 235+D	PCI/G	722	722	4.023E-04	3.424E-02	1.345E-01	1.027E+00	1.441E-01	1.441E-01	5.855E-03
Uranium 238+D	PCI/G	521	689	5.388E-02	3.164E-01	3.107E+00	2.031E+01	3.297E+00	3.297E+00	1.155E-01
Vanadium	MG/KG	18	18	1.000E+00	1.370E+01	1.831E+01	3.260E+01	2.019E+01	2.019E+01	1.083E+00
Zinc	MG/KG	112	676	9.600E+01	7.000E+00	5.664E+01	3.210E+02	5.890E+01	5.890E+01	1.373E+00

Table M.509. EFPC Phase IB chemical and radionuclide results: soil — background

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Aluminum	MG/KG	12	12	1.000E+01	7.950E+03	1.241E+04	1.990E+04	1.422E+04	1.422E+04	1.006E+03
Americium 241	PCI/G	12	12	8.010E−02	−1.200E−01	8.333E−04	2.500E−01	5.428E−02	5.428E−02	2.976E−02
Arsenic	MG/KG	12	12	3.600E+00	1.500E+00	2.542E+00	3.900E+00	2.911E+00	2.911E+00	2.054E−01
Barium	MG/KG	12	12	5.000E−01	6.920E+01	1.122E+02	1.650E+02	1.309E+02	1.309E+02	1.040E+01
Benzoic Acid	MG/KG	2	11	1.600E+00	2.400E−02	8.625E−01	1.800E+00	1.140E+00	1.140E+00	1.533E−01
Beryllium	MG/KG	12	12	2.000E−01	4.000E−01	6.750E−01	9.500E−01	7.651E−01	7.651E−01	5.014E−02
Bis(2−ethylhexyl)phthalate	MG/KG	2	11	3.300E−01	1.950E−01	2.473E−01	5.300E−01	3.025E−01	3.025E−01	3.048E−02
Cesium 137+D	PCI/G	12	12	2.482E−02	6.000E−02	3.058E−01	1.060E+00	4.500E−01	4.500E−01	8.025E−02
Chromium (III)	MG/KG	12	12	1.000E+00	1.290E+01	2.018E+01	2.980E+01	2.289E+01	2.289E+01	1.505E+00
Cobalt	MG/KG	12	12	1.000E+00	3.600E+00	9.208E+00	1.300E+01	1.070E+01	1.070E+01	8.303E−01
Cobalt 60	PCI/G	12	12	8.660E−03	−3.000E−02	−3.333E−03	3.000E−02	7.113E−03	7.113E−03	5.817E−03
Copper	MG/KG	12	12	1.000E+00	4.300E+00	8.650E+00	1.240E+01	9.911E+00	9.911E+00	7.019E−01
Lead	MG/KG	12	12	5.000E−01	9.200E+00	1.264E+01	1.820E+01	1.409E+01	1.409E+01	8.081E−01
Manganese	MG/KG	12	12	5.000E−01	1.380E+02	5.092E+02	1.170E+03	6.583E+02	6.583E+02	8.299E+01
Mercury	MG/KG	1	12	3.400E+00	5.000E−02	6.458E−02	1.300E−01	7.555E−02	7.555E−02	6.107E−03
Neptunium 237+D	PCI/G	12	12	2.028E−02	−7.000E−02	8.333E−04	1.000E−01	2.489E−02	2.489E−02	1.340E−02
Nickel	MG/KG	12	12	1.000E+01	7.200E+00	1.394E+01	2.050E+01	1.615E+01	1.615E+01	1.230E+00
Uranium 234	PCI/G	9	9	9.162E−03	2.300E−01	2.644E−01	3.100E−01	2.820E−01	2.820E−01	9.444E−03
Uranium 235+D	PCI/G	9	9	2.940E−03	0.000E+00	1.444E−02	4.000E−02	2.145E−02	2.145E−02	3.768E−03
Uranium 238+D	PCI/G	9	9	8.315E−03	1.800E−01	2.144E−01	2.700E−01	2.333E−01	2.333E−01	1.015E−02
Vanadium	MG/KG	12	12	1.000E+00	1.320E+01	1.947E+01	2.550E+01	2.159E+01	2.159E+01	1.177E+00
Zinc	MG/KG	11	12	9.600E+01	1.675E+01	3.333E+01	4.600E+01	3.841E+01	3.841E+01	2.830E+00

Table M.510. EFPC Phase IB chemical and radionuclide results: sediment

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
4,4'-DDD	MG/KG	7	34	1.600E-02	1.800E-04	7.834E-03	1.100E-01	1.365E-02	1.365E-02	3.437E-03
4,4'-DDE	MG/KG	2	34	1.600E-02	1.600E-04	7.963E-03	1.100E-01	1.376E-02	1.376E-02	3.428E-03
4,4'-DDT	MG/KG	7	34	1.600E-02	1.800E-04	7.823E-03	1.100E-01	1.364E-02	1.364E-02	3.438E-03
Acenaphthene	MG/KG	1	33	3.300E-01	7.900E-02	2.200E-01	4.500E-01	2.346E-01	2.346E-01	8.610E-03
Acenaphthylene	MG/KG	1	33	3.300E-01	1.600E-01	2.158E-01	2.400E-01	2.206E-01	2.206E-01	2.855E-03
Aldrin	MG/KG	14	34	8.000E-03	7.100E-05	3.707E-03	5.500E-02	6.644E-03	6.644E-03	1.736E-03
alpha-BHC	MG/KG	2	34	8.000E-03	1.000E-04	4.008E-03	5.500E-02	6.916E-03	6.916E-03	1.718E-03
alpha-Chlordane	MG/KG	22	34	8.000E-02	8.100E-05	3.244E-02	5.500E-01	6.220E-02	6.220E-02	1.759E-02
Aluminum	MG/KG	35	35	1.000E+01	3.800E+03	8.033E+03	1.720E+04	8.956E+03	8.956E+03	5.459E+02
Americium 241	PCI/G	8	8	8.930E-02	-1.800E-01	-8.750E-02	4.000E-02	-3.639E-02	-3.639E-02	2.698E-02
Anthracene	MG/KG	7	33	3.300E-01	6.500E-02	2.158E-01	8.500E-01	2.525E-01	2.525E-01	2.167E-02
Aroclor-1254	MG/KG	10	34	1.600E-01	7.100E-03	1.031E-01	1.100E+00	1.635E-01	1.635E-01	3.570E-02
Aroclor-1260	MG/KG	2	34	1.600E-01	1.700E-02	8.081E-02	1.100E+00	1.387E-01	1.387E-01	3.421E-02
Arsenic	MG/KG	35	35	4.000E+00	1.600E+00	4.554E+00	1.350E+01	5.268E+00	5.268E+00	4.224E-01
Barium	MG/KG	35	35	5.000E-01	3.780E+01	7.813E+01	2.030E+02	8.846E+01	8.846E+01	6.110E+00
Benzoic Acid	MG/KG	1	6	1.600E+00	5.000E-02	9.217E-01	2.200E+00	1.558E+00	1.558E+00	3.156E-01
Benzo(a)anthracene	MG/KG	14	33	3.300E-01	4.900E-02	3.252E-01	3.900E+00	5.171E-01	5.171E-01	1.133E-01
Benzo(a)pyrene	MG/KG	11	33	3.300E-01	8.100E-02	3.152E-01	3.500E+00	4.851E-01	4.851E-01	1.003E-01
Benzo(b)fluoranthene	MG/KG	15	33	3.300E-01	4.400E-02	3.749E-01	4.100E+00	5.806E-01	5.806E-01	1.214E-01
Benzo(g,h,i)perylene	MG/KG	6	33	3.300E-01	9.100E-02	2.711E-01	2.000E+00	3.644E-01	3.644E-01	5.506E-02
Benzo(k)fluoranthene	MG/KG	12	33	3.300E-01	6.900E-02	3.070E-01	1.600E+00	3.959E-01	3.959E-01	5.248E-02
Beryllium	MG/KG	29	35	2.000E-01	4.700E-01	9.153E-01	2.700E+00	1.025E+00	1.025E+00	6.512E-02
beta-BHC	MG/KG	4	34	8.000E-03	2.000E-04	4.012E-03	5.500E-02	6.920E-03	6.920E-03	1.718E-03
bis(2-Ethylhexyl)phthalate	MG/KG	15	33	3.300E-01	4.200E-02	2.026E-01	1.200E+00	2.607E-01	2.607E-01	3.429E-02
Butylbenzylphthalate	MG/KG	1	33	3.300E-01	1.950E-01	2.250E-01	4.500E-01	2.375E-01	2.375E-01	7.395E-03
Cadmium	MG/KG	15	35	1.000E+00	5.500E-01	1.418E+00	4.100E+00	1.712E+00	1.712E+00	1.737E-01
Carbazole	MG/KG	3	27	3.300E-01	5.700E-02	1.998E-01	2.400E-01	2.164E-01	2.164E-01	9.734E-03
Cesium 137+D	PCI/G	34	34	1.688E-02	9.580E-02	5.009E-01	1.270E+00	5.936E-01	5.936E-01	5.477E-02
Chromium (III)	MG/KG	35	35	1.000E+00	1.560E+01	4.774E+01	1.190E+02	5.504E+01	5.504E+01	4.317E+00
Chrysene	MG/KG	15	33	3.300E-01	4.800E-02	3.092E-01	3.700E+00	4.912E-01	4.912E-01	1.074E-01
Cobalt	MG/KG	35	35	1.000E+00	7.800E+00	1.300E+01	2.870E+01	1.433E+01	1.433E+01	7.828E-01
Cobalt 60	PCI/G	34	34	1.232E-02	-6.240E-02	2.415E-02	1.600E-01	3.947E-02	3.947E-02	9.051E-03
Copper	MG/KG	35	35	1.000E+00	6.700E+00	2.399E+01	8.130E+01	2.987E+01	2.987E+01	3.476E+00
delta-BHC	MG/KG	2	34	8.000E-03	5.100E-04	4.093E-03	5.500E-02	6.994E-03	6.994E-03	1.714E-03
Dibenzo(a,h)anthracene	MG/KG	3	33	3.300E-01	4.800E-02	2.195E-01	5.800E-01	2.414E-01	2.414E-01	1.294E-02
Dieldrin	MG/KG	8	34	1.600E-02	1.700E-04	7.677E-03	1.100E-01	1.351E-02	1.351E-02	3.445E-03
Diethyl phthalate	MG/KG	1	33	3.300E-01	6.000E-02	2.155E-01	4.500E-01	2.321E-01	2.321E-01	9.805E-03
Di-n-Butylphthalate	MG/KG	3	33	3.300E-01	7.100E-02	2.408E-01	9.700E-01	2.826E-01	2.826E-01	2.467E-02
Di-n-Octyl Phthalate	MG/KG	1	33	3.300E-01	1.950E-01	2.256E-01	4.500E-01	2.382E-01	2.382E-01	7.433E-03
Endosulfan I	MG/KG	1	34	8.000E-03	1.000E-03	4.063E-03	5.500E-02	6.966E-03	6.966E-03	1.715E-03
Endosulfan II	MG/KG	3	34	1.600E-02	3.600E-04	7.941E-03	1.100E-01	1.374E-02	1.374E-02	3.429E-03
Endosulfan Sulfate	MG/KG	6	34	1.600E-02	1.400E-04	7.721E-03	1.100E-01	1.355E-02	1.355E-02	3.442E-03
Endrin	MG/KG	11	34	1.600E-02	2.700E-04	7.543E-03	1.100E-01	1.338E-02	1.338E-02	3.452E-03
Endrin aldehyde	MG/KG	12	27	3.300E-03	2.600E-04	1.820E-03	5.100E-03	2.177E-03	2.177E-03	2.088E-04
Endrin aldehyde	MG/KG	12	27	0.000E+00	2.600E-04	1.820E-03	5.100E-03	2.177E-03	2.177E-03	2.088E-04
Fluoranthene	MG/KG	18	33	3.300E-01	4.600E-02	4.987E-01	7.100E+00	8.584E-01	8.584E-01	2.123E-01
Fluorene	MG/KG	3	33	3.300E-01	5.600E-02	2.067E-01	2.400E-01	2.178E-01	2.178E-01	6.530E-03
gamma-BHC	MG/KG	3	34	8.000E-03	1.800E-04	4.009E-03	5.500E-02	6.917E-03	6.917E-03	1.718E-03
gamma-Chlordane	MG/KG	23	34	8.000E-02	2.400E-04	3.270E-02	5.500E-01	6.244E-02	6.244E-02	1.757E-02
Heptachlor	MG/KG	11	34	8.000E-03	7.300E-05	3.751E-03	5.500E-02	6.684E-03	6.684E-03	1.733E-03
Heptachlor Epoxide	MG/KG	1	34	8.000E-03	8.000E-05	4.039E-03	5.500E-02	6.944E-03	6.944E-03	1.717E-03
Indeno(1,2,3-cd)pyrene	MG/KG	7	33	3.300E-01	5.800E-02	2.755E-01	2.200E+00	3.790E-01	3.790E-01	6.110E-02
Lead	MG/KG	35	35	5.000E-01	1.030E+01	5.296E+01	9.840E+02	9.948E+01	9.948E+01	2.751E+01
Manganese	MG/KG	35	35	5.000E-01	2.420E+02	8.864E+02	2.620E+03	1.036E+03	1.036E+03	8.830E+01
Mercury	MG/KG	35	35	1.000E-01	8.800E-01	1.495E+01	9.560E+01	2.045E+01	2.045E+01	3.252E+00
Neptunium 237+D	PCI/G	19	19	2.233E-02	-7.000E-02	1.903E-01	1.819E+00	3.979E-01	3.979E-01	1.197E-01
Nickel	MG/KG	35	35	1.000E+01	8.200E+00	2.314E+01	7.290E+01	2.771E+01	2.771E+01	2.705E+00
Phenanthrene	MG/KG	11	33	3.300E-01	5.000E-02	2.957E-01	1.700E+00	3.832E-01	3.832E-01	5.163E-02
Protactinium 233	PCI/G	26	26	3.203E-02	-1.210E-01	5.236E-02	7.420E-01	1.055E-01	1.055E-01	3.110E-02
Pyrene	MG/KG	17	33	3.300E-01	4.800E-02	4.727E-01	7.600E+00	8.542E-01	8.542E-01	2.252E-01
Selenium	MG/KG	2	33	1.000E+00	3.650E-01	5.592E-01	1.500E+00	6.204E-01	6.204E-01	3.613E-02
Thorium 228+D	PCI/G	2	2	8.645E-02	5.530E-01	8.635E-01	1.174E+00	2.824E+00	1.174E+00	3.105E-01
Thorium 230	PCI/G	1	1	1.010E-01	7.870E-01	7.870E-01	7.870E-01		7.870E-01	
Thorium 232	PCI/G	2	2	7.040E-02	5.430E-01	6.385E-01	7.340E-01	1.241E+00	7.340E-01	9.550E-02
Uranium 234	PCI/G	18	18	5.796E-02	1.620E+00	4.321E+00	9.110E+00	5.101E+00	5.101E+00	4.487E-01
Uranium 235+D	PCI/G	16	16	1.558E-02	8.000E-02	2.464E-01	6.220E-01	3.101E-01	3.101E-01	3.637E-02
Uranium 238+D	PCI/G	18	18	5.083E-02	1.540E-01	3.289E+00	6.440E+00	3.932E+00	3.932E+00	3.693E-01
Vanadium	MG/KG	35	35	1.000E+00	1.440E+01	2.904E+01	9.270E+01	3.374E+01	3.374E+01	2.779E+00
Zinc	MG/KG	35	35	1.000E+00	3.510E+01	9.707E+01	3.470E+02	1.208E+02	1.208E+02	1.402E+01

Table M.511. EFPC Phase IB chemical and radionuclide results: sediment — background

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Aluminum	MG/KG	2	2	1.000E+01	1.300E+04	1.370E+04	1.440E+04	1.812E+04	1.440E+04	7.000E+02
Americium 241	PCI/G	2	2	1.733E−01	−4.000E−02	−2.500E−02	−1.000E−02	6.971E−02	−1.000E−02	1.500E−02
Arsenic	MG/KG	2	2	4.000E+00	2.900E+00	4.250E+00	5.600E+00	1.277E+01	5.600E+00	1.350E+00
Barium	MG/KG	2	2	5.000E−01	1.490E+02	1.665E+02	1.840E+02	2.770E+02	1.840E+02	1.750E+01
Cesium 137+D	PCI/G	2	2	2.500E−02	2.000E−02	3.500E−02	5.000E−02	1.297E−01	5.000E−02	1.500E−02
Chromium (III)	MG/KG	2	2	1.000E+00	2.810E+01	2.875E+01	2.940E+01	3.285E+01	2.940E+01	6.500E−01
Cobalt	MG/KG	2	2	1.000E+00	1.140E+01	1.235E+01	1.330E+01	1.835E+01	1.330E+01	9.500E−01
Cobalt 60	PCI/G	2	2	2.121E−02	−1.000E−02	−1.000E−02	−1.000E−02	−1.000E−02	−1.000E−02	0.000E+00
Copper	MG/KG	2	2	1.000E+00	1.190E+01	1.420E+01	1.650E+01	2.872E+01	1.650E+01	2.300E+00
Lead	MG/KG	2	2	5.000E−01	4.900E+00	6.150E+00	7.400E+00	1.404E+01	7.400E+00	1.250E+00
Manganese	MG/KG	2	2	5.000E−01	5.410E+02	6.310E+02	7.210E+02	1.199E+03	7.210E+02	9.000E+01
Neptunium 237+D	PCI/G	2	2	4.243E−02	−3.000E−02	1.000E−02	5.000E−02	2.626E−01	5.000E−02	4.000E−02
Nickel	MG/KG	2	2	1.000E+01	2.270E+01	2.335E+01	2.400E+01	2.745E+01	2.400E+01	6.500E−01
Uranium 234	PCI/G	2	2	1.414E−02	2.200E−01	2.300E−01	2.400E−01	2.931E−01	2.400E−01	1.000E−02
Uranium 235+D	PCI/G	2	2	0.000E+00	1.000E−02	1.000E−02	1.000E−02	1.000E−02	1.000E−02	0.000E+00
Uranium 238+D	PCI/G	2	2	1.414E−02	1.600E−01	1.700E−01	1.800E−01	2.331E−01	1.800E−01	1.000E−02
Vanadium	MG/KG	2	2	1.000E+00	2.630E+01	2.845E+01	3.060E+01	4.202E+01	3.060E+01	2.150E+00
Zinc	MG/KG	2	2	1.000E+00	5.450E+01	5.480E+01	5.510E+01	5.669E+01	5.510E+01	3.000E−01

Table M.512. EFPC Phase IB chemical and radionuclide results: disturbed water

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Aluminum	UG/L	4	4	3.500E+01	1.390E+03	5.687E+03	9.120E+03	1.028E+04	9.120E+03	1.950E+03
Barium	UG/L	4	4	1.000E+00	5.180E+01	7.917E+01	1.050E+02	1.082E+02	1.050E+02	1.233E+01
bis(2-Ethylhexyl)phthalate	UG/L	3	4	1.000E+01	5.000E+00	9.500E+00	1.400E+01	1.385E+01	1.385E+01	1.848E+00
Chromium (III)	UG/L	3	4	5.000E+00	2.500E+00	7.800E+00	1.320E+01	1.327E+01	1.320E+01	2.325E+00
Cobalt	UG/L	2	4	6.000E+00	3.000E+00	5.475E+00	8.600E+00	8.895E+00	8.600E+00	1.453E+00
Copper	UG/L	4	4	4.000E+00	1.340E+01	1.850E+01	2.190E+01	2.282E+01	2.190E+01	1.836E+00
Dieldrin	UG/L	1	4	1.000E-01	4.900E-03	3.873E-02	5.000E-02	6.526E-02	5.000E-02	1.127E-02
Endrin	UG/L	1	4	1.000E-01	4.700E-03	3.868E-02	5.000E-02	6.533E-02	5.000E-02	1.133E-02
Fluoranthene	UG/L	1	4	1.000E+01	1.000E+00	4.000E+00	5.000E+00	6.353E+00	5.000E+00	1.000E+00
Manganese	UG/L	4	4	1.000E+00	1.690E+02	2.687E+02	4.470E+02	4.129E+02	4.129E+02	6.125E+01
Mercury	UG/L	4	4	2.000E-01	1.600E+00	2.675E+00	4.100E+00	3.933E+00	3.933E+00	5.344E-01
Vanadium	UG/L	2	4	5.000E+00	3.000E+00	8.400E+00	1.410E+01	1.574E+01	1.410E+01	3.120E+00
Zinc	UG/L	4	4	3.000E+00	5.440E+01	6.872E+01	9.600E+01	9.089E+01	9.089E+01	9.417E+00

Table M.513. EFPC Phase IB chemical and radionuclide results: disturbed water – background

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Aluminum	UG/L	1	1	3.500E+01	4.690E+03	4.690E+03	4.690E+03 .		4.690E+03 .	
Arsenic	UG/L	1	1	3.000E+00	5.200E+00	5.200E+00	5.200E+00 .		5.200E+00 .	
Barium	UG/L	1	1	1.000E+00	1.210E+02	1.210E+02	1.210E+02 .		1.210E+02 .	
bis(2-Ethylhexyl)phthalate	UG/L	1	1	1.000E+01	1.000E+01	1.000E+01	1.000E+01 .		1.000E+01 .	
Chromium (III)	UG/L	1	1	5.000E+00	7.100E+00	7.100E+00	7.100E+00 .		7.100E+00 .	
Cobalt	UG/L	1	1	6.000E+00	8.600E+00	8.600E+00	8.600E+00 .		8.600E+00 .	
Copper	UG/L	1	1	4.000E+00	1.340E+01	1.340E+01	1.340E+01 .		1.340E+01 .	
Manganese	UG/L	1	1	1.000E+00	6.430E+02	6.430E+02	6.430E+02 .		6.430E+02 .	
Vanadium	UG/L	1	1	5.000E+00	7.200E+00	7.200E+00	7.200E+00 .		7.200E+00 .	
Zinc	UG/L	1	1	3.000E+00	3.110E+01	3.110E+01	3.110E+01 .		3.110E+01 .	

Table M.514. EFPC Phase IB chemical and radionuclide results: baseflow

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
1,1,1-Trichloroethane	UG/L	1	14	5.000E+00	2.500E+00	4.321E+00	5.000E+00	4.851E+00	4.851E+00	2.993E-01
4,4'-DDD	UG/L	2	12	1.000E-01	2.700E-03	4.217E-02	5.000E-02	5.165E-02	5.000E-02	5.276E-03
4,4'-DDT	UG/L	3	12	1.000E-01	9.300E-03	4.019E-02	5.000E-02	4.940E-02	4.940E-02	5.128E-03
Acetone	UG/L	3	14	1.000E+01	5.000E+00	6.214E+00	1.500E+01	7.702E+00	7.702E+00	8.398E-01
Aldrin	UG/L	1	12	5.000E-02	3.800E-03	2.323E-02	2.500E-02	2.641E-02	2.500E-02	1.767E-03
Aluminum	UG/L	3	15	3.500E+01	2.590E+01	1.661E+02	6.870E+02	2.488E+02	2.488E+02	4.694E+01
Americium 241	PCI/L	15	15	2.976E+01	-5.860E+01	-8.081E+00	5.515E+01	5.115E+00	5.115E+00	7.492E+00
Barium	UG/L	15	15	1.000E+00	3.020E+01	4.181E+01	6.000E+01	4.600E+01	4.600E+01	2.376E+00
Bis(2-ethylhexyl)phthalate	UG/L	1	14	1.000E+01	1.000E+00	4.821E+00	6.500E+00	5.375E+00	5.375E+00	3.128E-01
Cesium 137+D	PCI/L	15	15	1.145E+01	-2.366E+01	3.523E+00	3.312E+01	1.122E+01	1.122E+01	4.367E+00
Chloroform	UG/L	1	14	5.000E+00	2.000E+00	4.071E+00	5.000E+00	4.686E+00	4.686E+00	3.471E-01
Cobalt 60	PCI/L	15	15	8.027E+00	-1.502E+01	-1.333E-01	2.703E+01	5.620E+00	5.620E+00	3.267E+00
Dieldrin	UG/L	4	12	1.000E-01	5.000E-03	3.621E-02	5.000E-02	4.690E-02	4.690E-02	5.956E-03
Diethylphthalate	UG/L	3	14	1.000E+01	1.000E+00	4.214E+00	5.000E+00	4.961E+00	4.961E+00	4.216E-01
Endosulfan I	UG/L	1	12	5.000E-02	2.000E-03	2.308E-02	2.500E-02	2.653E-02	2.500E-02	1.917E-03
Endosulfan II	UG/L	1	12	1.000E-01	3.300E-03	4.611E-02	5.000E-02	5.310E-02	5.000E-02	3.892E-03
Endosulfan Sulfate	UG/L	5	12	1.000E-01	8.500E-03	3.479E-02	5.000E-02	4.461E-02	4.461E-02	5.466E-03
Endrin	UG/L	1	12	1.000E-01	8.500E-03	4.654E-02	5.000E-02	5.275E-02	5.000E-02	3.458E-03
gamma-BHC	UG/L	4	12	5.000E-02	1.700E-03	1.818E-02	2.500E-02	2.343E-02	2.343E-02	2.926E-03
Heptachlor epoxide	UG/L	2	12	5.000E-02	3.400E-03	2.159E-02	2.500E-02	2.573E-02	2.500E-02	2.302E-03
Manganese	UG/L	14	15	1.000E+00	4.300E+00	2.450E+01	6.660E+01	3.206E+01	3.206E+01	4.290E+00
Mercury	UG/L	4	15	2.000E-01	1.000E-01	2.073E-01	7.200E-01	2.985E-01	2.985E-01	5.175E-02
Neptunium 237+D	PCI/L	14	15	2.400E+01	-8.817E+01	9.365E+00	7.520E+01	2.864E+01	2.864E+01	1.094E+01
Tetrachloroethene	UG/L	1	14	5.000E+00	1.000E+00	4.179E+00	5.000E+00	4.839E+00	4.839E+00	3.729E-01
Trichloroethylene	UG/L	1	14	5.000E+00	1.000E+00	4.000E+00	5.000E+00	4.682E+00	4.682E+00	3.852E-01
Uranium 234	PCI/L	11	11	1.071E-01	2.690E+00	3.676E+00	6.250E+00	4.294E+00	4.294E+00	3.408E-01
Uranium 235+D	PCI/L	12	12	2.575E-02	5.000E-02	2.158E-01	6.300E-01	2.945E-01	2.945E-01	4.379E-02
Uranium 238+D	PCI/L	12	12	1.119E-01	2.390E+00	4.127E+00	1.053E+01	5.311E+00	5.311E+00	6.596E-01
Zinc	UG/L	13	15	3.000E+00	6.600E+00	2.525E+01	5.970E+01	3.125E+01	3.125E+01	3.405E+00

Table M.515. EFPC Phase IB chemical and radionuclide results: baseflow – background

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Americium 241	PCI/L	3	3	6.735E+01	−3.792E+01	−2.183E+01	−3.450E+00	7.415E+00	−3.450E+00	1.002E+01
Barium	UG/L	3	3	1.000E+00	3.420E+01	4.277E+01	5.830E+01	6.549E+01	5.830E+01	7.780E+00
bis(2−Ethylhexyl)phthalate	UG/L	1	3	1.000E+01	3.000E+00	4.333E+00	5.000E+00	6.280E+00	5.000E+00	6.667E−01
Cesium 137+D	PCI/L	3	3	2.538E+01	−4.730E+00	5.523E+00	1.420E+01	2.165E+01	1.420E+01	5.521E+00
Cobalt 60	PCI/L	3	3	2.138E+01	−1.802E+01	4.007E+00	3.304E+01	4.825E+01	3.304E+01	1.515E+01
Copper	UG/L	1	3	4.000E+00	1.500E+00	2.533E+00	3.100E+00	4.044E+00	3.100E+00	5.175E−01
Manganese	UG/L	3	3	1.000E+00	8.300E+00	1.600E+01	2.310E+01	2.851E+01	2.310E+01	4.283E+00
Neptunium 237+D	PCI/L	3	3	5.575E+01	−4.409E+01	1.727E+00	3.890E+01	7.281E+01	3.890E+01	2.434E+01
Zinc	UG/L	1	3	3.000E+00	6.100E+00	1.228E+01	1.575E+01	2.133E+01	1.575E+01	3.099E+00

Table M.516. EFPC Phase Ib chemical and radionuclide results: Emory Valley Road

CHEMICAL	UNITS	DETECT	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Antimony	MG/KG	90	93	3.000E−01	1.900E−01	8.025E−01	1.800E+00	8.600E−01	8.600E−01	3.458E−02
Arsenic	MG/KG	93	93	2.000E+00	2.600E+00	9.552E+00	2.700E+01	1.018E+01	1.018E+01	3.792E−01
Chromium (III)	MG/KG	93	93	2.000E+01	3.700E+01	7.187E+01	1.120E+02	7.455E+01	7.455E+01	1.612E+00
Mercury	MG/KG	38	93	5.000E+00	8.500E−01	2.266E+01	1.620E+02	2.915E+01	2.915E+01	3.908E+00
Selenium	MG/KG	33	93	3.000E+01	4.300E+00	8.085E+00	2.100E+01	8.624E+00	8.624E+00	3.244E−01
Zinc	MG/KG	29	93	1.200E+02	2.200E+01	6.332E+01	2.840E+02	7.153E+01	7.153E+01	4.942E+00
Uranium (Total)	PCI/G	87	93	1.384E−01	9.580E−01	6.927E+00	2.448E+01	7.895E+00	7.895E+00	5.830E−01
Uranium 234	PCI/G	87	93	6.623E−02	5.203E−01	3.011E+00	1.141E+01	3.460E+00	3.460E+00	2.700E−01
Uranium 235+D	PCI/G	93	93	1.993E−03	2.996E−02	1.169E−01	4.922E−01	1.337E−01	1.337E−01	1.013E−02
Uranium 238+D	PCI/G	86	93	7.144E−02	4.163E−01	3.785E+00	1.299E+01	4.300E+00	4.300E+00	3.102E−01

Table M.517. EFPC Phase Ib chemical and radionuclide results: Fairbanks Avenue

CHEMICAL	UNITS	DETECT	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Antimony	MG/KG	59	62	3.000E−01	2.100E−01	8.505E−01	1.300E+00	9.138E−01	9.138E−01	3.790E−02
Arsenic	MG/KG	63	64	2.000E+00	1.000E+00	1.226E+01	2.200E+01	1.310E+01	1.310E+01	5.078E−01
Chromium (III)	MG/KG	76	76	2.000E+01	5.200E+01	6.917E+01	9.000E+01	7.099E+01	7.099E+01	1.093E+00
Mercury	MG/KG	27	67	5.000E+00	1.100E+00	2.511E+01	1.580E+02	3.318E+01	3.318E+01	4.835E+00
Selenium	MG/KG	25	76	3.000E+01	3.950E+00	7.562E+00	2.100E+01	8.305E+00	8.305E+00	4.463E−01
Zinc	MG/KG	25	76	1.200E+02	2.450E+01	6.019E+01	1.940E+02	6.764E+01	6.764E+01	4.475E+00
Uranium (Total)	PCI/G	76	76	1.103E−01	2.566E+00	6.177E+00	1.703E+01	6.964E+00	6.964E+00	4.728E−01
Uranium 234	PCI/G	76	76	6.119E−02	1.096E+00	3.022E+00	1.299E+01	3.531E+00	3.531E+00	3.055E−01
Uranium 235+D	PCI/G	76	76	2.079E−03	4.066E−02	1.332E−01	7.062E−01	1.607E−01	1.607E−01	1.652E−02
Uranium 238+D	PCI/G	76	76	5.011E−02	1.365E+00	3.013E+00	8.325E+00	3.348E+00	3.348E+00	2.013E−01

Table M.518. EFPC Phase Ib chemical and radionuclide results: Tulane Avenue

CHEMICAL	UNITS	DETECT	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Antimony	MG/KG	5	7	3.000E−01	1.650E−01	7.657E−01	1.800E+00	1.183E+00	1.183E+00	2.148E−01
Arsenic	MG/KG	7	7	2.000E+00	8.200E+00	1.166E+01	2.400E+01	1.579E+01	1.579E+01	2.125E+00
Chromium (III)	MG/KG	7	7	2.000E+01	4.900E+01	7.029E+01	9.500E+01	8.169E+01	8.169E+01	5.866E+00
Mercury	MG/KG	4	7	5.000E+00	7.500E−01	1.332E+01	3.300E+01	2.442E+01	2.442E+01	5.712E+00
Selenium	MG/KG	1	7	3.000E+01	3.850E+00	5.850E+00	1.200E+01	7.902E+00	7.902E+00	1.056E+00
Zinc	MG/KG	2	7	1.200E+02	2.000E+01	5.864E+01	1.830E+02	1.052E+02	1.052E+02	2.398E+01
Uranium (Total)	PCI/G	7	7	3.639E−01	2.922E+00	3.900E+00	5.200E+00	4.575E+00	4.575E+00	3.472E−01
Uranium 234	PCI/G	7	7	1.827E−01	1.123E+00	1.682E+00	2.705E+00	2.089E+00	2.089E+00	2.098E−01
Uranium 235+D	PCI/G	7	7	1.618E−03	4.280E−02	7.337E−02	1.305E−01	9.488E−02	9.488E−02	1.107E−02
Uranium 238+D	PCI/G	7	7	1.819E−01	1.565E+00	2.145E+00	2.697E+00	2.448E+00	2.448E+00	1.558E−01

COMPARISON OF PHASE Ia/Ib MONITORING DATA WITH LAND USE AREA RESULTS

Table M.519. Monitoring results comparison:
Segment 1 summary statistics and current/future land use area summary statistics

					Land use area EPC vs. Segment EPC Comparison (% of segment EPC)			
	Chemical	Units	Det	Total	Mean		UCL	
Ia/Ib	Antimony	mg/kg	74	97	1.109E+00		1.371E+00	
Commercial−C	Antimony	mg/kg	8	8	6.275E−01	57%	8.919E−01	65%
Open−C	Antimony	mg/kg	66	77	5.875E−01	53%	6.457E−01	47%
Commercial−F	Antimony	mg/kg	35	40	5.257E−01	47%	6.056E−01	44%
Open−F	Antimony	mg/kg	1	3	2.767E−01	25%	4.100E−01	30%
Residential−F	Antimony	mg/kg	38	42	6.761E−01	61%	7.567E−01	55%
Ia/Ib	Arsenic	mg/kg	97	101	6.308E+00		6.868E+00	
Commercial−C	Arsenic	mg/kg	7	8	5.294E+00	84%	8.126E+00	118%
Open−C	Arsenic	mg/kg	74	77	6.380E+00	101%	6.995E+00	102%
Commercial−F	Arsenic	mg/kg	36	40	5.247E+00	83%	6.040E+00	88%
Open−F	Arsenic	mg/kg	3	3	5.400E+00	86%	6.800E+00	99%
Residential−F	Arsenic	mg/kg	42	42	7.321E+00	116%	8.222E+00	120%
Ia/Ib	Chromium (III)	mg/kg	89	91	6.393E+01		6.839E+01	
Commercial−C	Chromium (III)	mg/kg	7	7	5.100E+01	80%	6.593E+01	96%
Open−C	Chromium (III)	mg/kg	67	67	7.354E+01	115%	7.749E+01	113%
Commercial−F	Chromium (III)	mg/kg	35	35	6.434E+01	101%	7.069E+01	103%
Open−F	Chromium (III)	mg/kg	3	3	7.600E+01	119%	9.400E+01	137%
Residential−F	Chromium (III)	mg/kg	36	36	7.789E+01	122%	8.261E+01	121%
Ia/Ib	Mercury	mg/kg	51	94	1.303E+02		1.834E+02	
Commercial−C	Mercury	mg/kg	1	8	3.913E+00	3%	7.997E+00	4%
Open−C	Mercury	mg/kg	33	69	9.869E+01	76%	1.486E+02	81%
Commercial−F	Mercury	mg/kg	14	40	5.958E+01	46%	1.159E+02	63%
Open−F	Mercury	mg/kg	1	3	3.673E+01	28%	1.070E+02	58%
Residential−F	Mercury	mg/kg	19	34	1.279E+02	98%	2.066E+02	113%
Ia/Ib	Selenium	mg/kg	11	99	8.246E+00		9.887E+00	
Commercial−C	Selenium	mg/kg	ND	ND	ND	0%	ND	0%
Open−C	Selenium	mg/kg	15	77	1.090E+01	132%	1.369E+01	138%
Commercial−F	Selenium	mg/kg	7	40	7.767E+00	94%	9.179E+00	93%
Open−F	Selenium	mg/kg	ND	ND	ND	0%	ND	0%
Residential−F	Selenium	mg/kg	8	42	1.321E+01	160%	1.815E+01	184%
Ia/Ib	Uranium 235+D	pCi/g	99	99	3.293E−01		3.908E−01	
Commercial−C	Uranium 235+D	pCi/g	8	8	9.898E−02	30%	1.596E−01	41%
Open−C	Uranium 235+D	pCi/g	81	81	3.250E−01	99%	3.929E−01	101%
Commercial−F	Uranium 235+D	pCi/g	40	40	2.069E−01	63%	2.710E−01	69%
Open−F	Uranium 235+D	pCi/g	3	3	1.541E−01	47%	3.638E−01	93%
Residential−F	Uranium 235+D	pCi/g	46	46	3.995E−01	121%	5.041E−01	129%
Ia/Ib	Uranium 238+D	pCi/g	83	86	7.191E+00		8.353E+00	
Commercial−C	Uranium 238+D	pCi/g	6	7	2.983E+00	41%	5.134E+00	61%
Open−C	Uranium 238+D	pCi/g	65	67	7.229E+00	101%	8.564E+00	103%
Commercial−F	Uranium 238+D	pCi/g	34	35	5.876E+00	82%	7.611E+00	91%
Open−F	Uranium 238+D	pCi/g	3	3	4.418E+00	61%	1.032E+01	124%
Residential−F	Uranium 238+D	pCi/g	34	36	7.953E+00	111%	9.856E+00	118%
Ia/Ib	Zinc	mg/kg	23	102	6.611E+01		7.345E+01	
Commercial−C	Zinc	mg/kg	1	8	6.331E+01	96%	8.926E+01	122%
Open−C	Zinc	mg/kg	13	77	6.677E+01	101%	7.579E+01	103%
Commercial−F	Zinc	mg/kg	7	40	5.615E+01	85%	6.404E+01	87%
Open−F	Zinc	mg/kg	1	3	1.178E+02	178%	2.330E+02	317%
Residential−F	Zinc	mg/kg	6	42	7.257E+01	110%	8.630E+01	117%

Ia/Ib – exposure point concentrations, mean and UCL, estimated using all samples collected within Segment 1
EPC – exposure point concentration
C– current
F – future

Table M.520. Monitoring results comparison:
Segment 2 summary statistics and current/future land use area summary statistics

	Chemical	Units	Det.	Total	Land use area EPC vs. Segment EPC Comparison (% of segment EPC) Mean		UCL	
Ia/Ib	Antimony	mg/kg	79	95	8.159E−01		9.766E−01	
Commercial−C	Antimony	mg/kg	15	15	7.453E−01	91%	8.713E−01	89%
Open−C	Antimony	mg/kg	61	69	6.568E−01	81%	7.131E−01	73%
Residential−C	Antimony	mg/kg	8	9	7.433E−01	91%	9.908E−01	101%
Commercial−F	Antimony	mg/kg	37	43	6.874E−01	84%	7.742E−01	79%
Open−F	Antimony	mg/kg	2	2	6.550E−01	80%	7.000E−01	72%
Residential−F	Antimony	mg/kg	45	48	6.733E−01	83%	7.347E−01	75%
Ia/Ib	Arsenic	mg/kg	93	98	8.545E+00		9.772E+00	
Commercial−C	Arsenic	mg/kg	15	15	9.867E+00	115%	1.363E+01	139%
Open−C	Arsenic	mg/kg	69	69	8.925E+00	104%	1.044E+01	107%
Residential−C	Arsenic	mg/kg	9	9	8.278E+00	97%	1.041E+01	107%
Commercial−F	Arsenic	mg/kg	43	43	1.071E+01	125%	1.336E+01	137%
Open−F	Arsenic	mg/kg	2	2	7.100E+00	83%	7.400E+00	76%
Residential−F	Arsenic	mg/kg	48	48	7.577E+00	89%	8.103E+00	83%
Ia/Ib	Chromium (III)	mg/kg	84	93	6.117E+01		6.390E+01	
Commercial−C	Chromium (III)	mg/kg	15	15	6.567E+01	107%	7.073E+01	111%
Open−C	Chromium (III)	mg/kg	63	63	6.867E+01	112%	7.157E+01	112%
Residential−C	Chromium (III)	mg/kg	9	9	6.533E+01	107%	7.915E+01	124%
Commercial−F	Chromium (III)	mg/kg	43	43	6.895E+01	113%	7.297E+01	114%
Open−F	Chromium (III)	mg/kg	2	2	6.150E+01	101%	6.200E+01	97%
Residential−F	Chromium (III)	mg/kg	42	42	6.693E+01	109%	7.037E+01	110%
Ia/Ib	Mercury	mg/kg	27	83	2.203E+01		3.326E+01	
Commercial−C	Mercury	mg/kg	2	12	2.854E+00	13%	4.978E+00	15%
Open−C	Mercury	mg/kg	19	58	2.235E+01	101%	3.671E+01	110%
Residential−C	Mercury	mg/kg	ND	ND	ND	0%	ND	0%
Commercial−F	Mercury	mg/kg	12	41	2.150E+01	98%	4.103E+01	123%
Open−F	Mercury	mg/kg	ND	ND	ND	0%	ND	0%
Residential−F	Mercury	mg/kg	9	35	1.317E+01	60%	2.132E+01	64%
Ia/Ib	Selenium	mg/kg	28	98	1.234E+01		1.457E+01	
Commercial−C	Selenium	mg/kg	9	15	1.945E+01	158%	2.653E+01	182%
Open−C	Selenium	mg/kg	20	69	1.167E+01	95%	1.404E+01	96%
Residential−C	Selenium	mg/kg	3	9	1.541E+01	125%	2.647E+01	182%
Commercial−F	Selenium	mg/kg	19	43	1.503E+01	122%	1.883E+01	129%
Open−F	Selenium	mg/kg	ND	ND	ND	0%	ND	0%
Residential−F	Selenium	mg/kg	13	48	1.207E+01	98%	1.496E+01	103%
Ia/Ib	Uranium 235+D	pCi/g	93	93	1.356E−01		1.574E−01	
Commercial−C	Uranium 235+D	pCi/g	15	15	6.663E−02	49%	8.142E−02	52%
Open−C	Uranium 235+D	pCi/g	70	70	1.540E−01	114%	1.808E−01	115%
Residential−C	Uranium 235+D	pCi/g	9	9	5.849E−02	43%	6.688E−02	42%
Commercial−F	Uranium 235+D	pCi/g	43	43	1.508E−01	111%	1.884E−01	120%
Open−F	Uranium 235+D	pCi/g	2	2	5.136E−02	38%	5.136E−02	33%
Residential−F	Uranium 235+D	pCi/g	49	49	1.167E−01	86%	1.405E−01	89%
Ia/Ib	Uranium 238+D	pCi/g	79	86	3.404E+00		3.860E+00	
Commercial−C	Uranium 238+D	pCi/g	12	12	2.151E+00	63%	2.629E+00	68%
Open−C	Uranium 238+D	pCi/g	55	61	3.719E+00	109%	4.310E+00	112%
Residential−C	Uranium 238+D	pCi/g	8	9	1.817E+00	53%	2.169E+00	56%
Commercial−F	Uranium 238+D	pCi/g	39	43	3.538E+00	104%	4.256E+00	110%
Open−F	Uranium 238+D	pCi/g	2	2	1.765E+00	52%	1.898E+00	49%
Residential−F	Uranium 238+D	pCi/g	34	37	3.064E+00	90%	3.681E+00	95%
Ia/Ib	Zinc	mg/kg	21	98	3.074E+02		4.364E+02	
Commercial−C	Zinc	mg/kg	8	15	1.009E+02	33%	1.451E+02	33%
Open−C	Zinc	mg/kg	25	69	7.075E+02	230%	1.069E+03	245%
Residential−C	Zinc	mg/kg	2	9	6.283E+01	20%	8.495E+01	19%
Commercial−F	Zinc	mg/kg	15	43	8.300E+01	27%	1.016E+02	23%
Open−F	Zinc	mg/kg	ND	ND	ND	0%	ND	0%
Residential−F	Zinc	mg/kg	20	~48	9.850E+02	320%	1.495E+03	343%

Ia/Ib – exposure point concentrations, mean and UCL, estimated using all samples collected within Segment 2
EPC – exposure point concentration
C – current
F – future

Table M.521. Monitoring results comparison:
Segment 3 summary statistics and current/future land use area summary statistics

					Land use area EPC vs. Segment EPC Comparison (% of segment EPC)			
	Chemical	Units	Det	Total	Mean		UCL	
Ia/Ib	Antimony	mg/kg	56	65	1.482E+00		1.873E+00	
Commercial−C	Antimony	mg/kg	14	14	7.879E−01	53%	8.875E−01	47%
Open−C	Antimony	mg/kg	11	11	1.064E+00	72%	1.316E+00	70%
Residential−C	Antimony	mg/kg	26	27	1.242E+00	84%	1.909E+00	102%
Commercial−F	Antimony	mg/kg	18	18	9.044E−01	61%	1.071E+00	57%
Residential−F	Antimony	mg/kg	33	34	1.176E+00	79%	1.702E+00	91%
Ia/Ib	Arsenic	mg/kg	69	70	8.792E+00		9.514E+00	
Commercial−C	Arsenic	mg/kg	14	14	9.271E+00	105%	1.046E+01	110%
Open−C	Arsenic	mg/kg	10	11	1.007E+01	115%	1.297E+01	136%
Residential−C	Arsenic	mg/kg	27	27	9.611E+00	109%	1.080E+01	114%
Commercial−F	Arsenic	mg/kg	17	18	9.636E+00	110%	1.146E+01	120%
Residential−F	Arsenic	mg/kg	34	34	9.606E+00	109%	1.058E+01	111%
Ia/Ib	Chromium (III)	mg/kg	71	71	6.904E+01		7.510E+01	
Commercial−C	Chromium (III)	mg/kg	14	14	8.657E+01	125%	1.060E+02	141%
Open−C	Chromium (III)	mg/kg	11	11	7.555E+01	109%	8.897E+01	118%
Residential−C	Chromium (III)	mg/kg	27	27	7.448E+01	108%	8.105E+01	108%
Commercial−F	Chromium (III)	mg/kg	18	18	8.611E+01	125%	1.013E+02	135%
Residential−F	Chromium (III)	mg/kg	34	34	7.365E+01	107%	7.976E+01	106%
Ia/Ib	Mercury	mg/kg	36	72	3.741E+01		5.893E+01	
Commercial−C	Mercury	mg/kg	2	13	1.641E+01	44%	3.579E+01	61%
Open−C	Mercury	mg/kg	3	11	2.658E+01	71%	5.063E+01	86%
Residential−C	Mercury	mg/kg	4	9	9.356E+00	25%	1.538E+01	26%
Commercial−F	Mercury	mg/kg	3	17	1.745E+01	47%	3.346E+01	57%
Residential−F	Mercury	mg/kg	6	16	1.832E+01	49%	3.318E+01	56%
Ia/Ib	Selenium	mg/kg	26	71	1.279E+01		1.551E+01	
Commercial−C	Selenium	mg/kg	6	14	1.514E+01	118%	2.101E+01	135%
Open−C	Selenium	mg/kg	4	11	9.441E+00	74%	1.274E+01	82%
Residential−C	Selenium	mg/kg	13	27	2.011E+01	157%	2.549E+01	164%
Commercial−F	Selenium	mg/kg	9	18	1.506E+01	118%	1.967E+01	127%
Residential−F	Selenium	mg/kg	14	34	1.729E+01	135%	2.182E+01	141%
Ia/Ib	Uranium 235+D	pCi/g	92	92	1.490E−01		1.815E−01	
Commercial−C	Uranium 235+D	pCi/g	16	16	1.189E−01	80%	1.853E−01	102%
Open−C	Uranium 235+D	pCi/g	11	11	1.554E−01	104%	2.500E−01	138%
Residential−C	Uranium 235+D	pCi/g	38	38	1.252E−01	84%	1.550E−01	85%
Commercial−F	Uranium 235+D	pCi/g	20	20	1.192E−01	80%	1.760E−01	97%
Residential−F	Uranium 235+D	pCi/g	45	45	1.331E−01	89%	1.641E−01	90%
Ia/Ib	Uranium 238+D	pCi/g	76	83	3.097E+00		3.658E+00	
Commercial−C	Uranium 238+D	pCi/g	11	14	3.315E+00	107%	5.378E+00	147%
Open−C	Uranium 238+D	pCi/g	8	11	3.268E+00	106%	5.111E+00	140%
Residential−C	Uranium 238+D	pCi/g	23	24	3.192E+00	103%	3.913E+00	107%
Commercial−F	Uranium 238+D	pCi/g	14	18	3.149E+00	102%	4.792E+00	131%
Residential−F	Uranium 238+D	pCi/g	28	31	3.299E+00	107%	4.058E+00	111%
Ia/Ib	Zinc	mg/kg	21	71	3.130E+02		4.656E+02	
Commercial−C	Zinc	mg/kg	7	14	4.297E+02	137%	9.709E+02	209%
Open−C	Zinc	mg/kg	5	11	9.814E+01	31%	1.411E+02	30%
Residential−C	Zinc	mg/kg	16	27	1.161E+03	371%	1.913E+03	411%
Commercial−F	Zinc	mg/kg	9	18	3.541E+02	113%	7.684E+02	165%
Residential−F	Zinc	mg/kg	19	34	9.433E+02	301%	1.547E+03	332%

Ia/Ib – exposure point concentrations, mean and UCL, estimated using all samples collected within Segment 3
EPC – exposure point concentration
C– current
F – future

Table M.522. Monitoring results comparison:
Segment 4 summary statistics and current/future land use area summary statistics

					Land use area EPC vs. Segment EPC Comparison (% of segment EPC)			
	Chemical	Units	Det	Total	Mean		UCL	
Ia/Ib	Antimony	mg/kg	86	100	1.145E+00		1.304E+00	
Open−C	Antimony	mg/kg	88	91	8.728E−01	76%	9.296E−01	71%
Residential−C	Antimony	mg/kg	ND	ND	ND	0%	ND	0%
Commercial−F	Antimony	mg/kg	48	48	9.071E−01	79%	9.878E−01	76%
Open−F	Antimony	mg/kg	2	2	5.200E−01	45%	6.800E−01	52%
Residential−F	Antimony	mg/kg	38	41	8.499E−01	74%	9.327E−01	72%
Ia/Ib	Arsenic	mg/kg	100	100	1.005E+01		1.075E+01	
Open−C	Arsenic	mg/kg	91	91	9.889E+00	98%	1.039E+01	97%
Residential−C	Arsenic	mg/kg	ND	ND	ND	0%	ND	0%
Commercial−F	Arsenic	mg/kg	48	48	9.942E+00	99%	1.064E+01	99%
Open−F	Arsenic	mg/kg	2	2	5.050E+00	50%	7.200E+00	67%
Residential−F	Arsenic	mg/kg	41	41	1.006E+01	100%	1.078E+01	100%
Ia/Ib	Chromium (III)	mg/kg	104	104	8.240E+01		8.784E+01	
Open−C	Chromium (III)	mg/kg	91	91	8.397E+01	102%	8.981E+01	102%
Residential−C	Chromium (III)	mg/kg	4	4	6.645E+01	81%	1.100E+02	125%
Commercial−F	Chromium (III)	mg/kg	48	48	8.525E+01	103%	9.379E+01	107%
Open−F	Chromium (III)	mg/kg	2	2	4.000E+01	49%	5.200E+01	59%
Residential−F	Chromium (III)	mg/kg	45	45	8.300E+01	101%	9.103E+01	104%
Ia/Ib	Mercury	mg/kg	69	109	1.542E+02		1.932E+02	
Open−C	Mercury	mg/kg	50	87	1.112E+02	72%	1.452E+02	75%
Residential−C	Mercury	mg/kg	3	5	7.701E+01	50%	1.663E+02	86%
Commercial−F	Mercury	mg/kg	29	44	7.885E+01	51%	1.084E+02	56%
Open−F	Mercury	mg/kg	2	2	6.450E+00	4%	7.400E+00	4%
Residential−F	Mercury	mg/kg	22	46	1.430E+02	93%	2.010E+02	104%
Ia/Ib	Selenium	mg/kg	13	103	7.394E+00		7.967E+00	
Open−C	Selenium	mg/kg	13	91	8.215E+00	111%	8.704E+00	109%
Residential−C	Selenium	mg/kg	ND	ND	ND	0%	ND	0%
Commercial−F	Selenium	mg/kg	6	48	7.314E+00	99%	7.896E+00	99%
Open−F	Selenium	mg/kg	ND	ND	ND	0%	ND	0%
Residential−F	Selenium	mg/kg	7	45	8.736E+00	118%	9.600E+00	120%
Ia/Ib	Uranium 235+D	pCi/g	95	95	3.668E−01		4.309E−01	
Open−C	Uranium 235+D	pCi/g	91	91	3.665E−01	100%	4.320E−01	100%
Residential−C	Uranium 235+D	pCi/g	1	1	6.634E−02	18%	6.634E−02	15%
Commercial−F	Uranium 235+D	pCi/g	48	48	3.738E−01	102%	4.627E−01	107%
Open−F	Uranium 235+D	pCi/g	2	2	5.885E−02	16%	5.992E−02	14%
Residential−F	Uranium 235+D	pCi/g	42	42	3.657E−01	100%	4.674E−01	108%
Ia/Ib	Uranium 238+D	pCi/g	84	94	7.585E+00		8.805E+00	
Open−C	Uranium 238+D	pCi/g	81	91	7.591E+00	100%	8.840E+00	100%
Residential−C	Uranium 238+D	pCi/g	ND	ND	ND	0%	ND	0%
Commercial−F	Uranium 238+D	pCi/g	45	48	7.874E+00	104%	9.614E+00	109%
Open−F	Uranium 238+D	pCi/g	2	2	1.632E+00	22%	1.665E+00	19%
Residential−F	Uranium 238+D	pCi/g	34	41	7.551E+00	100%	9.469E+00	108%
Ia/Ib	Zinc	mg/kg	34	104	1.025E+02		1.157E+02	
Open−C	Zinc	mg/kg	21	91	9.277E+01	91%	1.063E+02	92%
Residential−C	Zinc	mg/kg	4	4	1.777E+02	173%	2.490E+02	215%
Commercial−F	Zinc	mg/kg	15	48	9.190E+01	90%	1.123E+02	97%
Open−F	Zinc	mg/kg	ND	ND	ND	0%	ND	0%
Residential−F	Zinc	mg/kg	10	45	1.031E+02	101%	1.221E+02	106%

Ia/Ib – exposure point concentrations, mean and UCL, estimated using all samples collected within Segment 4
EPC – exposure point concentration
C– current
F – future

Table M.523. Monitoring results comparison:
Segment 5 summary statistics and current/future land use area summary statistics

					Land use area EPC vs. Segment EPC Comparison (% of segment EPC)			
	Chemical	Units	Det	Total	Mean		UCL	
Ia/Ib	Antimony	mg/kg	61	69	8.672E−01		1.008E+00	
Open−C	Antimony	mg/kg	61	66	7.294E−01	84%	7.852E−01	78%
Commercial−F	Antimony	mg/kg	36	38	6.989E−01	81%	7.640E−01	76%
Residential−F	Antimony	mg/kg	25	28	7.707E−01	89%	8.711E−01	86%
Ia/Ib	Arsenic	mg/kg	72	72	8.704E+00		9.417E+00	
Open−C	Arsenic	mg/kg	66	66	8.989E+00	103%	9.731E+00	103%
Commercial−F	Arsenic	mg/kg	38	38	8.761E+00	101%	9.969E+00	106%
Residential−F	Arsenic	mg/kg	28	28	9.300E+00	107%	9.983E+00	106%
Ia/Ib	Chromium (III)	mg/kg	72	72	7.111E+01		7.519E+01	
Open−C	Chromium (III)	mg/kg	66	66	7.417E+01	104%	7.796E+01	104%
Commercial−F	Chromium (III)	mg/kg	38	38	7.008E+01	99%	7.441E+01	99%
Residential−F	Chromium (III)	mg/kg	28	28	7.971E+01	112%	8.635E+01	115%
Ia/Ib	Mercury	mg/kg	35	72	4.350E+01		5.759E+01	
Open−C	Mercury	mg/kg	21	58	3.008E+01	69%	4.432E+01	77%
Commercial−F	Mercury	mg/kg	15	38	3.763E+01	87%	5.867E+01	102%
Residential−F	Mercury	mg/kg	6	20	1.573E+01	36%	2.651E+01	46%
Ia/Ib	Selenium	mg/kg	20	72	9.663E+00		1.086E+01	
Open−C	Selenium	mg/kg	20	66	1.051E+01	109%	1.166E+01	107%
Commercial−F	Selenium	mg/kg	10	38	9.461E+00	98%	1.079E+01	99%
Residential−F	Selenium	mg/kg	10	28	1.193E+01	123%	1.397E+01	129%
Ia/Ib	Uranium 235+D	pCi/g	70	70	2.030E−01		2.419E−01	
Open−C	Uranium 235+D	pCi/g	65	65	1.961E−01	97%	2.374E−01	98%
Commercial−F	Uranium 235+D	pCi/g	37	37	1.752E−01	86%	2.201E−01	91%
Residential−F	Uranium 235+D	pCi/g	28	28	2.237E−01	110%	3.013E−01	125%
Ia/Ib	Uranium 238+D	pCi/g	65	71	4.605E+00		5.334E+00	
Open−C	Uranium 238+D	pCi/g	60	66	4.574E+00	99%	5.346E+00	100%
Commercial−F	Uranium 238+D	pCi/g	35	38	4.474E+00	97%	5.420E+00	102%
Residential−F	Uranium 238+D	pCi/g	25	28	4.710E+00	102%	6.062E+00	114%
Ia/Ib	Zinc	mg/kg	16	72	8.186E+01		9.578E+01	
Open−C	Zinc	mg/kg	10	66	7.958E+01	97%	9.448E+01	99%
Commercial−F	Zinc	mg/kg	6	38	7.518E+01	92%	9.392E+01	98%
Residential−F	Zinc	mg/kg	4	28	8.555E+01	105%	1.108E+02	116%

Ia/Ib − exposure point concentrations, mean and UCL, estimated using all samples collected within Segment 5
EPC − exposure point concentration
C− current
F − future

Table M.524. Monitoring results comparison:
Segment 6 summary statistics and current/future land use area summary statistics

					Land use area EPC vs. Segment EPC Comparison (% of segment EPC)			
	Chemical	Units	Det	Total	Mean		UCL	
Ia/Ib	Antimony	mg/kg	54	61	9.748E−01		1.265E+00	
Residential−C	Antimony	mg/kg	54	56	6.118E−01	63%	6.554E−01	52%
Residential−F	Antimony	mg/kg	54	56	6.118E−01	63%	6.554E−01	52%
Ia/Ib	Arsenic	mg/kg	62	62	6.885E+00		7.397E+00	
Residential−C	Arsenic	mg/kg	56	56	7.170E+00	104%	7.665E+00	104%
Residential−F	Arsenic	mg/kg	56	56	7.170E+00	104%	7.665E+00	104%
Ia/Ib	Chromium (III)	mg/kg	63	63	6.430E+01		6.882E+01	
Residential−C	Chromium (III)	mg/kg	56	56	6.921E+01	108%	7.299E+01	106%
Residential−F	Chromium (III)	mg/kg	56	56	6.921E+01	108%	7.299E+01	106%
Ia/Ib	Mercury	mg/kg	28	63	1.926E+01		2.714E+01	
Residential−C	Mercury	mg/kg	21	56	1.907E+01	99%	2.762E+01	102%
Residential−F	Mercury	mg/kg	21	56	1.907E+01	99%	2.762E+01	102%
Ia/Ib	Selenium	mg/kg	29	63	2.202E+01		2.623E+01	
Residential−C	Selenium	mg/kg	32	56	2.491E+01	113%	2.926E+01	112%
Residential−F	Selenium	mg/kg	32	56	2.491E+01	113%	2.926E+01	112%
Ia/Ib	Uranium 235+D	pCi/g	59	59	1.727E−01		2.105E−01	
Residential−C	Uranium 235+D	pCi/g	56	56	1.690E−01	98%	2.058E−01	98%
Residential−F	Uranium 235+D	pCi/g	56	56	1.690E−01	98%	2.058E−01	98%
Ia/Ib	Uranium 238+D	pCi/g	54	59	3.873E+00		4.554E+00	
Residential−C	Uranium 238+D	pCi/g	51	56	3.914E+00	101%	4.605E+00	101%
Residential−F	Uranium 238+D	pCi/g	51	56	3.914E+00	101%	4.605E+00	101%
Ia/Ib	Zinc	mg/kg	36	63	8.024E+01		9.610E+01	
Residential−C	Zinc	mg/kg	29	56	7.886E+01	98%	9.371E+01	98%
Residential−F	Zinc	mg/kg	29	56	7.886E+01	98%	9.371E+01	98%

Ia/Ib – exposure point concentrations, mean and UCL, estimated using all samples collected within Segment 6
EPC – exposure point concentration
C– current
F – future

Table M.525. Monitoring results comparison:
Segment 7 summary statistics and current/future land use area summary statistics

					Land use area EPC vs. Segment EPC Comparison (% of segment EPC)			
	Chemical	Units	Det	Total	Mean		UCL	
Ia/Ib	Antimony	mg/kg	256	283	7.235E−01		7.660E−01	
Open−C	Antimony	mg/kg	125	134	8.456E−01	117%	9.183E−01	120%
Residential−C	Antimony	mg/kg	138	149	6.287E−01	87%	6.710E−01	88%
Agricultural−F	Antimony	mg/kg	165	178	6.366E−01	88%	6.759E−01	88%
Open−F	Antimony	mg/kg	98	105	8.920E−01	123%	9.789E−01	128%
Ia/Ib	Arsenic	mg/kg	280	291	7.674E+00		7.928E+00	
Open−C	Arsenic	mg/kg	133	134	8.224E+00	107%	8.633E+00	109%
Residential−C	Arsenic	mg/kg	148	149	7.532E+00	98%	7.813E+00	99%
Agricultural−F	Arsenic	mg/kg	177	178	7.529E+00	98%	7.793E+00	98%
Open−F	Arsenic	mg/kg	104	105	8.421E+00	110%	8.896E+00	112%
Ia/Ib	Chromium (III)	mg/kg	330	330	6.695E+01		6.897E+01	
Open−C	Chromium (III)	mg/kg	178	178	6.575E+01	98%	6.854E+01	99%
Residential−C	Chromium (III)	mg/kg	144	144	7.069E+01	106%	7.344E+01	106%
Agricultural−F	Chromium (III)	mg/kg	191	191	6.981E+01	104%	7.222E+01	105%
Open−F	Chromium (III)	mg/kg	131	131	6.527E+01	97%	6.861E+01	99%
Ia/Ib	Mercury	mg/kg	84	326	1.269E+01		1.571E+01	
Open−C	Mercury	mg/kg	28	169	1.035E+01	82%	1.413E+01	90%
Residential−C	Mercury	mg/kg	48	149	1.277E+01	101%	1.657E+01	105%
Agricultural−F	Mercury	mg/kg	58	200	1.221E+01	96%	1.567E+01	100%
Open−F	Mercury	mg/kg	18	118	1.025E+01	81%	1.450E+01	92%
Ia/Ib	Selenium	mg/kg	150	331	1.316E+01		1.443E+01	
Open−C	Selenium	mg/kg	72	174	8.789E+00	67%	9.574E+00	66%
Residential−C	Selenium	mg/kg	94	149	1.949E+01	148%	2.191E+01	152%
Agricultural−F	Selenium	mg/kg	111	192	1.751E+01	133%	1.951E+01	135%
Open−F	Selenium	mg/kg	55	131	8.185E+00	62%	8.780E+00	61%
Ia/Ib	Uranium 235+D	pCi/g	335	335	1.502E−01		1.662E−01	
Open−C	Uranium 235+D	pCi/g	185	185	1.504E−01	100%	1.756E−01	106%
Residential−C	Uranium 235+D	pCi/g	149	149	1.489E−01	99%	1.668E−01	100%
Agricultural−F	Uranium 235+D	pCi/g	192	192	1.501E−01	100%	1.679E−01	101%
Open−F	Uranium 235+D	pCi/g	142	142	1.493E−01	99%	1.785E−01	107%
Ia/Ib	Uranium 238+D	pCi/g	290	319	3.287E+00		3.578E+00	
Open−C	Uranium 238+D	pCi/g	152	171	3.035E+00	92%	3.453E+00	97%
Residential−C	Uranium 238+D	pCi/g	134	144	3.534E+00	108%	3.937E+00	110%
Agricultural−F	Uranium 238+D	pCi/g	174	191	3.273E+00	100%	3.605E+00	101%
Open−F	Uranium 238+D	pCi/g	112	124	3.248E+00	99%	3.790E+00	106%
Ia/Ib	Zinc	mg/kg	116	330	1.374E+02		1.770E+02	
Open−C	Zinc	mg/kg	56	187	1.778E+02	129%	2.689E+02	152%
Residential−C	Zinc	mg/kg	61	135	2.628E+02	191%	4.116E+02	233%
Agricultural−F	Zinc	mg/kg	82	184	3.278E+02	239%	4.692E+02	265%
Open−F	Zinc	mg/kg	35	138	6.099E+01	44%	6.814E+01	38%

Ia/Ib – exposure point concentrations, mean and UCL, estimated using all samples collected within Segment 7
EPC – exposure point concentration
C– current
F – future

Table M.526. Monitoring results comparison:
Segment 8 summary statistics and current/future land use area summary statistics

					Land use area EPC vs. Segment EPC Comparison (% of segment EPC)			
	Chemical	Units	Det.	Total	Mean		UCL	
Ia/Ib	Antimony	mg/kg	69	77	6.521E−01		6.995E−01	
Open−C	Antimony	mg/kg	56	61	6.907E−01	106%	7.443E−01	106%
Residential−C	Antimony	mg/kg	13	16	5.047E−01	77%	5.884E−01	84%
Residential−F	Antimony	mg/kg	69	77	6.521E−01	100%	6.995E−01	100%
Ia/Ib	Arsenic	mg/kg	84	85	7.197E+00		7.622E+00	
Open−C	Arsenic	mg/kg	61	61	7.631E+00	106%	8.084E+00	106%
Residential−C	Arsenic	mg/kg	16	16	7.638E+00	106%	8.396E+00	110%
Residential−F	Arsenic	mg/kg	77	77	7.632E+00	106%	8.018E+00	105%
Ia/Ib	Chromium (III)	mg/kg	85	85	7.062E+01		7.559E+01	
Open−C	Chromium (III)	mg/kg	61	61	7.370E+01	104%	7.967E+01	105%
Residential−C	Chromium (III)	mg/kg	16	16	6.200E+01	88%	6.780E+01	90%
Residential−F	Chromium (III)	mg/kg	77	77	7.127E+01	101%	7.619E+01	101%
Ia/Ib	Mercury	mg/kg	37	85	3.568E+01		4.911E+01	
Open−C	Mercury	mg/kg	28	61	3.639E+01	102%	5.057E+01	103%
Residential−C	Mercury	mg/kg	1	16	2.525E+00	7%	3.888E+00	8%
Residential−F	Mercury	mg/kg	29	77	2.935E+01	82%	4.084E+01	83%
Ia/Ib	Selenium	mg/kg	9	85	6.440E+00		6.939E+00	
Open−C	Selenium	mg/kg	7	61	7.131E+00	111%	7.520E+00	108%
Residential−C	Selenium	mg/kg	4	16	7.341E+00	114%	8.636E+00	124%
Residential−F	Selenium	mg/kg	11	77	7.175E+00	111%	7.570E+00	109%
Ia/Ib	Uranium 235+D	pCi/g	81	81	2.378E−01		2.917E−01	
Open−C	Uranium 235+D	pCi/g	62	62	2.665E−01	112%	3.337E−01	114%
Residential−C	Uranium 235+D	pCi/g	16	16	1.006E−01	42%	1.415E−01	49%
Residential−F	Uranium 235+D	pCi/g	78	78	2.324E−01	98%	2.876E−01	99%
Ia/Ib	Uranium 238+D	pCi/g	66	74	5.078E+00		6.054E+00	
Open−C	Uranium 238+D	pCi/g	51	56	5.064E+00	100%	6.202E+00	102%
Residential−C	Uranium 238+D	pCi/g	9	12	2.388E+00	47%	3.540E+00	58%
Residential−F	Uranium 238+D	pCi/g	60	68	4.591E+00	90%	5.564E+00	92%
Ia/Ib	Zinc	mg/kg	16	85	1.244E+02		2.051E+02	
Open−C	Zinc	mg/kg	8	61	1.471E+02	118%	2.597E+02	127%
Residential−C	Zinc	mg/kg	ND	ND	ND	0%	ND	0%
Residential−F	Zinc	mg/kg	8	77	1.274E+02	102%	2.165E+02	106%

Ia/Ib – exposure point concentrations, mean and UCL, estimated using all samples collected within Segment 8
EPC – exposure point concentration
C– current
F – future

Table M.527. Monitoring results comparison:
Segment 9 summary statistics and current/future land use area summary statistics

					Land use area EPC vs. Segment EPC Comparison (% of segment EPC)			
	Chemical	Units	Det	Total	Mean		UCL	
Ia/Ib	Antimony	mg/kg	524	651	6.672E−01		7.102E−01	
Open−C	Antimony	mg/kg	538	646	6.187E−01	93%	6.375E−01	90%
Agricultural−F	Antimony	mg/kg	393	488	6.204E−01	93%	6.431E−01	91%
Residential−F	Antimony	mg/kg	145	158	6.135E−01	92%	6.447E−01	91%
Ia/Ib	Arsenic	mg/kg	299	320	6.693E+00		6.923E+00	
Open−C	Arsenic	mg/kg	297	302	7.169E+00	107%	7.446E+00	108%
Agricultural−F	Arsenic	mg/kg	153	156	7.350E+00	110%	7.801E+00	113%
Residential−F	Arsenic	mg/kg	144	146	6.975E+00	104%	7.291E+00	105%
Ia/Ib	Chromium (III)	mg/kg	690	690	5.974E+01		6.085E+01	
Open−C	Chromium (III)	mg/kg	673	673	6.036E+01	101%	6.146E+01	101%
Agricultural−F	Chromium (III)	mg/kg	496	496	5.941E+01	99%	6.060E+01	100%
Residential−F	Chromium (III)	mg/kg	177	177	6.302E+01	105%	6.553E+01	108%
Ia/Ib	Mercury	mg/kg	143	697	1.069E+01		1.225E+01	
Open−C	Mercury	mg/kg	135	680	1.032E+01	97%	1.198E+01	98%
Agricultural−F	Mercury	mg/kg	103	503	1.076E+01	101%	1.270E+01	104%
Residential−F	Mercury	mg/kg	32	177	9.090E+00	85%	1.226E+01	100%
Ia/Ib	Selenium	mg/kg	100	699	7.075E+00		7.498E+00	
Open−C	Selenium	mg/kg	111	682	7.317E+00	103%	7.745E+00	103%
Agricultural−F	Selenium	mg/kg	48	493	6.301E+00	89%	6.486E+00	87%
Residential−F	Selenium	mg/kg	63	189	9.966E+00	141%	1.139E+01	152%
Ia/Ib	Uranium 235+D	pCi/g	722	722	1.345E−01		1.441E−01	
Open−C	Uranium 235+D	pCi/g	721	721	1.331E−01	99%	1.427E−01	99%
Agricultural−F	Uranium 235+D	pCi/g	517	517	1.356E−01	101%	1.467E−01	102%
Residential−F	Uranium 235+D	pCi/g	204	204	1.268E−01	94%	1.457E−01	101%
Ia/Ib	Uranium 238+D	pCi/g	521	689	3.107E+00		3.297E+00	
Open−C	Uranium 238+D	pCi/g	512	680	3.063E+00	99%	3.253E+00	99%
Agricultural−F	Uranium 238+D	pCi/g	364	503	3.117E+00	100%	3.341E+00	101%
Residential−F	Uranium 238+D	pCi/g	148	177	2.910E+00	94%	3.271E+00	99%
Ia/Ib	Zinc	mg/kg	112	676	5.664E+01		5.890E+01	
Open−C	Zinc	mg/kg	94	659	5.619E+01	99%	5.849E+01	99%
Agricultural−F	Zinc	mg/kg	57	482	5.445E+01	96%	5.676E+01	96%
Residential−F	Zinc	mg/kg	37	177	6.093E+01	108%	6.675E+01	113%

Ia/Ib – exposure point concentrations, mean and UCL, estimated using all samples collected within Segment 9
EPC – exposure point concentration
C– current
F – future

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ORNL BEIA

Toxicity Profiles

for Metals

TOXICITY SUMMARY FOR ANTIMONY

December, 1991

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EXECUTIVE SUMMARY

Antimony (Sb) is a naturally occurring metal that is used in various manufacturing processes. It exists in valence states of 3 and 5 (Budavari, 1989; ATSDR, 1990). Antimony is a common urban air pollutant (Beliles, 1979). Exposure to antimony may be via inhalation, oral and dermal routes (ATSDR, 1990).

Antimony is sparingly absorbed following ingestion or inhalation (Felicetti et al., 1974a; Gerber et al., 1982; ATSDR, 1990). Both gastrointestinal and pulmonary absorption are a function of compound solubility. Antimony is transported in the blood, its distribution varying among species and dependent on its valence state (Felicetti et al., 1974b). Antimony is not metabolized but may bind to macromolecules and react covalently with sulfhydryl and phosphate groups (ATSDR, 1990). Excretion of antimony is primarily via the urine and feces, and is also dependent upon valence state (Cooper et al., 1968; Ludersdorf et al., 1987; ATSDR, 1990).

Acute oral exposure of humans and animals to high doses of antimony or antimony-containing compounds (antimonials) may cause gastrointestinal disorders (vomiting, diarrhea), respiratory difficulties, and death at extremely high doses (Bradley and Frederick, 1941; Beliles, 1979; ATSDR, 1990). Subchronic and chronic oral exposure may affect hematologic parameters (ATSDR, 1990). Long-term exposure to high doses of antimony or antimonials has been shown to adversely affect longevity in animals (Schroeder et al., 1970). Limited data suggest that prenatal and postnatal exposure of rats to antimony interferes with vasomotor responses (Marmo et al., 1987; Rossi et al., 1987).

Acute inhalation exposure of humans may cause gastrointestinal disorders (probably due to ingestion of airborne antimony) (ATSDR, 1990). Exposure of animals to high concentrations of antimony and antimonials (especially stibine gas) may result in pulmonary edema and death (Price et al., 1979). Long-term occupational exposure of humans has resulted in electrocardiac disorders, respiratory disorders, and possibly increased mortality (Renes, 1953; Breiger et al., 1954). Antimony levels for these occupational exposure evaluations ranged from 2.2 to 11.98 mg Sb/m^3. Based on limited data, occupational exposure of women to metallic antimony and several antimonials has reportedly caused alterations in the menstrual cycle and an increased incidence of spontaneous abortions (Belyaeva, 1967). Reproductive dysfunction has been demonstrated in rats exposed to antimony trioxide (Belyaeva, 1967).

No data were available indicating that dermal exposure of humans to antimony or its compounds results in adverse effects. However dermal application of high doses of antimony oxide (1,584 mg Sb/kg) resulted in the death of rabbits within one day (IBTL, 1972). Eye irritation due to exposure to stibine gas and several antimony oxides has been reported for humans (Stevenson, 1965; Potkonjak and Pavlovich, 1983).

The U. S. EPA (U.S. EPA, 1991b) has calculated subchronic and chronic oral reference doses (RfDs) of 4E-4 mg/kg/day based on decreased longevity and alteration of blood chemistry in rats chronically exposed to potassium antimony tartrate in the drinking water (5 ppm equivalent to 0.35 mg Sb/kg/day). An uncertainty factor of 1,000 was applied: 10 for extrapolation from a lowest-observed-adverse-effect-level (LOAEL) to a no-observed-adverse-effect-level (NOAEL), 10 for extrapolation from animal data, and 10 for protection of sensitive populations.

The primary target organ for acute oral exposure to antimony appears to be the gastrointestinal tract (irritation, diarrhea, vomiting) and targets for long-term exposure are the blood (hematological disorders) and liver (mild hepatotoxicity) (ATSDR, 1990). Inhalation exposure to antimony affects the respiratory tract (pneumoconiosis, restrictive airway disorders), with secondary targets being the cardiovascular system (altered blood pressure and electrocardiograms) and kidneys (histological changes) (Renes, 1953; Breiger et al., 1954). Only limited evidence exists for reproductive disorders due to antimony exposure (Belyaeva, 1967).

Although some data indicate that long-term exposure of rats to antimony trioxide and trisulfide increased the incidence of lung tumors (Wong et al., 1979; Watt, 1980; Groth et al., 1986; Bio/dynamics, 1989), the U.S. EPA has not evaluated antimony or antimonials for carcinogenicity and a Weight-of-Evidence classification is currently unavailable.

1. INTRODUCTION

Antimony (CAS No. 7440-36-8) is a naturally occurring metalloid element (displaying both metallic and nonmetallic properties) existing in valence states of 3 and 5 (Budavari, 1989; ATSDR, 1990). Metallic antimony and a few trivalent antimony compounds are the most significant regarding exposure potential and toxicity (ATSDR, 1990). Antimony (Sb) is used in metallurgical processes, paints and enamels, various textiles, rubber, and fire retardation (antimony trioxide). Antimony is a common urban air pollutant, occurring at an average concentration of 0.001 $\mu g/m^3$ (Beliles, 1979). Exposure to antimony may occur via inhalation and by ingestion of contaminated food. Some antimonials such as potassium antimony tartrate have been used medicinally as parasiticides (Beliles, 1979).

2. METABOLISM AND DISPOSITION

2.1. ABSORPTION

Antimony is only slowly absorbed from the gastrointestinal tract. Based on animal data, gastrointestinal absorption of antimony was estimated to be 2 to 7% (Felicetti et al., 1974a; Gerber et al., 1982). The specific chemical form will determine the absorption efficiency of ingested antimony. Antimony has been detected in the blood of occupationally exposed individuals, but it is uncertain if this was due solely to pulmonary absorption or also to ingestion following mucociliary transport from the upper respiratory tract (ATSDR, 1990). Alveolar deposition and subsequent absorption of small particle-size antimony or antimony compounds is likely, with absorption also being a function of compound solubility. Sunagawa (1981) and Ainsworth (1988) provided data showing a lack of a dose-response relationship for absorption, and that antimony levels in lungs and livers of rodents reached a plateau, thereby suggesting that antimony absorption by tissues may be a saturable process. Studies with rabbits exposed to antimony trioxide or pentoxide provided evidence for dermal absorption of these forms of antimony (IBTL, 1972; Myers et al., 1978).

2.2. DISTRIBUTION

Antimony is transported in the blood, its partitioning between erythrocytes and plasma being a function of the valence state of the element. Exposure to trivalent antimony resulted in higher antimony levels in erythrocytes than in the plasma while exposure to pentavalent antimony resulted in a reversal of this partitioning (Felicetti et al., 1974b). However, the distribution of parenterally administered antimony is highly variable among species, and can not be accounted for solely by valence state (Felicetti et al., 1974b; Beliles, 1979). Antimony has been detected in the liver and spleen (more so for pentavalent forms), and the thyroid gland (trivalent forms) (Beliles, 1979). Felicetti et al. (1974a,b) also reported accumulation of antimony in the skeletal system and in fur.

2.3. METABOLISM

Like other metallic elements, antimony is not subject to catabolism. Its metabolic transformations are limited to binding with macromolecules, and covalent interactions with sulfhydryl groups and phosphates. There is no definitive data regarding the interconversion of valence states of antimony (ATSDR, 1990).

2.4. EXCRETION

Animal and human data are available indicating both urinary and fecal excretion of antimony (ATSDR, 1990). Workers exposed to antimony trioxide had increased urinary levels of antimony (Cooper et al., 1968; Ludersdorf et al., 1987). Urinary excretion of antimony was documented for workers exposed to antimony fumes (Renes, 1953; Breiger et al., 1954). Fecal excretion of antimony following ingestion of antimonials represents primarily unabsorbed antimony. However, there is evidence suggesting that the valence state of antimony may affect the excretory route. Parenteral administration experiments with animals and humans have indicated that trivalent antimony is excreted primarily in the urine while pentavalent antimony is excreted in the feces (Felicetti et al., 1974b; Edel et al., 1983). Whole-body clearance of trivalent antimony tartrate is biphasic with 90% of the body burden being excreted within 24 hours, and the slower phase having a half-life of 16 days (Felicetti et al., 1974b). Urinary antimony levels in a human subject remained above normal (1 μg/g creatinine) for one week following a single oral dose (amount unknown) of antimony trisulfate (Bailly et al., 1991). This same study also documented biliary excretion and enterohepatic circulation of parenterally administered antimony in rats.

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

Acute poisoning has occurred as the result of accidental or suicidal ingestion of antimonials (Beliles, 1979) with death ensuing within several hours. Symptoms of severe antimony poisoning include vomiting, watery diarrhea, collapse, irregular respiration, and hypothermia. A single dose of potassium antimony tartrate (equivalent to 0.53 mg Sb/kg) produced vomiting (Dunn, 1928).

3.1.1.2. Animal

Toxic effects ranging from gastrointestinal disorders to death have been documented for animals following acute oral exposure to antimonials. Bradley and Frederick (1941) reported that a single dose (300 mg Sb/kg) of the organic antimonial, potassium antimony tartrate, induced myocardial infarction and death in rats. However, several studies using inorganic antimonials (metallic antimony, antimony oxide, or antimony trioxide) reported that doses as high as 27,410 mg Sb/kg were not fatal to rats (ATSDR, 1990).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

No information was available regarding the toxic effects of subchronic oral exposure of humans to antimony or antimonials.

3.1.2.2. Animal

Several studies have described the systemic subchronic toxicity of antimony and antimonials in animals and are summarized in ATSDR (1990) and U.S. EPA (1980). Subchronic (24-week) exposure of rats to metallic antimony at doses of 500 to 1,000 mg/kg/day decreased plasma protein levels, hemoglobin levels, and hematocrit (Sungawa, 1981; Hiraoka, 1986). Sungawa (1981) also reported mild hepatotoxicity in rats receiving 418 mg Sb/kg/day (as antimony trioxide) or 500 mg Sb/kg/day (as metallic antimony). A decrease in red blood cell count was reported by Sungawa (1981) for rats given 418 mg Sb/kg/day (as antimony trioxide) for 24 weeks, and an increase reported by Smyth and Thompson (1945) in rats treated with same compound at a dose of 894 mg Sb/kg/day for 30 days. Fleming (1982) reported that dogs receiving antimony trioxide (6,644 mg Sb/kg/day) for 32 days exhibited severe weight loss, vomiting, and muscle weakness and dyskinesia of the hind limbs. A lower dose (84 mg Sb/kg/day) produced severe diarrhea. Using data from Fleming (1982), ATSDR (1990) reported a no-observed-adverse-effect-level (NOAEL) of 501 mg Sb/kg for rats receiving the compound for 20 days. Exposure of CD-1 mice to potassium antimony tartrate in the drinking water (5 ppm for 540 days) significantly reduced the lifespan of both males and females (Kanisawa and Schroeder, 1969).

3.1.3. Chronic Toxicity

3.1.3.1. Human

No information was available regarding the chronic toxicity of antimony in humans.

3.1.3.1. Animal

Schroeder et al. (1970) showed an increase in serum cholesterol and a decrease in fasting glucose levels for rats receiving a lifetime exposure to potassium antimony tartrate (746 mg Sb/kg) in drinking water. However, the biological significance of these findings is not certain (ATSDR, 1990). This same study also provided data showing that long-term exposure of rats to potassium antimony tartrate in the drinking water (0.262 mg Sb/kg/day equivalent to 2 ppm in drinking water)
resulted in decreased lifespan.

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

No information was available regarding the developmental or reproductive toxicity of antimony in humans.

3.1.4.1. Animal

The effect of prenatal and postnatal exposure of rats (gestation day one to postnatal day 60) to antimony trichloride indicated that drinking water levels as low as 0.1 mg% produced alterations in vasomotor responses (Marmo et al., 1987; Rossi et al., 1987). The same effect was observed for exposure throughout lactation to postnatal day 60. Although the antimony trichloride exposure affected vasomotor responses during the postnatal developmental period, the design of these studies did not allow for definitive conclusions regarding the prenatal developmental toxicity of the compound.

3.1.5. Reference Dose

3.1.5.1. Subchronic

ORAL RfD_s:	9E-4 mg/kg/day (potassium antimony tartrate)
	4E-4 mg/kg/day (antimony tetroxide, antimony trioxide)
	5E-4 mg/kg/day (antimony pentoxide)
UNCERTAINTY FACTOR:	1000
NOAEL: None	

3.1.5.2. Chronic

ORAL RfD_c:	9E-4 mg/kg/day (potassium antimony tartrate)
	4E-4 mg/kg/day (antimony tetroxide, antimony trioxide)
	5E-4 mg/kg/day (antimony pentoxide)
UNCERTAINTY FACTOR:	1000
MODIFYING FACTOR:	1
NOAEL: None	
LOAEL:	0.35 mg/kg/day

CONFIDENCE:

Study:	Low
Data base:	Low
RfD:	Low

VERIFICATION DATE: 11/06/85

PRINCIPAL STUDY: Schroeder et al., 1970

COMMENTS: Based on decreased longevity and altered blood chemistry values in rats chronically exposed to 5 ppm potassium antimony tartrate in drinking water. An uncertainty factor of 1,000 was applied to account for extrapolation from animal data (10), use of a LOAEL (10), and for protection of sensitive populations (10). The values for all of the compounds were calculated based on elemental equivalent weight of antimony (U.S. EPA, 1991a).

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

Inhalation of antimony dust by factory workers produced gastrointestinal irritation, probably the result of antimony dust transported via the mucociliary escalator (ATSDR, 1990). However, no information regarding the acute inhalation toxicity of antimony was available.

3.2.1.2. Animal

Exposure of rats and guinea pigs to stibine gas (SbH_3) at a concentration of 1,395 mg Sb/m^3 for 30 minutes resulted in pulmonary edema and death (Price et al., 1979). At 799 mg Sb/m^3, the guinea pigs and rats exhibited only renal tubular dilation.

3.2.2. Subchronic Toxicity

3.2.2.1. Human

Several occupational exposure studies have been conducted that evaluated the effects of subchronic exposure of smelter workers to antimony fumes. Renes (1953) reported that < 5 month exposures to antimony fumes at concentrations ranging from 4.69 to 11.82 mg/m^3 produced various conditions (rhinitis, dermatitis, laryngitis, bronchitis, pneumonitis, conjunctivitis, and septal perforations) the severity of which increased with increasing duration of exposure. These workers, however, were also exposed to low concentrations of arsenic (0.39 to 1.10 mg/m^3). The effects of occupational exposure to antimony trioxide (0.58 to 5.5 mg/m^3) for periods of 8 months to 2 years were reported by Breiger et al. (1954). Eight of the employees died during this period but only one death had occurred in the 16 years prior to the use of antimony. Additionally, abnormal electrocardiograms were detected in 37 of 75 workers and some workers also exhibited elevated blood pressure. The findings of this study are compromised by concurrent exposure to phenol formaldehyde resin. However, the investigators noted that no additional deaths occurred and the incidence of electrocardiac anomalies decreased following cessation of antimony use.

3.2.2.2. Animal

Gross et al. (1952) reported that inhalation exposure of rats to antimony trioxide for up to 14 months resulted in lipoid pneumonia. Myocardial damage and alteration of electrocardiograms were observed for rats and rabbits exposed for six weeks to antimony trisulfide dust at concentrations of 2.20 and 4.02 mg Sb/m^3, respectively (Brieger et al., 1954). This same study also noted similar effects in dogs exposed for 10 weeks to antimony trisulfide (3.98 mg Sb/m^3). Thirteen-week exposure of rats to antimony trioxide (0.92 mg Sb/m^3) resulted in nonreversible proliferation of alveolar macrophages (Bio/dynamics, 1989). Several studies reviewed in ATSDR (1990) reported interstitial fibrosis in rats exposed for 12 to 14.5 months to antimony trisulfide or antimony trioxide at concentrations ranging from 1.6 to 83.6 mg Sb/m^3.

3.2.3. Chronic Toxicity

3.2.3.1. Human

Occupational exposure to antimony trioxide and/or antimony pentoxide dust (9 to 31 years) resulted in respiratory effects including pneumoconiosis, chronic bronchitis, chronic emphysema, pleural adhesions, and obstructive pulmonary effects (Cooper et al., 1968; Potkonjak and Pavlovich, 1983). The pneumoconiosis was characterized by chronic coughing, wheezing, and upper airway irritation. Shorter-term occupational exposures (Renes, 1953; Brieger et al., 1954) are described in Section 3.2.2.1.

3.2.3.2. Animal

No information regarding the chronic toxicity of antimony or antimony-containing compounds was available, although animal studies employing long-term exposures (12 to 14.5 months) examined the effects of several antimony-containing compounds (see Section 3.2.2.2).

3.2.4. Developmental and Reproductive Toxicity

3.2.4.1. Humans

In a report lacking in detail, Belyaeva (1967) noted an increased incidence of spontaneous abortions and disturbances in the menstrual cycle of women occupationally exposed to airborne metallic antimony, antimony trioxide, and antimony pentasulfide.

3.2.4.2. Animal

Belyaeva (1967) reported a decrease in the number of offspring for rats exposed to antimony trioxide (209 mg Sb/m^3) prior to mating and throughout gestation. Exposure to this concentration prior to mating resulted in a 67% failure in conception. Metaplasia in the uterus and disturbances in ovum maturation were detected in the animals that did not conceive.

3.2.5. Reference Concentration

Reference concentrations are currently unavailable.

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

3.3.1.1. Human

No dermatologic or systemic effects were noted for human subjects having induction patches containing antimony trioxide in place for 24 hours (IBTL, 1972).

3.3.1.2. Animal

Dermal application of antimony oxide (1,584 mg Sb/kg) resulted in the death of rabbits within one day (IBTL, 1972) and dermal application of antimony trioxide (6,686 Sb mg/kg) was also fatal to rabbits within one day (Myers et al., 1978).

Ocular application of antimony oxide or antimony thioantimonate (79 to 100 mg Sb) to rabbits resulted in eye irritation (Horton et al., 1986; IBTL, 1972; WRL, 1979) but similar application of antimony trioxide (34.5 to 83.6 mg Sb) did not produce irritation (Gross et al., 1955; Myers et al., 1978).

Exposure of rats and guinea pigs to stibine gas (Price et al., 1979) or antimony trioxide (Bio/dynamics, 1985; 1989) caused eye irritation. It is likely that this effect was due to direct contact to airborne compounds rather than an inhalation-mediated toxicity.

3.3.2. Subchronic Toxicity

3.3.2.1. Human

Occupational exposure to airborne antimony or antimony trioxide has resulted in dermatitis (epidermal cellular necrosis with inflammatory cellular reactions) and ocular irritation (ocular conjunctivitis), the effects being more pronounced in higher temperature environments (Stevenson, 1965; Potkonjak and Pavlovich, 1983).

3.3.2.2. Animal

Thirteen-week dermal exposure of rabbits to a 5% solution of a mixture of antimony trisulfide and antimony pentasulfide did not produce significant signs of toxicity (Horton et al., 1986).

3.3.3. Chronic Toxicity

No human or animal data were available regarding the chronic toxicity of antimony by other exposure routes.

3.3.4. Developmental Toxicity

No human or animal data were available regarding the developmental/reproductive toxicity of antimony by other exposure routes.

3.4. TARGET ORGANS/CRITICAL EFFECTS

3.4.1. Oral Exposures

3.4.1.1. Primary Target(s)

1. Gastrointestinal tract: The gastrointestinal tract appears to be the primary target for acute and long-term oral exposure to antimony and antimonials. Effects are characterized by irritation resulting in vomiting and diarrhea. These effects have been documented for both humans and animals.

3.4.1.2. Other Target(s)

1. Cardiovascular system: Data are available suggesting that oral exposure to antimony or antimonials may affect the cardiovascular system resulting in a decreased hypotensive response.

2. Blood: Animal data are available showing mild hematologic effects although the biological significance of these effects is uncertain.

3. Liver: Limited data in animals have shown mild hepatotoxicity following oral exposure to antimony and antimonials.

4. Developmental toxicity is suggested by animal data showing that prenatal/postnatal exposure to antimony may affect cardiovascular functions.

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target(s)

1. Respiratory tract: The respiratory tract is the primary target for toxicity of inhaled antimony and antimonials following acute, subchronic, and chronic exposure. Both human and animal data have demonstrated various forms of restrictive airway diseases including pneumoconiosis, bronchitis, emphysema, pulmonary edema, and varying degrees of irritation and inflammation.

3.4.2.2. Other Target(s)

1.Cardiovascular system: Cardiovascular effects (alterations in blood pressure and electrocardiograms) have been documented in humans exposed to antimony and antimonials. Similar effects have also been verified using several animals species.

2. Kidney: Renal toxicity (histological changes) has been observed for animals exposed to stibine gas and various antimony oxides and sulfides.

3. Reproductive tract: Limited data are available indicating adverse effects on the reproductive system of women occupationally exposed to antimony. One study in rats has also shown reproductive/developmental toxicity of antimony.

4. CARCINOGENICITY

4.1. ORAL EXPOSURE

4.1.1. Human

No information was available regarding the carcinogenicity of antimony in humans.

4.1.2. Animal

No definitive data were available regarding the carcinogenicity of antimony in animals. Although evidence for an increased incidence of cancer was not observed for rats and mice fed potassium antimony tartrate (0.262 and 0.35 mg Sb/kg/day, respectively), the maximum tolerated dose was not used (Schroeder, 1968; Kanisawa and Schroeder, 1969; Schroeder, 1970).

4.2. Inhalation Exposure

4.2.1. Human

Evidence of increased incidence of cancer was not detected in workers exposed to antimony oxide for 9 to 31 years (Potkonjak and Pavlovich, 1983).

4.2.2. Animal

Lung tumor incidence was increased for rats exposed for one year to 4.2 or 36 mg Sb/m^3 as antimony trioxide (Wong et al., 1979; Watt, 1980; Groth et al., 1986) or 17.48 mg Sb/m^3 as antimony trisulfide (Wong et al., 1979; Groth et al., 1986). An increased incidence of lung tumors was also reported by Bio/dynamics (1989) for rats exposed to antimony trioxide (3.76 mg Sb/m^3) and by Watt (1983) for pigs exposed to the same compound at a concentration of 4.2 mg Sb/m^3.

4.3. OTHER ROUTES OF EXPOSURE

No data were available regarding the potential carcinogenicity of antimony and antimonials by other routes of exposure.

4.4. EPA WEIGHT-OF-EVIDENCE CLASSIFICATION

The U.S. EPA has not evaluated antimony regarding its potential carcinogenicity and, therefore, a Weight-of-Evidence classification has not been assigned (U.S. EPA, 1991).

4.5. CARCINOGENICITY SLOPE FACTORS

None have been calculated.

5. REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1990. Antimony. ATSDR/U.S. Public Health Service, DRAFT.

Ainsworth, N. 1988. Distribution and biological effects of antimony in contaminated grassland. Dissertation. (Cited in ATSDR, 1990)

Bailly, R., R. Lauwerys, J. P. Buchet, P. Mahieu and J. Konings. 1991. Experimental and human studies on antimony metabolism: their relevance for the biological monitoring of workers exposed to inorganic antimony. Brit. J. Indust. Med. 48:93-97.

Beliles, R. P. 1979. The lesser metals. In Oehme, F. W., Ed., Toxicity of heavy metals in the environment, Marcel Dekker, New York, pp. 547-615.

Belyaeva, A. P. 1967. The effect of antimony on reproduction. Gig. Truda. Prof. Zabol. 11:32. (Cited in ATSDR, 1990)

Bio/dynamics. 1985. A three month inhalation toxicity study of antimony trioxide in the rat followed by a recovery period. Prepared by Bio/dynamics, Inc. E. Millstone, NJ for the Antimony Oxide Industry Assoc., Washington, D.C. (Cited in ATSDR, 1990)

Bio/dynamics. 1989. A one-year inhalation toxicity study of antimony trioxide in the rat (with a one year recovery period)- month 18 interim report. Prepared by Bio/dynamics, Inc., E. Millstone, NJ for the Antimony Oxide Industry Assoc., Washington, D.C. (Cited in ATSDR, 1990)

Bradley, W.R. and W. G. Frederick. 1941. The toxicity of antimony - animal studies. Ind. Med. 10:15-22. (Cited in ATSDR, 1990)

Breiger, H., C. W. Semisch, J. Stasney and D.A. Piatnek. 1954. Industrial antimony poisoning. Indust. Med. Health 23:521-523. (Cited in ATSDR, 1990)

Budavari, S. ed. 1989. The Merck Index. An Encyclopedia of Chemicals, Drugs, and Biologicals. 11th Ed. Merck and Co., Rahway, NJ. p. 110.

Cooper, D.A., E. P. Pendergrass, A. J. Vorwald, et al. 1968. Pneumoconiosis among workers in an antimony industry. Am. J. Roentgenol. Rad. Ther. Nuclear Med. 103:495-508. (Cited in ATSDR, 1990)

Dunn, J. T. 1928. A curious case of antimony poisoning. Analyst 531:532-533. (Cited in ATSDR, 1990)

Felicetti, S. W., R. G. Thomas and R. O. McCLellan. 1974a. Retention of inhaled antimony-124 in the beagle dog as a function of temperature of aerosol formation. Health Phys. 26:525-531.

Felicetti, S. W., R. G. Thomas and R. O. McClellan. 1974b. Metabolism of two valence states of inhaled antimony in hamsters. Am. Ind. Hyg. Assoc. J. 355:292-300. (Cited in ATSDR, 1990)

Fleming, A. J. 1982. The toxicity of antimony trioxide. Sponsored by E. I. DuPont de Nemours and Co., Wilmington, DE. OTS215027. (Cited in ATSDR, 1990)

Gerber, G. B., J. Maes and B. Eykens. 1982. Transfer of antimony and arsenic to the developing organism. Arch. Toxicol. 49:159-168.

Gross, P., J. H. U. Brown, and T. F. Hatch. 1952. Experimental endogenous lipoid pneumonia. Am. J. Pathol. 28:211-221. (Cited in ATSDR, 1990)

Gross, P., J. H. U. Brown, M. L. Westrick, et al. 1955. Toxicological study of calcium halophosphate phosphers and antimony trioxide. I. Acute and chronic toxicity and some pharmacologic aspects. Arch. Ind. Health 11:473-478. (Cited in ATSDR, 1990)

Groth, D. H., L. E. Stettler, J. R. Burg, et al. 1986. Carcinogenic effects of antimony trioxide and antimony ore concentrate in rats. J. Toxicol. Environ. Health. 18:607-626. (Cited in ATSDR, 1990)

Hiraoka, N. 1986. The toxicity and organ-distribution of antimony after chronic administration to rats. J. Kyoto Prefect. Univ. Med. 95:997-1017. (Cited in ATSDR, 1990)

Horton J. R., Gawroski, C. L., Newton, P. E., et al. 1986. Evaluation of the acute toxicity, irritation, sensitization, and subchronic dermal toxicity of antimony thioantimonate lubricant. NTIS/AD-A166 873/0/ (Cited in ATSDR, 1990)

IBTL (Industrial Biotest Laboratories). 1972. Acute toxicity with antimony oxide. OTS206223. (Cited in ATSDR, 1990)

Kanisawa, M. and H. A. Schroeder. 1969. Life term studies on the effects of trace elements on spontaneous tumors in mice and rats. Cancer Res. 29:892-895. (Cited in ATSDR, 1990)

Ludersdorf, R., A. Fuchs, P. Mayer et al. 1987. Biological assessment of exposure to antimony and lead in the glass-producing industry. Int. Arch. Occup. Environ. Health 59:469-474. (Cited in ATSDR, 1990)

Marmo, E., M. G. Matera, R. Acampora, et al. 1987. Prenatal and postnatal metal exposure: effect on vasomotor reactivity development of pups. Cur. Ther, Res. 42:823-838.

Myers, R. C., E. R. Homan, C. S. Well, et al. 1978. Antimony trioxide range-finding toxicity studies. Carnegie-Mellon Inst. of Res, carnegie-Mellon Univ., Pittsburgh, PA. OTS206062. (Cited in ATSDR, 1990)

Potkonjak, V. and M. Pavlovich. 1983. Antimoniosis: A particular form of pneumoconiosis. I. Etiology, clinical and x-ray findings. Int. Arch. Occup. Environ. Health 51:199-207. (Cited in ATSDR, 1990)

Price, N. H., W. G. Yates and S. D. Allen. 1979. Toxicity evaluation for establishing IDLH values. National Institute for Occupational Safety and Health, Cincinnati, OH. PB87-229498. (Cited in ATSDR, 1990)

Renes, L. E. 1953. Antimony poisoning in industry. Arch. Ind. Hyg. 7:99-108.

Rossi, F., R. Acampora, C. Vacca, et al. 1987. Prenatal and postnatal antimony exposure in rats: effect on vasomotor reactivity development of pups. Teratogen. Carcinogen. Mutagen. 7:491-496.

Schroeder, H. A., M. Mitchener, J. J. Balassa, et al. 1968. Zirconium, niobium, antimony and fluorine in mice: Effects on growth, survival and tissue levels. Nutr. 95:95-101.

Schroeder, H. A., M. Mitchener and A. P. Nason. 1970. Zirconium, niobium, antimony, vanadium and lead in rats: Life-time studies. J. Nutr. 100:59-68.

Smyth, H.F., Jr. and W. L. Thompson. 1945. The single dose and subacute-toxicity of antimony oxide (Sb_2O_3). Mellon Inst. of Indust. Res., Univ. of Pittsburgh. OTS206062. (Cited in ATSDR, 1990)

Stevenson, C. J. 1965. Antimony spots. Trans. St. John's Hospital Dermat. Soc. 51:40-42. (Cited in ATSDR, 1990)

Sunagawa, S. 1981. Experimental studies on antimony poisoning. Igaku Kenkyu 51:129-142. (Cited in ATSDR, 1990)

U.S. EPA. 1980. Ambient water quality criteria document for antimony. EPA-440/5-80-020.

U.S. EPA. 1991. Health Effects Summary Tables, FY-1991 Annual. Office of Research and Development, Office of Emergency and Remedial Response, Washington, D.C. OERR 9200.6-303(91-1).

Watt, W.D. 1980. Chronic inhalation toxicity of antimony trioxide: validation for the TLV - ,progress report-summary of results. OTS206195. (Cited in ATSDR, 1990)

WRL (Wil Research Laboratories). 1979. Acute eye irritation study in rabbits with antimony oxide. PPG Indust., Inc., Pittsburgh, PA. (Cited in ATSDR, 1990)

Wong, L. C. K., J. M. Winston, J. Hagensen, et al. 1979. Study of carcinogenicity and toxicity of inhaled antimony trioxide, antimony ore concentrate and thallic oxide in rats. NIOSH/U.S. Dept. Health. OTS0511065. (Cited in ATSDR, 1990)

TOXICITY SUMMARY
for
INORGANIC ARSENIC

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OAK RIDGE RESERVATION ENVIRONMENTAL
RESTORATION PROGRAM

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EXECUTIVE SUMMARY

The toxicity of inorganic arsenic (As) depends on its valence state (-3, +3, or +5), and also on the physical and chemical properties of the compound in which it occurs. Trivalent (As^{+3}) compounds are generally more toxic than pentavalent (As^{+5}) compounds, and the more water soluble compounds are usually more toxic and more likely to have systemic effects than the less soluble compounds, which are more likely to cause chronic pulmonary effects if inhaled. One of the most toxic inorganic arsenic compounds is arsine gas (AsH_3). It should be noted that laboratory animals are generally less sensitive than humans to the toxic effects of inorganic arsenic. In addition, in rodents the critical effects appear to be immunosuppression and hepato-renal dysfunction, whereas in humans the skin, vascular system, and peripheral nervous system are the primary target organs.

Water soluble inorganic arsenic compounds are absorbed through the G.I. tract (>90%) and lungs; distributed primarily to the liver, kidney, lung, spleen, aorta, and skin; and excreted mainly in the urine at rates as high as 80% in 61 hr following oral dosing (U.S. EPA, 1984; ATSDR, 1989; Crecelius, 1977). Pentavalent arsenic is reduced to the trivalent form and then methylated in the liver to less toxic methylarsinic acids (ATSDR, 1989).

Symptoms of acute inorganic arsenic poisoning in humans are nausea, anorexia, vomiting, epigastric and abdominal pain, and diarrhea. Dermatitis (exfoliative erythroderma), muscle cramps, cardiac abnormalities, hepatotoxicity, bone marrow suppression and hematologic abnormalities (anemia), vascular lesions, and peripheral neuropathy (motor dysfunction, paresthesia) have also been reported (U.S. Air Force, 1990; ATSDR, 1989; Franzblau and Lilis, 1989; U.S. EPA, 1984; Armstrong et al., 1984; Hayes, 1982; Mizuta et al., 1956). Oral doses as low as 20-60 μg/kg/day have been reported to cause toxic effects in some individuals (ATSDR, 1989). Severe exposures can result in acute encephalopathy, congestive heart failure, stupor, convulsions, paralysis, coma, and death. The acute lethal dose to humans has been estimated to be about 0.6 mg/kg/day (ATSDR, 1989). General symptoms of chronic arsenic poisoning in humans are weakness, general debility and lassitude, loss of appetite and energy, loss of hair, hoarseness of voice, loss of weight, and mental disorders (Hindmarsh and McCurdy, 1986). Primary target organs are the skin (hyperpigmentation and hyperkeratosis) [Terada et al. 1960; Tseng et al., 1968; Zaldivar 1974; Cebrian et al., 1983; Huang et al., 1985], nervous system (peripheral neuropathy) [Hindmarsh et al., 1977, 1986; Valentine et al., 1982; Heyman et al., 1956; Mizuta et al., 1956; Tay and Seah, 1975], and vascular system [Tseng et al., 1968; Borgano and Greiber, 1972; Salcedo et al., 1984; Wu et al., 1989; Hansen, 1990]. Anemia, leukopenia, hepatomegaly, and portal hypertension have also been reported (Terada et al., 1960; Viallet et al., 1972; Morris et al., 1974; Datta, 1976). In addition, possible reproductive effects include a high male to female birth ratio (Lyster, 1977).

In animals, acute oral exposures can cause gastrointestinal and neurological effects (Heywood and Sortwell, 1979). Oral LD_{50} values range from about 10 to 300 mg/kg (ASTDR, 1989; U.S. Air Force, 1990). Low subchronic doses can result in immunosuppression, (Blakely et al., 1980) and hepato-renal effects (Mahaffey et al., 1981; Brown et al., 1976; Woods and Fowler, 1977, 1978; Fowler and Woods, 1979; Fowler et al., 1979). Chronic exposures have also resulted in mild hyperkeratosis and bile duct enlargement with hyperplasia, focal necrosis, and fibrosis (Baroni et al., 1963; Byron et al., 1967). Reduction in litter size, high male/female birth ratios, and fetotoxicity without significant fetal abnormalities occur following oral exposures

(Schroeder and Mitchener, 1971; Hood et al., 1977; Baxley et al., 1981); however, parenteral dosing has resulted in exencephaly, encephaloceles, skeletal defects, and urogenital system abnormalities (Ferm and Carpenter, 1968; Hood and Bishop, 1972; Beaudoin, 1974; Burk and Beandoin, 1977).

The Reference Dose for chronic oral exposures, 0.0003 mg/kg/day, is based on a NOAEL of 0.0008 mg/kg/day and a LOAEL of 0.014 mg/kg/day for hyperpigmentation, keratosis, and possible vascular complications in a human population consuming arsenic-contaminated drinking water (U.S. EPA, 1991a). Because of uncertainties in the data, U.S. EPA (1991a) states that "strong scientific arguments can be made for various values within a factor of 2 or 3 of the currently recommended RfD value." The subchronic Reference Dose is the same as the chronic RfD, 0.0003 mg/kg/day (U.S. EPA, 1992).

Acute inhalation exposures to inorganic arsenic can damage mucous membranes, cause rhinitis, pharyngitis and laryngitis, and result in nasal septum perforation (U.S. EPA, 1984). Chronic inhalation exposures, as occurring in the workplace, can lead to rhino-pharyno-laryngitis, tracheobronchitis, (Lundgren, 1954); dermatitis, hyperpigmentation, and hyperkeratosis (Perry et al., 1948; Pinto and McGill, 1955); leukopenia (Kyle and Pease, 1965; Hine et al., 1977); peripheral nerve dysfunction as indicated by abnormal nerve conduction velocities (Feldman et al., 1979; Blom et al., 1985; Landau et al., 1977); and peripheral vascular disorders as indicated by Raynaud's syndrome and increased vasospastic reactivity in fingers exposed to low temperatures (Lagerkvist et al., 1986). Higher rates of cardiovascular disease have also been reported in some arsenic-exposed workers (Lee and Fraumeni, 1969; Axelson et al., 1978; Wingren and Axelson, 1985). Possible reproductive effects include a high frequency of spontaneous abortions and reduced birth weights (Nordström et al., 1978a,b). Arsine gas (AsH_3), at concentrations as low as 3-10 ppm for several hours, can cause toxic effects. Hemolysis, hemoglobinuria, jaundice, hemolytic anemia, and necrosis of the renal tubules have been reported in exposed workers (ACGIH, 1986; Fowler and Weissberg, 1974).

Animal studies have shown that inorganic arsenic, by intratracheal instillation, can cause pulmonary inflammation and hyperplasia (Webb et al., 1986, 1987), lung lesions (Pershagen et al., 1982), and immunosuppression (Hatch et al. (1985). Long-term inhalation exposures have resulted in altered conditioned reflexes and CNS damage (Rozenshstein, 1970). Reductions in fetal weight and in the number of live fetuses, and increases in fetal abnormalities due to retarded osteogenesis have been observed following inhalation exposures (Nagymajtenyi et al., 1985).

Subchronic and chronic RfCs for inorganic arsenic have not been derived.

Epidemiological studies have revealed an association between arsenic concentrations in drinking water and increased incidences of skin cancers (including squamous cell carcinomas and multiple basal cell carcinomas), as well as cancers of the liver, bladder, respiratory and gastrointestinal tracts (U.S. EPA, 1987; IARC, 1987; Sommers et al., 1953; Reymann et al., 1978; Dobson et al., 1965; Chen et al., 1985, 1986). Occupational exposure studies have shown a clear correlation between exposure to arsenic and lung cancer mortality (IARC, 1987; U.S. EPA, 1991a). U.S. EPA (1991a) has placed inorganic arsenic in weight-of-evidence group A, human carcinogen. A drinking water unit risk of 5E-5$(\mu g/L)^{-1}$ has been proposed (U.S. EPA, 1991a); derived from drinking water unit risks for females and males that are equivalent to slope factors of 1.0E-3 $(\mu g/kg/day)^{-1}$ (females) and 2.0E-3 $(\mu g/kg/day)^{-1}$ (males) (U.S. EPA, 1987). For inhalation exposures, a unit risk of 4.3E-3 $(\mu g/m^3)^{-1}$ (U.S. EPA, 1991a) and a slope factor of 5.0E+1 $(mg/kg/day)^{-1}$ have been derived (U.S. EPA, 1992).

1. INTRODUCTION

The toxicity of inorganic compounds containing arsenic depends on the valence or oxidation state of the arsenic (-3, +3, or +5), as well as on the physical and chemical properties of the compound in which it occurs. Trivalent (As^{+3}) compounds such as arsenic trioxide (As_2O_3), arsenic trisulfide (As_2S_3), and sodium arsenite ($NaAsO_2$), are generally more toxic than pentavalent (As^{+5}) compounds such as arsenic pentoxide (As_2O_5), sodium arsenate (Na_2HAsO_4), and calcium arsenate ($Ca_3(AsO_4)_2$). Trivalent arsenic interacts with sulfhydryl groups of proteins and enzymes; pentavalent arsenic substitutes for phosphate groups important in oxidative phosphorylation (Squibb and Fowler, 1983). The relative toxicity of the trivalent and pentavalent forms may also be affected by factors such as the water solubility of the compound. Although the more water soluble arsenic compounds are generally more toxic and more likely to have systemic effects, the less soluble compounds are more likely to cause chronic pulmonary effects if inhaled. One of the most toxic arsenic compounds is arsine gas (AsH_3) with arsenic in the -3 valence state.

It should be noted that laboratory animals are generally less sensitive than humans to the toxic effects of inorganic arsenic. In addition, in rodents the critical effects appear to be immunosuppression and hepato-renal dysfunction, whereas in humans the skin, vascular system, and peripheral nervous system are the primary target organs.

2. METABOLISM AND DISPOSITION

2.1. ABSORPTION

Absorption of water soluble inorganic arsenic compounds through the G.I. tract is very high. In humans, absorption rates of 96.5% for trivalent sodium arsenite and 94% for soluble pentavalent arsenic have been reported (Bettley and O'Shea, 1975; Pomroy et al., 1980). In contrast, G.I. absorption of the less soluble arsenic trisulfide and lead arsenate was reported to be only 20-30% in hamsters (Marafante and Vahter, 1987). In tests on humans, absorption of the insoluble arsenic selenide appeared to be neglible as indicated by the absence of an increase in urinary arsenic excretion (Mappes, 1977).

Absorption of arsenic in the lungs is dependant on particle size as well as water solubility; respirable particles (0.1-1 μ) are carried further into the lungs and are therefore more likely to be absorbed (ATSDR, 1989). Estimates of pulmonary absorption may be complicated by the fact that some of the particles may be cleared from the lungs, then swallowed and absorbed through the G.I. tract. In studies on smelter workers exposed to arsenic dusts of about 5 μ particle size, Lagerkvist et al. (1986) estimated that 75% of the dust would be deposited in the respiratory tract and 80% of this would be absorbed directly or through the stomach after mucocillary clearance.

2.2. DISTRIBUTION

Following absorption of trivalent or pentavalent arsenic compounds, arsenic is initially accumulated in the liver, kidney, lung, spleen, aorta, and skin. With the exception of the skin, clearance from these organs is rapid. Arsenic is also extensively deposited in the hair and nails (U.S. EPA, 1984).

2.3. METABOLISM

Arsenic compounds are subject to metabolic transformation. In both humans and animals, pentavalent arsenic compounds are reduced to trivalent forms and then methylated in the liver to less toxic methylarsinic acids (ATSDR, 1989).

2.4. EXCRETION

Arsenic is cleared from the body relatively rapidly and primarily in the urine. Urinary excretion rates of 80% in 61 hr following oral doses and 30-80% in 4-5 days following parenteral doses have been measured in humans (Crecelius, 1977; Hunter et al., 1942). Arsenic is also lost from the body in the hair and nails, since this represents a non-biologically available arsenic pool.

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

Common symptoms of inorganic arsenic poisoning are nausea, anorexia, vomiting, epigastric and abdominal pain, and diarrhea. Dermatitis (exfoliative erythroderma), muscle cramps, cardiac abnormalities, hepatotoxicity, bone marrow suppression and hematologic abnormalities (anemia and leukopenia), vascular lesions, and peripheral neuropathy (motor dysfunction, long axon Wallerian degeneration) have also been reported (U.S. Air Force, 1990; ATSDR, 1989; Franzblau and Lilis, 1989; U.S. EPA, 1984; Armstrong et al., 1984; Hayes, 1982; Mizuta et al., 1956).

Oral doses as low as 20-60 μg/kg/day have been reported to cause toxic effects in some individuals (ATSDR, 1989). Severe exposures can result in acute encephalopathy, congestive heart failure, stupor, convulsions, paralysis, coma, and death. The acute lethal dose to humans has been estimated to be about 0.6 mg/kg/day (ATSDR, 1989). A dose estimated at 3 mg/day for a 1-2 month period was fatal to 1% of a group of infants receiving arsenic-contaminated milk (Hamamoto, 1955).

3.1.1.2. Animal

Monkeys exposed to acutely toxic doses of inorganic arsenic exhibit gastrointestinal distress and neurological effects. Adolescent and infant Rhesus monkeys receiving 5 daily oral doses of a complex inorganic arsenic compound containing the equivalent of 7.5 mg/kg of arsenic trioxide exhibited loss of condition, vomiting, diarrhea, salivation and uncontrolled shaking of the head (Heywood and Sortwell, 1979).

LD_{50} values for inorganic arsenic compounds in laboratory animals range from about 10 to 300 mg/kg. (ASTDR, 1989; U.S. Air Force, 1990).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

Depending on the dose and duration, subchronic exposures to inorganic arsenic can cause toxic effects similar to those caused by acute and/or chronic exposures. Skin and vascular disorders, neuropathy, gastroenteritis, hepatotoxicity, and hematological abnormalities (anemia and leukopenia) have been reported in individuals exposed for time periods ranging from less than 6 months to 13 years (ATSDR, 1989; Huang et al., 1985).

Borgono and Greiber (1972) reported a 12% incidence of skin abnormalities in children whose drinking water contained 0.6-0.8 mg As/L. The earliest cases occurred about 4-5 years after the initial exposure. Cardiovascular effects, including Raynaud's syndrome, acrocyanosis, angina pectoris, hypertension, myocardial infarction, mesenteric thrombosis, systemic occlusive arterial disease, bronchiectasis, and recurrent broncho-pneumonia were also observed in this group of subjects (Zaldivar, 1980). The bronchiectasis and recurrent broncho-pneumonia were attributed to an immunosuppressive action of arsenic in the lungs. A significant decrease in the incidence of skin abnormalities was observed following a reduction in drinking water concentration to about 0.04 mg/L. After 4 years at the lower exposure, effects were rarely seen in children younger than 12 years old (Borgono et al., 1977).

Central nervous system deficits (hearing loss, eye damage, abnormal EEGs, mental retardation, epilepsy), electrocardiographic changes (elevated ST wave and extended QT interval), and skin abnormalities (melanosis, desquamation, rashes, and hyperkeratosis) occurred in infants who had been fed arsenic-contaminated milk for 1-2 months (Hamamoto, 1955). It was estimated that the daily arsenic intake was about 3 mg/day (U.S. EPA, 1984).

3.1.2.2. Animal

Immunosuppression and hepato-renal toxicity have been identified as toxic effects in rodents. Immunosuppression, as measured by hemagglutination, radial immunodiffusion, and Cunningham plaque assays, was observed in mice exposed for 3 weeks to sodium arsenite levels of 0.5 ppm in drinking water (Blakely et al., 1980). Reported hepato-renal effects include: (1) mild swelling of renal tubular cell mitochondria and decreases in liver-derived serum enzymes (aspartate aminotransferase [AST] and alkaline phosphatase) in rats following 10 weeks exposure to 50 ppm dietary arsenate (Mahaffey et al., 1981); (2) functional and ultrastructural changes in the kidneys of rats exposed for 6 weeks to arsenate concentrations of 85 and 125 ppm in drinking water (Brown et al., 1976); (3) disruption of liver biosynthesis of heme and δ-aminolevulinic (ALA) synthetase activity in mice and rats exposed for 6 wk to 40 and 85 ppm arsenic in

drinking water (Woods and Fowler, 1977, 1978); (4) alteration of hepatocyte mitochondrial structure and liver enzyme activity (monoamine oxidase, cytochrome oxidase) in rats and mice exposed for 6 weeks to 20-85 ppm sodium arsenate in drinking water (Fowler and Woods, 1979; Fowler et al., 1979); and (5) increases in serum AST and alanine aminotransferase (ALT) levels due to hepatocyte plasma membrane dysfunction in beagle dogs fed dietary levels of sodium arsenite equivalent to 4 mg/kg for 58 days followed by 8 mg/kg/day for an additional 125 days (Neiger and Osweiler, 1989).

In a six-month study in which rats were fed 250 ppm pentavalent or trivalent arsenic, Douglas and Blendermann (1961) found that trivalent arsenic caused bile duct lesions and a significant depression in growth.

Although arsenic-induced skin disorders are not commonly seen in rodents, eczema, hyperplasia, and hyperkeratosis were reported in two-week-old rats dosed for 40 days by stomach intubation with 2 mg/kg/day or 10 mg/kg/day of arsenic trioxide (Ishinishi et al., 1976). Avoidance conditioning responses were also impaired by these dose levels (Osato, 1977).

3.1.3. Chronic Toxicity

3.1.3.1. Human

General symptoms of chronic arsenic poisoning are weakness, general debility and lassitude, loss of appetite and energy, loss of hair, hoarseness of the voice, loss of weight, and mental abnormalities (Hindmarsh and McCurdy, 1986). Skin, neurological, and vascular disorders are the most common effects seen following long-term exposures.

Skin abnormalities, particularly hyperpigmentation and hyperkeratosis have been observed in populations exposed to arsenic in drinking water (Terada et al. 1960; Tseng et al., 1968; Zaldivar 1974; Cebrian et al., 1983; Huang et al., 1985). Tseng et al. (1968) reported an incidence rate of 18% for hyperpigmentation and 7% for hyperkeratosis in a Taiwanese population whose drinking water contained an average arsenic concentration of 0.4-0.6 ppm. Skin abnormalities were also reported in 40% of patients consuming Fowler's solution for 6-26 years (Fierz, 1965).

Arsenic-induced neurotoxicity is manifested as a peripheral neuropathy involving both sensory and motor nerves, and resulting in numbness and paresthesia, diminished sensations of touch, pain, heat, and cold, and muscle weakness (Hindmarsh et al., 1977; Hindmarsh and McCurdy, 1986; Valentine et al., 1982; Heyman et al., 1956; Mizuta et al., 1956; Tay and Seah, 1975).

Peripheral vascular disorders have been reported in several populations whose drinking water contained high arsenic levels (Tseng et al., 1968; Salcedo et al., 1984; Chen et al., 1988). Blackfoot disease (a condition caused by arteriosclerosis and thromboangiitis obliterans), which can result in gangrene of the lower extremities, occurred in 0.9% of one such population (Tseng et al., 1968; 1977). Epidemiological studies and mechanistic considerations have implicated arsenic as a possible causative factor in arteriosclerotic plaque formation and cardiovascular disease (Wu et al., 1989; Hansen, 1990; Penn, 1990).

Chronic oral exposures to arsenic reportedly have also resulted in anemia, leukopenia, liver swelling, and noncirrhotic portal hypertension (Terada et al., 1960; Viallet et al., 1972; Morris et al., 1974; Datta, 1976; Nevens et al., 1990).

3.1.3.2. Animal

Studies in rats have demonstrated no-adverse-effect levels of 1.4 (males) and 1.6 mg As/kg/day (females) for sodium arsenite and 2.8 (males) and 3.25 mg As/kg/day (females) for sodium arsenate (Byron et al., 1967). Similar studies on dogs revealed a no-adverse-effect level at 1.1 mg As/kg/day. A drinking water concentration of 5 ppm produced no toxic effects in rats when administered over an entire lifetime (Schroeder et al., 1968).

Mild hyperkeratosis has been reported in mice exposed for a lifetime to arsenic oxide in drinking water at a concentration of 0.01% (Baroni et al., 1963).

Bile duct enlargement with hyperplasia of the glandular elements, focal necrosis, and fibrosis was seen in rats receiving dietary arsenic levels of 125 and 250 ppm as sodium arsenite and 250 and 400 ppm as sodium arsenate for up to two years (Byron et al., 1967). Lifetime (29 mo) exposure to lead arsenate at a dietary level of 1850 ppm also caused bile duct lesions in rats (Kroes et al., 1974).

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

A high male-to-female birth ratio (157 to 100) was reported for a population that may have been exposed to elevated arsenic levels in their drinking water 10 to 11 months earlier (Lyster, 1977).

3.1.4.2. Animal

Chronic exposure of pregnant mice to 5 ppm sodium arsenite in drinking water resulted in a slight reduction in litter size and a higher male/female ratio (increased from 0.93 to 1.71), but no adverse effects on fetal development (Schroeder and Mitchner, 1971). Oral doses as high as 120 mg/kg/day of sodium arsenate were reported to be fetotoxic but not teratogenic to rats (Hood et al., 1977). Oral doses of 25-40 mg/kg of sodium arsenite caused prenatal mortality and a low, but non-significant, incidence of fetal malformations (exencephaly) in mice (Baxley et al., 1981).

3.1.5. Reference Dose

3.1.5.1. Subchronic

ORAL RfD: 0.0003 mg/kg/day (U.S. EPA, 1992)
UNCERTAINTY FACTOR: 3
NOAEL: 0.0008 mg/kg/day, epidemiological study.

COMMENT: The same study applies to the subchronic and chronic RfD (see Section 3.1.5.2).

3.1.5.2. Chronic

ORAL RfD: 0.0003 mg/kg/day (U.S. EPA, 1991a)
UNCERTAINTY FACTOR: 3
MODIFYING FACTOR: 1
NOAEL: 0.0008 mg/kg/day, epidemiological study
CONFIDENCE:

Study:	Medium
Data Base:	Medium
RfD:	Medium

VERIFICATION DATE: 11/15/90

PRINCIPAL STUDIES: Tseng, W.P. 1977; Tseng et al., 1968

COMMENT: The NOAEL was based on an arithmetic mean of 0.009 mg/L in drinking water (range 0.001-0.17 mg/L), a daily water consumption of 4.5 L, and an arsenic intake in food of 0.002 mg/day. A LOAEL of 0.014 mg/kg/day for hyperpigmentation, keratosis, and possible vascular complications, was based on an arithmetic mean of 0.14 mg/L in drinking water (4.5 L/day), and 0.002 mg/kg in food. The UF of 3 is to account for both the lack of data to preclude reproductive toxicity as a critical effect and to account for some uncertainty in whether the NOAEL of the critical study accounts for all sensitive individuals.

NOTE: U.S. EPA (1991a) states that "strong scientific arguments can be made for various values within a factor of 2 or 3 of the currently recommended RfD value, i.e., 0.1-0.8 μg/kg/day"; therefore, considerable flexibility is allowed in formulating regulatory decisions.

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

Inorganic arsenic dusts can cause respiratory irritation and mucous membrane damage leading to rhinitis, pharyngitis or laryngitis. Several weeks exposure to high concentrations can result in nasal septum perforation (U.S. EPA, 1984). Although inhalation exposures to most inorganic arsenic compounds are not usually associated with acute lethality (ATSDR, 1989); exposure to 250 ppm of arsine gas is instantly fatal and several hours exposure to concentrations as low as 10 ppm can produce toxic symptoms and may also be fatal (Fowler and Weissberg, 1974; NIOSH, 1979). Arsine causes severe hemolysis, hemoglobinuria, jaundice, hemolytic anemia, and necrosis of the renal tubules (ACGIH, 1986; Fowler and Weissberg, 1974).

3.2.1.2. Animal

Intratracheal instillation studies indicate that inorganic arsenic can have direct toxic effects on respiratory tissue. Trivalent arsenic oxide and gallium arsenide were shown to cause pulmonary inflammation and hyperplasia in rats (Webb et al., 1986, 1987), and calcium arsenate

caused lung lesions in hamsters; however, arsenic trioxide and arsenic trisulfide did not have such an effect (Pershagen et al., 1982).

The pulmonary immune response can be affected by inorganic arsenic compounds. Hatch et al. (1985) reported significant increases in mortality of mice due to infectious streptococcal challenge following intratracheal injection of sodium arsenite, and Aranyi et al. (1985) reported similar increases in mortality as well as decreases in pulmonary bactericidal activity to *Klebsiella pneumonia* following single and multiple inhalation exposures to arsenic trioxide.

Exposure of mice to arsine concentrations as low as 2.5 ppm caused significant decreases in red blood cells, hematocrit and hemoglobin, as well as significant increases in white blood cell counts, and mean corpuscular volume of RBC. Erythropoiesis in bone marrow cells was impaired and erythropoiesis in the spleen was increased (Hong et al., 1989).

3.2.2. Subchronic Toxicity

3.2.2.1. Human

Subchronic inhalation exposures to inorganic arsenic are expected to cause toxic effects similar to those resulting from chronic exposures (see Section 3.2.3).

3.2.2.2. Animal

Rats exposed for 3 months to 46 $\mu g/m^3$ of arsenic trioxide aerosol exhibited altered conditioned reflexes and CNS damage as evidenced by pericellular edema and neuronal cytolysis in the brain (Rozenshstein, 1970).

Rats exposed to 0.025 ppm arsine gas for 90 days developed anemia (Blair et al., 1990). Higher exposure levels (primarily 2.5 ppm) resulted in bone marrow hyperplasia, increased splenic hemosiderosis and extramedullary hematopoiesis, decreased packed cell volume, increased delta-aminolevulinic acid dehydratase activity, and increased relative spleen weight. Similar effects were seen in mice and hamsters.

3.2.3. Chronic Toxicity

3.2.3.1. Human

Information on the inhalation toxicity of inorganic arsenic is derived primarily from occupational exposure studies, particularly those involving smelter workers. Early studies identified chronic respiratory diseases (rhinitis, pharyngitis, laryngitis, tracheobronchitis, and pulmonary insufficiency) and blood disorders (leukopenia) in exposed workers (Lundgren, 1954; Kyle and Pease, 1965). In one study, a 23% incidence of relative neutropenia occurred in 130 smelter workers exposed to arsenic air concentrations averaging less than 0.5 mg/m^3 (Hine et al., 1977).

Neurological disorders (peripheral nerve dysfunction indicated by abnormal nerve conduction velocities) have been documented in smelter workers exposed to arsenic concentrations of ≤ 0.5 mg/m^3 (Feldman et al., 1979; Blom et al., 1985; Landau et al., 1977). Chronic encephalopathy, evidenced by cognitive impairment and psychological symptoms was reported

in two workers exposed to arsenic fumes for 14-18 months (Morton and Caron, 1989). Abnormal electromyograms were reported for populations living near an arsenic mine and smelter (Takahashi, 1974). Hearing losses have been reported in children living near a coal-fired power plant burning high-arsenic content coal (U.S. EPA, 1984).

Chronic exposure of smelter workers to low levels of atmospheric arsenic (≤ 0.5 mg/m^3) caused subtle changes in the peripheral vascular system, as indicated by an increased incidence of Raynaud's syndrome (white fingers) and increased vasospastic reactivity in fingers exposed to low temperatures (Lagerkvist et al., 1986). Higher rates of cardiovascular disease have also been reported in some arsenic-exposed workers (Lee and Fraumeni, 1969; Axelson et al., 1978; Wingren and Axelson, 1985).

Dermatitis, hyperpigmentation, and hyperkeratosis were observed in early studies of workers exposed to inorganic arsenic (Perry et al., 1948; Pinto and McGill, 1953); however, it is not known to what degree the reported effects were due to direct skin contact and accidental ingestion of the arsenic dust.

Chronic exposure to very low levels of arsine gas may have a cumulative effect in causing anemia (Fowler and Weissberg, 1974).

3.2.3.2 Animal

Glaser et al. (1986) exposed male Wistar rats to aerosols (<0.3 μm MMAD) of arsenic trioxide for 18 months at concentrations of 0, 60, and 200 μg/m^3. The animals were observed for one year after the termination of the exposures and no adverse effects on body weight, hematology, clinical chemistry, or macro- or microscopic structure of internal organs were reported.

3.2.4. Developmental and Reproductive Toxicity

3.2.4.1. Human

A significantly higher frequency of spontaneous abortions (11% vs 7.6%) and significantly reduced birth weights were recorded for a population living near a copper smelter when compared with control populations (Nordström et al., 1978a,b).

3.2.4.2. Animal

Nagymajtenyi et al. (1985) exposed mice for 4 hr/day to an aerosol of arsenic trioxide (28.5 mg/m^3) on days 9-12 of gestation, and found a significant reduction in fetal weight and in the number of live fetuses. In addition, there was a significant increase in the number of fetuses with retarded osteogenesis and an increase in the frequency of chromosomal aberrations (chromosome breaks and chromatid exchanges). Concentrations of 2.9 mg/m^3 and 0.26 mg/m^3 caused no significant changes, except a slight decrease in fetal weight.

3.2.5. Reference Dose/Concentration

Subchronic and chronic RfCs for inorganic arsenic have not been derived.

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

3.3.1.1. Human

Information on the acute toxicity of inorganic arsenic to humans by other routes of exposure was not available.

3.3.1.2. Animal

Intraperitoneal LD_{50} values of 4-20 mg/kg for various inorganic arsenic compounds have been reported (ATSDR, 1989).

3.3.2. Subchronic Toxicity

3.3.2.1. Human

Information on the subchronic toxicity of inorganic arsenic to humans by other routes of exposure was not available.

3.3.2.2. Animal

Intraperitoneal injections of sodium arsenate solution at a dose level of 0.2 mg/kg for two months, resulted in inner ear damage and hearing loss in guinea pigs (Aly et al., 1975).

3.3.3. Chronic Toxicity

3.3.3.1. Human

Skin contact with inorganic arsenic dusts in occupationally exposed workers has been associated with direct dermatitis, allergenic hypersensitivity, and conjunctivitis (U.S. EPA, 1984; Pinto and McGill, 1953; Holmqvist, 1951).

3.3.3.2. Animal

Weekly injections of up to 10 mg/kg/day, for 18 months did not produce signs of neuropathy in rats (Schaumburg, 1980).

3.3.4. Developmental and Reproductive Toxicity

3.3.4.1. Human

Information on the developmental and reproductive toxicity of inorganic arsenic to humans by other routes of exposure was not available.

3.3.4.2. Animal

Some inorganic arsenic compounds cause teratogenic effects when administered parenterally. Intravenous injections of sodium arsenate into hamsters on day 8 of gestation at dose levels of 15, 17.5, or 20 mg/kg/day resulted in exencephaly, encephaloceles, skeletal defects, and urogenital system abnormalities in fetuses (Ferm and Carpenter, 1968). Intraperitoneal injections of sodium arsenate, at doses levels of 30 mg/kg/day or higher, resulted in similar terata in rats and mice (Hood and Bishop, 1972; Beaudoin, 1974; Burk and Beaudoin, 1977).

3.4. TARGET ORGAN/CRITICAL EFFECTS

3.4.1. Oral Exposures

3.4.1.1. Primary Target Organs

1. Skin: Hyperpigmentation and hyperkeratosis in humans.

2. Nervous System: Peripheral neuropathy and CNS effects in humans.

3. Cardiovascular System: Peripheral and cardiovascular disorders in humans.

3.4.1.2. Other Target Organs

1. Blood: Hematological changes (anemia, leukopenia).

2. Liver: Liver swelling in humans; cirrhosis and portal hypertension in animals.

3. G.I. System: Gastroenteritis in humans and monkeys at high doses.

4. Reproductive Effects: Increased male to female birth ratio in animals and possibly in humans.

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target Organs

1. Skin: Dermatitis and possibly hyperpigmentation and hyperkeratosis in humans.

2. Nervous System: Peripheral neuropathy and CNS effects in humans.

3. Cardiovascular System: Peripheral vascular disorders in humans.

3.4.2.2. Other Target Organs

1. Respiratory system: Rhinitis, laryngitis, tracheobronchitis, pulmonary insufficiency, and nasal septum perforation.

2. Blood: Hematological changes (anemia, leukopenia).

3. Developmental Effects: Increase in spontaneous abortions, reduction in birth weight observed in animals and humans.

4. CARCINOGENICITY

4.1. ORAL EXPOSURES

4.1.1. Human

Epidemiological studies have revealed a close association between arsenic concentrations in drinking water and increased incidences of skin cancers, including squamous cell carcinomas and multiple basal cell carcinomas (U.S. EPA, 1987). Tseng et al. (1968) reported skin cancer rates of 2.6, 10.1 and 21.4 per 1000 in Taiwanese populations whose drinking water contained $\leq$0.30, 0.30-0.59, and $\geq$0.6 ppm As, respectively. No cases of skin cancer were seen in a control population of 7500 whose drinking water contained 0.001-0.017 ppm As. Cebrian et al. (1983) reported a 3.6-fold increase in skin lesions thought to be associated with epidermoid or basal cell carcinomas, in residents of a Mexican town whose drinking water contained 0.4 ppm As.

Chronic oral exposure to arsenic has also been linked to various types of internal cancers, including those of the liver, bladder, and respiratory and gastrointestinal tracts (U.S. EPA, 1987; IARC, 1987; Sommers and McManus, 1953; Reymann et al., 1978; Dobson et al., 1965; Chen et al., 1985, 1986).

4.1.2. Animal

Of the many studies conducted on laboratory animals, only a few have been able to show a positive association between oral exposure to arsenic and increased tumor incidence. Knoth (1966/67) reported increased incidences of adenocarcinomas of the skin, lung, peritoneum, and lymph nodes in NMRI mice dosed with arsenic trioxide or Fowler's solution once per week for

5 months (estimated total dose 7 mg/animal). Katsnelson et al. (1986) reported that arsenic trioxide induced a low incidence of adenocarcinomas at the site of its implantation in the stomach of rats. In addition, Shirachi et al. (1983) reported that sodium arsenite enhanced the incidence of renal tumors induced in rats by intraperitoneal injection of the carcinogen *N*-nitrosodiethylamine.

4.2. INHALATION EXPOSURES

4.2.1. Human

Occupational exposure studies of smelter and pesticide workers have shown a close association between exposure to arsenic and lung cancer mortality (IARC, 1987; U.S. EPA, 1991a). A dose- and duration-dependent increased frequency of respiratory tract cancers was found in copper smelter workers exposed to air-borne arsenic concentrations averaging up to 62 mg/m^3 (arithmetic mean) (Lee and Fraumeni, 1969; Lee-Feldstein, 1983, 1986, 1989). Standardized mortality ratios (SMR) as high as 981 and a maximum relative risk of 6 were reported (Lee-Feldstein, 1986, 1989). At another smelter, lung cancer mortality rates were correlated with cumulative arsenic exposure as measured by urinary arsenic excretion values, and arsenic concentrations of 10 mg/m^3 were linked to a SMR greater than 200 (Enterline and Marsh, 1982; Enterline et al., 1987). Similarly, in a study of Swedish smelter workers, a clear positive dose-response relationship was found between cumulative arsenic exposure and lung cancer mortality and the overall SMR was 372 (Järup et al., 1989). Both proportionate mortality and cohort studies of pesticide workers have also shown an increased incidence of lung cancer deaths (Ott et al., 1974; Mabuchi et al., 1979).

An increased risk of lung cancer may also occur in non-occupationally exposed populations living in areas with high atmospheric levels of arsenic resulting from industrial emissions. Higher lung cancer rates have been reported in residents living near smelters (Brown et al., 1984; Pershagen 1985) and near an arsenic pesticide manufacturing plant (Matanoski et al., 1981).

4.2.2. Animal

Several animal studies have shown an association between tumor induction and exposure to arsenic by inhalation or intratracheal instillation. Ivankovic et al. (1979) reported that lung tumors developed in 9 of 15 BD IX rats given a single intratracheal instillation of Bordeaux mixture (4% calcium arsenate containing 0.07 mg As). In another study, calcium arsenate induced a borderline increase in lung adenomas following intratracheal instillation, but arsenic trisulfide had no effect on tumor incidence. Perinatal treatment of mice with arsenic trioxide resulted in the induction of lung adenomas (Rudnay and Börzsönyi 1981), and intratracheal instillation of the same compound in hamsters resulted in respiratory tract carcinomas, adenomas, papillomas and adenomatoid lesions (Ishinishi et al., 1983; Pershagen et al., 1984a,b).

4.3. OTHER ROUTES OF EXPOSURE

Osswald and Goerttle (1971) reported a high incidence (11/19) of lymphocytic leukemia or lymphomas in female Swiss mice injected intravenously with 0.5 mg As/kg (as sodium arsenate) once per week for 20 weeks. In a second study with pregnant mice injected subcutaneously with

0.5 mg/kg, once per day for 20 days during pregnancy, 11 of 24 developed the same types of tumors.

DiPaolo and Casto (1979) reported that sodium arsenate induced cell transformations *in vitro* in Syrian hamster embryo cells, and Casto et al. (1979) reported that sodium arsenite enhanced virus-induced cell transformation.

4.4. EPA WEIGHT-OF-EVIDENCE

4.4.1. Oral

Classification -- A; human carcinogen (U.S. EPA, 1991b)
Basis -- Increased skin cancer incidence in several populations consuming drinking water with high arsenic concentrations.

4.4.2. Inhalation

Classification -- A; human carcinogen (U.S. EPA, 1991a)
Basis -- Increased lung cancer mortality in populations exposed primarily through inhalation.

4.5. SLOPE FACTORS

4.5.1. Oral

SLOPE FACTOR: 1.0E-3 $(\mu g/kg/day)^{-1}$ (females) and 2.0E-3 $(\mu g/kg/day)^{-1}$ (males) (U.S. EPA, 1987). These slope factors were based on unit risks of 3E-5 (females) and 7E-5 $(\mu g/L)^{-1}$ (males) that were used to derive a single drinking water unit risk as shown below.

DRINKING WATER UNIT RISK: 5E-5 $(\mu g/L)^{-1}$ (U.S. EPA, 1991a).

PRINCIPAL STUDIES: Tseng et al., 1968; Tseng, 1977

VERIFICATION DATE: Not given.

COMMENT: The final unit risk is the arithmetic mean of the unit risks derived for females and males in a population in Taiwan exposed to arsenic in drinking water. Uncertainties associated with this unit risk involve the dose-response relationship, particularly in regard to (1) differential mortality due to other arsenic-induced diseases, (2) the possibility that ingestion of arsenic-contaminated foods contributed to the effects, and (3) the shape of the dose-response curve at low doses. A memorandum from the EPA administrator noted that the "uncertainties associated with ingested inorganic arsenic are such that estimates could be modified downwards as much as an order of magnitude, relative to risk estimates associated with most other carcinogens."

4.5.2. Inhalation

SLOPE FACTOR: 5.0E+1 $(mg/kg/day)^{-1}$ (U.S. EPA, 1992)

INHALATION UNIT RISK: 4.3E-3 $(\mu g/m^3)^{-1}$ (U.S. EPA, 1991a)

PRINCIPAL STUDIES: Brown and Chu, 1983a-c, Lee-Feldstein, 1983; Higgins, 1982; Enterline and Marsh, 1982.

VERIFICATION DATE: 01/13/88

COMMENT: The final unit risk is the geometric mean of the geometric means for distinct exposed populations of workers at two different copper smelters. It was assumed that the increase in age-specific mortality was a function only of cumulative exposure. The unit risk should not be used if the air concentration exceeds 2 $\mu g/m^3$ (U.S. EPA, 1992).

5. REFERENCES

ACGIH (American Conference of Governmental Industrial Hygienists). 1986. Documentation of TLVs. Arsine. American Conference of Governmental Industrial Hygienists, Cincinnati, OH. p. 39.

Aly, S. Mousa; El-Kahky, M.; Saleh, A.; El-Mofty, A. 1975. Toxic deafness. Histological study of the effect of arsenic, salicylates, and quinine on the organ of Corti of guinea pigs. J. Egypt. Med. Assoc. 58:144-157. (Cited in U.S. EPA, 1984).

Aranyi, C.; Bradof, J.N.; O'Shea, W.J.; Graham, J.A.; Miller, F.J. 1985. Effects of arsenic trioxide inhalation exposure on pulmonary antibacterial defenses in mice. J. Toxicol. Environ. Health 15:163-172.

Armstrong, C.W.; Stroube, R.B.; Rubio, T.; Siudyla, E.A.; Miller, G.B. 1984. Outbreak of fatal arsenic poisoning caused by contaminated drinking water. Arch. Environ. Health 39:276-279.

ATSDR (Agency for Toxic Substances and Disease Registry). 1989. Toxicological Profile for Arsenic. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, Atlanta, GA. ATSDR/TP-88/02.

Axelson, O.; Dahlgren, E.; Jasson, C.-D.; Rehnlund, S.O. 1978. Arsenic exposure and mortality: a case-referent study from a Swedish copper smelter. Br. J. Ind. Med. 35:8-15. (Cited in ATSDR, 1989)

Baroni, C; van Esch, G.J.; Saffiotti, U. 1963. Carcinogenesis tests of two inorganic arsenicals. Arch. Environ. Health 7:668-674.

Baxley, M.N; Hood, R.D.; Vedel, G.C.; Harrison, W.P.; Szczech, G.M. 1981. Prenatal toxicity of orally administered sodium arsenite in mice. Bull. Environ. Contam. Toxicol. 26:749-756.

Beaudoin, A.R. 1974. Teratogenicity of sodium arsenate in rats. Teratology 10:153-158. (Cited in U.S. EPA, 1984).

Bettley, F.R.; O'Shea, J.A. 1975. The absorption of arsenic and its relation to carcinoma. Br. J. Dermatol. 92:563. (Cited in Hindmarsh and McCurdy, 1986).

Blair, P.C.; Thompson, M.B.; Morrissey, R.E.; et al. 1990. Comparative toxicity of arsine gas in B6C3F1 mice, Fischer 344 rats, and Syrian golden hamsters: system organ studies and comparison of clinical indices of exposure. Fundam. Appl. Toxicol. 14:776-787.

Blakely, B. R.; Sisodia, C.S.; Mukkur, T.K. 1980. The effect of methylmercury, tetraethyl lead, and sodium arsenite on the humoral immune response in mice. Toxicol. Appl. Pharmacol. 52:245-254.

Blom, S.; Lagerkvist, B.; Linderholm, H. 1985. Arsenic exposure to smelter workers: clinical and neurophysiological studies. Scand. J. Work Environ. Health 11:265-270.

Borgono, J.M.; Greiber, R. 1972. Epidemiological study of arsenism in the city of Antofagasta. In: Trace Substances in Environmental Health, vol. 5. D.C. Hemphill, ed. University of Missouri, Columbia, MS. pp. 13-24.

Borgono, J.M.; Vincent, P.; Venturino, H.; Infante, A. 1977. Arsenic in the drinking water of the city of Antofagast; epidemiological and clinical study before and after the installation of the treatment plant. Environ. Health Perspect. 19:103-106.

Brown, C.C.; Chu, K.C. 1983a. Approaches to epidemiologic analysis of prospective and retrospective studies: Example of lung cancer and exposure to arsenic. In: Risk Assesment Proc. SIMS Conf. on Environ. Epidemiol. June 28 -July 2, 1982, Alta VT. (Cited in U.S. EPA, 1992).

Brown, C.C.; Chu, K.C. 1983b. Implication of the multistage theory of carcinogenesis applied to occupational arsenic exposure. J. Natl. Cancer Inst. 70:455-463. (Cited in U.S. EPA, 1992).

Brown, C.C.; Chu, K.C. 1983c. A new methoid for the analysis of cohort studies, implications of the multistage theory of carcinogenesis applied to occupational arsenic exposure. Environ. Health Perspect. 50:293-308. (Cited in U.S. EPA, 1992).

Brown, M.M.; Rhyne, B.C.; Goyer, R.A.; Fowler, B.A. 1976. Intracellular effects of chronic arsenic administration on renal proximal tubule cells. J. Toxicol. Environ. Health 1:505-514.

Brown, L.M.; Pottern, L.M.; Blot, W.J. 1984. Lung cancer in relation to environmental pollutants emitted from industrial sources. Environ. Res. 34:250-261.

Burk, D.; Beaudoin, A.R. 1977. Arsenate-induced renal agenesis in rats. Teratology 16:247-260.

Byron, W.R.; Bierbower, G.W.; Brouwer, J.B.; Hansen, W.H. 1967. Pathologic changes in rats and dogs from two-year feeding of sodium arsenite or sodium arsenate. Toxicol. Appl. Pharmacol. 10:132-147.

Casto, B.C.; Meyers, J.; DiPaolo, J.A. 1979. Enhancement of viral transformation for evaluation of the carcinogenic or mutagenic potential of inorganic metal salts. Cancer Res. 39:193-198.

Cebrian, M.E.; Albores, A.; Aguilar, M.: Blakely, E. 1983. Chronic arsenic poisoning in the north of Mexico. Hum. Toxicol. 2:121-133.

Chen, C.J.; Chuang, Y.C.; Lin, T.M.; Wu, H.Y. 1985. Malignant neoplasms among residents of a Blackfoot disease-endemic area in Taiwan: High-arsenic artesian well water and cancers. Cancer Res. 45:5895-5899.

Chen, C.J.; Chuang, Y.C.; You, S.L.; Lin, T.M.; Wu, H.Y. 1986. A retrospective study on malignant neoplasms of bladder, lung, and liver in a Blackfoot disease-endemic area in Taiwan. Br. J. Cancer 53:399-405.

Chen, C.J.; Wu, S.; Lee, J.; et al. 1986. Atherogenicity and carcinogenicity of high-arsenic artesian well water: Multiple risk factors andf related malignant neoplasms of blackfoot disease. Arteriosclerosis 8:452-460. (Cited in Hansen, 1990).

Crecelius, E.A. 1977. Changes in the chemical speciation of arsenic following ingestion by man. Environ. Health Perspect. 19:147-150. (Cited in U.S. EPA, 1984).

Datta, D.V. 1976. Arsenic and noncirrhotic portal hypertension. Lancet 1:433.

DiPaolo, J.A; Casto, B.C. 1979. Quantitative studies of *in vitro* morphological transformation of Syrian hamster cells by inorganic metal salts. Cancer Res. 39:1008-1013.

Dobson, R.L.; Young, M.R.; Pinto, J.S. 1965. Palmar keratoses and cancer. Arch. Dermatol. 92:553-556.

Douglass, C.D.; Blendermann, E.M. 1961. Observations on the influence of some arsenic compounds on pyruvic oxidase activity *in vitro* and *in vivo*. In: Proc. 5th Inter. Congr. Biochem., vol. 9, p. 582 (Intern. Union Biochem. Symp. Ser., vol. 29, 1963). Macmillan, New York. (Cited in Byron et al., 1967).

Enterline, P.E.; Henderson, V.L.; Marsh, G.M. 1987. Exposure to arsenic and respiratory cancer. A reanalysis. Am. J. Epidemiol. 125(6):929-938.

Enterline, P.E.; Marsh, G.M. 1982. Mortality among workers exposed to arsenic and other substances in a copper smelter. Am. J. Epidemiol. 116:895-910.

Feldman, R.G.; Niles, C.A.; Kelly-Heyes, M.; Sax, D.S.; Dixon, W.J.; Thompson, D.J.; Landau, E. 1979. Peripheral neuropathy in arsenic smelter workers. Neurology 29:939-944.

Ferm, V.H.; Carpenter, S.J. 1968. Malformations induced by sodium arsenate. J. Reprod. Fert. 17:199-201.

Fierz, U. 1965. Katamnestische Untersuchungen Uber die Nebenwirkungen der Therapie mit anorganischen Arsen bei Hautkrankheiten. Dermatologica 131:41-58. (Cited in U.S. EPA, 1984)

Fowler, B.A.; Weissberg, J.B. 1974. Arsine poisoning. New Eng. J. Med. 291:1171-1174.

Fowler, B.A.; Woods, J.S. 1979. The effects of prolonged oral arsenate exposure on liver mitochondria of mice: morphometric and biochemical studies. Toxicol. Appl. Pharmacol. 50:177-187.

Fowler, B.A.; Woods, J.S.; Schiller, C.M. 1979. Studies of hepatic mitochondria structure and function: Morphometric and biochemical evaluation of *in vivo* perturbation by arsenate. Lab. Invest. 42:313-320.

Franzblau, A.; Lilis, R. 1989. Acute arsenic intoxication from environmental arsenic exposure. Arch. Environ. Health 44(6):385-390.

Glaser, U.; Hochrainer, D.; Oldiges, H.; Takenaka, S. 1986. Long-term inhalation studies with nickel oxide and arsenic trioxide aerosols in Wistar rats. Excerpta Med. 676:325-328.

Hamamoto, E. 1955. Infant arsenic poisoning by powdered milk. Jap. Med. J. 1649:2-12. (Cited in U.S. EPA, 1984).

Hansen, E.S. 1990. Shared risk factors for cancer and artherosclerosis - a review of the epidemiological evidence. Mutat. Res. 239:163-179.

Hatch, G.E.; Boykin, E.; Graham, J.A.; Lewtas, J.; Pott, F.; Loud, K.; Mumford, J.L. 1985. Inhalable particles and pulmonary host defense: *in vivo* and *in vitro* effects of ambient air and combustion particles. Environ. Res. 36:67-80.

Hayes, W.J., Jr. 1982. Pesticide Studies in Man. Williams and Eilkins, Baltimore, MD. pp. 41-50.

Heyman, A.; Pfeiffer, J.B.; Willett, R.W.; Taylor, H.M. 1956. Peripheral neuropathy caused by arsenical intoxication. New England J. Med. 254(9): 401-409.

Heywood. R.; Sortwell, R.J. 1979. Arsenic intoxication in the rhesus monkey. Toxicol. Lett. 3:137-144.

Higgins, I. 1982. Arsenic and respiratory cancer among a sample of Anaconda smelter workers. Report submitted to the Occupational Safety and Health Administration in the comments of the Kennecott Minerals Company report on the inorganic arsenic rulemaking. (Exhibit 203-5).

Hindmarsh, J.T.; McCurdy, R.F. 1986. Clinical and environmental aspects of arsenic toxicity. CRC Crit. Rev. Clin. Lab. Sci. 23:315-347.

Hindmarsh, J.T.; McLetchie, O.R.; Heffernan, L.P.; Haynie, O.A.; Ellenberger, H.A.; McCurdy, R.F.; Thiebaux, H.J. 1977. Electromyographic abnormalities in chronic environmental arsenicalism. J. Anal. Toxicol. 1:270-276.

Hine, C.H.; Pinto, S.S.; Nelson, K.W. 1977. Medical problems associated with arsenic exposure. J. Occup. Med. 19(6):391-396.

Holmqvist, I. 1951. Occupational arsenical dermatitis. A study among employees at a copper ore smelting work, including investigations of skin reactions to contact with arsenic compounds. Acta Derm. Venereol. 31:1-214.

Hong, H.L.; Fowler, B.A.; Boorman, G.A. 1989. Hematopoietic effects in mice exposed to arsine gas. Toxicol. Appl. Pharmacol. 97:173-182.

Hood, R.D.; Bishop, S.L. 1972. Teratogenic effects of sodium arsenate in mice. Arch. Environ. Health 24:62-65.

Hood, R.D.; Harrison, W.P. 1982. Effects of prenatal arsenite exposure in hamsters. Bull. Environ. Contam. Toxicol. 29:671-678.

Hood, R.D.; Thacker, G.T.; Patterson, B.L. 1977. Effects in the mouse and rat of prenatal exposure to arsenic. Environ. Health Perspect. 19:219-222. (Cited in ATSDR, 1989).

Huang, Y.Z.; Qian, X.C.; Wang, G.Q.; Xiao, B.-Y.; Ren, D.D.; Feng, Z.Y.; Wu, J.Y.; Xu, R.J.; Zhang, F. 1985. Endemic chronic arsenism in Xinjiang. Chin. Med. J. (Eng). 98:219-222.

Hunter, F.T.; Kip, A.F.; Irvine, J.W. 1942. Radioactive tracer studies on arsenic injected as potassium arsenite. J. Pharmacol. Exp. Therap. 76:207-220. (Cited in U.S. EPA, 1984).

IARC (International Agency for Research on Cancer. 1980. Some metals and metallic compounds. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, vol. 23. Geneva.

IARC (International Agency for Research on Cancer (IARC). 1987. Overall Evaluations of Carcinogenicity: an Updating of IARC Monographs Volumes 1 to 42. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans, supplement 7. Geneva.

Ishinishi, N.; Osato, K.; Kodama, Y.; Kunitake, E. 1976. Skin effects and carcinogenicity of arsenic trioxide: a preliminary experimental study in rats. In: Effects and Dose-Response Relationships of Toxic Metals, G.F. Nordberg, ed. Elsevier Scientific, Amsterdam. pp. 471-479.

Ishinishi, N.; Yamamoto, A.; Hisanaga, A.; Inamasu, T. 1983. Tumorigenicity of arsenic trioxide to the lung in Syrian golden hamsters by intermittent instillations. Cancer Lett. 21:141-147. (Cited in IARC, 1987).

Ivankovic, S.; Eisenbrand, G.; Preussmann, R. 1979. Lung carcinoma induction in BD rats after single intratracheal instillation of an arsenic-containing pesticide mixture formerly used in vineyards. Int. J. Cancer. 24:786-788. (Cited in IARC, 1980).

Järup, L.; Pershagen, G.; Wall, S. 1989. Cumulative arsenic exposure and lung cancer in smelter workers: a dose-response study. Am. J. Ind. Med. 15:31-42.

Katsnelson, B.A.; Neizvestnova, Y.M.; Blokhin, V.A. 1986. Stomach carcinogenesis induction by chronic treatment with arsenic (Russ.). Vopr. Onkol. 32:68-73. (Cited in IARC, 1987).

Knoth, W. - 1966-67. Arsenic treatment. Arch. Klin. Exp. Derm. 227:228-234. (Cited in IARC, 1980)

Kroes, R.; Van Logten, M.J.; Berkvins, J.M.; deVries, I.; van Esch, G.J. 1974. Study on the carcinogenicity of lead arsenate and sodium arsenate and the possible synergistic effect of diethylnitrosamine. Food Cosmet. Toxicol. 12:671-679.

Kyle, R.A.; Pease, G.L. 1965. Hematologic aspects of arsenic intoxication. New Eng. J. Med. 273(1):18-23.

Lagerkvist, B.E.A.; Linderholm, H.; Nordberg, G.F. 1986. Vasospastic tendency and Raynaud's phenomenon in smelter workers exposed to arsenic. Environ. Res. 39:465-474.

Lagerkvist, B.E.A.; Linderholm, H.; Nordberg, G.F. 1988. Arsenic and Raynaud's phenomenon. Vasospastic tendency and excretion of arsenic in smelter workers before and after summer vacation. Int. Arch. Occup. Environ. Health 60:361-364.

Landau, E.D.; Thompson, D.J.; Feldman, R.G.; Goble, G.J.; Dixon, W.J. 1977. Selected Noncarcinogenic Effects of Industrial Exposure to Inorganic Arsenic. U.S. Environmental Protection Agency, Washington, DC. EPA 659/6-77-018.

Lee, A.M.; Fraumeni, J.F., Jr. 1969. Arsenic and respiratory cancer in man - an occupational study. J. Natl. Cancer Inst. 42:1045-1052.

Lee-Feldstein, A. 1983. Arsenic and respiratory cancer in man: Follow-up of an occupational study. In: Arsenic: Industrial, Biomedical, and Environmental Perspectives, W. Lederer and R. Fensterheim, eds. Van Nostrand Reinhold, New York.

Lee-Feldstein, A. 1986. Cumulative exposure to arsenic and its relationship to respiratory cancer among copper smelter employees. J. Occup. Med. 28:296-302.

Lee-Feldstein, A. 1989. A comparison of several measures of exposure to arsenic: matched case control study of copper smelter employees. Am. J. Epidemiol. 129:112-124.

Lundgren, K.D. 1954. Damage in the respiratory organs of workers at a smeltery. Nord. Hyg. Tidskr. 3:66-82.

Lyster, W.R. 1977. Arsenic and sex ratio in man. Med. J. Austral. 2:442.

Mabuchi, K.; Lilienfeld, A.; Snell, L. 1979. Lung cancer among pesticide workers exposed to inorganic arsenicals. Arch. Environ. Health 34:312-320.

Mahaffey, K.R.; Capar, S.G.; Gladen, B.C.; Fowler, B.A. 1981. Concurrent exposure to lead, cadmium, and arsenic: effects on toxicity and tissue metal concentrations in the rat. J. Lab. Clin. Med. 98:463-481.

Mappes, R. 1977. Experiments on excretion of arsenic in urine (Ger.) Int. Arch. Occup. Environ. Health 40:267-272. (Cited in ATSDR, 1989).

Marafante, E.; Vahter, H. 1987. Solubility, retention, and metabolism of intratracheally and orally administered inorganic arsenic compounds in the hamster. Environ. Res. 42:72-82.

Matanoski, G.; Landau, E.; Towascia, J. et al. 1981. Lung Cancer/ Mortality in Proximity to a Pesticide Plant. U.S. Public Health Service, Washington, DC. PB80-207376.

Mizuta, N,; Mizuta, M.; Ita, F.; Ito, T.; Uchida, H.; Watanabe, Y.; Akama, H.; Murakami, T.; Hayashi, F.; Nakamura, K.; Yamaguchi, T.; Mizuia, W.; Oishi, S.; Matsumura, H. 1956. An outbreak of acute arsenic poisoning caused by arsenic-contaminated soy sauce (shoye). A clinical report of 220 cases. Bull. Yamaguchi Med. Sch. 4:131-150. (Cited in U.S. EPA, 1984).

Morris, J.S.; Schmid, M.; Newman, S.; Scheuer, P.J.; Sherlock, S. 1974. Arsenic and noncirrhotic portal hypertension. Gastroenterology 64:86-94.

Morton, W.E.; Caron, G.A. 1989. Encephalopathy: an uncommon manifestation of workplace arsenic poisoning? Am. J. Ind. Med. 15:1-5.

Nagymjtenyi, L.; Selypes, A.; Berencsi, G. 1985. Chromosomal aberrations and fetotoxic effects of atmospheric arsenic exposure in mice. J. Appl. Toxicol. 5:61-63. (Cited in ATSDR, 1989).

Neiger, R.D.; Osweiler, G.D. 1989. Effect of subacute low level dietary sodium arsenite on dogs. Fund. Appl. Toxicol. 13:439-451.

Nevens, F.; Fevery, J.; Van Steenbergen, W.; et al. 1990. Arsenic and non-cirrhotic portal hypertension. J. Hepatol. 11:80-85. (Cited in TOXBIB/90/375885)

NIOSH (National Institute for Occupational Safety and Health). 1979. Arsine (arsenic hydroxide) poisoning in the workplace. Current Intelligence Bulletin 32. Cincinnati, OH.

Nordström, S.; Beckman, L.; Nordenson, I. 1978a. Occupational and environmental risks in and around a smelter in northern Sweden. I. Variations in birth weight. Hereditas 88:43-46.

Nordström, S.; Beckman, L.; Nordenson, I. 1978b. Occupational and environmental risks in and around a smelter in northern Sweden. III. Frequencies of spontaneous abortions. Hereditas 88:51-54.

Osato, K. 1977. Effects of oral administration of arsenic trioxide during the suckling stage of rats. Fukuoka Igaku Zasshi 68:464-491. (Cited in U.S. EPA, 1984).

Osswald, H; Goerttler, K. 1971. Arsenic induced leucoses in mice after placental and postnatal application (Ger.). Verh. Dtsch. Gesellsch. Path. 55:289-293. (Cited in IARC, 1980).

Ott, M.G.; Holder, B.B.; Gordon, H.I. 1974. Respiratory cancer and occupational exposure to arsenicals. Arch. Environ. Health 29:250-255. (Cited in ATSDR, 1989).

Penn, A. 1990. Mutational events in the etiology of arteriosclerotic plaques. Mutat. Res. 239:149-162.

Perry, K.; Bowler, R.G.; Buckell, H.M.; Druett, H.A.; Schilling, R.S.F. 1948. Studies in the incidence of cancer in a factory handling inorganic compounds of arsenic - II: clinical and environmental investigations. Br. J. Ind. Med. 5:6-15.

Pershagen, G.; Lind, B.; Bjorklund, N.-E. 1982. Lung retention and toxicity of some inorganic arsenic compounds. Environ. Res. 29:425-434.

Pershagen, G.; Nordberg, G.; Bjorkland, N.E. 1984a. Carcinomas of the respiratory tract in hamsters given arsenic trioxide and/or benzo-a-pyrene by the pulmonary route. Environ. Res. 37:425-432. (Cited in IARC, 1987).

Pershagen, G.; Nordberg, G.; Bjorkland, N.E. 1984b. Experimental evidence on the pulmonary carcinogenicity of arsenic trioxide. Arch. Toxicol. 7:403-404. (Cited in IARC, 1987).

Pershagen, G. 1985. Lung cancer mortality among men living near an arsenic-emitting smelter. Am. J. Epidemiol. 122:684-696.

Pinto, S.S.; McGill, C.M. 1953. Arsenic trioxide exposure in industry. Ind. Med. Surg. 22:281-287. (Cited in U.S. EPA, 1984)

Pomroy, C.; Charbonneau, S.M.; McCullough, R.S.; Tam, G.K.H. 1980. Human retention studies with ^{74}As. Toxicol. Appl. Pharmacol. 53:550. (Cited in Hindmarsh and McCurdy, 1986).

Reymann, F.; Moller, R.; Nielsen, A. 1978. Relationship between arsenic intake and internal malignant neoplasms. Arch. Dermatol. 114:378-381.

Rozenshstein, I.S. 1970. Sanitary toxicological assessment of low concentrations of arsenic trioxide in the atmosphere. Hyg. Sanit. 34:16-22. (Cited in U.S. EPA, 1984).

Rudnay, P.; Bõrzsõnyi, M. 1981. The tumorigenic effect of treatment with arsenic trioxide (Hung.). Magyar. Onkol. 25:73-77. (Cited in IARC, 1987).

Salcedo, J.C.; Portales, A.; Landecho, E.; Diaz, R. 1984. Transverse study of a group of patients with vasculopathy from chronic arsenic poisoning in communities of the Francisco de Madero and San Pedro Districts, Coahuila, Mexico. Revista de la Facultad de Medicina de Torreon 12:16. (Cited in ATSDR, 1989).

Schaumburg, H.A. 1980. Failure to produce arsenic neurotoxicity in the rat. An experimental study. Office of Toxic Substances, U.S. Environmental Protection Agency, Washington, DC. EPA 560/11-80-022. (Cited in ATSDR, 1989).

Schroeder, H.A.; Kanisawa, M.; Frost, D.V.; Mitchener, M. 1968. Germanium, tin and arsenic in rats: effects on growth, survival and tissue levels. J. Nutr. 96:37-45.

Schroeder, H.A., Mitchener, M. 1971. Toxic effects of trace elements on the reproduction of mice and rats. Arch. Environ. Health 23:102-106.

Shirachi, D.Y.; Johansen, M.G.; McGowan, J.P.; Tu, S-H. 1983. Tumorigenic effect of sodium arsenite in rat kidney. Proc. West. Pharmacol. Soc. 26:413-415. (Cited in IARC, 1987).

Sommers, S.C.; McManus, R.G. 1953. Multiple arsenical cancers of the skin and internal organs. Cancer 6:347-359.

Squibb, K.S.; Fowler, B.A. 1983. The toxicity of arsenic and its compounds. In: Biological and Environmental Effects of Arsenic. B.A. Fowler, ed. Elsevier Science Publishers B.V., New York. pp. 233-269.

Takahashi, K. 1974. Investigation of chronic arsenic poisoning. Jap. Public Health Assoc. (cited in U.S. EPA, 1984).

Tay, C.H.; Seah, C.S. 1975. Arsenic poisoning from anti-asthmatic herbal preparations. Med. J. Aust. 2:424-428.

Terada, H.; Katsuta, K.; Sasakawa, T.; Saito, T.; Shrota, H.; Fukuchi, K.; Sekiya, E.; Yokoyama, Y.; Hirokawa, S.; Watanabe, G.; Hasegawa, K.; Shina, T.O.; Sekiguchi, E. 1960. Clinical observations of chronic toxicosis by arsenic. Nihon Rinsho 18:2394-2403.

Tseng, W.P.; Chu, H.M.; How, S.W.; Fong, J.M.; Lin, C.S.; Yeh, S. 1968. Prevalence of skin cancer in an endemic area of chronic arsenium in Taiwan. J. Natl. Cancer Inst. 40:453-463.

Tseng, W.P. 1977. Effects and dose-response relationships of skin cancer and blackfoot disease with arsenic. Environ. Health Perspect. 19:109-119.

U.S. Air Force. 1990. Arsenic. In: The Installation Restoration Program Toxicology Guide, vol. 5. Wright-Patterson Air Force Base, OH. pp. 75-1 to 75-102.

U.S. EPA. 1984. Health Assessment Document for Arsenic. Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Research Triangle Park, NC. EPA 600/8-32-021F.

U.S. EPA. 1987. Special Report on Ingested Arsenic: Skin Cancer; Nutritional Essentiality. Prepared for the Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, DC. EPA/625/3-87/013.

U.S. EPA. 1991a. Integrated Risk Information System (IRIS). Risk Estimate for Carcinogenicity and Reference Dose for Oral Exposure for Arsenic. (Online file, retrieved Nov. 1991). Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA. 1991b. Drinking Water Regulations and Health Advisories. Prepared by the Office of Water. U.S. Environmental Protection Agency, Washington, DC.

U.S. EPA. 1992. Health Effects Summary Tables. FYI 1992. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH, for the Office of Emergency and Remedial Response. Washington, DC.

Valentine, J.L.; Campion, D.S.; Schluchter, M.D.; Massey, F.J. 1982. Arsenic effects on human nerve conduction. In: Proceedings of the Fourth International Symposium on Trace Element Metabolism in Man and Animals, J.M. Gawthorne, J.M. Howell, and C.L. White, eds. Springer-Verlag, New York. pp. 409-412.

Viallet, A.; Guillaume, L.; Cote, J.; Legare, A.; Lavoie, P. 1972. Presinusoidal portal hypertension following chronic arsenic intoxication. Gastroenterology 62:177

Webb, D.R.; Wilson, S.E.; Carter, D.E. 1986. Comparative pulmonary toxicity of gallium arsenide, gallium (III) oxide, and arsenic (III) oxide intratracheally instilled into rats. Toxicol. Appl. Pharmacol. 82:405-416.

Webb, D.R.; Wilson, S.E.; Carter, D.E. 1987. Pulmonary clearance and toxicity of respirable gallium arsenide particulates intratracheally instilled into rats. Am. Ind. Hyg. Assoc. J. 48(7):660-667.

Willhite, C.C.; Ferm, V.H. 1984. Prenatal and developmental toxicology of arsenicals. Ad. Exp. Med. Biol. 177:205-228. (Cited in U.S. EPA, 1984)

Wingren, G.; Axelson, O. 1985. Mortality pattern in a glass producing area in S.E. Sweden. British J. Indust. Med. 42:411-414.

Woods, J.S.; Fowler, B.A. 1977. Effects of chronic arsenic exposure on hematopoietic function in adult mammalian liver. Environ. Health Perspect. 19:209-213.

Woods, J.S.; Fowler, B.A. 1978. Altered regulation of mammalian hepatic heme biosynthesis and urinary porphyrin excretion during prolonged exposure to sodium arsenate. Toxicol. Appl. Pharmacol. 43:361-371.

Wu, M.M.; Kuo, T.L.; Hwang, Y.H.; Chen, C.J. 1989. Dose-response relation between arsenic concentration in well water and mortality from cancers and vascular diseases. Am. J. Epidemiol. 130:1123-1132.

Zaldivar, R. 1974. Arsenic contamination of drinking water and foodstuffs causing endemic chronic poisoning. Beitr. Path. 151:384-400.

Zaldivar, R. 1980. A morbid condition involving cardio-vascular, broncho-pulmonary, digestive and neural lesions in children and young adults after dietary arsenic exposure. Zbl. Bakt. I. Abt. Orig. B 170:44-56.

TOXICITY SUMMARY FOR BARIUM

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EXECUTIVE SUMMARY

The soluble salts of barium, an alkaline earth metal, are toxic in mammalian systems. They are absorbed rapidly from the gastrointestinal tract and are deposited in the muscles, lungs and bone. Barium is excreted primarily in the feces.

At low doses, barium acts as a muscle stimulant and at higher doses affects the nervous system eventually leading to paralysis. Acute and subchronic oral doses of barium cause vomiting and diarrhea, followed by decreased heart rate and elevated blood pressure. Higher doses result in cardiac irregularities, weakness, tremors, anxiety and dyspnea. A drop in serum potassium may account for some of the symptoms. Death can occur from cardiac and respiratory failure. Acute doses around 0.8 grams can be fatal to humans.

Subchronic and chronic oral or inhalation exposure primarily affects the cardiovascular system resulting in elevated blood pressure. A LOAEL of 0.51 mg barium/kg/day based on increased blood pressure was observed in chronic oral rat studies (Perry et al., 1983), whereas human studies identified a NOAEL of 0.21 mg barium/kg/day (Wones et al., 1990; Brenniman and Levy, 1984). The human data were used by the EPA to calculate a chronic and subchronic oral reference dose (RfD) of 0.07 mg/kg/day. In the Wones et al. study, human volunteers were given barium up to 10 mg/L in drinking water for 10 weeks. No clinically significant effects were observed. An epidemiological study was conducted by Brenniman and Levy in which human populations ingesting 2 to 10 mg/L of barium in drinking water were compared to a population ingesting 0 to 0.2 mg/L. No significant individual differences were seen; however, a significantly higher mortality rate from all combined cardiovascular diseases was observed with the higher barium level in the 65+ age group. The average barium concentration was 7.3 mg/L, which corresponds to a dose of 0.20 mg/kg/day. Confidence in the oral RfD is rated medium by the EPA.

Subchronic and chronic inhalation exposure of human populations to barium-containing dust can result in a benign pneumoconiosis called "baritosis". This condition is often accompanied by an elevated blood pressure but does not result in a change in pulmonary function. Exposure to an air concentration of 5.2 mg/m^3 for 4 hours/day for 6 months has been reported to result in elevated blood pressure and decreased body weight gain in rats (Tarasenko et al., 1977). Reproduction and developmental effects were also observed. Increased fetal mortality was seen after untreated females were mated with males treated with 5.2 mg/m^3 of barium. Similar results were obtained with female rats treated with 13.4 mg/m^3. The NOAEL for developmental effects was 1.15 mg/m^3. An inhalation reference concentration (RfC) of 0.005 mg/m^3 for both subchronic and chronic exposure was calculated by the EPA based on the NOAEL for developmental effects. These effects have not been substantiated in humans or other animal systems.

The EPA weight-of-evidence classification for cancer is D, not classifiable as to human carcinogenicity based on inadequate evidence in humans and animals.

1. INTRODUCTION

Barium (CAS registry number 7440-39-2) is a divalent alkaline-earth metal found only in combination with other elements in nature. The most important of these combinations are the peroxide, chloride, sulfate, carbonate, nitrate, and chlorate. The pure metal oxidizes readily and reacts with water emitting hydrogen; it is chemically similar to calcium (Weast, R.C. 1987). The most likely source of barium in the atmosphere is from industrial emissions. Since it is usually present as a particulate form, it can be removed from the atmosphere by wet precipitation and deposition. Due to the element's tendency to form salts with limited solubility in soil and water, it is expected to have a residence time of hundreds of years and is not expected to be very mobile. Acidic conditions, however, will increase the solubility of some barium compounds facilitating their movement from the soil to the groundwater (U.S. EPA, 1984). Trace amounts of barium were found in over 99% of the surface waters and finished drinking water samples (average values of 43 μg/L, and 28.6 μg/L, respectively) across the United States (National Academy of Sciences, 1977).

2. METABOLISM AND DISPOSITION

2.1. Absorption

The soluble forms of barium salts are rapidly absorbed into the blood from the intestinal tract. The rates of absorption of a number of barium salts have been measured in rats following oral exposure to small quantities (30 mg/kg body weight). The relative absorption rates were found to be: barium chloride > barium sulfate > barium carbonate. Large doses of barium sulfate do not increase the uptake of this salt because of its low solubility (McCauley and Washington, 1983; U.S. EPA, 1984).

Systemic toxic effects have been observed following both oral and inhalation exposure. No absorption kinetics are available following inhalation exposure, although it is obvious that absorption does occur (U.S. EPA, 1984).

2.2. Distribution

Barium absorbed into the bloodstream disappears in about 24 hours, however, it is deposited in the muscles, lungs and bone. Very little is stored in the kidneys, liver, spleen, brain, heart or hair. It remains in the muscles about 30 hours after which the concentration decreases slowly. The deposition of barium into bone is similar to calcium but occurs at a faster rate (Stokinger, 1981). The half life of barium in bone is estimated to be about 50 days (Machata, 1988).

2.3. Metabolism

About 54% of the barium dose is protein bound. Barium is known to activate the secretion of catecholamines from the adrenal medulla without prior calcium deprivation. It may displace calcium from the cell membranes, thereby increasing permeability and providing

stimulation to muscles. Eventual paralysis of the central nervous system can occur (Stokinger, 1981).

2.4. Excretion

A tracer study in rats utilizing ^{140}Ba demonstrated that 7% and 20% of the barium dose was excreted in 24 hours in the urine and feces respectively. In contrast, calcium is primarily excreted in the urine. The clearance of barium is enhanced with saline infusion. (Stokinger, 1981).

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. Oral Exposures

3.1.1. Acute Toxicity

3.1.1.1. Human

A number of accidental barium poisonings have occurred following the ingestion of barium salts. The estimated fatal dose of barium carbonate, a rodenticide, is about 5 grams for a 70 kg human (Arena, 1979). The LD_{50} for barium chloride is estimated at about 1 gram for a 70 kg human (Machata, 1988), and the LD_{Lo} (lowest published lethal dose) is reported to be about 0.8 grams (Lewis and Sweet, 1984). The acute symptoms include: excess salivation, vomiting, diarrhea, increased blood pressure, muscular tremors, weakness, paresis, anxiety, dyspnea, and cardiac irregularities. A severe loss of potassium can account for some of the symptoms. Convulsions and death from cardiac and respiratory failure can occur. Magnesium and sodium sulfate are antidotal if taken soon after ingestion since either salt will result in the formation of insoluble barium sulfate and prevent further absorption. Survival for more than 24 hours is usually followed by complete recovery (Arena, 1979).

3.1.1.2. Animal

Similar acute symptoms occur in animals, however higher doses are usually involved. The LD_{50} for rats is listed as 630 mg/kg for barium carbonate; 118 mg/kg for barium chloride, and 921 mg/kg for barium acetate (Lewis and Sweet, 1984).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

An experiment testing the subchronic toxicity of barium chloride on human volunteers was conducted by Wones et al. (1990). The diets of 11 male subjects were controlled. They were given 1.5 L/day of distilled and charcoal-filtered drinking water that contained 0 mg/l barium for weeks 1 and 2, 5 mg/L for weeks 3 to 6, and 10 mg/L for weeks 7 to 10. No clinically significant effects were observed in blood pressures, serum chemistry, urinalysis, or electrocardiograms. The 10 mg/L (0.21 mg/kg/day) dose was identified as a NOAEL.

3.1.2.2. Animal

Groups of 30 male and 30 female Charles River rats were exposed to barium chloride at 0, 10, 50 or 250 ppm in drinking water for 90 days (Tardiff et al., 1980). The highest average dose in this study was calculated to be 45.7 mg/kg/day for female rats. No significant clinical signs of toxicity were observed. Blood pressure was not measured.

McCauley et al. (1985) conducted drinking water studies in which six male Sprague-Dawley rats/group were given water containing 0, 10, 100 or 250 mg/L barium for 36 weeks, or 1, 10, 100 or 1000 mg/L barium for 16 weeks. Female rats were given 0 or 250 mg/L for 46 weeks. Animals receiving the 1000 mg/L dose developed ultrastructural changes in the kidney glomeruli. No other effects were reported.

Tardiff et al. (1980) exposed groups of 30 male and 30 female Charles River rats to 0, 10, 50, or 250 ppm barium (given as barium chloride) in drinking water for 90 days. A slight reduction in adrenal weights was seen in female rats with the 250 ppm (45.7 mg/kg/day) dose at 13 weeks and in male rats with the 50 ppm (8.1 mg/kg/day) and the 250 ppm (38.1 mg/kg/day) doses at 8 weeks, no other adverse effects were observed. No clear dose effect or dose duration effect was seen with the adrenal weight decrease; therefore, the clinical significance is uncertain.

3.1.3. Chronic Toxicity

3.1.3.1. Human

An epidemiology study conducted by Brenniman and Levy (1984) compared a human population ingesting barium levels of 2 to 10 mg/L in their drinking water to a population ingesting 0 to 0.2 mg/L. Although significantly higher mortality rates from all cardiovascular diseases were observed with the higher barium level in the 65 and over age group, there were no significant individual differences in blood pressures, strokes, or heart and renal diseases within the two groups. The average barium concentration for the mortality study was 7.3 mg/L, which corresponds to a dose of 0.20 mg/kg/day assuming drinking water consumption of 2 L/day for a 70 kg human.

3.1.3.2. Animal

A series of experiments were performed in which groups of 52 male and female Long-Evans rats and 42 male and female Swiss mice were exposed to 5 mg barium/L (given as barium acetate) in drinking water for their lifetime (Schroeder and Mitchener, 1975a,b). The barium doses were about 0.25 and 0.825 mg/kg/day for rats and mice, respectively. No adverse clinical effects were observed, however, blood pressure was not measured. There was a slight but significant reduction in longevity of treated male mice when measured as the mean age at death of the last surviving 10% of animals. The overall average life span of the group, however, was about the same as the control group (U.S. EPA, 1984; U.S. EPA, 1989)

Perry et al. (1983) exposed 12-13 female weanling rats/group to 0, 1, 10 or 100 ppm barium (given as barium chloride) for up to 16 months. Average doses were calculated to be 0, 0.051, 0.51 and 5.1 mg/kg/day (U.S. EPA, 1985). A clinically significant increase in average blood pressure was observed in the highest dose group; a slight but statistically significant

increase was seen in the 10 ppm (0.51 mg/kg/day) dose group. The controlled diet, which restricted the intake of trace metals, calcium and potassium, may have contributed to the effect.

3.1.4. Developmental and Reproductive Toxicity

Information on developmental and reproductive toxicity in humans or animals following oral exposure was unavailable.

3.1.5. Reference Dose

3.1.5.1. Subchronic

ORAL RfD_s: 0.07 mg/kg/day (U.S. EPA, 1990b)
UNCERTAINTY FACTOR: 3
NOAEL: 0.21 mg/kg/day
PRINCIPAL STUDIES:

The same studies and comments apply to both the subchronic and chronic RfD derivations. See Section 3.1.5.2.

3.1.5.2. Chronic

ORAL RfD_c: 0.07 mg/kg/day (U.S. EPA, 1990a,b)
UNCERTAINTY FACTOR: 3
MODIFYING FACTOR: 1
NOAEL: 0.21 mg/kg/day
CONFIDENCE:
Study: Medium
Data Base: Medium
RfD: Medium
VERIFICATION DATE: 06/21/90

PRINCIPAL STUDIES: Wones et al. (1990); Brenniman and Levy (1984).

COMMENTS: The RfD values are based on a weight-of-evidence approach using subchronic to chronic human drinking water studies. The uncertainty factor accounts for protecting sensitive individuals and is reduced from the usual factor of 10 because the selected studies examined the population judged most at risk.

3.2. Inhalation Exposures

3.2.1. Acute Toxicity

Barium carbonate dust has been reported to be a bronchial irritant. Barium oxide dust is considered a dermal and nasal irritant (Stokinger, 1981).

3.2.2. Subchronic Toxicity

3.2.2.1. Human

Industrial workers exposed to barium dust, usually in the form of barium sulfate or carbonate, often develop a benign pneumoconiosis referred to as "baritosis". Because of the radiopacity of barium compounds, this condition can be specifically diagnosed radiologically. After removal from the sources of exposure, baritosis is reversible in most cases. Baritosis results in a significantly higher incidence of hypertension, but no changes are usually seen in pulmonary function (Stokinger, 1981; U.S. EPA, 1990a).

3.2.2.2. Animal

Male rats were exposed to 1.15 and 5.2 mg/m^3 of barium carbonate dust for 4 hours/day for 6 months. The high dose animals developed increased arterial pressure; decreased body weight gain; decreased blood levels of hemoglobin, sugar, protein, cholinesterase and thrombocytes; increased blood levels of leukocytes, phosphorous and alkaline phosphatase; increased urine calcium; and perivascular and peribronchial sclerosis in the lungs. (U.S. EPA, 1984; Tarasenko et al., 1977).

3.2.3. Chronic Toxicity

3.2.3.1. Human

Baritosis also occurs in workers chronically exposed to barium containing dust. Hypertension is the only reported adverse clinical effect (U.S. EPA, 1990a).

3.2.3.2. Animal

Information on the chronic inhalation toxicity of barium in animals was unavailable.

3.2.4. Developmental and Reproductive Toxicity

Tarasenko et al. (1977) performed a series of experiments designed to test for possible reproductive and developmental effects. Increased fetal mortality was observed following the mating of males exposed to barium carbonate (5.2 mg/m^3 air) with untreated females. Decreased sperm motility was observed in males treated with 22.6 mg/m^3. the mating of females exposed to 13.4 mg/m^3 for 4 months also resulted in increased fetal mortality and a general underdevelopment of the newborn pups. Ovarian follicle atresia was seen in female rats exposed to 3.1 mg/m^3. There were no significant adverse effects with the 1.15 mg/m^3 concentration (U.S. EPA, 1984).

3.2.5. Reference Concentration/Dose

3.2.5.1. Subchronic

INHALATION RfC$_s$: 0.005 mg/m^3; 0.001 mg/kg/day (U.S. EPA, 1990b)
UNCERTAINTY FACTOR: 100
NOAEL: 1.15 mg $BaCO_3$/m^3 given 4 hr/day (U.S. EPA, 1990b)

PRINCIPAL STUDY: The same study and comments apply to the subchronic and chronic RfC. The study is described in section 3.2.4.

3.2.5.2 Chronic

INHALATION RfC_c: 0.0005 mg/m^3; 0.0001 mg/kg/day; (U.S. EPA, 1990b)
UNCERTAINTY FACTOR: 1000
NOAEL: 1.15 mg $BaCO_3$/m^3 given 4 hr/day (U.S. EPA, 1990b)

PRINCIPAL STUDY: Tarasenko et al., 1977.

COMMENTS: The 1.15 mg/m^3 dose was a NOAEL, however the 5.2 mg/m^3 dose, which resulted in developmental effects, was used as the basis for the RfC calculations.

3.3. Other Routes of Exposure

3.3.1. Acute Toxicity

3.3.1.1. Human

Barium oxide dust is considered to be a dermal and nasal irritant (Stokinger, 1981).

3.3.1.2. Animal

A number of experiments have utilized intravenous and subcutaneous injections to measure lethal levels of soluble barium compounds. LD_{50} values for barium chloride, nitrate and acetate were determined in two strains of mice by intravenous injection (Syed and Hosain, 1972). The affected animals either died within one hour or survived the treatment. The LD_{50} values obtained were: 8.12, 8.49 and 11.32 mg barium/kg for the chloride, nitrate and acetate, respectively, in Swiss-Webster mice; 19.20, 20.10 and 23.31 mg barium/kg for the chloride, nitrate and acetate, respectively, in ICR mice. Although the relative toxicity of the barium salts remained the same, there was an unexplained two-fold difference in the LD_{50} values between the two mice strains.

The LD_{Lo} has been determined by subcutaneous injection in mice to be 10 mg/kg for the barium nitrate and chloride salts. The LD_{Lo} in rabbits was 55 mg/kg for the chloride and 96 mg/kg for the acetate salts. The LD_{Lo} values vary widely with the route and test animal. For example, with barium chloride the LD_{Lo} value for oral administration to rabbits is 170 mg/kg, whereas the value for subcutaneous injection is 55 mg/kg. Subcutaneous injection in mice results in a value of 10 mg/kg, which is higher than the LD_{50} value for intravenous injection in the Swiss-Webster strain (Lewis and Sweet, 1984).

3.3.2. Subchronic Toxicity

Information on the subchronic toxicity in humans and animals is unavailable.

3.3.3. Chronic Toxicity

Information on the chronic toxicity in humans and animals is unavailable.

3.3.4. Developmental and Reproductive Toxicity

Information on the developmental and reproductive toxicity in humans and animals is unavailable.

3.4. Target Organs/Critical Effects

3.4.1. Oral Exposures

3.4.1.1. Primary Target(s)

1. Cardiovascular system: Subchronic to chronic symptoms include increased blood pressure and increased incidence of cardiovascular disease in humans. An acute overdose can result in cardiac irregularities. Convulsions and death from cardiac and respiratory failure can occur.

2. Nervous system: Acute to subchronic symptoms include weakness, tremors, anxiety, and dyspnea. An acute overdose can result in convulsions and death from cardiac and respiratory failure.

3.4.1.2. Other Targets

1. Gastrointestinal system: Acute to subchronic symptoms include excess salivation, vomiting and diarrhea in humans.

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target(s)

1. Cardiovascular system: Symptoms include increased blood pressure in humans.

2. Reproduction and development: Subchronic exposure of rats resulted in decreased sperm motility and ovarian follicle atresia. Increased fetal mortality and underdevelopment of newborn pups were also reported.

3.4.2.2. Other Target(s)

1. Lungs: Subchronic to chronic exposure in humans results in a pneumoconiosis known as "baritosis" that usually does not adversely affect pulmonary function.

4. CARCINOGENICITY

4.1. Oral Exposures

4.1.1. Human

Information on the carcinogenicity of barium in humans is unavailable.

4.1.2. Animal

No significant differences in tumor incidence were found in either rats or mice in the lifetime exposure experiments of Schroeder and Mitchener (1975a,b), described in Section 3.1.3.2.

4.2. Inhalation Exposures

Information on the carcinogenicity of barium in humans and animals is unavailable.

4.3. Other Routes of Exposure

Information on the carcinogenicity of barium in humans and animals is unavailable.

4.4. EPA Weight-of-Evidence Classification

Barium has not been evaluated by the U.S. EPA for evidence of human carcinogenic potential (U.S. EPA, 1990a). Barium was designated a Group D chemical (not classifiable) because of insufficient evidence by the U.S. EPA, 1984.

4.5. Carcinogenicity Slope Factors

Data are insufficient to calculate a slope factor for barium.

5. REFERENCES

Arena, J.M. 1979. Poisoning - Toxicology - Symptoms - Treatments. Charles C. Thomas, Publisher, Springfield, Ill. pp. 173-179.

Brenniman, G.R. and P.S. Levy. 1984. High barium levels in public drinking water and its association with elevated blood pressure. In: Advances in Modern Toxicology IX, E.J. Calabrese, Ed. Princeton Scientific Publications, Princeton NJ. pp. 231-249.

Lewis, R.J. and D.V. Sweet, eds. 1984. Registry of Toxic Effects of Chemical Substances, Vol. 1. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Cincinnati, OH.

Machata, G. 1988. Barium. In Handbook on Toxicity of Inorganic Compounds, eds. H.G. Seiler and H. Sigel, Marcel Dekker, Inc. pp. 97-101.

McCauley, P.T. and I.S. Washington. 1983. Barium bioavailability as the chloride, sulfate or carbonate salt in the rat. Drug Chem. Toxicol. 6(2): 209-217.

McCauley, P.T., B.H. Douglas, R.D. Laurie and R.J. Bull. 1985. Investigations into the effect of drinking water barium on rats. Environ. Health Perspect. Vol. IX, E.J. Calabrese, Ed. Princeton Scientific Publications, Princeton, NJ. pp.197-210.

Perry, H.M., S.J. Kopp, M.W. Erlanger and E.F. Perry. 1983. Cardiovascular effects of chronic barium ingestion. In: Trace Substances in Environmental Health, XVII, D.D. Hemphill, Ed. Proc. Univ. Missouri's 17th Ann. Conf. on Trace Substances in Environmental Health. University of Missouri Press, Columbia, MO. pp. 155-164.

Schroeder, H. and M. Mitchener. 1975a. Life-term studies in rats: Effects of aluminum, barium, beryllium and tungsten. J. Nutr. 105: 421-427.

Schroeder, H. and M. Mitchener. 1975b. Life-term effects of mercury, methyl mercury and nine other trace metals on mice. J. Nutr. 105: 452-458.

Stokinger, H.E. 1981. The Metals. In Patty's Industrial Hygiene and Toxicology, Vol 2A, eds. G.D. Clayton and F.E. Clayton, John Wiley & Sons, New York. pp. 1531-1537.

Syed, I.B. and F. Hosain. 1972. Determination of LD50 of Barium Chloride and Allied Agents. Toxicol. Appl. Pharm. 22: 150-152.

Tarasenko, M, O. Promin and A. Silayev. 1977. Barium compounds as industrial poisons (an experimental study). J. Hyg. Epidem. Microbiol. Immunol. 21: 361-373.

Tardiff, R.G., M. Robinson and N.S. Ulmer. 1980. Subchronic oral toxicity of barium chloride in rats. J. Environ. Pathol. Toxicol. 4(5-6): 267-276.

U.S. EPA. 1984. Health Effects Assessment for Barium. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Emergency and Remedial Response, Washington, D.C.

U.S. EPA. 1985. Drinking Water Health Effects Criteria Document on Barium. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria And Assessment Office, Cincinnati, OH for the Office of Drinking Water, Washington, DC. NTIS PB 86-118031.

U.S. EPA. 1989. Reportable Quantity Document for Barium and Compounds. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA. 1990a. Integrated Risk Information System (IRIS). Health Risk Assessment for Barium. On line. (Verification date 6/21/90.) Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH.

U.S. EPA. 1990b. Health Effects Assessment Summary Tables Forth Quarter 1990. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Emergency and Remedial Response, Washington DC. NTIS PB90-921104.

U.S. National Academy of Sciences. 1977. Drinking Water and Health. Safe Drinking Water Committee, Advisory Center on Toxicology, Assembly of Life Sciences, National Research Council. Washington, D.C. pp 211-212.

Weast, R.C., J.A. Melvin and W.H. Beyer (ed). 1987. CRC Handbook of Chemistry and Physics. CRC Press, Inc., Boca Raton, Florida, pp B-9.

Wones, R.G., B.L. Stadler and L.A. Frohman. 1990. Lack of effect of drinking water barium on cardiovascular risk factor. Environ. Health Perspect. 85: 1-13.

TOXICITY SUMMARY FOR BERYLLIUM

April, 1992

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EXECUTIVE SUMMARY

Beryllium is present in the earth's crust, in emissions from coal combustion, in surface water and soil, and in house dust, food, drinking water, and cigarette smoke (U.S. EPA, 1987a). However, the highest risk for exposure occurs among workers employed in beryllium manufacturing, fabricating, or reclamation industries (ATSDR, 1988). Workers encounter dusts and fumes of many different beryllium compounds; the current occupational standard for worker exposure to beryllium is 2 $\mu g/m^3$ during an 8-hour workshift (OSHA, 1989).

Inhaled beryllium is absorbed slowly and localizes mainly in the lungs, bone, liver and kidneys (Stiefel et al., 1980; Reeves et al., 1967; Reeves and Vorwald, 1967; Zorn et al., 1988; Tepper et al., 1961; Meehan and Smyth, 1967). Ingested beryllium undergoes limited absorption and localizes in liver, kidneys, lungs, stomach, spleen and the large and small intestines (Crowley et al., 1949; Furchner et al., 1973; Watanabe et al., 1985). Significant absorption of beryllium or its compounds through intact skin is unlikely because of its chemical properties (U.S. EPA, 1987b). Beryllium per se is not biotransformed, but soluble salts may be converted to less soluble compounds in the lung (U.S. EPA, 1987b). Most orally administered beryllium passes through the gastrointestinal tract unabsorbed and is excreted in the feces (Reeves, 1965), whereas inhaled water-soluble beryllium salts are excreted mainly by the kidneys (Zorn et al., 1988).

Limited data indicate that the oral toxicity of beryllium is low. No adverse effects were noted in mice given 5 ppm beryllium in the drinking water in a lifetime bioassay (Schroeder and Mitchener, 1975a,b). The dose (converted to 0.54 mg/kg bw/day) was the no-adverse-effect level (NOAEL) used in the calculation of the chronic oral RfD for beryllium of 0.005 mg/kg/day (U.S. EPA, 1991a).

In contrast, the toxicity of inhaled beryllium is well-documented. Humans inhaling "massive" doses of beryllium compounds (such as the water soluble sulfate, fluoride, chloride, and oxide) may develop acute berylliosis (Constantinidis, 1978). ATSDR (1988) estimated that, based on existing data, the disease could develop at levels ranging from approximately 2-1000 μg Be/m^3. This disease usually develops shortly after exposure and is characterized by rhinitis, pharyngitis, and/or tracheobronchitis, and may progress to severe pulmonary symptoms. The severity of acute beryllium toxicity correlates with exposure levels, and the disease is now rarely observed in the United States because of improved industrial hygiene (Zorn et al., 1988; Kriebel et al., 1988b).

Humans inhaling beryllium may also develop chronic berylliosis which, in contrast to acute berylliosis, is highly variable in onset, is more likely to be fatal, and can develop a few months to $\geq$20 years after exposure (Constantinidis, 1978; Hall et al., 1959; Kriebel et al., 1988b). Chronic beryllium disease is a systemic disease that primarily affects the lungs and is characterized by the development of non-caseating granulomas. The disease most likely results from a hypersensitivity response to beryllium as evidenced by positive patch tests (Nishimura, 1966) and positive lymphocyte transformation tests (Williams and Williams (1983) in exposed individuals. Granulomas may also appear in the skin, liver, spleen, lymph nodes, myocardium, skeletal muscles, kidney, bone, and salivary glands (Kriebel et al., 1988b; Freiman and Hardy, 1970).

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Epidemiologic studies have suggested that beryllium and its compounds could be human carcinogens. In a study that covered 15 regions of the U.S., Berg and Burbank (1972) found a significant correlation between cancers of the breast, bone and uterus and the concentration and detection frequency of beryllium in drinking water. However, imperfect analytical and sampling methods used in the study prompted the U.S. EPA (1986b) to conclude that these results are not proof of cause and effect relationships between cancer and beryllium in drinking water. Studies in workers exposed to beryllium, mostly via inhalation, have shown significant increases in observed over expected lung cancer incidences (Bayliss et al., 1971; Bayliss and Lainhart, 1972; Bayliss and Wagoner, 1977; Wagoner et al., 1980; Mancuso, 1970; 1979; 1980). The U.S. EPA (1986a), in evaluating the total database for the association of lung cancer with occupational exposure to beryllium, noted several limitations, but concluded that the results must be considered to be at least suggestive of a carcinogenic risk to humans. In laboratory studies, beryllium sulfate caused increased incidences of pulmonary tumors in rats and rhesus monkeys (Vorwald, 1953, 1962, 1968; Vorwald et al., 1955, 1966; Schepers et al., 1957; Reeves and Deitch, 1969).

Based on sufficient evidence for animals and inadequate evidence for humans, beryllium has been placed in the EPA weight-of-evidence classification B2, probable human carcinogen (U.S. EPA, 1991a). For inhalation exposure, the unit risk value is 2.4E-3 $(\mu g/m^3)^{-1}$, and the slope factor is 8.4 $(mg/kg/day)^{-1}$ (U.S. EPA, 1991b). For oral exposure, the unit risk value is 1.2E-4 $(\mu g/L)^{-1}$ and the slope factor is 4.3 $(mg/kg/day)^{-1}$ (U.S. EPA, 1991a).

1. INTRODUCTION

Beryllium (Be), a metallic element, belongs to Group IIA of the periodic table and has an atomic weight of 9.012 and an oxidation state of +2 (U.S. EPA, 1987a; Budavari et al., 1989). Beryllium occurs naturally in the earth's crust at concentrations ranging from 2-10 ppm. It is also released into the atmosphere from coal combustion at concentrations of ~0.01-0.1 ng/m^3, most likely as beryllium oxide (U.S. EPA, 1987a). Beryllium occurs in house dust (0.05-0.1 μg/g), surface water (0.01-1.0 ng/g), and soil (0.3-6.0 μg/g) (U.S. EPA, 1987a). Total daily intake values for beryllium in the general population are estimated at 1.6 ng/day in air, 120 ng in food, and 285 ng in water (U.S. EPA, 1987b). In addition, a smoker of one pack of cigarettes/day could inhale up to 700 ng of beryllium, depending on the type of tobacco used (U.S. EPA, 1987b).

Currently, beryllium has many industrial uses (e.g., in brake systems of airplanes, for neutron monochromatization, as window material for x-ray tubes, and in radiation detectors) (Zorn et al., 1988). The commercially important compound, beryllium oxide, is used in the electronics industry as a substrate for transistors and silicon chips, coil cores, and laser tubes (Zorn et al., 1988).

Although beryllium ore is relatively nontoxic, all other commercially important beryllium compounds exhibit significant pulmonary toxicity (ATSDR, 1988). Individuals employed in beryllium manufacturing, fabricating, or reclaiming industries are at highest risk for exposure and may encounter dusts and fumes of many different beryllium compounds. The current occupational standard for worker exposure to beryllium is 2 μg/m^3 over an 8-hour workshift (OSHA, 1989). The U.S. EPA (1987b) reports that new cases of chronic beryllium disease are surfacing in industries where the OSHA standard is exceeded, but that few cases have been reported where levels do not exceed 2 μg/m^3.

2. METABOLISM AND DISPOSITION

2.1. ABSORPTION

The gastrointestinal absorption of beryllium and its compounds is limited; instead, these compounds form insoluble precipitates at about pH 7 (Zorn et al., 1988) and pass out of the g.i. tract unabsorbed (Reeves, 1965; Furchner et al., 1973). Two studies in which beryllium was given orally to animals as ^{7}Be in single or repeated doses demonstrated that <1% of the administered beryllium was absorbed (Crowley et al., 1949; Furchner et al., 1973). In another study, rats given beryllium sulfate (6.6 or 66.6 μg beryllium/day) in drinking water for up to 24 weeks eliminated 60-90% in the feces, suggesting at first that significant absorption had taken place; however, further analysis of the recovery data revealed that the metal was probably precipitated as the phosphate and was not available for absorption (Reeves, 1965).

The small amount of gastrointestinal absorption of beryllium that does occur depends on the specific compound administered. In hamsters, the absorption of soluble beryllium sulfate from the g.i. tract exceeded that of insoluble beryllium oxide and beryllium metal (Watanabe et al., 1985); and in rats, the absorption of beryllium oxide exceeded that of the hydroxide, and the

absorption of beryllium fluoride exceeded that of the chloride, sulfate, nitrate, and hydroxide (Bugryshev et al., 1984). Reeves (1965) concluded from his studies that most of the beryllium found in the body was absorbed from the stomach at pH values (3.0-3.6 in the rat) that are favorable for maintaining beryllium salts in their ionized and soluble form.

Beryllium is slowly absorbed and retained by the lungs (Stiefel et al., 1980; Reeves et al., 1967; Reeves and Vorwald, 1967; Zorn et al., 1988). In one study, rats and guinea pigs were exposed for 3 hours to beryllium sulfate aerosol containing ^{7}Be added as the chloride (Zorn et al., 1977). Of the <3 mg of beryllium that were inhaled, 10 ng were ^{7}Be. Immediately after exposure, ~5 ng of ^{7}Be were retained, 67% in the lungs and 15% in the skeleton. In another study, levels of beryllium reached steady state in the blood of rats and guinea pigs after 8 to 12 hours of exposure to beryllium nitrate (35 $\mu g/m^3$ Be), and equilibrated in the lungs of rats after 32 weeks of exposure to beryllium sulfate (35 $\mu g/m^3$ Be) (Stiefel et al., 1980).

Dermal absorption of water-soluble beryllium sulfate or beryllium chloride occurred at pH 3 in animal experiments (Zorn et al., 1988); however, U.S. EPA (1987b) concluded that significant absorption of beryllium or its compounds through intact skin is unlikely because of its chemical properties.

2.2. DISTRIBUTION

Watanabe et al. (1985) studied the distribution of beryllium in groups of hamsters given several different beryllium compounds in the diet for 3 to 12 months. The animals were sacrificed for tissue examination at various times. Beryllium administered as the soluble sulfate localized in liver, large intestine, small intestine, kidneys, lungs, stomach, and spleen; whereas beryllium administered as beryllium metal or beryllium oxide, both insoluble, localized mainly in the large and small intestines. Zorn et al. (1988) reported that a portion of beryllium or its compounds is stored in the liver and skeleton.

Analysis of tissues from workers exposed to beryllium via inhalation revealed that the highest levels of the metal were in the lungs, then bone, liver, and kidneys (Tepper et al., 1961; Meehan and Smyth, 1967).

2.3. METABOLISM

Beryllium is not biotransformed, but soluble salts may be converted to less soluble compounds in the lung (U.S. EPA, 1987b).

2.4. EXCRETION

Animal studies have shown that most orally administered beryllium passes through the gastrointestinal tract unabsorbed and is excreted in the feces. In one study, rats given beryllium sulfate (6.6 or 66.6 μg beryllium/day) in drinking water for up to 24 weeks eliminated 60-90% in the feces and <1% in the urine (Reeves, 1965). Another study demonstrated that urinary beryllium levels for rats fed beryllium sulfate doses of 5, 50, or 500 mg/kg for 2-years were proportional to intake (Morgareidge et al., 1977).

Inhaled water-soluble beryllium salts are excreted mainly by the kidneys, with a half-life of 2-8 weeks (Zorn et al., 1988). Stiefel et al. (1980) found increased levels of beryllium in the urine of cigarette smokers (2 $\mu g/L$ compared with 0.9 $\mu g/L$, normal level); in animals, urinary

elimination of beryllium peaked at 300 ng/g 10 hours after exposure ended. Stress, such as that brought on by pregnancy or major surgery, may mobilize beryllium in the body, and excretion of the metal in the urine may continue for years. Thus, urinary concentrations of beryllium at any point in time reflect only the amount released, and not the total body burden (Parkes, 1984).

Beryllium particles are cleared slowly from the lungs. Sanders et al. (1975) measured the clearance of beryllium oxide in rats and hamsters. Females of both species had slower clearance than did males. Reeves and Vorwald (1967) made similar observations in rats exposed to beryllium sulfate, and reported that the clearance half-time exceeded 63 days. Rhoads and Sanders (1985) reported that the half-time for removal of 50% of the initial lung burden of beryllium, following up to 3 hours of exposure to the metal, was 400 days.

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

Information on the acute toxicity of beryllium following oral exposure to humans was unavailable.

3.1.1.2. Animal

Acute oral LD_{50} values for beryllium range from 18 mg Be/kg as beryllium fluoride in the mouse to 200 mg Be/kg as beryllium chloride in the rat (Reeves, 1986).

3.1.2. Subchronic Toxicity

Information on the subchronic toxicity of beryllium following oral exposure to humans and animals was unavailable.

3.1.3. Chronic Toxicity

3.1.3.1. Human

Information on the chronic toxicity of beryllium following oral exposure to humans was unavailable.

3.1.3.2. Animal

In early studies, chronic feeding of large doses of beryllium carbonate (0.1-0.5%, 1-5 g/kg of food) to young animals produced rickets (Guyatt et al., 1933; Jacobson, 1933; Kay and Skill, 1934). This effect was thought to be the result of the binding of phosphate to beryllium in the gut and the subsequent depletion of phosphorus in the body. In a two-year feeding study, rats were given dietary levels of 5, 50, or 5000 ppm beryllium (as beryllium sulfate) (Morgareidge

et al., 1977). Animals of the 5000 ppm group (5 g/kg of food) had slightly decreased body weights. U.S. EPA (1991a) indicates that an unpublished dietary study by Cox et al. (1975) provided a NOEL of 25 mg/kg/day for beryllium.

Groups of approximately 50 male and female Long-Evans rats and Swiss mice received drinking water containing 5 ppm beryllium sulfate for life (Schroeder and Mitchener, 1975a,b). Body weights were measured throughout the study, and at the time of death, the animals were dissected and gross pathology recorded. Blood and urine samples were taken from the rats only. A slight depression in growth rate was observed for male rats at 2-6 months of age and glucose was detected in the urine of the female rats ($p < 0.025$, compared with control values, Chi square analysis). No other consistent differences were noted between treated and control rats regarding urinalysis, or serum glucose, uric acid, and cholesterol. No differences were noted between treated and control mice.

3.1.4. Developmental and Reproductive Toxicity

Information on the developmental/reproductive toxicity of beryllium following oral exposure to humans or animals was unavailable.

3.1.5. Reference Dose

3.1.5.1. Subchronic

ORAL RfD: 0.005 mg/kg/day (U.S. EPA, 1991b)
UNCERTAINTY FACTOR: 100
NOAEL: 5 ppm in drinking water (0.54 mg/kg bw/day)

COMMENT: The principal study (Schro^O and fr the protection of sensitive human subpopulations. The RfD is limited to soluble beryllium salts.

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

Acute beryllium diseases in humans result from the inhalation of high concentrations of highly dispersed forms of beryllium or its compounds (Zorn et al., 1988). Individuals inhaling massive doses of beryllium compounds (such as the water soluble sulfate, fluoride, chloride, and oxide) may develop acute berylliosis (Constantinidis, 1978). This disease usually develops shortly after exposure and is characterized by rhinitis, pharyngitis, and/or tracheobronchitis, and may progress to severe pulmonary disease. The severity of acute beryllium toxicity correlates with exposure levels (Zorn et al., 1988). Brief exposure to concentrations of beryllium in air above 100 $\mu g/m^3$, may cause acute pneumonitis characterized by shortness of breath, malaise, anorexia, weight loss, coughing, cyanosis, tachypnea and tachycardia (U.S. EPA, 1987; Eisenbud et al., 1948). Lung volumes are reduced and diffuse or localized infiltrates are seen on the chest x-ray (Kriebel et al., 1988b). Although some cases of acute beryllium disease are fatal, most are resolved within a few months (Dutra, 1948). Sprince et al. (1983) reported that 17% of a group of patients with the acute disease developed chronic disease in 10 or more years. Acute

beryllium disease is now rarely observed in the United States because of improved industrial hygiene (Kriebel et al., 1988b).

3.2.1.2. Animal

LC_{50} values for beryllium were not found in the available literature. In rats, the lethal dose for acute inhalation of beryllium sulfate was 10 mg of the salt/m^3 6 hours/day for 5 days (Stiefel et al., 1980).

Brief exposures to beryllium can result in long-term effects. In a pulmonary toxicity study, male rats were exposed for one hour in a nose only chamber to an aerosol of 4.05 μg of Be/L (as beryllium sulfate) and were examined for toxicity for a year after exposure (Sendelbach et al., 1989). Parameters for lung toxicity included bronchoalveolar lavage, lung cell kinetics, and histopathologic analysis. The activities of alkaline phosphatase (Alk Pase), acid phosphatase (Ac Pase), and lactate dehydrogenase (LDH) in lavage fluids were elevated 3 weeks after exposure; Alk Pase and LDH levels peaked 3 months after. Microscopic examination revealed progressive focal interstitial pneumonitis with a prominent alveolar component of heteromorphic macrophages, neutrophils, and debris.

In a similar study, higher concentrations of beryllium (800 μg Be metal/m^3 for 50 min; initial lung burden, 625 μg) caused severe, acute chemical pneumonitis that is followed by a quiescent period of minimal inflammation and mild fibrosis (Haley et al., 1990). Progressive, chronic-active, fibrosing pneumonitis appeared later.

3.2.2. Subchronic Toxicity

3.2.2.1. Human

Information on the subchronic toxicity of beryllium following inhalation exposure to humans was unavailable.

3.2.2.2. Animal

The respiratory tract is the target for the subchronic inhalation toxicity of beryllium. Schepers et al. (1957) exposed 115 male and female Sherman and Wistar rats to 35 μg/m^3 of beryllium (as beryllium sulfate) 8 hours/day, 5 days/week and 4 hours/day 1 day/week for 180 days. During exposure, 46 exposed rats died from a bacterial infection that affected the heart and lungs. At the end of exposure, 17 rats were sacrificed and examined for pulmonary effects. Foam-cell clusters, infiltration of macrophages, lobular septal-cell proliferation and peribronchial and alveolar-wall epithelialization were observed in the treated animals. Untreated controls had none of these effects. Fifty-two of the exposed rats were maintained in beryllium-free air for up to 18 months. These animals demonstrated a progressive increase in the frequency of pulmonary changes that included atrophic-vesicular emphysema and metaplasia of the bronchial epithelium.

A dose-response for pulmonary effects was suggested in a study of rats exposed to beryllium sulfate aerosol 7 hours/day for 1-560 days (Vorwald et al., 1966). The animals exhibited no specific inflammatory abnormalities at an aerosol concentration of 2.8 μg/m^3, significant inflammatory changes at 21 μg/m^3, chronic pneumonitis at 42 μg/m^3, and acute berylliosis at 194 μg/m^3. Durations of exposure associated with these effects were not clear.

Tumors developed in animals in both of the above studies; these are discussed in Section 4.

3.2.3. Chronic Toxicity

3.2.3.1. Human

Humans inhaling beryllium may develop chronic berylliosis which, in contrast to acute berylliosis, is highly variable in onset and can develop a few months to ≥20 years after exposure (Constantinidis, 1978; Kriebel et al., 1988b). Exposure lasting for months to years is essential for the development of the disease (Kriebel et al., 1988b).

The risk of disease, estimated at 1 to 10% (Eisenbud and Lisson, 1983), is probably related to both the magnitude of the exposure and the type of beryllium compound. The more soluble compounds apparently cause the acute disease; whereas, the less soluble compounds are more likely to be associated with the chronic disease (Machle et al., 1948). This suggests that the risks are now much lower as a result of the increased effectiveness of current occupational and environmental controls (Kriebel et al., 1988b). In at least one exception to this, five workers developed lung granulomas after working in an area where beryllium fume concentrations were consistently $<2\ \mu g/m^3$, the OSHA standard (Cullen et al. 1987). However, the investigators suspect that exposure was underestimated because of the collection method used.

Chronic beryllium disease is a systemic, granulomatous disease that primarily affects the lungs (Kriebel et al., 1988b). Non-caseating granulomas may also be observed in the skin, liver, spleen, lymph nodes, myocardium, skeletal muscles, kidney, bone, and salivary glands (Freiman and Hardy, 1970). Other symptoms of the disease include dyspnea, weight loss, chest pain, cough, arthralgias, and fatigue (Kriebel et al., 1988b). Physical findings include bibasilar crackles, skin lesions, hepatosplenomegaly, clubbing of the nail beds, and lymphadenopathy, and in severe cases, right heart failure and cor pulmonale may occur (Kriebel et al., 1988b). X-rays may show diffuse infiltrates and hilar adenopathy. In addition, a cross-sectional study conducted on 297 white male workers employed for an average of 17 years in a large beryllium plant, revealed decrements in pulmonary function (Kriebel et al., 1988a).

Chronic pulmonary beryllium disease proceeds at one of the following three levels, as characterized by Zorn et al. (1988): (1) after the onset of lung function diminution, the pathological changes regress, leaving minimal fibrosis and respiratory impairment; (2) following an asymptotic period of 2-30 years, the disease "burns out" at a more advanced fibrotic stage with little effect on the overall life expectancy: or (3) a continuous activity with progressive inflammatory and fibrotic changes, resulting in increasing respiratory disability such as shortness of breath on exertion, chronic dry cough, and burning substernal pain. The progressive form of berylliosis is associated with decreased life expectancy.

The Beryllium Case Registry (BCR) at the Massachusetts General Hospital requires that at least four of the following six criteria be met for diagnosis of chronic beryllium disease: (1) epidemiologic evidence of significant beryllium exposure; (2) presence of beryllium in lung tissue, lymph nodes, or urine; (3) evidence of lower respiratory tract disease and a clinical course consistent with beryllium disease; (4) radiologic evidence of interstitial disease consistent with a fibronodular process; (5) evidence of a restrictive or obstructive ventilatory defect or diminished carbon monoxide diffusing capacity; (6) pathologic changes consistent with beryllium disease on examination of lung tissue and/or lymph nodes (Sprince and Kazemi, 1983).

The disease most likely results from a hypersensitivity response to beryllium as evidenced by positive patch tests (Nishimura, 1966) and positive lymphocyte transformation tests (Williams and Williams, 1983). Circulating humoral antibodies to beryllium have never been demonstrated, thus, the hypersensitivity to beryllium appears to be strictly cell-mediated (Reeves, 1979; Stiefel et al., 1980). A predisposition to the development of chronic beryllium disease, consistent with the inability of susceptible individuals to develop a sufficient number of suppressor cells to prevent the immune response from becoming excessive and destructive against autologous lung tissue, has been suggested (Zorn et al., 1988).

The chronic disease is more likely to be fatal than the acute disease. For example, in a study of 601 cases of berylliosis (61% were chronic), 31% of the patients with chronic disease died compared with 6% of the acute cases (Hall et al., 1959).

3.2.3.2. Animal

Rats exposed 7 hours/day, 5 days/week for 72 weeks to 34 $\mu g/m^3$ of beryllium (as beryllium sulfate) had increased lung weights and inflammatory and proliferative changes and clusters of macrophages in the alveolar spaces (Reeves et al., 1967).

See also the section on subchronic exposure, inhalation effects (3.2.2.2).

3.2.4. Developmental and Reproductive Toxicity

Information on the developmental/reproductive toxicity of beryllium following inhalation exposure to humans and animals was unavailable.

3.2.5. Reference Concentration

A subchronic or chronic reference concentration for beryllium was not available.

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

3.3.1.1. Human

Beryllium is a direct irritant and may cause edema and inflammation of any contacted tissue (Kriebel et al., 1988b). The eyes and skin are common targets of the acute irritant effects of beryllium (Kriebel et al., 1988b). Cutaneous injuries from beryllium metal, alloys, or oxide may require surgical excision of the foreign substance to promote healing (Zorn et al., 1988). In addition to primary dermatitis, beryllium may sensitize the skin to subsequent contact with the metal. Dermatitis usually abates after exposure stops, but ulceration can result from particles retained in the skin (Kriebel et al., 1988b).

3.3.1.2. Animal

Information on the acute toxicity of beryllium following exposure to animals by other routes was unavailable.

3.3.2. Subchronic Toxicity

Information on the subchronic toxicity of beryllium following exposure to humans or animals by other routes was unavailable.

3.3.3. Chronic Toxicity

3.3.3.1. Human

Chronic dermal contact by beryllium and its compounds may result in skin sensitization and contact dermatitis in predisposed persons (Zorn et al., 1988).

3.3.3.2. Animal

Information on the chronic toxicity of beryllium following exposure to animals by other routes was unavailable.

3.3.4. Developmental and Reproductive Toxicity

Information on the developmental/reproductive toxicity of beryllium following exposure to humans by other routes was unavailable.

3.3.4.2. Animal

Intratracheal injection of rats with 50 mg/kg of beryllium chloride or beryllium oxide on (one or more) days 3, 5, or 8 of gestation produced increases in fetal mortality, decreases in fetal weight, and increases in the percentages of pups with internal abnormalities (Selivanova and Savinova, 1986).

Rats, treated intratracheally with beryllium oxide (0.2 mg beryllium/rat) and allowed to mate repeatedly over 15 months, displayed no change in reproductive performance (Clary et al., 1975).

3.4. TARGET ORGANS/CRITICAL EFFECTS

3.4.1. Oral Exposures

3.4.1.1. Primary Target Organs

Skeletal system: Rickets in young animals appeared to be the result of the binding of phosphate to beryllium in the gut.

3.4.1.2. Other Target Organs

None

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target Organs

Lungs: Chronic beryllium disease is characterized as an immunologically mediated granulomatous lung disease in humans and appears to be the result of direct chemical toxicity and foreign-body-type reactions in rats.

3.4.2.2. Other Target Organs

Skin, liver, spleen, lymph nodes, myocardium, skeletal muscles, kidney, bone, and salivary glands may exhibit granulomas, similar to those of the lungs.

4. CARCINOGENICITY

4.1. ORAL EXPOSURES

4.1.1. Human

In the late 1970's, epidemiological studies suggested that beryllium and its compounds could be human carcinogens. In a study that covered 15 regions of the U.S., Berg and Burbank (1972) found a significant correlation between cancers of the breast, bone, and uterus and the concentration and detection frequency of beryllium in drinking water. Mortality rates in areas with beryllium in the drinking water were excessive only for nonwhite males. The probability of a positive association ranged from 0.006-0.040. However, imperfect analytical and sampling methods used in the study prompted the U.S. EPA (1986b) to conclude that these results were not proof of cause and effect relationships between cancer and beryllium in drinking water.

4.1.2. Animal

Chronic oral administration of beryllium to animals produced equivocal carcinogenicity results in two studies. In one study, mice and rats treated with drinking water containing 5 ppm beryllium (as beryllium sulfate) had slightly higher incidences of leukemias and grossly observed tumors, but the increases were not statistically significant (Schroeder and Mitchener, 1975a,b). In the other study, male Wistar rats fed diets containing 0, 5, 50, or 500 ppm beryllium as beryllium sulfate for 104 weeks had statistically significant increases in the incidence of reticulum cell sarcoma at the two lowest doses, but no response at the highest dose (Morgareidge et al., 1975). The U.S. EPA (1986b) concluded that this study is suggestive of a carcinogenic response to ingested beryllium, but the lack of response at the high dose and the lack of peer review or publication of the study limits the interpretation as a positive study.

4.2. INHALATION EXPOSURES

4.2.1. Human

Infante et al. (1980) conducted a lung cancer mortality study of white males listed in the BCR using a retrospective cohort method. Of the cohort consisting of 421 individuals, 139 had died and 64 had no vital statistics; 15 of the 139 that died had no cause of death listed. In terms of total cancer, 19 deaths were observed vs. 12.41 expected for white males. In terms of lung cancer, 6 deaths were observed 15 or more years after exposure vs. 2.81 expected ($p<0.01$). However, the study used the NIOSH life table program which results in an 11% excess in the calculated expected number of lung cancer deaths (Wagoner et al., 1980). When the expected lung cancer deaths were adjusted for using the NIOSH program, the p value was reduced to <0.09, questionable or borderline significance. Further analysis of the data from this study revealed a positive correlation for increased cancer and acute (but not chronic) beryllium disease. However, the NIOSH life tables were used for some of the calculations and the results are therefore questionable (U.S. EPA, 1987).

Several epidemiological studies of lung cancer were conducted among beryllium workers from two plants (Bayliss et al., 1971; Bayliss and Lainhart, 1972; Bayliss and Wagoner, 1977; Wagoner et al., 1980; Mancuso, 1970; 1979; 1980). The studies, based on personnel records and social security quarterly earnings reports, were equivocal regarding the carcinogenicity of beryllium. For example, three studies revealed significant increases in observed over expected lung cancer cases in workers who were (a) employed from 1942-1967 and followed for ten additional years ($p<0.05$) (Bayliss and Wagoner, 1977; Wagoner et al., 1980); (b) employed from 1937-1948 and followed for 30 additional years ($p<0.01$) (Mancuso, 1980); and (c) combined workers of both plants who were employed from 1942-1948 and followed for an additional 28 years ($P<0.01$) (Mancuso, 1979). However, the studies were considered to be limited because of methodological constraints and deficiencies such as no correction for smoking (U.S. EPA, 1991a).

The U.S. EPA (1986a) evaluated the total database for the association of lung cancer with occupational exposure to beryllium, and noted several limitations. However, in spite of the limitations of the studies, U.S. EPA (1986a,b) concluded that the results must be considered to be at least suggestive of a carcinogenic risk to humans.

4.2.2. Animal

Inhalation studies have tested the carcinogenic potential of beryllium in various animal species. Table 1 shows that beryllium sulfate causes increased incidences of pulmonary tumors in rats and rhesus monkeys (Vorwald, 1953, 1962, 1968; Vorwald et al., 1955, 1966; Schepers et al., 1957; Reeves and Deitch, 1969). Rats exposed to concentrations of beryllium ranging from 1.8 to 180 mg/m^3 exhibited increased incidences of pulmonary carcinomas that ranged from 20 to 100% (Vorwald 1953; 1962). The animals were exposed 33-38 hours/week for 3 to 24 months. The incidence of lung tumors exhibited a weakly positive correlation with exposure concentration and duration. Schepers et al. (1957) observed a 43% increase in the incidence of pulmonary carcinomas in rats exposed to 32-35 mg/m^3 beryllium 44 hours/week for 6-9 months followed by an 18-month observation period. These investigators identified eight histologically distinct types of tumors in the lungs of exposed rats. The tumors were metasticizing and transplantable. Reeves and Deitch (1969) observed an approximate 100% incidence in lung tumors in rats exposed to 36 mg/m^3 beryllium 35 hours/week for up to 18 months. The studies of these investigators indicated that tumor yield in rats was dependent upon age at exposure rather than on duration of exposure.

Tumor incidences were also increased in rats exposed to beryllium phosphate, beryllium fluoride, and beryl ore (Schepers, 1961; Wagner et al., 1969).

4.3. OTHER ROUTES OF EXPOSURE

Beryllium is carcinogenic when administered by intratracheal and intravenous injections and implantation into bone. Intratracheal injection of beryllium into rats induced cancer incidences ranging from 0-100%, with latency periods of at least 6 to 9 months (Vorwald and Reeves, 1959; Spencer et al., 1968; 1972; Ishinishi et al., 1980; Groth et al., 1972; 1976; 1980; Groth and MacKay, 1971). Several investigators have induced osteosarcomas in rabbits (Nash, 1950; Dutra and Largent, 1950; Yamaguchi and Katsura, 1963; Sissons, 1950; and others) and mice (Cloudman et al., 1949) with intravenous injection and subperiosteal or intraosseous implantation of beryllium and several of its compounds. The incidence of osteosarcoma ranged from 0-100% by either route of administration, with a latency period of $\geq$9 months.

TABLE 1. Pulmonary Carcinoma from Inhalation Exposure of Animals to Beryllium (Cont.)

Compound/Species	Concentration (mg/m^3 as Be)	Weekly Exposure Time (hours)	Duration of Exposure (months)	Incidence of Pulmonary Carcinoma	Reference
Beryllium sulfate					
Rat	33-35	33-38	12-14	4/8 (females)	Vorwald, 1953
Rat	33-35	33-38	13-18	17/17	Vorwald et al., 1955
Rat	32-35	44	6-9, followed by 18-month observation	58/136	Schepers et al., 1957
Rat	55	33-38	3-18	55/74	Vorwald, 1962
Rat	180	33-38	12	11/27	Vorwald, 1962
Rat	18	33-38	3-22	72/103	Vorwald, 1962
Rat	18	33-38	8-21	31/63	Vorwald, 1962
Rat	18	33-38	9-24	47/90	Vorwald, 1962
Rat	18	33-38	11-16	9/21	Vorwald, 1962
Rat	1.8-2.0	33-38	8-21	25/50	Vorwald, 1962
Rat	1.8-2.0	33-38	9-24	43/95	Vorwald, 1962
Rat	1.8-2.0	33-38	13-16	3/15	Vorwald, 1962
Rat	21-42	33-38	18	almost all	Vorwald et al., 1966

TABLE 1. Pulmonary Carcinoma from Inhalation Exposure of Animals to Beryllium (Cont.)

Compound/Species	Concentration (mg/m^3 as Be)	Weekly Exposure Time (hours)	Duration of Exposure (months)	Incidence of Pulmonary Carcinoma	Reference
Rat	2.8	33-38	18	13/21	Vorwald et al., 1966
Rat	34	35	13	43/43 (females)	Reeves et al., 1967
Rat	36	35	3	19/22 (both sexes)	Reeves and Deitch, 1969
Rat	36	35	6	33/33 (both sexes)	Reeves and Deitch, 1969
Rat	36	35	6	33/33 (both sexes)	Reeves and Deitch, 1969
Beryllium sulfate					
Rat	36	35	9	15/15 (both sexes)	Reeves and Deitch, 1969
Rat	36	35	12	21/21 (both sexes)	Reeves and Deitch, 1969
Rat	36	35	18	13/15 (both sexes)	Reeves and Deitch, 1969
Rhesus monkey	35-200	42	8	0/4 (females)	Schepers, 1964
Rhesus monkey	38.8	15	36+	8/11	Vorwald, 1968

TABLE 1. Pulmonary Carcinoma from Inhalation Exposure of Animals to Beryllium (Cont.)

Compound/Species	Concentration (mg/m^3 as Be)	Weekly Exposure Time (hours)	Duration of Exposure (months)	Incidence of Pulmonary Carcinoma	Reference
Guinea pig	35	NR	12	0	Schepers, 1961
Guinea pig	36	35	12	2/20	Schepers, 1971
Guinea pig	3.7-30.4	35	18-24	0/58	Reeves et al., 1972
Beryllium phosphate					
Rat	32-35	NR	1-12	35-60/170[b]	Schepers, 1961
Rat	227	NR	1-12	7/40[b]	Schepers, 1961
Rhesus monkey	200	42	8	0/4 (females)	Schepers, 1964
Rhesus monkey	1100	42	8	1/4 (females)	Schepers, 1964
Rhesus monkey	8300	42	8	0/4 (females)	Schepers, 1964
Beryllium fluoride					
Rat	9	NR	6-15	10-20/200	Schepers, 1961
Rhesus monkey	180	42	8	0/4 (females)	Schepers, 1964
ZnBeMnSiO3					
Rat	700	NR	9	4-20/220[b]	Schepers, 1961
Rabbit	700	NR	24	0	Schepers, 1961

TABLE 1. Pulmonary Carcinoma from Inhalation Exposure of Animals to Beryllium (Cont.)

Compound/Species	Concentration (mg/m^3 as Be)	Weekly Exposure Time (hours)	Duration of Exposure (months)	Incidence of Pulmonary Carcinoma	Reference
Guinea pig	700	NR	22	0	Schepers, 1961
Beryl ore					
Rat	620	30	17+	18/19	Wagner et al., 1969
Hamster	620	30	17+	0/48	Wagner et al., 1969
Squirrel monkey	620	30	17+	0/12	Wagner et al., 1969

4.4. EPA WEIGHT-OF-EVIDENCE

4.4.1. Oral

Not assigned.

4.4.2. Inhalation

Classification – B2, probable human carcinogen
Basis – Inadequate evidence for humans; sufficient evidence for animals (U.S. EPA, 1991a). "Beryllium has been shown to induce lung cancer via inhalation in rats and monkeys and to induce osteosarcomas in rabbits via intravenous or intramedullary injection. Human epidemiology studies are considered to be inadequate."

4.5. SLOPE FACTORS

4.5.1. Oral

SLOPE FACTOR: 4.3 $(mg/kg/day)^{-1}$
DRINKING WATER UNIT RISK: 1.2E-4 $(\mu g/L)^{-1}$
VERIFICATION DATE: 02/01/89 (U.S. EPA, 1991a)
PRINCIPAL STUDY: Schroeder and Mitchener (1975a)

4.5.2. Inhalation

SLOPE FACTOR: 8.4 $(mg/kg/day)^{-1}$
INHALATION UNIT RISK: 2.4E-3 $(\mu g/m^3)^{-1}$
VERIFICATION DATE: 05/04/88 (U.S. EPA, 1991a)
PRINCIPAL STUDY: Wagoner et al. (1980)

5. REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1988. Toxicological Profile for Beryllium. Prepared by Syracuse Research Corporation under Contract 68-C8-0004. U.S. Public Health Service. ATSDR/TP-88/09.

Bayliss, D.L. and W.S. Lainhart. 1972. Mortality patterns in beryllium production workers. Presented at the Am. Ind. Hygiene Assoc. Conf. OSHA Exhibit No. 66, Docket No. H005. (Cited in U.S. EPA, 1987a)

Bayliss, D.L. and J.K. Wagoner. 1977. Bronchogenic cancer and cardio-respiratory disease mortality among white males employed in a beryllium production facility. OSHA Beryllium hearing, 1977, Exhibit 13.F. (Cited in U.S. EPA, 1987a)

Bayliss, D.L., W.S. Lainhart, L.J. Crally, R. Ligo, H. Ayer and F. Hunter. 1971. Mortality patterns in a group of former beryllium workers. In: Tran. 334rd Ann. Meeting ACGIH, Toronto, Canada. p. 94-107. (Cited in U.S. EPA, 1987a)

Berg, J.W. and F. Burbank. 1972. Correlations between carcinogenic trace metals in water supply and cancer mortality. Ann. N.Y. Acad. Sci. 199: 249-261.

Budavari, S., M.J. O'Neil, A. Smith and P.E. Heckelman, Eds. 1989. Beryllium. In: The Merck Index. Merck & Co., Inc., Rahway, NJ. p. 181.

Bugryshev, P.F, T.I. Zaikina, Y.I. Moskalev. 1984. Adsorption of beryllium from the rat gastrointestinal tract. Gig. Tr. Prof. Zabol. 6: 52-53. (Cited in ATSDR, 1988)

Clary, J.J., L.S. Bland and H.E. Stokinger. 1975. The effect of reproduction and lactation on the onset of latent chronic beryllium disease. Toxicol. Appl. Pharmacol. 33: 214-221.

Cloudman, A.M., D. Vining, S. Barkulis and J.j. Nickson. 1949. Bone changes following intravenous injections of beryllium. Am. J. Pathol. 25: 810-811.

Constantinidis, K. 1978. Acute and chronic beryllium disease. Br. J. Clin. Pract. 32: 127-136. (Cited in U.S. EPA, 1987a)

Cox, G.E., D.E. Bailey and K. Morgareidge. 1975. Chronic feeding studies with beryllium sulfate in rats. Unpublished report submitted by the Food and Drug Research Laboratories, Inc., to the Aluminum Company of America, Pittsburgh, PA. (Cited in U.S. EPA, 1991a)

Crowley, J.F., J.G. Hamilton and K.J. Scott. 1949. The metabolism of carrier-free radioberyllium in the rat. J. Biol. Chem. 177: 975-984.

Cullen, M.R., J.R. Kominsky, M.D. Rossman, et al. 1987. Chronic beryllium disease in a precious metal refinery; clinical epidemiologic and immunologic evidence for continuous risk from exposure to low level beryllium fume. Am. Rev. Respir. Dis. 135: 201-208.

Dutra, F.R. and E.J. Largent. 1950. Osteosarcoma induced by beryllium oxide. Am. J. Pathol. 26: 197-208.

Dutra, F.R. 1948. The pneumonitis and granulomatosis peculiar to beryllium workers. Am. J. Pathol. 24: 1137.

Eisenbud, M. and J. Lisson. 1983. Epidemiological aspects of beryllium-induced nonmalignant lung disease: 30-year update. J. Occup. Med. 25: 196-202.

Eisenbud, M., C.F. Berghout and L.T. Steadman. 1948. Environmental studies in plants and laboratories using beryllium: the acute disease. J. Ind. Hyg. 30: 281-285.

Freiman, D.G. and H.L. Hardy. 1970. Beryllium disease: the relation of pulmonary pathology to clinical course and prognosis based on a study of 130 cases from the U.S. Beryllium Case Registry. Hum. Pathol. 1: 25-44. (Cited in Kriebel et al., 1988b)

Furchner, J.E., C.R. Richmond and J.E. London. 1973. Comparative metabolism of radionuclides in mammals: VII. Retention of beryllium in the mouse, rat, monkey and dog. Health Phys. 24: 292-300.

Groth, D.H. and C.R. MacKay. 1971. Chronic pulmonary pathology in rats after intratracheal injection. Toxicol. Appl. Pharmacol. 19: 392.

Groth, D.H., C. Kommiheni and G.R. MacKay. 1980. Carcinogenicity of beryllium hydroxide and alloys. Environ. Res. 21: 63-84.

Groth, D.H., L.P. Scheel and G.R. MacKay. 1972. Comparative pulmonary effects of Be and As compounds in rats. Lab. Invest. 26; 447-448.

Groth, D.H., L. Stehler and G. MacKay. 1976. Interactions of mercury, cadmium, selenium, tellurium, arsenic and beryllium. In: G.F. Nordberg, Ed. Effects and Dose-Response Relationships of Toxic Metals. Elsevier Publishing Co., Amsterdam. p. 527-543.

Guyatt, B.L., H.D. Kay and H.D. Branion. 1933. Beryllium rickets. J. Nutr. 6: 313-324.

Haley, P.J., G.L. Finch, M.D. Hoover and R.G. Cuddihy. 1990. The acute toxicity of inhaled beryllium metal in rats. Fundam. Appl. Toxicol. 15: 767-778.

Hall, T.C., C.H. Wood, J.D. Stoeckle and L.B. Tepper. 1959. Case data from the Beryllium Registry. Am. Med. Assoc. Arch. Ind. Health 19: 100-103.

Infante, P.F., J.K. Wagoner and N.I. Sprince. 1980. Mortality patterns from lung cancer and non-neoplastic respiratory disease among white males in the United States Beryllium Case Registry. Environ. Res. 21: 35-43.

Ishinishi, N., M. Mizunow, T. Inamasu and A. Hisanagel. 1980. Experimental study on carcinogenicity of beryllium oxide and arsenic trioxide to the lung of the rats by intratracheal instillation. Fukuokd Igaku Zasshi 71: 19-26. (Cited in U.S. EPA, 1987a)

Jacobson, S.A. 1933. Bone lesions in rats produced by the substitution of beryllium for calcium in the diets. Arch. Pathol. 15: 18-26.

Kay, H.D. and D.L. Skill. 1934. Prevention and cure of beryllium rickets. Biochem. J. 28: 1222-1229.

Kriebel, D., N.L. Sprince, E.A. Eisen, I.A. Greaves, H.A. Feldman and R.E. Greene. 1988a. Beryllium exposure and pulmonary function: A cross sectional study of beryllium workers. Br. J. Ind. Med. 45: 167-173.

Kriebel, D., J.D. Brain, N.L. Sprince and H. Kazemi. 1988b. The pulmonary toxicity of beryllium. Am. Rev. Respir Dis. 137: 464-473.

Machle, W., E. Beyer and F. Gregorius. 1948. Berylliosis. Occup. Med. 5: 671-683.

Mancuso, T.F. 1970. Relation of duration of employment and prior illness to respiratory cancer among beryllium workers. Environ. Res. 3: 251-275.

Mancuso, T.F. 1979. Occupational lung cancer among beryllium workers in dusts and disease. In: R. Lemen and J. Dement, Eds. Proc. Conf. Occup. Exp. to Fibrous and Particulate Dust and Their Extension into the Environment. Pathrotox Publishers, Inc. (Cited in U.S. EPA, 1987a)

Mancuso, R.f. 1980. Mortality study of beryllium industry workers' occupational lung cancer. Environ. Res. 21: 48-55.

Meehan, W.R. and L.E. Smyth. 1967. Occurrence of beryllium as a trace element in environmental materials. Environ. Sci. Technol. 1: 839-844.

Morgareidge, K., G.E. Cox and D.E. Bailey. 1975. Chronic feeding studies with beryllium sulfate in rats. Food and Drug Research Laboratories, Inc. Final Report to the Aluminum Company of America, Pittsburgh, Pa. (Cited in U.S. EPA, 1987a)

Morgareidge, K., G.E. Cox, D.E. Bailey and M.A. Gallo. 1977. Chronic oral toxicity of beryllium in the rat. Toxicol. Appl. Pharmacol. 41: 204-205.

Nash, P. 1950. Experimental production of malignant tumors by beryllium. Lancet 1: 519.

Nishimura, M. 1966. Clinical and experimental studies on acute beryllium disease. Nagoya J. Med. Sci. 18: 17-44. (Cited in U.S. EPA, 1987a)

OSHA (Occupational Safety and Health Administration). 1989. Toxic and hazardous substances. Table Z-1. 29 CFR XVII; section 1910.1000.

Parkes, W.R. 1984. Occupational Lung Disorders, 2nd ed. Butterworths, London. p. 333. (Cited in Zorn et al., 1988)

Reeves, A.L. 1965. The absorption of beryllium from the gastrointestinal tract. Arch. Environ. Health 11: 209-214.

Reeves, A.L. 1979. In: L. Friberg, G.F. Nordberg and V.B. Vouk, Eds. Handbook of the Toxicology of Metals. Elsevier/North Holland, Amsterdam. p. 329.

Reeves, A.L. 1986. Beryllium. In: Toxicology of Metals, Vol. II., 2nd ed. Elsevier Science Publishing Co., New York, pp.

Reeves, A.L. and D. Deitch. 1969. Influence of age on the carcinogenic response to beryllium inhalation. In: S. Harishima, Ed. Proc. 16th Internat. Cong. Occup. Health, Tokyo, Japan. Japan Industrial Safety Association, Tokyo, Japan. p. 651-652. (Cited in U.S. EPA, 1987a)

Reeves, A.L. and A.J. Vorwald. 1967. Beryllium carcinogenesis. II. Pulmonary deposition and clearance of inhaled beryllium sulfate in the rat. Cancer Res. 27: 446-451.

Reeves, A.L., D. Deitch and A.J. Vorwald. 1967. Beryllium carcinogenesis. I. Inhalation exposure of rats to beryllium sulfate aerosol. Cancer Res. 27: 439-445.

Reeves, A.L., N.D. Krivanek, E.K. Busby and R.H. Swanborg. 1972. Immunity to pulmonary berylliosis in guinea pigs. Int. Arch. Occup. Environ. Health 29: 209-220.

Rhoads, K. and C.L. Sanders. 1985. Lung clearance, translocation and acute toxicity of arsenic, beryllium, cadmium, cobalt, lead, selenium, vanadium, and ytterbium oxides following deposition in rat lung. Environ. Res. 36: 359-378.

Sanders, C.L., W.C. Cannon, G.J. Powers, R.R. Adee and D.M. Meier. 1975. Toxicology of high-fired beryllium oxide inhaled by rodents. Arch. Environ. Health 30: 546-551.

Schepers, G.W.H. 1961. Neoplasia experimentally induced by beryllium compounds. Prog. Exp. Tumor Res. 2: 203-224.

Schepers, G.W.H. 1964. Biological action of beryllium: Reaction of the monkey to inhaled aerosols. Ind. Med. Surg. 33: 1-16.

Schepers, G.W.H. 1971. Lung tumors of primates and rodents. II. Ind. Med. 40: 23-31.

Schepers, G.W.H., T.M. Durkan, A.B. Delahant and F.T. Creedon. 1957. The biological action of inhaled beryllium sulfate: A preliminary chronic toxicity study on rats. Am. Med. Assoc Arch. Ind. Health 15: 32-38.

Schroeder, H.A. and M. Mitchener. 1975a. Life-term studies in rats; Effects of aluminum, barium, beryllium and tungsten. J. Nutr. 105: 421-427.

Schroeder, H.A. and M. Mitchener. 1975b. Life-term effects of mercury, methyl mercury, and nine other trace metals on mice. J. Nutr. 105: 452-458.

Selivanova, L.M. and T.B. Savinova. 1986. Effects of beryllium chloride and oxide on the sexual function of female rats and development of their progeny. Gig. Sanit. 8: 44-46.

Sendelbach, L.E., A.F. Tryka and H. Witchi. 1989. Progressive lung injury over a one-year period after a single inhalation exposure to beryllium sulfate. Am. Rev. Resp. Dis. 139: 1003-1009. (MEDLARS II, TOXLINE)

Sissons, H.A. 1950. Bone sarcomas produced experimentally in the rabbit using compounds of beryllium. Acta Unio. Int. Contra. Cancrum. 7: 171. (Cited in U.S. EPA, 1987a)

Spencer, J.C., R.H. Hook, J.A. Blumenshine, S.B. McCollister, S.E. Sadek and J.C. Jones. 1968. Toxicological studies on beryllium oxides and beryllium-containing exhaust products. AMRL-7R-68-148. Aeromedical Res. Lab., Wright-Patterson AFB, Dayton, OH. 94. (Cited in U.S. EPA, 1987a)

Spencer, H.C., S.B. McCollister, J.J. Kociba, C.G. Humiston and G.L. Sparschu. 1972. Toxicological evaluation of beryllium motor exhaust products. AMRL-72-118. Aeromedical Research Lab., Wright-Patterson A.F.B., Dayton, OH. 94 p. (Cited in U.S. EPA, 1987a)

Sprince, N.L. and H. Kazemi. 1983. Beryllium disease. In: Rom, W., Ed. Environmental and Occupational Medicine, 1st ed. Little, Brown, Boston. pp. 481-490. (Cited in Kriebel et al., 1988b)

Stiefel, T., K. Schulze, H. Zorn and G. Tolg. 1980. Toxicokinetic and toxicodynamic studies of beryllium. Arch. Toxicol. 45: 81-92.

Tepper, L.B., H.L. Hardy and R.J. Chamberlin. 1961. Toxicity of Beryllium Compounds. Elsevier, New York, pp. 146-168. (Cited in ATSDR, 1988)

U.S. EPA (U.S. Environmental Protection Agency). 1986a. Health Assessment Document for Beryllium. Prepared by the Office of Health and environmental Assessment, Environmental Criteria and Assessment Office, Research Triangle Park, NC. External Review Draft. EPA 600-8-84-026B. (Cited in U.S. EPA, 1987a)

U.S. EPA (U.S. Environmental Protection Agency). 1986b. Drinking Water Criteria Document for Beryllium. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the office of Drinking Water, Washington, DC.

U.S. EPA (U.S. Environmental Protection Agency). 1987a. Health Effects Assessment for Beryllium and Compounds. Prepared for Office of Solid Waste and Emergency Response by Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, U.S. EPA, Washington, DC. ECAO-CIN-H113.

U.S. EPA (U.S. Environmental Protection Agency). 1987b. Health Assessment Document for Beryllium. Office of Health and Environmental Assessment, U.S. EPA. (EPA/600/8-84/026F)

U.S. EPA (U.S. Environmental Protection Agency). 1991a. Beryllium. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA (U.S. Environmental Protection Agency). 1991b. Health Effects Summary Tables. FY-1991 Annual, January, 1991. Office of Research and Development, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, DC. p. A-10.

Vorwald, A.J. 1968. Biologic manifestation of toxic inhalation in monkeys. In: H. Vagtborg, Ed. Use of Nonhuman Primates in Drug Evaluation. Univ of Texas Press, Austin, TX. p. 2. (Cited in U.S. EPA, 1987a)

Vorwald, A.J. 1962. Progress report (unpublished). Grant No. F-253-6. Am. Cancer Soc. (Cited in U.S. EPA, 1987a)

Vorwald, A.J. 1953. Adenocarcinoma in the lung of albino rats exposed to compounds of beryllium. In: Cancer of the Lung - An Evaluation of the Problem. Proc. of the Scientific Session, Annual Meeting, November. Am. Cancer Soc., New York. p. 103-109. (Cited in U.S. EPA, 1987a)

Vorwald, A.J. and A.L. Reeves. 1959. Pathologic changes induced by beryllium compounds. Arch. Ind. Health 19: 190-199.

Vorwald A.J., P.C. Pratt and E.J. Urban. 1955. The production of pulmonary cancer in albino rats exposed by inhalants to an aerosol of beryllium sulfate. Acta. Unio. Int. Cancrum. 11: 735. (Cited in U.S. EPA, 1987a)

Vorwald, A.J., A.L. Reeves and E.J. Urban. 1966. Experimental beryllium toxicology. In: H.E. Stokinger, Ed. Beryllium - Its industrial Hygiene Aspects. Academic Press, New York. pp. 201-234.

Wagner, W.D., D.H. Groth, J.L. Holtz, G.E. Madden and H.E. Stokinger. 1969. Comparative chronic inhalation toxicity of beryllium ores, bertrandite and beryl, with production of pulmonary tumors by beryl. Toxicol. Appl. Pharmacol. 15: 10-29.

Wagoner, J.K., P.F. Infante and D.L. Bayliss. 1980. Beryllium: An etiologic agent in the induction of lung cancer, nonneoplastic respiratory disease and heart disease among industrially exposed workers. Environ. Res. 21: 15-34.

Watanabe, K., S. Shima, S. Tachikawa, et al. 1985. Biotoxicity and beryllium distribution in organs by oral administration of beryllium compounds for long periods. II. Experimental study

TOXICITY SUMMARY FOR CADMIUM

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EXECUTIVE SUMMARY

Cadmium is a naturally occurring metal that is used in various chemical forms in metallurgical and other industrial processes, and in the production of pigments. Environmental exposure can occur via the diet and drinking water (ATSDR, 1989).

Cadmium is absorbed more efficiently by the lungs (30 to 60%) than by the gastrointestinal tract, the latter being a saturable process (Nordberg et al., 1985). Cadmium is transported in the blood and widely distributed in the body but accumulates primarily in the liver and kidneys (Goyer, 1991). Cadmium burden (especially in the kidneys and liver) tends to increase in a linear fashion up to about 50 or 60 years of age after which the body burden remains somewhat constant. Metabolic transformations of cadmium are limited to its binding to protein and nonprotein sulfhydryl groups, and various macromolecules, such as metallothionein, which is especially important in the kidneys and liver (ATSDR, 1989). Cadmium is excreted primarily in the urine.

Acute oral exposure to 20-30 g have caused fatalities in humans. Exposure to lower amounts may cause gastrointestinal irritation, vomiting, abdominal pain, and diarrhea (ATSDR, 1989). An asymptomatic period of one-half to one hour may precede the onset of clinical signs. Oral LD_{50} values in animals range from 63 to 1125 mg/kg, depending on the cadmium compound (USAF, 1990). Longer term exposure to cadmium primarily affects the kidneys, resulting in tubular proteinosis although other conditions such as "itai-itai" disease may involve the skeletal system. Cadmium involvement in hypertension is not fully understood (Goyer, 1991).

Inhalation exposure to cadmium and cadmium compounds may result in effects including headache, chest pains, muscular weakness, pulmonary edema, and death (USAF, 1990). The 1-minute and 10-minute lethal concentration of cadmium for humans has been estimated to be about 2,500 and 250 mg/m^3, respectively (Barrett et al., 1947; Beton et al., 1966). An 8-hour TWA (time-weighted-average) exposure level of 5 mg/m^3 has been estimated for lethal effects of inhalation exposure to cadmium, and exposure to 1 mg/m^3 is considered to be immediately dangerous to human health (Friberg, 1950). Renal toxicity (tubular proteinosis) may also result from inhalation exposure to cadmium (Goyer, 1991).

Chronic oral RfDs of 5E-4 and 1E-3 mg/kg/day have been established for cadmium exposure via drinking water and food, respectively (U.S. EPA, 1991). Both values reflect incorporation of an uncertainty factor of 10. The RfDs are based on an extensive data base regarding toxicokinetics and toxicity in both human and animals, the critical effect being renal tubular proteinuria. Confidence in the RfD and data base is high.

Inhalation RfC values are currently not available.

The target organ for cadmium toxicity via oral exposure is the kidney (Goyer, 1991). For inhalation exposure, both the lungs and kidneys are target organs for cadmium-induced toxicity (ATSDR, 1989; Goyer, 1991).

There is limited evidence from epidemiologic studies for cadmium-related respiratory tract cancer (ATSDR, 1989). An inhalation unit risk of 1.8E-3 $(\mu g/m^3)^{-1}$ and an inhalation slope factor of 6.1E+0 $(mg/kg/day)^{-1}$ are based on respiratory tract cancer associated with occupational exposure (U.S. EPA, 1985). Based on limited evidence from multiple occupational exposure studies and adequate animal data, cadmium is placed in weight-of-evidence group B1 - probable human carcinogen.

1. INTRODUCTION

Cadmium (Cd) is a naturally occurring metallic element that is used for electroplating and galvanization processes, in the production of pigments, in batteries, as a chemical reagent, and in miscellaneous industrial processes (ATSDR, 1989). Cadmium compounds have varying degrees of solubility ranging from very soluble to nearly insoluble. The solubility affects their absorption and toxicity. Exposure to cadmium and cadmium compounds may occur in both occupational and environmental settings, the latter primarily via the diet and drinking water (ATSDR, 1989).

2. METABOLISM AND DISTRIBUTION

2.1. ABSORPTION

Cadmium is more efficiently absorbed from the lungs than from the gastrointestinal tract (ATSDR, 1989). The absorption efficiency is a function of solubility of the specific cadmium compound as well as its exposure concentration and route.

Inhalation absorption usually involves cadmium in a particulate matter form with absorption being a function of deposition, which in turn is dependent upon the particle size (particles $\geq$ 10μm diameter tend to be deposited in the upper airways and particles $\leq$ 0.1 μm diameter are deposited in the alveolar region). Alveolar deposition efficiency in animal models ranges from 5 to 20% (Barrett et al., 1947; Boisset et al., 1978). Based on physiological modeling, cadmium deposition in the alveolar region of humans was estimated to be up to 50% for small particles (Nordberg et al., 1985). Actual cadmium absorption via inhalation exposure has been estimated to be 30 to 60% in humans (Friberg et al., 1974; Elinder et al., 1976).

Absorption of cadmium from the gastrointestinal tract appears to be a saturable process with the fraction absorbed decreasing at high doses (Nordberg et al., 1985). It is also important to distinguish true absorption from simple retention of cadmium in the microvilli of the small intestine (Foulkes et al., 1986). Shaikh and Smith (1980) reported a mean retention of 2.8% (1.1 to 7.0% range) for 12 human subjects given a single oral dose of radiolabeled cadmium chloride, and McLellan et al. (1978) reported 5.9% retention of cadmium chloride by 14 human subjects.

Also of importance relative to cadmium absorption is that its absorption may be decreased by divalent and trivalent cations (Zn^{+2}, Mg^{+2}, Cr^{+3}), and increased by iron and calcium deficiencies (Flanagan et al., 1978; Foulkes et al., 1986; Goyer, 1991). Dermal absorption is relatively unimportant (ATSDR, 1989).

2.2. DISTRIBUTION

Cadmium is transported in the blood by red blood cells and high-molecular-weight proteins such as albumin (Goyer, 1991). Normal blood cadmium levels in adults are < 1μg/dL. Although cadmium is widely distributed throughout the body, most (50 to 70% of the body

burden) accumulates in the kidneys and liver (Goyer, 1991). Cadmium burden, especially in the kidneys, tends to increase in a linear fashion with age up to about 50 or 60 years of age after which the kidney levels remain somewhat constant or slightly decline (Goyer, 1991). There is evidence that the placenta is a partial barrier to cadmium, and that the fetus is exposed to only small amounts of maternal cadmium (ATSDR, 1989).

2.3. METABOLISM

As with most metallic elements, there is little or no direct metabolic conversions of cadmium, but rather binding to various biological components, such as protein and nonprotein sulfhydryl groups and anionic groups of various macromolecules (ATSDR, 1989). Of special importance, is the binding protein, metallothionein which is very effective in binding cadmium and some other metals and is instrumental in determining the disposition of cadmium in the body (e.g. concentration of cadmium in the kidneys).

2.4. EXCRETION

The principal route of excretion is via the urine, with average daily excretion for humans being about 2 to 3 μg (ATSDR, 1989). Daily excretion represents only a small percentage of the total body burden, which accounts for the 17 to >30 years half-life of cadmium in the body (Tsuchiya et al., 1972; Friberg et al., 1974). Unabsorbed cadmium is removed from the gastrointestinal tract by fecal excretion. Typical daily cadmium excretion has been reported to be about 0.01% of the total body burden (ATSDR, 1989). There is some evidence for biliary excretion of cadmium (Klaassen et al., 1978).

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

Doses of 1,500 to 8,900 mg (20 to 30 mg/kg) of cadmium have resulted in human fatalities, but generally, fatal poisoning from cadmium is rare (ATSDR, 1989). High doses of cadmium are known to cause gastrointestinal irritation resulting in vomiting, abdominal pain, and diarrhea (ATSDR, 1989). Lauwerys (1979) reported that the emetic threshold for cadmium in drinking water was about 15 mg/L and CEC (1978) reported that 3 mg was an emetic threshold.

Following ingestion of cadmium, an asymptomatic period of 0.5 to 1.0 hour may precede the onset of clinical signs. Depending on the severity of exposure, clinical signs of cadmium poisoning following acute exposure include: nausea, vomiting, abdominal cramps, headache, muscle cramps, exhaustion, shock, and death (USAF, 1990).

3.1.1.2. Animal

Oral LD_{50} values for animals range from 225 to 890 mg/kg for elemental cadmium, 63 to 88 mg/kg for cadmium chloride, 72 mg/kg for cadmium oxide, and 590 to 1125 mg/kg for cadmium stearate (USAF, 1990).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

Because the toxic effects of cadmium are a function of a critical concentration being attained in a target organ, similar effects will occur following long-term exposure to low cadmium levels and
short-term exposure to high concentrations (Wang and Foulkes, 1984). Consequently, renal and hepatic toxicity may occur if toxic cadmium levels are attained in these organs even during subchronic exposure. A description of cadmium-induced toxicity following oral exposure is presented in Section 3.1.3. Generally, cadmium is not as toxic via oral routes as via inhalation.

3.1.2.2. Animal

Exposure of rabbits to 1.5 mmol cadmium chloride in drinking water (equivalent to 13 μg/kg/day) produced histological alterations in the liver but no clinical signs of toxicity (Stowe et al., 1972). In a study by Kotsonis and Klaassen (1978), rats exhibited proteinuria after receiving cadmium chloride in the drinking water for six weeks at 30 or 100 mg/L (equivalent to 3.1 and 8.0 mg Cd/kg/day).

Although the effects of cadmium on the immune system of humans is unclear, evidence for cadmium-induced immunotoxicity in animals is available. Koller et al. (1975) noted a decrease in the number of spleen placque-forming cells in mice receiving cadmium at 0.6 mg/kg/day for 10 weeks, and Blakley (1985) reported a dose-dependent suppression of the humoral immune system in mice receiving cadmium in drinking water at concentrations of 5 to 50 mg/L for three weeks. These immune system effects occurred at kidney tissue concentrations (0.3 to 6.0 μg/g) lower than those associated with renal toxicity.

3.1.3. Chronic Toxicity

3.1.3.1. Humans

The most serious chronic effect of oral exposure to cadmium is renal toxicity. This critical effect is characterized by tubular proteinuria resulting from renal tubular dysfunction. Friberg et al. (1974) estimated that this critical effect will not occur in humans until the cadmium concentration in the renal cortex exceeds 200 μg/g.

Dietary intake of cadmium has also been implicated in osteomalacia, osteoporosis and spontaneous fractures, conditions collectively termed "itai-itai" (ouch-ouch) disease and originally

documented in postmenopausal women in cadmium-contaminated areas of Japan (Friberg et al., 1974).

Cadmium exposure has also been implicated in hypertensive disorders, a situation that is currently not thoroughly understood or verified (ATSDR, 1989).

3.1.3.1. Animals

Rats given cadmium chloride in the drinking water at a concentration of 10 mg/L (1.2 mg Cd/kg/day) exhibited no renal effects even after 24 months, although higher exposure levels induced proteinuria after six weeks exposure (Kotsonis and Klaassen, 1978).

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

Developmental and reproductive toxicity in humans have not been demonstrated for oral exposure to cadmium (ATSDR, 1989).

3.1.4.1. Animal

Developmental toxicity data for cadmium administered orally to rats are equivocal. Pond and Walker (1975) reported few, if any effects, for rats exposed to cadmium chloride in the drinking water (15 mg/kg/day) during gestation. Baranski et al. (1985) reported teratogenic effects (fused or absent legs) in rats following gavage administration of cadmium chloride (40 mg/kg/day) during gestation. Neurological effects in rat pups were detected following gestational exposure to 0.4 or 4 mg Cd/kg (Baranski et al., 1986).

3.1.5. Reference Dose

3.1.5.1. Subchronic

ORAL RfD_s:	Not available
UNCERTAINTY FACTOR:	Not available
NOAEL:	Not available

3.1.5.2. Chronic

ORAL RfD_c:	5E-4 mg/kg/day (water) (U.S. EPA, 1991)
	1E-3 mg/kg/day (food)
UNCERTAINTY FACTOR:	10 (for both food and water)
MODIFYING FACTOR:	1 (for both food and water)
NOAEL:	0.005 mg/kg/day (water)
	0.01 mg/kg/day (food)
LOAEL:	Not available

CONFIDENCE:

Study	Not applicable
Data base	High
RfD	High

VERIFICATION DATE: 05/25/88

PRINCIPAL STUDY: The data supporting the RfD have been derived from many animal and human studies that have provided information on cadmium toxicity (renal toxicity using proteinuria as the critical effect) and the calculation of pharmacokinetic parameters regarding calcium absorption, distribution and excretion.

COMMENTS: Due to background cadmium in the diet, no subchronic RfD was calculated.

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

Inhalation of cadmium fumes or dust may result in a wide range of effects, including a metallic taste, headache, dyspnea, chest pains, cough with foamy or bloody sputum, and muscular weakness. Severe exposure may result in pulmonary edema and death (USAF, 1990). If the pulmonary edema is resolved, late-occurring kidney and/or liver damage may develop. Peculiar to inhalation exposure to cadmium is an asymptomatic period that may precede clinical illness by four to eight hours (USAF, 1990).

Based on cadmium lung burdens measured during postmortem examinations, Barrett et al. (1947) estimated a 1-minute lethal concentration of 2,500 mg/m^3. Beton et al. (1966) conducted similar calculations and reported a 10-minute lethal concentration of 250 mg/m^3. This value was further extrapolated to an 8-hour lethal concentration of 5 mg/m^3. Friberg et al. (1974) indicated that exposure to 1 mg Cd/m^3 for 8 hours is "immediately dangerous to humans" and the World Health Organization (WHO, 1980) identified 0.5 mg Cd/m^3 as the threshold for respiratory effects resulting from an 8-hour exposure.

3.2.1.2. Animal

Acute toxicity values (10-min. LC_{50}) for inhalation exposure of animals (monkeys, rats, mice, guinea pigs, dogs) to cadmium oxide range from 340 mg/m^3 to 15 g/m^3 (USAF, 1990).

3.2.2. Subchronic Toxicity

3.2.2.1. Human

Both pulmonary effects (emphysema, bronchiolitis, alveolitis) and renal effects (proteinuria) may occur following subchronic inhalation exposure to cadmium and cadmium compounds (ATSDR, 1989).

3.2.2.2. Animal

Pulmonary and renal toxicity have been documented for short-term inhalation exposure of animals to cadmium and cadmium compounds (USAF, 1990). Dose-dependent fibrotic lesions were observed in rats exposed to cadmium chloride aerosol at 0.3 to 1.0 mg/m^3, 6 hours/day for 12 weeks, but at a concentration of 2.0 mg/m^3 most rats died within 45 days (Kutzman et al., 1986). Friberg (1950) reported emphysema in rabbits exposed to cadmium chloride at 5 mg/m^3, 3 hours/day, 20 days/month for 8 months.

3.2.3. Chronic Toxicity

3.2.3.1. Human

Several occupational exposure studies have indicated that inhalation to cadmium dust and cadmium compounds may result in renal and pulmonary effects.

Bonnell (1955) reported that occupational exposure to cadmium oxide (1 to 270 μg/m^3) resulted in proteinuria in 16% of the workers exposed for five years or more, and an increased incidence of emphysema in those exposed for more than 10 years. The latter group, however, may have received much higher initial exposures. Kidney lesions were also reported for the majority of workers exposed to the compound at a concentration of 20 μg/m^3 for 27 years (Materne et al., 1975) and tubular proteinuria detected in workers exposed to cadmium dust (0.05 mg/m^3) for 6 to 12 years (Kjellstrom et al. 1977).

Based on occupational exposure studies, an 8-hour TWA (time-weighted-average) concentration of 0.02 mg/m^3 was established for a 20-year exposure to cadmium (OSHA, 1989), which is equivalent to continuous exposure to 0.007 mg/m^3 over a lifetime (ATSDR, 1989).

3.2.3.2. Animal

Chronic inhalation exposure studies for animals have demonstrated the carcinogenic potential of cadmium chloride and are discussed in Section 4.2.2.

3.2.4. Developmental and Reproductive Toxicity

3.2.4.1. Humans

Definitive data were not available regarding the developmental or reproductive toxicity of cadmium or cadmium compounds in humans.

3.2.4.2. Animal

Decreased fetal weight (with and without decreased maternal body weight) and minor neurobehavioral alterations in pups have been reported for rats exposed to cadmium oxide (0.16 mg/m^3) or cadmium sulfate (about 3 mg/m^3) during gestation (ATSDR, 1989). No other significant effects have been documented.

3.2.5. Reference Concentration

The RfC for cadmium is currently under review (U.S. EPA, 1991).

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

No data were available regarding the acute toxicity of cadmium by other routes of exposure.

3.3.2. Subchronic Toxicity

No data were available regarding the subchronic toxicity of cadmium by other routes of exposure.

3.3.3. Chronic Toxicity

No data were available regarding the chronic toxicity of cadmium by other routes of exposure.

3.3.4. Developmental Toxicity

No data were available regarding the developmental toxicity of cadmium by other routes of exposure.

3.4. TARGET ORGANS/CRITICAL EFFECTS

3.4.1. Oral Exposures

3.4.1.1. Primary Target(s)

1. Kidney: Renal tubular proteinuria is the primary toxic effect of long-term cadmium exposure.

2. Gastrointestinal tract: Acute exposure to high levels of cadmium and cadmium may cause irritation, vomiting, nausea, and diarrhea.

3.4.1.2. Other Target(s)

The liver, bones, testes, and cardiovascular system have been shown to be affected to various degrees by cadmium.

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target(s)

1. Kidney: Renal tubular proteinuria may result from chronic exposure to cadmium and cadmium compounds.

2. Lung: Inhalation exposure to cadmium dust, fumes, aerosols, and some cadmium compounds causes irritation of the respiratory tract, emphysema, and death for acute exposure to high cadmium concentrations.

3.4.2.2. Other Target(s)

No data were available indicating additional target organs/tissues for inhalation exposure to cadmium and cadmium compounds.

4. CARCINOGENICITY

4.1. ORAL EXPOSURE

4.1.1. Human

Limited epidemiologic studies have indicated that exposure to cadmium in food or drinking water is not carcinogenic (Bernard and Lauwerys, 1986).

4.1.2. Animal

Chronic exposure studies using animals exposed to cadmium in the diet or drinking water, have all provided negative results (ATSDR, 1989).

4.2. INHALATION EXPOSURE

4.2.1. Human

Limited evidence is available from epidemiologic studies indicating that inhalation exposure to cadmium may be associated with an increased incidence of respiratory tract cancer (ATSDR, 1989). An exposure-related increase in mortality due to lung cancer in workers with cumulative exposures of 585 to >2,920 mg Cd/m^3 (equivalent to TWA daily exposures of 168 to 2,522 μg/ Cd/m^3) was reported by Thun et al. (1985).

Limited evidence is available showing that inhalation exposure to cadmium dust and fumes may be associated with prostate cancer, but the total number of cases in the various studies is small (ATSDR, 1989).

A unit risk of 1.8×10^{-3} $(\mu g/m^3)^{-1}$ based on an increase in respiratory tract tumors in cadmium smelter workers was calculated by the U.S. EPA (1985).

4.2.2. Animal

Chronic exposure of rats to cadmium chloride aerosols (12.5, 25, or 50 $\mu g/m^3$) produced a dose-related increase in the frequency of primary lung carcinomas (Takenaka et al., 1983).

4.3. OTHER ROUTES OF EXPOSURE

No data were available regarding the carcinogenic potential of cadmium by other routes of exposure.

4.4. EPA WEIGHT-OF-EVIDENCE CLASSIFICATION

4.4.1. Oral

Not assigned.

4.4.2. Inhalation

Classification-B1: Probable human carcinogen
Basis - Limited evidence from multiple occupational exposure studies showing an association between cadmium exposure and increased incidence of lung cancer. Adequate data are available showing a carcinogenic response to cadmium by rats and mice following inhalation exposure and parenteral administration.

4.5. CARCINOGENICITY SLOPE FACTORS

4.5.1. Oral

Not assigned.

4.5.2. Inhalation

SLOPE FACTOR:	6.1 $(mg/kg/day)^{-1}$
VERIFICATION DATE:	11/12/86
(U.S. EPA, 1985; 1991)	

COMMENT: The inhalation unit risk is based on occupational exposure of humans to cadmium fumes (Thun et al., 1985).

5. REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1989. Toxicological profile for cadmium. ATSDR/U.S. Public Health Service, ATSDR/TP-88/08.

Baranski, B. 1985. Effect of exposure of pregnant rats to cadmium on prenatal and postnatal development of the young. J. Hyg. Epidemiol. Microbiol. Immunol. 29:253-262. (Cited in ATSDR, 1989)

Baranski, B. 1986. Effect of maternal cadmium exposure on postnatal development and tissue cadmium, copper, and zinc concentrations in rats. Arch. Toxicol. 58:255-260. (Cited in ATSDR, 1989)

Barrett, H.M., D.A. Irwin and E. Semmons. 1947. Studies on the toxicity of inhaled cadmium. I. The acute toxicity of cadmium oxide by inhalation. J. Ing. Hyg. Toxicol. 29:279. (Cited in ATSDR, 1989)

Bernard, A. and R. Lauwerys. 1986. Cadmium in human populations. Experimentia 40:143-152. (Cited in ATSDR, 1989)

Beton, D.C., G.S. Andrews, H. J. Davies, L. Howelss and G.F. Smith. 1966. Acute cadmium fume poisoning: Five cases with one death from renal necrosis. Br. J. Ind. Med. 23:292. (Cited in ATSDR, 1989)

Blakley, B.R. 1985. The effects of cadmium chloride on the immune response in mice. Can. J. Comp. Med. 49:104-108. (Cited in ATSDR, 1989)

Boisset, M., F. Girard, J. Godin and C. Boudene. 1978. Cadmium content of lung, liver, and kidney in rats exposed to cadmium oxide fumes. Int. Arch. Occup. Environ. Health 41:41-53. (Cited in ATSDR, 1989)

Bonnell, J.A. 1955. Emphysema and proteinuria in men casting copper-cadmium alloys. Br. J. Ind. Med. 12:181-197. (Cited in ATSDR, 1989)

CEC (Commission of the European Communities). 1978. Criteria (dose/effect relationships) for cadmium. Pergamon Press, Oxford. pp. 1-198.

Elinder, C.G., T. Kjellstrom, L. Friberg, B. Lind and L. Linman. 1976. Cadmium in kidney cortex, liver, and pancreas for Swedish autopsies. Arch. Environ. Health 31:292-302.

Flanagan, P.R., J. McLellan, J. Haist, M.G. Cherian, M.J. Chamberlain and L.S. Valbar. 1978. Increased dietary cadmium absorption in mice and human subjects with iron deficiency. Gastroenterology 72:841-846.

Foulkes, E.C. 1986. Absorption of cadmium. In: Foulkes, E.C., ed. Handbook of Experimental Pharmacology. Vol. 80, Springer-Verlag, Berlin, pp. 75-100. (Cited in ATSDR, 1989)

Friberg, L. 1950. Health hazards in the manufacture of alkaline accumulators with special reference to chronic cadmium poisoning. Acta Med. Scad. (Suppl 240) 138:1-124. (Cited in ATSDR, 1989)

Friberg, L., M. Piscator, G.F. Nordberg and T. Kjellstrom. 1974. Cadmium in environment. 2nd. Ed. CRC Press, Boca Raton, FL.

Goyer. R. 1991. Toxic effects of metals. In: Amdur, M.O., J.D. Doull and C.D. Klaassen, Eds. Casarett and Doull's Toxicology. 4th ed. Pergamon Press, New York. pp.623-680.

Klaassen, C. D. 1978. Effect of metallothionein on hepatic disposition of metals. Am. J. Physiol. 234:E47-E53. (Cited in ATSDR, 1989)

Kjellstrom, T., P.E. Evrin and B. Rahnster. 1977. Dose-response analysis of cadmium-induced tubular proteinuria. A study of urinary $ß_2$-microglobulin excretion among workers in a battery factory. Environ. Res 13:303-317. (Cited in ATSDR, 1989)

Koller, L.D., J. H. Exon and J.G. Roan. 1975. Antibody suppression by cadmium. Arch. Environ. Health 30:598. (Cited in ATSDR, 1989)

Kotsonis, F. N. and C. D. Klaassen. 1978. The relationship of metallothionein to the toxicity of cadmium after prolonged administration to rats. Toxicol. Appl. Pharmacol. 46:39-54.

Kutzman, R.S., R.T. Drew, R.N. Shiotsuka and B. Y. Cockrell. 1986. Pulmonary changes resulting from subchronic exposure to cadmium chloride aerosol. J. Toxicol. Environ. Health 17:175-189. (Cited in ATSDR, 1989)

Lauwerys, R. 1979. Cadmium in man. In: Webb, N. ed. The chemistry, biochemistry, and biology of cadmium. Elsevier/North Holland Biomedical Press, pp. 433-453. (Cited in ATSDR, 1989)

Materne, D. R. Lauwerys, J. P. Buchet, H. Roels, J. Brouwers and D. Stanescu. 1975. Investigations sur le risques resultant de l'exposition au cadmium dans deux enterprises de production et deux entreprises d'utilisation du cadmium. Cahiers de Medecine du Travail XII:1.

McLellan, J.S. P. R. Flanagan, M. J. Chamberlain and L. S. Valberg. 1978. Measurement of dietary cadmium absorption in humans. J. Toxicol. Environ. Health 4:131-138. (Cited in ATSDR, 1989)

Nordberg, G. F., T. Kjellstrom and M. Nordberg. 1985. Kinetics and metabolism . In: Friberg, L., C.G. Elinder, T. Kjellstrom and G.F. Nordberg, eds. Cadmium and Health: A toxicological and epidemiological appraisal. Vol. 1. Exposure, dose, and metabolism. CRC Press, Boca Raton, FL., pp. 103-178. (Cited in ATSDR, 1989)

OSHA (Occupational Safety and Health Administration). 1989. Air contaminants: final rule. 29CFR1910, Fed. Regist. 1/19/89, 54:2332-2983, as corrected 54:28054.

Pond, W. G. and E. F. Walker. 1975. Effects of dietary Ca and Cd level of pregnant rats on reproduction and on dam and progeny tissue mineral concentrations. Proc. Soc. Exp. Biol. Med. 148:655. (Cited in ATSDR, 1989)

Shaikh, Z. A. and J. C. Smith. 1980. Metabolism of orally ingested cadmium in humans. In: Holmstead, B., et al., eds. Mechanisms of toxicity and hazard evaluation. Elsevier/North Holland, Amsterdam. pp. 569-574. (Cited in ATSDR, 1989)

Stowe, H. D., M. Wilsom and R. A. Goyer. 1972. Clinical and morphological effects of oral cadmium toxicity in rabbits. Arch. Pathol. 94:389-405.

Takenaka, S., H. Oldiges, H. Konig, D. Hochrainer and G. Oberdörster. 1983. Carcinogenicity of cadmium chloride aerosols in Wistar rats. J. Natl. Cancer Inst. 70:367-373.

Thun, M. J., T. M. Schnorr, A. Smith, W. E. Halperin and R. A. Lemen. 1985. Mortality among a cohort of U.S. cadmium production workers - an update. J. Natl. Cancer Inst. 74:325-333. (Cited in ATSDR, 1989)

Tsuchiya, K., Y. Seki and M. Sugita. 1972. Organ and tissue cadmium concentration of cadavers from accidental deaths. Proc. 17th Internat. Congress Occup. Health, Buenos Aires. (Cited in ATSDR, 1989)

USAF. 1990. Cadmium. In: Installation Restoration Program Toxicology Guide, Vol. 5. Harry G. Armstrong Aerospace Medical Research Laboratory, Wright Patterson AFB, OH.

U.S. EPA. 1985. Integrated Risk Information System (IRIS). On-line file, 03/31/87.

U.S. EPA. 1991. Health Effects Summary Tables, FY-1991 Annual. Office of Research and Development, Office of Emergency and Remedial Response, Washington, D.C. OERR 9200.6-303(91-1).

Wang, X. P. and E. C. Foulkes. 1984. Specificity of acute effects of cadmium on renal function. Toxicology 30:243-247. (Cited in ATSDR, 1989)

WHO (World Health Organization). 1980. Recommended health-based limits in occupational exposure to heavy metals. Geneva. (Cited ATSDR, 1989)

TOXICITY SUMMARY FOR CHROMIUM

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EXECUTIVE SUMMARY

Elemental chromium (Cr) does not occur in nature, but is present in ores, primarily chromite ($FeOCr_2O_3$) (Hamilton and Wetterhahn, 1988). Only two of the several oxidation states of chromium, Cr(III) and Cr(VI), are reviewed in this report based on their predominance and stability in the ambient environment and their toxicity in humans and animals.

Chromium plays a role in glucose and cholesterol metabolism and is thus an essential element to man and animals (Schroeder et al., 1962). Non-occupational exposure to the metal occurs via the ingestion of chromium-containing food and water, whereas occupational exposure occurs via inhalation (Langard, 1982; Pedersen, 1982). Workers in the chromate industry have been exposed to estimated chromium levels of 10-50 $\mu g/m^3$ for Cr(III) and 5-1000 $\mu g/m^3$ for Cr(VI); however, improvements in the newer chrome-plating plants have reduced the Cr(VI) concentrations 10- to 40-fold (Stern, 1982).

Chromium(III) is poorly absorbed, regardless of the route of exposure, whereas chromium(VI) is more readily absorbed (Hamilton and Wetterhahn, 1988). Humans and animals localize chromium in the lung, liver, kidney, spleen, adrenals, plasma, bone marrow, and red blood cells (RBC) (Langard, 1982; ATSDR, 1989; Bragt and van Dura, 1983; Hamilton and Wetterhahn, 1988). There is no evidence that chromium is biotransformed, but Cr(VI) does undergo enzymatic reduction, resulting in the formation of reactive intermediates and Cr(III) (Hamilton and Wetterhahn, 1988). The main routes for the excretion of chromium are via the kidneys/urine and the bile/feces (Guthrie, 1982; Langard, 1982).

Animal studies show that Cr(VI) is generally more toxic than Cr(III), but neither oxidation state is very toxic by the oral route. In long-term studies, rats were not adversely affected by ~1.9 g/kg/day of chromic oxide [Cr(III)] (diet), 2.4 mg/kg/day of Cr(III) as chromic chloride (drinking water), or 2.4 mg/kg/day of Cr(VI) as potassium dichromate (drinking water) (Ivankovic and Preussmann, 1975; MacKenzie et al., 1958).

The respiratory and dermal toxicity of chromium are well-documented. Workers exposed to chromium have developed nasal irritation (at <0.01 mg/m^3, acute exposure), nasal ulcers, perforation of the nasal septum (at ~2 $\mu g/m^3$, subchronic or chronic exposure) (Hamilton and Wetterhahn, 1988; ATSDR, 1989; Lindberg and Hedenstierna, 1983) and hypersensitivity reactions and "chrome holes" of the skin (Pedersen, 1982; Burrows, 1983; U.S Air Force, 1990). Among the general population, contact dermatitis has been associated with the use of bleaches and detergents (Love, 1983).

Compounds of both Cr(VI) and Cr(III) have induced developmental effects in experimental animals that include neural tube defects, malformations, and fetal deaths (Iijima et al., 1983; Danielsson et al., 1982; Matsumoto et al., 1976).

Subchronic and chronic oral RfD values are 1 mg/kg/day for Cr(III) and 0.02 and 0.005 mg/kg/day, respectively, for Cr(VI) (U.S. EPA, 1991a,b,c). The subchronic and chronic oral RfD values for Cr(VI) and Cr(III) are derived from no-observed-adverse-effect levels (NOAELs) of 1.47 g/kg Cr(III)/day and 25 ppm of potassium dichromate (Cr[VI]) in drinking water,

respectively (Ivankovic and Preussmann, 1975; MacKenzie et al., 1958). The inhalation RfC values for both Cr(III) and Cr(VI) are currently under review by an EPA workgroup.

The inhalation of chromium compounds has been associated with the development of cancer in workers in the chromate industry. The relative risk for developing lung cancer has been calculated to be as much as 30 times that of controls (Hayes, 1982; Leonard and Lauwerys, 1980; Langard, 1983). There is also evidence for an increased risk of developing nasal, pharyngeal, and gastrointestinal carcinomas (Hamilton and Wetterhahn, 1988). Quantitative epidemiological data were obtained by Mancuso and Hueper (1951), who observed an increase in deaths (18.2%; $p<0.01$) from respiratory cancer among chromate workers compared with 1.2% deaths among controls. In a follow-up study, conducted when more than 50% of the cohort had died, the observed incidence for lung cancer deaths had increased to approximately 60% (Mancuso, 1975). The workers were exposed to 1-8 mg/m^3/year total chromium. Mancuso (1975) observed a dose response for total chromium exposure and attributed the lung cancer deaths to exposure to insoluble [Cr(III)], soluble [Cr(VI)], and total chromium. The results of inhalation studies in animals have been equivocal or negative (Nettesheim et al., 1971; Glaser et al, 1986; Baetjer et al., 1959; Steffee and Baetjer, 1965).

Based on sufficient evidence for humans and animals, Cr(VI) has been placed in the EPA weight-of-evidence classification A, human carcinogen (U.S. EPA, 1991a). For inhalation exposure, the unit risk value is 1.2E-2 $(\mu g/m^3)^{-1}$ and the slope factor is 4.1E+01 $(mg/kg/day)^{-1}$ (U.S. EPA, 1991a).

1. INTRODUCTION

Elemental chromium (Cr) (CAS No. 7440-47-3) has an atomic weight of 51.996, a density of 7.2 g/mL at 28°C, a melting point of 1857 ± 20°C, a vapor pressure of 1 mm Hg at 1610°C, and is insoluble in water (Weast et al., 1988-1989). Elemental chromium does not occur in nature, but is present in ores, primarily chromite ($FeOCr_2O_3$) (Hamilton and Wetterhahn, 1988). Chromium can exist in several oxidation states, but only two of them, Cr(III) and Cr(VI), are considered in this report because of their predominance and stability in the ambient environment and their toxicological characteristics. Cr(III) results from the weathering of minerals and is the most stable state of environmental chromium. Cr(VI) in the environment is man-made, the result of contamination by industrial emissions (WHO, 1984; Hertel, 1986), and is the more toxic (U.S. EPA, 1984b). Examples of Cr(III) compounds include chromium acetate, chromium chloride, chromic oxide, and chromium sulfate; examples of Cr(VI) compounds include ammonium chromate, calcium chromate, potassium chromate, potassium dichromate, and sodium chromate (U.S. Air Force, 1990).

Chromium plays a role in glucose and cholesterol metabolism and is thus essential to man and animals (Schroeder et al., 1962). Reference values for chromium vary, but one source estimates a level of 70 ng/dL for whole blood [this includes Cr(VI) bound to red blood cells] and 14 ng/dL for serum (Tietz, 1986). The major non-occupational source of chromium for animals and humans is food, such as vegetables, meat, unrefined sugar, fish, vegetable oil, and fruits (Hertel, 1986; U.S. Air Force, 1990; U.S. EPA, 1984b). Other potential non-occupational sources include urban air, hip or knee prostheses, and cigarettes (U.S. EPA, 1984b).

Workers are exposed to chromium during its use in (1) the production of dichromate, (2) the chemical, stainless-steel, refractory and chromium-plating industries, and (3) the production and use of alloys (Langard and Norseth, 1986). Workers in the chromate industry encounter both Cr(III) and Cr(VI) (U.S. EPA, 1984). Chromium (III) concentrations in tanning facilities have been estimated at 10-50 $\mu g/m^3$; the average concentration of Cr(VI) in fumes and dust of the various industries ranged from 5 to 1000 $\mu g/m^3$ (Stern, 1982). Ten- to forty-fold reductions in Cr(VI) concentrations have been reported in modern chrome plating plants (Stern, 1982).

Chromium enters the body through the lungs, gastrointestinal tract and, to a lesser extent, the skin (Hamilton and Wetterhahn, 1988). Inhalation is the most important route for occupational exposure (Hertel, 1986). Although overt signs of chromium toxicity (e.g. perforation of the nasal septum, skin ulcers, and liver and kidney damage) are rarely seen today, some workers are still exposed to toxic concentrations of the metal (Hamilton and Wetterhahn, 1988). Non-occupational exposure occurs via the ingestion of chromium-containing food and water (Langard, 1982; Pedersen, 1982).

In the environment, Cr(III) is generally immobile in soil and is not very toxic to plants and animals (Kabata-Pendias and Pendias, 1984), whereas Cr(VI) is both mobile and toxic. Chromium (VI) in solution exists as hydrochromate ($HCrO_4^-$), chromate (CrO_4^{2-}), and dichromate ($Cr_2O_7^{2-}$) ionic species (U.S. EPA, 1984a) and reacts over time to form Cr(III) (U.S. EPA, 1984b).

2. METABOLISM AND DISPOSITION

2.1. ABSORPTION

Chromium(III) and chromium(VI) exhibit different absorption characteristics. Chromium(III) is poorly absorbed, regardless of route of exposure, whereas chromium(VI) is more readily absorbed (Hamilton and Wetterhahn, 1988). In one study, for example, animals absorbed approximately 10% of an orally administered dose of Cr(VI), but less than 0.5% of the orally administered Cr(III) (Langard, 1982); therefore, the reduction of Cr(VI) to Cr(III) (which can occur in the stomach) may result in decreased absorption. In another study, humans and rats absorbed approximately 2% of the chromium that was administered orally as $Na_2{}^{51}CrO_4$ and measured in the urine (humans) and feces (rat) as ^{51}Cr (Donaldson and Barreras 1966). However, when $Na_2{}^{51}CrO_4$ was administered intraduodenally and intrajejunally, absorption of the administered dose was ~50% in humans and ~25% in animals.

The detection of chromium in the urine, serum, and red blood cells (RBC) of humans exposed in the workplace suggests that the metal is absorbed following inhalation exposure. Limited experimental data indicate that water-soluble inhaled Cr(VI) is absorbed rapidly (Langard et al., 1978). Rats exposed to 7.35 mg/m^3 of zinc chromate dust for 1, 100, 250 and 350 minutes had chromium levels in the blood of 0.007, 0.024, 0.22, and 0.31 $\mu g/mL$, respectively. Animals were also exposed to the same concentration of zinc chromate 6 hours/day for 4 days and blood levels were measured at the end of each day. Blood chromium levels peaked at the end of the second exposure and began to decline at the end of the third exposure.

Both Cr(VI) and Cr(III) compounds can be absorbed by the skin, but the degree of absorption is apparently determined by valence state, anionic form and concentration and pH of the solution (U.S. EPA, 1984c).

2.2. DISTRIBUTION

Humans and animals exhibit similar patterns of distribution for chromium. Workers exposed to chromium by inhalation had levels of the metal in the lung, liver, kidney, and adrenals that were 300-fold, 2- to 4-fold, 10-fold, and 10- to 50-fold higher, respectively, than those in of controls (Langard, 1982). Workers also exhibit elevated chromium levels in the urine, serum [Cr(III) and Cr(VI)] and RBC [Cr(VI) only] (ATSDR, 1989). Animals exposed by intratracheal or intravenous injection distributed both Cr(III) and Cr(VI) throughout the body, but mainly to the lungs, spleen, bone marrow, liver, and kidney (Bragt and van Dura, 1983; Hamilton and Wetterhahn, 1988).

Chromium (given in drinking water to rats for one year as potassium chromate or chromic chloride and to dogs for 4 years as potassium chromate) was distributed to the bone (rat only), liver, kidney, and spleen (MacKenzie et al. 1958; Anwar et al., 1961). Other studies have demonstrated higher tissue levels in animals receiving Cr(VI) in the drinking water than those receiving Cr(III) (ATSDR, 1989).

2.3. METABOLISM

Chromium is not biotransformed, but Cr(VI) undergoes enzymatic reduction, resulting in the formation of reactive intermediates and Cr(III) (Hamilton and Wetterhahn, 1988). *In vitro* and under physiologic conditions, ascorbic acid, the thiols, glutathione, cysteine, cysteamine, lipoic acid, coenzyme A, and coenzyme M reduce Cr(VI) at a significant rate (Hamilton and Wetterhahn, 1988). The *in vitro* reaction of Cr(VI) with glutathione results in the formation of a Cr(V) intermediate that is possibly the form that interacts with cellular macromolecules (Jennette, 1982). DT-diaphorase is a major cytosolic enzyme involved in Cr(VI) reduction (DeFlora et al., 1985). The NADPH-dependent Cr(VI) reductase activity of rat liver microsomes has been attributed to cytochrome P-450, whereas the Cr(VI) reductase activity of rat liver mitochondria is attributed to NADH-ubiquinone oxidoreductase (complex I) (Hamilton and Wetterhahn, 1988).

2.4. EXCRETION

The main routes for the excretion of chromium are via the kidneys/urine and the bile/feces; minor routes include milk, sweat, hair, and nails (Guthrie, 1982; Langard, 1982). Studies in humans and/or animals have shown that chromium administered orally or intravenously is excreted principally in the urine, whereas chromium administered by inhalation or intratracheal injection is excreted in both the urine and the feces (Love 1983; Hamilton and Wetterhahn, 1988).

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

For humans, the estimated lowest lethal dose is 71 mg/kg for chromium (oxidation state not identified) (Sax and Lewis, 1989) and 1-5 g for unspecified Cr(VI) compounds (Leonard and Lauwerys, 1980; Langard and Norseth, 1986).

3.1.1.2. Animal

Oral LD_{50} values for Cr(VI) compounds range from 54 mg/kg for ammonium dichromate in the rat (Gad et al., 1986) to 300 mg/kg for potassium chromate in the mouse (Shindo et al., 1989). Oral LD_{50} values for Cr(III) and Cr(II) compounds in the rat are 11.26 g/kg (chromic acetate) and 1.87 mg/kg (chromous chloride), respectively (Smyth et al., 1969). Animals given lethal doses of sodium chromates, potassium dichromate, or ammonium dichromate exhibited hypoactivity, lacrimation, mydriasis, diarrhea, changes in body weight, pulmonary congestion, fluid in the stomach and intestine, and erosion and discoloration of the gastrointestinal mucosa (Gad et al., 1986). Lethal doses of chromium trioxide produce cyanosis, tail necrosis, diarrhea,

and gastric ulcers (Kobayashi, 1976). Because the gastrointestinal absorption of chromium is poor, the oral toxicity of the metal has been attributed to other than systemic poisoning, e.g. gastrointestinal bleeding (Hamilton and Wetterhahn, 1988).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

Information on the subchronic toxicity of chromium following oral exposure in humans was unavailable.

3.1.2.2. Animal

In one study, BD rats received 2 or 5% chromic oxide [Cr(III)] in the diet for 90 days (total doses, 72-75 g/kg or 160-170 g/kg) (Ivankovic and Preussmann, 1975). Food consumption and body weight were monitored and serum protein, bilirubin, hematology, urinalysis, organ weights, and histopathology were evaluated. Other than 12-37% reductions in the absolute weights of the livers and spleens at the higher dose, no adverse effects were observed.

In another study, MacKenzie et al. (1958) administered 0-25 ppm of Cr(III) (as chromic chloride) or Cr(VI) (as potassium dichromate) in drinking water to groups of male and female rats for one year, and saw no effect on body weight, gross external condition, histopathology, and blood chemistry at any dose. Microscopic examination revealed accumulations of chromium in the liver, kidneys, bone, and spleen (MacKenzie et al., 1958). The No Adverse Effect Level (NOAEL) of 25 ppm was used to calculate the chronic and subchronic oral RfD values for Cr(VI) (U.S. EPA, 1991a).

3.1.3. Chronic Toxicity

3.1.3.1. Human

Information on the chronic toxicity of chromium following oral exposure in humans was unavailable.

3.1.3.2. Animal

Animals appear to tolerate long-term oral treatment with chromium. Ivankovic and Preussmann (1975) conducted a feeding study in which male and female rats were fed chromic oxide [Cr(III)] baked in bread at levels of 0, 1, 2, or 5%, 5 days/week for 600 feedings (over 840 days). The total doses given were 360, 720, and 1800 g/kg body weight. After termination of exposure, animals that died or were killed when moribund were examined for microscopic lesions. The investigators did not mention other specific toxicologic parameters, but did report that adverse effects were not observed in any of the groups. The U.S. EPA (1991b) selected the 5% level as the no-observed-effect level (NOEL) to be used in the derivation of a chronic oral RfD.

Dogs (2/group) were not adversely affected by exposure to 0, 0.45, 2.25, 4.5, 6.75, and 11.2 ppm potassium chromate in the drinking water for 4 years (Anwar et al., 1961). The toxicologic evaluation consisted of gross and microscopic analysis of all major organs, urinalysis, and weights of spleen, liver and kidney. Assuming an average water consumption for the dog of 0.0275 L/kg/day, the U.S. EPA (1984a) converted the highest dose tested, 11.2 ppm, to the NOEL of 0.31 mg potassium chromate/kg/day [0.089 mg Cr(VI)/kg/day].

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

Information on the developmental or reproductive toxicity of chromium following oral exposure in humans was unavailable.

3.1.4.2. Animal

As part of a 90-day feeding study, male and female BD rats received 2% or 5% chromium oxide 5 days/week (Ivankovic and Preussmann, 1975). During the last 30 days of treatment, males and females from each treatment group were paired for a developmental toxicity assay. All females became pregnant, the gestation period was normal, and the young had no malformations or other adverse effects. One group of progeny, observed for 600 days, developed no tumors. The investigators concluded that no toxic or teratogenic effects resulted from treatment of both males and females with chromium oxide prior to and throughout the gestation period. No other information on the developmental or reproductive toxicity of chromium following oral exposure in animals was available.

3.1.5. Reference Dose

3.1.5.1. Subchronic

3.1.5.1.1. Chromium(III)

ORAL RfD: 1 mg/kg/day (as an insoluble salt) (U.S. EPA, 1991b)
UNCERTAINTY FACTOR: 1000
NOAEL: 5% Cr_2O_3 in diet 5 days/week for 90 days (1468 mg/kg Cr(III)/day)

COMMENT: The principal study (Ivankovic and Preussmann, 1975) is the same for the subchronic and chronic RfD and is described in section 3.1.3.2.

3.1.5.1.2. Chromium(VI)

ORAL RfD: 0.02 mg/kg/day (U.S. EPA, 1991b)
UNCERTAINTY FACTOR: 100
NOAEL: 25 ppm (mg/L) of chromium as K_2CrO_4 converted to 2.4 mg of Cr(VI)/kg/day.

COMMENT: The principal study (MacKenzie et al., 1958) is the same for the subchronic and chronic RfD and is described in section 3.1.2.2.

3.1.5.2. Chronic

3.1.5.2.1. Chromium(III)

ORAL RfD: 1.0 mg/kg/day (as an insoluble salt) (U.S. EPA, 1991c)
UNCERTAINTY FACTOR: 100
NOEL: 5% Cr_2O_3 in diet 5 days/week for 600 feedings (1800 g/kg b.w. average total dose; 1468 mg/kg Cr(III)/day)

CONFIDENCE:

Study	Low
Data Base	Low
RfD	Low

VERIFICATION DATE: 11/21/85

PRINCIPAL STUDY: Ivankovic and Preussmann, 1975

COMMENTS: The NOEL was based on no effects reported at the highest dose tested in a one year feeding study in rats. The RfD is limited to metallic Cr(III) of soluble salts (U.S. EPA, 1991c). The uncertainty factor of 1000 reflects a factor of 10 to account for interspecies variability, a factor of 10 for interhuman variability in the toxicity of the chemical in lieu of specific data, and an additional modifying factor of 10 for uncertainty in the NOEL.

3.1.5.2.2. Chromium(VI)

ORAL RfD: 0.005 mg/kg/day (U.S. EPA, 1991a)
UNCERTAINTY FACTOR:500
NOAEL: 25 mg/L of chromium as K_2CrO_4 for one year, converted to 2.4 mg of Cr(VI)/kg/day.

CONFIDENCE:

Study	Low
Data Base	Low
RfD	Low

VERIFICATION DATE: 02/05/86

PRINCIPAL STUDY: MacKenzie et al., 1958

COMMENTS: The NOAEL was based on no effects reported at the highest dose tested in a one year drinking water study in rats. The RfD is limited to metallic Cr(VI) of soluble salts (U.S. EPA, 1991). The calculation assumed drinking water consumption of 0.097 L/kg/day. The uncertainty factor of 500 reflects a factor of 10 to account for interspecies variability and a factor of 10 for interhuman variability in the toxicity of the

chemical in lieu of specific data, and an additional factor of 5 to compensate for the less-than-lifetime exposure duration of the study (U.S. EPA, 1991a).

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

Estimated LC_{50} values for humans range from 5 mg/m^3 for zinc chromate [Cr(VI)] (Sax and Lewis, 1989) to 94 mg/m^3 for potassium dichromate [Cr(VI)] (Gad et al., 1986). The inhalation of chromium can cause nasal ulcers and perforation of the nasal septum (Hamilton and Wetterhahn, 1988). The perforation lesions do not disappear when exposure ceases. Nasal irritation has been observed following short-term exposure to chromium levels of <0.01 mg/m^3 (ATSDR, 1989).

3.2.1.2. Animal

The estimated LC_{50} values (mg/m^3) in the Sprague Dawley rat (males and females combined) exposed to Cr(VI) compounds are: 158 for ammonium dichromate, 104 for sodium chromate, 124 for sodium dichromate, and 94 for potassium dichromate (Gad et al., 1986). Clinical signs of toxicity include respiratory distress and irritation and body weight loss (Gad et al., 1986). Lethality data were not found for Cr(III) compounds.

3.2.2. Subchronic Toxicity

3.2.2.1. Human

The respiratory tract is the target of subchronic inhalation exposure to chromium compounds. In one study, chromeplaters exposed to hot chromic acid concentrations <1.4 mg/m^3 for less than one year exhibited various symptoms including simple scarring and perforation of the nasal septum, dental lesions, coughing and expectoration, sneezing, and nasal irritation (Gomes, 1972).

3.2.2.2. Animal

Johansson et al. (1986a, 1986b) exposed rabbits to aerosols of sodium chromate [0.9 mg of Cr(VI)/m^3] or chromium nitrate [0.6 mg of Cr(III)/m^3], 6 hours/day, 5 days/week for 4-6 weeks and examined the lungs and pulmonary macrophages for adverse effects. Neither compound affected lung morphology, but macrophages in both groups were enlarged, multinucleated, or vacuolated, and accumulated in intraalveolar or intrabronchiolar spaces as nodules ("naked" granulomas). In addition to producing morphological changes, the chromium nitrate also reduced the phagocytic activity of the cells.

Immunological effects have been noted following subchronic exposure to chromium compounds. In rats, 0.2 mg/m^3 Cr(VI) (90-days continuous exposure) depressed the activity of alveolar macrophages and the humoral immune response, whereas ≤ 0.1 mg/m^3 Cr(VI) stimulated

phagocytic activity of the alveolar macrophages and increased the humoral immune response (Glaser et al., 1985).

Nettesheim et al. (1971) reported rapid weight loss, fatty liver, distended and atrophic intestines, and early death in C57Bl/6 mice exposed to calcium chromate concentrations of 30 mg/m^3. The study was preliminary and exposure duration was described only as "subchronic".

3.2.3. Chronic Toxicity

3.2.3.1. Human

Long-term exposure to chromium produced various effects in workers in the chromium industry. For example, nine chromeplaters exposed to chromic acid concentrations of 0.18 to 1.4 mg/m^3 for 0.5-12 months, had upper respiratory tract lesions that ranged from nasal itching and soreness to septal ulcerations and perforations (Kleinfeld and Rosso, 1965). Thirty-five of thirty-seven chromeplaters, engaged in using the hot chromic acid process for 0.3 months to 11 years and exposed to air concentrations of 7.1 μg total Cr/m^3 and 2.9 μg Cr(VI)/m^3, developed nasal lesions that ranged from shallow erosions to frank perforations (Cohen et al., 1974). Forty-three Swedish chrome-plating workers, exposed to chromic acid [Cr(VI)] for a median of 2.5 years, were examined for respiratory symptoms (Lindberg and Hedenstierna, 1983). A dose-response was observed for nasal symptoms. Workers exposed to concentrations of $<$1-2 μg/m^3 (8-hour mean) complained of runny nose and stuffy nose ($p<0.05$); workers exposed to $>$2 μg/m^3 suffered ulceration and perforation of the nasal mucosa.

3.2.3.2. Animal

Nettesheim et al. (1971) exposed C57Bl/6 mice to calcium chromate dust concentrations of 13 mg/m^3 [4.33 mg Cr(VI)/m^3, as calculated by U.S. EPA (1984)] 5 hours/day, 5 days/week for the lifetime of the animals. Sizes of 99% of the calcium chromate particles averaged $\leq$1.0 micron. Toxicity in the animals, as evidenced by decreased body weight gain, was observed after 6 months of exposure. Other non-carcinogenic effects observed in animals exposed for 6 months or longer included marked hyperplasia, necrosis, and atrophy of the bronchial epithelium; bronchiolization of alveoli (growth of the bronchial epithelium into alveoli); proteinosis of terminal bronchioli and alveoli (emphysema-like changes); extreme dilation of alveolar ducts and disruption of alveolar membranes; atrophy of spleen and liver; and enlargement, followed by atrophy of the lymph nodes (particularly tracheal and submandibular).

In other studies: (1) rats and rabbits exposed to 3 to 4 mg/m^3 of potassium dichromate [Cr(VI)] and sodium chromate [Cr(VI)] 4 hours/day, 5 days/week for life developed nasal perforations and foreign-body type inflammation of the lung, but did not develop systemic effects (Stefee and Baetjer, 1965); (2) Wistar rats, exposed continuously to 100 μg Cr/m^3 [Cr(III) and Cr(VI)] as chromium oxide for 18 months, exhibited a slight increase in white blood cells, and significant increases in red blood cell, hemoglobin and hematocrit values (Glaser et al., 1986); and (3) rats and hamsters exposed to calcium chromate aerosol levels of 2 mg/m^3 (0.67 mg Cr(VI)/m^3) for 589 days over a period of 891 days had laryngeal hyperplasias and metaplasias (Laskin et al., 1972). Non-specific effects of inhalation exposure to Cr(III) and Cr(VI) included pneumonia in mice and "nuisance dust reaction" in rats (Baetjer et al., 1959; Lee et al. 1988).

3.2.4. Developmental and Reproductive Toxicity

Information on the developmental or reproductive toxicity of chromium following inhalation exposure in humans and animals was unavailable.

3.2.5. Reference Concentration

The inhalation RfC values for both Cr(III) and Cr(VI) are currently under review by an EPA workgroup.

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

3.3.1.1. Human

Dermal exposure to chromium compounds can induce contact dermatitis or the formation of lesions that, without treatment, can develop into deep ulcers or "chrome holes". The chrome holes usually heal when exposure ceases (Pedersen, 1982; Burrows, 1983).

3.3.1.2. Animal

LD_{50} values (mg/kg) for chromium compounds applied to the skin of New Zealand rabbits (male and female combined) are 1.64 for ammonium dichromate, 1.6 for sodium chromate, 1.00 for sodium dichromate, and 1.7 for potassium dichromate (Gad et al., 1986). Lethal doses of these chemicals produced dermal necrosis, corrosion, edema and erythema; eschar formation; diarrhea; and hypoactivity. Non-lethal doses of the dichromates were also tested for corrosion and irritation potential. Based on a four-hour exposure time and a 48-hour observation period, the chemicals, in the dry solid form, were not corrosive, but sodium dichromate and ammonium dichromate caused erythema in some animals. When moistened with saline, the chemicals were not corrosive but all were irritating.

Dermal hypersensitivity reactions are elicited by both Cr(III) and Cr(VI) compounds (U.S. Air Force, 1990). For example, Schwarz-Speck and Grundmann (1972) induced hypersensitivity in the guinea pig with chromium sulfate ([Cr(III)] dissolved in Triton X-100 and with potassium dichromate [Cr(VI)] in an aqueous solution and in the BALB/c and ICR mice with potassium dichromate in dimethyl sulfoxide (Mor et al., 1988). BALB/c mice treated with potassium dichromate in Triton X-100 or methanol did not develop hypersensitivity (Mor et al., 1988).

For injected trivalent and hexavalent chromium compounds, the kidney is the main target for toxicity (U.S. EPA, 1984b). Gumbleton and Nicholls (1988) examined the effect of single subcutaneous doses of potassium dichromate on the release of tissue enzymes into the urine, an early and sensitive indicator of renal toxicity. The enzyme assays were conducted 52-727 hours after injection. There was no effect on the enzymes at 6 mg/kg. At doses of 10, 15, and 20 mg/kg, excretion rates for the cytosolic and lysosomal enzymes (aspartate aminotransferase and lactate dehydrogenase) and the lysosomal enzyme (*N*-acetyl-ß-D-glucosamidase) were increased

while brush border enzymes (γ-glutamyl transferase, alkaline phosphatase, and leucine aminopeptidase) were unchanged. The enzyme changes were accompanied by dose-related necrosis of the proximal tubules in the outer cortex of the kidney and loss of alkaline phosphatase from the outer cortex of the kidney. Necrosis of the inner cortex of the kidney and loss of alkaline phosphatase from that tissue were observed at the highest dose. The effects appeared to be transient.

3.3.2. Subchronic Toxicity

Information on the subchronic toxicity of chromium by other routes of exposure in humans and animals was unavailable.

3.3.3. Chronic Toxicity

Information on the chronic toxicity of chromium by other routes of exposure in humans and animals was unavailable.

3.3.4. Developmental and Reproductive Toxicity

3.3.4.1. Human

Information on the developmental or reproductive toxicity of chromium by other routes of exposure in humans was unavailable.

3.3.4.2. Animal

Danielsson et al. (1982) reported that radioactive sodium dichromate [Cr(VI)], injected into pregnant mice was more efficiently taken up by the fetus than radioactive chromic chloride [Cr(III)]. Nevertheless, compounds of both Cr(VI) and Cr(III) have induced developmental effects in experimental animals. In one study, for example, one noninbred and two inbred strains of hamsters injected intravenously with 5 mg/kg of chromium trioxide [Cr(VI)] on day 8 of gestation and sacrificed on day 15 exhibited cleft palate and external malformations that included edema, omphalocele, tail bud abnormalities and encephalocele. The noninbred strain also had increased resorptions and hydrocephalus.

In another study, Matsumoto et al. (1976) administered 19.5 mg Cr/kg as chromic chloride [Cr(III)] to pregnant mice by subcutaneous injection on days 7, 8, or 9 of gestation and examined the fetuses on day 18. The highest frequency of fetal deaths occurred with the day 9 injection and the highest number of malformations (exencephaly, open eyelids, cleft palate, and fused ribs) occurred with the day 8 injection. Further studies (injection on day 8 of gestation) demonstrated a dose response for the effects. No significant fetal effects were noted with 9.76 mg Cr/kg administered as chromic chloride every other day from day 0 to day 16 of gestation.

Iijima et al. (1983) administered 19.5 mg Cr/kg as chromic chloride [Cr(III)] to pregnant mice by intraperitoneal injection on day 8 of gestation and observed pyknosis within the neuroepithelium and defects in the neural tube 8 and 24 hours, respectively, after injection.

3.4. TARGET ORGANS/CRITICAL EFFECTS

3.4.1. Oral Exposures

3.4.1.1. Primary Target Organs

The poor gastrointestinal absorption of chromium and its low oral toxicity preclude the identification of primary target organs/critical effects.

3.4.1.2. Secondary Target Organs

Gastrointestinal system: Animals exposed to very high doses acute of chromium exhibit diarrhea, gastric ulcers, and discoloration and erosion of the gastric mucosa, most likely local, rather than systemic effects.

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target Organs

The primary target organ for the subchronic/chronic toxicity of chromium is the respiratory system as evidenced by various symptoms in humans that range from irritation of the respiratory tract to perforation of the nasal septum and symptoms in animals that include severe bronchiolar and alveolar damage.

3.4.2.2. Other Target Organs

1. Immune system: In rats, accumulations of alveolar macrophages formed "naked granulomas" in the bronchioles and alveoli of rabbits. In rats the activity of alveolar macrophages and the humoral immune response were depressed, whereas phagocytic activity of the alveolar macrophages and the humoral immune response were increased.

2. Spleen and liver: Mice exhibited atrophy of the spleen and liver.

3.4.3. Other Routes of Exposure

3.4.3.1. Primary Target Organs

1. Skin: Acute dermal toxicity is characterized by dermatitis and the formation of "chrome holes" in humans and by dermatitis and dermal hypersensitivity in animals.

2. Fetus: Compounds of both Cr(III) and Cr(VI), injected into pregnant animals, induced fetal toxicity and fetal malformations.

3.4.3.2. Other Target Organs

Kidney: Injection of Cr(VI) caused renal enzyme changes and necrosis.

4. CARCINOGENICITY

4.1. ORAL EXPOSURES

4.1.1. Human

Information on the carcinogenicity of chromium by oral exposure in humans was unavailable.

4.1.2. Animal

Chromium was not carcinogenic in Sprague-Dawley rats exposed to 25 ppm of potassium chromate [Cr(VI)] and chromic chloride [Cr(III)] in their drinking water for one year (MacKenzie et al., 1958), or in male or female BD rats exposed to 5% chromic oxide [Cr(III)] in food 5 days/week for over 2 years (total dose, 1800 g/kg body weight) (Ivankovic and Preussmann, 1975).

4.2. INHALATION EXPOSURES

4.2.1. Human

Workers occupationally exposed to chromium are considered to be at risk for developing lung cancer (Hayes, 1982; Leonard and Lauwerys, 1980; Langard, 1983; Mackison et al. 1981; Mancuso and Hueper, 1951; Mancuso, 1975; Sano and Mitohara, 1978). The relative risk for developing lung cancer has been calculated to be up to 30 times that of controls (Hayes, 1982; Leonard and Lauwerys, 1980; Langard, 1983). There is also evidence for an increased risk of developing nasal, pharyngeal, and gastrointestinal carcinomas (Hamilton and Wetterhahn, 1988). Many of the early epidemiology studies failed to identify the specific etiologic agent [i.e. Cr(III) or Cr(VI)] (U.S. EPA, 1984b).

Mancuso and Hueper (1951) investigated lung cancer incidence in a cohort of workers employed for more than one year (from 1931-1949) in a chromate production plant. In the county where the plant was located, 34 of 2931 deaths (1.2%) of control males were due to respiratory cancer, whereas among the chromate workers, 6 of 33 deaths (18.2%; $p<0.01$) were due to respiratory cancer. Mancuso (1975) then followed 332 workers (employed from 1931-1951) until 1974, when more than 50% of the cohort had died. The workers were exposed to 1-8 mg/m^3/year total chromium. Incidences for cancer deaths were 63.6% for men employed from 1931-1932, 62.5% for men employed from 1933-1934, and 58.3% for those employed from 1935-1937. Mancuso (1975) observed a dose response for total chromium exposure and attributed the lung cancer deaths to exposure to insoluble [Cr(III)], soluble [Cr(VI)], and total chromium. However, the U.S. EPA (1984b) questioned the correlation because of small sample number.

Studies of workers in the chrome pigment industry revealed a correlation between exposure to Cr(VI) and lung cancer (Langard and Norseth, 1975; Davies, 1978, 1979; Frentzel-

Beyme, 1983). Studies from the chrome-plating industry either showed a correlation (Royle, 1975; U.S. EPA, 1984a) or were inconclusive (Silverstein et al., 1981; Okubo and Tsuchiya, 1979; U.S. EPA, 1984a) regarding lung cancer and exposure to chromium compounds. Studies of ferrochromium workers were also inconclusive regarding lung cancer risk (Pokrovskaya and Shabynina, 1973; Langard et al., 1980, 1990; Axelsson et al., 1980).

4.2.2. Animal

The results of inhalation studies in animals are equivocal regarding the carcinogenicity of chromium.

Nettesheim et al. (1971) observed an increase in the incidence of pulmonary adenomas and decreased tumor latency in C57Bl/6 mice exposed to 13 mg/m^3 calcium chromate dust [4.33 mg Cr(VI)/m^3, as calculated by U.S. EPA (1984)] 5 hours/day, 5 days/week for life. Ninety-nine percent of the calcium chromate particles were $\leq$1.0 micron. Early mortality among the unexposed controls may have affected cumulative tumor incidence, but examination of groups of animals dying of lung tumors at subsequent 10-week periods revealed that at 60-70 and 70-80 weeks (approximately 30 animals/group), none of the unexposed mice died with lung tumors, whereas 5 and >6%, respectively, of the exposed mice died with lung tumors (animal numbers not clear). The significance of the study was questioned because statistical analysis was not performed (U.S. EPA, 1984a). IARC (1980) concluded that the study did not show a significant increase in treatment-related tumors.

Glaser et al. (1986) observed "weak" tumor responses in groups of 20 rats exposed for 18 months to 100 μg/m^3 sodium dichromate dust (3 lung tumors) or to the slightly soluble chromium oxide containing both Cr(VI) and Cr(III) in a ratio of 3:2 (1 lung tumor). Lee et al. (1988) described a unique tumor in the lungs of rats exposed to 0.54-22 mg/m^3 of chromium dioxide [Cr(IV)] 6 hours/day, 5 days/week for 2 years. The tumor (in 2/108 females, but not in males) was described as a cystic keratinizing squamous cell carcinoma. The investigators indicated that the tumors were devoid of characteristics of true malignancy and have negligible relevance to man.

In other studies, mice and rats exposed to mixed chromate dust ($\sim$1 mg/m^3) containing both Cr(III) and Cr(VI) did not develop tumors (Baetjer et al., 1959); and neither did rabbits, guinea pigs or rats exposed, 4-5 hours/day, 1 to 2 times/week for life, to various mixes of chromate dust either with or without chromate mist (Steffee and Baetjer, 1965).

4.3. OTHER ROUTES OF EXPOSURE

Chromium(VI) induces cancer in experimental animals at some sites of exposure, whereas chromium(III) does not. Chromium(VI) induced tumors (1) at the site of intrapleural implantation as calcium chromate (Hueper and Payne, 1962), (2) at the site of intrabronchial implantation as strontium, calcium, or zinc chromate (Levy and Martin, 1983), and (3) in the rat lung following intratracheal injection of sodium chromate and calcium chromate (Steinhoff et al., 1983). However, there is no evidence in humans and little evidence in animals that skin cancer is induced by topical application of chromium (Hayes, 1982; Leonard and Lauwerys, 1980; Langard, 1983).

4.4. EPA WEIGHT-OF-EVIDENCE

4.4.1. Chromium(III)

Chromium(III) has not been evaluated by the U.S. EPA for evidence of human carcinogenic potential (U.S. EPA, 1991b).

4.4.2. Chromium(VI)

4.4.2.1. Oral

Not assigned.

4.4.2.2. Inhalation

Classification – A; human carcinogen
Basis – Sufficient evidence for humans and animals (U.S. EPA, 1991a). "Results of occupational epidemiologic studies of chromium-exposed workers are consistent across investigators and study populations. Dose response relationships have been established for chromium exposure and lung cancer. Chromium-exposed workers are exposed to both chromium III and chromium VI compounds. However, because only chromium VI has been found to be carcinogenic in animals studies, it was concluded that only chromium(VI) should be classified as a human carcinogen" (U.S. EPA, 1991a).

4.5. SLOPE FACTORS [Chromium(VI)]

4.5.1. Oral

Not available.

4.5.2. Inhalation

SLOPE FACTOR: 4.1E+01 $(mg/kg/day)^{-1}$
INHALATION UNIT RISK: 1.2E-2 $(\mu g/m^3)^{-1}$
PRINCIPAL STUDY: Mancuso, 1975
VERIFICATION DATE: 06/26/86
(U.S. EPA, 1991a)

COMMENT: Extrapolation method, multistage, extra risk (U.S. EPA, 1991a). Based on dose response data for inhalation carcinogenicity in humans (Mancuso, 1975).

5. REFERENCES

Anwar, R.A., R.F. Langham, C.A. Hoppert, B.V. Alfredson and R.U. Byerrum. 1961. Chronic toxicity studies III. Chronic toxicity of cadmium and chromium in dogs. Arch. Environ. Health 3: 456-460.

ATSDR (Agency for Toxic Substances and Disease Registry). 1989. Toxicological Profile for Chromium. Prepared by Syracuse Research Corporation under Contract 68-C8-0004. U.S. Public Health Service. ATSDR/TP-88/10.

Axelsson, G., R. Rylander and A. Schmidt. 1980. Mortality and incidence of tumours among ferrochromium workers. Br. J. Ind. Med. 37: 121-127.

Baetjer, A.M., J.F. Lowney, H. Stefee and V. Budacz. 1959. Effect of chromium on incidence of lung tumors in mice and rats. Arch. Ind. Health 20: 124-135.

Bragt, P.C. and E.A. van Dura. 1983. Toxicokinetics of hexavalent chromium in the rat after intratracheal administration of chromates of different solubilities. Ann. Occup. Hyg. 27: 315-322.

Burrows, D. 1983. In: Burrows, D. Ed. Chromium: Metabolism and Toxicity. CRC Press, Inc., Boca Raton, FL. p. 137-163.

Cohen, S.R.; Davis, D.M.; Kramdowski, R.S. 1974. Clinical manifestations of chromic acid toxicity: nasal lesions in electroplate workers. Cutis 13: 558-568.

Danielsson, G.R.G., E. Hassoun and L. Dencker. 1982. Embryotoxicity of chromium: Distribution in pregnant mice and effects on embryonic cells in vitro. Arch. Toxicol. 51: 233-245.

Davies, J.M. 1979. Lung cancer mortality in workers in chromate pigment manufacture: An epidemiological survey. J. Oil Chem Assoc. 62: 157-163. (Cited in U.S. EPA, 1984a)

Davies, J.M. 1978. Lung-cancer mortality of workers making chrome pigments. Lancet 1: 384.

DeFlora, S., A. Morelli, C. Basso, M. Ramano, D. Serra and A. DeFlora. 1985. Prominent role of DT-diaphorase as a cellular mechanism reducing chromium(VI) and reverting its mutagenicity. Cancer Res. 45: 3188.

Donaldson, R.M. and R.F. Barreras. 1966. Intestinal absorption of trace quantities of chromium. J. Lab. Clin. Med. 68: 484-493.

Frentzel-Beyme, R. 1983. Lung cancer mortality of workers employed in chromate pigment factories. A multicentric European epidemiological study. J. Cancer Res. Clin. Oncol. 105: 183-188.

Gad, S.C., W.J. Powers, B.J. Dunn, et al. 1986. Acute toxicity of four chromate salts. In: Serrone, D.M., Ed. Proc. Chromium Symp. 1986: An Update. May 20-21, 1986. Industrial Health Foundation, Inc., Pittsburgh, PA, pp. 43-58.

Gale, T.F. 1982. The embryotoxic response to maternal chromium trioxide exposure in different strains of hamsters. Environ. Res. 29: 196-203.

Glaser, U., D. Hochrainer, H. Kloppel and Kuhnen. 1985: Low level chromium(VI) inhalation effects on alveolar macrophages and immune functions in Wistar rats. Arch. Toxicol. 57: 250-256.

Glaser, U., D. Hochrainer, H. Kloppel and H. Oldiges. 1986. Carcinogenicity of sodium dichromate and chromium (VI/III) oxide aerosols inhaled by male Wistar rats. Toxicology 42: 219-232.

Gomes, E.R. 1972. Incidence of chromium-induced lesions among electroplating workers in Brazil. Ind. Med. 41: 21-25.

Gumbleton, M.; Nicholls, P.J. 1988. Dose-response and time-response biochemical and histological study of potassium dichromate-induced nephrotoxicity in the rat. Fd. Chem. Toxic. 26: 37-44.

Guthrie, B.E. 1982. The nutritional role of chromium. In: Langard, S., Ed. Biological and Environmental Aspects of Chromium. Elsevier Biomedical Press, Amsterdam, pp. 117-148.

Hamilton, J.W. and K.E. Wetterhahn. 1988. Chromium. In: Seiler, H.G. and H. Sigel, Eds. Handbook on Toxicity of Inorganic Compounds. Marcel Dekker, Inc., New York, pp. 239-250.

Hayes, R.B. 1982. Carcinogenic effects of chromium. In: Langard, S., Ed. Biological and Environmental Aspects of Chromium. Elsevier Biomedical Press, Amsterdam, pp. 221-247.

Hertel, R.F. 1986. Sources of exposure and biological effects of chromium. In: Environmental Carcinogens Selected Methods of Analysis, Vol. 8. International Agency for Research on Cancer, Lyon, pp. 79-92. IARC Scientific Publication No. 71.

Hueper, W.C. and W.W. Payne. 1962. Experimental studies in metal carcinogenesis: Chromium, nickel, iron, arsenic. Arch. Environ. Health 5: 445-462.

IARC (International Agency for Research on Cancer). 1980. Chromium and chromium compounds. In: Some Metals and Metallic Compounds. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. IARC, WHO, Lyon, France. 23: 205-323.

Iijima, S., N. Matsumoto and C.-C. Lu. 1983. Transfer of chromic chloride to embryonic mice and changes in the embryonic mouse neuroepithelium. Toxicology 26: 257-265.

Ivankovic, S. and R. Preussmann. 1975. Absence of toxic and carcinogenic effects after administrations of high doses of chromic oxide pigment in subacute and long-term feeding experiments in rats. Fd. Cosmet. Toxicol. 13: 347-351.

Jennette, K.W. 1982. Microsomal reduction of the carcinogen chromate produced chromium(V). J. Am. Chem. Soc. 104: 874-875.

Johansson, A., B. Robertson, T. Curstedt, P. Camner. 1986a. Rabbit lung after inhalation of hexa- and trivalent chromium. Environ. Res. 41: 110-119.

Johansson, A., A. Wiernik, C. Jarstrand, P. Camner. 1986b. Rabbit alveolar macrophages after inhalation of hexa- and trivalent chromium. Environ. Res. 39: 372-385.

Kabata-Pendias, A.; Pendias, H. 1984. Trace Elements in Soils and Plants. CRC Press, Boca Raton, FL, pp. 1-68, 193-199.

Kleinfeld, M.; Russo, A. 1965. Ulcerations of the nasal septum due to inhalation of chromic acid mist. Ind. Med. Surg. 34: 242-243.

Kobayashi, H. 1976. Toxicological studies on chromium. Acute toxicities of chromium trioxide. Tokyo Toritsu Eisei Kenkyusho Kenkyu Nempo; 27: 119-123. (Cited in U.S. Air Force, 1990)

Langard, S. 1982. Absorption, transport and excretion of chromium in an and animals. In: S. Langard, Ed. Biological and Environmental Aspects of Chromium. Elsevier Biomedical Press, Amsterdam, pp. 149-169.

Langard, S. 1983. The carcinogenicity of chromium compounds in man and animals. In: Burrows, C., Ed. Chromium: Metabolism and Toxicity. CRC Press, Inc., Boca Raton, FL, pp. 13-30.

Langard, S. and T. Norseth. 1975. A cohort study of bronchial carcinomas in workers producing chromate pigments. Br. J. Ind. Med. 32: 62-65.

Langard, S. and T. Norseth. 1986. Chromium. In: Friberg, L., G.F. Nordberg, V. Vouk, Eds. Elsevier, New York, pp. 185-205. (Cited in U.S. Air Force, 1990)

Langard, S., A. Andersen and B. Gylseth. 1980. Incidence of cancer among ferrochromium and ferrosilicon workers. Br. J. Ind. Med. 37: 114-120.

Langard, S., A. Andersen and J. Ravnestad. 1990. Incidence of cancer among ferrochromium and ferrosilicon workers: an extended observation period. Br. J. Ind. Med. 47: 14-19.

Langard, S., N.J. Gundersen, D.L. Tsalev and B. Gylseth. 1978. Whole blood chromium level and chromium excretion in the rat after zinc chromate inhalation. Acta Pharmacol. Toxicol. 42: 142-149.

Laskin, S. 1972. Research in Environmental Sciences, Washington, DC, Institute of Environmental Medicine, pp. 92-97. (Cited in U.S. EPA, 1984a)

Lee, K.P., C.E. Ulrich, R.G. Geil and H.J. Trochimowicz. 1988. Effects of inhaled chromium dioxide dust on rats exposed for two years. Fundam. Appl . Toxicol. 10: 125-145.

Leonard, A. and R.R. Lauwerys. 1980. Carcinogenicity and mutagenicity of chromium. Mutat. Res. 76: 227-239.

Levy, L.S. and P.A. Martin. 1983. The effects of a range of chromium containing materials on rat lung. Dye Color Manufacturers Assoc. (Cited in U.S. EPA, 1984a)

Lindberg, E. and Hedenstierna, G. 1983. Chrome plating: symptoms, findings in the upper airways, and effects on lung function. Arch. Environ. Health 38: 367-374.

Love, A.H.G. 1983. Chromium - biological and analytical considerations. In: Burrows, D., Ed. Chromium: Metabolism and Toxicity. CRC Press, Inc., Boca Raton, FL, p. 1.

MacKenzie, R.D., R.U. Byerrum, C.F. Decker, C.A. Hoppert and R.F. Langham. 1958. Chronic toxicity studies II. Hexavalent and trivalent chromium administered in drinking water to rats. Arch. Ind. Health 18: 232-234.

Mackison, F.W., R.S. Stricoff and L.J. Partridge, Jr. Eds. 1981. NIOSH/OSHA Occupational Health Guidelines for Chemical Hazards. National Institute for Occupational Safety and Health, DHHS (NIOSH) Washington, DC. Pub. No. 81-123.

Mancuso, T.F. 1975. International Conference on Heavy Metals in the Environment. Toronto, Ontario, Canada. (Cited in U.S. EPA, 1991; and in U.S. EPA, 1984a)

Mancuso, T.F. and W.C. Hueper. 1951. Occupational cancer and other health hazards in a chromate plant: A medical appraisal. I. Lung cancer in chromate workers. Ind. Med. Surg. 20: 358-363.

Matsumoto, N., S. Iijima and H. Katsunuma. 1976. Placental transfer of chromic chloride and its teratogenic potential in embryonic mice. J. Toxicol. Sci. 2: 1-13.

Mor, S., S. Ben-Efraim, J. Leibovici and A. Ben-David. 1988. Successful contact sensitization to chromate in mice. Int. Arch. Allergy Appl. Immunol. 85: 452-457.

Nettesheim, P., M.G. Hanna, Jr., D.G. Doherty, R.F. Newell and A. Hellman. 1971. Effect of calcium chromate dust, influenza virus, and 100 R whole-body X-radiation on lung tumor incidence in mice. J. Natl. Cancer Inst. 47: 1129-1138.

Okubo, T. and k. Tsuchiya. 1979. Epidemiological study of chromium plater in Japan. Biol. Trace Element Res. 1: 35-44.

Pedersen, N.B. 1982. The effects of chromium on the skin. S. Langard, Ed. Biological and Environmental Aspects of Chromium. Elsevier Biomedical Press, Amsterdam, pp. 249-275.

Pokrovskaya, L.V. and N.K. Shabynina. 1973. Carcinogenic hazards in the production of chromium ferroalloys. Gig. Tr. Prof. Zabol. 10: 23-26. (Cited in U.S. EPA, 1991)

Royle, H. 1975. Toxicity of chromic acid in the chromium plating industry (2). Environ. Res. 10: 141-163.

Sano, T. and I. Mitohara. 1978. Occupational cancer among chromium workers. Jap. J. Chest Disorders 37: 90-101. (Cited in U.S. EPA, 1984a)

Sax, N.I. and R.J. Lewis, Eds. 1989. Dangerous Properties of Industrial Materials, 7th ed. Van Nostrand Reinhold Co., New York.

Schroeder, H.A., J.J. Balassa and I.H. Tipton. 1962. Abnormal trace metals in man: chromium. J. Chron. Dis 15: 941. (Cited in U.S. Air Force, 1990)

Schwarz-Speck, M. and H.P. Grundmann. 1972. Experimental sensitization of guinea pigs with trivalent and hexavalent chromium. In-vivo and in-vitro reactions. Arch. Derm. Forsch. 242: 273-284.

Shindo, Y., Y. Toyoda, K. Kawamura et al. 1989. Micronucleus test with potassium chromate (VI) administered intraperitoneally and orally to mice. Mutat. Res. 223: 403-406.

Silverstein, M., F. Miere, D. Kotelchuck, B. Siverstein and M. Bennett. 1981. Mortality among workers in a die-casting and electroplating plant. Scand. J. Work Environ. Health 7: 156-165.

Smyth, H.F., C.P. Carpenter, C.S. Weil et al. 1969. Range-finding toxicity data: List VII. Am. Ind. Hyg. Assoc. J. 30: 470-476.

Steffee, C.H. and A.M. Baetjer. 1965. Histopathologic effects of chromate chemicals. Report of studies in rabbits, guinea pigs, rats, and mice. Arch. Environ. Health 11: 66-75.

Steinhoff, S., C. Gud, G.K. Hatfield and U. Mohr. 1983. Listing sodium dichromate and soluble calcium chromate for carcinogenicity in rats. Bayer AG Institute of Toxicology. (Cited in U.S. EPA, 1984a)

Stern, R.M. 1982. Chromium compounds; production and occupational exposure. In: Langard, S., Ed. Biological and Environmental Aspects of Chromium. Elsevier, New York, pp. 7-47.

Tietz, N.W. 1986. Textbook of Clinical Chemistry. W.B. Saunders Co., Philadelphia, p. 1819.

U.S. Air Force. 1990. Chromium. In: The Installation Restoration Program Toxicology Guide. Wright-Patterson Air Force Base, OH, pp. 72-1 to 72-81.

U.S. EPA (U.S. Environmental Protection Agency). 1984a. Health Effects Assessment for Hexavalent Chromium. Office of Research and Development, Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, U.S. Environmental Protection Agency, Cincinnati, OH, 37 pp. EPA/540/1-86-019.

U.S. EPA (U.S. Environmental Protection Agency). 1984b. Health Assessment Document for Chromium. Environmental Criteria and Assessment Office, U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA 600/8-83-014F. NTIS PB 85-115905.

U.S. EPA (U.S. Environmental Protection Agency). 1984c. Health Effects Assessment for Chromium. Final Report. Environmental Criteria and Assessment Office. Research Triangle Park, NC. EPA-600/8-83-014F. PB85-115905.

U.S. EPA (U.S. Environmental Protection Agency). 1991a. Chromium(VI). Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA (U.S. Environmental Protection Agency). 1991b. Health Effects Summary Tables. FY-1991 Annual, January, 1991. Office of Research and Development, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, DC, p. A-22.

U.S. EPA (U.S. Environmental Protection Agency). 1991c. Chromium(III). Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH.

Weast, R.C., M.J. Astle and W.H. Beyer, Eds. 1988-1989. CRC Handbook of Chemistry and Physics, 69th ed. CRC Press, Inc., Boca Raton, FL.

WHO (World Health Organization). 1984. Chromium. In: Guidelines for Drinking-Water Quality, Vol. 2. World Health Organization, Geneva, pp. 91-96.

TOXICITY SUMMARY FOR COPPER

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EXECUTIVE SUMMARY

Copper occurs naturally in elemental form and as a component of many minerals. Because of its high electrical and thermal conductivity, it is widely used in the manufacture of electrical equipment. Common copper salts, such as the sulfate, carbonate, cyanide, oxide, and sulfide are used as fungicides, as components of ceramics and pyrotechnics, for electroplating, and for numerous other industrial applications (ACGIH, 1986). Copper can be absorbed by the oral, inhalation, and dermal routes of exposure. It is an essential nutrient that is normally present in a wide variety of tissues (ATSDR, 1990; U.S. EPA, 1987).

In humans, ingestion of gram quantities of copper salts may cause gastrointestinal, hepatic, and renal effects with symptoms such as severe abdominal pain, vomiting, diarrhea, hemolysis, hepatic necrosis, hematuria, proteinuria, hypotension, tachycardia, convulsions, coma, and death (U.S. AF, 1990). Gastrointestinal disturbances and liver toxicity have also resulted from long-term exposure to drinking water containing 2.2-7.8 mg Cu/L (Mueller-Hoecker et al., 1988; Spitalny et al., 1984). The chronic toxicity of copper has been characterized in patients with Wilson's disease, a genetic disorder causing copper accumulation in tissues. The clinical manifestations of Wilson's disease include cirrhosis of the liver, hemolytic anemia, neurologic abnormalities, and corneal opacities (Goyer, 1991; ATSDR, 1990; U.S. EPA, 1987). In animal studies, oral exposure to copper caused hepatic and renal accumulation of copper, liver and kidney necrosis at doses of $\geq$100 mg/kg/day; and hematological effects at doses of 40 mg/kg/day (U.S. EPA, 1986; Haywood, 1985; 1980; Rana and Kumar, 1978; Gopinath et al., 1974; Kline et al., 1971).

Acute inhalation exposure to copper dust or fumes at concentrations of 0.075-0.12 mg Cu/m^3 may cause metal fume fever with symptoms such as cough, chills and muscle ache (U.S. AF, 1990). Among the reported effects in workers exposed to copper dust are gastrointestinal disturbances, headache, vertigo, drowsiness, and hepatomegaly (Suciu et al., 1981). Vineyard workers chronically exposed to Bordeaux mixture (copper sulfate and lime) exhibit degenerative changes of the lungs and liver. Dermal exposure to copper may cause contact dermatitis in some individuals (ATSDR, 1990).

Oral or intravenous administration of copper sulfate increased fetal mortality and developmental abnormalities in experimental animals (Lecyk, 1980; Ferm and Hanlon, 1974). Evidence also indicates that copper compounds are spermicidal (ATSDR, 1990; Battersby et al., 1982).

A Reference Dose (RfD) for elemental copper is not available (U.S. EPA, 1991b). However, EPA established an action level of 1300 μg/L for drinking water (56 FR 26460, June 7, 1991). Data were insufficient to derive a Reference (RfC) concentration for copper.

No suitable bioassays or epidemiological studies are available to assess the carcinogenicity of copper. Therefore, U.S. EPA (1991a,b) has placed copper in weight-of-evidence group D, not classifiable as to human carcinogenicity.

1. INTRODUCTION

Copper (Cu, CAS Reg. No. 7440-50-8) is classified as a noble metal and occurs naturally in elemental form and as a component of many minerals. It has a molecular weight of 63.55, a density of 8.94, a melting point of 1083°C, and a boiling point of 2595°C (Budavari et al., 1989). Copper is soluble in nitric acid and hot sulfuric acid, very slightly soluble in hydrochloric acid and ammonia, and insoluble in water (Stokinger, 1981). Because of its high electrical and thermal conductivity and other properties such as malleability, metallic copper is widely used in the manufacture of electrical equipment. Copper forms many important alloys that modify its properties for special applications (ATSDR, 1990; Stokinger, 1981). Copper sulfate is the most common copper salt; however, other important copper salts include carbonate, cyanide, oxide, and sulfide. These are used as fungicides, as components of ceramics and pyrotechnics, for electroplating, and for numerous other industrial applications (ACGIH, 1986).

Copper is an essential trace element that is widely distributed in animal and plant tissues. It is a component of a number of metalloenzymes such as catalase, peroxidases, and cytochrome oxidase, and is essential for the utilization of iron (Goyer, 1991; Stokinger, 1981). Although most copper salts occur in two valence states, as cuprous (Cu^{+}) or cupric (Cu^{2+}) ions, the biological availability and toxicity of copper is most likely associated with the divalent state (ATSDR, 1990). The general population may be exposed to increased levels of copper in drinking water largely as a result of the corrosion of plumbing materials (U.S. EPA, 1987). Contact with copper may also result from use of copper fungicides and algicides. Workers may be exposed to copper in agriculture, and in various industries such as copper production and metal plating. The largest anthropogenic releases of copper to the environment result from mining operations, agriculture, solid waste, and sludge from sewage treatment plants. Natural discharges to air and water, such as windblown dust and volcanic eruptions, may be significant (ATSDR, 1990).

2. METABOLISM AND DISPOSITION

2.1. ABSORPTION

Copper can be absorbed into the systemic circulation from the gastrointestinal tract, the lungs, and skin (U.S. EPA, 1987). Gastrointestinal absorption of copper is normally regulated by homeostatic mechanisms, providing a balance between copper intake and elimination (Goyer, 1991; U.S. EPA, 1987). Humans absorb approximately 50% of the dietary copper (U.S. Air Force, 1990), with values ranging from 15 to 97% (Strickland et al., 1972; Weber et al., 1969). Absorption of ingested copper occurs primarily in the upper portion of the gastrointestinal tract, with rapid appearance of copper bound to albumin and amino acids in the blood 1-2 hours after administration (U.S. EPA, 1987). The gastrointestinal absorption of copper is influenced by a number of factors, including it's chemical form: soluble copper compounds (oxides, hydroxides, citrates) are readily absorbed but water-insoluble compounds (sulfides) are poorly absorbed (Venugopal and Luckey, 1978). The biological availability of copper is also affected by the presence of other chemicals. For example, zinc, molybdenum and other metals decrease dietary

copper absorption (U.S. AF, 1990); whereas, certain amino acids appear to enhance its absorption (Venugopal and Luckey, 1978). The amount of stored copper does not appear to influence copper absorption in humans (Strickland et al., 1972).

Data regarding the absorption of inhaled copper in humans are limited. Deposition of copper in the lungs and liver was observed in workers exposed to Bordeaux mixture (an aqueous solution of lime and 1-2% copper sulfate) during the spraying of vineyards (U.S. AF, 1990). Copper oxide was found in alveolar capillaries 3 hours after rats were exposed to welding dusts generated from pure copper wires (Batsura, 1969). Dermal absorption of copper has been demonstrated through intact and burned human skin. In animals, copper was absorbed from copper-containing intrauterine devices (IUDs) (U.S. EPA, 1987).

2.2. DISTRIBUTION

Copper is an essential trace element that is normally present in a wide variety of tissues such as liver, kidney, spleen, heart, lung, muscle, stomach, intestine, nails, and hair. The recommended safe and adequate dietary intake for copper is 1.5-3.0 mg/day for adults, 0.7-2.5 mg/day for children and adolescents, and 0.4-0.7 mg/day for infants (U.S. AF, 1990). Absorbed copper binds to plasma albumin and amino acids in the portal blood and is transported to the liver where it is incorporated into ceruloplasmin and later released into the plasma (ATSDR, 1990). Ceruloplasmin contains about 95% of the copper found in adult human plasma (Venugopal and Luckey, 1978). Hepatic copper is distributed in several subcellular fractions associated with copper-dependent enzymes and copper-dependent proteins. Copper is also found in erythrocytes in the form of erythrocuprein and other proteins (U.S. EPA, 1987) and in bone marrow bound to metallothionine (Goyer, 1991). Age, sex, amount of dietary copper, and overall health determine the amount of copper distributed to the various tissues. Newborns have 6-10 times higher copper concentrations in the liver than adults (U.S. EPA, 1987).

High levels of copper are found in liver, kidneys, brain, bones, and cornea of patients with Wilson's disease (a genetic disorder characterized by impaired copper metabolism) and in the liver of patients with primary biliary cirrhosis, cholestasis, and Indian childhood cirrhosis (Stokinger, 1981; Scheinberg, 1983). Low tissue levels of copper resulting from abnormally low copper absorption are seen in patients with Menke's syndrome (kinky hair disease), a neurodegenerative disorder (Aaseth and Norseth, 1986).

Localized copper deposits in liver and kidneys were observed in monkeys with copper IUDs and in rats with uterine copper wire implants (U.S. EPA, 1987). Copper (as the citrate) has been shown to pass through the placenta of hamsters (Ferm and Hanlon, 1974).

2.3. METABOLISM

The metabolism of copper involves mainly its transfer to and from various organic ligands, most notably sulfhydryl and imidazole groups on amino acids and proteins (ATSDR, 1990). The liver, the most important organ involved in copper disposition, receives its copper from serum α-globulin. It serves as a storage depot of copper; as a site for ceruloplasmin synthesis, which is then released into the blood; and as a site for the formation of various copper complexes for subsequent biliary excretion (U.S. EPA, 1987). Biliary copper is returned to the

intestine and excreted in the feces (Stokinger, 1981). The half-life of injected copper was approximately 4 weeks in normal human subjects (Aaseth and Norseth, 1986).

2.4. EXCRETION

The major pathway of copper excretion in humans and animals is the biliary system. About 80% of the absorbed copper is excreted in the bile, while about 15% of unabsorbed copper passes directly into the bowel. Only 2-4% of the absorbed copper is excreted in the urine, with small amounts appearing in sweat (Venugopal and Luckey, 1978). Other potential routes of excretion are nails and hair. Following intravenous injection of radioactive copper, normal human subjects excreted only about 10% of the administered dose in urine and feces after 72 hours. Although patients with Wilson's disease have an increased urinary excretion of copper, they excrete copper at about half the rate of healthy individuals (Aaseth and Norseth, 1986).

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

A number of reports describe accidental as well as intentional poisoning in humans following copper ingestion. Symptoms occurring immediately after ingestion are metallic taste in the mouth, abdominal pain, diarrhea, and vomiting (ATSDR, 1990). Ingestion of gram quantities of copper may cause systemic toxicity including hemolysis, hepatic necrosis, gastrointestinal bleeding, oliguria, azotemia, hemoglobinuria, hematuria, proteinuria, hypotension, tachycardia, convulsions, coma, and death (U.S. AF, 1990). Acute hemolytic anemia and kidney effects, indicative of renal tubular damage, were observed in a child 2 days after drinking a solution containing approximately 3 g copper sulfate (Walsh et al., 1977). Gastrointestinal irritation can result following ingestion of carbonated water or citrus fruit juices that have been in contact with copper containers or pipes (Scheinberg, 1983).

3.1.1.2. Animal

Rat oral LD_{50} values for various copper compounds are 140 mg/kg for copper chloride ($CuCl_2$); 470 mg/kg for copper oxide (Cu_2O); 940 mg/kg for copper nitrate [$Cu(NO_3)_2 \cdot 3H_2O$]; and 960 mg/kg for copper sulfate ($CuSO_4 \cdot 5\ H_2O$) (Stokinger, 1981). Deaths in animals given lethal doses of copper have been attributed to extensive hepatic centrilobular necrosis (U.S. AF, 1990).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

Recurrent nausea, vomiting, and abdominal pain was observed in a family over a period of about 1.5 years after drinking water or beverages made with water containing 7.8 mg Cu/L. The effects disappeared when the family stopped drinking the water (Spitalny et al., 1984). Two children who were exposed to drinking water containing 2.2-3.4 mg Cu/L for ≤9 months exhibited hepatosplenomegaly, and increased serum transaminase and bilirubin levels. A liver biopsy revealed micronodular cirrhosis (Mueller-Hoecker et al., 1988).

An increased dietary intake of copper may be partially responsible for a disease known as Indian childhood cirrhosis, which usually occurs in children, ages 6 months to 5 years. The disease is characterized by high levels of copper in the liver, Mallory's hyaline inclusions in hepatocytes, intralobular fibrosis, and widespread hepatic necrosis with poor hepatic regeneration (U.S. AF, 1990).

3.1.2.2. Animal

Rats treated by gavage with copper sulfate at a dose of 100 mg/kg/day for 20 days exhibited significantly decreased skeletal growth and weight gain, heavy deposition of copper in the livers and kidneys, parenchymal degeneration and perilobular sclerosis of the liver, and tubular engorgement and necrosis of the kidneys (Rana and Kumar, 1978). Increased serum alanine aminotransferase (ALT) activity in the absence of histopathological liver changes was seen in rats fed a diet containing 100 mg Cu/kg/day as copper sulfate for 1 week (Haywood and Comerford, 1980). Rats exposed to dietary levels of 150-250 mg Cu/kg/day for 4-5 weeks exhibited extensive liver necrosis and associated inflammatory responses (Haywood, 1985). Exposure of rats to 300 mg Cu/kg/day for 6 weeks induced chronic hepatitis. Regeneration of parenchymal tissue was observed in rats killed between week 6 and 15 and regeneration was complete after 15 weeks (Haywood, 1980; 1985). Decreased hemoglobin and hematocrit values were observed in rats receiving 40 mg Cu/kg/day by gavage for 20 days (Rana and Kumar, 1980). Increased blood pressure was reported in rats exposed to 20 mg Cu/kg/day (as copper carbonate) for 20 weeks (Liu and Medeiros, 1986).

In a 90-day subchronic study with copper cyanide (CuCN), male and female Sprague-Dawley rats were administered by gavage 0, 0.5, 5, or 50 mg CuCN/kg/day (U.S. EPA, 1986). Mean body weights, body weight gains, and food consumption for CuCN-treated rats were significantly decreased. CuCN affected both absolute organ weights and relative organ weight ratios of the kidneys, spleen and brain in rats receiving 50 mg/kg/day. In the high-dose group, there were also significantly decreased serum globulin concentrations, increased ALT and aspartate aminotransferase (AST) activities, decreased red blood cell counts (RBC), and increased mean cell volume (MCV) and platelet counts. High mortality, attributed to hemolytic anemia, was seen in both male and female rats receiving 50 mg/kg/day. Microscopic findings included the presence of hemoglobin in the cytoplasm of the renal tubular epithelium, pigmentation of the spleen and liver, and hyperplasia of hematopoietic tissue. In general, male rats appeared to be more sensitive to the effects of CuCN than female rats.

Pigs exposed to dietary copper levels equivalent to 6.1 mg Cu/kg/day (as copper sulfate) for 54 days exhibited decreased weight gain, reduced hemoglobin and hematocrit values, and increased levels of copper in the liver (Kline et al., 1971). Pigs that accidentally received feed containing 700 mg Cu/kg for a period of several months developed iron-deficiency anemia and gastric ulcers (Hatch et al., 1979). Hemolysis associated with acute tubular renal damage was observed in sheep receiving daily oral doses of copper sulfate (20 mg/kg) for 9 weeks (Gopinath et al., 1974). Access by sheep to salt licks containing 5-9% copper sulfate caused a sudden onset of anorexia, hemolytic anemia, icterus, and hemoglobinuria, followed by death within two days. The estimated ingested dose was 40-49 g over a 25 to 86-day period. At necropsy, the liver, kidneys, and spleen showed degenerative changes (Stokinger, 1981).

3.1.3. Chronic Toxicity

3.1.3.1. Human

Although the chronic toxicity from long-term exposure to copper has not been investigated extensively, studies of patients with Wilson's disease, a genetic defect that results in accumulation of copper in tissues, provide information on the chronic toxicity of copper. Wilson's disease may affect many organs and systems and is characterized by hepatic cirrhosis, brain damage and demyelination, kidney damage, and hemolytic anemia. Patients may also suffer from poor coordination, psychological impairment, tremors, disturbed gait, rigidity, and eye opacities (Goyer, 1991; ATSDR, 1990; U.S. EPA, 1987).

A recent prospective population study of men residing in eastern Finland, an area with high levels of copper in drinking water, established a positive correlation between serum copper levels and risk of acute myocardial infarction (Salonen et al., 1991).

3.1.3.2. Animal

Lifetime exposure to 42.5 mg Cu/kg/day (as copper gluconate) in drinking water caused a 13% decrease of the maximal lifespan in mice (Massie and Aiello, 1984).

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

Information on the developmental and reproductive toxicity of copper in humans following oral exposure was unavailable.

3.1.4.2. Animal

Lecyk (1980) observed reduced litter size, decreased fetal weights, and skeletal abnormalities in the offspring of mice fed diets supplemented with 3000 or 4000 ppm copper sulfate (155 or 207 mg Cu/kg/day, respectively) for one month prior to gestation and on days 0-19 of gestation. Aulerich et al. (1982) reported an increased mortality rate in the offspring of minks fed a diet supplemented with >3 mg Cu/kg/day as copper sulfate for 50 weeks. The reproductive performance was not affected.

Copper deficiency has been associated with teratogenic effects such as neural degeneration, reduced growth, skeletal malformations, and cardiovascular lesions in several animal species (U.S. EPA, 1987).

3.1.5. Reference Dose

A Reference Dose (RfD) for elemental copper is not available at this time (U.S. EPA, 1991b). However, EPA established an action level of 1300 μg/L for drinking water (56 FR 26460, June 7, 1991). The RfD calculated for copper cyanide (CuCN) is presented below.

3.2.5.1. Subchronic

Oral RfD: 0.05 mg/kg/day (CuCN) (U.S. EPA, 1991a,c)
UNCERTAINTY FACTOR: 100
PRINCIPAL STUDY: U.S. EPA (1986)

COMMENTS: The same study applies to the subchronic and chronic RfD. The study is described in Section 3.1.2.2. An uncertainty factor (UF) of 100 was used to account for species extrapolation (10) and interspecies variability (10).

3.1.5.2. Chronic

Oral RfD: 0.005 mg/kg/day (CuCN) (U.S. EPA, 1991a,c)
UNCERTAINTY FACTOR: 1000
PRINCIPAL STUDY: U.S. EPA (1986)

CONFIDENCE:

Study:	Medium
Data Base:	Medium
RfD:	Medium

COMMENTS: The chronic RfD was based on a no-observed-adverse-effect level (NOAEL) of 5 mg/kg/day derived from a 90-day gavage study with rats. Decreased organ and body weights and morphological changes of liver and kidneys were seen at 15 mg/kg/day which was considered the lowest-observed-adverse-effect level (LOAEL). An uncertainty factor (UF) of 1000 was used to account for species extrapolation (10), interspecies variability (10), and extrapolation from subchronic to chronic exposure (10).

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

Short-term occupational exposure to copper dust or fumes can cause eye and respiratory tract irritation, headaches, vertigo, drowsiness, and a condition known as "metal fume fever". This 24-48 hour illness is characterized by an influenza-like syndrome with chills, fever, aching

muscles, and dryness in the mouth and throat (U.S. AF, 1990). In one study in which workers reported such symptoms, airborne copper levels ranged from 0.075 to 0.12 mg/m^3. Recovery takes place within days, usually without any sequelae. Other effects resulting from exposure to coppers fume include metallic or sweet taste and, in some instances, discoloration of the skin and hair (ATSDR, 1990).

Inhalation of dusts and mists of copper salts can result in irritation of nasal mucous membranes, sometimes of the pharynx, and occasionally in ulceration with perforation of the nasal septum. If copper salts reach the gastrointestinal tract, they act as irritants and may produce increased salivation, nausea, vomiting, gastric pain, hemorrhagic gastritis, and diarrhea (ACGIH, 1986).

3.2.1.2. Animal

Mild respiratory effects were reported in mice and hamsters exposed to 3.3 mg Cu/m^3 (as copper sulfate) for 3 hours (Drummond et al., 1986).

3.2.2. Subchronic Toxicity

3.2.2.1. Human

Pulmonary copper deposition, fibrosis, and granulomas of the lung have been reported in workers after years of exposure to Bordeaux mixture while spraying vineyards (U.S. AF, 1990). In addition, some workers developed liver disease (morphological changes in Kupffer cells, fibrosis, and cirrhosis) (Stokinger, 1981). Anorexia, nausea, occasional vomiting, headache, vertigo, drowsiness, and hepatomegaly were recorded in factory workers sieving copper dust (Suciu et al., 1981). Although inhalation was considered an important exposure route for these workers, a portion of the airborne copper dust was probably swallowed (ATSDR, 1990).

3.2.2.2. Animal

Daily inhalation exposure of mice to an aerosol prepared from a 5% aqueous solution of copper sulfate for 4 months resulted in focal accumulation of macrophages in alveoli and interstitial infiltration of cells (Eckert and Jerochim, 1982). Guinea pigs exposed 3 times daily for 6.5 months to an atmosphere saturated with Bordeaux mixture exhibited copper-containing micronodular lesions and small histiocytic granulomas of the lungs. The lesions were described as similar to those seen in the lungs of vineyard workers exposed to Bordeaux mixture (Pimental and Marques, 1969). A significant increase in the number of alveolar type II cells in the absence of gross signs of pulmonary toxicity was observed in rabbits exposed to 0.6 mg/m^3 cupric chloride, 6 hours/day, 5 days/week for 4-6 weeks (Johansson et al., 1984).

3.2.3. Chronic Toxicity

3.2.3.1. Human

ACGIH (1986) reports that chronic inhalation exposure to copper salts may result in anemia. Swedish workers exposed for 17-40 years to dusts of mixed copper salts (copper nitrate, sulfate, silicate, and oxide) while handling copper sheeting resulted in atrophic rhinitis with complaints of metallic taste, runny nose, and mucosal irritation of the mouth and eyes (Askergren and Mellgren, 1975). An epidemiologic study of 14,562 white male workers in the copper and zinc smelting industries revealed no overall increase in the mortality rates as compared with the mortality rates for the total U.S. population (Enterline et al., 1986).

3.2.3.2. Animal

Information on the chronic inhalation toxicity of copper in animals was unavailable.

3.2.4. Developmental and Reproductive Toxicity

Information on the developmental and reproductive toxicity following inhalation exposure in humans or animals was unavailable.

3.2.5. Reference Concentration/Dose

Data are insufficient to calculate a Reference Concentration (RfC) for copper.

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

3.3.1.1. Human

Exposure to metallic copper in jewelry may produce pruritic dermatitis. Patch tests using a copper penny and/or a copper sulfate solution have been shown to induce allergic contact dermatitis in some individuals. Eye irritation has been reported by factory workers exposed to copper dust (ATSDR, 1990). Fragments of copper metal or copper alloys that lodge in the eye, a condition known as chalcosis, may lead to uveitis, abscess, and loss of the eye (Scheinberg, 1983).

3.3.1.2. Animals

Mouse intraperitoneal LD_{50}s are 3.5 mg/kg for copper metal dust, 7 mg/kg for copper sulfate and chloride, and 33 and 9.4 mg/kg for the hydrated forms of copper sulfate and chloride, respectively (Stokinger, 1981). Subcutaneous LD_{50}s for copper compounds in rodents range from 3 to 7 mg/kg (Aaseth and Norseth, 1986). Rats treated intraperitoneally with 2 mg Cu/kg (as cupric chloride) showed significantly increased brain dopamine and norepinephrine levels (Malhotra et al., 1982).

3.3.2. Subchronic Toxicity

3.3.2.1. Human

Several episodes of copper-induced hemolysis after hemodialysis have been reported. The clinical symptoms included chills, nausea, abdominal pain, vomiting, and watery yellow stools. Copper was introduced into the dialysate from the copper tubing and copper-containing semipermeable membranes in the equipment. Hemolytic anemia has also been reported in a patient treated with applications of copper sulfate to large areas of burned skin (U.S. AF, 1990). Internal exposure to copper in the form of IUDs has caused contact dermatitis and eczematous dermatitis (Venugopal and Luckey, 1978).

3.3.2.2. Animal

Information on the subchronic toxicity of copper in animals by other routes of exposure is unavailable.

3.3.3. Chronic Toxicity

Information on the chronic toxicity of copper in humans or animals by other routes of exposure is unavailable.

3.3.4. Developmental and Reproductive Toxicity

3.3.4.1. Human

Incubation of human spermatozoa with metallic copper caused a significant decrease in sperm motility (Battersby et al., 1982).

3.3.4.2. Animal

Intravenous administration of 2.13 mg Cu/kg (as copper sulfate) to female hamsters on the 8th day of gestation resulted in 26% resorptions and 6% abnormalities (thoracic wall hernias, encephalocoeles, spina bifida, and microphthalmia). A dose of 4.25 mg Cu/kg caused 86% resorptions and 8% abnormalities (exencephaly, hydrocephalus, abdominal hernia, and abnormal spinal curvature), and a dose of 7.5 mg Cu/kg resulted in 100% embryo mortality, 74% resorptions, and 8% abnormalities. A dose of 10 mg/kg was lethal to dams. In the same study, intravenous administration of 0.25-1.5, 1.8, or 2.2 mg Cu/kg (as the citrate) produced resorptions in 16, 41, or 34% resorptions and 2, 17, or 35% abnormalities, respectively. A dose of 4 mg Cu/kg was lethal to both embryos and dams (Ferm and Hanlon, 1974).

Copper compounds have been shown to be spermicidal in animals and use of copper-containing IUDs has been shown to prevent mammalian embryogenesis (U.S. AF, 1990). The insertion of copper wire into the vas deferens or uterus prior to conception or at gestational day 3 resulted in decreased fertility or decreased number of implantation sites in monkeys, rats, hamsters, and rabbits (ATSDR, 1990).

3.4. TARGET ORGANS/CRITICAL EFFECTS

3.4.1. Oral Exposures

3.4.1.1. Primary Target Organs

1. Gastrointestinal system: In humans, exposure to high levels of copper in drinking water has resulted in gastrointestinal irritation characterized by recurrent nausea, vomiting, and abdominal pain. Gastric ulcers were observed in pigs exposed to high dietary levels of copper.

2. Liver: Hepatomegaly and cirrhosis of the liver were reported in children exposed to high levels of copper in drinking water. Cirrhosis of the liver may occur in patients with Wilson's disease. Hepatic effects observed in animals include increased copper deposition, necrosis, inflammation, and increased ALT and AST levels.

3. Kidneys: Renal effects observed in animals include deposition of copper in the kidneys, and degenerative kidney changes including necrosis and acute tubular damage. Patients with Wilson's disease may suffer kidney damage.

4. Hematopoietic system: Hemolytic anemia, hyperplasia of hematopoietic tissue, decreased hemoglobin and hematocrit values, and hemolytic anemia were reported in animals orally exposed to copper. Hemolytic anemia is also one of the effects seen in patients with Wilson's disease.

5. Reproduction and development: Increased fetal mortality and developmental abnormalities were seen in animals receiving oral doses of copper.

3.4.1.2. Other Target Organs

1. Spleen: Enlarged spleens were observed in children exposed to high levels of copper in drinking water. Sheep ingesting high levels of copper exhibited degenerative changes of the spleen.

2. Cardiovascular system: One epidemiologic study correlated high levels of copper in drinking water with an increased risk of myocardial infarction in Finnish men. Rats fed a diet supplemented with copper exhibited increased systolic blood pressure.

3. Nervous system: Although neurological effects have not been observed in healthy humans exposed to high copper levels, symptoms in patients with Wilson's disease include poor coordination, psychological impairment, tremors, disturbed gait, and rigidity.

4. Eyes: Eye opacities have been reported in patients with Wilson's disease.

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target Organs

1. Respiratory system: Pulmonary copper deposition, fibrosis, and granulomas of the lung were seen in vineyard workers exposed to Bordeaux mixture. Similar lung lesions occurred in guinea pigs exposed to an atmosphere saturated with Bordeaux mixture. Workers exposed to various copper salts experienced irritation of the nose, mouth, and eyes.

2. Liver: Hepatic effects in vineyard workers exposed to Bordeaux mixture included morphological changes in Kupffer cells, fibrosis, and cirrhosis. Hepatomegaly was recorded in workers exposed to copper dust.

3. Gastrointestinal tract: Workers exposed to copper dust experienced anorexia, nausea, and occasional vomiting.

4. Nervous system: Headache, vertigo, and drowsiness have been reported in factory workers exposed to copper dust.

3.4.2.2. Other Target Organs

No other target organs following inhalation exposure to copper or copper compounds were identified.

3.4.3. Other Routes of Exposure

3.4.3.1. Primary Target Organs

1. Hematopoietic system: Copper-induced hemolysis has been reported in patients undergoing hemodialysis. Repeated applications of copper sulfate to large areas of burned skin may induce hemolytic anemia.

2. Reproduction and development: Increased fetal mortality and developmental abnormalities were seen in animals injected with copper. Intrauterine placement of a copper wire resulted in decreased fertility or decreased number of implantation sites in animals. Copper has been shown to have spermicidal effects in animals.

3. Skin: In humans, dermal exposure to metallic copper may cause pruritic dermatitis.

4. Immune system: In humans, dermal exposure to copper or exposure via IUDs may cause allergic contact dermatitis.

3.4.3.2. Other Target Organs

Additional target organs by other routes of exposure to copper or copper compounds have not been identified.

4. CARCINOGENICITY

4.1. ORAL EXPOSURES

4.1.1. Human

In studies conducted at several U.S. locations, Schrauzer et al. (1977) reported a positive association between dietary copper intake, blood copper concentrations and cancer of the intestine in men and cancer of the intestine, lung, breast, and thyroid in women. However, the study was inconclusive because a positive correlation was also established for zinc, cadmium, and chromium.

4.1.2. Animal

Male and female $B6C3F_1$ and $B6AKF_1$ mice were treated daily by gavage with 1000 mg copper hydroxyquinoline/kg body weight (180.6 mg Cu/kg) until they were 28 days old, after which they were given 2800 ppm (505.6 ppm Cu) in their diet for an additional 50 weeks. The incidence of tumors was not significantly increased in treated mice compared with controls (BRL, 1968).

4.2. INHALATION EXPOSURES

Information on the carcinogenicity of copper in humans or animals following inhalation exposure was unavailable.

4.3. OTHER ROUTES OF EXPOSURE

4.3.1. Human

Information on the carcinogenicity of copper in humans by other routes of exposure was unavailable.

4.3.1. Animal

Gilman (1962) administered intramuscular injections containing 20 mg cupric oxide (CuO), cupric sulfide (CuS), or cuprous sulfide (Cu_2S) into the right and left thighs of 2- to 3-month-old Wistar rats. There were no injection-site tumors after 20 months of observation in any of the animals, but a very low incidence of other tumors occurred in the animals receiving cupric sulfide (2/30) and cuprous sulfide (1/30).

BRL (1968) administered a single subcutaneous injection of 1000 mg copper hydroxyquinoline/kg (180.6 mg Cu/kg) to male and female $B6C3F_1$ and $B6AKF_1$ mice. After 50 days of observation, the male $B6C3F_1$ mice had an increased incidence of reticulum cell sarcomas compared with controls. A low incidence of reticulum cell sarcomas was also observed in copper-treated female mice of both strains.

4.4. EPA WEIGHT-OF-EVIDENCE

Classification D – Not classifiable as to human carcinogenicity (U.S. EPA, 1991).
Basis – There are no human data, inadequate animal data from assays of copper compounds, and equivocal mutagenicity data.

4.5. CARCINOGENICITY SLOPE FACTORS

Data were insufficient to derive carcinogenicity slope factors.

5. REFERENCES

Aaseth, J. and T. Norseth. 1986. In: L. Friberg, G.F. Nordberg and V.B. Vouk, Eds. Handbook on the Toxicology of Metals, 2nd. ed., Vol. II. Specific Metals, Elsevier, Amsterdam, pp. 233-254.

ACGIH (American Conference of Governmental Industrial Hygienists). 1986. Copper. In: Documentation of the Threshold Limit Values and Biological Exposure Indices, 5th ed. ACGIH, Cincinnati, OH, p. 146.

Askergren, A. and M. Mellgren. 1975. Changes in the nasal mucosa after exposure to copper salt dust. Scand. J. Work Environ. Health 1: 45-49. (Cited in ATSDR, 1990; Stokinger, 1981)

ATSDR (Agency for Toxic Substances and Disease Registry). 1990. Toxicological Profile for Copper. Prepared by Syracuse Research Corporation for ATSDR, U.S. Public Health Service under Contract 88-0608-2. ATSDR/TP-90-08.

Aulerich, R.J., R.K. Ringer, M.R. Bleavins, et al. 1982. Effects of supplemental dietary copper on growth, reproductive performance and kit survival of standard dark mink and the acute toxicity of copper to mink. J. Animal Sci. 55: 337-343. (Cited in ATSDR, 1990)

Batsura, Y.D. 1969. Electron-microscopic investigation of penetration of copper oxide aerosol from the lungs into the blood and internal organs. Bull. Exp. Biol. Med. 45: 1175-1178. (Cited in ATSDR, 1990)

Battersby, S., J.A. Chandler and M.S. Morton. 1982. Title not given. Fertil. Steril. 37: 230-235. (Cited in Aaseth and Norseth, 1986)

BRL (Bionetics Research Laboratories). 1968. Evaluation of the carcinogenic, teratogenic, and mutagenic properties of selected pesticides. Vol. I. Carcinogenic study prepared for the National Cancer Institute. NCI-DCCP-CG-1973-1-1. (Cited in U.S. EPA, 1991b; U.S. AF, 1990)

Budavari, S., M.J. O'Neil and A. Smith (Eds.). 1989. The Merck Index. Merck & Co., Inc., Rahway, NJ, p. 2516.

Drummond, J.G., C. Aranyi, L.J. Schiff, et al. 1986. Comparative study of various methods used for determining health effects of inhaled sulfates. Environ. Res. 41: 514-528.

Eckert, H. and S. Jerochin. 1982. Title not given. Z. Erkr. Atmungsorgane. 158: 270-276. (Cited in Aaseth and Norseth, 1986)

Enterline, P.E., G.M. Marsh, N. Esmen, et al. 1986. Report on Mortality Among Copper and Zinc Smelter Workers in the United States. Report prepared for Smelter Environmental Research Association by the School of Public Health, University of Pittsburgh. (Cited in U.S. AF, 1990)

Ferm, V.H. and D.P. Hanlon. 1974. Toxicity of copper salts in hamster embryonic development. Biol. Reprod. 11: 97-101. (Cited in U.S. AF, 1990)

Gilman, J.P.W. 1962. Metal Carcinogenesis. II. A study on the carcinogenic activity of cobalt, copper, iron and nickel compounds. Cancer Res. 22: 158-166.

Gopinath, C., G.A. Hall and J.McC. Howell. 1974. Title not given. Res. Vet. Sci. 16: 57-69. (Cited in Aaseth and Norseth, 1986)

Goyer, R.A. 1991. Toxic effects of metals. In: M.O. Amdur, J. Doull and C.D. Klaasen, Eds., Casarett and Doull's Toxicology, 4th ed. Pergamon Press, New York, NY, p. 653-655.

Hatch, R.C., J.L. Blue, E.A. Mahaffey, et al. 1979. Title not given. J. Am. Vet. Med. Assoc. 174: 616-619. (Cited in Aaseth and Norseth, 1986)

Haywood, S. 1980. The effect of excess dietary copper on the liver and kidney of the male rat. J. Comp. Pathol. 90: 217-232.

Haywood, S. 1985. Copper toxicosis and tolerance in the rat. I. Changes in copper content of the liver and kidney. J. Pathol. 145: 149-158.

Haywood, S. and B. Comerford. 1980. The effect of excess dietary copper on plasma enzyme activity and on the copper content of the blood of the male rat. J. Comp. Pathol. 90: 233-238. (Cited in ATSDR, 1990)

Johansson, A., T. Curstedt, B. Robertson, et al. 1984. Lung morphology and phospholipids after experimental inhalation of soluble cadmium, copper, and cobalt. Environ. Res. 34: 285-309.

Kline, R.D., V.W. Hays and G.L. Cromwell. 1971. Effects of copper, molybdenum and sulfate on performance, hematology and copper stores of pigs and lambs. J. Animal Sci. 33: 771-779. (Cited in ATSDR, 1990)

Lecyk, M. 1980. Toxicity of cupric sulfate in mice embryonic development. Zool. Pol. 28: 101-105. (Cited in U.S. AF, 1990)

Liu, C.-C.F. and D.M. Medeiros. 1986. Excess diet copper increases systolic blood pressure in rat. Biol. Trace Element Res. 9: 15-24. (Cited in ATSDR, 1990)

Malhotra, K.M., G.S. Shukla and S.V. Chandra. 1982. Neurochemical changes in rats coexposed to lead and copper. Arch. Toxicol. 49: 331-336. (Cited in U. S. AF, 1990)

Massie, H.R. and V.R. Aiello. 1984. Excessive intake of copper: Influence on longevity and cadmium accumulation in mice. Mech. Ageing Dev. 26: 195-203.

Mueller-Hoecker, J., U. Meyer, B. Wiebecke, et al. 1988. Copper storage disease of the liver and chronic dietary copper intoxication in two further German infants mimicking Indian childhood cirrhosis. Pathol. Red. Pract. 183: 39-45. (Cited in ATSDR, 1990)

Pimental, J.C. and F. Marques. 1969. 'Vineyard sprayer's lung': A new occupational disease. Thora. 24: 678-688. (Cited in U.S. EPA, 1987)

Rana, S.V.S. and A. Kumar. 1978. Simultaneous effects of dietary molybdenum and copper on the accumulation of copper in the liver and kidney of copper poisoned rats. A histochemical study. Ind. Health 18: 9-17. (Cited in U.S. AF, 1990)

Salonen, J.T., R. Salonen, H. Korpela, et al. 1991. Serum copper and the risk of acute myocardial infarction: A prospective population study in men in Eastern Finland. Am. J. Epidem. 134: 268-276.

Scheinberg, H.I. 1983. Copper, alloys, and compounds. In: L. Parmeggiani, Ed., Encyclopaedia of Occupational Health and Safety, Vol. 1. International Labour Office, pp. 546-548.

Schrauzer, G.N., D.A. White and C.J. Schneider. 1977. Cancer mortality correlation studies. IV. Association with dietary intakes and blood levels, notably Se-antagonists. Bioinorg. Chem. 7: 35-56.

Spitalny, K.C., J. Brondum, R.L. Vogt, et al. 1984. Drinking-water-induced copper intoxication in a Vermont family. Pediatrics 74: 1103-1106.

Stokinger, H.E. 1981. Copper. In: G.D. Clayton and E. Clayton, Eds, Patty's Industrial Hygiene and Toxicology, Vol. 2A. John Wiley & Sons, New York, NY, pp. 1620-1630.

Strickland, G.T., W.M. Beckner and M.L. Leu. 1972. Absorption of copper in homozygotes and heterocygotes for Wilson's Disease and controls: Isotope tracer studies with ^{67}Cu and ^{64}Cu. Clin. Sci. 43: 617-625. (Cited in ATSDR, 1990)

Suciu, I., L. Prodan, V. Lazar, et al. 1981. Research on copper poisoning. Med. Lav. 72: 190-197. (Cited in ATSDR, 1990)

U.S. AF (U.S. Air Force). 1990. Copper. In: The Installation Program Toxicology Guide, Vol. 5. Wright-Patterson Air Force Base, Ohio, pp. 77(1-43).

U.S. EPA. 1986. 90-Day oral toxicity study of copper cyanide (CuCN) in Sprague-Dawley rats. Prepared by IIT Research Institute, Chicago, IL, for the Office of Solid Waste, Washington, DC.

U.S. EPA. 1987. Drinking Water Criteria Document for Copper. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH, for the Office of Drinking Water, Washington, DC. ECAO-CIN-417.

U.S. EPA. 1991a. Health Effects Assessment Summary Tables. Annual FY-1991. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment

Office, Cincinnati, OH, for the Office of Emergency and Remedial Response, Washington, DC. NTIS PB91-921199.

U.S. EPA. 1991b. Copper. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA. 1991c. Copper Cyanide. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH.

Venugopal, B. and T.D. Luckey. 1978. Metal Toxicity in Mammals. 2. Chemical Toxicity of Metals and Metalloids. Plenum Press, New York, NY, pp. 24-32.

Walsh, F.M., F.J. Crosson, J. Bayley, et al. 1977. Acute copper intoxication. Am. J. Dis. Child 131: 149-151. (Cited in ATSDR, 1990)

Weber, P.M., S. O'Reilly, M. Pollycove, et al. 1969. Gastrointestinal absorption of copper: Studies with ^{64}Cu, ^{65}Zn, a whole body counter and the scintillation camera. J. Nucl. Med. 10: 591-596. (Cited in ATSDR, 1990)

TOXICITY SUMMARY FOR MANGANESE

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OAK RIDGE RESERVATION ENVIRONMENTAL RESTORATION PROGRAM

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EXECUTIVE SUMMARY

Manganese is an essential trace element in humans, which can elicit a variety of serious toxic responses upon prolonged exposure to elevated concentrations either orally or by inhalation. The central nervous system is the primary target. Initial symptoms are headache, insomnia, disorientation, anxiety, lethargy and memory loss. These symptoms progress with continued exposure and eventually include motor disturbances, tremors and difficulty in walking, similar to symptoms seen in Parkinsonism. These motor difficulties are most often irreversible. Based on human epidemiological studies, 0.8 mg/kg/day for drinking water exposure and 0.34 mg/m^3 in air for inhalation exposure have been estimated as lowest-observed-adverse-effect levels (LOAELs) for central nervous system effects.

Effects on reproduction (decreased fertility, impotence) have been observed in humans with inhalation exposure and in animals with oral exposure at the same or similar doses that initiate the central nervous system effects. An increased incidence of coughs, colds, dyspnea during exercise, bronchitis and altered lung ventilatory parameters have also been seen in humans and animals with inhalation exposure. A possible effect on the immune system may account for some of the respiratory symptoms.

Chronic and oral RfDs of 5E-3 and 1.4E-1 mg/kg/d have been established for manganese exposure via drinking water and food, respectively (EPA 1993). A subchronic oral RfD of 0.10 is listed in HEAST. The oral reference dose (RfD) for food has been calculated by the EPA from a human no-observed-adverse-effect level (NOAEL) of 0.14 mg/kg/d, which was determined from a series of epidemiological studies (Schroeder et al. 1966; WHO 1973; NRC 1989). Large populations with different concentrations of manganese in their drinking water were examined. No adverse effects that were attributable to manganese were seen in any of these groups. The RfD was derived from these studies without uncertainty factors since manganese is essential in human nutrition and the exposure of the most sensitive groups was included in the population examined. Confidence in the oral RfD is rated medium by the EPA.

A reference concentration (RfC) of 0.4 ug/m^3 for both chronic and subchronic inhalation exposure was calculated from a human LOAEL of 0.34 mg/m^3 for respiratory and psychomotor disturbances from an epidemiological study by Roels et al. (1987). The study population was occupationally exposed to airborne manganese dust with a median concentration of 0.97 mg/m^3 for 1 to 19 years with a mean duration of 7.1 years. Neurological examinations, psychomotor tests, lung function tests, blood tests and urine tests were used to determine the possible effects of exposure. The LOAEL was calculated by expanding the dose to continuous exposure. Confidence in the inhalation RfC is rated medium by the EPA.

There are some conflicting data on possible carcinogenesis following injections of manganese chloride and manganese sulfate in mice. However, the EPA weight-of-evidence classification is: D, not classifiable as to human carcinogenicity based on no evidence in humans and inadequate evidence in animals.

1. INTRODUCTION

Manganese (CAS registry number 7439-96-5) makes up about 0.10% of the earth's crust and is the 12th most abundant element. It can exist in oxidation states from -3 to +7, the most common being +4 in the chemical form of manganese dioxide (Keen and Leach, 1988). The oxides and peroxides are used in industry as oxidizers, and the metal is used for manufacturing metal alloys to increases hardness and corrosion resistance. In living systems, manganese is an essential element that is found most often in the +2 valence (Keen and Leach, 1988; Stokinger, 1981).

Normal nutritional requirements of manganese are satisfied through the diet, which is the normal source of the element, with minor contributions from water and air (U.S. EPA, 1984). The National Research Council (NRC, 1989) recommends a dietary allowance of 2 to 5 mg/day for a safe and adequate intake of manganese for an adult human. Toxic exposures occur largely due to particulate material in the air from mining and manufacturing activity.

2. METABOLISM AND DISTRIBUTION

2.1. Absorption

Intestinal absorption has been estimated to be between 3 and 10% of the amount of manganese ingested and is a multiple step process similar to and involving some of the same binding sites as in iron absorption. The absorption of manganese by inhalation depends on the particle size. The larger particles are cleared from the respiratory tract by the cilia and swallowed, whereas, the fine particles (< 2.5 microns) are deposited in the lungs and must be cleared by absorption into the blood and lymph circulation (U.S. EPA, 1990a). It is estimated that 60 to 70% of the inhaled particles are eventually swallowed (Stokinger, 1981).

2.2. Distribution

Once absorbed, manganese is transported to organs rich in mitochondria (liver, pancreas and pituitary in particular) where it is rapidly concentrated. Accumulation of manganese in the central nervous system following an intraperitoneal or intramuscular injection occurs slowly reaching a maximum in about 30 days. Distribution is homogeneous in the brain with lower concentrations in the spinal cord. The average turnover time in the central nervous system is reported to be about 110 days following intraperitoneal injection and about 55 days for intramuscular injection (Stokinger, 1981).

2.3. Metabolism

Manganese does not undergo metabolism; it is absorbed and excreted unchanged. However, manganese is an essential trace element and is involved as an activator or cofactor with a number of diverse enzymes involved with energy metabolism, digestion, and lipid and protein metabolism (Orten and Neuhaus, 1975).

2.4. Excretion

The normal adult body pool of about 20 mg is maintained by the liver and the excess manganese is excreted into the intestine via the bile. This control is achieved with a daily intake of 10 to 20% of the total pool, thus relatively large amounts are handled by this mechanism. The normal urinary level of manganese averages about 2.75 μg/L with a range of about 1.0 to 8.0 μg/L. Urinary levels over 10 μg/L are indicative of manganese over exposure (Stokinger, 1981).

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. Oral Exposures

3.1.1. Acute Toxicity

3.1.1.1. Human

Information on the acute oral toxicity of manganese in humans was unavailable.

3.1.1.2. Animal

Due to the control exerted by mammals over manganese absorption and excretion, acute oral toxicity is observed only after relatively large doses. Several LD_{50} values have been calculated. In one oral study using Sprague-Dawley rats, manganese dichloride tetrahydrate was given by stomach tube and the animals were observed for 14 days. The LD_{50} was calculated to be 1484 mg/kg or 7.5 mmole/kg. The manganese concentrations in liver, kidney, spleen, heart, testes, brain and blood of the surviving animals returned to control values within the 14 day period. (Holbrook et al., 1975).

Other oral values include an LD_{50} of 1715 mg/kg for manganese dichloride in mice and 3730 mg/kg for manganese^{2+} acetate in rats (Lewis and Sweet, 1984). Potassium permanganate, a strong oxidizing agent, is an irritant to mucosal tissues, is hemolytic and damages capillaries regardless of the route. An oral LD_{50} of 1090 mg/kg has been determined for potassium permanganate in rats (Stokinger, 1981).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

A number of epidemiological studies have been performed that have documented the response of human populations to subchronic or chronic exposure to elevated manganese concentrations. Signs of toxicity may appear within months and continue for years. Initial signs of manganese toxicity usually include headache, disorientation, speech disturbances, memory loss and acute anxiety. Prompt removal of the affected person from the source of manganese exposure usually results in reversal of most of the symptoms; however, the symptoms will increase and eventually become irreversible if the individual continues to be exposed to high

manganese concentrations (Keen and Leach, 1988). See section 3.1.3 for discussions of individual studies.

3.1.2.2. Animal

A decrease in brain amines was observed in a study on the effects of manganese chloride on brain chemistry. Male Sprague-Dawley rats were given 0.1 or 1.0 mg manganese/Ml in drinking water for eight months after which the brains were removed, dissected and analyzed for various brain amines. Effects were seen with both doses. Decreases in the following amines were observed: dihydroxyphenylacetic, noradrenaline, homovanillic acid, 5-hydroxyindolacetic acid, noradrenaline and serotonin.

3.1.3. Chronic Toxicity

3.1.3.1. Human

An epidemiological study by Schroeder et al. (1966) on normal diets in the United States, England and Holland demonstrated that the average daily intake of manganese ranged from about 2.3 to 8.8 mg/day. Certain other diets (vegetarian) were possibly higher in manganese, but all were considered safe for chronic human consumption. In another portion of the study, patients were given 9 mg manganese/day as manganese citrate for many months. Assuming the average dietary intake of 2.5 mg/day, the total manganese intake was about 11.5 mg/day. No signs of toxicity were seen in either part of the study.

The World Health Organization reviewed the above study and other dietary information and concluded that 2 to 3 mg manganese/day is adequate for adults and 8 to 9 mg/day is safe (WHO, 1973). The Food and Nutrition Board of the National Research Council also examined the available evidence and determined 10 mg manganese/day to be safe. They chose an adequate and safe intake of manganese to be 2 to 5 mg/day for adults (NRC, 1989).

Sixteen cases of manganese toxicity from drinking contaminated water were reported in a study by Kawamura et al. (1941). The symptoms included lethargy, increased muscle tonus, tremor and mental disturbances. Children were affected less than the elderly. The drinking water was estimated to contain at least 28 mg manganese/L, which would be equivalent to an intake of 0.8 mg/kg/day (56 mg/day) for a 70 kg adult drinking 2 L of water/day.

Kondakis et al. (1989) conducted an epidemiological study in three areas of northwestern Greece containing maximum manganese concentrations of 14.6, 252.6 and 2300 μg/L in drinking water. Mean concentrations of manganese in hair samples were 3.51, 4.49 and 10.99 μg/g dry weight from the areas with low, medium and high manganese concentrations in drinking water. The concentration in whole blood was the same for all three areas. The individuals in the study

3.1.5. Reference Dose

3.1.5.1. Subchronic

ORAL RfD_s: 0.10 mg/kg/day (U.S. EPA, 1990b)

dietary data. Nevertheless, the experiment established an uncertainty about extrapolating dietary risk factors to drinking water without considering the possibility of differential absorption (U.S. EPA, 1990a).

In addition to the central nervous system effects, an iron-responsive anemia is commonly found with orally induced manganese toxicity (Keen and Leach, 1988).

3.1.3.2. Animal

A number of studies have shown that biochemical changes occur in the brains of rodents following the administration of about 1 mg/Ml manganese dichloride tetrahydrate in drinking water (Lai et al., 1981; Leung et al., 1981; see also the discussion in section 3.1.2.2).

A study of more relevance to humans was conducted by Gupta et al. (1980). Neurological symptoms, including muscular weakness and rigidity of the lower limbs, were seen in a group of 4 rhesus monkeys after 18 months treatment with 6.9 mg manganese/kg/day (given as manganese dichloride tetrahydrate). Degenerated neurons in the substantia nigra and scanty neuromelanin granules in pigmented cells were reported upon histological analysis.

Lambs on a high manganese diet developed a reduction in hemoglobin. This observation is consistent with the anemia seen in humans and indicates that large amounts of manganese can interfere with intestinal iron absorption (Stokinger, 1981).

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

Information on developmental and reproductive toxicity of manganese in humans was unavailable.

3.1.4.2. Animal

Groups of four male adult rhesus monkeys were given daily doses of 0 or 25 mg manganese chloride tetrahydrate/kg (6.94 mg manganese/kg) by oral gavage for 18 months. The testes of the treated monkeys exhibited interstitial edema and degeneration of the seminiferous tubules (Murthy et al., 1980; U.S. EPA, 1989).

Pregnant Long-Evans rats were fed diets containing 0, 400, 1100 or 3550 ppm manganese from day 2 of gestation. The F_1 offspring were fed the same diet until they were up to 225 days old. Decreased serum testosterone was observed in 100 day old offspring exposed to 400 ppm manganese. Decreased fertility was seen upon mating the offspring receiving the 3550 ppm dose (Laskey et al., 1982).

3.1.5. Reference Dose

3.1.5.1. Subchronic

ORAL RfD_s: 0.10 mg/kg/day (U.S. EPA, 1990b)
UNCERTAINTY FACTOR: 1
NOAEL: 0.14 mg/kg/day

PRINCIPAL STUDIES: The same studies and comments apply for both the subchronic and chronic RfD derivations. See section 3.1.5.2.

3.1.5.2. Chronic

ORAL RfD_c: 0.14 mg/kg/day (water) (U.S. EPA, 1990a,b)
0.005 mg/kg/day (food) (U.S. EPA, 1990a,b)
UNCERTAINTY FACTOR: 1
MODIFYING FACTOR: 1
NOAEL: 0.14 mg/kg/day
CONFIDENCE:
Study: High
Data Base: Medium
RfD: Medium
VERIFICATION DATE: 01/01/93

PRINCIPAL STUDIES: Schroeder et al., 1966; WHO, 1973; NRC, 1989.

COMMENTS: The RfD is based on a composite of data from the above three references. The uncertainty factor of 1 was applied because the information used to determine the RfD was taken from large adult human populations and the most sensitive subpopulation was represented within the group. Humans exert an efficient homeostatic control over manganese. It is important to recognize that manganese is an essential human nutrient. The RfD is not necessarily acceptable if the intake is from drinking water alone because of the possibility of differential bioavailability (U.S. EPA, 1990a).

3.2. Inhalation Exposures

3.2.1. Acute toxicity

3.2.1.1. Human

The inhalation of manganese oxide fumes, such as could be produced from welding, can result in chills, fever, sweating, nausea, and cough. These influenza-like symptoms begin four to 12 hours after exposure and diminish after 24 hours. This "metal fume fever" usually causes no permanent damage unless exposure is continually repeated (Proctor et al., 1988).

3.2.1.2. Animal

Intratracheal injections of manganese oxides (particle size <3 μ) caused congestion, pulmonary edema and histological changes in the lungs of young rats. The higher oxides were more toxic (Stokinger, 1981).

Monkeys exposed to high concentrations of manganese in an aerosol exhibited alternating periods of sudden movement followed by torpor, nervousness, severe tremor, alternate flection and extension of the upper limbs, yawning, and cyanosis. The monkeys returned to normal three weeks after exposure, but more severe symptoms, including uncertain gait and paresis, appeared in five months (Stokinger, 1981).

Groups of three male and female Sprague-Dawley rats were exposed 6 hours/day, 5 days/week for 2 weeks to 0, 43, 82 or 138 mg manganese/m^3 (given as manganese dioxide). Dose-related increases in the incidence and severity of pneumonitis and wet weight of the lungs were seen. Granulomas were seen in the 138 mg/m^3 exposure group (Shiotsuka, 1984).

Several animal studies reviewed in U.S. EPA (1990a) demonstrate probable immunosuppression following exposure to manganese tetroxide and *Streptococci, Enterobacter* or *Klebsiella*. In one such study, DC-1 mice were exposed to various levels of manganese tetroxide for two hours followed by exposure to *Streptococcus pyogenes* aerosol for 20 minutes. The incidence of mortality was related to the dose of manganese. Prior immunity to *Streptococci* did not counteract the effects of manganese tetroxide inhalation and consequent *Streptococci* infection (Adkins et al, 1980).

3.2.2. Subchronic Toxicity

3.2.2.1. Human

Most human studies on manganese toxicity are epidemiological studies on populations exposed to manganese compounds in dust particles. Individuals in these studies were exposed to manganese for less than one year to more than 20 years. The primary difference between subchronic and chronic central nervous system symptoms is the reversibility of the early subchronic symptoms.

There is an overlap between the inhalation and oral routes since manganese contained in larger particle sizes (greater than about 2.5 μ) is deposited in the tracheobronchial and extrathoracic regions and is cleared by the action of the cilia into the gastrointestinal tract. It is not surprising that the same central nervous system symptoms are seen with both routes (See section 3.1.2.1.). Respiratory system effects, nasal irritation, colds, bronchitis and pneumonia are increased in exposed populations and these symptoms can be seen following subchronic and chronic exposures (See section 3.2.3. for individual experiments).

3.2.2.2. Animal

Dose dependent hyperplasia of the peribronchial tissue, pulmonary emphysema and atelectasis, exudate in the bronchioles and thickening of the alveolar wall were observed in rhesus

monkeys exposed 22 hours/day for 10 months to manganese at concentrations of 0, 0.7 or 3.0 mg/m^3 (given as manganese dioxide dust) (Suzuki et al., 1978).

3.2.3. Chronic Toxicity

3.2.3.1. Human

A study was conducted by Roels et al. (1987) in which 141 males occupationally exposed to manganese dioxide, tetroxide, sulfate, carbonate and nitrate were compared to a group of 104 males who were not occupationally exposed to these compounds. The groups were matched in background environmental factors, work load and shift responsibilities. The duration of employment ranged from 1 to 19 years with a mean of 7.1 years. A higher frequency of coughs, dyspnea during exercise, episodes of acute bronchitis and altered lung ventilatory parameters were found in the exposed group. Significant alterations were also found in visual reaction time, audioverbal short-term memory, eye-hand coordination, and hand steadiness in the exposed group. A LOAEL of 0.34 mg/m^3 was determined from these observations.

A group of 60 welders from three separate plants who were exposed to manganese fumes were studied by Chandra et al. (1981). The mean concentrations of manganese were 0.31, 0.57 and 1.74 mg/m^3 measured in the air from plant 1, 2, and 3 respectively. Frequent colds, cough and fever were reported by the individuals from plant 1; workers from all three plants reported insomnia. Signs of neurological effects measured by "brisk, deep reflexes" in the legs and/or arms were seen in 25, 50 and 45% of workers in plant 1, 2 and 3 respectively. Tremors were also observed in one worker in plant 1 and four workers in plant 2. Increased urinary manganese and serum calcium levels were also seen in workers from all plants. A LOAEL of 0.11 mg/m^3 was determined from the mean exposure at plant 1.

A similar study was reported by Iregren (1990) in which 15 workers from each of two Swedish foundries were studied for manganese exposure. The inhalation exposure concentration varied from 0.02 to 1.4 mg/m^3 and the time of exposure varied from 1 to 35 years. A reference group of two unexposed workers from the same geographic area was matched (age, type of work) to each exposed worker. Neurobehavioral function was evaluated by eight computerized tests from the Swedish Performance Evaluation System and two manual dexterity tests. Significant differences were found between the exposed and unexposed groups in simple reaction time and manual dexterity (finger tapping speed). A concentration-response relationship, however, could not be established. A LOAEL of 0.09 mg/m^3 was determined for the neurological effects.

Respiratory effects, including an increased incidence of colds, bronchitis and pneumonia, have been reported in at least four other human studies. It is believed unlikely that exposure to manganese is solely responsible for the increased respiratory symptoms. A decrease in resistance to infectious agents, possibly as a result of a weakened immune response, is probably a contributing factor (U.S. EPA, 1990a).

3.2.3.2. Animal

Groups of 4 female rhesus monkeys were exposed to 0 or 30 mg/m^3 manganese 6 hours/day, 5 days/week for 2 years. Significantly decreased dopamine concentrations were

observed in the caudate and globus pallidus regions of the brains of treated monkeys. No behavioral abnormalities were noted during routine (cage side) observations. Neurobehavioral dysfunction was not specifically tested (Bird et al., 1984).

3.2.4. Developmental and Reproductive Toxicity

3.2.4.1 Human

The same population of male factory workers studied by Roels (see section 3.2.3.1.) was also studied by Lauwerys et al. (1985) for reproductive effects. The results of a fertility questionnaire indicated that fewer children were born to workers exposed to manganese dust between the ages of 16-25 and 26-35. The same LOAEL of 0.34 mg/m^3 was calculated for reproductive effects.

3.2.4.2. Animal

Decreased body weight and impaired neurobehavioral performance (balance and coordination) were seen in the offspring of female HA/ICR mice that were exposed to 48.9 mg manganese/m^3 7 hours/day, 5 days/week. Exposure was initiated 4 months prior to breeding and continued through day 18 of gestation. Similar neurobehavioral responses were obtained from offspring of unexposed mice which were fostered to manganese-exposed females during lactation (Massaro et al., 1980).

3.2.5. Reference Concentration/Dose

3.2.5.1. Subchronic

INHALATION RfC: 0.0004 mg/m^3, U.S. EPA, 1990b
UNCERTAINTY FACTOR: 900
LOAEL: 0.34 mg/m^3

PRINCIPAL STUDY: The same study and comments apply for the subchronic and chronic RfC. The study is discussed in section 3.2.3.1.

3.2.5.2. Chronic

INHALATION RfC: 0.0004 mg/m^3, U.S. EPA, 1990a,b
UNCERTAINTY FACTOR: 300
MODIFYING FACTOR: 3, U.S. EPA, 1990a
LOAEL: 0.34 mg/m^3
VERIFICATION DATE: 09/19/90

PRINCIPAL STUDY: Roels et al., 1987

COMMENTS: The LOAEL was based on increased prevalence of respiratory symptoms and psychomotor disturbances as a result of occupational exposure to manganese dust. The uncertainty factor accounts for the use of a LOAEL (10), the

protection of sensitive individuals (10) and the less than chronic exposure period for portions of the population exposed (3). The modifying factor of 3 was used to account for the uncertainty of exposure in the principal study.

3.3. Other Routes of Exposure

3.3.1. Acute Toxicity

3.3.1.1. Human

Taylor and Price (1982) reported a clinical case of acute pancreatitis that resulted from hemodialysis of a patient with a solution contaminated with manganese. Symptoms, which appeared within one hour from the start of dialysis, included severe vomiting, epigastric pain, increased heart rate and increased blood pressure. The dialysis was discontinued after 30 minutes. The dialysate was found to contain 715 μmol/L manganese sulfate. The diagnosis of acute pancreatitis was made the next day (day 2). The patient suffered from a high fever, persistent abdominal pain, weakness and a drop in serum calcium from day 2 through day 4. A high leukocyte count persisted past day 14 after which it returned to normal. The serum manganese levels were found to be 4.55, 1.71 and 0.65 μmol/L on days 2, 3 and 6, respectively. The patient was discharged free from abdominal pain and on a normal diet 31 days after manganese exposure.

3.3.1.2. Animal

A number of experiments have indicated that manganese is considerably more toxic by injection. LD_{50} values of 121 and 255 mg/kg in mice were determined for manganese dichloride given by intraperitoneal and intramuscular injections, respectively. The tetrahydrate is less toxic with LD_{50} values of 190 mg/kg for intraperitoneal injection in mice and 138 mg/kg for intraperitoneal injection in rats. The latter value can be compared to the LD_{50} of 1484 mg/kg for oral exposure in rats discussed in section 3.1.1.2 (Lewis and Sweet, 1984).

Histological changes in the lungs of rats have been reported to occur within minutes after the injection of 40 mg/kg of manganese dioxide. An injection of manganese dioxide followed by a like injection of manganese dichloride resulted in severe congestion and pulmonary edema that was often fatal (Stokinger, 1981).

Sprague-Dawley or Osborne-Mendel rats injected intraperitoneally with 40 mg manganese/kg (given as manganese dichloride) became hyperglycemic within two hours. The increase in blood sugar was accompanied by a decrease in plasma insulin. Manganese was rapidly concentrated in the liver (45 minutes) and the pancreas (15 minutes). Blood sugar values returned to control levels within eight hours after the injection (Baly et al., 1985).

3.3.2. Subchronic Toxicity

Information on the subchronic toxicity of manganese in humans or animals was unavailable.

3.3.3. Chronic Toxicity

Information on the chronic toxicity of manganese in humans or animals was unavailable.

3.3.4. Developmental Toxicity

Information on the developmental toxicity of manganese in humans or animals was unavailable.

3.4. Target/Organs/Critical/Effects

3.4.1. Oral Exposures

3.4.1.1. Primary Target(s)

1. Central nervous system: Initial symptoms include headache, insomnia, disorientation, speech disturbances, memory loss and acute anxiety. Prompt removal of the affected person from the manganese source usually results in reversal of most of these symptoms. Continued subchronic to chronic exposure can result in motor difficulties, tremors, difficulty walking and exaggerated reflexes similar to Parkinson's disease. These later stages of toxicity are apparently secondary effects and are not reversible even though the manganese concentrations in the tissues decrease to normal levels upon removal from the manganese source.

2. Reproductive system: Chronic feeding studies in rats have indicated decreased fertility results from chronic manganese exposure. Similar subchronic studies in monkeys have shown degenerative changes in the seminiferous tubules.

3.4.1.2. Other Targets

Blood: An iron-responsive anemia can occur with orally induced manganese toxicity possibly due to an interference with intestinal iron absorption by excess manganese.

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target(s)

1. Central nervous system: The same symptoms are seen as with acute to chronic oral exposure (Sect. 3.4.1.1.). Since individuals are occupationally exposed to dust containing manganese during mining and manufacturing and to metal fumes during welding, inhalation is by far the most common route of exposure for manganese toxicity.

2. Respiratory system: Subchronic to chronic symptoms include an increased incidence of colds, bronchitis and pneumonia. Dyspnea during exercise,

decreased vital capacity and decreased forced expiratory vital capacity have also been reported.

3. Reproductive system: Decreased fertility has been seen in subchronic to chronic human inhalation studies.

3.4.2.2. Other Targets

1. Pancreas: Manganese is known to concentrate in the pancreas and to alter insulin production in rats. Acute pancreatitis has been reported in humans following accidental intravenous exposure.

2. Immune system: There is evidence in animal studies that acute manganese exposure by inhalation results in an immunosuppression. The observed increase in the incidence of respiratory infections with subchronic to chronic human exposure to manganese substantiates this observation.

4. CARCINOGENICITY

4.1. Oral Exposures

Information on the carcinogenicity of manganese in humans or animals was unavailable.

4.2. Inhalation Exposures

Information on the carcinogenicity of manganese in humans or animals was unavailable.

4.3. Other Routes of Exposure

4.3.1. Human

Information on the carcinogenicity of manganese in humans was unavailable.

4.3.2. Animal

DBA/1 mice were injected subcutaneously or intraperitoneally with 0.1 Ml of a 1% aqueous solution of manganese chloride twice weekly for 6 months. An increased number of lymphosarcomas developed in the treated animals compared with the controls. The tumor incidence/number of animals in the dose group was: 24/36, 16/39 and 16/66 for the subcutaneous, intraperitoneal and water control groups respectively. The tumors appeared earlier in the treated groups as well (DiPaolo, 1964).

Groups of 10 male and 10 female each of strain A Strong mice were injected intraperitoneally with 0, 6, 15 or 30 mg/kg manganous sulfate 3 times/week for 7 weeks. The

animals were sacrificed and examined for tumors after 30 weeks. There was an apparent increase in the average number of pulmonary adenomas/mouse at the mid and high doses but the increase was significant only at the high dose (Stoner et al., 1976).

F344 rats and female Swiss mice were injected intramuscularly with manganese powder and manganese dioxide (10 mg each). The F344 rats were also injected with manganese^{2+} acetylacetonate. No differences were seen in tumor incidence between treated and control animals with manganese powder or manganese dioxide; however, there was a significant increase in injection site fibrosarcomas with the manganese^{2+} acetylacetonate (Furst, 1978).

Witschi et al. (1981) injected female A/J mice intraperitoneally with 80 mg/kg methylcyclopentadienyl manganese tricarbonyl. Cell proliferation was produced in the lungs but no increase in tumor incidence was seen.

4.4. EPA Weight-of-Evidence Classification

Classification D — Not classifiable as to human carcinogenicity
Basis — Existing studies are inadequate to assess the carcinogenicity of manganese.

4.5. Carcinogenicity Slope Factors

None were calculated.

5. REFERENCES

Adkins, B., Jr., G.H. Luginbuhl, F.J. Miller and D.E. Gardner. 1980. Increased pulmonary susceptibility to streptococcal infection following inhalation of manganese oxide. Environ. Res. 23: 110-120.

Baly, D.L., B. Lonnerdal and C.L. Keen. 1985. Effects of high doses of manganese on carbohydrate homeostasis. Toxicology Letters. 25: 95-102.

Bird, E.D., A.H. Anton and B. Bullock. 1984. The effect of manganese inhalation on basal ganglia dopamine concentrations in rhesus monkeys. Neurotoxicology. 5(1): 59-66.

Chandra, S.V., G.S. Shukla, R.S. Strivastava, H. Singh and V.P. Gupta. 1981. An exploratory study of manganese exposure to welders. Clin. Toxicol. 18: 407-416.

DiPaolo, J.A. 1964. The potentiation of lymphosarcomas in mice by manganous chloride. Fed. Proc. 23: 393.

Furst, A. 1978. Tumorigenic effect of an organomanganese compound on F344 rats and Swiss albino mice: Brief communication. J. Natl. Cancer Inst. 60: 1171-1173.

Gupta, S.K., R.C. Murthy and S.V. Chandra. 1980. Neuromelanin in manganese-exposed primates. Toxicol. Lett. 6(1): 17-20.

Holbrook, C.J. Jr., M.E. Washington, H.B. Leake and P.E. Brubaker. 1975. Studies on the evaluation of the toxicity of various salts of lead, manganese, platinum, and palladium. Environ. Health Persp. 10: 95-101.

Iregren, A. 1990. Psychological test performance in foundry workers exposed to low levels of manganese. Neurotox. Teratol. 12: (in press).

Kawamura, R., H. Ikuta, S. Fukuzumi, et al. 1941. Intoxication by manganese in well water. Kitasato Arch. Exp. Med. 18: 145-169.

Keen, C.L. and R.M. Leach. 1988. Manganese. In: Handbook on Toxicity of Inorganic Compounds, eds. H.G. Seiler and H. Sigel, Marcel Dekker, Inc. pp. 405-415.

Kondakis, X.G., N. Makris, M. Leotsinidis, M. Prinou and T. Papapetropoulos. 1989. Possible health effects of high manganese concentration in drinking water. Arch. Environ. Health. 44(3): 175-178.

Lai, J.C.K., T.K.C. Leung and L. Lim. 1981. Brain regional distribution of glutamic acid decarboxylase, choline acetyltransferase, and acetylcholinesterase in the rat: Effects of chronic manganese chloride administration after two years. J. Neurochem. 36(4): 1443-1448.

Laskey, J.W., G.L. Rehnberg, J.F. Hein and S.D. Carter. 1982. Effects of chronic manganese (Mn_3O_4) exposure on selected reproductive parameters in rats. J. Toxicol. Environ. Health. 9: 677-687.

Lauwerys, R., H. Roels, P. Genet, et al. 1985. Fertility of male workers exposed to mercury vapor or to manganese dust: A questionnaire study. Am. J. Ind. Med. 7: 171-176.

Lewis, R.J. and D.V. Sweet, eds. 1984. Registry of Toxic Effects of Chemical Substances, Vol. 1. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Cincinnati, OH.

Leung, T.K.C., J.C.K. Lai and L. Lim. 1981. The regional distribution of monoamine oxidase activities towards different substrates: Effects in rat brain of chronic administration of manganese chloride and of aging. J. Neurochem. 36(6): 2037-2043.

Massaro, E.J., R.B. D'Agostino, C. Stineman, J.B. Marganti and B.A. Lown. 1980. Alterations in behavior of adult offspring of female mice exposed to MnO_2 dust during gestation. Fed. Proc. Fed. Am. Soc. Exp. Biol. 39: 623.

Murthy, R.C., R.S. Srivastava, S.K. Gupta and S.V. Chandra. 1980. Manganese induced testicular changes in monkeys. Exp. Path. 18: 240-244.

NRC (National Research Council). 1989. Recommended Dietary Allowances, 9th rev. ed. Food and Nutrition Board, National Research Council, National Academy Press, Washington, DC. p. 230-235.

Orten, J.M. and O.W. Neuhaus. 1975. Human Biochemistry, Ninth Edition, The C.V. Mosby Company, St. Louis. pp. 546-547.

Proctor, N.H., J.P. Hughes and M.L. Fischman. 1988. Manganese (and Compounds) in: Chemical Hazards of the Workplace, Second Edition, J.B. Lippincott Company, Philadelphia. pp.307-308.

Roels, H., R. Lauwerys, J.P. Buchet, et al. 1987. Epidemiological survey among workers exposed to manganese: Effects on lung, central nervous system, and some biological indices. Am. J. Ind. Med. 11: 307-328.

Schroeder, H.A., D.D. Balassa and I.H. Tipton. 1966. Essential trace metals in man: Manganese, a study in homeostasis. J. Chron. Dis. 19: 545-571.

Shiotsuka, R.N. 1984. Inhalation toxicity of manganese dioxide and magnesium oxide-manganese dioxide mixture. GRAI. 85(7): 34.

Stokinger, H.E. 1981. The Metals. In Patty's Industrial Hygiene and Toxicology, Vol 2A, eds. G.D. Clayton and F.E. Clayton, John Wiley & Sons, New York. pp. 1749-1769.

Stoner, G.D., M.B. Shimkin, M.C. Troxell, T.L. Thompson and L.S. Terry. 1976. Test for carcinogenicity of metallic compounds by the pulmonary tumor response in strain A mice. Cancer Res. 36: 1744-1747.

Suzuki, Y., N. Fujii, H. Yano, T. Ohkita, A. Ichikawa and K. Nishiyama. 1978. Effects of the inhalation of manganese dioxide dust on monkey lungs. Tokushima J. Exp. Med. 25: 119-125.

Taylor, P.A. and J.D.E. Price. 1982. Acute manganese intoxication and pancreatitis in a patient treated with a contaminated dialysate. Can. Med. Assoc. J. 126: 503-505.

U.S. EPA. 1984. Health Assessment Document for Manganese. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Research Triangle Park, NC. EPA 600/8-83-013F.

U.S. EPA. 1989. Reportable Quantity Document for Manganese. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA. 1990a. Integrated Risk Information System (IRIS). Health Risk Assessment for Manganese. On line. (Verification date 6/21/90.) Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH.

U.S. EPA. 1990b. Health Effects Assessment Summary Tables Forth Quarter 1990. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Emergency and Remedial Response, Washington DC. NTIS PB90-921104.

WHO (World Health Organization). 1973. Trace elements in human nutrition: Manganese. Report of a WHO Expert Committee. Technical Report Service, 532, Who, Geneva, Switzerland. p. 34-36.

Witschi, H.P., P.J. Hakkinen and J.P. Kehrer. 1981. Modification of lung tumor development in A.J mice. Toxicology. 21: 37-45.

TOXICITY SUMMARY FOR MERCURY

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EXECUTIVE SUMMARY

Mercury is a naturally occurring element existing in multiple forms and in various oxidation states. It is used in a wide variety of products and processes. In the environment, mercury may undergo transformations among its various forms and among its oxidation states. Exposure to mercury may occur in both occupational and environmental settings, the latter primarily involving dietary exposure (ATSDR, 1989).

Absorption, distribution, metabolism, and excretion of mercury is dependent upon its form and oxidation state (ATSDR, 1989; Goyer, 1991). Organic mercurials are more readily absorbed than are inorganic forms. An oxidation-reduction cycle is involved in the metabolism of mercury and mercury compounds by both animals and humans (ATSDR, 1989). The urine and feces are primary excretory routes. The elimination half-life is 35 to 90 days for elemental mercury and mercury vapor, and about 40 days for inorganic salts (Goyer, 1991).

Ingestion of mercury metal is usually without effect (Goldwater, 1972). Ingestion of inorganic salts may cause severe gastrointestinal irritation, renal failure and death with acute lethal doses in humans ranging from 1-4 g (ATSDR, 1989). Mercuric (divalent) salts are usually more toxic than are mercurous (monovalent) salts (Goyer, 1991). Mercury is also known to induce hypersensitivity reactions such as contact dermatitis and acrodynia (pink disease) (Mathesson et al., 1980). Inhalation of mercury vapor may cause irritation of the respiratory tract, renal disorders, CNS effects characterized by neurobehavioral changes, peripheral nervous system toxicity, renal toxicity (immunologic glomerular disease), and death (ATSDR, 1989).

Toxicity resulting from subchronic and chronic exposure to mercury and mercury compounds usually involves the kidneys and/or nervous system, the specific target and effect being dependent on the form of mercury (ATSDR, 1989). Organic mercury, especially methyl mercury, rapidly enters the central nervous system (CNS) resulting in behavioral and neuromotor disorders (ATSDR, 1989; Goyer, 1991). The developing CNS is especially sensitive to this effect, as documented by the epidemiologic studies in Japan and Iraq where ingestion of methyl mercury-contaminated food resulted in severe toxicity and death in adults and severe CNS effects in infants (Bakir et al., 1973; Amin-Zaki et al., 1974; Harada et al., 1978). Blood mercury levels of < 10 μg/dL and 300 μg/dL corresponded to mild effects and death, respectively (Bakir et al., 1973). Teratogenic effects due to organic or inorganic mercury exposure do not appear to be well documented for humans or animals, although some evidence exists for mercury-induced menstrual cycle disturbances and spontaneous abortions (Derobert and Tara, 1950; Amin-Zaki, 1974; ATSDR, 1989).

A subchronic and chronic oral RfD of 0.0003 mg/kg/day for methyl mercury is based on the ambient level required to produce a blood mercury level of 200 ng Hg/mL (U.S. EPA, 1991a,b). A subchronic and chronic oral RfD of 0.0003 mg/kg/day for inorganic mercury has been proposed and is based on immunologic glomerulonephritis (U.S. EPA, 1991a,b). A Lowest-Observed-Adverse-Effect-Level (LOAEL) of 0.317 mg Hg/kg/day for inorganic mercury was identified in the key study (Bernaudin et al., 1981). No-Observed-Adverse-Effect-Levels (NOAELs) were not available for oral exposure to inorganic mercury or methyl mercury. A subchronic and chronic inhalation RfC of 0.0003 mg Hg/m^3 for inorganic mercury has been

proposed (U.S. EPA, 1991b) and is based on neurological disorders (increased frequency of intention tremors) following long-term occupational exposure to mercury vapor (Fawer et al., 1983). The LOAELs for subchronic and chronic inhalation exposures to inorganic mercury are 0.32 and 0.03 mg Hg/m^3, respectively. NOAELs were unavailable. An inhalation RfC for methyl mercury has not been determined.

No data were available regarding the carcinogenicity of mercury in humans or animals. The U.S. EPA has placed inorganic mercury in weight-of-evidence classification D, not classifiable as to human carcinogenicity. Methyl mercury has not been evaluated by the U.S. EPA for evidence of human carcinogenic potential and no carcinogenicity slope factors have been calculated.

1. INTRODUCTION

Mercury (Hg) is a naturally occurring element that may exist in elemental, inorganic, or organic forms, and in various oxidation states. Mercury is used in a wide variety of products and processes, including pressure sensitive devices (thermometers, barometers), electrical apparatus (wiring, switches, batteries), paints, pharmaceuticals, and in the production of various chemicals (ATSDR, 1989). The oxidation state and chemical form of mercury are important in determining its toxicity, with mercurous salts (monovalent mercury) being less toxic than mercuric salts (divalent mercury). Organic mercurials such as methyl mercury are highly toxic. In the environment, mercury may undergo transformations among the various oxidation states and chemical forms. Both environmental and occupational exposure are relevant to mercury and its compounds, although environmental exposure is unimportant for mercury vapor. Mercury intake from occupational exposure is of greater significance than that from environmental exposure. Environmental exposure to mercury may involve dietary intake (especially from fish) and possibly from dental amalgams, the latter source being controversial (ATSDR, 1989; Langworth et al., 1991).

2. METABOLISM AND DISTRIBUTION

2.1. ABSORPTION

Generally, organic mercurials are absorbed much more rapidly than are inorganic forms. However, approximately 80% of mercury vapor is absorbed following inhalation exposure. Data on the inhalation absorption of organic mercury are limited and inconclusive. Metallic mercury and mercurous salts (e.g. Hg_2Cl_2) are poorly absorbed (<0.10%) following oral exposure (Friberg and Nordberg, 1973). Absorption of mercuric chloride by adult mice was reported to be only 1-2% (Clarkson, 1971) but 1-week old mice absorbed 38% of the orally administered compound. Gastrointestinal absorption of inorganic salts of mercury from food is <15% for mice and about 7% for humans (Goyer, 1991). Organic mercury compounds (methyl- and phenylmercury) have been shown to readily absorbed (>80%) by humans and animals following oral exposure (ATSDR, 1989; Goyer, 1991).

2.2. DISTRIBUTION

Being lipid soluble, mercury vapor readily enters the red blood cells and the CNS following inhalation exposure. The kidneys will exhibit the greatest concentration of mercury following exposure to inorganic mercury salts. Organic mercury is readily distributed throughout the body but tends to concentrate in the brain and kidneys (ATSDR, 1989; Goyer, 1991). Mercury is known to bind to microsomal and mitochondrial enzymes resulting in cell injury and death. Mercury in renal cells localizes in lysosomes (Madsen and Christensen, 1971). Petersson et al. (1991) administered ^{203}Hg-labeled methyl mercury intraperitoneally to rabbits twice weekly for nine weeks. After one week of treatment, the highest concentration of ^{203}Hg was detected in the fur with substantially lower levels being found in the kidney, liver, brain, muscle, and blood. Inorganic mercury levels in the liver of the rabbits increased with time after cessation of treatment. A report by Dutczak et al. (1991) providing data for guinea pigs, hamsters and a macaque monkey indicate that extensive absorption of methyl mercury occurs in the gall bladder. Subsequent biliary-hepatic cycling of the compound may contribute to the long

biologic half-life of methyl mercury. Yoshida et al. (1991) reported that substantial concentrations of metallothionein-associated mercury were found in the kidneys and livers of neonate guinea pigs exposed to mercury vapor for 120 minutes on the day of birth. Metallothionein synthesis increased in the liver but not in the kidneys. Animal data indicate that all forms of mercury cross the placenta, and that mercury levels may be 2-fold greater than in maternal levels with fetal red blood cells containing mercury levels 30% higher than maternal red blood cells (Goyer, 1991).

2.3. METABOLISM

Mercury is not destroyed by metabolism but rather converted to different forms and oxidation states. The metabolism of mercury and mercury compounds appears to be similar for animals and humans (ATSDR, 1989), and involves an oxidation-reduction cycle. Inhaled mercury vapor is rapidly oxidized to the divalent form in red blood cells (Halbach and Clarkson, 1978). Oxidation of elemental mercury also occurs in the lungs of humans and animals (Magos et al., 1973; Hursh et al., 1980), and there is some evidence for hepatic-mediated oxidation (Magos et al., 1978). Animal studies have provided some data suggesting that the divalent inorganic mercury cation may be further reduced to elemental mercury (Clarkson and Rothstein, 1964; Dunn et al., 1981). Organic mercury compounds are also converted to divalent mercury by cleavage of the carbon-mercury bond (Goyer, 1991) with subsequent metabolism occurring via the oxidation reduction cycle. Aryl mercury compounds (e.g. phenylmercury) undergo this conversion more readily than do the short-chain (methyl) mercury compounds. No evidence of demethylation of methyl mercury by the brain of rabbits was noted following parenteral administration of the compound (Petersson et al., 1991).

2.4. EXCRETION

The urine and feces are the primary routes for the excretion of inorganic mercury by humans (ATSDR, 1989). Following brief exposure of humans to inorganic mercury, urinary excretion accounts for 13% of the total body burden, whereas this value increases to 58% for long-term exposure. For inorganic mercury, the urinary levels do not parallel blood levels (ATSDR, 1989). Henderson et al. (1974) identified three forms of mercury in the urine of occupationally-exposed individuals: elemental mercury, a reducible mercuric-cysteine complex, and a large complex in which the mercury can only be released following organic destruction. The data available for elemental mercury and mercury vapor indicate half-times for these forms to be 35 to 90 days (Goyer, 1991). The biologic half-time for inorganic mercury salts is about 40 days.

Fecal elimination is an important excretory route following exposure to organic mercury compounds (Norseth and Clarkson, 1970). However, Petersson et al. (1991) using ^{203}Hg-labeled methyl mercury administered intraperitoneally to rabbits twice weekly for nine weeks, showed that 12 weeks after cessation of treatment 54% of administered dose had been excreted in the urine and only 5% had been excreted in the feces.

The elimination of organic mercury compounds generally follows first-order kinetics with whole body clearance times and blood clearance times being longer than for inorganic mercury. The biologic half-time for methyl mercury is about 70 days. There is some evidence that females

tend to excrete organic mercury faster than males (Aberg et al., 1969; Miettinen, 1973). Additional excretory routes include saliva, bile, and sweat (ATSDR, 1989).

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

Generally, any form of mercury in high acute doses may cause tissue damage resulting from the ability of mercury to denature proteins, thereby disrupting cellular processes (WHO, 1976). However, oral exposure to mercury metal is usually without serious effects. A dose of 200 g caused no adverse health effects in a 2-year old child and unspecified large amounts were without effect in adults (Goldwater, 1972).

Ingestion of inorganic salts of mercury such as mercury bichloride (corrosive sublimate) may cause gastrointestinal disorders including pain, vomiting, diarrhea and hemorrhage, and renal failure resulting in death. Additional effects of acute mercury poisoning include shock and cardiovascular collapse (WHO, 1976). Acute lethal doses in humans range from 1 to 4 g (10-42 mg Hg/kg for a 70 kg adult) for inorganic mercuric salts (ATSDR, 1989)

A hypersensitivity reaction to mercurous compounds such as mercurous chloride (calomel) is characterized by vasodilation, hyperkeratosis, and hypersecretion of the sweat glands. Children exhibiting this condition, also known as acrodynia or pink disease, may also develop fever, a pink-colored rash, swelling of the spleen and lymph nodes, and hyperkeratosis and swelling of the fingers (Matheson et al., 1980; Goyer, 1991).

The effects of acute exposure to organic mercury compounds are not well documented. However, exposure to organomercurials are known to contribute to the body burden of mercury and have resulted in serious developmental and neurological effects as reported in the following sections.

3.1.1.2. Animal

The acute toxicity of inorganic mercury in animals is similar to that observed in humans (ATSDR, 1989). Neurological effects and death have been reported for various animal species receiving inorganic mercury orally (ATSDR, 1989). The LD_{50} values in animals for elemental mercury range from 10 to 40 mg/kg (WHO, 1976).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

The effects of subchronic exposure to mercury and mercury compounds are likely to be similar to those of chronic exposure if the exposure level and body burden of mercury is increased (see Section 3.1.3.1.). Renal toxicity and neurological effects would be the most typical effects associated with subchronic exposure.

In Iraq, over 6000 individuals were hospitalized and 459 individuals died as a result of consuming bread prepared with flour made from wheat and barley treated with a methylmercurial fungicide (Bakir et al., 1973). Methyl mercury concentration in the wheat flour ranged from 4.8-14.6 μg/g (mean=9.1 μg/g). The clinical symptoms included paresthesia, visual disorders, dysarthria, and deafness. The most severe cases resulted in coma and death due to CNS failure. Based on data obtained during this incident, a dose-response relationship between blood mercury levels (<10 μg/dL to 500 μg/dL), and frequency and severity of symptoms showed that mild symptoms occurred at the lower blood mercury levels and that deaths occurred at levels $>300\mu$g/dL.

3.1.2.2. Animal

Oral exposure to inorganic mercury has produced neurological, immunological and systemic effects in rodents exposed for periods of 1-11 weeks. The no-observed-adverse-effect level (NOAEL) for these studies was 0.42 mg/kg/day, and the lowest-observed-adverse effect level (LOAEL) was 0.8 mg/kg/day (ATSDR, 1989).

In a 110-day exposure of mice to mercuric chloride (1 or 3 mg/kg/day) only decreased body weight gain was noted (Ganser and Kirschner, 1985).

Behavioral and pathological effects were reported for cats receiving methyl mercury at doses of 0.01 mg/kg/day for 11 months or 0.45 mg/kg/day for 83 days, and for rats receiving the compound at 0.6-2.4 mg/kg/day for 8 weeks or 1 mg/kg/day for 11 weeks (USAF, 1990). Systemic, neurological and developmental effects resulting from subchronic, oral exposure to organic mercury have been reported for various species of rodents (ATSDR, 1989). Necrosis and degeneration of brain tissue were reported for rabbits exposed to metallic mercury vapor (0.86 mg/m^3) for 12 weeks (Ashe et al., 1953).

3.1.3. Chronic Toxicity

3.1.3.1. Human

Chronic oral exposure to mercury or mercury compounds may affect the CNS, gastrointestinal tract and the kidneys; the renal effect, in part, involving an immunologically-mediated response (ATSDR, 1989). Davis et al. (1974) reported dementia, colitis, and renal failure in two women chronically (6 and 25 years) ingesting a mercurous chloride-containing laxative. Generally, little information is available regarding the toxicity of inorganic mercury following chronic oral exposure.

Exposure to organic mercury causes CNS effects, especially in the fetus and neonate. Although any exposure to organic mercury compounds will contribute to the body burden of mercury, exposure during pregnancy or the postnatal period has the most significant consequences as discussed in Section 3.1.4.

3.1.3.2. Animals

Chronic oral exposure (2 years) of rats to inorganic mercury produces glomerulonephritis (Fitzhugh et al., 1950).

Neurological as well as other systemic toxic effects have resulted following chronic oral exposure of animals to organic mercury compounds (ATSDR, 1989). Neurotoxic effects indicative of CNS involvement have been reported for mice and rats orally administered organic mercury compounds (usually methyl mercury) for several weeks to over a year (ATSDR, 1989). Glomerulonephrotic changes were observed in rats fed phenylmercuric acetate for two years (Fitzhugh et al., 1950). Monkeys orally exposed to methyl mercury for 1000 days at doses adjusted to maintain a blood mercury level of 100-400 μg/mL, exhibited reduced sensitivity to visual stimulation, somesthetic impairment, and incoordination (Evans et al., 1977). Rice and Gilbert (1982) noted impaired spatial vision in monkeys given methyl mercury at 0.05 mg/kg/day from birth until 3-4 years of age.

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

No information was available regarding developmental/reproductive toxicity of inorganic mercury in humans following oral exposure.

The developmental toxicity of organic mercury is best exemplified by the epidemic poisonings by methyl mercury in Iraq and Minamata and Niigata, Japan. Although no evidence of teratogenicity was observed, Amin-Zaki et al. (1974) found other severe developmental effects (impaired motor and mental function, hearing loss and blindness) in infants of mothers exposed via contaminated grain during the Iraqi epidemic. The most severely affected infants had mercury blood levels ranging from 319 to 422 μg Hg/dL. It is also important to note that a 45% mortality rate was reported for pregnant women with signs of mercury poisoning versus a 7% mortality rate for the general population. In Minamata and Niigata, Japan, methyl mercury poisoning resulted from the ingestion of fish that had accumulated methyl mercury and other mercury compounds resulting from contaminated surface waters (WHO, 1976). Harada (1978) reported that at about 6 months of age 13 of the 220 infants prenatally exposed to methyl mercury during the Minamata Bay incident showed signs of mercury poisoning characterized by instability of the neck, convulsions, and severe neurological and mental impairment. Choi et al. (1978) reported abnormal cytoarchitecture of the brain in infants prenatally exposed to methyl mercury. No other significant anatomical defects have been reported.

3.1.4.2. Animal

Only limited information was available regarding the developmental toxicity of inorganic mercury. Gale (1974) reported an increase in fetal resorptions in hamsters receiving a single oral dose of mercuric chloride (31.4 mg Hg/kg). This study also identified a dose of 15.7 mg Hg/kg as a NOAEL for hamsters based on the absence of developmental toxicity.

A 100% incidence of neonatal deaths and failure of dams to deliver was reported for rats receiving dietary methylmercuric chloride equivalent to 5 mg Hg/kg/day (Khera and Tabacova, 1973). The investigators reported no maternal toxicity.

Ultrastructural changes in the nervous system of mice exposed in utero to methylmercuric hydroxide (up to 10 mg Hg/kg/day) were reported by Hughes and Annau (1976). A dose of 3 mg Hg/kg/day produced significant behavioral changes in the mice. Ultrastructural changes in the nervous system have also been reported for rats prenatally exposed to methylmercuric chloride (4 mg Hg/kg/day) (Chang et al., 1977).

Exposure of rats to methyl mercury in the drinking water (0.25-0.50 mg Hg/kg/day) from 1 month prior to mating to the end of gestation resulted in ultrastructural changes in the livers of the fetuses (Fowler and Woods, 1977).

In their study using monkeys exposed from birth to 3 or 4 years of age (Section 3.1.3.1.), Rice and Gilbert (1982) noted that the young, developing monkeys were especially vulnerable to the toxic effects of methyl mercury on visual function as demonstrated by the low dose at which these effects occurred.

Pregnant monkeys (Macaca fascicularis) given methyl mercury in apple juice (50 or 90 μg methyl mercury/kg/day resulting in blood mercury levels of 1.0 ± 0.13 ppm or 2.0 ± 0.33 ppm, respectively) exhibited a decrease in pregnancy rate and increased abortion rate for mercury blood levels above 1 ppm (Mottet et al., 1985).

3.1.5. Reference Dose

3.1.5.1. Subchronic

Inorganic mercury:

ORAL RfD_s:		3E-4 mg/kg/day (U.S. EPA, 1991b)
UNCERTAINTY FACTOR:	1000	
NOAEL:		Not available
LOAEL:		0.317 mg Hg/kg/day

PRINCIPAL STUDY: Bernaudin et al., 1981

Methyl mercury:

ORAL RfD_s: 3E-4 mg/kg/day (U.S. EPA, 1991b)
UNCERTAINTY FACTOR: 10
MODIFYING FACTOR: 1
NOAEL: None
LOAEL: 200 ng Hg/mL blood equivalent to 0.003 mg Hg/kg/day

CONFIDENCE:
Study: Medium
Data base: Medium
RfD: Medium

PRINCIPAL STUDY: Clarkson et al., 1976; Nordberg and Strangert, 1976; WHO, 1976

COMMENTS: The RfD is based on an exposure that would produce a blood level of 200 ng Hg/mL, which is the blood concentration associated with early mercury-induced health effects in humans.

3.1.5.2. Chronic

Inorganic mercury:

ORAL RfD_c: 3E-4 mg/kg/day (U.S. EPA, 1991a)
UNCERTAINTY FACTOR: 1000
MODIFYING FACTOR: None
NOAEL: Not available
LOAEL: 0.317 mg Hg/kg/day
CONFIDENCE: Not available (see comments)

VERIFICATION DATE: See comments

PRINCIPAL STUDY: Bernaudin et al., 1981

COMMENTS: RfD is not yet verified but the review panel is in concordance with the data (U.S. EPA, 1991).

Methyl mercury:

ORAL RfD_c: 3E-4 mg/kg/day (U.S. EPA, 1991a)
UNCERTAINTY FACTOR: 10
MODIFYING FACTOR: 1
NOAEL: None
LOAEL: 200 ng Hg/mL blood equivalent to 0.003 mg Hg/kg/day

CONFIDENCE:
Study: Medium
Data base: Medium
RfD: Medium

VERIFICATION DATE: 12/02/85 (U.S. EPA, 1991)

PRINCIPAL STUDY: Clarkson et al., 1976; Nordberg and Strangert, 1976, WHO, 1976

COMMENTS: RfD is based on an exposure that would produce a blood level of 200 ng Hg/mL, which is the blood concentration associated with early mercury-induced health effects in humans.

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

Inhalation of mercury vapor may result in corrosive bronchitis, interstitial pneumonitis, and death (Goyer, 1991). Systemic effects following inhalation exposure may include shock, renal disorders, and CNS effects characterized by lethargy and neurobehavioral effects (insomnia, loss of memory, excitability, etc.). Occupational exposure to metallic mercury vapor at concentrations of 1.1 to 44 mg/m^3 for 4 to 8 hours produced chest pains, dyspnea, cough, hemoptysis, impairment of pulmonary function, and interstitial pneumonitis (ATSDR, 1989). Acute effects of inorganic mercury poisoning may be accompanied by a metallic taste, sore gums, and excessive salivation.

A case report cited an incident wherein four adults were acutely exposed to mercury vapor resulting from the smelting of dental amalgams (Taueg et al., 1991). Initial signs of toxicity included nausea, diarrhea, dyspnea, and chest pains. Despite chelation therapy, all four patients died 11 to 24 days after initial exposure. Mercury concentrations in the house were as high as 912 μg/m^3 at or within 11 to 188 days after the exposure, and postmortem blood mercury levels ranged from 58 to 369 μg/L.

Historically, the triad of increased excitability, tremors, and gingivitis has been recognized as characteristic for mercury poisoning (Goyer, 1991).

3.2.1.2. Animal

Death resulting from severe pulmonary edema has been reported for mice, guinea pigs, and rats following inhalation exposure to mercury vapor (Christensen et al., 1937). Similarly, inhalation exposure of rabbits to mercury vapor at a concentration of 1 to 1.1 mg/m^3 for 1 to 30 hours resulted in death (Ashe et al., 1953). This same study also showed that 30-hour exposure of rabbits to mercury vapor at a concentration of 28.8 mg/m^3 caused extensive necrosis of the lungs.

Data are lacking regarding the effects of inhalation exposure of animals to organic mercury compounds (ATSDR, 1989).

3.2.2. Subchronic Toxicity

3.2.2.1. Human

Subchronic inhalation exposure to mercury vapor will result in effects similar to those for acute exposure, and will vary depending on exposure severity and duration. Sax and Lewis (1989) reported a lowest toxic exposure level of 0.15 mg/m^3 for human females exposed to mercury vapor for 46 days. Sexton et al. (1976) reported tremors (especially in activities requiring fine control), insomnia, and nervousness resulting from 7 to 25 weeks of exposure to mercury vapor.

Langolf et al. (1978) noted that short-term exposure to high levels of mercury appears to induce greater neurological effects than does long-term exposure to lower mercury levels.

Exposure of humans to diethylmercury at vapor concentrations of 1 to 1.1 mg/m^3 for 4 to 5 months resulted in death, the cause of which was not determined (Hill, 1943). Data are lacking regarding inhalation exposure to methyl mercury.

3.2.2.2. Animal

The effects of subchronic inhalation exposure to mercury or mercury compounds is dependent on the exposure concentration and the specific form of mercury. Low levels of exposure will generally affect the kidney and CNS while high-level exposure will target the respiratory, cardiovascular, and gastrointestinal systems as described in Section 3.1. Exposure of rabbits to mercury vapor (0.86-6.0 mg/m^3) for 2 to 12 weeks resulted in marked degeneration and necrosis of the heart (Ashe et al., 1953). Subchronic inhalation exposure of rats and rabbits to mercury has also produced neurobehavioral changes (ATSDR, 1989). Evidence for a systemic autoimmune response was reported by Bernaudin et al. (1981) for rats inhaling vapors of mercuric chloride or methyl mercuric chloride 4 hours/day for 60 days. The kidney, lungs, and spleen were identified as target organs.

3.2.3. Chronic Toxicity

3.2.3.1. Human

Chronic exposure to low levels of mercury vapor may induce immunologic glomerular disease (Goyer, 1991). A number of studies have been conducted with individuals occupationally exposed to inorganic mercury compounds (mercuric oxides, mercurial chlorides, mercuric nitrate) and are reviewed in USAF (1990). Briefly, neuropsychological symptoms (insomnia, fatigue, headaches, etc.) and renal effects that correlated with blood mercury levels were reported for those exposed $\geq$ 2 years. The emotional and psychological disturbances often referred to as the "Mad Hatter Syndrome" has been attributed to inhalation of the dust or vapors of mercuric nitrate used in the making of felt hats (Clarkson, 1989).

Chronic exposure to mercury vapor results in CNS effects including fatigue and tremors, and gingivitis (Goyer, 1991). As exposure increases, the frequency and magnitude of muscle tremors increase and are accompanied by personality and behavioral changes (memory loss, excitability, depression, and hallucinations).

Chronic exposure to low levels of mercury may affect the peripheral nervous system resulting in polyneuropathies (reduced sensory and motor nerve function), and neuropsychological effects (visual alterations, sensory loss, stress) (ATSDR, 1989), these effects correlating with tissue levels of 20-40 μg/g. Fawer et al. (1983) reported an increase in the frequency of intention tremors of workers exposed to mercury vapor (time-weighted-average [TWA] of 0.026 mg/m^3) over an average of 26 years. Neuropsychological effects were also reported by Smith et al (1970) for occupational exposure to mercury levels of >0.1 mg/m^3. Mercury concentrations below this value did not appear to cause observable effects.

Inhalation exposure to alkyl mercury compounds may occur during the manufacture or use of alkylmercury fungicides. The effects reported for these compounds include paresthesia of the extremities, mouth and lips, constriction of the visual field, deafness, motor incoordination and compromised reflex function. In severe cases, loss of speech and mental deterioration may occur (McComish et al., 1988).

3.2.3.2. Animal

Chronic inhalation exposure (72-83 weeks) of rats, rabbits and dogs to metallic mercury vapor (0.01 mg/m^3) did not produce histological evidence of renal toxicity (Ashe et al., 1953). Additional information on the chronic inhalation toxicity of inorganic mercury in animals was not available.

Information regarding the toxicity of organic mercury following chronic exposure of animals was not available.

3.2.4. Developmental and Reproductive Toxicity

3.2.4.1. Humans

There is evidence that chronic exposure of women to metallic mercury vapor may increase the frequency of menstrual disturbances and spontaneous abortions (Derobert and Tara, 1950; ATSDR, 1989). Mishonova et al. (1980) reported an increased frequency of pregnancy complications for women occupationally exposed to metallic mercury vapor.

No data were available regarding the developmental/reproductive toxicity potential of inhaled organic mercury compounds.

3.2.4.2. Animal

Steffek et al. (1987) showed that exposure of pregnant rats to metallic mercury vapor at concentrations of 0.5 mg/m^3 on gestational days 10-15 caused an increase in resorptions and congenital defects in the offspring.

Prolongation of the estrus cycle of rats exposed to metallic mercury vapor at concentrations of 2.6 mg/m^3, 6 hours/day for 21 days was reported by Baranski and Szmczyk (1973). This same study also showed that gestational exposure of rats to metallic mercury vapor (2.5 mg/m^3) resulted in a decrease in the number of living fetuses and increased pup mortality.

3.2.5. Reference Concentration

3.2.5.1. Subchronic

Inorganic mercury:

INHALATION RfC:		0.0003 mg Hg/m^3 (U.S. EPA, 1991b)
UNCERTAINTY FACTOR:	30	
MODIFYING FACTOR:		None
NOAEL:		None
LOAEL:		0.03 mg Hg/m^3

PRINCIPAL STUDY: Fawer et al., 1983

Methyl mercury:

Not available.

3.2.5.2. Chronic

Inorganic mercury:

INHALATION RfC:		0.0003 mg Hg/m^3 (U.S. EPA, 1991b)
UNCERTAINTY FACTOR:	30	
MODIFYING FACTOR:		None
NOAEL:		None
LOAEL:		0.03 mg Hg/m^3
CONFIDENCE:	Not available	

VERIFICATION DATE: Not verified (U.S. EPA, 1991b)

PRINCIPAL STUDY: Fawer et al. (1983)

COMMENTS: RfC is not yet verified but the review panel is in concordance with the data.

Methyl mercury:

Not available.

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

Dermal contact with organic or inorganic mercury compounds may cause dermatitis especially in hypersensitive individuals (USAF, 1990). Renal effects have been reported following dermal exposure to organic mercurials, and neurological effects have been reported for dermal exposure to inorganic mercury (ATSDR, 1989).

No data are available for other routes of exposure.

3.3.2. Subchronic Toxicity

No information was available regarding the subchronic toxicity of mercury by other routes of exposure.

3.3.3. Chronic Toxicity

No information was available regarding the chronic toxicity of mercury by other routes of exposure.

3.3.4. Developmental Toxicity

No information was available regarding developmental toxicity of mercury by other routes of exposure.

3.4. TARGET ORGANS/CRITICAL EFFECTS

3.4.1. Oral Exposures

3.4.1.1. Primary Target(s)

1. CNS and Kidney: Both the CNS and kidneys are affected by inorganic mercury. The toxic effects may occur with acute, subchronic, or chronic exposure depending on the exposure level and the resulting body burden of mercury. Animal data suggests that the renal effects may be immunologically mediated. The CNS, especially during prenatal and postnatal development, is the primary target organ for methyl mercury.

3.4.1.2. Other Target(s)

1. Cardiovascular system: acute exposure to mercury has caused cardiovascular collapse and some effects associated with acrodynia involve cardiovascular responses.

2. Immune system: As noted in section 3.4.1.1., animal data suggests that the nephrotoxic effects of mercury may, in part, be the result of mercury-induced immunological effects.

3. Skin: Skin rashes and hyperkeratosis are involved in acrodynia, a response to mercurous chloride (calomel).

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target(s)

1. CNS and Peripheral Nervous System: The critical target organs for inhalation exposure to elemental mercury vapor are the CNS and the peripheral nervous system.

2. Kidney: Inorganic mercury salts will primarily affect the kidneys.

Definitive data were unavailable regarding the target organ for inhalation exposure to organic mercury compounds but, as for oral exposure, it is likely that the CNS would be the primary target organ.

3.4.2.2. Other Target(s)

1. Respiratory System: Exposure to high concentrations of metallic mercury vapor may cause irritation of the respiratory system.

2. Cardiovascular System: Exposure to high concentrations of metallic mercury vapor may also affect the cardiovascular system.

3. Gastrointestinal Tract: Exposure to high concentrations of metallic mercury vapor may also affect the gastrointestinal systems, probably as a result of swallowing mercury that has been removed from the airways by the mucociliary escalator.

4. CARCINOGENICITY

4.1. ORAL EXPOSURE

4.1.1. Human

Definitive data regarding the potential carcinogenicity of mercury and mercury compounds in humans was unavailable.

4.1.2. Animal

Definitive data regarding the potential carcinogenicity of mercury and mercury compounds in animals was unavailable.

4.2. INHALATION EXPOSURE

4.2.1 Human

Definitive data regarding the potential carcinogenicity of mercury and mercury compounds in humans was unavailable. An equivocal study by Janicki et al. (1987) reported an association between exposure to mercury-containing fungicides and leukemia.

4.2.2. Animal

Definitive data regarding the potential carcinogenicity of mercury and mercury compounds in humans was unavailable.

4.3. OTHER ROUTES OF EXPOSURE

No information was available regarding the potential carcinogenicity of mercury or mercury compounds by other routes of exposure.

4.4. EPA WEIGHT-OF-EVIDENCE

Inorganic mercury:

Classification D - Not classifiable as to human carcinogenicity
Basis - No human data available. Animal and supporting data are inadequate.
(U.S. EPA, 1991a)

Methyl mercury:

Methyl mercury has not been evaluated by the U.S. EPA for evidence of human carcinogenic potential.

4.5. CARCINOGENICITY SLOPE FACTOR

None have been calculated

5. REFERENCES

Aberg, B., R. Ekman, U. Falk, et al. 1969. Metabolism of methylmercury (^{203}Hg) compounds in man: Excretion and distribution. Arch. Environ. Health 19:478-484. (Cited in ATSDR, 1989)

Amin-Zaki, L., S. Elhassani, M.A. Majeed, T.W. Clarkson, R.A. Doherty and M. Greenwood. 1974. Intra-uterine methylmercury poisoning. Pediatrics 54:587-595. (Cited in USAF, 1990)

ATSDR (Agency for Toxic Substances and Disease Registry). 1989. Toxicological Profile for Mercury. ATSDR/U.S. Public Health Service.

Ashe, W., E. Largent, F. Dutra, et al. 1953. Behavior of mercury in the animal organism following inhalation. Arch. Ind. Hyg. Occup. Med. 17: 19-43. (Cited in ATSDR, 1989)

Bakir, F., S.F. Kamluji, L. Amin-Zaki, et al. 1973. Methylmercury poisoning in Iraq. Science 181: 230-241.

Baranski, B. and I. Szmczyk. 1973. Effects of mercury vapor upon reproductive functions of female white rats. Med. Pr 24: 248. (Cited in ATSDR, 1989)

Bernaudin, J.F., E. Druet, P. Druet and R. Masse. 1981. Inhalation or ingestion of organic or inorganic mercurials produces auto-immune disease in rats. Clin. Immun. Immunopath. 20: 129-135.

Chang, L.W., K.R. Reuhl and G.W. Lee. 1977. Degenerative changes in the developing nervous system as a result of in utero exposure to methylmercury. Environ. Res. 14: 414-425.

Choi, C.M., L.W. Lapham, L. Amin-Zake, et al. 1978. Abnormal neuronal migration, deranged cerebral cortical organization and diffuse white matter astrocytosis of human fetal brain: a major effect of methylmercury poisoning in utero. J. Neuropathol. Exp. Neurol. 37: 719-732 (Cited in ATSDR, 1989).

Christensen, H. M. Krohg and M. Nielsen. 1937. Acute mercury poisoning in a respiration chamber. Nature 139: 1026-1670. (Cited in ATSDR, 1989)

Clarkson, T.W. 1971. Epidemiological and experimental aspects of lead and mercury contamination. Food Cosemt. Toxicol. 9: 229-243. (Cited in ATSDR, 1989)

Clarkson, T.W. 1989. Mercury. J. Am. Coll. Toxicol. 8: 1291-1295.

Clarkson, T.W. and A. Rothstein. 1964. The excretion of volatile mercury by rats injected with mercuric salts. Health Phys. 10: 1115-1121. (Cited in ATSDR, 1989)

Davis, L.E., J.R. Wands, S.A. Weiss, et al. 1974. Central nervous intoxication from mercurous chloride laxatives - quantitative, histochemical and ultrastructure studies. Arch. Neurol. 30: 428-431. (Cited in ATSDR, 1989)

Derobert, L. and S. Tara. 1950. Mercury intoxication in pregnant women. Ann. Med. Leg. 30: 222-225. (Cited in ATSDR, 1989)

Dunn, J.D., T.W. Calrkson and L. Magos. 1981. Ethanol reveals novel mercury detoxification step in tissues. Science 213: 1123-1125. (Cited in ATSDR, 1989)

Dutczak, W., T.W. Clarkson and N. Ballatori. 1991. Biliary-hepatic recycling of a xenobiotic: gallbladder absorptin of methyl mercury. Amer. J. Physiol. 260: G873-G880.

Evans, H.L., R. Garman and B. Weiss. 1977. Methylmercury: Exposure duration and regional distribution as determinants of neurotoxicity in nonhuman primates. Toxicol. Appl. Pharmacol. 41: 15-33. (Cited in ATSDR, 1989)

Fawer, R.F., Y. De Ribaupierre, M.P. Guillemin, M. Berode and M. Lob. 1983. Measurement of hand tremor induced by industrial exposure to metallic mercury. Br. J. Indust. Med. 40: 204-208.

Fitzhugh, O.G., A.A. Nelson, E.P. Laug, et al. 1950. Chronic oral toxicities of mercuri-phenyl and mercuric salts. Arch. Ind. Hyg. Occup. Med. 2: 433-442. (Cited in ATSDR, 1989)

Friberg, L. and F. Nordberg. 1973. Inorganic mercury - a toxicological and epidemiological appraisal. In: Miller, M.W. and T.W. Clarkson, eds. Mercury, mercurials and mercaptans. Charles C. Thomas Co., Springfield, Il. pp. 5-22.

Fowler, B. and J.S. Woods. 1977. The transplacental toxicity of methylmercury to fetal rat liver mitochondria. Lab. Invest. 36: 122-130 (Cited in ATSDR. 1989)

Gale, T.F. 1974. Embryopathic effects of different routes of administration of mercuric acetate on the hamster. Environ. Res. 8: 207-213. (Cited in ATSDR, 1989)

Ganser, A.L. and D.A. Kirschner. 1985. The interaction of mercurials with myelin: Comparison of in vitro and in vivo effects. Neurotoxicology 6: 63-78. (Cited in ATSDR, 1989)

Goldwater, L.J. 1972. Mercury: A history of quicksilver. York Press, Baltimore, MD. (Cited in USAF, 1990)

Goyer. R. 1991. Toxic effects of metals. In: Amdur, M.O., J.D. Doull and C.D. Klassen, Eds. Casarett and Doull's Toxicology. 4th ed. Pergamon Press, New York. pp.623-680.

Halbach, S. and T.W. Clarkson. 1978. Enzymatic oxidation of mercury vapor by erythrocytes. Biochem. Biophys. Acta 523: 522-531. (Cited in ATSDR, 1989)

Harada, M. 1978. Congenital Minamata disease: Intrauterine methylmercury poisoning. Teratology 18: 285-288.

Henderson, R., H.P. Shotwell and L.A. Kraus. 1974. Analyses for total, ionic and elemental mercury in urine as a basis for biological standard. Ann. Ind. Hyg. Assoc. J. 38: 576ff. (Cited in ATSDR, 1989)

Hill, W. 1943. A report on two deaths from exposure to the fumes of a di-ethyl mercury. Can. J. Pub. Health 34: 158-160. (Cited in ATSDR, 1989)

Hughes, J.A. and Z. Annau. 1976. Postnatal behavioral effects in mice after prenatal exposure to methylmercury. Pharmacol. Biochem. Behav. 4: 385-391. (Cited in ATSDR, 1989)

Hursh, J.D, M.R. Greenwood, T.W. Clarkson, et al. 1980. The effect of ethanol on the fate of mercury vapor inhaled by man. J. Pharmacol. Exp. Ther. 214: 520-527. (Cited in ATSDR, 1989)

Janicki, K., J. Dobrowolski and K. Drasnicki. 1987. Correlation between contamination of the rural environment with mercury and occurrence of leukemia in men and cattle. Chemosphere 16: 253-257. (Cited in ATSDR, 1989)

Khera, K.S. and S.A. Tabacova. 1973. Effects of methylmercuric chloride on the progeny of mice and rats treated before or during gestation. Food Cosmet. Toxicol. 11: 245-254. (Cited in ATSDR, 1989)

Langolf, G.D., D.B. Chaffin, R. Henderson, et al. 1978. Evaluation of wrokers exposed to elemental mercury using quantitative tests. Am. Ind. Hyg. Assoc. J. 39: 976-984. (Cited in ATSDR, 1989)

Langworth, S., C. -G. Elinder, C. -J. Göthe and O. Vesterberg. 1991. Biological monitoring of environemntal and occupational exposure to mercury. Int. Arch. Occup. Environ. Health 63: 161-167.

McComish, M.F., and J.H. Ong. 1988. Trace metals. In: Environmental Inorganic Chemistry. Properties, Processes, and Estimation Methods. Bodek, I. et al. Eds., Pergamon Press, New York, pp. 7.10-1 - 7.10-17.

Madsen, K.M. and E.F. Christensen. 1978. Effects of mercury on lysosomal protein digestion in the kidney proximal tubule. Lab. Invest. 38: 165-171. (Cited in Goyer, 1991)

Magos, L., T.W. Clarkson and M.R. Greenwood. 1973. The depression of pulmonary retention of mercury vapor by ethanol; identification of the site of action. Toxicol. Appl. Pharmacol. 26: 1-4. (Cited in ATSDR, 1989)

Magos, L., S. Halbach and T.W. Clarkson. 1978. Role of catalase in the oxidation of mercury vapor. Biochem. Pharmacol. 27: 1373-1377. (Cited in ATSDR, 1989)

Matheson, D.S., T.W. Clarkson and E. Gelfand. 1980. Mercury toxicity (acrodynia) induced by long-term injection of gamma globulin. J. Pediatr. 97: 153-155. (Cited in Goyer, 1991)

Miettinen, J.K. 1973. Absorption and elimination of dietary (Hg^{++}) and methylmercury in man. In: Miller, M.W. and T.W. Clarkson, Eds. Mercury. Mercurials, and Mercaptans. Springfield, IL. pp 233-243. (Cited in ATSDR, 1989)

Mishonova, V.N., P.A. Stepanova and V.V. Zarudin. 1980. Characteristics of the course of pregnancy and births in women with occupational contact with small concentrations of metallic mercury vapors in industrial facilities. Gig. Truda. i Prof. Zabol. 24: 21-23. (Cited in ATSDR, 1989)

Mottet, N.K., C.-M. Shaw and T.M. Bubacher. 1985. Health risks from increases in methylmercury exposure. Environ. Health Perspect. 63: 133-140.

Petersson, K., L. Dock, K. Söderling and M. Vahter. 1991. Distribution of mercury in rabbits subchronically exposed to low levels of radiolabeled methyl mercury. Pharmacol. Toxicol. 68: 464-468.

Rice, D.C. and S.G. Gilbert. 1982. Early chronic low-level methylmercury poisoning in monkeys impairs spatial vision. Science 216: 759-761. (Cited in ATSDR, 1989).

Norseth, T. and T.W. Clarkson. 1970. Studies on the biotransformation of ^{203}Hg-labeled methylmercury chloride. Arch. Environ. Health 21: 717-727. (Cited in ATSDR, 1989)

Sax, N.I. and R.J. Lewis, Sr., Eds. 1989. Dangerous Properties of Industrial Materials. 7th. ed. Van Nostrand Reinhold, New York.

Sexton, D., K. Powell, J. Liddle, et al. 1976. A nonoccupational outbreak of inorganic mercury vapor poisoning. Arch. Environ. Health 33: 186-191. (Cited in ATSDR, 1989)

Smith, R.G., A.J. Vorwald, L.S. Patil and T.F. Mooney. 1970. Effects of exposure to mercury in the manufacture of chlorine. Am. Ind. Hyg. Assoc. J. 31: 687-700.

Steffek, A.J., R. Clayton, C. Seiw and A.C. Verrusio. 1987. Effects of elemental mercury vapor on pregnant Sprague-Dawley rats. Teratology 35: 59A.

Taueg, C., D.J. Sanfilippo, B. Rowens, J. Szejda and J.L. Hesse. 1991. J. Amer. Med. Assoc. 266: 196-197.

USAF. 1990. Mercury. In: Installation Restoration Toxicology Guide. Vol. 5. Harry G. Armstrong Aerospace Medical Research Laboratory, Wright Patterson AFB, OH.

U.S. EPA. 1991a. Mercury. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA. 1991b. Health Effects Summary Tables, FY-1991 Annual. Office of Research and Development, Office of Emergency and Remedial Response, Washington, D.C. OERR 9200.6-303(91-1).

WHO (World Health Organization). 1976. Environmental health criteria. 1. Mercury. United Nations Environment Programme and World Health Organiztion, Geneva, 131 pp.

Yoshida, M., H. Satoh, S. Kojima and Y. Yamamura. 1991. Metallothionein concentrations and organ retention of mercury in the liver and kidney of the neonatal guinea pig after exposure to mercury. Tohoku J. Exp. Med. 164: 13-22.

TOXICITY SUMMARY FOR NICKEL

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EXECUTIVE SUMMARY

Nickel is a naturally occurring element that may exist in various mineral forms. Nickel is used in a wide variety of applications including metallurgical processes and electrical components, such as batteries (ATSDR, 1988; USAF, 1990). There is some evidence that nickel may be an essential trace element for mammals.

The absorption of nickel is dependent on its physicochemical form, with water soluble forms being more readily absorbed. The metabolism of nickel involves conversion to various chemical forms and binding to various ligands (ATSDR, 1988). Nickel is excreted in the urine and feces with relative amounts for each route being dependent on the route of exposure and chemical form. Most nickel enters the body via food and water consumption, although inhalation exposure in occupational settings is a primary route for nickel-induced toxicity.

In large doses (>0.5 g) some forms of nickel may be acutely toxic to humans when taken orally (Daldrup et al., 1983; Sunderman et al., 1988). Oral LD_{50} values for rats range from 67 mg Ni/kg (nickel sulfate hexahydrate) to > 9,000 mg Ni/kg (nickel powder) (ATSDR, 1988). Toxic effects of oral exposure to nickel usually involve the kidneys with some evidence from animal studies showing a possible developmental/reproductive toxicity effect (ATSDR, 1988; Goyer, 1991).

Inhalation exposure to some nickel compounds will cause toxic effects in the respiratory tract and immune system (ATSDR, 1988; Goyer, 1991). Inhalation LC_{50} values for animals range from 0.97 mg Ni/m^3 for rats (6-hour exposure) to 15 mg Ni/m^3 for guinea pigs (time not specified) (USAF, 1990). Acute inhalation exposure of humans to nickel may produce headache, nausea, respiratory disorders and death (Goyer, 1991). Asthmatic conditions have also been documented for inhalation exposure to nickel (Goyer, 1991). Soluble nickel compounds tend to be more toxic than insoluble compounds (Goyer, 1991). Nickel carbonyl is known to be extremely toxic to humans upon acute inhalation exposure (Goyer, 1991).

Sensitivity reactions to nickel are well documented and usually involve contact dermatitis reactions resulting from contact with nickel-containing items such as cooking utensils, jewelry, coins, etc (ATSDR, 1988).

A chronic and subchronic oral RfD of 0.02 mg/kg/day for soluble nickel salts is based on changes in organ and body weights of rats receiving dietary nickel sulfate hexahydrate (5 mg/kg/day) for two years (U.S. EPA, 1991a). A No-Observed-Adverse-Effects-Level (NOAEL) and Lowest-Observed-Adverse-Effects-Level (LOAEL) of 5 mg/kg/day and 50 mg/kg/day, respectively, were reported in the key study (Ambrose et al., 1976). An uncertainty factor of 300 reflects interspecies extrapolation uncertainty, protection of sensitive populations, and a modifying factor of 3 for a database deficient in reproductive/developmental studies.

An inhalation RfC for soluble nickel salts is under review and not currently available.

The primary target organs for nickel-induced systemic toxicity are the lungs and upper respiratory tract for inhalation exposure and the kidneys for oral exposure (ATSDR, 1988;

Goyer, 1991). Other target organs include the cardiovascular system, immune system and the blood.

Epidemiologic studies have shown that occupational inhalation exposure to nickel dust (primarily nickel subsulfide) at refineries has resulted in increased incidences of pulmonary and nasal cancer (NAS, 1975; Enterline and Marsh, 1982; ATSDR, 1988). Inhalation studies using rats have also shown nickel subsulfide or nickel carbonyl to be carcinogenic (Sunderman et al., 1959; Sunderman and Donnelly, 1965; Ottolenghi et al., 1974). Based on these data, the U.S. EPA has classified nickel subsulfide and nickel refinery dust in weight-of-evidence group A, Human Carcinogen. Carcinogenicity slope factors of 1.7E+0 and 8.4E-01 $(mg/kg/day)^{-1}$ and unit risks of 4.8×10^{-4} $(\mu g/m^3)^{-1}$ and 2.4×10^{-4} $(\mu g/m^3)^{-1}$ have been calculated for nickel subsulfide and nickel refinery dust, respectively (U.S. EPA, 1991a). Based on an increased incidence of pulmonary carcinomas and malignant tumors in animals exposed to nickel carbonyl by inhalation or by intravenous injection, this compound had been placed in weight-of-evidence group B2, probable human carcinogen. No unit risk values were available for nickel carbonyl.

1. INTRODUCTION

Nickel is a naturally occurring metal existing in various mineral forms. Nickel may be found throughout the environment including rivers, lakes, oceans, soil, air, drinking water, plants, and animals. Soil and sediment are the primary receptacles for nickel but mobilization may occur depending on physico-chemical characteristics of the soil (ATSDR, 1988; USAF, 1990). Nickel is used in a wide variety of metallurgical processes such as electroplating and alloy production, as well as in nickel-cadmium batteries. There is some evidence that nickel may be an essential trace element for mammals (Goyer, 1991). As for most metals, the toxicity of nickel is dependent on the route of exposure and the solubility of the nickel compound (Coogan et al., 1989).

2. METABOLISM AND DISPOSITION

2.1. ABSORPTION

Pulmonary absorption is the major route of concern for nickel-induced toxicity. Nickel may be absorbed as the soluble nickel ion (Ni^{+2}) while sparingly soluble nickel compounds may be phagocytized. The chemical form and its deposition site (determined by size, shape, density, and electrical charge of the nickel particles) in the lungs will affect the extent of absorption (ATSDR, 1988). Nickel may be removed from portions of the respiratory tract via mucociliary transport resulting in the material entering the gastrointestinal tract. Although nickel is poorly absorbed from the gastrointestinal tract, dietary exposure and exposure via drinking water provide most of the intake of nickel and nickel compounds (Coogan et al., 1989; Goyer, 1991). As reviewed by the U.S. EPA (1986), humans and animals absorb approximately 1-10% of dietary nickel. Similar values were reported for drinking water exposure and gavage administration (ATSDR, 1988). Nickel metal is poorly absorbed dermally but some nickel compounds such as nickel chloride or nickel sulfate can penetrate occluded skin resulting in up to 77% absorption within 24 hours (ATSDR, 1988).

2.2. DISTRIBUTION

Nickel is readily distributed throughout the body but may be affected by route of exposure, the chemical form, and time after exposure (Coogan et al., 1989). Although the kidney and lungs are the primary sites of accumulation of nickel, other organs such as the spleen, liver, heart and testes may also accumulate the metal to a much lesser extent. Additionally, Jasmin and Tjalve, 1984; 1986) have shown that the placenta has a high affinity for nickel. Nickel is known to bind to specific proteins and/or amino acids in the blood serum and the placenta. These ligands are instrumental in the transport and distribution of nickel in the body. Nickel distribution may be altered by the formation of lipophilic nickel complexes.

2.3. METABOLISM

Nickel is not destroyed in the body but its chemical form may be altered. The metabolism of nickel is most appropriately viewed in light of its binding to form ligands and its transport throughout the body. Much of the toxicity of nickel may be associated with its interference with the physiological processes of Mg, Zn, Ca, and Mn (Coogan et al., 1989). Various disease states (myocardial infarction and acute stroke) and injuries (burn injury) are associated with altered transport and serum concentrations of nickel (ATSDR, 1988).

2.4. EXCRETION

Nickel is excreted in the urine and feces but because it is poorly absorbed, most ingested nickel is excreted in the feces. It has been reported that fecal nickel is usually about 100 times that of urinary nickel and represents the removal of unabsorbed nickel (ATSDR, 1988; Goyer, 1991). Nickel that is absorbed is excreted primarily in the urine (ATSDR, 1988). Nickel may also be excreted in the hair and sweat (ATSDR, 1988).

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

The acute lethality of nickel following oral exposure is dependent upon the chemical form of nickel. A fatal case of nickel poisoning was reported for a 2 1/2-year old girl who had ingested 15 g of nickel sulfate (Daldrup et al., 1983). The cause of death was cardiac arrest. Nausea, vomiting, abdominal pain, diarrhea, headache, cough, shortness of breath, and giddiness were reported for workers of an electroplating plant who drank water contaminated with nickel chloride and nickel sulfate (1.63 g/L) (Sunderman et al., 1988). Signs and symptoms of toxicity lasted for up to 2 days with uneventful recoveries for all 32 workers. The nickel doses were estimated to be 0.5 to 2.5 g, serum nickel concentrations were 13 to 1,340 μg/L, and urinary nickel concentrations were 0.15 to 12 mg/g creatinine.

Some studies have provided information indicating the aggravation of nickel-induced dermatitis in women following exposure to dietary nickel (ATSDR, 1988).

3.1.1.2. Animal

Oral LD_{50} values for rats range from 67 mg Ni/kg for nickel sulfate hexahydrate to >9,000 mg Ni/kg for nickel powder (ATSDR, 1988). Generally, soluble nickel compounds are more toxic than insoluble compounds. A 2-week exposure of rats to 1,000 ppm nickel chloride in the drinking water resulted in excessive mortality (RTI, 1987).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

No data were available regarding the toxicity of nickel or nickel compounds in humans following subchronic oral exposure.

3.1.2.2. Animal

With the exception of vomiting during the initial phase of exposure to the highest dose, exposure of dogs to dietary nickel sulfate hexahydrate (100, 1,000, or 2,500 ppm) for two years failed to produce significant signs of compound-related toxicity (Ambrose et al., 1976).

A 91-day study using rats given nickel chloride hexahydrate by gavage at doses of 5, 35, or 100 mg Ni/kg/day resulted in the death of all rats in the high-dose group by day 78, and an increase in white blood cell counts for those in the 35 mg/kg/day group at an interim sacrifice, and an elevated platelet count and decreased blood glucose level in the 35 mg/kg group at final sacrifice (American Biogenics Corp., 1986).

Renal tubular degeneration was reported for rats receiving dietary nickel acetate (0.1 to 1.0%) for several weeks.

3.1.3. Chronic Toxicity

3.1.3.1. Humans

No studies were available regarding the toxicity of nickel in humans following chronic oral exposure.

3.1.3.1. Animals

No studies were available that examined the chronic oral systemic toxicity of nickel or nickel compounds in animals.

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

No studies were available that addressed the developmental/reproductive toxicity of orally administered nickel or nickel compounds.

3.1.4.1. Animal

Research Triangle Institute (1987) conducted a multigeneration study using rats exposed to nickel chloride in the drinking water at nickel concentrations of 50, 250, or 500 ppm (equivalent to 7.3, 30.8, or 51.6 mg Ni/kg/day). The highest exposure produced maternal toxicity characterized by a decrease in body weight and decreased absolute and relative liver

weights of the dams. A decrease in the number of live pups per litter, an increase in pup mortality, and a decrease in the average body weight of the pups was noted for the $F1_a$ and $F1_b$ generations of the 500 ppm test group. Following statistical analyses, both the 50 and 250 ppm exposures were considered to be a no-observed-adverse-effect-level (NOAEL).

3.1.5. Reference Dose

3.1.5.1. Subchronic

ORAL RfD_s: 2E-2 mg/kg/day (soluble nickel salts) (U.S. EPA, 1991b)
UNCERTAINTY FACTOR: 300
NOAEL: 100 ppm (5 mg/kg/day)

3.1.5.2. Chronic

ORAL RfD_c: 2E-2 mg/kg/day (soluble nickel salts)
UNCERTAINTY FACTOR: 100
MODIFYING FACTOR: 3
NOAEL: 100 ppm (5 mg/kg/day)
LOAEL: 1000 ppm (50 mg/kg/day)

CONFIDENCE:
Study: Low
Data base: Medium
RfD: Medium

VERIFICATION DATE: 07/16/87

PRINCIPAL STUDY: Ambrose et al., 1976

COMMENTS: The RfD is based on decreased organ and body weights of rats receiving dietary nickel sulfate hexahydrate (100 ppm equivalent to a dose of 5 mg/kg/day) for two years. An uncertainty factor of 100 reflects interspecies extrapolation and protection of sensitive populations. A modifying factor of three was applied to account for the absence of definitive reproductive/developmental studies. This RfD is being reconsidered by the RfD workgroup.

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

Acute inhalation exposure to nickel carbonyl results in initial headache, nausea, vomiting, and chest pain, progressing to hyperpnea, cyanosis, respiratory failure and death if the exposure

is severe (Goyer, 1991). A lowest toxic concentration (TC_{Lo}) of 7 mg/m^3 for nickel carbonyl has been reported (Sax and Lewis, 1989).

Asthmatic disease resulting from inhalation exposure to nickel and nickel compounds has been reported for nickel-plating workers and stainless steel welders (ATSDR, 1988).

3.2.1.2. Animal

Acute inhalation toxicity studies in animals have provided LC_{Lo} values ranging from 0.97 mg/m^3 for 6-hour exposure of rats to nickel subsulfide to 15 mg/m^3 (time not specified) for guinea pigs exposed to nickel dust (USAF, 1990). Acute toxic effects will be dependent upon the chemical form, exposure concentration, and exposure duration.

Several studies summarized in ATSDR (1988) indicated that 2-hour exposure of mice to nickel chloride at concentrations of 0.25 to 0.50 mg Ni/m^3 caused a suppression of immune responses.

3.2.2. Subchronic Toxicity

3.2.2.1. Human

In an evaluation of workers welding high-nickel alloys, it was reported that six-week exposure to nickel fumes (0.07 to 1.1 mg Ni/m^3) caused an increase in airway and eye irritations, headaches, and tiredness (Akesson and Skervfing, 1985).

3.2.2.2. Animal

A number of studies have examined the toxic effects of short-term exposure of animals to various chemical forms of nickel (ATSDR, 1988). Exposure of rats and mice to aerosols of nickel sulfate hexahydrate (0.7 to 13.5 mg Ni/m^3) for 12 days resulted in pulmonary inflammation, degenerative changes in the bronchiolar mucosa, and atrophy of the olfactory epithelium (Benson et al., 1988). Another study using the same protocol and nickel subsulfide (0.4, 0.9, 1.8, 2.7, 3.7, or 7.3 mg Ni/m^3) showed that exposure to $\geq$ 5 mg Ni_3S_2 (3.7 mg Ni/m^3) caused necrotizing pneumonia, emphysema, and fibrosis in both rats and mice (Benson et al., 1987). Degeneration of the olfactory epithelium was reported for the rats and mice exposed to concentrations $\geq$ 1.2 mg/m^3 (0.9 mg Ni/m^3). Inhalation exposure of rats to nickel chloride (0.109 mg Ni/m^3) produced hyperplastic changes in the bronchial epithelium and increased mucus secretion (Bingham et al., 1972). Similar effects have been observed for rabbits inhaling nickel dust for three to eight months (Curstedt et al., 1983, 1984; Johansson et al., 1983).

A 13-week inhalation study conducted by the Inhalation Toxicology Research Institute compared the effects of exposure of rats and mice to nickel sulfate hexahydrate, nickel subsulfide, and nickel oxide at occupationally relevant exposure concentrations. Severity of inflammation and fibrosis of the lungs and alveolar macrophage hyperplasia corresponded to the water solubility of the nickel compounds with nickel sulfate being the most toxic, followed by nickel subsulfide and nickel oxide (Dunnick et al., 1989). Biochemical indices of pulmonary toxicity

(lactate dehydrogenase and beta-glucuronidase activity, and total protein levels) indicated the order of toxicity to be $NiSO_4$ > Ni_3S_2 > NiO (Benson et al., 1989). Varying degrees of immunological effects in mice were also noted for these three compounds, with effects depending on dose and physicochemical form (Haley et al., 1990). The investigators concluded that inhalation of these nickel compounds at occupationally relevant concentrations can result in significant alterations of pulmonary and systemic immune defenses.

3.2.3. Chronic Toxicity

3.2.3.1. Human

Most chronic inhalation exposures involve occupational exposure to nickel dust or nickel vapors resulting from welding nickel alloys. Generally, chronic inhalation exposure to nickel dusts and aerosols contribute to respiratory disorders such as asthma, bronchitis, rhinitis, sinusitis, and pneumoconiosis (USAF, 1990). Chronic exposure to nickel and nickel compounds have been implicated in carcinogenic responses as discussed in Section 4.2.

3.2.3.2. Animal

A 31-month exposure of rats to nickel oxide (0.06 or 0.20 mg Ni/m^3) resulted in the development of focal septal fibrosis and histological changes indicative of alveolar proteinosis (Takenaka et al., 1985). A lifetime exposure of rats to nickel oxide (42 mg Ni/m^3) produced emphysema and other proliferative and inflammatory changes (Wehner et al., 1975).

3.2.4. Developmental and Reproductive Toxicity

3.2.4.1. Human

No clinical evidence of developmental or reproductive toxicity were reported for women working in a nickel refinery (Warner et al., 1979).

3.2.4.2. Animal

A reduction in fetal body weight was observed for pregnant rats exposed to nickel oxide (1.3 or 2.5 mg/m^3) throughout gestation (Weischer et al. (1980). The number of fetuses per litter was unaffected. Benson et al. (1988) reported degeneration of the germinal epithelium of testes in rats exposed to nickel sulfate at concentrations ≥ 7 mg/m^3 (≥ 1.6 mg Ni/m^3) for 12 days. Similar effects were observed for mice and rats exposed to nickel subsulfide at concentrations of ≥ 2.5 mg/m^3 (≥ 1.8 mg Ni/m^3) (Benson et al., 1987).

3.2.5. Reference Concentration

3.2.5.1. Subchronic

An inhalation RfC_s is not currently available.

3.2.5.2. Chronic

An inhalation RfC_c for nickel salts is currently under review.

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

3.3.1.1. Human

Nickel-induced contact dermatitis is well documented for humans, and is the most prevalent effects of nickel in humans (ATSDR, 1988). Both occupational and nonoccupational exposures are common, the latter involving commodities such as eating utensils, coins, jewelry, and tools. Data indicate women to be at greater risk for dermatitis of the hands, possibly due to more frequent contact with nickel-containing items. No dose-response data are available for nickel sensitivity reactions.

3.3.1.2. Animal

Nickel sensitivity has not been adequately demonstrated in animals (ATSDR, 1988) and no information was available regarding other acute effects following dermal exposure to nickel or nickel compounds.

3.3.2. Subchronic Toxicity

3.3.2.1. Human

No information was available on the subchronic toxicity of nickel or nickel compounds in humans by other routes of exposure.

3.2.2.2. Animal

No information was available on the subchronic toxicity of nickel or nickel compounds in animals by other routes of exposure.

3.3.3. Chronic Toxicity

3.3.2.1. Human

No information was available on the chronic toxicity of nickel or nickel compounds in humans by other routes of exposure.

3.2.2.2. Animal

No information was available on the chronic toxicity of nickel or nickel compounds in animals by other routes of exposure.

3.3.4. Developmental Toxicity

No definitive information was available. In a study by Mathur et al. (1977), it was reported that application of nickel sulfate hexahydrate (60 or 100 mg/kg/day for 30 days) to the shaved backs of rats resulted in tubular damage of the testes and sperm degeneration. However, the effects may have been due to ingestion of the compound during grooming.

3.4. TARGET ORGANS/CRITICAL EFFECTS

3.4.1. Oral Exposures

3.4.1.1. Primary Target(s)

1. Kidney: Although not documented for humans, parenteral administration studies in animals have verified the nephrotoxicity of nickel and nickel compounds (ATSDR, 1988; USAF, 1990).

2. Blood: Alterations in white blood cell counts of mice and decreased hematocrit in rats have been reported following gavage administration of nickel chloride (USAF).

3.4.1.2. Other Target(s)

1. Skin: Some studies are available documenting the aggravation of nickel-induced dermatitis in women following exposure to dietary nickel.

2. Cardiovascular system: Anecdotal information suggested that very high (15 g) acute doses of nickel sulfate may cases cardiac arrest.

3.4.2. Inhalation Exposures

1. Respiratory tract: Inhalation of nickel or nickel compounds may cause respiratory conditions such as asthma, bronchitis, rhinitis, sinusitis, and pneumoconiosis. Inhalation of nickel carbonyl may be fatal. The nature and severity of the adverse effects may vary depending on the specific nickel compound and the duration of exposure.

3.4.2.1. Other Target(s)

1. Testes: Degeneration of the germinal epithelium of the testes was observed in rats exposed to nickel sulfate at concentrations $\geq$ 7 mg/m^3 ($\geq$ 1.6 mg Ni/m^3) for 12 days.

4. CARCINOGENICITY.

4.1. Oral Exposures

4.1.1. Human

No information was available on the carcinogenicity of nickel or nickel compounds in humans following oral exposure.

4.1.2. Animal

Although several studies have been conducted assessing the carcinogenic potential of nickel compounds following oral exposure, the studies suffered from inadequate design (ATSDR).

4.2. Inhalation Exposure

4.2.1. Human

Several epidemiologic studies have investigated the potential carcinogenicity of inhaled nickel and nickel compounds (ATSDR, 1988). Based on analyses of studies completed prior to 1975, the National Academy of Sciences (NAS, 1975) concluded that nickel refinery workers demonstrated an increase in the incidence of pulmonary and nasal cavity cancers, specifically epidermoid, anaplastic, and pleomorphic cancers. Enterline and Marsh (1982) showed that there was an excess risk of nasal sinus cancer in nickel refinery workers. The standardized mortality ratio (SMR) was 2,443.

Doll et al. (1977) also showed an excess of lung and nasal cancer among nickel refinery workers. The incidence was virtually eliminated after the implementation of respirators.

Magnus et al. (1980) studied workers from several job categories in a nickel refinery and found an increase in the risk of nasal cancer in all jobs, with the highest risk being in roasting/smelting jobs and for electrolysis workers. The authors also reported that smoking and nickel exposure appeared to be additive in their carcinogenic potential.

4.2.2. Animal

In an inhalation study by Ottolenghi et al. (1974), rats of both sexes were exposed to nickel subsulfide (0.97 mg Ni/m^3) for 78 to 84 weeks followed by a 30-week observation period. Relative to controls, there was an increase in the incidence of adenomas and adenocarcinomas in the nickel-exposed rats.

Sunderman et al. (1959) showed that repeated inhalation exposures of rats to nickel carbonyl (0.03 or 0.06 mg/L) over a 1-year period resulted in an increased incidence of tumors relative to controls. Lifetime inhalation exposure of rats to nickel carbonyl vapor (0.6 mg/L for 30 minutes or 0.03 mg/L, three times/week) resulted in pulmonary carcinomas and metastases

(Sunderman and Donnelly, 1965). Lau et al. (1972) induced malignant tumors at various sites in rats injected with nickel carbonyl.

4.3. Other Routes of Exposure

No information was available on the carcinogenicity of nickel or nickel compounds in animals by other routes of exposure.

4.4. EPA Weight-of-Evidence Classification

Classification A - Human carcinogen (Nickel subsulfide)
Basis - Increased risks of lung and nasal cancer in humans exposed to nickel refinery dust, most of which is believed to be nickel subsulfide; increased tumor incidences in several species and strains of animal for multiple routes of administration; positive results in genotoxicity assays.

Classification A - Human carcinogen (nickel refinery dust)
Basis - Epidemiologic studies in several different countries showed nickel refinery dust to cause lung and nasal tumors in nickel sulfide matte refinery workers; animal data showed an increased incidence of carcinomas in rats following administration via inhalation or injection.

Classification B2 - Probable human carcinogen (nickel carbonyl)
Basis - Observation of pulmonary carcinomas and malignant tumors at various sites in rats administered nickel carbonyl by inhalation and intravenous injection, respectively; nickel administered as nickel carbonyl binds to DNA.

The U.S. EPA has not evaluated soluble nickel salts for potential human carcinogenicity.

4.5. Carcinogenicity Slope Factor (U.S. EPA, 1991a)

5.5.1. Oral

None have been calculated.

5.5.2. Inhalation

SLOPE FACTORS: 8.4E-01 $(mg/kg/day)^{-1}$ (nickle refinery dust)
1.7E+0 $(mg/kg/day)^{-1}$ (nickel subsulfide)

PRINCIPAL STUDY: Data sets from several occupational exposure studies were utilized and are described in U.S. EPA (1986).

VERIFICATION DATE: 04/01/87

No slope factors have been calculated for other nickel compounds.

UNIT RISKS:

Inhalation:	4.8E-4 $(\mu g/m^3)^{-1}$ (nickel subsulfide)
Inhalation:	2.4E-4 $(\mu g/m^3)^{-1}$ (nickel refinery dust)

Nickel refinery dust is a mixture of many nickel moieties, and the identity of the specific carcinogenic nickel species is not known (U.S. EPA, 1991a).

5. REFERENCES

Akesson, B. and S. Skervfing. 1985. Exposure in welding og high nickel alloy. Int. Arch. Occup. Environ. Health 56: 111-117.

Ambrose, A.M., P.S. Larson, J. R. Borzelleca and G.R. Hennigar, Jr. 1976. Long term toxicologic assessment of nickel in rats and dogs. J. Food. Sci. Technol. 13: 181-187.

American Biogenics Corp. 1986. Ninety day gavage study in albino rats using nickel. Final Draft report to Research Triangle Inst. (Cited in ATSDR, 1988).

ATSDR (Agency for Toxic Substances and Disease Registry). 1988. Toxicological Profile for Nickel. ATSDR/U.S. Public Health Service, ATSDR/TP-88/19.

Benson, J.M., R.L. Carpenter, F.F. Hahn, et al. 1987. Comparative inhalation toxicity of nickel subsulfide to F344/N rats and B6C3F$_1$ mice exposed for twelve days. Fund. Appl. Toxicol. 9: 251-265.

Benson, J.N., D.G. Burt, R.L. Carpenter, et al. 1988. Comparative inhalation toxicity of nickel sulfate to F344/N rats and B6C3F$_1$ mice exposed for twelve days. Fund. Appl. Toxicol. 10: 164-178.

Benson, J.M., D.G. Burt, Y.-S. Yung, et al. 1989. Biochemical responses of rat and mouse lung to inhaled nickel compounds. Toxicology 57: 255-266.

Bingham, E., W. Barkley, M. Zerwas, K. Stemmer and P. Taylor. 1972. Responses of alveolar macrophages to metals. I. Inhalation of lead and nickel. Arch. Environ. Health 25: 406-414.

Coogan, T.P., D.M. Latta, E.T. Snow and M. Costa. 1989. Toxicity and carcinogenicity of nickel compounds. In: McCllean, R.O., ed. Critical Reviews in Toxicology, Vol 19. CRC Press, Boca Raton, FL. pp. 341-384.

Curstedt, T., M. Hafman, B. Robertson and P. Camner. 1983. Rabbit lungs after exposure to low nickel dust combustion. I. Effects on phospholipid concentration and surfactant activity. Environ. Res. 30: 89-94.

Curstedt, T., M. Casarett-Bruce and P. Camner. 1984. Changes in glycerophosphatides and their ether analogs in lung lavage of rabbits exposed to nickel dust. Exp. Mol. Pathol. 41: 226-234.

Daldrup, T., K. Haarhoff and S.C. Szathmary. 1983. Toedliche nickel sulfate-intoxikation. Berichte zur Gerichtlichen Medizin 41:141-144. (Cited in ATSDR, 1988)

Dunnick, J.K., M.R. Elwell, J.M. Benson, et al. 1989. Lung toxicity after 13-week inhalation exposure to nickel oxide, nickel subsulfide, or nickel sulfate hexahydrate in F344/N rats and B6C3F$_1$ mice. Fundam. Appl. Toxicol. 12: 584-594.

Enterline, P.E. and G.M. Marsh. 1982. Mortality among workers in a nickel refinery and alloy plant in West Virginia. J. Natl. Cancer Inst. 68: 925-933.

Goyer. R. 1991. Toxic effects of metals. In: Amdur, M.O., J.D. Doull and C.D. Klassen, Eds. Casarett and Doull's Toxicology. 4th ed. Pergamon Press, New York. pp.623-680.

Haley, P.J., Shopp, G.M., J.M. Benson et al. 1990. The immunotoxicity of htree nickel compounds following 13-week inhalation exposure in the mouse. Fundam. Appl. Toxicol. 15: 476-487.

Lau, T.J., R.L. Hackett and F.W. Sunderman. 1972. The carcinogenicity of intravenous nickel carbonyl in rats. Cancer Res. 32: 2253.

Magnus, K. A. Anderen and A.C. Hogetveit. 1980. Cancer of respiratory organs among workers at a nickel refinery in Norway. Int. J. Cancer 30: 681-685.

Mathur, A.K., T.S.S. Dikshith, M.M. Llal and S.K. Tandon. 1978. Distribution of nickel and cytogenetic changes in poisoned rats. Toxicology 10: 105-113. (Cited in ATSDR, 1988)

Ottolenghi, A.D., J.K. Haseman, W.W. Payne, H.L. Falk and H.N. MacFarlnad. 1974. Inhalation studies of ncikel sulfide in pulmonary carcinogenesis of rats. J. Natl. Cancer Inst. 54: 1165-1172.

RTI (Research Triangle Institute). 1987. Two generation reproduction and fertility study of nickel chloride administered to CD rats in drinking water. Report submitted to Office of Solid Waste, U.S. EPA, Washington, DC.

Sax, N.I. and R.J. Lewis, Jr., eds. 1989. Dangerous Properties of Industrial Materials. 7th Ed., Van Nostrand Reinhold, New York.

Sunderman, F.W., A.J. Donnelly, B. West and J.F. Kincaid. 1959. Nickel poisoning. IX. Carcinogenesis in rats exposed to nickel carbonyl. Arch. Ind. Health 20: 36.

Sunderman, F.W. and A.J. Donnelly. 1965. Stuies of nickel carcinogenesis metastasizing pulmonary tumors in rats induced by the inhalation of nickel carbonyl. Am. J. Pathol. 46: 1027.

Sunderman, F.W., Jr., B. Dingle, S.M. Hopfer and T. Swift. 1988. Acute nickel toxicity in electroplating workers who accidentally ingested a solution of nickel sulfate and nickel chloride. Am. J. Indust. Med. 14: 257-266.

Takenaka, S. D. Hochrainer and H. Oldiges. 1985. Alveolar proteinosis induced in rats by long-term inhalation of nickel oxide. In: Brown, S.S. and F.W. Sunderman, Jr., eds. Progress in Nickel Toxicology. Proc. 3rd. Int. Congress on Nickel Metabolism and Toxicology. Blackwell Publ. Co., Oxford, UK. pp. 89-92.

USAF. 1990. Nickel. In: Installation Restoration Program Toxicology Guide, Vol. 5. Harry G. Armstrong Aerospace Medical Research Laboratory, Wright Patterson AFB, OH.

U.S. EPA. 1986. Health Assessment Document for Nickel and Nickel Compounds. Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Research Triangle Park, NC. EPA-600/8-83-012F. NTIS PB 86-232212.

U.S. EPA. 1991a. Nickel. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA. 1991b. Health Effects Summary Tables, FY-1991 Annual. Office of Research and Development, Office of Emergency and Remedial Response, Washington, D.C. OERR 9200.6-303(91-1).

Warner, J.S. 1979. Nickel carbonyl. Prenatal exposure. Science 203: 1194-1195.

Wehner, A.P., R.H. Busch, R.J. Olson and D.K. Craig. 1975. Chronic inhalation of nickel oxide and cigarette smoke in hamsters. Am. Ind. Hyg. Assoc. J. 36: 801-809. (Cited in ATSDR, 1988)

Weischer, C.H., W. Kordel and D. Hochrainer. 1980. Effects of $NiCl_2$ and NiO in Wistar rats after oral uptake and inhalation exposure, respectively. Zentral Bakteriol. Mikrobiol. Hyg. (B) 171:336-351. (Cited in ATSDR, 1988)

TOXICITY SUMMARY FOR SILVER

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EXECUTIVE SUMMARY

Silver is a relatively rare metal that occurs naturally in the earth's crust and is released to the environment from various industrial sources. Human exposure to silver and silver compounds can occur orally, dermally, or by inhalation. Silver is found in most tissues, but has no known physiologic function.

In humans, accidental or intentional ingestion of large doses of silver nitrate has produced corrosive damage of the gastrointestinal tract, abdominal pain, diarrhea, vomiting, shock, convulsions, and death (U.S. EPA, 1985). Respiratory irritation was noted following acute inhalation exposure to silver or silver compounds. Silver nitrate solutions are highly irritating to the skin, mucous membranes, and eyes (Stokinger, 1981).

Ingestion, inhalation, or dermal absorption of silver may cause argyria, the most common indicator of long-term exposure to silver or silver compounds in humans. Argyria is a gray or blue-gray, permanent discoloration of the skin and mucous membranes that is not a toxic effect per se, but is considered cosmetically disfiguring. Chronic inhalation exposure of workers to silver oxide and silver nitrate dusts resulted in upper and lower respiratory irritation, deposition of granular silver-containing deposits in the eyes, impaired night vision, and abdominal pain (Rosenman et al., 1979). Mild allergic responses have been attributed to dermal contact with silver (ATSDR, 1990).

In long-term oral studies with experimental animals, silver compounds have produced slight thickening of the basement membranes of the renal glomeruli, growth depression, shortened lifespan, and granular silver-containing deposits in skin, eyes, and internal organs (Matuk et al., 1981; Olcott, 1948, 1950). Hypoactivity was seen in rats subchronically exposed to silver nitrate in drinking water (Rungby and Danscher, 1984).

A Reference Dose (RfD) for oral exposure is estimated as 0.005 mg/kg/day based on the observation of argyria in a 2 to 9-year human intravenous study (EPA 1991b). Data are presently insufficient to derive a Reference Concentration (RfC) for silver (U.S. EPA, 1991b).

Data adequate for evaluating the carcinogenicity of silver to humans or animals by ingestion, inhalation, or other routes of exposure were not found. Based on U.S. EPA guidelines, silver is placed in weight-of-evidence group D, not classifiable as to human carcinogenicity (U.S. EPA, 1991b).

1. INTRODUCTION

Silver (Ag; CAS Reg. No. 7440-22-4) is a relatively rare element occurring naturally in the earth's crust as a soft, silver colored metal. It can exist in several oxidation states, with elemental silver and monovalent silver ion as the most common (ATSDR, 1990). Silver has a molecular weight of 107.868, a density of 10.5 g/cm^3 at 20°C, and a melting point of 961.93°C (Weast et al., 1988). It is insoluble in water and alkalis, but is soluble in nitric acid, hot sulfuric acid, and potassium cyanide. Some of the more common silver compounds used in industry include nitrate, chloride, bromide, acetate, oxide, sulfate, and cyanide (Stokinger, 1981).

The principal uses of silver and silver compounds are in photographic materials, electroplating, electrical conductors, dental alloys, solder and brazing alloys, paints, jewelry, coins, and mirror production. Silver is also used for cloud seeding, as an antibacterial agent, and has been used for water purification. Silver may be discharged into surface waters by various industries and accumulated in soils from the fallout emissions from coal-fired power plants. The increasing cost of the metal, however, is spurring development of recovery practices (Nordberg and Gerhardsson, 1988; U.S. EPA, 1985).

2. METABOLISM AND DISPOSITION

2.1. ABSORPTION

Studies in humans and animals indicate that silver compounds are absorbed via the oral and inhalation routes of exposure, with some absorption occurring through both intact and damaged skin (ATSDR, 1990). East et al. (1980) reported that a patient with argyria (gray or blue-gray discoloration of the skin) absorbed approximately 18% of a single dose of orally administered silver. Generalized argyria in a woman who repeatedly applied a silver nitrate solution to her gums indicates absorption across the oral mucosa (Marshall and Schneider, 1977). Absorption from the lung was documented in a case of accidental exposure to radiolabeled silver metal dust (Newton and Holmes, 1966). Following intratracheal administration to beagle dogs, the absorption of metallic silver particles appears to be extensive. Phalen and Morrow (1973) estimated that up to 90% of silver (mean aerodynamic diameter = 0.5 μm) deposited in the lungs of dogs was absorbed into the systemic circulation 6 hours after exposure. In humans, less than 1% of dermally applied silver compounds are absorbed through the skin (Snyder et al., 1975).

2.2. DISTRIBUTION

Silver has been detected in 50% of the samples of 29 human tissues, but at lower levels than other trace elements (U.S. EPA, 1985). Silver has no known physiological function in man, but its accumulation leads to argyria when the body burden is > 1 g (Stokinger, 1981). Granular deposits that contain silver have been observed in both pigmented and unpigmented skin of silver-exposed humans and animals. Once absorbed, orally-administered silver undergoes a first-pass effect through the liver, resulting in excretion into the bile, and thereby reducing the systemic distribution to tissues (ATSDR, 1990). Following ingestion of silver nitrate and silver chloride,

silver was distributed widely in tissues of rats, with high concentrations seen in the tissues of the reticuloendothelial system (liver, spleen, bone marrow, lymph nodes, skin, and kidney) (Olcott, 1948). Silver was confined mainly to the liver of a worker who had accidentally inhaled radiolabeled silver metal; a biological half-life of 52 days was estimated (Newton and Holmes, 1966). Six hours after intratracheal administration of metallic silver to dogs, 96.9, 2.4, and 0.35% of the initially deposited dose was detected in the lungs, liver, and blood, respectively. The remaining silver was detected in the gall bladder and bile, intestines, and stomach. After 225 days, the distribution in tissue type was similar, with most of the silver found in the liver (Phalen and Morrow, 1976).

2.3. METABOLISM

ATSDR (1990) reports that the deposition of silver in tissues is the result of the precipitation of insoluble silver salts, such as silver chloride and silver phosphate. These insoluble silver salts are then transformed into soluble silver sulfide albuminates, to bind or to form complexes with amino or carboxyl groups in RNA, DNA, and proteins, or to be reduced by ascorbic acid or catecholamines. The skin discoloration of humans with argyria may be caused by a photoreduction of silver chloride to metallic silver. The metallic silver is then oxidized by tissue, subsequently forming black silver sulfide.

2.4. EXCRETION

Following oral or inhalation exposure to silver compounds, humans excrete silver primarily in the feces and only very minor amounts in the urine (East et al., 1980; Newton and Holmes, 1966). In rats and mice, the cumulative recovery of silver in the feces was 98-99% on the second day after oral exposure to silver; monkeys excreted 94% (U.S. EPA, 1985). Dogs excreted approximately 90% of an inhaled dose of metallic silver particles in the feces within 30 days of exposure (Phalen and Morrow, 1973).

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

Accidental or intentional ingestion of large doses of silver nitrate caused corrosive damage to the gastrointestinal tract, abdominal pain, diarrhea, vomiting, shock, convulsions, and death. The estimated fatal dose of silver nitrate is $\geq$ 10 g, but recoveries have been reported following ingestion of larger doses (U.S. EPA, 1985).

3.1.1.2. Animal

The acute toxicity of silver compounds appears to be high. Oral LD_{50} values for mice reported for colloidal silver and silver nitrate are 100 mg/kg and 129 mg/kg, respectively; for silver cyanide, the LD_{50} for rats is 125 mg/kg. An LD_{LO} of 2820 mg/kg for rats is reported for the relatively insoluble silver oxide (Venugopal and Luckey, 1978).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

Argyria (see Section 3.1.3.1.) has been observed in individuals that have ingested both metallic silver and silver compounds in small doses over periods of months to years (ATSDR, 1990). Blumberg and Carey (1934) reported argyria in an emaciated female adult who had ingested an estimated total dose 6.4 g silver nitrate over a 1-year period. Symptoms of argyria appeared in one individual after the first 6 months of exposure to unknown quantities of silver acetate (East et al., 1980).

3.1.2.2. Animal

One study indicated that female mice exposed to silver nitrate in drinking water for 4 months were less active than controls. The mice also had granular silver-containing deposits in some areas of the central nervous system, with highest concentrations in areas involved in motor control (Rungby and Danscher, 1984).

3.1.3. Chronic Toxicity

3.1.3.1. Human

Argyria, a characteristic and irreversible gray or blue-gray discoloration of the skin and mucous membranes, has been observed in individuals that have ingested both metallic silver and silver compounds in small doses over periods of months or years. Argyria, both generalized or localized, has resulted from such uses as antismoking lozenges containing silver acetate, breath mints coated with silver, silver nitrate solutions for the treatment of gum disease, and silver nitrate capsules for relief of gastrointestinal discomfort (ATSDR, 1990; Stokinger, 1981). Argyria is most noticeable in areas of skin exposed to light (ATSDR, 1990) and blond individuals are considered more susceptible to argyria than others (Nordberg and Gerhardsson, 1988). The pigmentation is not a toxic effect per se, but can be considered a cosmetic disfigurement in some cases. Silver-containing granules, particularly concentrated in basement membranes and elastic fibers surrounding sweat glands, have been observed during histopathologic examination of the skin of these individuals (ATSDR, 1990). When argyria is localized in the eyes, the conjunctiva is most frequently affected, with silver deposition on the elastic fibers (Stokinger, 1981). The estimated total dose required to induce argyria by ingestion is in the range of 1-30 g for soluble silver salts (Nordberg and Gerhardsson, 1988).

3.1.3.2. Animal

Exposure of rats to 222 mg silver/kg/day in drinking water for 37 weeks resulted in growth depression and shortened lifespan. Also observed were granular silver deposits in the eyes (Matuk et al., 1981).

Olcott (1948, 1950) reported enlargement of the left ventricle of the heart in rats receiving drinking water containing 635-660 mg silver/day as either silver nitrate or silver chloride for life. Histologic examination showed slight thickening of the basement membranes of kidney glomeruli in the absence of severe renal lesions. Deposition of silver granules was observed in the skin, eyes, and several internal organs.

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

Information on the developmental and reproductive toxicity in humans following inhalation exposure to silver was unavailable.

3.1.4.2. Animal

There was no decrease of fertility in male rats exposed for life to drinking water containing 635-660 mg silver/day as either silver nitrate or silver chloride (Olcott, 1948).

3.1.5. Reference Dose

A Reference Dose (RfD) for oral exposure is estimated as 0.005 mg/kg/day based on the observation of argyria in a 2 to 9-year human intravenous study (EPA 1991b).

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

Acute irritation of the respiratory tract can occur from inhalation of silver nitrate dust, but generally only at concentrations that produce argyria (Stokinger, 1981). One case report described severe respiratory effects in a worker who had become ill 14 hours after working with molten silver ingots (Forycki et al., 1983).

3.2.1.2. Animal

Acute inhalation (2-8 hours) of an aerosol containing colloidal silver caused ultrastructural damage and disruption of cells of the tracheal epithelium of rabbits (ATSDR, 1990).

3.2.2. Subchronic Toxicity

Because the available human inhalation studies do not permit a clear distinction between subchronic and chronic effects, the data are presented only in Section 3.2.3.1., Chronic Toxicity.

3.2.2.2. Animal

Information on the subchronic inhalation toxicity of silver in animals was unavailable.

3.2.3. Chronic Toxicity

3.2.3.1. Human

Generalized argyria has been reported in workers associated with manufacturing and packaging of silver nitrate and in workers engaged in mining, smelting, polishing, and hammering of silver (U.S. EPA, 1985). Argyria may be localized in the respiratory tract, with isolated areas of pigmentation occurring at the tracheobronchial junction and around the orifices of the smaller bronchi in more severe cases (Stokinger, 1981). The estimated total dose required to induce argyria by inhalation is in the range of 1-8 g for soluble silver salts (Nordberg and Gerhardsson, 1988).

Rosenman et al. (1979) reported that 25/30 workers exposed to silver nitrate and silver oxide dusts for < 1 to > 10 years experienced respiratory irritation (sneezing, stuffiness, and running nose or sore throat) at some time during their employment. Cough, wheezing, chest tightness, and abdominal pain were reported in 20/30 workers. The abdominal pain was significantly correlated with blood silver levels. Granular silver-containing deposits, observed in the conjunctiva and cornea of the eyes of 20/30 workers, correlated with the duration of employment. Decreased night vision was recorded in some workers. The exposure levels (8-hour time-weighted average), determined 4 months prior to the study, ranged from 0.039 to 0.378 mg silver/m^3.

Decreased night vision was also reported in a group of workers manufacturing metal silver powder (Rosenman et al., 1987). Also seen was increased excretion of the kidney enzyme N-acetyl-ß-D-glucosaminidase and decreased creatinine clearance, suggestive of impaired kidney function. However, the workers were also exposed to cadmium, a known nephrotoxic compound.

In a study with silver reclamation workers exposed to silver and insoluble silver compounds, conjunctival and corneal argyria was seen in 21% and 25% of the workers, respectively (Pifer et al., 1989). Many of the workers exhibited internal nasal-septal pigmentation. There were no significant differences in the levels of several liver enzymes between exposed individuals and those with no history of silver exposure.

3.2.3.2. Animal

Information on the chronic inhalation toxicity of silver in animals was unavailable.

3.2.4. Developmental and Reproductive Toxicity

Information on the developmental and reproductive toxicity in humans or animals following inhalation to silver was unavailable.

3.2.5. Reference Concentration/Dose

Available data are not sufficiently quantified to permit calculation of an RfC.

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

3.3.1.1. Human

Silver nitrate solutions are highly irritating to the skin, mucous membranes, and eyes. Ocular damage has been reported from application of solutions containing > 2% silver nitrate. Corneal opacification may be so severe as to cause blindness. Application of silver nitrate to the gingiva may result in necrotizing, ulcerative gingivitis (Stokinger, 1981).

3.3.1.2. Animals

Early studies reported effects on the nervous system, including weakness, rigidity of legs, loss of voluntary movement, and respiratory paralysis following intravenous administration of high doses of silver compounds to rats, dogs, and guinea pigs (U.S. EPA, 1985). Intravenous administration of 25.2 mg/kg silver nitrate, 420 mg/kg colloidal silver, or 11.6 mg/kg silver proteinate resulted in the death of rats within 24-48 hours (Dequidt et al., 1974).

3.3.2. Subchronic Toxicity

3.3.2.1. Human

Intravenous administration of an estimated total dose of 0.9-15.5 g silver arsphemamine over a 2- to 3-year period caused argyria in humans (Gaul and Straud, 1935).

3.3.2.2. Animal

Guinea pigs ceased to gain weight when a 0.239 molar solution of silver nitrate was applied to 3.1 cm^2 of skin for 8 weeks (Wahlberg, 1965).

3.3.3. Chronic Toxicity

3.3.3.1. Human

Case histories indicate that dermal exposure to silver or silver compounds for extended periods can lead to generalized skin discoloration similar to that seen after oral exposure. Also reported were mild allergic responses attributed to dermal contact with silver or silver

compounds. Sensitization has resulted from contact with powdered silver cyanide, radiographic processing solutions containing silver compounds, and to silver in dental amalgam (ATSDR, 1990).

3.3.4. Developmental and Reproductive Toxicity

3.3.4.1. Human

Information on the developmental and reproductive toxicity in humans by other routes of exposure to silver was unavailable.

3.3.4.2. Animal

A single subcutaneous injection of 0.04 millimole/kg silver nitrate caused temporary histopathological damage to testicular tissue of male rats (Hoey, 1966).

3.4. TARGET ORGANS/CRITICAL EFFECTS

3.4.1. Oral Exposures

3.4.1.1. Primary Target Organs

Skin and mucous membranes: Argyria, both general and localized, is the most common effect of chronic exposure to silver and silver compounds in humans. Granular silver-containing deposits are seen in animals.

3.4.1.2. Other Target Organs

1. Heart: Chronic exposure of rats caused enlargement of the left ventricle of the heart.

2. Kidneys: Chronic exposure of rats caused a slight thickening of the basement membranes of the renal glomeruli.

3. Central nervous system: Hypoactivity was observed in rats subchronically exposed to silver.

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target Organs

1. Skin and mucous membranes: Argyria, both general and localized, is the most common effect of chronic inhalation exposure to silver in humans.

2. Respiratory tract: Occupational exposure to silver has caused upper and lower respiratory tract irritation.

3.4.2.2. Other Target Organs

1. Eyes: Impairment of night vision was reported in some workers chronically exposed to silver.

2. Kidneys: An occupational study suggests impairment of kidney function as evidenced by increased excretion of a kidney enzyme indicative of cellular damage and by decreased creatinine clearance.

3. Gastrointestinal tract: Abdominal pain was one of the symptoms recorded in workers exposed to silver.

4. CARCINOGENICITY

4.1. ORAL EXPOSURES

Information on the oral carcinogenicity of silver in humans or animals is unavailable.

4.2. INHALATION EXPOSURES

Information on the carcinogenicity of inhaled silver in humans or animals is unavailable.

4.3. OTHER ROUTES OF EXPOSURE

4.3.2. Human

4.3.1. Animal

Subcutaneous embedding of silver foil induced a 32% incidence of local fibrosarcomas in rats, with a latency period of 275 days (Oppenheimer et al., 1956). Silver apparently produced fibrosarcomas earlier and more frequently than several other metal foils. Schmähl and Steinhoff (1960) reported that colloidal silver injected subcutaneously into rats resulted in tumors in 8/26 rats that survived longer than 14 months. In six of the eight rats, the tumors were at the injection site. However, use of the subcutaneous route of exposure is questionable, because almost any implanted solid may induce a fibrosarcoma at the site (Furst, 1981). In another study, no tumors were found at the injection site of rats intramuscularly injected with silver (Furst and Schlauder, 1977).

4.4. EPA WEIGHT-OF-EVIDENCE

Classification D -- Not classifiable as to human carcinogenicity
Basis -- In animals, local sarcomas have been induced after implantation of foils and discs of silver. However, the interpretation of these findings has been questioned due to the phenomenon of solid-state carcinogenesis in which even insoluble solids such as plastics have been shown to result in local fibrosarcomas (U.S. EPA, 1991a,b).

4.5. CARCINOGENICITY SLOPE FACTORS

None were calculated.

5. REFERENCES

ATSDR (Agency for Toxic Substances and Disease Registry). 1990. Toxicological Profile for Silver. Prepared by Clement International Corporation, under Contract 205-88-0608. U.S. Public Health Service. ATSDR/TP-90-24.

Blumberg, H. and T.N. Carey. 1934. Argyremia: Detection of unsuspected and obscure argyria by the spectrographic demonstration of high blood silver. J. Am. Med. Assoc. 103: 1521-1524. (Cited in U.S. EPA, 1991a)

Dequidt, J., P. Vasseur and J. Gromez-Potentier. 1974. Experimental toxicological study of some silver derivatives. Bulletin de la Societe de Pharmacie de Lille 1: 23-25. (In French; cited in ATSDR, 1990)

East, B.W., K. Boddy, E.D. Williams, et al. 1980. Silver retention, total body silver and tissue silver concentrations in argyria associated with exposure to an anti-smoking remedy containing silver acetate. Clin. Exp. Dermatol. 5: 305-311. (Cited in ATSDR, 1990)

Forycki, Z., W. Zegarski, J. Bardzik, et al. 1983. Acute silver poisoning through inhalation. Bulletin of the Institute of Maritime and Tropical Medicine in Gdynia. 34: 100-203. (Cited in ATSDR, 1990)

Furst, A. 1981. Bioassay of metals for carcinogenesis: Whole animals. Environ. Health Perspect. 40: 83-91.

Furst, A. and M.C. Schlauder. 1977. Inactivity of two nobel metals as carcinogens. J. Environ. Pathol. Toxicol. 1: 51-57.

Gaul, L.E. and A.H. Staud. 1935. Clinical spectroscopy. Seventy cases of generalized argyria following organic and colloidal silver medication. J. Am. Med. Assoc. 104: 1387-1390. (Cited in U.S. EPA, 1991a)

Hill, W.R. and D.M. Pillsbury. 1939. Argyria, the Pharmacology of Silver. The Williams and Wilkins Co., Baltimore, MD, 167 p.

Hoey, M.J. 1966. The effects of metallic salts on the histology and functioning of the rat testes. J. Reprod. Fertil. 12: 461-471. (Cited in ATSDR, 1990)

Marshall, J.P., II, and R.P. Schneider. 1977. Systemic argyria: Secondary to topical silver nitrate. Arch. Dermatol. 113: 1077-1079.

Matuk, Y., M. Gosh and C. McCulloch. 1981. Distribution of silver in the eyes and plasma proteins of the albino rat. Can. J. Ophthalmol. 16: 145-150. (Cited in ATSDR, 1990)

Newton, D. and A. Holmes. 1966. A case of accidental inhalation of zinc-65 and silver-110m. Radiat. Res. 29: 403-412.

Nordberg, G.F. and L. Gerhardsson. 1988. Silver. In: Handbook on Toxicity of Inorganic Compounds, H.G. Seiler and H. Sigel, eds. Marcel Dekker, Inc., New York, pp. 619-623.

Olcott, C.T. 1948. Experimental argyrosis. IV. Morphologic changes in the experimental animal. Am. J. Path. 24: 813-833.

Olcott, C.T. 1950. Experimental argyrosis. V. Hypertrophy of the left ventricle of the heart. Archives of Pathol. 49: 138-149.

Oppenheimer, B.S., E.T. Oppenheimer, I. Danishefsky, et al. 1956. Carcinogenic effects of metals in rodents. Cancer Res. 16: 439-441.

Phalen, R.F. and P.E. Morrow. 1973. Experimental inhalation of metallic silver. Health Physics 24: 509-518.

Pifer, J.W., B.R. Friedlander, R.T. Kintz, et al. 1989. Absence of toxic effects in silver reclamation workers. Scand. J. Work Environ. Health 15: 210-221.

Rosenman, K.D., A. Moss and S. Kon. 1979. Argyria: Clinical implications of exposure to silver nitrate and silver oxide. J. Occup. Med. 21: 430-435.

Rosenman, K.D., N. Seixas and I. Jacobs. 1987. Potential nephrotoxic effects of exposure to silver. Br. J. Ind. Med. 44: 267-272.

Rungby, J. and G. Danscher. 1984. Hypoactivity in silver exposed mice. Acta Pharmacol. Toxicol. 55: 398-401.

Schmähl, D. and D. Steinhoff. 1960. Experimental carcinogenesis in rats with colloidal silver and gold solutions. Z. Krebsforsch. 63: 586-591. (In German; cited in ATSDR, 1991; Stokinger, 1981)

Snyder, W.S., et al. 1975. Report of the Task Group on Reference Man. Pergamon Press, Oxford, England, pp. 407-708. (Cited in ATSDR, 1990)

Stokinger, H.E. 1981. Silver. In: Patty's Industrial Hygiene and Toxicology, vol. 2A, G.D. Clayton and E. Clayton, eds. John Wiley & Sons, New York, NY, pp. 1881-1894.

U.S. EPA. 1985. Drinking Water Criteria Document for Silver (Final Draft). Environmental Criteria and Assessment Office, Cincinnati, OH. ECAO-CIN-026, PB86-118288.

U.S. EPA. 1991a. Silver. Integrated Risk Information System (IRIS), 03/01/91. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA. 1991b. Silver. Integrated Risk Information System (IRIS), 08/01/91. Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, Cincinnati, OH.

Venugopal, B. and T.D. Luckey. 1978. Metal Toxicity in Mammals: 2. Chemical Toxicity of Metals and Metalloids, Chapter 1. Plenum Press, New York, pp. 32-36.

Wahlberg, J.E. 1965. Percutaneous toxicity of metal compounds. A comparative investigation in guinea pigs. Arch. Environ. Health 11: 201-204.

Weast, R.C., J.A. Spadaro, R.O. Becker, et al. 1988-1989. Handbook of Chemistry and Physics, 69th ed. CRC Press, Inc., Boca Raton, FL., pp. (B)127-128.2

TOXICITY SUMMARY
for
VANADIUM AND VANADIUM COMPOUNDS

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RESTORATION PROGRAM

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EXECUTIVE SUMMARY

Vanadium is a metallic element that occurs in six oxidation states and numerous inorganic compounds. Some of the more important compounds are vanadium pentoxide (V_2O_5), sodium metavanadate ($NaVO_3$), sodium orthovanadate (Na_3VO_4), vanadyl sulfate ($VOSO_4$), and ammonium vanadate (NH_4VO_3). Vanadium is used primarily as an alloying agent in steels and non-ferrous metals (ATSDR, 1990). Vanadium compounds are also used as catalysts and in chemical, ceramic or specialty applications.

Vanadium compounds are poorly absorbed through the gastrointestinal system (0.5-2% of dietary amount) (NRCC, 1980; ICRP, 1960; Byrne and Kosta, 1978), but slightly more readily absorbed through the lungs (20-25%) (ICRP, 1960; Davies and Bennett, 1983). Absorbed vanadium is widely distributed in the body, but short-term localization occurs primarily in bone, kidneys, and liver (Vouk, 1979; Roshchin et al., 1980; Parker et al., 1980; Sharma et al., 1980; Wiegmann et al., 1982). In the body, vanadium can undergo changes in oxidation state (interconversion of vanadyl (+4) and vanadate (+5) forms) and it can also bind with blood protein (transferin) (Harris et al., 1984). Vanadium is excreted primarily in the feces following oral exposures and primarily in the urine following inhalation exposures (Tipton et al., 1969; ATSDR, 1990).

The toxicity of vanadium depends on its physico-chemical state; particularly on its valence state and solubility. Based on acute toxicity, pentavalent NH_4VO_3 has been reported to be more than twice as toxic as trivalent VCl_3 and more than 6 times as toxic as divalent VI_2. Pentavalent V_2O_5 has been reported to be more than 5 times as toxic as trivalent V_2O_3 (Roschin, 1967). In animals, acutely toxic oral doses cause vasoconstriction, diffuse desquamative enteritis, congestion and fatty degeneration of the liver, congestion and focal hemorrhages in the lungs and adrenal cortex (Gosselin et al., 1984). Minimal effects seen after subchronic oral exposures to animals include diarrhea, altered renal function, and decreases in erythrocyte counts, hemogloblin, and hematocrit (Domingo et al., 1985; Zaporowska and Wasilewski, 1990). In humans, intestinal cramps and diarrhea may occur following subchronic oral exposures. These studies indicate that for subchronic and chronic oral exposures the primary targets are the digestive system, kidneys, and blood.

Reference Doses (RfD) for chronic oral exposures are: 0.007 mg/kg/day for vanadium; 0.009 mg/kg/day for vanadium pentoxide; 0.02 mg/kg/day for vanadyl sulfate; and 0.001 mg/kg/day for sodium metavanadate (U.S. EPA, 1987, 1991a,b). The subchronic RfDs for these compounds are the same as the chronic RfDs, except for sodium metavanadate, which is 0.01 mg/kg/day (U.S. EPA, 1987, 1991a,b).

Inhalation exposures to vanadium and vanadium compounds result primarily in adverse effects to the respiratory system (Sax, 1984; ATSDR, 1990). In laboratory studies, minimal effects (throat irritation and coughing) occurred after an 8-hr exposure to 0.1 mg V/m^3 (Zenz and Berg, 1967). In studies on workers occupationally exposed to vanadium, the most common reported symptoms were: irritation of the respiratory tract, conjunctivitis, dermatitis, cough, bronchospasm, pulmonary congestion, and bronchitis (Symanski, 1939; Sjoberg, 1950, 1951,

1955, 1956; Vintinner et al., 1955; Lewis 1959; Tebrock and Machle, 1968; Roshchin, 1968; Kiviluoto et al., 1981b). Quantitative data are; however, insufficient to derive a subchronic or chronic inhalation Reference Concentration (RfC) for vanadium or vanadium compounds.

There is little evidence that vanadium or vanadium compounds are reproductive toxins or teratogens. There is also no evidence that any vanadium compound is carcinogenic; however, very few adequate studies are available for evaluation. Vanadium has not been classified as to carcinogenicity by the U.S. EPA (1991a).

1. INTRODUCTION

Vanadium (V) is a metal that occurs in six oxidation states and numerous chemical forms. From a toxicological standpoint, the most important inorganic vanadium compounds are vanadium pentoxide (V_2O_5), sodium metavanadate ($NaVO_3$), sodium orthovanadate (Na_3VO_4), vanadyl sulfate ($VOSO_4$), and ammonium vanadate (NH_4VO_3) (ATSDR, 1990).

About 97% of the total production of vanadium is used as an alloying agent in steels and non-ferrous metals such as copper, aluminum and titanium (ATSDR, 1990). Vanadium may also have applications as an intermetallic compound (V_3Ga) for superconductor applications (Baroch, 1983). Vanadium compounds are also used as catalysts or in chemical, ceramic or specialty applications (Rosenbaum, 1983). Minor uses include applications as color modifiers in mercury-vapor lamps, as driers in paints and varnish, and as corrosion inhibitors in flue-gas scrubbers (Rosenbaum, 1983).

2. METABOLISM AND DISPOSITION

2.1. ABSORPTION

Absorption of vanadium into the body depends on the chemical composition of the compound containing the vanadium, as well as on the species exposed and the route of exposure. In humans, vanadium salts are poorly absorbed from the gastrointestinal tract (Curran and Burch, 1967). Estimates of the extent of gastrointestinal absorption of dietary vanadium are 0.5 to 2% (NRCC, 1980; ICRP, 1960, 1981). In rats, gastrointestinal absorption of vanadium amounted to 2.6% following oral dosing with vanadium pentoxide or vanadium oxydichloride and 17.5% following oral dosing with sodium orthovanadate (Conklin et al., 1982; Sollenberger, 1981; Wiegmann et al., 1982).

Because atmospheric vanadium would most likely be present in particulate form, deposition in the lungs will be greatest for particles in the submicron size range (Waters, 1977). In humans, a pulmonary retention value of 35% and a blood absorption value of 20% have been used to determine whole body burden of vanadium (Davies and Bennett, 1983). ICRP (1960) estimated that 26% of soluble vanadium is absorbed through the lungs. Studies in rats have shown that intratracheally instilled vanadium compounds such as V_2O_5 and $VOCl_2$ disappear rapidly from the lungs; Conklin et al. (1982) reported a 40% loss of V_2O_5 in 1 hr and 90% after 3 days; Oberg et al. (1978) reported a >50% loss of $VOCl_2$ in one day; Rhoads and Sanders (1985) reported a two-phase exponential loss model for V_2O_5 with 72% of the dose cleared from the lungs in the first phase ($t_{1/2}$ = 11 min), 28% in the second phase ($t_{1/2}$ = 1.8 days), and Edel and Sabbioni (1988) reported 80-85% clearance of tetravalent and pentavalent forms of vanadium within 3 hr.

Although it has been shown that vanadium (as aqueous solutions of vanadate salts) can be absorbed through the skin of experimental animals, uptake of vanadium through skin contact with airborne particulate matter is considered to be only a minor source of human exposure (NRC, 1974).

2.2. DISTRIBUTION

Absorbed vanadium is widely distributed in the body, but short-term localization occurs primarily in bone, kidneys, and liver, and possibly also in the spleen and lungs (Vouk, 1979; Roshchin et al., 1980; Parker et al., 1980; Sharma et al., 1980; Wiegmann et al., 1982).

2.2.1. Human

Concentrations of vanadium in human tissues have been reported to range from 0 to 12 μg/g (Scanlon, 1975). On a wet weight basis, concentrations of 19-140 ng/g in lung, 4.5-40 ng/g in liver, 30 ng/g in brain, 0.45-10 ng/g in muscle, 400 ng/g in lymph nodes, 200 ng/g in testes, 2.6-3.3 ng/g in kidney, and 3.0-3.2 ng/g in thyroid have been reported (Hamilton et al., 1972/73; Byrne and Kosta, 1978). In a study of workers at a metallurgic plant, the median vanadium concentration in the blood was 2.9 μg/L (Thurauf et al., 1979). In a study of workers in a ferroalloy plant, vanadium blood levels averaged 20.2 nmol/L in nonexposed or low exposure workers, and 35.7 nmol/L in moderate and high exposure workers (Gylseth et al., 1979). Kiviluoto et al. (1981a) reported vanadium levels of 393 ± 223 nmol/L in serum of workers exposed to TWAs of 0.03-0.77 mg V/m^3.

2.2.2. Animal

Acute oral exposure to vanadium compounds results in rapid tissue distribution, particularly to bone (ATSDR, 1990). Intermediate exposures result in low levels in bone, kidneys, liver and lungs (ATSDR, 1990). Long-term dietary studies conducted on dogs revealed limited accumulation of vanadium in femoral epiphyses (1.2 to 1.5 ug/g) following 2.5 years on a diet containing 10 or 100 ppm vanadium added as vanadium pentoxide (Stokinger et al. unpublished, as reported in Stokinger, 1981). Uptake of vanadium was greater in the bones of rats than in bones of dogs exposed to the same dietary levels of vanadium. Tissue deposition of vanadium has been reported to be greater following dietary exposure to ammonium metavanadate than to vanadium pentoxide (Stokinger et al., 1981).

In rats, inhalation exposure to vanadium pentoxide (0.5 mg V/m^3, 6 hr daily, for 6 mo) resulted in deposition of vanadium primarily in lungs (30 μg V/g), kidneys (0.8 μg V/g), and spleen (0.6 μg V/g) (Stokinger et al., 1981). Intratracheal instillation of vanadium pentoxide in the same species resulted in rapid transport to the blood, liver, and bone (Conklin et al., 1982), and deposition of 12% of the dose in the skeleton (Rhoads and Sanders, 1985). Intratracheal studies with $VOCl_2$ also revealed rapid transport to blood, heart, spleen, liver, and kidneys, and relatively large deposition in the skeleton of rats (Oberg et al., 1978).

2.3. METABOLISM

In the body, vanadium can undergo changes in oxidation state and it can also form chemical complexes with blood proteins (ATSDR, 1990). Harris et al. (1984) followed the distribution of vanadium in blood cells and plasma of dogs injected i.v. with radiolabeled vanadyl chloride (+4 oxidation state) or ammonium vanadate (+5 oxidation state). A significant fraction of the vanadium was associated with red blood cells and 77% of the plasma vanadium was eventually bound to serum transferrin. Harris et al. (1984) noted that there is an interconversion

of vanadyl and vanadate in the blood, probably with oxidation of the vanadyl transferrin complex taking place in the plasma, and reduction of vanadate to vanadyl ions occurring in red blood cells. Transferrin-bound vanadium may be exhanged with liver ferritin (Harris et al., 1984; Chasteen et al., 1986).

2.4. EXCRETION

2.4.1. Human

Excretion of vanadium depends on the exposure route and chemical form of the vanadium. Following oral administration of sodium metavanadate (12.5 mg/d for 12 days), 87.6% of the dose was recovered in the feces and the remainder (12.4%) in the urine (Proescher et al., 1917). The ratio of vanadium in urine to that in the diet was reported to be about 0.13 (Tipton et al., 1969).

Following inhalation exposures to vanadium compounds, urinary levels can be quite high. Workers occupationally exposed to vanadium dust (0.5 mg/m^3) had detectable levels of vanadium in their urine for up to 2 weeks after the exposure ended (Zenz et al., 1962). Workers exposed to 0.1-0.19 mg/m^3 vanadium in a manufacturing plant had significantly higher urinary levels of vanadium (20.6 μg/L) than non-exposed workers (2.7 μg/L) (Orris et al. 1983). Vanadium concentrations of 37.8 μg/L, median value (Thurauf et al., 1979), 46.7 μg/L, mean value (Lewis, 1959), and 200-500 μg/L, range (Gul'ko, 1956) have been reported for urine samples from other occupationally exposed workers. In a study of workers in a ferroalloy plant, vanadium concentrations in urine when adjusted for creatinine excretion, averaged 3.6 nmol/mmol creatinine for nonexposed workers and 15.2 nmol/mmol creatinine for exposed workers (Gylseth et al., 1979). Kiviluoto et al. (1981a) reported vanadium levels of 73 $\pm$50 nmol/mmol of creatinine in urine of workers exposed to TWAs of 0.03-0.77 mg V/m^3.

2.4.2. Animal

Because vanadium is poorly absorbed through the gastrointestinal tract, a large percentage of an ingested dose will be excreted unabsorbed in the feces; Patterson et al. (1986) reported that in rats, 80% of a dose of ammonium metavanadate was excreted in the feces over a period of 6 days. Of the absorbed vanadium, that fraction that is deposited in the liver is excreted rapidly, but that retained in bone is mobilized more slowly (Curran and Burch, 1967). Following inhalation exposure or intratracheal or intravenous injection, much of the absorbed vanadium is excreted in the urine (ATSDR, 1990). In rats, 32-40% of an intratracheal or intravenous dose was excreted in the urine in the first 3-4 days (Sabbioni and Marafante, 1978; Conklin et al., 1982). Excretion of vanadium in the urine may continue for up to 6 mo after chronic exposure is discontinued (Curran, unpublished).

3. NONCARCINOGENIC HEALTH EFFECTS

The toxicity of vanadium depends on its physico-chemical state; particularly on its valence state and solubility. Pentavalent vanadium is generally considered to be the most toxic form,

regardless of whether it functions as an anion or cation (NRC, 1974). Based on relative median lethal doses, pentavalent ammonium vanadate (NH_4VO_3) has been reported to be more than twice as toxic as trivalent vanadium trifluoride (VCl_3) and more than 6 times as toxic as divalent vanadium diiodide (VI_2). Similarly, the pentavalent vanadium pentoxide (V_2O_5) was reported to be more than 5 times as toxic as the trivalent vanadium trioxide (V_2O_3). In *in vitro* tests on rabbit alveolar macrophages, V_2O_5 was more toxic than V_2O_3 which, in turn, was more toxic than VO_2 (Waters et al., 1974).

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

Vanadium pentoxide and sodium metavanadate have a toxicity rating of 5, equivalent to a probable lethal oral dose in humans of 5-50 mg/kg (Gosselin et al., 1984). The elemental metallic form is considered to be non-toxic.

3.1.1.2. Animal

Animals exposed to acutely toxic doses of vanadium compounds exhibit immediate distress, a hemorrhagic exudate from the nose, marked diarrhea, hindlimb paralysis, labored respiration, and convulsions that can lead to death (Gosselin et al., 1984). Pathologic effects include diffuse desquamative enteritis and congestion of lungs, liver, kidneys, adrenal cortex, brain, spinal cord, and bone marrow (Gosselin et al., 1984). Fatty degeneration of lungs and liver and focal hemorrhages in the lungs and adrenal cortex may also occur (Gosselin et al., 1984). High concentrations of vanadium compounds may cause irreversible damage to the kidneys (Kumar and Corder, 1980). Vanadium compounds have also been reported to be vasoconstricting agents affecting blood vessels of the lungs, spleen, kidneys, and intestine (Proescher et al., 1917; Erdmann et al., 1984). LD_{50} values for sodium metavanadate administered by gavage to rats and mice are 41 mg V/kg and 31 mg V/kg, respectively (ATSDR, 1990).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

Volunteers given 0.47-1.3 mg V/kg/day orally as ammonium vanadyl tartrate for three months, developed intestinal cramping and diarrhea, but no hematological abnormalities, no changes in serum chemistry indicative of adverse liver effects (glutamic oxaloacetic transferase, cholesterol, triglyceride, or phospholipid levels), and no changes in urine chemistry indicative of adverse renal effects (albumin, hemoglobin, BUN, or formed elements) (Dimond et al., 1963).

3.1.2.2. Animal

Sodium metavanadate at a concentration of 50 ppm in the drinking water of rats for three months resulted in slight increases in blood urea and uric acid and mild histopathological lesions in kidneys (corticomedullar microhaemorrhagic foci) and spleen (hypertrophy and hyperplasia in

the white pulp) (Domingo et al., 1985). The exposure was equivalent to a daily dose level of 6.56 mg/kg/day or 2.74 mg V/kg/day. An exposure level of 10 ppm (1.32 mg/kg/day or 0.55 mg V/kg/day) was considered a NOAEL (U.S. EPA, 1987). The same compound added to the food of rats at levels of 25 and 50 ppm for 100 days had no effect on hemoglobin levels, but did cause dose-related decreases in growth as well as diarrhea at the highest dose (9.3 mg/kg/day) (Franke and Moxon, 1937). No other parameters of toxicity were evaluated.

Sodium orthovanadate in the diet of rats for six months caused no changes in heart rate or blood pressure, but did induce vasoconstriction (Susic and Kentera, 1988).

Ammonium vanadate (15 mg V/kg) in the diet of rats for 2 months resulted in increased right ventricular pressure and pulmonary hypertension (Susic and Kentera, 1986). The same compound administered in drinking water of rats (200 ppm vanadium) for two months resulted in decreased growth, decreased erythrocyte count, and reduced hemoglobin and hematocrit (Gorski and Zaporowska, 1983). Additional studies confirmed that vanadium in the drinking water of rats (300 ppm V for 4 weeks) caused a decrease in erythrocyte count and hemoglogin level (Zaporowska and Wasilewski, 1991). In addition, a relative increase in reticulocytes and polychromatophilic erythrocytes indicated an effect on erythrocyte maturation (Zaporowska and Wasilewski, 1991).

Vanadium pentoxide in the diet of male rats for 103 days (25 ppm for 35 days followed by 100 ppm for 68 days or 50 ppm for 35 days followed by 150 ppm for 68 days) resulted in a decrease in cystine content in hair and significant reductions in RBC count and hemoglobin in the high-dose group (Mountain et al., 1953).

3.1.3. Chronic Toxicity

3.1.3.1. Human

Information on the chronic oral toxicity of vanadium to humans was not available.

3.1.3.2. Animal

A vanadyl sulfate concentration of 5 μg/mL in drinking water, plus a vanadium level of 3.2 μg/g in the diet (4.1 mg V/kg total) of mice, was reported to cause no adverse effects over a lifetime exposure period (Schroeder and Balassa, 1967). In similar lifetime studies, rats and mice exhibited no adverse effects when exposed to 5 ppm vanadium (as vanadyl sulfate) in drinking water (Schroeder et al., 1970; Schroeder and Mitchner, 1975). The estimated dose levels were 0.7 mg V/kg/day for rats and 0.9 mg V/kg/day for mice.

Vanadium pentoxide in the diet of rats at levels of 10 and 100 ppm for their entire lifetime resulted in no significant toxicological effects except for a reduction in hair cystine content (Stokinger et al., 1953). The exposure level of 10 ppm was equivalent to 0.9 mg/kg/day of vanadium pentoxide (U.S. EPA, 1987).

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

Information on the oral developmental and reproductive toxicity of vanadium to humans was not available.

3.1.4.2. Animal

Exposure of male and female rats before mating, and of female rats during gestation and lactation to sodium metavanadate by gavage (maximum of 8.4 mg V/kg/day) did not induce any adverse effects on fertility, reproduction, or parturition; however, doses of 4.2 mg V/kg/day significantly reduced pup size and body weight at birth and 21 days later (Domingo et al., 1986). Gavage doses of 8.4 mg V/kg/day, as sodium metavanadate, to pregnant rats on gestation days 6-14 did not result in embryolethality, teratogenicity or significant visceral or skeletal abnormalities; however, there was an increase in facial and dorsal hemorrhages (Paternain et al., 1987). In a two-generation study, altered lung collagen metabolism was seen in fetuses of adult rats receiving 2.8 mg V/kg, as sodium metavanadate in drinking water (Kowalska et al., 1988).

3.1.5. Reference Dose

Separate subchronic and chronic oral reference doses have been derived for vanadium, vanadium pentoxide, vanadyl sulfate, and sodium metavanadate (U.S. EPA, 1987, 1991a).

3.1.5.1. Subchronic

<u>Vanadium</u>

ORAL RfD:	0.007 mg/kg/day (U.S. EPA, 1991a)
UNCERTAINTY FACTOR:	100
MODIFYING FACTOR:	NA
NOAEL:	0.7 mg/kg/day (rat), drinking water, lifetime
PRINCIPAL STUDY:	Schroeder et al., 1970

COMMENTS: The NOAEL is derived from a lifetime single exposure level study in which rats were exposed to 5 ppm V, as vanadyl sulfate, in drinking water. The only reported effects were minor changes in serum chemistry. The Uncertainty Factor of 100 is the product of a 10-fold uncertainty in extrapolating from laboratory animals to humans and a 10-fold uncertainty to protect sensitive individuals.

<u>Vanadium pentoxide</u>

ORAL RfD:	0.009 mg/kg/day (U.S. EPA, 1991b)
UNCERTAINTY FACTOR:	100
MODIFYING FACTOR:	1
NOAEL:	0.89 mg/kg/day

PRINCIPAL STUDY: Stokinger et al., 1953

COMMENTS: The NOAEL is derived from a study in which rats received 10 or 100 ppm dietary vanadium pentoxide for 2.5 yr. The only change reported was a decrease in cystine levels in the hair of the exposed animals. The 10 ppm level was selected as a NOAEL. The Uncertainty Factor of 100 is the product of a 10-fold uncertainty in extrapolating from laboratory animals to humans and a 10-fold uncertainty to protect sensitive individuals.

Vanadyl sulfate

ORAL RfD: 0.02 mg/kg/day (U.S. EPA, 1991a)
UNCERTAINTY FACTOR: 100
MODIFYING FACTOR: NA
NOAEL: 2.24 mg/kg/day

PRINCIPAL STUDY: Schroeder et al., 1970, as reported in U.S. EPA, 1987

COMMENTS: The NOAEL is derived from a single exposure level study in which rats were exposed to 5 ppm V, as vanadyl sulfate, in drinking water for 2.5 yr for a lifetime. The only reported effects were minor changes in serum chemistry. The Uncertainty Factor of 100 is the product of a 10-fold uncertainty in extrapolating from laboratory animals to humans and a 10-fold uncertainty to protect sensitive individuals.

Sodium metavanadate

ORAL RfD: 0.01 mg/kg/day (U.S. EPA, 1987, 1991a)
UNCERTAINTY FACTOR: 100
MODIFYING FACTOR: NA
NOAEL: 1.32 mg/kg/day

PRINCIPAL STUDY: Domingo et al., 1985

COMMENTS: The NOAEL is derived from a study in which rats were given 0, 5, 10 and 50 ppm sodium metavanadate, in drinking water for 3 months. Impaired kidney function was seen at 50 ppm, and 10 ppm was considered a NOAEL. The Uncertainty Factor of 100 is the product of a 10-fold uncertainty in extrapolating from laboratory animals to humans and a 10-fold uncertainty to protect sensitive individuals.

3.1.5.2. Chronic

Vanadium

ORAL RfD: 0.007 mg/kg/day (U.S. EPA, 1987, 1991a)
UNCERTAINTY FACTOR: 100
MODIFYING FACTOR: NA
NOAEL: 0.7 mg/kg/day (rat), drinking water, lifetime

PRINCIPAL STUDY: Schroeder et al., 1970

COMMENTS: The NOAEL is derived from a lifetime single exposure level study in which rats were exposed to 5 ppm V, as vanadyl sulfate, in drinking water. The only reported effects were minor changes in serum chemistry. The Uncertainty Factor of 100 is the product of a 10-fold uncertainty in extrapolating from laboratory animals to humans and a 10-fold uncertainty to protect sensitive individuals.

Vanadium pentoxide

ORAL RfD: 0.009 mg/kg/day (U.S. EPA, 1987, 1991b)
UNCERTAINTY FACTOR: 100
MODIFYING FACTOR: 1
NOAEL: 0.89 mg/kg/day
CONFIDENCE:
Study: Low
Data Base: Low
RfD: Low

VERIFICATION DATE: 02/26/86

PRINCIPAL STUDY: Stokinger et al., 1953

COMMENTS: The NOAEL is derived from a study in which rats received 10 or 100 ppm dietary vanadium pentoxide for 2.5 yr. The only change reported was a decrease in cystine levels in the hair of the exposed animals. The 10 ppm level was selected as a NOAEL. The Uncertainty Factor of 100 is the product of a 10-fold uncertainty in extrapolating from laboratory animals to humans and a 10-fold uncertainty to protect sensitive individuals.

Vanadyl sulfate

ORAL RfD: 0.02 mg/kg/day (U.S. EPA, 1987, 1991a)
UNCERTAINTY FACTOR: 100
MODIFYING FACTOR: NA
NOAEL: 2.24 mg/kg/day

PRINCIPAL STUDY: Schroeder et al., 1970

COMMENTS: The NOAEL is derived from a single exposure level study in which rats were exposed to 5 ppm V, as vanadyl sulfate, in drinking water for 2.5 yr for a lifetime. The only reported effects were minor changes in serum chemistry. The Uncertainty Factor of 100 is the product of a 10-fold uncertainty in extrapolating from laboratory animals to humans and a 10-fold uncertainty to protect sensitive individuals.

Sodium metavanadate

ORAL RfD: 0.001 mg/kg/day (U.S. EPA, 1987, 1991a)
UNCERTAINTY FACTOR: 1000
MODIFYING FACTOR: NA
NOAEL: 1.32 mg/kg/day

PRINCIPAL STUDY: Domingo et al., 1985

COMMENTS: The NOAEL is derived from a study in which rats were given 0, 5, 10 and 50 ppm sodium metavanadate, in drinking water for 3 months. Impaired kidney function was seen at 50 ppm, and 10 ppm was considered a NOAEL. The Uncertainty Factor of 100 is the product of a 10-fold uncertainty in extrapolating from laboratory animals to humans, a 10-fold uncertainty to extrapolate from a subchronic to chronic exposure, and a 10-fold uncertainty to protect sensitive individuals.

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

In studies on humans, the acute toxic effects of inhaled vanadium were found to be limited to eye and respiratory tract irritation; there being no evidence of disturbances to the cardiovascular system, gastrointestinal tract, kidneys, blood, or CNS (Sax, 1984; ATSDR, 1990). Typical symptoms include coughing, wheezing, rhinorrhea, sore throat and chest pain (ATSDR, 1990). There is usually a latency period of 1-6 days before effects appear (Lagerkvist et al., 1986). In severe cases bronchospasms and bronchitis, accompanied by wheezing and dyspnea may occur, and bronchopneumonia may result from very high exposures (Lagerkvist et al., 1986)

NIOSH (1977) reported that respiratory irritation from inhalation of vanadium-containing dusts or fumes occurred at concentrations ranging from 0.1 to 85 mg/m^3. At a concentration of about 1.0 mg/m^3, vanadium dust caused coughing and throat irritation (Zenz and Berg, 1967). At a level of 0.1 mg/m^3, an 8-hr exposure to vanadium pentoxide (0.06 mg V/m^3) caused only mucus formation which was cleared by slight coughing that lasted 3-4 days (Zenz and Berg, 1967). A level of 0.06 mg V/m^3 was considered a NOAEL for acute exposures by ATSDR (1990).

Lees (1980) reported that workers occupationally exposed (several hours per day for eight days) to vanadium-containing dust (as a component in fuel oil ash) exhibited significant decreases in several lung function tests including forced vital capacity, forced expiratory volume, and forced mid-expiratory flow. Lung functions returned to normal several weeks after the exposures ended.

There is some evidence that workers exposed to vanadium compounds become sensitized such that there is increased severity and more rapid onset of respiratory symptoms after multiple exposures (Zenz and Berg, 1967; Zenz et al., 1962; Roshchin, 1968).

3.2.1.2. Animal

Two of four rabbits died following 7 hr exposure to 114 mg V/m^3, as V_2O_5; the exposures resulted in tracheitis, pulmonary edema and bronchopneumonia (Sjoberg, 1950).

Monkeys exposed to 2.8 mg V/m^3, as V_2O_5, for 6 hr developed increased pulmonary resistance and had increased numbers of polymorphonuclear leucocytes in bronchoalveolar lavage fluid (Knecht et al., 1985). Exposure of rats to bismuth orthovanadate 6 hr/day for 2 weeks resulted in increases in lung weight and increased accumulation of alveolar macrophages, lung lipids and type II epithelial cells (Lee and Gillies, 1986). Rabbits exposed to vanadium pentoxide dust showed no evidence of adverse effects on cardiovasular or gastrointestinal systems, blood, spleen or brain; but they did exhibit conjunctivitis and some degree of fatty degeneration in the liver and kidneys (Sjoberg, 1950).

3.2.2. Subchronic Toxicity

3.2.2.1. Human

Information on the subchronic inhalation toxicity of vanadium and vanadium compounds to humans was not available.

3.2.2.2. Animal

Repeated inhalation of vanadium pentoxide (20-40 mg/m^3, 1 hr/day, for several months) by rabbits resulted in chronic rhinitis and tracheitis, emphysema, patches of lung atelectasia, and bronchopneumonia (Sjoberg, 1950). Exposure of rabbits to vanadium trioxide aerosol (40-75 mg/m^3, 2 hr/day, 9-12 months) resulted in sneezing, nasal discharge, dyspnea and tachypnea and sometimes bronchial asthma (Roshchin et al., 1964; Roshchin, 1967). Similar effects were seen in rabbits exposed under the same conditions to vanadium pentoxide concentrations of 8-18 mg/m^3 or to vanadium carbide levels of 40-80 mg/m^3, and also in rats exposed to vanadium pentoxide condensation aerosol (3-5 mg/m^3, 2 hr/day, every second day for 3 months) and to vanadium pentoxide dust (10-40 mg/m^3, 1 hr/day, for 4 months).

Stokinger et al. (1953) reported that a concentration of 0.5 mg V/m^3 as vanadium pentoxide dust, 6 hr/day for 6 months caused no adverse effects in rats, dogs, guinea pigs, and rabbits.

Pazynich (1966) reported that albino rats exposed continuously for 70 days to 0.2 mg/m^3 of vanadium pentoxide aerosol exhibited altered motor chronaxy of antagonistic muscles, decreased blood cholinesterase activity, reduced serum protein levels, including ß-globulins, reduced oxyhemoglobin, and also pathological changes in the lungs (congestion, hemorrhages, bronchitis), the liver (central vein congestion, hemorrhages, infilrates and degeneration), the kidneys (degeneration and necrosis of the epithelial cells of the convoluted tubules), and in the myocardial blood vessels (focal perivascular hemorrhages). No adverse effects were seen in rats exposed to 0.002 mg/m^3.

Sugiura (1978) exposed rats and mice to 1-2 mg/m^3 of vanadium pentoxide 6 hr/day for 3 months. At concentrations up to 0.4 mg/m^3, no adverse effects were seen. At higher

concentrations, the rats had decreased growth rates and enlarged lungs; whereas. mice had thickened alvelolar walls and congested lungs.

3.2.3. Chronic Toxicity

3.2.3.1. Human

Data on the effects of long term inhalation exposure to vanadium have been derived mainly from studies of workers occupationally exposed to vanadium pentoxide. The most frequently reported effects were irritation to the respiratory tract, conjunctivitis and dermatitis. Cough, bronchospasm, pulmonary congestion, and bronchitis are the most common symptoms, but rhinitis, pharyngitis, pneumosclerosis, asthma, and dyspnea have also been reported (Symanski, 1939; Sjoberg, 1950; Vintinner et al., 1955; Lewis 1959; Tebrock and Machle, 1968; Kiviluoto et al., 1981b; Sjoberg, 1956; Sjoberg, 1951, 1955; Roshchin, 1968). There is no clear evidence that chronic lung disease (emphysema, pneumoconiosis, fibrosis) results from long term exposure to vanadium compounds (NIOSH, 1977); however, it has been noted that cases of bronchial asthma and bronchitis have been reported with "sufficient frequency to warrant concern for decreased ventilatory function, and possibly, a progressively decreasing ventilatory function" (NIOSH, 1977). Bronchiopneumonia may possibly be a secondary complication caused by the effects of vanadium on respiratory mucosa (Sjoberg, 1955).

Evaluation of dose-response relationships from occupational exposure studies is difficult because of fluctuations in concentrations, lack of continuous monitoring, and potential exposure through routes other than inhalation. Generally, occupational exposures occur over wide concentration ranges, i.e., 0.05-5.58 mg/m^3 (Sjoberg, 1950), 0.02-3.2 mg V/m^3 (Tebrock and Machle, 1968), 0.004-2.116 mg V/m^3 in ore dust and 0.018-58.82 mg V/m^3 in vanadium pentoxide dust (Vintenner et al., 1955), and 0.012-2.3 mg V/m^3 (time-weighted average exposures) for smelter workers (Kiviluoto et al., 1981a). Therefore, minimum effect levels are difficult to quantify. The lowest exposure levels at which there was an increased incidence of respiratory distress were those in the study of Lewis (1959) in which workers were exposed to vanadium pentoxide for an average duration of 2.5 years. In this study, vanadium concentrations in seven air samples ranged from 0.018-0.925 mg V/m^3, but five of the measurements were 0.1-0.38 mg/m^3. In another study, vanadium processing workers exposed to 0.1-0.3 mg/m^3 had lowered serum cholesterol levels but no other adverse effects (Vintinner et al., 1955).

Most investigators have reported that long term occcupational exposure to vanadium compounds did not result in any gastrointestinal symptoms or adverse effects to the hemopoietic system, kidneys, liver, or nervous sytem (Symanski, 1939; Sjoberg, 1956: Kiviluoto et al., 1981a, 1981b). However, some workers chronically exposed to vanadium dust have reported dizziness, depression, headache, or tremors of the fingers and arms (Levy et al., 1984; Vintinner et al., 1955).

From the available pre-1974 clinical, experimental, and occupational exposure data, IIEQ (1974) concluded that clinical signs of severe chronic intoxication (hemoptysis, pneumonia, hacking cough, chest pain, lesions of the nose, and rales) occurred at vanadium pentoxide air concentrations of around 1000 μg/m^3; clinical signs of subtle chronic intoxication (green tongue, cough, vascularization of the cornea, conjunctivitis, colic, respiratory tract irritation, mucus, and

rhinorrhea) occurred at vanadium pentoxide concentrations of about 100 $\mu g/m^3$ or less, and subclinical chronic intoxication resulting in metabolic disorders occurred at about 1-20 $\mu g/m^3$. IIEQ (1974) considered reductions in body cystine levels (as measured in fingernails) to be a major subclinical effect of vanadium exposure. Other biochemical effects that may occur without clinical signs of toxicity include reductions in serum cholesterol, decreases in coenzyme A in liver and in coenzyme Q in mitochrondria and changes in activity of Na^+-, K^+-ATPase, Ca-ATPase, adenylate kinase, ribonuclease, phosphofructokinase, and glucose-6-phosphatase) (Lagerkvist et al., 1986).

3.2.3.2. Animal

Animal data indicate that chronic toxic effects on the respiratory system are similar to those seen in acute exposures. In addition, when the dose is sufficiently high or the exposure sufficiently long, systemic effects such as edema, hemorrhaging, and lesions can occur in the lungs, liver, and kidney.

Rabbits chronically exposed to vanadium pentoxide dust showed no evidence of adverse effects on the cardiovasular or gastrointestinal systems, blood, spleen or brain; but they did develop conjunctivitis and had some fatty degeneration in the liver and kidneys (Sjoberg, 1950). Fatty changes with partial cell necrosis were seen in the liver and kidneys of rats and rabbits exposed to vanadium pentoxide, trioxide and chloride (10-70 mg/m^3, 2 hr/day, 9-12 mo) (Roshchin, 1968).

3.2.4. Developmental and Reproductive Toxicity

3.2.4.1. Human

Information on the developmental and reproductive toxicity of vanadium and vanadium compounds following inhalation exposure was not available.

3.2.4.2. Animal

Information on the developmental and reproductive toxicity of vanadium and vanadium compounds following inhalation exposure was not available.

3.2.5. Reference Concentration

A subchronic or chronic reference concentration for vanadium is not available at this time (U.S. EPA, 1991b).

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

3.3.1.1. Human

Stokinger et al. (1953) reported that a 10% solution of sodium metavanadate is a primary irritant to human skin. Saturated solutions of ammonium metavanadate (0.5%) and vanadium pentoxide (0.8% solution) did not irritate the skin. Sjoberg (1951) reported that several workers occupationally exposed to vanadium developed what appeared to be a contact dermatitis and that in one case, skin patch tests produced eczematous lesions indicative of an allergic reaction.

Proescher et al. (1917) estimated that 30 mg of sodium tetravanadate, injected intravenously, would be a fatal dose to a 70-kg man. Signs and symptoms of toxicity following a single intravenous injection of 100 mg vanadium pentoxide include nausea, vomiting, salivation, lacrimation, loss of pulse, and albumin and cylindrical casts in urine (Lagerkvist et al., 1986).

3.3.1.2. Animal

Administered to the eye of a rabbit, sodium orthovanadate caused a significant fall in intraocular pressure (Mittrag et al., 1984). The LD_{50} values for sodium metavanadate injected intrperitoneally is 0.11 mg V/kg in rats and 0.13 mg V/kg in mice (Chanh, 1965).

3.3.2. Subchronic Toxicity

3.3.2.1. Human

Information on the subchronic toxicity of vanadium or vanadium compounds to humans by other routes of exposure was not available.

3.3.2.2. Animal

Fatty changes were seen in the liver of rats following subcutaneous injections of ammonium vanadate (1 mg V/kg/day, for 30 days) (Kaku et al., 1971).

3.3.3. Chronic Toxicity

Information on the chronic toxicity of vanadium and vanadium compounds to humans or animals by other routes of exposure was not available.

3.3.4. Developmental and Reproductive Toxicity

3.3.4.1. Human

Information on the developmental and reproductive toxicity of vanadium or vanadium compounds to humans by other routes of exposure was not available.

3.3.4.2. Animal

There is no clear evidence that vanadium compounds are teratogenic to laboratory animals; however, in one study, exposure of pregnant Syrian golden hamsters to ammonium metavanadate (0, 0.47, 1.88, or 3.75 mg/kg injected i.p. on gestation days 5 through 10) resulted in a significant increase in fetal skeletal abnormalities (micrognathia, supernumerary ribs, and alternations in sternebral ossification) (Carlton et al., 1982). The number of malformed offspring was small, and there was no clear-cut dose/response relationship, thus, a definite assessment of teratogenicity was not possible. In this same study, there was also a decrease in the male-female fetal sex ratio, but no external and soft tissue anomalies. A delay in fetal skeletal ossification, but no implantation or teratogenic effects occurred in the offspring of mice injected with 0.15 mL of a 1 mM solution of vanadium pentoxide on day 8 of pregnancy (Wide, 1984). Exposure of female rats to 0.85 mg/kg of sodium metavanadate by subcutaneous injection on the 4th day of pregnancy resulted in an increase in preimplantation embryo mortality, but no teratogenic effects (Roshchin and Kazimov, 1980; Roshchin et al., 1980). However, in male rats dosed intraperitoneally (0.85 mg/kg/day of sodium metavanadate for 20 days), spermatogenesis was altered, sperm motility and osmotic resistance was reduced, the number of dead spermatozoa increased, and morphological damage to the seminiferous epithelium was observed. There was also a decrease in fertilization of females mated to exposed males and an increase in preimplantation embryo mortality.

In tests on pregnant rats, Hackett and Kelman (1983) found that vanadium accumulates in the placenta, preferentially concentrating in the membranes rather than in the fetus itself.

3.4. TARGET ORGAN/CRITICAL EFFECTS

Minimal effect levels and target organs may vary with the chemical form and oxidation state of the vanadium.

3.4.1. Oral Exposures

3.4.1.1. Primary Target Organs

1. Gastrointestinal system: Diarrhea has been reported in humans and animals receiving ammonium vanadyl tartrate and sodium metavanadate, respectively.

2. Kidney: Slight changes in renal function as suggested by increases in blood urea nitrogen and uric acid have been reported in animals exposed to sodium metavanadate.

3. Blood: Decreases in erythrocytes, hemogloblin, or hematocrit have been reported in animals receiving ammonium vanadate or vanadium pentoxide.

3.4.1.2. Other Target Organs

Other effects seen in animals chronically exposed to vanadium compounds include reduced growth rates in adults and fetuses (sodium metavanadate, ammonium vanadate), vasoconstriction

(sodium orthovanadate), and facial and dorsal hemorrhages and altered lung collagen metabolism in fetuses (sodium metavanadate).

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target Organs

Respiratory system: Exposure to vanadium dusts can result in respiratory tract irritation. Bronchospasms and bronchitis, accompanied by wheezing and dysnea may occur, and bronchopneumonia may result from very high and prolonged exposures. The mechanism of vanadium's effect on the respiratory system is similar to that of other metals. Vanadium damages alveolar macrophages and affects lung clearance rates.

3.4.2.2. Other Target Organs

1. Nervous System: Some workers chronically exposed to vanadium dust reported dizziness, depression, headache, or tremors of the fingers and arms.

2. Liver and Kidney: Limited animal data suggest that chronic exposure may lead to liver and kidney abnormalities.

Other effects seen in animals exposed to vanadium compounds include perivascular hemorrhages in myocardial vessels, altered muscle motor chronaxie, and changes in blood chemistry (vanadium pentoxide).

4. CARCINOGENICITY

4.1. ORAL EXPOSURES

4.1.1. Human

Citing a progress report submitted to the National Cancer Institute, Sax (1981) lists the carcinogenicity of vanadium as questionable (no other data available).

4.1.2. Animal

Kanisawa and Schroeder (1967) evaluated the carcinogenicity of vanadium in lifetime studies on Swiss mice. The test animals were given vanadyl sulfate in their drinking water (5 μg/mL water) and in their diet (3.2 μg/g feed) from the time they were 20-22 days old until death. NIOSH (1977) calculated that the total annual intake of vanadium in each animal would amount to 19.8 mg/100 g of body weight. There were no significant differences in the incidences of tumors (heart, lungs, kidneys, liver, spleen, and other organs were examined) between the exposed animals and the controls. Other studies using the same experimental procedures on both rats and mice also indicated that vanadium was not carcinogenic at a level of 5 μg vanadyl sulfate

per mL of drinking water over a lifetime exposure (Schroeder and Balassa, 1967; Schroeder et al., 1970; Schroeder and Mitchner, 1975).

Stoner et al. (1976) evaluated the potential of various metallic compounds to induce lung adenomas in strain A mice. In one test group, mice were given 24 i.p. injections of vanadium (III) 2,4-pentanedione (total dose, 120, 60, or 24 mg/kg) over a 30-week period. The incidence of lung tumors was not significantly different from that of the controls.

Several studies have suggested that vanadium exhibits anti-carcinogenic activity. Thompson et al. (1984) reported that vanadyl sulfate inhibited murine mammary carcinogenesis by 1-methyl-1-nitrosourea in rats, and Djordjevic and Wampler (1985) reported that several vanadium complexes have antitumor activity against L1210 murine leukemia.

4.2. INHALATION EXPOSURES

4.2.1. Human

In a statistical study relating concentrations of air pollutants to mortality indices in Great Britain, Stocks (1960) found that together with arsenic and zinc, vanadium showed a weak correlation with lung cancer, and together with beryllium and molybdenum, showed correlations with other cancers in males. In a similar study conducted by Hickey et al. (1967), there was little correlation between lung cancer mortality and vanadium levels.

4.2.2. Animal

Information on the carcinogenicity of vanadium to animals after inhalation exposure was not available.

4.3. OTHER ROUTES OF EXPOSURE

Information on the carcinogenicity of vanadium to humans or animals from other routes of exposure was not available.

4.4. EPA WEIGHT-OF-EVIDENCE

The limited weight of evidence suggests that vanadium and vanadium compounds are not carcinogenic; however, few vanadium compounds have been adequately tested. Vanadium has not been classified as to carcinogenicity by the EPA. The NTP has approved vanadium pentoxide for carcinogenicity testing, but the results are yet not available (U.S. EPA, 1991b).

4.5. CARCINOGENICITY SLOPE FACTORS

Calculation of slope factors is not possible due to inadequate data.

5. REFERENCES

Athanassiadis, Y.C. 1969. Preliminary Air Pollution Survey of Vanadium and its Compounds. A Literature Review. Prepared by Litton Systems, Incorp., under Contract No. PH 22-68-25. National Air Pollution Control Administration, U.S. Public Health Service. APTD-69-48. 91 pp.

ATSDR (Agency for Toxic Substances and Disease Registry). 1990. Toxicological Profile for Vanadium. Prepared by Clement Associates, Inc., under Contract 205-88-0608. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, Atlanta, GA. Draft report, October 1990.

Baroch, E.F. 1983. Vanadium and vanadium alloys. In: Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., vol. 23. John Wiley and Sons, New York. pp. 673-687.

Byrne, A.R. and L. Kosta. 1978. Vanadium in foods and in human body fluids and tissues. Sci. Total Environ. 10: 17-30.

Carlton, B.D., M.B. Beneke and G.L. Fisher. 1982. Assessment of the teratogenicity of ammonium vanadate using Syrian golden hamsters. Environ. Res. 29: 256-262.

Chanh, P. 1965. The comparative toxicity of sodium chromate, molybdate, tungstate and metavanadate I. Experiments on mice and rats. Arch. Int. Pharmacodyn. Ther. 154: 243-249. (Cited in ATSDR, 1990)

Chasten, N.D., E.M. Lord, H.J. Thompson and J.K. Grady. 1986. Vanadium complexes of transferrin and ferritin in the rat. Biochim. Biophys. Acta 884: 84-92. (Cited in Zaporowska and Wasilewski, 1991)

Conklin, A.W., C.S. Skinner, T.L. Felten, et al. 1982. Clearance and distribution of intratracheally instilled vanadium-48 compounds in the rat. Toxicol. Lett. 11: 199-203.

Curran, G.L. and R.E. Burch. 1967. Biological and health effects of vanadium. In: D.D. Hemphill, Ed. Proceedings of the Conference on Trace Substances in Environmental Health. University of Missouri, Columbia, MO, pp. 96-104.

Davies, D.J.A. and B.G. Bennett. 1983. Summary exposure assessments for copper, vanadium, antimony. In: Exposure Assesments of Environmental Pollutants, vol. 30. Monitoring and Assessment Research Centre, Chelsea College, University of London, London. 55 pp.

Dimond, E.G. J. Caravaca and A. Benchimol. 1963. Vanadium: excretion, toxicity, and lipid effect in man. Am. J. Clin. Nutr. 12: 49-53. (Cited in ATSDR, 1990)

Djordjevic, C. and G.L. Wampler. 1985. Antitumor activity and toxicity of peroxo heteroligand vanadates (V) in relation to biochemistry of vanadium. J. Inorg. Biochem. 25: 51-55.

Domingo, J.L., J.M. Llobet and J. Corbella. 1985. Protection of mice against the lethal effects of sodium metavanadate: a quantitative comparison of a number of chelating agents. Toxicol. Lett. 26: 95-99.

Domingo, J.L., J.L. Paternain, J.M. Llobet et al. 1986. Effects of vanadium on reproduction, gestation, parturition, and lactation in rats upon oral administration. Life Sci. 39: 819-824.

Edel, J. and E. Sabbioni. 1988. Retention of intratracheally instilled and ingested tetravalent and pentavalent vanadium in the rat. J. Trace Elem. Electrolytes Health Dis. 2: 23-30. (Cited in ATSDR, 1990)

Erdmann, E., K. Werdan, W. Krawietz, et al. 1984. Vanadate and its significance in biochemistry and pharmacology. Biochem. Pharmacol. 33: 945-950.

Franke, K.W. and A.L. Moxon. 1937. Toxicity of orally ingested arsenic, selenium, tellurium, vanadium, and molybdenum. J. Pharmacol. Exp. Therap. 61: 89-102. (Cited in ATSDR, 1990)

Gorski, M. and H. Zaporowska. 1983. Growth and changes in the internal organs and blood of Wistar rats in chronic vanadium poisoning. Ann. Univ. Mariae Curie-Sklodowska, Sect. c. 37: 59-65. (Cited in U.S. EPA, 1987)

Gosselin, R.E. R.P. Smith, H.C. Hodge, et al. 1984. Clinical Toxicology of Commercial Products, 5th ed. Williams and Wilkins, Baltimore, MD. pp. II-148-149.

Gul'ko A.G. 1956. Characterization of vanadium as an industrial poison. Gig. Sanit. 21: 24-28. (Cited in NIOSH, 1977)

Gylseth, B., H.L. Leira, E. Steinnes, et al. 1979. Vanadium in the blood and urine of workers in a ferroalloy plant. Scand. J. Work Environ. Health 5: 188-194.

Hackett, P.L. and B.J. Kelman. 1983. Availability of toxic trace metals to the conceptus. Sci. Total Environ. 28: 433-442.

Hamilton, E.I., M.J. Minski and J.J. Cleary. 1972/73. The concentration and distribution of some stable elements in healthy human tissues from the United Kingdom. An environmental study. Sci. Total Environ. 1: 341-374. (Cited in Vouk, 1979; Davies and Bennett, 1983)

Harris, W.R., S.B. Friedman and D. Silberman. 1984. Behavior of vanadate and vanadyl ion in canine blood. J. Inorg. Biochem. 20: 157-169. (Cited in Zaporowska and Wasilewski, 1991)

Hickey, R.J., E.P. Schof and R.C. Clelland. 1967. Relationship between air pollution and certain chronic disease rates. Multivariate statistical studies. Arch. Environ. Health 15: 728-738. (Cited in Athanassiadis, 1969)

ICRP (International Commission on Radiological Protection). 1960. Report of Committee II on Permissible Dose for Internal Radiation. Recommendations of the International Commission on Radiological Protection. ICRP Publ. No. 2. Pergamon Press, Oxford, England. p. 163.

ICRP (International Commission on Radiological Protection). 1981. Limits for Intakes of Radionuclides by Workers. ICRP Publ. No. 30, Part 2. Pergamon Press, Oxford, England. ICRP Publ. #30, Part 2. pp. 22-23. (Cited in Davies and Bennett, 1983)

IIEQ (Illinois Institute for Environmental Quality, Environmental Health Resource Center) 1974. Air-Borne Vanadium - Health Effects and Recommended Standard. State of Illinois Institute for Environmental Quality, Chicago, IL. IIEQ No. 74-63, 38 pp.

Kaku, S., M. Hoshide, S. Matsuo, et al. 1971. (Title not given). Jap. J. Ind. Health 13: 163-267. (Cited in Lagerkvist et al., 1986)

Kanisawa, M. and H.A. Schroeder HA. 1967. Life term studies on the effects of arsenic, germanium, tin, and vanadium on spontaneous tumors in mice. Cancer Res. 27: 1192-1195.

Kiviluoto, M., L. Pyy and A. Pakarinen. 1981a. Serum and urinary vanadium of workers processing vanadium pentoxide. Int. Arch. Occup. Environ. Health 48: 251-256.

Kiviluoto, M., L. Pyy and A. Pakarinen. 1981b. Clinical laboratory results of vanadium-exposed workers. Arch. Environ. Health 36: 109-113.

Knecht, E.A., W.J. Moorman, J.C. Clark, et al. 1985. Pulmonary effects of acute vanadium pentoxide inhalation in monkeys. Am. Rev. Resp. Dis. 132: 1181-1185. (Cited in ATSDR, 1990)

Kowalska, M. 1988. The effect of vanadium on lung collagen content and compopsition in two successive generations of rats. Toxicol. Lett. 41: 203-208. (Cited in ATSDR, 1990)

Kumar, A. and C.N. Corder. 1980. Diuretic and vasoconstrictor effects of sodium orthovanadate on the isolated perfused rat kidney. J. Pharmacol. Exp. Ther. 213: 85-90. (Cited in Phillips et al. 1983)

Lagerkvist, B., G.F. Nordberg and V. Vouk. 1986. Vanadium. In: L. Friberg, G.F. Nordberg and V. Vouk, Eds. Handbook on the Toxicology of Metals, vol. II, Specific metals. 2nd edition. Elsevier, New York. pp. 638-663.

Lee, K.P. and P.J. Gillies. 1986. Pulmonary response and intrapulmonary lipids in rats exposed to bismuth orthovanadate dust by inhalation. Environ. Res. 40: 115-135. (Cited in ATSDR, 1990)

Lees, R.E.M. 1980. Changes in lung function after exposure to vanadium compounds in fuel oil ash. Br. J. Industr. Med. 37: 253-256.

Levy, B.S., L. Hoffman and S. Gottsegen. 1984. Boilermakers' bronchitis. Respiratory tract irritation associated with vanadium pentoxide exposure during oil-to-coal conversion of a power plant. J. Occup. Med. 26: 567-570. (Cited in ATSDR, 1990)

Lewis C. 1959. The biological effects of vanadium. II. The signs and symptoms of occupational vanadium exposure. A.M.A. Arch. Ind. Health 19: 497-503. (Cited in NIOSH, 1977)

Mittag, T.W., J.B. Serle, S.M. Podos, et al. 1984. Vanadate effects on ocular pressure, (Na+, K+)ATPase and adenylate cyclase in rabbit eyes. Invest. Ophthal. Vis. Sci. 25: 1335-1338.

Mountain, J.T., L.L. Delker and H.E. Stokinger. 1953. Studies in vanadium toxicology. Reduction in cystine content of rat hair. A.M.A. Arch. Ind. Hyg. Occup. Med. 8: 406-411. (Cited in U.S. EPA, 1987)

NIOSH (National Institute of Occupational Safety and Health). 1977. NIOSH Criteria for a Recommended Standard....Occupational Exposure to Vanadium. National Institute of Occupational Safety and Health, U.S. Department of Health, Education, and Welfare, Washington, DC, NIOSH-77-222. pp. 142.

NRC (National Research Council). 1974. Medical and Biologic Effects of Environmental Pollutants. Vanadium. National Academy of Sciences, Washington, DC, 117 pp.

NRCC (National Research Council of Canada). 1980. Effects of Vanadium in the Canadian Environment. National Research Council of Canada, Ottawa. Report No. 18132. (Cited in Davies and Bennett 1983)

Oberg, S.G., R.D.R. Parker and R.P. Sharma. 1978. Toxicodynamics of intratracheally administered vanadium in rats. Toxicol. Appl. Pharmacol. 45: 307.

Orris, P., J. Cone and S. McQuilkin. 1983. Health Hazard Evaluation Report: Eureka Company, Bloomington, IL (HETA 80-096-1359). National Institute of Occupational Safety and Health, Washington, DC. NTIS-PB85-163574. (Cited in ATSDR, 1990)

Parker, R.D.R., R.P. Sharma and S.G. Oberg. 1980. Distribution and accumulation of vanadium in mice tissues. Arch. Environ. Contam. Toxicol. 9: 393-403.

Paternain, J.L., J.L. Domingo, J.M. Llobet, et al. 1987. Embryotoixic effects of sodium-metavanadate administered to rats during organogenesis. Revista Espanola de Fisiologia 43: 223-228. (Cited in ATSDR, 1990)

Patterson, B.W., S.L. Hansard, C.B. Ammerman, et al. 1986. Kinetic model of whole-body vanadium metabolism: studies in sheep. Am. J. Physiol. 251:R325-R332. (Cited in ATSDR, 1990)

Pazynich, V.M. 1966. Experimental data for the hygienic substantiation of the maximum permissible concentration of vanadium pentoxide in the atmosphere. Gig. Sanit. 7: 8-12.

Phillips, T.D. B.R. Nechay and N.D. Heidelbaugh. 1983. Vanadium: chemistry and the kidney. Proc. Fed. Am. Soc. Exp. Biol. 42(13): 2969-2973.

Proctor, N.H. and J.P. Hughes. 1978. Chemical Hazards in the Workplace. J.B. Lippincott Company, Philadelphia, PA, pp. 503-505.

Proescher, F., H.A. Seil and A.W. Stillians. 1917. A contribution to the action of vanadium with particular reference to syphilis. Am. J. Syph. 1: 347. (Cited in Lagerkvist et al., 1986; Voul, 1979, NIOSH, 1977, Hudson, 1964)

Rhoads, K. and C.L. Sanders. 1985. Lung clearance, translocation, and acute toxicity of arsenic, beryllium, cadmium, lead, selenium, vanadium, and ytterbium oxides following deposition in rat lung. Environ. Res. 36: 359-378.

Rosenbaum, J.B. 1983. Vanadium compounds. In: Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., vol. 23. John Wiley and Sons, New York, pp. 688-704.

Roshchin, I.V. 1967. Toxicity of vanadium compounds used in modern industry. Gig. Sanit. 32: 26-32. (Cited in NRC 1974)

Roschin, I.V. 1967. [Title not given]. In: Toxicology of Rare Metals. English translation, AEC-tr-6710. Washington, DC. (Cited in Lagerkvist et al., 1986)

Roshchin, I.V. 1968. Vanadium and its Compounds. Medicina, Moscow. (Cited in Lagerkvist, 1986)

Roshchin, I.V., A.V. Il'nitskaia, L.A. Lutsenko, et al. 1964. [Title not given]. Gig. Tr. Prof. Zabol. 4: 25-30. (Cited in Lagerkvist et al. 1986)

Roshchin, I.V. and M.A. Kazimov. 1980. Effect of vanadium on the generative function of tested animals. Gig. Tr. Prof. Zabol. 5: 49-51. (Cited in Shepard, 1983)

Roshchin, I.V. E.K. Ordzhonikidze and I.V. Shalganova. 1980. Vanadium - toxicity, metabolism, carrier state. J. Hyg. Epidemiol. Microbiol. Immunol. 24: 377-383. (Cited in Shepard, 1983)

Sabbioni, E. and E. Marafante. 1978. Metabolic patterns of vanadium in the rat. Bioinorg. Chem. 9: 389-407.

Sax, N.I. 1984. Dangerous Properties of Industrial Materials, 6th ed. Van Nostrand Reinhold Company, New Yoek, pp. 2717-2720.

Scanlon, J.W. 1975. Dangers to the human fetus from certain heavy metals in the environment. Rev. Environ. Health 2: 39-64.

Schroeder, H. and J.J. Balassa. 1967. Arsenic, germanium, tin, and vanadium in mice: effects on growth, survival and tissue levels. J. Nutrit. 92: 245-252.

Schroeder, H. and M. Mitchener. 1975. Life term effects of mercury, methyl mercury, and nine other trace metals on mice. J. Nutrit. 105: 452-458.

Schroeder, H., M. Mitchener and A.P. Nason. 1970. Zirconium, niobium, antimony, vanadium and lead in rats: life term studies. J. Nutrit. 100: 59-68.

Sharma, R.P., S.G. Oberg and R.D.R. Parker. 1980. Vanadium retention in rat tissues following acute exposures to different dose levels. J. Toxicol. Environ. Health 6: 45-54.

Shepard, T.H. 1983. Catalog of Teratogenic Agents, 4th ed. Johns Hopkins University Press, Baltimore, MD, pp. 447-448.

Sjoberg, S.G. 1950. Vanadium pentoxide dust - A clinical and experimental investigation on its effect after inhalation. Acta Med. Scand. 238(suppl): 338. (Cited in Lagerkvist et al., 1986; U.S. EPA, 1987; ATSDR, 1990)

Sjoberg, S.G. 1951. Health hazards in the production and handling of vanadium pentoxide. A.M.A. Arch. Ind. Hyg. Occup. Med. 3: 631-646. (Cited in Lagerkvist etal., 1986)

Sjoberg, S.G. 1955. Vanadium bronchitis from cleaning oil-fired boilers. A.M.A. Arch. Ind. Health 11: 505-12. (Cited in Lagerkvist et al., 1986).

Sjoberg, S.G. 1956. Vanadium dust, chronic bronchitis and possible risk of emphysema - A follow-up investigation of workers at a vanadium factory. Acta Med. Scand. 154: 381-386. (Cited in NRC, 1974; NIOSH, 1977)

Smith, R.G. 1972. Vanadium. In: D.H.K. Lee, Ed. Metallic Contaminants and Human Health. Academic Press, New York, pp. 153-157.

Sollenberger, D.M. 1981. The fate of intragastrically or intratracheally administered or inhaled vanadium-48 oxydichloride in juvenile and mature rats. Ph.D. dissertation. Purdue University, West Layfayette, IN. (Cited in Diss. Abstr. Int. B 42(8): 3176)

Stocks, P. 1960. On the relations between atmospheric pollution in urban and rural localities and mortality from cancer, bronchitis, and pneumonia, with particular reference to 3:4 benzopyrene, beryllium, molybdenum, vanadium and arsenic. Brit. J. Cancer 14: 397-418.

Stokinger, H.E., W.D. Wagner, J. T. Mountain et al. 1953. Unpublished data. (Cited in Stokinger, 1981)

Stokinger, H.E. 1981. Vanadium. In: G.D. Clayton and E. Clayton, Eds. Patty's Industrial Hygiene and Toxicology, 3rd rev. ed., vol. 2A. John Wiley and Sons, New York. pp. 2013-2033.

Stoner, G.D. M.D. Shimkin, M.C. Troxell et al. 1976. Test for carcinogenicity of metallic compounds by the pulmonary tumor response in strain A mice. Cancer Res. 36(5): 1744-1747.

Sugiura, S. 1978. Inhalation toxicity of vanadium pentoxide dust in rats and mice. Shikoku Igaku Zasshi 34: 209-219. (Cited in U.S. EPA, 1987)

Susic, D. and D. Kentera. 1986. Effect of chronic vanadate administration on pulmonary circulation in the rat. Respiration 49: 68-72. (Cited in ATSDR, 1990)

Susic, D. and D. Kentera. 1988. Dependence of the hypertensive effect of chronic vanadate administration on renal excretory function in the rat. J. Hypertension. 6: 199-204. (Cited in ATSDR, 1990)

Symanski, H. 1939. Industrial vanadium poisoning, its origin and symptomatology. Arch. Gewerbepathol. Gewerbehyg. 9: 295-313. (Cited in U.S. EPA, 1987)

Talvitie, N.A. and W.D. Wagner. 1954. Vanadium toxicology. II. Distribution and excretion of vanadium in animals. A.M.A. Arch. Indust. Hyg. Occup. Med. 9: 414-422.

Tebrock, H.E. and W. Machle. 1968. Exposure to europium-activated yttrium orthovanadate - A cathodoluminescent phosphor. J. Occup. Med. 10: 692-696. (Cited in U.S. EPA, 1987)

Thompson, H.J., N.D. Chasteen and L.D. Meeker. 1984. Dietary vanadyl(IV) sulfate inhibits chemically-induced mammary carcinogenesis. Carcinogenesis 5(6): 849-851.

Thurauf, J., G. Syga and K.H. Schaller. 1979. Field tests carried out to determine the occupational exposure to vanadium. Zbl. Bakt. Parasit. Infekt. Hyg, Erste Abt. Orig., Reihe B, Hyg. Krankenhaus Betriebs. Praevent. Med. 168: 273-290. (Cited in NIOSH, 1977)

Tipton, I.H., P.I. Stewart and J. Dickson. 1969. Patterns of elemental excretion in long-term balance studies. Health Phys. 16: 455. (Cited in USEPA, 1977; Vouk, 1979)

U.S. EPA. 1987. Health Effects Assessment for Vanadium and Compounds. Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. ECAO-CINN-H108.

U.S. EPA. 1991a. Health Effects Assessment Summary Tables. Annual FY-91. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH, for the Office of Emergency and Remedial Response. Washington, DC. OERR 9200.6-303(91-1). NTIS PB91-921199.

U.S. EPA. 1991b. Vanadium Pentoxide. Integrated Risk Information System (IRIS). Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. (Verification date 06/01/91).

Vintinner, F.J., R. Vallenas, C.E. Carlin, et al. 1955. Study of the health of workers employed in mining and processing vanadium ore. A.M.A. Arch. Ind. Health 12(6): 635-642. (cited in ATSDR, 1990)

Vouk, V. 1979. Vanadium. In: L. Friberg, G.F. Nordberg and V.B. Voul, Eds. Handbook on the Toxicology of Metals. Elsivie/North-Holland Biomedical Press, New York. pp. 659-674.

Waters, M.D. 1977. Toxicology of Vanadium. In: R.A. Goyer and M.A. Mehlman, Eds. Advances in Modern Toxicology, vol. 2, Toxicology of Trace Elements. Hemisphere Publishing Corp., Washington, DC, pp. 147-189.

Waters, M.D., D.E. Gardner and D.L. Coffin. 1974. Cytotoxic effects of vanadium on rabbit alveolar macrophages in vitro. Toxicol. Appl. Pharmacol. 28(2): 253-263.

Wide, M. 1984. Effect of short-term exposure to five industrial metals on the embryonic and fetal development of the mouse. Environ. Res. 33(1): 47-53.

Wiegmann, T.B., H.D. Day and R.V. Patak. 1982. Intestinal absorption and secretion of radioactive vanadium ($^{48}VO_3$) in rats and effect of aluminum hydroxide. J. Toxicol. Environ. Health 10(2): 233-245.

Zaporowska, H. and W. Wasilewski. 1991. Significance of reduced food and water consumption in rats intoxicated with vanadium. Comp. Biochem. Physiol. 99C (3): 349-352.

Zenz, C. and B.A. Berg. 1967. Human responses to controlled vanadium pentoxide exposure. Arch. Environ. Health 14(5): 709-712.

Zenz, C., J.P. Bartlett and W.H. Thiede. 1962. Acute vanadium pentoxide intoxica-tion. Arch. Environ. Health 5: 542. (Cited in NIOSH, 1977; Proctor and Hughes, 1978)

TOXICITY SUMMARY
for
ZINC AND ZINC COMPOUNDS

April 1992

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EXECUTIVE SUMMARY

Zinc is used primarily in galvanized metals and metal alloys, but zinc compounds also have wide commercial applications as chemical intermediates, catalysts, pigments, vulcanization activators and accelerators in the rubber industry, UV stabilizers, and supplements in animal feeds and fertilizers. They are also used in rayon manufacture, smoke bombs, soldering fluxes, mordants for printing and dyeing, wood preservatives, mildew inhibitors, deodorants, antiseptics, and astringents (Lloyd, 1984; ATSDR, 1989). In addition, zinc phosphide is used as a rodenticide.

Zinc is an essential element with recommended daily allowances ranging from 5 mg for infants to 15 mg for adult males (NRC, 1989).

Gastrointestinal absorption of zinc is variable (20-80%) and depends on the chemical compound as well as on zinc levels in the body and dietary concentrations of other nutrients (U.S. EPA, 1984). In individuals with normal zinc levels in the body, gastrointestinal absorption is 20-30% (ATSDR, 1989). Information on pulmonary absorption is limited and complicated by the potential for gastrointestinal absorption due to mucociliary clearance from the respiratory tract and subsequent swallowing. Zinc is present in all tissues with the highest concentrations in the prostate, kidney, liver, heart, and pancreas. Zinc is a vital component of many metalloenzymes such as carbonic anhydrase, which regulates CO_2 exchange (Stokinger, 1981). Homeostatic mechanisms involving metallothionein in the mucosal cells of the gastrointestinal tract regulate zinc absorption and excretion (ATSDR, 1989).

In humans, acutely toxic oral doses of zinc cause nausea, vomiting, diarrhea, and abdominal cramps and in some cases gastric bleeding (Elinder, 1986; Moore, 1978; ATSDR, 1989). Ingestion of zinc chloride can cause burning in the mouth and throat, vomiting, pharyngitis, esophagitis, hypocalcemia, and elevated amylase activity indicative of pancreatitis (Chobanian, 1981). Zinc phosphide, which releases phosphine gas under acidic conditions in the stomach, can cause vomiting, anorexia, abdominal pain, lethargy, hypotension, cardiac arrhythmias, circulatory collapse, pulmonary edema, seizures, renal damage, leukopenia, and coma and death in days to weeks (Mack, 1989). The estimated fatal dose is 40 mg/kg. Animals dosed orally with zinc compounds develop pancreatitis, gastrointestinal and hepatic lesions, and diffuse nephrosis.

Gastrointestinal upset has also been reported in individuals taking daily dietary zinc supplements for up to 6 weeks (Samman and Roberts, 1987). There is also limited evidence that the human immune system may be impaired by subchronic exposures (Chandra, 1984). In animals, gastrointestinal and hepatic lesions, (Allen et al., 1983; Brink et al., 1959); pancreatic lesions (Maita et al., 1981; Drinker et al., 1927a); anemia (ATSDR, 1989; Fox and Jacobs, 1986; Maita et al., 1981); and diffuse nephrosis (Maita et al., 1981; Allen et al., 1983) have been observed following subchronic oral exposures.

Chronic oral exposures to zinc have resulted in hypochromic microcytic anemia associated with hypoceruloplasminemia, hypocupremia, and neutropenia in some individuals (Prasad et al., 1978; Porter et al., 1977). Anemia and pancreatitis were the major adverse effects observed in

chronic animal studies (Aughey et al., 1977; Drinker et al., 1927a; Walters and Roe, 1965; Sutton and Nelson, 1937). Teratogenic effects have not been seen in animals exposed to zinc; however, high oral doses can affect reproduction and fetal growth (Ketcheson et al., 1969; Schlicker and Cox 1967, 1968; Sutton and Nelson, 1937).

The reference dose for chronic oral exposure to zinc is 0.3 mg/kg/d based on clinical data from the investigation of effects of oral zinc supplements on copper and iron balance (IRIS Database, Oct. 1991). The currently accepted RfD for subchronic exposures is also 0.3 mg/kg/d based on clinical data demonstrating zinc-induced copper deficiency and anemia in patients taking zinc sulfate for the treatment of sickle cell anemia (EPA 1992). The chronic oral RfD for zinc phosphide is 0.0003 mg/kg/d (EPA 1991a), and the subchronic RfD is 0.003 mg/kg/d (EPA 1992).

Under occupational exposure conditions, inhalation of zinc compounds (mainly zinc oxide fumes) can result in a condition identified as "metal fume fever", which is characterized by nasal passage irritation, cough, rales, headache, altered taste, fever, weakness, hyperpnea, sweating, pains in the legs and chest, leukocytosis, reduced lung volume, and decreased diffusing capacity of carbon monoxide (ATSDR, 1989; Bertholf, 1988). Inhalation of zinc chloride can result in nose and throat irritation, dyspnea, cough, chest pain, headache, fever, nausea and vomiting, and respiratory disorders such as pneumonitis and pulmonary fibrosis (ITII, 1988; ATSDR, 1989; Nemery, 1990). Pulmonary inflammation and changes in lung function have also been observed in inhalation studies on animals (Amur et al., 1982; Lam et al., 1985; Drinker and Drinker, 1928).

Although "metal fume fever" occurs in occupationally exposed workers, it is primarily an acute and reversible effect that is unlikely to occur under chronic exposure conditions when zinc air concentrations are less than 8-12 mg/m^3 (ATSDR, 1989). Gastrointestinal distress, as well as enzyme changes indicative of liver dysfunction, have also been reported in workers occupationally exposed to zinc (NRC, 1979; Stokinger, 1981; U.S. EPA, 1991a; Guja, 1973; Badawy et al., 1987a); however, it is unclear as to what extent these effects might have been caused by pulmonary clearance, and subsequent gastrointestinal absorption. Consequently, there are no clearly defined toxic effects that can be identified as resulting specifically from pulmonary absorption following chronic low level inhalation exposures. Animal data for chronic inhalation exposures are not available.

An inhalation reference concentration has not been derived for zinc or zinc compounds (U.S. EPA, 1992).

No case studies or epidemiologic evidence has been presented to suggest that zinc is carcinogenic in humans by the oral or inhalation route (U.S. EPA, 1991a). In animal studies, zinc sulfate in drinking water or zinc oleate in the diet of mice for a period of one year did not result in a statistically significant increase in hepatomas, malignant lymphomas, or lung adenomas (Walters and Roe, 1965); however, in a 3-year, 5-generation study on tumor-resistant and tumor-susceptible strains of mice, exposure to zinc in drinking water resulted in increased frequencies of tumors from the F_0 to the F_4 generation in the tumor-resistant strain (from 0.8 to 25.7%, vs. 0.0004% in the controls), and higher tumor frequencies in two tumor-susceptible strains (43.4% and 32.4% vs. 15% in the controls) (Halme, 1961).

Zinc is placed in weight-of-evidence Group D, not classifiable as to human carcinogenicity due to inadequate evidence in humans and animals (U.S. EPA, 1991a).

1. INTRODUCTION

Zinc is used primarily in galvanized metals and metal alloys. In addition, various inorganic zinc salts have numerous commercial uses. Zinc oxide is used in the rubber industry as a vulcanization activator and accelerator and to slow down oxidation, and also as a reinforcing agent, heat conductor, pigment, UV stabilizer, supplement in animal feeds and fertilizers, catalyst, chemical intermediate, and mildew inhibitor. Zinc sulfate is used in rayon manufacture, agriculture, zinc plating, and as a chemical intermediate and mordant. Zinc chloride is used in smoke bombs, in cements for metals, in wood preservatives, in flux for soldering; in the manufacture of parchment paper, artificial silk, and glues; as a mordant in printing and dye textiles, and as a deodorant, antiseptic, and astringent. Zinc chromate is used as a pigment in paints, varnishes, and oil colors (Lloyd, 1984; ATSDR, 1989). In addition, zinc phosphide is used as a rodenticide and zinc cyanide is used in electroplating (NRC, 1979). The toxicity of the latter two compounds is due primarily to their anion component. Zinc cyanide is discussed in the toxicity summary for cyanide.

Zinc is an essential element. The recommended daily allowance is 15 mg for adult males, 12 mg for adult females, 15 mg for pregnant women, 19 mg for nursing mothers during the first six months and 16 mg during the second six months, 10 mg for children older than 1 year, and 5 mg for infants 0-12 months old (NRC, 1989).

2. METABOLISM AND DISPOSITION

2.1. ABSORPTION

Gastrointestinal absorption of zinc is variable (20-80%) and depends on chemical characteristics of the compound, on the amount of zinc in the body, and on the dietary levels of other nutrients (U.S. EPA, 1984). High dietary levels of phytate, calcium, or phosphorus reduce absorption, but protein enhances uptake (ATSDR, 1989). In individuals with normal zinc levels in the body, gastrointestinal absorption is 20-30%. Information on pulmonary absorption is limited and complicated by the potential for gastrointestinal absorption following mucociliary clearance and swallowing.

2.2. DISTRIBUTION

Zinc is present in all tissues, but the highest concentrations occur in the prostate gland (Bertholf, 1988). Concentrations in the kidney, liver, heart, and pancreas are also high (Stokinger, 1981).

2.3. METABOLISM

After absorption into the body, zinc becomes bound to protein complexes, the most important of which is metallothionein, which acts as a carrier and transport mechanism

(Stokinger, 1981). As an element zinc is not metabolized per se; however, it is a vital component of many metalloenzymes such as carbonic anhydrase, which regulates CO_2 exchange (Stokinger, 1981). Other enzyme systems in which zinc plays a role are RNA polymerase, superoxide dismutase, carboxypeptidase, isocitric dehydrogenase, alcohol dehydrogenase, and ceruloplasmin.

2.4. EXCRETION

Homeostatic mechanisms control zinc absorption and excretion. Metallothionein in the mucosal cells lining the gastrointestinal tract binds with zinc and regulates uptake in the body (ATSDR, 1989). Under conditions where there is a physiological excess of zinc, the metallothionein-zinc complex is eliminated from the body when the mucosal cells are sloughed off. Mass balance studies indicate that most zinc is excreted in the feces, with small amounts in the urine, sweat and semen (Schroeder et al., 1967); however, a significant amount may be lost in sweat in hot climates (Prasad et al., 1963).

3. NONCARCINOGENIC HEALTH EFFECTS

3.1. ORAL EXPOSURES

3.1.1. Acute Toxicity

3.1.1.1. Human

Gastrointestinal distress is a common symptom of acute oral exposure to zinc compounds (ATSDR, 1989), particularly when zinc salts of strong mineral acids are ingested (Stokinger, 1981). Accidental poisonings have occurred as a result of the therapeutic use of zinc supplements and from food contamination caused by the use of zinc galvanized containers. Symptoms develop within 24 hr and include nausea, vomiting, diarrhea, and abdominal cramps (Stokinger, 1981; Elinder, 1986). The concentration in drinking water that can cause an emetic effect ranges from 675 to 2,280 ppm (Stokinger, 1981). High doses may result in gastrointestinal bleeding and subsequent hematological signs of anemia as was seen in the case of an individual taking zinc sulfate capsules (6.47 mg/kg/day) for one week (Moore, 1978).

Severe toxic effects have also been reported in cases of ingestion of zinc chloride. A single dose (amount not reported) caused burning in the mouth and throat, vomiting, pharyngitis, esophagitis, hypocalcemia, and elevated levels of amylase activity; the latter two changes being indicative of acute pancreatitis (Chobanian, 1981). An elevated serum amylase activity was also reported in an individual ingesting 12 g of elemental zinc (150 mg/kg) over a 2-day period (Murphy, 1970). Other reported symptoms were headache, lethargy, a staggering gait, and difficulty in writing.

Minimal clinical chemistry changes observed in individuals ingesting zinc sulfate include reductions in serum HDL-cholesterol levels following daily doses of 2.3 mg Zn/kg/day for 5-6

days (Hooper et al., 1980), and a transitory decrease in plasma adrenal cortisol levels following single doses of 25, 37.5 or 50 mg Zn (Brandao-Neto et al., 1990).

One of the most toxic inorganic zinc compounds is the rodenticide zinc phosphide, which releases phosphine gas under acidic conditions in the stomach. Poisonings with this substance can result in vomiting, anorexia, abdominal pain, lethargy, hypotension, cardiac arrhythmias, circulatory collapse, pulmonary edema, seizures, renal damage, leukopenia, and coma and death in days to weeks (Mack, 1989). The estimated fatal dose is 40 mg/kg.

3.1.1.2. Animal

The acute toxic effects of zinc have been observed in animals in the field and laboratory. Sheep consuming zinc (dose not quantifiable) as a result of environmental contamination developed diarrhea, proteinuria, intestinal and adrenal lesions, and pancreatic acinar cell degeneration (Allen et al., 1983). In laboratory studies, hepatic and gastrointestinal lesions and pancreatitis occurred in sheep treated with 33 mg Zn/kg/day (as zinc sulfate) for 13 days (Allen et al., 1983). Pancreatitis, diffuse nephrosis, intestinal hemorrhages, and anemia were observed in ferrets given 850 mg Zn/kg/day (as zinc oxide in the diet) for 9-13 days (Straube et al., 1980). This dose level was lethal to 1 of 3 animals. A dose level of 425 mg Zn/kg/day for 7-21 days also resulted in nephrosis, pancreatitis, and anemia, as well as fatty infiltration of the liver. A dose level of 142 mg Zn/kg/day for up to 6 months had no adverse effects.

Acute lethality values for varous zinc compounds are as follows: 0.25 g/kg LD_{Lo} for zinc fluoride (guinea pigs); 1.19 g/kg LD_{50} for zinc nitrate hexahydrate (rats); 2.2 g/kg LD_{Lo} for zinc sulfate heptahydrate (rats); and 2.46 g/kg LD_{Lo} for zinc acetate dihydrate (rats) (Stokinger, 1981).

3.1.2. Subchronic Toxicity

3.1.2.1. Human

Gastrointestinal upset is the most common adverse effect from subchronic ingestion of zinc. Twenty-six of 47 individuals developed such symptoms after taking 150 mg Zn/day (2.24 mg/kg/day) for 6 weeks (Samman and Roberts, 1987). Similar symptoms were reported in 10 individuals taking 2.14 mg Zn/kg/day for 43-61 days; however, only one of 80 individuals taking 100 mg Zn/day (1.57 mg Zn/kg/day, as zinc sulfate), for 3-6 months developed such symptoms (Henkin et al., 1976). In another study, no adverse renal, hepatic, or hematological effects were observed in individuals treated with 3.4 mg Zn/kg/day (as zinc sulfate) for 18 weeks (Hallbook and Lanner, 1972).

There is limited evidence that the immune system may be affected by excessive intake of zinc. Chandra (1984) reported that zinc sulfate, in doses equivalent to 4.29 mg Zn/kg/day for 6 weeks, impaired the immune system as measured by the mitogenic response of peripheral blood lymphocytes and the chemotactic and phagocytic responses of polymorphonuclear leukocytes. *In vitro* studies conducted by Baginski (1990) revealed a diminished phagocytic capacity of polymorphonuclear leukocytes and a promotion of inflammatory reactions due to an increase of toxic oxygen species in the presence of zinc ions.

3.1.2.2. Animal

Zinc-induced gastrointestinal effects have been reported in a number of subchronic animal studies. Rats and mice ingesting zinc sulfate (510 mg Zn/kg/day and 1,120 mg Zn/kg/day, respectively) for 13 weeks developed stomach ulcers (Maita et al., 1981). The latter concentration was lethal to 5 of 12 test animals. Gastrointestinal and hepatic lesions were observed in sheep treated with 18.6 mg Zn/kg/day for 49-72 days (Allen et al., 1983), and inflammation of the gastrointestinal tract and stunted growth occurred in weanling pigs treated with 1,000 mg Zn/kg/day for more than a month (Brink et al., 1959). Pancreatic lesions have been reported in rats receiving 510 mg Zn/kg/day (as zinc sulfate) for 13 weeks (Maita et al., 1981), and in cats receiving 266.6 mg Zn/kg/day (as zinc oxide) for 3-53 weeks (Drinker et al., 1927a).

Anemia has been observed in mice, rats, ferrets, and sheep following oral exposures to zinc oxide, zinc oleate or zinc sulfate (ATSDR, 1989; Fox and Jacobs, 1986; Maita et al., 1981). The anemia may have been due to intestinal hemorrhaging.

Adverse kidney effects have been observed in mice dosed with 1,120 mg Zn/kg/day (as zinc sulfate) in their diet for 13 weeks (Maita et al., 1981); in sheep dosed with 18.6 mg Zn/kg/day (as zinc oxide) for 49-72 days (Allen et al., 1983); and in rats dosed with 640 mg Zn/kg/day (as zinc acetate dihydrate) in drinking water for 3 months (Llobet et al., 1988). Histopathological lesions accompanied by increased liver, kidney, and brain weights were observed in rats fed diets containing 200 or 500 ppm zinc phosphide for 13 weeks (Bai et al., 1980). Dietary levels of 50 and 100 ppm caused no adverse effects except for extensive body hair loss.

Increased adrenal and thymus weights and decreased plasma levels of 11-hydroxysteroids occurred in rats receiving zinc in their drinking water at a level corresponding to 10 mg $ZnSO_4$/day (time period not reported) (Quarterman, 1974). Decreased hexobarbital sleeping time was observed in rats receiving 40 mg Zn/kg/day (as zinc sulfate) for 30 days (Kadiiska et al., 1985). This has been attributed to the induction of hepatic monooxygenases (ATSDR, 1989). Chromosomal aberrations have been observed in the bone marrow cells of mice maintained on a low calcium diet and dosed with 650 mg/kg/day of zinc chloride for one month (Deknudt, 1982). Alopecia has been observed in zinc-treated animals and is thought to be a secondary effect of zinc-induced copper deficiency (Mulhern et al., 1986; ATSDR, 1989).

3.1.3. Chronic Toxicity

3.1.3.1. Human

Chronic oral exposures to zinc can result in sideroblastic or hypochromic microcytic anemia associated with hypoceruloplasminemia, hypocupremia, and neutropenia (U.S. EPA, 1984; Broun et al., 1990). Doses of ≥2 mg Zn/kg/day for 11 mo to 2 years were reported to cause such effects (Prasad et al., 1978; Porter et al., 1977; Hoffman et al., 1988). Shorter exposure periods at the dose levels of 2 mg Zn/kg/day or less did not produce any adverse effects (U.S. EPA, 1984).

3.1.3.2. Animal

Several animal studies have evaluated the chronic toxicity of inorganic zinc compounds. Pancreatic lesions were reported in mice ingesting 38 mg Zn/kg/day (as zinc sulfate) in drinking water for 14 months (Aughey et al., 1977) and in cats ingesting 223.8 mg Zn/kg/day (as zinc oxide) for 10-53 weeks (Drinker et al., 1927a). Anemia was reported in mice receiving a dietary level of 2500 ppm zinc (as zinc oleate) (Walters and Roe, 1965) and in rats dosed with 250 or 500 mg Zn/kg/day (as zinc carbonate) for 39 weeks (Sutton and Nelson, 1937). Rats ingesting up to 25.5 mg Zn/kg/day (as zinc acetate) in drinking water for 47 weeks exhibited no overt toxic effects (Drinker et al., 1927b), nor did rats ingesting zinc oxide (250 mg Zn/kg/day) or zinc dust (125 mg Zn/kg/day) in their diet over three generations; however, in the latter case there was a slight reduction in growth rates in the high-dose group (Heller and Burke, 1927).

3.1.4. Developmental and Reproductive Toxicity

3.1.4.1. Human

Of four women given 1.42 mg Zn/kg/day (as zinc sulfate) during the third trimester of pregnancy, three had premature deliveries and one delivered a stillborn infant (Kumar, 1976).

3.1.4.2. Animal

Teratogenic effects have not been observed in animals dosed orally with zinc; however, high oral doses can affect reproduction and fetal growth. Fetal growth of albino rats was reduced and the incidence of stillbirths increased in tests in which pregnant females were maintained during the gestation period on a diet containing 0.05% zinc (as zinc oxide and equivalent to 250 mg Zn/kg/day) (Ketcheson et al., 1969). Similar changes in fetal growth and decreased fetal copper and iron levels, as well as an increase in fetal resorptions occurred in pregnant rats dosed with 200 mg/kg/day (Schlicker and Cox 1967, 1968). Complete inhibition of reproduction occurred in female rats ingesting 500 mg Zn/kg/day (as zinc carbonate) for 5 months (Sutton and Nelson, 1937). It was reported that these effects may have been associated with a zinc-induced anemia as indicated by reduced hemoglobin and RBC levels.

3.1.5. Reference Dose

The generic oral Reference Dose for zinc and zinc compounds is currently under review by EPA (U.S. EPA, 1991a). The subchronic and chronic RfDs listed below are those currently used (U.S. EPA, 1992). The chronic RfD for zinc phosphide listed below has been verified and included on IRIS (U.S. EPA 1991a).

3.1.5.1. Subchronic

<u>Zinc (metallic)</u>

ORAL RfD: 0.2 mg/kg/day (U.S. EPA, 1992)
UNCERTAINTY FACTOR: 10
LOAEL: 2.14 mg/kg/day.

COMMENT: The same study applies to the subchronic and chronic RfD.

Zinc phosphide

ORAL RfD: 0.003 mg/kg/day (U.S. EPA, 1991a)
UNCERTAINTY FACTOR: 1,000
MODIFYING FACTOR: 1
LOAEL: 50 ppm diet (3.48 mg/kg/day), rats, 13 weeks.

COMMENT: The same study applies to the subchronic and chronic RfD.

3.1.5.2. Chronic

Zinc (metallic)

ORAL RfD: 0.3 mg/kg/day (U.S. EPA, 1992)
UNCERTAINTY FACTOR: 3
LOAEL: 2.14 mg/kg/day.

COMMENT: Based on clinical data demonstrating zinc-induced copper deficiency and anemia in patients taking zinc sulfate for the treatment of sickle cell anemia (U.S. EPA, 1992). The Office of Drinking Water also recognizes an oral RfD of 0.2 mg/kg/day (U.S. EPA, 1991b).

Zinc phosphide

ORAL RfD: 0.0003 mg/kg/day (U.S. EPA, 1991a)
UNCERTAINTY FACTOR: 10,000
MODIFYING FACTOR: 1
LOAEL: 50 ppm diet (3.48 mg/kg/day), rats.
CONFIDENCE:

Study:	Medium
Data Base:	Low
RfD:	Low

VERIFICATION DATE: 05/14/96

PRINCIPAL STUDIES: Bai et al., 1980

COMMENT: Based on a subchronic study of female weanling rats on diets containing 10, 50, 100, 200 or 500 ppm Zn for 13 weeks. The only effect noted at 50 and 100 ppm was hair loss, which returned to normal after week 6. Concentrations of 200 or 500 ppm Zn increased liver, kidney, and brain weight and caused histopathological lesions. The UF of 10,000 includes factors of 10 for interspecies extrapolation, 10 for providing added protection to unusually sensitive individuals, 10 for expanding subchronic to chronic exposures, and 10 for a lack of a NOAEL (U.S. EPA, 1991a).

3.2. INHALATION EXPOSURES

3.2.1. Acute Toxicity

3.2.1.1. Human

Inhalation exposure to high concentrations of some zinc compounds can result in toxic effects to the respiratory system (ATSDR, 1989). Inhalation of zinc oxide fumes has been associated with "metal fume fever" (Bertholf, 1988) characterized by nasal passage irritation, cough, rales, headache, altered taste, fever, weakness, hyperpnea, sweating, pains in the legs and chest, reduced lung volume, and decreased diffusing capacity of carbon monoxide. Hives and angioedema were also reported in one case (Farrell, 1987). General symptoms can appear at concentrations as low as 15 mg/m^3. A concentration as high as 600 mg Zn/m^3 for only a few minutes can cause effects in several hours. Recovery usually takes 6 to 48 hours (Elinder, 1986). Some exposed individuals exhibit radiographic lung abnormalities (diffuse nodular infiltrates) and reductions in forced expiratory volume and forced vital capacity (Malo et al., 1990). Leukocytosis is a secondary effect that has been reported in cases of "metal fume fever" (Sturgis et al., 1927; Malo et al., 1990).

Inhalation of zinc chloride can cause nose and throat irritation, dyspnea, cough, chest pain, headache, fever, nausea and vomiting, bilateral diffuse infiltrations, pneumothorax, and acute pneumonitis (ITII, 1988; ATSDR, 1989; Nemery, 1990). More severe effects include ulcerative and edematous changes in mucous membranes, subpleural hemorrhage, advanced pulmonary fibrosis, and respiratory distress syndrome. Fatalities have occurred in some accidental exposures (Elinder, 1986; Hjortso et al., 1988). A TC_{Lo} of 4,800 mg/m^3 for a 30-min exposure has been reported for zinc chloride (Stokinger, 1981).

3.2.1.2. Animal

Decreased lung compliance was observed in guinea pigs exposed to 1 mg zinc oxide/m^3 for 1 hr (Amur et al., 1982). Exposure of guinea pigs to 5 mg/m^3 for 3 hr/day for six days resulted in decreased lung compliance, decreased diffusing capacity, increased flow resistance, inflammation of the alveoli and alveolar ducts, interstitial thickening, and increased numbers of pulmonary macrophages and neutrophils (Lam et al., 1985). Biochemical and histopathological evidence of pulmonary inflammation was observed in guinea pigs exposed to 5.9 mg zinc oxide/m^3, 3 hr daily for 3 days (Conner et al., 1988). Severe lung damage was observed in rats, rabbits and cats acutely exposed to 110-600 mg zinc oxide/m^3 (Drinker and Drinker, 1928). The LCT_{50} (concentration multiplied by exposure time) for zinc chloride has been reported to be 11,800 mg • min/m^3 in mice (Schenker et al., 1981).

Mice exposed to zinc oxide had an increase in chromosomal aberrations in bone marrow cells (Voroshilin et al., 1978).

3.2.2. Subchronic Toxicity

3.2.2.1. Human

Information on the toxicity of zinc and zinc compounds in humans following subchronic inhalation exposures was not available.

3.2.2.2. Animal

Rats exposed to zinc oxide at 15 mg/m^3 for 8 hr daily for up to 84 days showed only minor histological changes in the lung, but pulmonary function tests were indicative of chronic pulmonary inflammation (Elinder, 1986). Rats exposed to 14 mg/m^3 of zinc oxide for 4 hr/day, 5 days per week, for 56 days, developed inflammatory changes in the lungs, including infiltration of leukocytes and macrophages (Pistorius, 1976). Histological examination of lungs from rats exposed to zinc stearate at 5 mg/m^3 for 3-5 months showed no signs of fibrosis (Elinder, 1986).

3.2.3. Chronic Toxicity

3.2.3.1. Human

Non-cancer health effects have been reported in occupationally exposed workers. Workers exposed to zinc compounds have exhibited gastrointestinal symptoms including anorexia, nausea, vomiting, epigastric discomfort, and weight loss, as well as respiratory distress, leukocytosis, and hypocalcemia (NRC, 1979; Stokinger, 1981; U.S. EPA, 1991a). Since many of these effects are the same as those occurring in cases of "metal fume fever," it is possible that they may have been due, at least in part, to transient elevations in exposure levels.

Some studies have suggested a correlation between concentrations of zinc in the air and changes in serum enzyme activities indicative of liver dysfunction (Guja, 1973; Badawy et al., 1987a). In addition, some workers exposed to zinc have a higher than normal incidence of chromosome anomalies in leukocytes (Badawy et al., 1987b). Concomitant exposure to other toxic substances may have contributed to these effects; however, *in vitro* studies have shown that zinc chloride can cause chromosome aberrations in human lymphocytes (Elinder, 1986).

3.2.3.2. Animal

Information on the chronic toxicity of inorganic zinc to animals by inhalation was not available.

3.2.4. Developmental and Reproductive Toxicity

Little information is available on the developmental and reproductive toxicity of inorganic zinc to humans or animals. In an occupational exposure study of a group of pregnant women working in metallurgy, Pietrois et al. (1991) found no significant complications or increase in spontaneous abortions in women having significantly higher zinc serum levels than a control group.

3.2.5. Reference Dose/Concentration

U.S. EPA (1992) has not developed subchronic or chronic inhalation reference concentrations for zinc.

3.3. OTHER ROUTES OF EXPOSURE

3.3.1. Acute Toxicity

3.3.1.1. Human

Exposure to zinc-chromium compounds from galvanized steel was considered to be partially responsible for an outbreak of irritant hand dermatitis, which affected 24 of 41 employees working on a new assembly line of an electronics factory (Bruynzeel et al., 1988).

When administered parenterally, zinc depresses the central nervous system, causing tremors and paralysis of the extremities (Stokinger, 1981).

3.3.1.2. Animal

The subcutaneous LD_{Lo} for zinc sulfate heptahydrate is 330 mg/kg in rats, and that for zinc fluoride is 100 mg/kg (Stokinger, 1981). The intravenous LD_{50} for zinc sulfate is 40 mg/kg in rats, and the i.v. LD_{Lo} for zinc chloride is 30 mg/kg.

3.3.2. Subchronic Toxicity

Information on the subchronic toxicity of inorganic zinc compounds to humans or animals by other routes of exposure was not available.

3.3.3. Chronic Toxicity

Information on the chronic toxicity of inorganic zinc compounds to humans or animals by other routes of exposure was not available.

3.3.4. Developmental and Reproductive Toxicity

3.3.4.1. Human

Information on the developmental and reproductive toxicity of inorganic zinc compounds to humans by other routes of exposure was not available.

3.3.4.2. Animal

Parenteral injections of zinc compounds in rodents during gestation have resulted in adverse developmental effects. The offspring of pregnant golden hamsters injected intravenously with a single dose of 2 mg zinc sulfate/kg on the eighth day of gestation exhibited exencephaly and rib fusions (Ferm and Carpenter, 1968). Similar skeletal anomalies including delayed ossification, and ripple ribs were observed in the offspring of mice injected intraperitoneally with single doses of 12.5, 20.5, and 25 mg zinc chloride/kg on day 8, 9, 10, or 11 of gestation (Chang et al., 1977).

3.4. TARGET ORGAN/CRITICAL EFFECTS

3.4.1. Oral Exposures

3.4.1.1. Primary Target Organs

1. Blood: Copper deficiency and hypochromic microcytic anemia in humans chronically exposed. Anemia in animals.

2. Pancreas: Pancreatitis in humans acutely exposed, and in animals acutely, subchronically, or chronically exposed.

3. Gastrointestinal Tract: Vomiting, diarrhea, cramps, and possibly bleeding following acute or subchronic exposures in humans and animals.

3.4.1.2. Other Target Organs

1. Immune System: Possible impairment in humans following subchronic exposures.

2. Kidney: Renal lesions in animals following acute and subchronic exposures.

3. Developmental Effects: Reduced fetal growth in animals.

4. Reproductive Effects: Inhibition of reproduction in animals following subchronic exposures.

5. Skin: Hair loss in animals following subchronic exposure to zinc phosphide.

3.4.2. Inhalation Exposures

3.4.2.1. Primary Target Organs

Lung: Pulmonary congestion, leukocytic infiltration (zinc oxide); pneumonitis, ulceration, subpleural hemmorhage, and fibrosis (zinc chloride) in occupationally exposed workers most likely from acute exposures.

3.4.2.2. Other Target Organs

1. Blood: Leukocytosis, hypocalcemia in humans following acute exposures.

2. Gastrointestinal Tract: Possible ulcers in occupationally exposed workers.

3. Liver: Possible changes in hepatic enzymes in occupationally exposed workers.

4. CARCINOGENICITY

There is some evidence that zinc may act antagonistically towards the carcinogenic effects of other compounds. For example, administration of zinc sulfate in drinking water reduced the incidence of 9,10-dimethyl-1,2-benzanthracene-induced tumors in the cheek pouches of golden hamsters (Poswillo and Cohen, 1971).

4.1. ORAL EXPOSURES

4.1.1. Human

An excess rate of gastric cancer was reported for a region of Great Britain having a high zinc to copper ratio in home garden soil (Stocks and Davies, 1964); however, in another study significantly lower gastric cancer rates were reported for areas with a similar zinc-copper soil composition (Phillip et al., 1982).

4.1.2. Animal

The potential carcinogenicity of zinc has been evaluated in only a few animal studies. Walters and Roe (1965) maintained groups of newborn Chester Beatty stock mice for one year on drinking water containing 0, 1000, or 5000 ppm Zn (0, 170, 850 mg Zn/kg/day, as zinc sulfate), or on a diet containing zinc oleate (5000 ppm Zn for 3 months followed by 2500 ppm for 3 months, and then 1250 ppm for the rest of the study period). The incidence of hepatomas, malignant lymphomas, and lung adenomas was not statistically different from control values, although the incidence of hepatomas in mice on the zinc-augmented diet was increased over that in the controls (30.4% vs 12.5%) (U.S. EPA, 1991a).

In a 3-year, 5-generation study on tumor resistant and tumor-susceptible strains of mice, Halme (1961) found that zinc concentrations of 10-20 mg/L in drinking water resulted in increased frequencies of tumors from the F_0 to the F_4 generation in the resistant strain (from 0.8 to 25.7% vs. 0.0004% in the controls), and higher tumor frequencies in two susceptible strains (43.4% and 32.4% vs. 15% in the controls). Statistical analysis of the data was not reported.

Aughey et al. (1977) reported hypertrophy of the adrenal cortex and pancreatic islets, but no corresponding tumors in C3H mice given drinking water containing 500 mg/L zinc sulfate for 14 months.

4.2. INHALATION EXPOSURES

4.2.1. Human

Several epidemiological studies have examined cancer mortality rates in occupationally exposed workers and in residents in areas with potentially high zinc contamination. No association between cancer mortality and zinc exposure could be established for workers employed in electrolytic zinc and copper refining plants; however, analysis of the data was limited by the small number of deaths in workers exposed to zinc (Logue et al., 1982). Lung cancer mortality was reported to be elevated in residents living in an old lead/zinc mining and smelting area, but there was no association with environmental levels of zinc (Neuberger and Hollowell, 1982). Because many confounding factors (i.e., smoking, occupation, and duration of residence) were not considered, it is unlikely that the study could have detected zinc-related effects (ATSDR, 1989).

4.2.2. Animal

Marrs et al. (1988) evaluated the carcinogenic effects of a zinc oxide/hexachloroethane smoke mixture on several species of animals and found a statistically significant increase in the frequency of alveologenic carcinomas in female mice exposed to 123 mg Zn/m^3, 1 hr/day, 5 days/week for 18 months. Carcinogenic effects were not seen when similar studies were conducted on rats and guinea pigs. Evaluation of this study is complicated by the presence of several compounds in the smoke mixture that may have contributed to the carcinogenic effects.

4.3. OTHER ROUTES OF EXPOSURE

Injection of zinc chloride or zinc sulfate in the testes of roosters resulted in the formation of teratomas (Michalowsky, 1926; Falin and Gromtseve, 1939). Similar results were reported in rats (Rivere et al., 1959).

4.4. EPA WEIGHT-OF-EVIDENCE

Classification – D; not classifiable as to human carcinogenicity (U.S. EPA, 1991b)
Basis – Inadequate evidence in humans or animals.

4.5. SLOPE FACTORS

The calculation of slope factors is not possible due to the lack of evidence of carcinogenicity.

5. REFERENCES

Allen, J.G.; Master, H.G.; Peet, R.L.; et al. 1983. Zinc toxicity in ruminants. J. Comp. Pathol. 93:363-377. (Cited in ATSDR, 1989).

Amur, M.; McCarthy, J.; Gill, M. 1982. Respiratory response of guinea pigs to zinc oxide fume. Am. Ind. Hyg. Assoc. J. 43:887-889. (Cited in ATSDR, 1989).

ATSDR (Agency for Toxic Substances and Disease Registry). 1989. Toxicological Profile for Zinc. Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, Atlanta, GA. 121 pp. ATSDR/TP-89-25.

Aughey, E.; Grant, L.; Furman, B.L.; Dryden, W.F. 1977. The effects of oral zinc supplementation in the mouse. J. Comp. Pathol. 87:1-14. (Cited in U.S. EPA, 1991a).

Badawy, N.B.A.; El Salam, M.A.; Eissa, S.M.; et al. 1987a. Studies on some enzymatic activities among zinc workers. In: Heavy Metals in the Environment, 6th International Conference, New Orleans, September 1987. vol. 2, S.E. Lindberg and T.C. Hutchinson, eds. CEP Consultants, Edinburgh. pp. 77-79.

Badawy, N.B.A.; El Salam, M.A.; Eissa, S.M.; et al. 1987b. Chromosomal aberrations in peripheral lymphocytes of zinc workers. In: Heavy Metals in the Environment, 6th International Conference, New Orleans, September 1987. vol. 1, S.E. Lindberg and T.C. Hutchinson, eds. CEP Consultants, Edinburgh. pp. 343-345.

Baginski, B. 1990. Alterations of the oxidative metabolism and other microbiocidal activities of human polymorphonuclear leukocytes by zinc. Free Radic. Res. Commun. 10:227-235. (Cited in TOXBIB/91/146937).

Bai, K.M.; Krishnakumari, M.K.; Ramesh, H.P.; et al. 1980. Short-term toxicity study of zinc phosphide in albino rats. Indian J. Exptl. Biol. 18:854-857. (Cited in U.S. EPA, 1991a).

Bertholf, R.L. 1988. Zinc. In: Handbook on Toxicity of Inorganic Compounds, H. Sigel and H.G. Seiler, eds. Marcel Dekker, Inc., New York. pp. 787-800.

Brandao-Neto, J.; de Mendonca, B.B.; Shuhama, T.; et al. 1990. Zinc acutely and temporarily inhibits adrenal cortisol secretion in humans. Biol. Trace Element Res. 24:83-89.

Brink, M.F.; Becker, D.E.; Terrill, S.W.; et al. 1959. Zinc toxicity in the weanling pig. J. Anim. Sci. 18:836-842.

Broun, E.R.; Greist, A.; Tricot, G.; Hoffman, R. 1990. Excessive zinc ingestion. A reversible case of sideroblastic anemia and bone marrow depression. J. Am. Med. Assoc. 264:1441-1443.

Bruynzeel, D.P.; Hennipman, G.; van Ketel, W.G. 1988. Irritant contact dermatitis and chrome-passivated metal. Contact Dermatitis 19:175-179.

Chandra, R.K. 1984. Excessive intake of zinc impairs immune response. J. Amer. Med. Assoc. 252:1443-1446. (Cited in ATSDR, 1989).

Chang, D.; Mann, D.J.; Gautieri, R. 1977. Teratogenicity of zinc chloride, 1,10-phenanthroline and zinc-1,10-phenanthroline complex in mice. J. Pharm. Sci. 66:1755-1758.

Chobanian, S.J. 1981. Accidental ingestion of liquid zinc chloride: local and systemic effects. Ann. Emerg. Med. 10:91-93. (Cited in ATSDR, 1989).

Conner, M.W.; Flood, W.H.; Rogers, A.E.; Amdur, M.O. 1988. Lung injury in guinea pigs caused by multiple exposures to ultrafine zinc oxide: changes in pulmonary lavage fluid. J. Toxicol. Environ. Health 25:57-69.

Deknudt, G.H. 1982. Clasatogenic effects of zinc in mammals. CR. Soc. Biol. 176:563-567.

Drinker, K.; Drinker, P. 1928. Metal fume fever: V. Results of the inhalation by animals of zinc and magnesium oxide fumes. J. Ind. Hyg. 10:56-70. (Cited in ATSDR, 1989).

Drinker, K.R.; Thompson, P.K.; Marsh, M. 1927a. An investigation of the effect of long continued ingestion of zinc, in the form of zinc oxide, by cats and dogs, together with observations upon the excretion and storage of zinc. Am. J. Physiol. 80:31-64. (Cited in ATSDR, 1989).

Drinker, K.R.; Thompson, P.K.; Marsh, M. 1927b. An investigation of the effect upon rats of long continued ingestion of zinc compounds, with a special reference to the relation of zinc excretion to zinc intake. Am. J. Physiol. 80:284-306. (Cited in U.S. EPA, 1984).

Elinder, C.-G. 1986. Zinc. In: Handbook on the Toxicology of Metals, 2nd ed., vol. II: Specific Metals, L. Friberg, G.F. Nordberg and V.B. Vouk, V.B., eds. Elsevier, New York.

Falin, L.I.; Gromtseva, K.E. 1939. The pathogenesis of experimental teratoid tumors of the genital glands. I. Experimental zinc sulfate teratoma of the testicle of the rooster. Arch. Sci. Biol. USSR 56:101. (Cited in Furst, 1981).

Farrell, F.J. 1987. Angioedema and urticaria as acute and late phase reactions to zinc fume exposure, with associated metal fume fever-like symptoms. Am. J. Ind. Med. 12:331-337. (Cited in ATSDR, 1989).

Ferm, V.H.; Carpenter, S.J. 1968. Teratogenic effect of cadmium and its inhibition by zinc. Nature 216:1123.

Fox, M.R.S.; Jacobs, R.M. 1986. Zinc: essentiality, function, effects of deficiency, and requirementsy. In: Metal Ions in Biological Systems, H. Sigel, ed. Marcel Dekker, Inc., New York. pp. 214-248.

Furst, A. 1981. Bioassay of metals for carcinogenesis: whole animals. Environ. Health Perspect. 40:83-91.

Guja, A. 1973. Gastric disorders and the uropepsin level in persons exposed to the action of zinc oxides. Wiad. Lek. 26:141. (Cited in Stokinger, 1981).

Hallbook, T.; Lanner, E. 1972. Serum-zinc and healing of vnous leg ulcers. Lancet:780-782. (Cited in ATSDR, 1989).

Halme, E. 1961. On the carcinogenic effect of drinking water containing zinc. (Ger.). Vitalstoffe. 6:59-66. (Cited in U.S. EPA, 1991a).

Heller, V.G.; Burke, A.D. 1927. Toxicity of zinc. J. Biol. Chem. 74:85-93. (Cited in U.S. EPA, 1984).

Henkin, R.I.; Schechter, P.H.; Friedewald, W.T.; et al. 1976. A double-blind study of the effects of zinc sulfate on taste and smell dysfunction. Amer. J. Med. Sci. 272:285-299. (Cited in ATSDR, 1989).

Hoffman, H.N.; Phyliky, R.L.; Fleming, C.R. 1988. Zinc-induced copper deficiency. Gastroenterology 94:508-512.

Hooper, P.L.; Visconti, L.; Garry, P.J.; et al. 1980. Zinc lowers high density lipoprotein-cholesterol levels. J. Am. Med. Assoc. 244:1960-1961. (Cited in ATSDR, 1989).

Hjortso, E.; Qvist, J.; Bud, M.I. et al. 1988. ARDS after accidental inhalation of zinc chloride smoke. Intensive Care Med. 14:17-24. (Cited in ATSDR, 1989).

ITII (International Technical Information Institute). 1988. Toxic and Hazardous Industrial Chemicals Safety Manual for Handling and Disposal, with Toxicity and Hazard Data. Toyko, Japan. pp. 562-564

Kadiiska, M.; Stoytchev, T.; Serbinova, E. 1985. Effects of some heavy metal salts on hepatic monooxygenases after subchronic exposures. Arch. Toxicol. Suppl. 8:313-315. (Cited in ATSDR, 1989).

Ketcheson, M.R.; Barron, G.P.; Cox, D.H. 1969. Relationship of maternal dietary zinc during gestation and lactation to development and zinc, iron, and copper content of the postnatal rat. J. Nutr. 98:303-311.

Kumar, S. 1974. Effect of zinc supplementation of rats during pregnancy. Nutr. Rept. Int. 13:33-36. (Cited in ATSDR, 1989).

Lam, H.F.; Conner, M.W.; Rogers, A.E. et al. 1985. Functional and morphological changes in the lungs of guinea pigs exposed to freshly generated ultrafine zinc oxide. Toxicol. Appl. Pharmacol. 78:29-38. (Cited in ATSDR, 1989).

Llobet, J.M.; Domingo, J.L.; Colomina, M.T.; et al. 1988. Subchronic oral toxicity of zinc in rats. Bull. Environ. Contam. Toxicol. 41:36-41.

Lloyd, T.B. 1984. Zinc compounds. In: Kirk-Othmer Encyclopedia of Chemical Technology, 3rd ed., H.F. Mark, D.F. Othmer, C.G. Overberger, G.T. Seaborg, eds. John Wiley & Sons, New York. pp. 851-863.

Logue, J.; Koontz, M.; Hattwick, A. 1982. A historical perspective mortality study of workers in copper and zinc refineries. J. Occup. Med. 24:398-408. (Cited in ATSDR, 1989).

Mack, R.B. 1989. A hard day's knight, zinc phosphide poisoning. N.C. Med. J. 50: 17-18.

Maita, K.; Hirano, M.; Mitsumori, K.; et al. 1981. Subacute toxicity with zinc sulfate in mice and rats. J. Pest. Sci. 6:327-336. (Cited in ATSDR, 1989).

Malo, J-L.; Malo, J.; Cartier, A.; Dolovich, J. 1990. Acute lung reaction due to zinc inhalation. Eur. Respir. J. 3:111-114.

Marrs, T.C.; Colgrave, H.F.; Edginton, J.A.G.; et al. 1988. The repeated dose toxicity of a zinc oxide/hexachloroethane smoke. Arch. Toxicol. 62:123-132. (Cited in ATSDR, 1989).

Michalowsky, I. 1926. Die experimentelle Erzeugung einer teratoiden Neubildung der Hoden beim Hahn. Zentralbl. Allg. Pathol. Pathol. Anat. 38:585. (Cited in Furst, 1981).

Moore, R. 1978. Bleeding gastric erosion after oral zinc sulfate. Br. Med. J. 1:754. (Cited in ATSDR, 1989).

Mulhern, S.A.; Stroube, W.B.; Jacobs, R.M. 1986. Alopecia induced in young mice by exposure to excess dietary zinc. Experientia 42:551-553. (Cited in ATSDR, 1989).

Murphy, J.V. 1970. Intoxication following ingestion of elemental zinc. J. Amer. Med. Assoc. 212:2119-2120. (Cited in ATSDR, 1989).

Nemery, B. 1990. Metal toxicity and the respiratory tract. Eur. Respir. J. 3:202-219.

Neuberger, J.; Hollowell, J. 1982. Lung cancer excess in an abandoned lead-zinc mining and smeltering area. Sci. Total Environ. 25:287-294. (Cited in ATSDR, 1989).

NRC (National Research Council). 1979. Zinc. University Park Press, Baltimore, MD.

NRC (National Reseach Council). 1989. Recommended Dietary Allowances. 10th ed. National Academy Press, Washington, DC.

Phillip, R.; Hughes, A.; Robertson, M. 1982. Stomach cancer and soil metal content. Brit. J. Cancer 45:482. (Cited in ATSDR, 1989).

Pietrois, J.; Koisut, O.; Pomyjovia, D. 1991. The effect of zinc on pregnancy complications in women working in heavy industry. Cesk. Gynekol. 56:11-14. (Cited in TOXBIB/91/256328).

Pistorius, D. 1976. Fruhe Reaktionen der Rattenlunge auf zinkoxidehaltige Atemluft. Beitr. Silikose-Forsch. 28:70. (Cited in U.S. EPA, 1984).

Porter, K.G.; McMaster. D.; Elmes, M.E.; et al. 1977. Anemias and low serum-copper during zinc therapy. Lancet:744. (Cited in U.S. EPA, 1984; ATSDR, 1989).

Poswillo, D.E.; Cohen, B. 1971. Inhibition of carcinogenesis by dietary zinc. Nature 231:447.

Prasad, A.S.; Schulert, A.R.; Sandstead, H.H. et al. 1963. Zinc, iron, and nitrogen content of sweat in normal and deficient subjects. J. Lab. Clin. Med. 62:84-89. (Cited in Stokinger, 1981).

Prasad, A.S.; Brewer, G.J.; Schoomaker, E.B. et al. 1978. Hypocupremia induced by zinc therapy in adults. J. Amer. Med. Assoc. 240:2166-2168. (Cited in ATSDR, 1989).

Quarterman, J. 1974. The effects of zinc deficiency or excess on the adrenals and the thymus in the rat. In: Trace Element Metabolism in Animals - 2. W.G. Hoekstra, J.W. Suttie, H.E. Ganther, W. Mertz, eds. University Park Press, Baltimore, MD. pp. 742-744.

Rivere, M.; Chouroulinkov, I.; Guerin, M. 1959. Testicular tumors in the rat after injection of zinc chloride. Compt. Rend. 240:2649. (Cited in Furst, 1981).

Samman, S.; Roberts, D.C.K. 1987. The effect of zinc supplements on plasma zinc and copper levels and the reported symptoms in healthy volunteers. Med. J. Australia 146:246-249. (Cited in ATSDR, 1989).

Schenker, M.; Speizer, F.E.; Taylor, J.O. 1981. Acute upper respiratory symptoms resulting from exposure to zinc chloride aerosol. Environ. Res. 25:317-324. (Cited in ATSDR, 1989).

Schlicker, S.A.; Cox, D.H. 1967. Maternal dietary Zn in excess, fetal development, and Fe and Cu metabolism. (Abstract). Fed. Amer. Proc. 26:520. (Cited in ATSDR, 1989).

Schlicker, S.A.; Cox, D.H. 1968. Maternal dietary zinc and development; zinc, iron, and copper content of the rat fetus. J. Nutr. 95:287-294. (Cited in ATSDR, 1989).

Schroeder, H.A.; Nason, A.P.; Tipton, I.H. 1967. Essential trace metals in man. Relation to environmental cadmium. J. Chron. Dis. 20:179-210. (Cited in Stokinger, 1981).

Stocks, P.; Davies, R. 1964. Zinc and copper content of soils associated with the incidence of cancer of the stomach and other organs. Brit. J. Cancer 18:14. (Cited in ATSDR, 1989).

Stokinger, H.E. 1981. Zinc. In: Patty's Industrial Hygiene and Toxicology, 3rd rev. ed., vol. 2A. G.D. Clayton and E. Clayton, eds., John Wiley and Sons, New York. pp. 2033-2049.

Straube, E.F.; Schuster, N.H.; Sinclair, A.J. 1980. Zinc toxicity in the ferret. J. Comp. Pathol. 90:355-361. (Cited in ATSDR, 1989).

Sturgis, C.C.; Drinker, P.; Sinclair, A.J. 1927. Metal fume fever: I. Clinical observations on the effect of the experimental inhalation of zinc oxide by two apparently normal persons. J. Ind. Hyg. 9:88-97. (Cited in ATSDR, 1989).

Sutton, W.R.; Nelson, V.E. 1937. Studies on zinc. Proc. Soc. Exp. Biol. Med. 36:211-213. (Cited in U.S. EPA, 1984; ATSDR, 1989).

U.S. EPA. 1984. Health Effects Assessment for Zinc (and Compounds). U.S Environmental Protection Agency, Office of Research and Development, Washington, DC. EPA/540/1-86-048.

U.S. EPA. 1991a. Integrated Risk Information System (IRIS). Carcinogenicity Assessment for Zinc and Compounds, and Oral RfD Assessment for Zinc phosphide. (Online file, retrieved Feb. 1992). Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA. 1991b. Drinking water regulations and health advisories. Office of Drinking Water, Washington, D.C.

U.S. EPA. 1992. Health effects assessment summary tables. FY 1992 Annual. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

Voroshilin, S.I.; Plotko, E.G.; Fink, T.V. et al. 1978. Cytogenetic effects of inorganic and acetate compounds of tungsten, zinc, cadmium, and cobalt in animal and human somatic cells. Tsitol. Genet. 12:241-243. (Cited in ATSDR, 1989).

Walters, M.; Roe, F.J.C. 1965. A study of the effects of zinc and tin administered orally to mice over a prolonged period. Food Cosmet. Toxicol. 3:271-276. (Cited in U.S. EPA, 1991a).

Toxicity Profiles

for Organic Compounds and Radionuclides

Polycyclic Aromatic Hydrocarbons (PAHs)

CAS Numbers:

Benzo(a)anthracene [B(a)A]:56-55-3
Benzo(k)fluoranthene [B(k)F]:207-08-9
Chrysene (C):218-01-9
Indeno[1,2,3-cd]pyrene (IP):193-39-5
Benzo(b)fluoranthene [B(b)F]:205-99-2
Benzo(a)pyrene [B(a)P]:50-32-8
Dibenzo(a,h)anthracene (DBA):53-70-3
Pyrene (P):129-00-0

PHYSICOCHEMICAL CHARACTERISTICS

A. Wt.	MP (°C)	BP (°C)	SG (@25°C)	Water Sol (mg/L)	Log K_{oc}	Log K_{ow}	Vapor Pressure
B[a]A: 228.30 B[b]F: 252.32 B[k]F: 252.32 B[a]P: 252.32 C: 228.30 DBA: 278.36 IP: 276.34 P: 202.26	B[a]A: 162 B[b]F: 168 B[k]F: 217 B[a]P: 179 C: 255 DBA: 269 IP: 160 P: 156	B[a]A: 437.6 B[b]F: ND B[k]F: 480 B[a]P: 495 C: 448 DBA: 524 IP: 536 P: 393	B[a]A: 1.274 B[b]F: ND B[k]F: ND B[a]P: 1.351 C: 1.274 DBA: 1.282 IP: ND P: 1.271	B[a]A: 0.014 B[b]F: 0.0012 B[k]F: 5.5E-4 B[a]P: 0.0038 C: 0.006 DBA: 0.0005 IP: 0.062 P: 0.013	B[a]A: 6.14 B[b]F: 5.74 B[k]F: 6.64 B[a]P: 5.60 C: 5.39 DBA: 6.22 IP: 7.49 P: 4.66	B[a]A: 5.61 B[b]F: 6.57 B[k]F: 6.85 B[a]P: 5.99 C: 5.60 DBA: 6.36 IP: 7.70 P: 4.88	B[a]A: 5E-9 B[b]F: 5E-7 B[k]F:9E-11 B[a]P: 5E-9 C: 6.3E-9 DBA:1E-11 IP: 10E-10 P: 6.85E-7

NONCARCINOGENIC TOXICITY VALUES

[a]Oral RfD (mg/kg/d)		Uncertainty Factor		Inhal. RfC (mg/m³)		Uncertainty Factor	
Subchron	Chronic	Subchron	Chronic	Subchron	Chronic	Subchron	Chronic
B[a]A: 3.00E-01 B[b]F: 3.00E-01 B[k]F: 3.00E-01 B[a]P: 3.00E-01 C: 3.00E-01 DBA: 3.00E-01 IP: 3.00E-01 P: 3.00E-01	B[a]A: 3.00E-02 B[b]F: 3.00E-02 B[k]F: 3.00E-02 B[a]P: 3.00E-02 C: 3.00E-02 DBA: 3.00E-02 IP: 3.00E-02 P: 3.00E-02	P: 300	P: 3000	NA	NA	NA	NA

CARCINOGENIC TOXICITY VALUES

[b]Cancer Slope Factor (CSF) (mg/kg/d)$^{-1}$		Unit Risk Factor (URF)		Weight-of-Evidence	Reference of study (RfD/RfC/CSF/URF)
Oral	Inhalation	Oral (µg/L)$^{-1}$	Inhalation (µg/m³)$^{-1}$		
B[a]A: 7.30E-01 B[b]F: 7.30E-01 B[k]F: 7.30E-01 B[a]P: 7.30E+00 C: 7.30E-02 DBA: 7.30E+00 IP: 7.30E-01	B[a]A:6.10E-01 B[b]F:6.10E-01 B[k]F:6.10E-01 B[a]P: 6.10E+00 C:6.10E-02 DBA: 6.10E+00 IP: 6.10E-01	B[a]A: NA B[b]F: NA B[k]F: NA B[a]P: 2.10E-04 C: NA DBA: NA IP: NA	B[a]A: NA B[b]F: NA B[k]F: NA B[a]P:1.70E-03 C: NA DBA: NA IP: NA	B[a]A: B2 B[b]F: B2 B[k]F: B2 B[a]P: B2 C: B2 DBA: B2 IP: B2	EPA 1989; NA; Thyssen et al. 1981; Neal and Rigdon 1967

[a] In the absence of toxicity data, the RfDs for pyrene have been adopted for these compounds.
[b] The CSFs for these compounds have been estimated by multiplying the CSF for benzo(a)pyrene by a toxicity equivalence factor (EPA 1992a, Region IV Interim Guidance).

Polycyclic aromatic hydrocarbons (PAHs) are a diverse class of compounds consisting of substituted and unsubstituted polycyclic and heterocyclic aromatic rings formes as a result of incomplete combustion of organic compounds with insufficient oxygen (USEPA, 1980).

General Toxicity

Data on the health effects of PAHs are predominantly on the possible carcinogenic effects. However, application of carcinogenic PAHs on the skin in experimental animals is reported to cause destruction of sebaceous glands (skin), hyperkeratosis, hyperplasia and ulceration. Many carcinogenic PAHs are immunosuppressive agents. Toxic manifestations in the liver and kidney are reported in experimental animals exposed to PAHs. Workers exposed to PAH-containing materials have exhibited chronic dermatitis, hyperkeratosis and other skin manifestations (USEPA, 1980).

There is an increasing body of evidence that several carcinogenic PAHs produce severe, long-term immunotoxicity. Exposure to benzo[a]pyrene results in a long-lasting reductions in the activity of antibody-producing cells. Exposure of pregnant mice to a single dose (100-150 mg/kg) of benzo[a]pyrene gave severe suppression of antibody response to pups shortly after birth (Dean et al., 1986).

An oral RfD of 0.03 mg/kg/day was estimated for pyrene based on kidney effects (renal tubular pathology and decreased kidney weights) in a mouse subchronic oral bioassay (USEPA, 1989). A subchronic toxicity value of 0.3 mg/kg/day is listed in HEAST. In the absence of specific toxicity data for noncarcinogenic effects for the PAHs that are compounds of concern in this assessment, the RfDs for pyrene have been adopted.

Evidence of Carcinogenicity

Several PAHs are strongly implicated in the proven association between smoking and lung cancer, between occupational exposure to coke-oven emissions, coal-tar pitch, mineral oils and similar products and cancer of skin, lung, bladder and the gastro-intestinal tract. However, in humans, because of the fact that exposure involves complex mixtures where, clearly, there is interaction between a number of initiators and promoters, it is more difficult to assess the activity of individual members of the group (USEPA, 1980).

A number of PAHs have been found to induce tumors in experimental animals upon exposure by different routes of administration (B[a]A, B[b]F, B[k]F, B[a]P, DBA and IP). The more active congeners, like dibenz[a,h]anthracene induce tumors in multiple sites, and do also act as transplacental carcinogens. For benzo[a]pyrene lung and liver tumors have been induced by exposure to pregnant mice (Dean et al, 1986). There is limited evidence that chrysene is carcinogenic in animals and the available data for pyrene provides no evidence that it is carcinogenic.

The skin of many rodent species, like the mouse, is extremely sensitive to chemical carcinogens of this type, and experience from epidemiological investigations tend to demonstrate a much lower sensitivity of e.g. human skin than that of the mouse, a finding which has been corroborated by investigations in monkeys (Pucknat, 1981).

In the past, estimation of risk from carcinogenic PAHs has been conducted assuming that all carcinogenic PAHs have the same potency as benzo[a]pyrene. This approach has little scientific validity and may result in great overestimation of risk. In this risk assessment, as specified in the EPA Region IV Guidance, toxicity equivalence factors (TEFs) have been used to obtain toxicity values relative to benzo[a]pyrene (the latter of which is assigned a TEF of one). The toxicity values listed in this section incorporate the TEFs specified in the EPA Region IV Guidance. The carcinogenic effects of the individual PAHs are summarized below.

Following is a brief description of the carcinogenic effects of the individual PAHs.

BENZ[a]ANTHRACENE

No oral slope factor is estimated for benz[a]anthracene but a value was estimated based on tumors produced in mice exposed by gavage (Klein, 1963), intraperitoneal (Wislocki et al., 1986), subcutaneous or intramuscular injection (Steiner and Faulk, 1951; Steiner and Edgecomb, 1952) and topical application (IARC, 1973) (USEPA, 1990b). Benz[a]anthracene is classified as a probable human carcinogen (weight-of-evidence classification B2).

BENZO[b]FLUORANTHENE

No quantitative estimate of carcinogenic risk from oral or inhalation exposure has been estimated for benzo[b]fluoranthene but it is classified as a probable human carcinogen (weight-of-evidence classification B2) based on sufficient data from animal bioassays (USEPA, 1990c). Benzo[b]fluoranthene produced tumors in mice after lung implantation (Deutsch-Wenzel et al., 1983), intraperitoneal (LaVoie et al, 1987) or subcutaneous injection (Lacassagne et al,, 1963). Although there are no human data that specifically link exposure to benzo[b]fluoranthene to human cancer, it is a component of mixtures that have been associated with human cancer (coal tar, soot, coke oven emissions and cigarette smoke) (USEPA, 1984; USEPA, 1990d).

BENZO[k]FLUORANTHENE

No quantitative estimate of carcinogenic risk from oral or inhalation exposure has been estimated for benzo[k]fluoranthene but it is classified as a probable human carcinogen (weight-of-evidence classification B2) based on sufficient data from animal bioassays (USEPA, 1990e). Benzo[k]fluoranthene produced tumors after lung implantation in mice (Deutsch-Wenzel et al., 1983) and when administered with a promoting agent in skin-painting studies (Van Duuren et al., 1966). Although there are no human data that specifically link exposure to benzo[k]fluoranthene to human cancer, it is a component of mixtures that have been associated with human cancer (coal tar, soot, coke oven emissions and cigarette smoke) (USEPA, 1984; USEPA, 1990d).

BENZO[a]PYRENE

An oral slope factor of 11.5 and inhalation slope factor of 6.1 $(mg/kg/day)^{-1}$ were estimated for benzo[a]pyrene base on multiple animal studies in rodent and nonrodent species demonstrating B[a]P to be carcinogenic following administration by oral (Neal and Rigdon, 1967), intratracheal (Feron et al., 1973; Kobayashi, 1975), inhalation (Thyssen et al., 1981) and dermal (IARC, 1973) routes. Benzo[a]pyrene has produced positive results in several in vitro bacterial and mammalian genetic toxicology assays (IARC, 1973, 1983; Santodanato et al., 1981).

Human carcinogenicity data are inadequate for benzo[a]pyrene. Lung cancer has been shown to be induced by humans by various mixtures of polycyclic aromatic hydrocarbons known

to contain BaP, including cigarette smoke, roofing tar and coke oven emissions. It is not possible, however, to conclude from this information that BaP is the responsible agent (USEPA, 1990d). Benzo[a]pyrene is classified as a probable human carcinogen (weight-of-evidence classification B2) (USEPA, 1990f).

CHRYSENE

No quantitative estimate of carcinogenic risk from oral or inhalation exposure has been estimated for chrysene. It is classified as a probable human carcinogen (weight-of-evidence classification B2) based on sufficient data from animal bioassays (USEPA, 1990g). Chrysene produced carcinomas and malignant lymphoma in mice after intraperitoneal injection (Wislocki et al., 1986; Buening et al., 1979) and skin carcinomas in mice following dermal exposure (Wynder and Hoffman, 1959). Chrysene produced chromosomal abnormalities in hamsters and mouse germ cells after gavage exposure (Basler et al., 1977; Roszinsky-Kocher et al., 1979), positive responses in bacterial gene mutation assays (McCann et al., 1975; Tokiwa et al., 1977; Wood et al., 1977; LaVoie et al., 1979; Dunkel and Simmon, 1980; Sakai et al., 1985; Kaden et al., 1979) and transformed mammalian cells exposed in culture (Marquardt and Heidelberger, 1972; Pienta et al., 1977).

Although there are no human data that specifically link exposure to chrysene to human cancer, it is a component of mixtures that have been associated with human cancer (coal tar, soot, coke oven emissions and cigarette smoke) (USEPA, 1984, 1990d; IARC, 1983, 1984).

DIBENZ[a,h]ANTHRACENE

While no quantitative estimate of carcinogenic risk from oral or inhalation exposure has been estimated for dibenz[a,h]anthracene, it is classified as a probable human carcinogen (weight-of-evidence classification B2) based on sufficient data from animal bioassays (USEPA, 1990h). Dibenz[a,h]anthracene produced carcinomas in mice following oral (Snell and Stewart, 1962, 1963; Biancifiori and Caschera, 1962; Berenblum and Haran, 1955) or dermal exposure (Wynder and Hoffman, 1959; Van Duuren et al., 1967) and injection site tumors in several species following subcutaneous (Bryan and Shimkin, 1943; Lubet et al., 1981) or intramuscular (USEPA, 1990d) administration. Dibenz[a,h]antracene has induced DNA damage and gene mutations in bacteria as well as gene mutations and transformation in several types of mammalian cell cultures (USEPA, 1990d).

Although there are no human data that specifically link exposure to dibenz[a,h]anthracene to human cancer, it is a component of mixtures that have been associated with human cancer (coal tar, soot, coke oven emissions and cigarette smoke) (USEPA, 1984, 1990d; IARC, 1984).

INDENO[1,2,3-cd]PYRENE

While no quantitative estimate of carcinogenic risk from oral or inhalation exposure has been estimated for indeno[1,2,3-cd]pyrene, it is classified as a probable human carcinogen (weight-of-evidence classification B2) based on sufficient data from animal bioassays (USEPA, 1990i). Indeno[1,2,3-cd]pyrene produced tumors in mice following lung implants (Deutsch-Wenzel et al., 1983), subcutaneous injection (Lacassagne et al, 1963) and skin tumors in dermal application studies (Hoffman and Wynder, 1966; Rice et al., 1985a, 1986). Indeno[1,2,3-cd]pyrene tested positive in bacterial gene mutation assays (LaVoie et al, 1979; Hermann et al., 1980; Rice et al., 1985b).

Although there are no human data that specifically link exposure to dibenz[a,h]anthracene to human cancer, it is a component of mixtures that have been associated with human cancer (coal tar, soot, coke oven emissions and cigarette smoke) (USEPA, 1984, 1990d; IARC, 1984).

PYRENE

Pyrene is not classifiable as to human carcinogenicity (weight-of-evidence classification D) based on no human data and inadequate data from animal bioassays (USEPA, 1991).

References

Basler, A., B. Herbold, S. Peter and G. Rohrborn. 1977. Mutagenicity of polycyclic hydrocarbons. II. Monitoring genetical hazards of chrysene in vitro and in vivo. Mutat. Res. 48: 249-254.

Berenblum, I. and N. Haran. 1955. The influence of croton oil and of polyethylene glycol-400 on carcinogenesis in the forestomach of the mouse. Cancer Res. 15: 510-516.

Biancifiori, C. and F. Caschera. 1962. The relation between pseudo-pregnancy and the chemical induction by four carcinogens of mammary and ovarian tumours in BALB/c mice. Br. J. Cancer. 16: 722-730.

Buening, M.K., W. Levin, J.M. Karle, H. Yagi, D.M. Jerina and A.H. Cooney. 1979. Tumorigenicity of bay-region epoxides and other derivatives of chrysene and phenanthrene in newborn mice. Cancer Res. 39: 5063-5068.

Dean, J.H., M.J. Murray and E.C. Ward. 1986. in Cassarett and Doull's Toxicology, 3rd Ed., Macmillan Publ. Co., N.Y. pp. 271-272.

Deutsch-Wenzel, R., H. Brune, G. Grimmer, G. Dettbarn and J. Misfeld. 1983. Experimental studies in rat lungs on the carcinogenicity and dose-response relationships of eight frequently occurring environmental polycyclic aromatic hydrocarbons.

Dunkel, V.C. and V.F. Simmon. 1980. Mutagenic activity of chemicals previously tested for carcinogenicity in the National Cancer Institute Bioassay Program. In: Molecular and Cellular Aspects of Carcinogenic Screening Tests, R. Montesano, H. Bartsch and L. Tomatis, Ed. IARC Sci. Publ. No. 27, International Agency for Research and Cancer, Lyon, France. p. 283-301.

Feron, V.J., D. Jong and P. Emmelot. 1973. Dose-response correlation for the induction of respiratory-tract tumors in Syrian golden hamsters by intratracheal installations of benzo(a)pyrene. Eur. J. Cancer. 9: 387.

Hermann, M., J.P. Durand, J.M. Charpentier, et al. 1980. Correlations of mutagenic activity with polynuclear aromatic hydrocarbon content of various mineral oils. In: Polynuclear Aromatic Hydrocarbons: Chemistry and Biological Effects, 4th Int. Symp., A. Bjorseth and A.J. Dennis, Ed. Battelle Press, Columbus, OH. p. 899-916.

International Agency for Research on Cancer (IARC). 1973. Certain Polycyclic Aromatic Hydrocarbons and Heterocyclic Compounds. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Polynuclear Aromatic Compounds. Vol. 3. Lyon, France.

International Agency for Research on Cancer (IARC). 1983. Polynuclear Aromatic Compounds, Part 1, Chemical, Environmental and Experimental Data. In: IARC Monographs of the Carcinogenic Risk of Chemicals to Humans. WHO, IARC, Lyon, France. Vol 32.

Kaden, D.A., R.A. Hites and W.G. Thilly. 1979. Mutagenicity of soot and associated polycyclic aromatic hydrocarbons to Salmonella typhimurium. Cancer Res. 39: 4152-4159.

Klein, M. 1963. Susceptibility of strain B6AF/J hybrid infant mice to tumorigenesis with 1,2-benzanthracene, deoxycholic acid, and 3-methylcholanthrene. Cancer Res. 23: 1701-1707.

Kobayashi, N. 1975. Production of respiratory tract tumors in hamsters by benzo(a)pyrene. Gann. 66: 311.

Lacassagne, A., N.P. Buu-Hoi, F. Zajdela, D. Lavit-Lamy and O. Chalvet. 1963. Activite cancerogene d'hydrocarbures aromatiques polycycliques a noyau fluoranthene. Un. Int. Cancer Acta. 19(3-4): 490-496. (Fre.)

LaVoie, E.J., E.V. Bedenko, N. Hirota, S.S. Hecht and D. Hoffmann. 1979. A comparison of the mutagenicity, tumor-initiating activity and complete carcinogenicity of polynuclear aromatic hydrocarbons. In: Polynuclear Aromatic Hydrocarbons, P.W. Jones and P. Leber, Ed. Ann Arbor Science Publishers, Ann Arbor, MI. p. 705-721.

LaVoie, E.J., J. Braley, J.E. Rice and A. Rivenson. 1987. Tumorigenic activity for non-althernant polynuclear aromatic hydrocarbons in newborn mice. Cancer Lett. 34: 15-20.

Marquardt, H. and C. Heidelberger. 1972. Influence of "feeder cells" and inducers and inhibitors of microsomal mixed-function oxidases on hydrocarbon-induced malignant transformation of cells derived from C3H mouse prostate. Cancer Res. 32: 721-725.

McCann, J.E., E. Choi, E. Yamasaki and B.N. Ames. 1975. Detection of carcinogens as mutagens in the Salmonella/microsme test: Assay of 300 chemicals. Proc. Natl. Acad. Sci. USA. 72(12): 5135-5139.

Neal, J. and R.H. Rigdon. 1967. Gastric tumors in mice fed benzo(a)pyrene: A quantitative study. Texas Rep. Biol. Med. 25: 553.

Pienta, F.J., J.A. Poiley and W.B. Labherz, III. 1977. Morphological transformation of early passage golden Syrian hamster embryo cells derived from cryopreserved primary cultures as a reliable in vitro bioassay for identifying diverse carcinogens. Int. J. Cancer. 19: 642-655.

Pucknat, A.W. (ed.). 1981. Health impacts of polynuclear aromatic hydrocarbons. Environmental Health Review No. 5. Noyes Data Corp., Park Ridge, New Jersey. 271 pp.

Rice, J.E., D.T. Coleman, T.J. Hosted, Jr., E.J. LaVoie, D.J. McCaustland and J.C. Wiley, Jr. 1985a. On the metabolism, mutagenicity, and tumor-initiating activity of indeno[1,2,3-cd]pyrene. In: Polynuclear Aromatic Hydrocarbons: Mechanism, Methods and Metabolism, M. Cooke and A.J. Dennis, Ed. Battelle Press, Columbus, OH. p. 1097-1109.

Rice, J.E., D.T. Coleman, T.J. Hosted, Jr., E.J. LaVoie, D.L. McClausland and J.C. Wiley, Jr. 1985b. Identification of mutagenic metabolites in indeno[1,2,3-cd]pyrene formed in vitro with rat liver enzymes. Cancer Res. 45: 5421-5425.

Rice, J.D., T.J. Hosted, Jr., M.C. DeFloria,, E.J. LaVoie, D.L. Fischer and J.C. Wiley, Jr. 1986. Tumor-initiating activity of major in vivo metabolites of indeno[1,2,3-cd]pyrene on mouse skin. Carcinogenesis. 7(10): 1761-1764.

Roszinsky-Kocher, G., A. Basler and G. Rohrborn. 1979. Mutagenicity of polycyclic hydrocarbons. V. Induction of sister-chromatid exchanges in vivo. Mutat. Res. 66: 65-67.

Sakai, M., D. Yoshida and S.. Mizusaki. 1985. Mutagenicity of polycyclic aromatic hydrocarbons and quinones on Salmonella typhimurium TA97. Mutat. Res. 156: 61-67.

Santodanato, J., P. Howard and D. Basu. 1981. Health and Ecological Assessment of Polynuclear Aromatic Hydrocarbons. Pathotox Publishers, Inc., Park Forest South, IL.

Snell, K.C. and H.L. Stewart. 1962. Pulmonary adenomatosis induced in DBA/2 mice by oral administration of dibenz[a,h]anthracene. J. Natl. Cancer Inst. 28(5): 1043-1049.

Snell, K.C. and H.L. Stewart. 1963. Induction of pulmonary adenomatose in DBA/2 mice by the oral administration of dibenz[a,h]anthracene. Acta. Un. Int. Cancer. 19: 692-694.

Steiner, P.E. and J.H. Edgecomb. 1952. Carcinogenicity of 1,2-benzanthracene. Cancer Res. 12: 657-659.

Steiner, P.E. and H.L. Faulk. 1951. Summation and inhibition effects of weak and strong carcinogenic hydrocarbons: 1,2-Benzanthracene, chrysene, 1:2:5:6-dibenzanthracene and 20-methylcholanthrene. Cancer Res. 11: 56-63.

Thyssen, J., J. Althoff, G. Kimmerle and U. Mohr. 1981. Inhalation studies with benzo[a]pyrene in Syrian golden hamsters. J. Natl. Cancer Inst. 66(3): 575-577.

Tokiwa, H., K. Morita, H. Takeyoshi, K. Takohashi and Y. Ohnishi. 1977. Detection of mutagenic activity in particulate air pollutants. Mutat. Res. 48: 237-248.

U.S. Environmental Protection Agency (USEPA). 1980. Ambient Water Quality Criteria for Polynuclear Aromatic Hydrocarbons. Office of Water, Washington, D.C. EPA 440/5-80-069.

U.S. Environmental Protection Agency (USEPA). 1984. Carcinogen Assessment of Coke Oven Emissions. Office of Health and Environmental Assessment, Washington, DC. EPA 600/6-82-003F. NTIS PB 84-170181.

U.S. Environmental Protection Agency (USEPA). 1985. Chemical, Physical and Biological Properties of Compounds Present at Hazardous Waste Sites. Prepared by Clement Associates, Inc. Under Subcontract to GCA Corporation.

U.S. Environmental Protection Agency (USEPA). 1989. Mouse Oral Subchronic Toxicity of Pyrene. Study conducted by Toxicity Research Laboratories, Muskegon, MI for the Office of Solid Waste, Washington, DC.

U.S. Environmental Protection Agency (USEPA). 1990a. Integrated Risk Information System (IRIS database). Chemical file for pyrene (CAS No. 129-00-0). Verification Date 11/15/89. Last Revised 09/01/90.

U.S. Environmental Protection Agency (USEPA). 1990b. Integrated Risk Information System (IRIS database). Chemical file for benz[a]antracene (CAS No. 56-55-3). Verification Date 02/07/90. Last Revised 12/01/90.

U.S. Environmental Protection Agency (USEPA). 1990c. Integrated Risk Information System (IRIS database). Chemical file for benz[b]fluoranthene (CAS No. 205-99-2). Verification Date 02/07/90. Last Revised 12/01/90.

U.S. Environmental Protection Agency (USEPA). 1990d. Drinking Water Criteria Document for Polycyclic Aromatic Hydrocarbons (PAHs). Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Drinking Water, Washington, DC. Final Draft. ECAO-CIN-D010, September, 1990.

U.S. Environmental Protection Agency (USEPA). 1990e. Integrated Risk Information System (IRIS database). Chemical file for benz[k]fluoranthene (CAS No. 207-08-9). Verification Date 02/07/90. Last Revised 11/01/90.

U.S. Environmental Protection Agency (USEPA). 1990f. Integrated Risk Information System (IRIS database). Chemical file for benz[a]pyrene (CAS No. 50-32-8). Verification Date 02/07/90. Last Revised 12/01/90.

U.S. Environmental Protection Agency (USEPA). 1990g. Integrated Risk Information System (IRIS database). Chemical file for chrysene (CAS No. 218-01-9). Verification Date 02/07/90. Last Revised 12/01/90.

U.S. Environmental Protection Agency (USEPA). 1990h. Integrated Risk Information System (IRIS database). Chemical file for dibenz[a,h]anthracene (CAS No. 53-70-3). Verification Date 02/07/90. Last Revised 12/01/90.

U.S. Environmental Protection Agency (USEPA). 1990i. Integrated Risk Information System (IRIS database). Chemical file for indeno[1,2,3-cd]pyrene (CAS No. 193-39-5). Verification Date 02/07/90. Last Revised 12/01/90.

U.S. Environmental Protection Agency (USEPA). 1991. Integrated Risk Information System (IRIS database). Chemical file for pyrene (CAS No. 129-00-0). Verification Date 02/07/90. Last Revised 01/01/91.

Van Duuren, B.L., A. Sivak, A. Segal, L. Orris and L. Langseth. 1966. The tumor-promoting agents of tobacco leaf and tobacco smoke condensate. J. Natl. Cancer Inst. 37(4): 519-526.

Van Duuren, B.L., L. Langseth, B.M. Goldschmidt, et al. 1967. Carcinogenicity of epoxides, lactones and peroxy compounds. VI. Structure and carcinogenic activity. J. Natl. Cancer Inst. 21: 623.

Wislocki, P.G., E.S. Bagan, A.Y.H. Lu, et al. 1986. Tumorigenicity of nitrated derivatives of pyrene, benz[a]anthracene, chrysene and benzo[a]pyrene in the newborn mouse assay. Carcinogenesis. 7(8): 1317-1322.

Wood, A.W., W. Levin, D. Ryan, et al. 1977. High mutagenicity of metabolically activated chrysene 1,2-dihydrodiol: Evidence for bay region activation of chrysene. Biochem. Biophys. Res. Commun. 78(3): 847-854.

Wynder, E.L. and D. Hoffman. 1959. A study of tobacco carcinogenesis. VII. The role of higher polycyclic hydrocarbons. Cancer. 12: 1079-1086.

POLYCHLORINATED BIPHENYLS (PCBs)
1336-36-3 (PCB-1254 11097-69-1; PCB-1260 11096-82-5)

PHYSICOCHEMICAL CHARACTERISTICS							
A. Wt.	MP (°C)	BP (°C)	SG (@25°C)	Water Sol (mg/L)	Log K_{oc}	Log K_{ow}	Vapor Pressure
1254: 327 1260:324-460	1254: 10 1260: 31	1254: 365-390 1260: 385-420	1254: 1.505 1260: 1.566	1254: 0.057 1260: 0.080	1254: 5.61 1260: 6.42	1254: 6.47 1260: 6.91	1254: 7.71E-05 1260: 4.05E-05

NONCARCINOGENIC TOXICITY VALUES							
Oral RfD (mg/kg/d)		Uncertainty Factor		Inhal. RfC (mg/m³)		Uncertainty Factor	
Subchron	Chronic	Subchron	Chronic	Subchron	Chronic	Subchron	Chronic
NA	NA	NA	NA	NA	NA	NA	NA

CARCINOGENIC TOXICITY VALUES					
Cancer Slope Factor (CSF) $(mg/kg/d)^{-1}$		Unit Risk Factor (URF)		Weight-of-Evidence	Reference of study (RfD/RfC/ CSF/URF)
Oral	Inhalation	Oral $(\mu g/L)^{-1}$	Inhalation $(\mu g/m^3)^{-1}$		
PCBs: 7.70E+00	NA	PCBs: 2.20E-04	NA	B2	NA; NA; Norback and Weltman 1985

Polychlorinated biphenyls (PCBs) are a group of synthetic halogenated aromatic hydrocarbons. PCBs are organic compounds produced by chlorination of a biphenyl with anhydrous chlorine in the presence of iron filings or ferric chloride as the catalysts. There are many Aroclor PCB formulations, of which 1254 and 1260 are two. Aroclor 1254 is a light yellow, viscous liquid with a weak odor while Aroclor 1260 is a light yellow sticky, soft resin with a weak odor (Eisler, 1986).

General Toxicity

The toxicological properties of individual PCBs are influenced primarily by two factors: the partition coefficient based on solubility in N-octanol/water (K_{ow}); and steric factors, resulting from different patterns of chlorine substitution. In general, PCB isomers with high K_{ow} values, and high numbers of substituted chlorines in adjacent positions, constitute the greatest health concern. Biological responses to individual isomers or mixtures vary widely, even among closely related taxonomic species. The issue is further confounded by the presence of toxic impurities, such as polychlorinated dibenzofurans, which may have been formed during the PCB manufacturing process, or result from product usage (Eisler, 1986).

There is no data available at this time to evaluate the chronic health hazard assessment for noncarcinogenic effects (RfDs or RfCs) (USEPA, 1989).

Evidence of Carcinogenicity

PCBs are probable human carcinogens (weight-of-evidence classification B2) based on hepatocellular carcinomas in three strains of rats and two strains of mice and inadequate yet suggestive evidence of risk of liver cancer in humans by ingestion and inhalation or dermal contact (USEPA, 1989).

Although there are many studies of human carcinogenicity, the data are inadequate due to confounding exposures or lack of exposure quantification (Bahn et al., 1976, 1977; NIOSH, 1977; Brown and Jones, 1981; Brown, 1987; Bertazzi et al., 1987; Amano et al., 1984). There is sufficient animal carcinogenicity data available on PCB mixtures. Norback and Weltman (1985) fed 70 male and 70 female Sprague-Dawley rats a diet containing Aroclor 1260 (in corn oil) at 100 ppm for 16 months, followed by a 50 ppm diet for an additional 8 months. A sequential progression of liver lesions to hepatocellular carcinomas were observed.

The EPA reported that although it is known that PCB congeners vary greatly as to their potency in producing biological effects, for purposes of estimating the carcinogenicity assessment, Aroclor 1260 is intended to be representative of all PCB mixtures. The Norback and Weltman study used an adequate number of animals which were observed for their normal lifespan. Only one non-zero test dose was used. A risk estimate was calculated based on the numbers of malignant tumors alone, as called for in the EPA's guidelines for carcinogen risk assessment. The slope factor thus derived is 5.7 mg/kg/day, which is 26% less than that derived using combined malignant tumors and neoplastic nodules. The risk estimate is supported by one based on data of Kimbrough et al. (1975). The EPA pointed out that PCB mixtures in drinking water may not be the same as mixtures introduced or used for testing of carcinogenicity in animals (USEPA, 1989).

References

Amano, M., K. Yagi, H. Nakajima, R. Takehara, H. Sakai and G. Umeda. 1984. Statistical observations about the causes of the death of patients with oil poisoning. Japan Hygiene. 39(1): 1-5.

Bahn, A.K., P. Grover, I. Rosenwaike, K. O'Leary and J. Stellman. 1977. Reply to letter from C. Lawrence entitled, "PCB? and melanoma." New Engl. J. Med. 296: 108.

Bahn, A.K., I. Rosenwaike, N. Herrmann, P. Grover, J. Stellman and K. O'Leary. 1976. Melanoma after exposure to PCB's. New Engl. J. Med. 295: 450.

Bertazzi, P.A., L. Riboldi, A. Pesatori, L. Radice and C. Zacchetti. 1987. Cancer mortality of capacitor manufacturing workers. Am. J. Ind. Med. 11(2): 165-176.

Brown, D.P. and M. Jones. 1981. Mortality and industrial hygiene study of workers exposed to polychlorinated biphenyls. Arch. Environ. Health. 35(3): 120-129.

Brown, D.P. 1987. Mortality of workers exposed to polychlorinated biphenyls -- An update. Arch. Environ. Health. 42(6): 333-339.

Eisler, R. 1986. Polychlorinated biphenyl hazards to fish, wildlife, and invertebrates: a synoptic review. U.S. Fish and Wildl. Serv. Biol. Rep. 85(1.7). 72 pp.

Kimbrough, R.D., R.A. Squire, R.E. Linder, J.D. Strandberg, R.J. Montali and V.W. Burse. 1975. Induction of liver tumors in Sherman strain female rats and polychlorinated biphenyl Aroclor 1260. J. Natl. Cancer Inst. 55(66): 1453-1459.

National Institute for Occupational Safety and Health (NIOSH). 1977. Criteria for a Recommended Standard . . . Occupational Exposure to Polychlorinated Biphenyls (PCBs). U.S. DHEW, PHS, CDC, Rockville, Md. Publ. No. 77-225.

Norback, D.H. and R.H. Weltman. 1985. Polychlorinated biphenyl induction of hepatocellular carcinoma in the Sprague-Dawley rat. Environ. Health Perspect. 60: 97-105.

U.S. Environmental Protection Agency (USEPA). 1989. Integrated Risk Information System (IRIS database). Chemical file for Polychlorinated Biphenyls (CAS No. 1336-36-3). Verification Date 04/22/87. Last Revised 05/01/89.

URANIUM

Introduction

There are three naturally occurring isotopes of uranium: U-238, U-235, and U-234. Uranium is a solid silvery metal that forms complexes with oxygen and fluoride to form various solids ranging in color from brown-black (UO_2) to yellow-red (UO_3) and green (U_3O_8 and UF_4). Soluble compounds of uranium include uranium hexafluoride, uranyl fluoride, uranyl acetate, and uranyl nitrate. By weight, it is generally assumed that >99% of the total naturally occurring uranium is of the isotope U-238. By activity as measured in picocuries (pCi), roughly 47.5% of total naturally occurring uranium is U-238. Another 47.5% is U-234, and the remaining 5% activity is that of U-235.

The average concentration of total uranium in soils is approximately 1.2 pCi/g, although this concentration differs with the bedrock from which the soil is formed (NCRP 1984).

Physicochemical Characteristics

Group: rare earth
Crystal structure: orthorhombic
Atomic number: 92
Atomic weight: 238.029
Shells: 2, 8, 18, 32, 21, 9, 2
Filling orbital: 5f3
Melt: 1132 C
Boil: 3818 C
Electronegativity: 1.38
Covalent radius: 1.42 A
Atomic volume: 12.59 cm^3/mol
First ionization potential: 6.05 V
Oxidation states: (6), 5, 4, 3
Density @ 293 K: 18.9 g/cm^3
Specific heat: 0.12 J/gK
Heat of vaporization: 477.0 kJ/mol
Heat of fusion: 8.520 kJ/mol
Electrical conductivity: 0.0380 10^6/cm ohm
Thermal conductivity: 0.276 W/cmK

Element Nuclides

Nuclide	Abundance	Weight	Half-Life
U230	0%	230	20.8 d
U231	0%	231	4.20 d
U232	0%	232.0371	70 y
U233	0%	233.0396	1.59E+05 y
U234	5.5E-03%	234.0409	2.47E+05 y
U235	0.72%	235.0439	7.04E+08 y
U236	0%	236.0456	2.34E+07 y
U237	0%	237	6.75 d
U238	99.27%	238.0508	4.47E+09 y
U239	0%	239	23.5 m
U240	0%	240	14.1 h

Metabolic Data

Data from Reference Man (ICRP 1975)	
Uranium content of the body	90 μg
of the skeleton	59 μg
of the kidneys	7 μg
Daily intake in food and fluids	1.9 μg

Studies have been conducted on the uptake of uranium to the blood from the gastrointestinal tract. These studies show that the uptake for water-soluble inorganic compounds of uranium is much greater than for relatively insoluble compounds. Similarly, more soluble compounds are rapidly absorbed from the lung. Once in the blood, uranium is retained by the bone and kidneys. Uranium isotopes with shorter half-lives are assumed to be distributed uniformly over the bone surfaces; whereas, isotopes with longer half-lives are assumed to be uniformly distributed throughout the volume of mineral bone following their deposition in the skeleton (ICRP 1979).

Carcinogenic Toxicity

Uranium is listed as a Class A carcinogen, primarily based on the results of follow-up studies of populations exposed to the atomic bomb dropped on Hiroshima in 1945. Slope factors have been published in HEAST for assessing risk from exposure to U-238, U-235, and U-234.

U-238 and U-235 are the parent isotopes for separate decay chains. The most probable effect of exposure to uranium would be an increase in bone sarcomas (BEIR IV).

Risk from exposure to the decay products of these isotopes can be addressed in part by using the "plus daughter" slope factors for U-238 and U-235, as indicated in HEAST. Slope factors are given for external exposure (primarily gamma radiation), oral exposure, and inhalation exposures (alpha and gamma radiation). Other components of risk from uranium exposure include the risk from the *progeny* of uranium, specifically radium-226 and radon-222.

Cancer Risk Slope Factors (HEAST 1992)	Oral risk/pCi	External risk/yr/pCi	Inhalation risk/pCi
U-234	1.6E-11	3.0E-11	2.6E-8
U-235	1.6E-11	2.4E-7	2.5E-8
U-235+D	1.6E-11	2.4E-07	2.5E-8
U-238	1.6E-11	2.1E-11	2.4E-8
U-238+D	2.8E-11	3.6E-08	5.2E-8

Decay Chains

U-234

U-234 ——→ Ra-226 ——→ 222 ——→ Po-218

Result of decaying 1 curie of U-234 for 365.25 days:

Nuclide	Half-life	Branching from parent	Fraction	Curies
U-234	24.45E+04 y	(parent)	1.0000E+00	1.0000E+00
Th-230	7.70E+04 y	1.00	9.0019E-06	9.0019E-06
Ra-226	1.60E+03 y	1.00	1.9496E-09	1.9496E-09
Rn-222	3.82E+00 d	1.00	1.8916E-09	1.8916E-09
Po-218	3.05E+00 m	1.00	1.8916E-09	1.8916E-09

U-235

U-235 ——▸ Th-231 ——▸ Pa-231 ——▸ Ac-227 ——▸ Fr-223
——▸ Th-227

Result of decaying 1 curie of U-235 for 365.25 days:

Nuclide	Half-life	Branching from parent	Fraction	Curies
U-235	70.380E+07 y	(parent)	1.0000E+00	1.0000E+00
Th-231	2.552E+01 h	1.00	1.0000E+00	1.0000E+00
Pa-231	3.276E+04 y	1.00	2.1069E-05	2.1069E-05
Ac-227	2.177E+01 y	1.00	3.3047E-07	3.3047E-07
Fr-223	2.180E+01 m	0.0138	4.5599E-09	4.5599E-09
Th-227	1.872E+01 d	0.9862	2.8130E-07	2.8130E-07

U-238

U-238 ——▸ Th-234 ——▸ Pa-234m ——▸ Pa-234 ——▸ U-234
U-234 ——▸ Th-230

Result of decaying 1 curie of U-238 for 365.25 days:

Nuclide	Half-life	Branching from parent	Fraction	Curies
U-238	44.680E+08 y	(parent)	1.0000E+00	1.0000E+00
Th-234	2.410E+01 d	1.000	9.9997E-01	9.9997E-01
Pa-234m	1.170E+00 m	1.000	9.9997E-01	9.9997E-01
Pa-234	6.700E+00 h	0.0016	1.6000E-03	1.6000E-03
U-234	2.445E+05 y	0.9984	2.5610E-06	2.5610E-06
U-234	2.445E+05 y	1.000	4.0991E-09	4.0991E-09
Th-230	7.700E+04 y	1.000	1.0545E-11	1.0545E-11

References

Amdur, M.O., Doull, J., and Klaasen, C.D. 1991. Casarett and Doull's Toxicology. Fourth Edition. Pergammon Press.

BEIR IV, 1988. Health Risks of Radon and Other Internally Deposited Alpha-Emitters. Committee on the Biological Effects of Ionizing Radiations. National Academy Press, Washington, D.C.

Health Effects Assessment Summary Tables, 1992. USEPA, Office of Emergency and Remedial Response, Washington, D.C. 20480.

ICRP, 1979. International Commission on Radiologic Protection. Publication 30, Part I including Addendum. Limits for Intakes of Radionuclides by Workers. Vol. 2, No. 3/4, 1979. Pergamon Press.

IRIS Computerized Database. Updated March, 1993.

NCRP, 1984. Exposures from the uranium series with emphasis on radon and its daughters. NCRP Report No. 77. Bethesda, MD, National Council on Radiation Protection and Measurements.

Periodic Table Of the Elements v. 2.0, 1992. A software program by SMI Corporation, Tulsa, Oklahoma.

RADDECAY 2.02, 1987. A software program on radioactive decay information for the public domain by Grove Engineering, Inc., Rockville, Maryland.

Toxicological Profile for Uranium, 1990 (Draft). Agency for Toxic Substances and Disease Registry, U.S. Public Health Service.

Cesium

Introduction

Cesium is a soft, light, silvery-white alkali metal. It was discovered in Germany in 1860. It is found in pollucite and as trace in one epidolite. It is used to remove air traces in vacuum tubes, and, since it readily ionizes, it is used as an ion rocket motor propellant.

Physicochemical Characteristics

Group: Alkali metals
Crystal structure: cubic body centered
Atomic number: 55
Atomic weight: 132.9054
Shells: 2, 8, 18, 18, 8, 1
Filling Orbital: 6s1
Melt: 28.5 C
Boil: 678.4 C
Electronegativity: 0.79
Covalent radius: 2.35 A
Atomic radius: 3.34 A
Atomic volume: 71.07 cm^3/mol
First ionization potential: 3.894 V
2nd ionization potential: 25.10 V
Oxidation states: 1
Density @ 293 K: 1.873 g/cm^3
Specific heat: 0.24 J/gK
Heat of vaporization: 67.740 kJ/mol
Heat of fusion: 2.092 kJ/mol
Electrical conductivity: 0.0489 10^6/cm ohm
Thermal conductivity: 0.359 W/cmK

Element Nuclides

Nuclide	Abundance	Weight	Half-life
Cs126	0%	126	1.64 m
Cs129	0%	129	1.336 d
Cs131	0%	131	9.69 d
Cs132	0%	132	6.48 d
Cs133	100%	33.9054	
Cs134	0%	134	2.065 y
Cs134m	0%	134	2.91 h
Cs135	0%	135	2.3E+06 y
Cs136	0%	136	13.16 d
Cs137	0%	137	30.17 y
Cs138	0%	138	32.2 m
Cs139	0%	139	9.3 m

Metabolic Data

Data from Reference Man (ICRP 1975)

Cesium content of the body	1.5 mg
of the muscle	0.57 mg
of the bone	0.16 mg
Daily intake in food and fluids	10 μg

Studies conducted on cesium uptake to blood have indicated that commonly occurring compounds of cesium are rapidly and almost completely absorbed from the gastrointestinal tract. In addition, available evidence indicates that cesium is distributed uniformly throughout all organs and tissues in the body (ICRP 1979).

Carcinogenic Toxicity

Cesium is listed as a Class A carcinogen. Slope factors have been published in the HEAST for assessing risk from exposure to several cesium isotopes. Cs-137 is the parent isotope for a separate decay chain.

Risk from exposure to the decay products can be addressed in part by using the "plus daughter" slope factors for Cs-137, as indicated in HEAST. Slope factors are given for external exposure (primarily gamma radiation), oral exposure, and inhalation exposures (alpha and gamma radiation). Other components of risk from exposure include the risk from the *progeny* of cesium.

Cancer Risk Slope Factors (HEAST 1992)	Oral risk/pCi	External risk/pCi	Inhalation risk/pCi
Cs-137	2.8E-11	0.0E+00	1.9E-11
Cs-137+D	2.8E-11	2.0E-06	1.9E-11

Decay Chains

Cs-137

Cs-137 ——→ Ba-137m ——→ stable

Result of decaying 1 curie of Cs-137 for 0.0 days:
No daughters activity because parent fraction is >0.9999999

Nuclide	Half-life	Branching from parent	Fraction	Curies
Cs-137	30.17E+00 y	(parent)	1.0000E+00	1.0000E+00
Ba-137m	2.552E+00 m	0.9460	0.0	0.0

References

Amdur, M.O., Doull, J., and Klaasen, C.D. 1991. Casarett and Doull's Toxicology. Fourth Edition. Pergammon Press.

Health Effects Assessment Summary Tables, 1992. USEPA, Office of Emergency and Remedial Response, Washington, D.C. 20480.

ICRP 1975. International Commission on Radiologic Protection. Publication 23. Report of the Task Group on Reference Man. Pergamon Press, Oxford, 1975.

ICRP 1979. International Commission on Radiologic Protection. Publication 30, Part I including Addendum. Limits for Intakes of Radionuclides by Workers. Vol. 2, No. 3/4. Pergamon Press, Oxford, 1979.

Periodic Table Of the Elements v. 2.0, 1992. A software program by SMI Corporation, Tulsa, Oklahoma.

RADDECAY 2.02, 1987. A software program on radioactive decay information for the public domain by Grove Engineering, Inc., Rockville, Maryland.

Derivation of Alternate RfDs for Mercury Compounds

DERIVATION OF ALTERNATE RFDS FOR MERCURY COMPOUNDS

Mercury, a toxic heavy metal, is the principal contaminant of concern at EFPC. Evidence of mercury toxicity is replete, as documented from human and experimental animal studies performed for over a century. Moreover, metallic mercury and various mercurial compounds are known environmental toxicants. No oral and inhalation RfDs for mercury are currently available with EPA (EPA 1992f). The Agency RfD work group is currently evaluating the chronic health effects data on mercury for its potential noncarcinogenic effects. In the interim, however, EPA has published a tentative oral RfD of 0.0003 mg per kg per day for inorganic mercury based on the induction of immune-type glomerulonephritis (GN) by mercuric chloride in Brown-Norway rats (EPA 1991f). Selection of an autoimmune-type disease observed in sensitive rat strains exposed to very low levels of mercury as the basis for deriving the RfD is a critical problem with the interim RfD. Subsequent sections will describe other limitations in detail and propose alternate RfDs based on the aqueous solubilities of inorganic mercurial compounds.

As a principal contaminant of concern at EFPC, information on the physicochemical properties of mercury was considered crucial in order to estimate more accurately the intrinsic public health and environmental hazards posed by mercury contamination in the creek and floodplains of EFPC. During the RI, chemical analysis of the soil samples collected from the floodplains indicated that mercury was predominantly present in an insoluble form, probably as mercuric sulfide (Revis et al. 1989). Since the toxicity of mercury closely parallels its solubility in the aqueous media, and the existing RfD for mercury is based on the toxicities of mercuric chloride (a highly soluble form of mercury), a detailed examination of the toxicity of inorganic mercurial species was considered necessary to evaluate the toxicities of mercury contamination at EFPC.

SAIC and ORNL worked jointly on a review of the available toxicity information in the literature. The objective was to evaluate the existing scientific literature and determine if sufficient data were available to reassess the inherent toxicity of inorganic mercury species. As a result of this effort, alternate RfDs have been derived and are presented for review in this report. However, these values are not used in the BRA. The RfD of 3×10^{-4} is currently found in the EPA HEAST compilation (FY92)*. SAIC, in discussions with EPA Region IV, has agreed that no alternate RfDs will be used unless EPA ORD has given its approval.

General summary on toxicity

Acute exposure to elemental mercury is not highly toxic, although a massive single dose causes severe hemorrhage of the kidney, brain, heart, colon, and lung. Inhalation of high concentrations of mercury vapor cause pneumonitis, bronchitis, chest pain, dyspnea, coughing, stomatitis, gingivitis, salivation, and diarrhea.

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*Note: There is not a current listing on the IRIS data base.

Chronic exposure to mercury vapor results in disturbances of the central nervous system, kidney, and gastro-intestinal tract. Effects on the central nervous system are characterized by psychic and emotional disturbances. Increased irritability, combativeness, defective patterns, ocular disturbances, and tremors may occur. Most of the nervous system manifestations are reversible, although slowly in a few cases.

Chronic health hazard assessment of mercury (inorganic) for noncarcinogenic effects is presently under review with EPA. Based on the induction of immune-type GN by methyl chloride, an interim RfD of 3×10^{-4} mg per kg per day for mercury is currently available, although this RfD is presently under review by EPA.

Embryo toxicity and teratogenic effects of methyl mercury have been reported in various experimental animals. Mercuric chloride is considered to be teratogenic in experimental animals. However, evidences of teratogenic effects of mercury vapor are inconclusive.

Evidence of mercury as a human carcinogen is unavailable. However, metallic mercury pro-duced implantation-site sarcoma in rats (EPA 1992f; Druckery et al. 1957). Although data from studies on organic mercury are irrelevant for the determination of carcinogenicity of inorganic mercury, several organic mercurial compounds are genotoxic in various bacterial test systems.

Based on existing evidence of toxicity, regulatory agencies worldwide involved in human health and environmental protection have promulgated environmental and occupational standards and safe exposure doses for mercury and its organic and inorganic derivatives. Table N.1 summarizes the existing standards for mercury and its compounds.

Table N.1. Summary of long-term toxicity studies on mercuric chloride

Experimental Model	LOAEL/NOAEL	References
Rat (Brown-Norway)	0.64 mg/kg/d	Knoflach et al. (1986)
Rat (Wistar)	0.2 mg/kg/d	Bariety et al. (1971)
Rat (LEW and B-N)	0.86 mg/kg/d	Andres (1984)
Rat (Sprague-Dawley)	0.16 mg/kg/d	Hall et al. (1986)
Rat (Brown-Norway)	0.43 mg/kg/d	Bernaudin et al. (1981)
Rat (Sprague-Dawley)	1.7 mg/kg/d[a]	Carmignani and Boscolo (1984)
Rat (Brown-Norway)	0.021-0.06 mg/kg/d	Druet et al. (1978); Sapin et al. (1977); Bernaudin et al. (1981); Weening et al. (1978)
Horse	0.8 mg/kg/d	Roberts et al. (1982)
Human (epidemiologic)	0.008 mg/kg/d[b]	Piikivi (1989a,b,c)
Human	0.4 mg/kg/d	Friberg (1971)

[a] Higher doses were used to induce cardiovascular effects in the exposed groups. This dose may not represent the lowest observable adverse effect level.

[b] Based on chlorine-alkali workers exposed to mercury vapors (Hg^o).

Evidences for long-term toxicities of inorganic mercuric compounds

Chronic toxicity due to prolonged exposure to mercury and mercurial compounds is well-documented in the literature (see reviews by Friberg and Vostal 1972; Winship 1985). Traditionally, inorganic mercurials, such as mercuric chloride ($HgCl_2$), mercurous chloride (Hg_2Cl_2), mercuric nitrate [$Hg(NO_2)_2$], mercuric cyanide [$Hg(CN)_2$], mercuric sulfide (HgS), and mercuric iodide (HgI_2), have been used as topical antiseptics and disinfectants, antibacterials (HgS), and as a cathartic (Hg_2Cl_2) in human and veterinary medicine.

Chronic exposure scenarios of human exposure to mercury and mercurial compounds can be broken down into the following categories:

- chronic exposure to inorganic mercurials as therapeutic agents;
- long-term exposure to metallic mercury (Hg^o) vapors in an occupational setting; and
- chronic exposure to organic mercurials from food, particularly exposure from eating fish contaminated with methyl mercury.

Long-term exposures to low levels of mercurials from epidemiologic (occupational or environmentally related exposures) and clinical studies on poisoning due to therapeutic uses in general have yielded the following adverse effects:

- Accumulation of mercury and mercurial compounds in various parts of the body, such as the kidney, brain, liver, and bone.
- Manifestation of clinical symptoms suggesting weak to marginally increased disturbances in the central nervous system, cardiovascular system, and psychological performance. However, exposures to high concentrations of mercury and mercurial compounds for a relatively shorter duration have produced profound effects, including irreversible damage of the kidney, CNS, and hematopoietic system. Likewise, some clinical studies on patients ingesting laxatives containing mercurous chloride for 20 to 35 years have demonstrated irreversible damage to the kidney, CNS, and hematopoietic system (Tylor 1965; Gritzka and Trump 1968; Wands et al. 1974; Conso et al. 1980).
- Lowest doses for the relative chronic oral toxicity of inorganic and organic mercurials in humans are estimated as 0.4 mg per kg per day (based on 28 mg/d), and 0.004 mg per kg per day (based on 0.3 mg/d, respectively [Friberg 1971]). Based on relative chronic oral toxicity values, inorganic mercurials are approximately 100-fold less toxic than methyl mercury.

Toxicity classification based on solubility was considered relevant, since significant differences in the toxicities of soluble and less soluble forms of mercury have been reported.

In order to consider the effects of solubility of various inorganic mercurial compounds on toxicity, the available evidences were broadly classified into two categories: those with more soluble inorganic mercurials, such as mercuric chloride, and mercuric nitrate; and those with less soluble inorganic mercurial compounds, such as mercuric sulfide.

Evidences of Long-term Renal Toxicities for More Soluble Mercury Species. Inorganic mercurial compounds, such as mercuric chloride, mercuric nitrate, and organic mercurial compounds, are comparatively more soluble in water than mercuric sulfide and mercuric sulfate. Among the more soluble mercury species, mercuric chloride and methyl mercury are the most toxic. Literature is replete with studies reporting short- and long-term renal toxicities of soluble mercuric compounds, such as $HgCl_2$ and methyl mercury, in humans and experimental animals. However, only mercuric chloride toxicity data will be reviewed in this report for the derivation of an alternative oral RfD.

Allergic reactions involving the skin and kidney in humans exposed to mercuric chloride are not uncommon (Kazantzis et al. 1962, 1977; Mandema et al. 1963). In experimental studies, mercuric chloride was able to induce anti-glomerular basement membrane (GBM) antibodies in syngeneic Brown-Norway (BN) rats (Druet et al. 1977, 1978; Sapin et al. 1977; Bernaudin et al. 1979, 1981), PVG/c rats (Weening et al. 1978), and rabbits (Roman-Franco et al. 1978). Induction of immune-type GBM-induced nephrotoxicity was observed in experimental animals exposed chronically to mercuric chloride via subcutaneous (Druet et al. 1977, 1978; Sapin et al. 1977; Weening et al. 1978; Bernaudin et al. 1978), oral, and inhalation (Bernaudin et al. 1981) routes. However, induction of an extremely sensitive, immunologically mediated effect in hypersensitive BN rats is the basis for the existing interim oral RfD for inorganic mercury (EPA 1992f).

Druet et al. (1978) reported induction of immune-type GN in BN rats exposed to mercuric chloride by subcutaneous route. In this study, BN rats of either sex were administered mercuric chloride by subcutaneous route at doses of 0, 5, 10, 25, 50, 100 or 200 μg/100 g body weight, three times a week for periods ranging from 8 to 12 weeks (Druet et al. 1978). During the exposure regimen, 24-hour urinary protein levels were analyzed twice a week in 52 rats belonging to various dosed and control groups during the first 0 to 20 days, and then once a week. Histologic and immunologic examinations of the kidney were performed on a few rats belonging to various dosed and control groups (Druet et al. 1978).

Twenty-three out of 30 rats belonging to 200 and 100 μg/100 g body weight dose-groups died during the first month of the exposure regimen. They were anuric and had a serum creatinine level of 9.9 to 12 mg%. However, only six rats died among the 18 belonging to 25, 10, and 5 μg/100 g body weight groups; all rats belonging to the 10 μg group survived up to the end of the experiment (Druet et al. 1978).

Groups exposed to 10 and 5 μg/100 g body weight were relatively free from the toxic symptoms observed in the higher dose groups. In most of the 10 and 5 μg/100 g groups, immunofluorescent analysis of the kidney samples indicated only a weak granular, mesangial pattern of anti-rat IgG anti-serum fixation, suggesting a low level of toxic response. Likewise, proteinuria was not detectable in the 5 μg/100 g group, although it was observed in most of the rats belonging to the higher dosed groups. Serum protein profiles of 5 μg/100 g

groups for albumin, ($\alpha_1 + \alpha_2$), and creatinine were comparable to the background levels in the controls. Based on these observations, 0.021 mg per kg per day was identified as the LOAEL for mercuric chloride to induce immune-type GN in the sensitive BN rats. The LOAEL was calculated as estimated daily intake dose based on the 5 μg/100 g body weight for 3 times a week regimen adopted in the study (Druet et al. 1978).

In a similar study, Sapin et al. (1977) reported induction of anti-GBM antibodies in BN rats exposed to $HgCl_2$. In this study, $HgCl_2$ was administered subcutaneously to groups of BN rats three times a week for 2 weeks with 0.1 mL of a 2 mg/mL solution of $HgCl_2$. A total of 0.2 to 1.2 mg of $HgCl_2$ was administered over a 15-day period. Anti-GBM antibodies in the kidneys were present in all of the exposed groups, as revealed by a combination of histological and immunological evidence.

Induction of a biphasic renal disease was reported in BN rats exposed chronically to $HgCl_2$ (Bernaudin et al. 1979). The biphasic renal disease, characterized as systemic immunologic disease, consisted of a first stage where anti-GBM antibodies were detected in the kidney, and a second stage where an immune complex (IC)-type glomerulonephritis was observed. Induction of two-stage glomerular disease in rats exposed to $HgCl_2$ was reported earlier by Druet et al. (1978) and Sapin et al. (1977).

In this study, 7 to 9 week old male and female BN rats received $HgCl_2$ subcutaneously three times a week for up to 16 weeks. $HgCl_2$ doses used in this study were 5, 10, 50, 100, and 200 μg $HgCl_2$/100 g body weight. Immunohistological and ultrastructural studies of the lung, spleen, and liver were performed on exposed and control groups.

A linear pattern of fixation of anti-basement membrane (BM) antibodies as measured by fluorescence spectroscopy was observed in exposed groups. Fixation was particularly intense in the spleen, and was granular in the lung, liver, intestine, and heart. Control groups did not demonstrate a linear or granular pattern of anti-BM fixation (Bernaudin et al. 1979). During the second stage, deposits characteristic of IC were observed in all vascular structures and the extent of deposition varied with the administered doses of $HgCl_2$. However, the IC deposits had no major pathological modifications in the vital tissues, as revealed by light microscopy. Following reports of immune-type nephrotic disease in BN rats, formation of IC deposits along the glomerular basement membrane and in the mesangial area was reported in PVG/G rats exposed to $HgCl_2$ (Weening et al. 1978).

Induction of IC deposits in various vital organs of rabbits injected with $HgCl_2$ was reported (Roman-Franco et al. 1978). In this study, New Zealand rabbits received 2 mg $HgCl_2$ by subcutaneous route three times a week for 3 weeks and were observed for up to 28 weeks thereafter. Membranous glomerulonephritis developed 1 to 2 months with granular subepithelial deposits containing rabbit IgG and C3. Similar deposits were present in the basement membranes of other organs. The results of this study were consistent with the earlier findings that $HgCl_2$ induces a biphasic disease characterized first by the production of antibodies to BMs and the extracellular collagen matrix, and subsequently immune complexes formed both *in situ* and in circulation.

Bernaudin et al. (1981) reported for the first time induction of systemic autoimmune nephrotic disease in BN rats exposed to organic and inorganic mercurials via oral and inhalation routes. In this study, $HgCl_2$ was administered by intratracheal instillation or by aerosol containing varying concentrations of $HgCl_2$ ranging from 6 to 75 μg/100 g body weight per week. Groups receiving $HgCl_2$ by oral route were forcibly fed an oral dose of 300 μg/100 g body weight per week for 2 months. The exposure and observation period ranged from 15 to 60 days for both oral and inhalation routes.

A linear pattern of fixation of the fluoresceinated anti-rat IgG antiserum along the glomerular capillary wall and mesangium was observed in the high-dosed group. However, no fixation was observed in groups exposed to the lowest doses of $HgCl_2$ (6 and 11 μg in the inhalation exposure group) throughout the study. A weak to moderate proteinuria was observed in rats depending upon the exposure route and exposure doses. Heavy proteinuria was observed in groups receiving $HgCl_2$ by subcutaneous route, whereas a weak proteinuria was observed in aerosol exposed groups. Proteinuria was not observed in the lowest dosed groups.

Evidences of Long-term Toxicities for Less Soluble Mercury Species. Inorganic mercurial compounds, such as mercuric sulfide, mercuric subsulfate, mercuric sulfate, and mercuric thiocyanate, are comparatively less soluble in water than mercurial halides and organic mercurial compounds. Among the less soluble mercury species, mercuric sulfide is the least soluble and most prevalent form of inorganic mercurial compounds. Limited oral exposure studies are available, which use animals to examine the long-term toxicities of the relatively insoluble mercuric sulfide.

Revis et al. (1989) conducted feeding studies using male and female Swiss mice receiving mercury-contaminated soil in the diet for up to 20 months. In this study, 30 groups of 40 male and 40 female mice were fed a diet *ad libitum* containing 5% soil or sediment taken from 30 sampling sites along the mercury-contaminated EFPC. Prior chemical analysis of the soil and sediment samples indicated that mercury concentrations ranged from 0.59 to 1799 ppm. A predominant fraction of the mercury in these samples was found to be insoluble (88% mercuric sulfide and 7% elemental mercury). Methyl mercury was detected at levels of 0.01%.

Various concentrations of mercury-containing soil in the diet were fed *ad libitum* to groups of rats. However, there were no control groups for mercury exposure in the exposure protocol. Depending on the sampling site used as the source for the mercury-contaminated soil or sediment, mercury intakes ranged from 0.1 to 392 μg Hg/d for male mice and 0.1 to 282 μg Hg/d for female mice. At 6, 12, or 20 months of treatment, body weights, mortality, neurobehavioral testing, and histopathology of the kidney and liver from mice of each group were examined. At 6 months of exposure, three pairs of mice from each exposure group also were selected for reproductive toxicity studies.

In this study, no significant differences in body weight were observed among the 30 treatment groups. Although the absence of control groups prohibited a comparison with animals with no mercury intake, analysis of mortality data failed to show a correlation between mortality and mercury intake. An exposure-related increase in the levels of mercury

in the kidney and liver of exposed mice was observed. The liver-to-kidney ratio of mercury (wet weight) was similar to that reported for inorganic mercury (0.01 to 0.21) as opposed to that for methyl mercury (0.6 to 0.9). Examination of the kidneys revealed no significant evidence of exposure-related pathology in 87% of female mice and 85% of male mice ingesting mercury-containing soil for over a 6-month period. The remaining mice showed only minor proximal tubule damage.

Histologic examinations at 12 months of exposure indicated normal kidney structure and function status in 90% of the male mice and 94% of the female mice. Similar results were noted for the mice exposed for up to 20 months. It was reported that the mercury concentrations in the kidneys of exposed mice did not exceed 20 μg Hg/g kidney (wet weight). Overall, the authors concluded that the long-term ingestion by mice of contaminated soil containing mercury levels as high as 1799 ppm (corresponding to 392 and 282 μg Hg/d for males and females, respectively) did not result in significant signs of exposure-related toxicity as determined by mortality rates, liver and kidney histopathology, or neurobehavioral responses. Litter sizes of mice exposed for 6 months to a diet containing soil with various concentrations of mercury were not significantly different among the exposure groups. However, no comparison was made with historical or concurrent controls. Based on these findings, the animal dose of 392 μg Hg/mouse (13.07 mg Hg per kg per day for a 30 g mouse) can be identified as a NOAEL.

Sin et al. (1983) compared the uptake and distribution of soluble mercuric chloride ($HgCl_2$) and relatively insoluble (HgS) forms of mercury in mice. $HgCl_2$ or HgS (equivalent to 100 μg Hg/mouse) was administered to groups of 15 C3H mice (males and females, 20 to 25 g) by gavage three times per week for 8 weeks (10-week treatment for HgS derived from laxative pills). The HgS was administered in a purified form (purchased from Merck, West Germany) or as a crude product (derived from powdered laxative pills [P.C.®] that contained crude mercuric sulfide). An untreated group of 15 mice served as controls. An adjusted animal dose of 1.90 mg Hg per kg per day is obtained by using the median of the body weight range (22.5 g) and adjusted for the discontinuous exposure (3 days/7 days). Groups of mice receiving $HgCl_2$ exhibited significant accumulation of Hg in various organs, with the spleen and kidney containing the highest concentrations (7.7 and 19.1 μg/g wet weight, respectively). However, accumulation of Hg in the groups receiving either form of HgS was not significant (0.26 and 0.34 μg/g wet weight for spleen and kidneys of pure HgS treatment; 1.04 and 0.30 μg/g wet weight for laxative pill-derived HgS).

Histochemical analyses confirmed the presence of Hg in tissues of the $HgCl_2$ and HgS treated mice and showed no accumulation in the tissues of control mice. Histopathological examination of various organs from the mercury-treated mice was negative. Although the distribution pattern was similar for both the soluble and insoluble forms of mercury, the absorption and tissue burden following gavage treatment with the pure and crude insoluble forms were negligible. Furthermore, no evidence of toxicity was observed in any of the mice treated with any of the mercury compounds. Based on these findings, the adjusted animal dose of 1.9 mg per kg per day can be identified as the NOAEL. Studies using animal models have provided additional evidence for the minimal absorption of mercuric sulfide following oral exposure. Gastrointestinal absorption of inorganic mercury salts from the diet is less than 15% in mice and approximately 7% in humans (Goyer 1991).

In a study by Revis et al. (1990), 0.3 mL of a slurry containing approximately 1×10^5 dpm ^{203}HgS, deionized water, and powdered rat chow was administered by gavage to five male Swiss mice (26 ± 1.8 g). The mice were allowed feed and water *ad libitum* after dosing, and fecal samples were collected for 10 days. Analyses of fecal radioactivity and residual radioactivity in the gastrointestinal tract indicated that only 0.4% of the ^{203}HgS dose had been absorbed. In contrast, experiments using $^{203}HgCl_2$ showed that 2.1% of the gavage dose was absorbed.

Three groups (two males and two females) of Swiss mice (20 to 25 g) were fed a diet containing mercuric sulfide (2.98 mg/g), cinnabar (0.13 mg/g), or a control diet for 7 days (Yeoh et al. 1986). Food and water was available *ad libitum* during the entire study period. The investigators estimated the mercury intake to be 0.0004, 7.32, and 0.27 mg per mouse per day for the control, mercuric sulfide, and cinnabar-treated groups, respectively (equivalent to approximately 0.000002, 0.33, and 0.010 mg/g/d).

Absorption of mercury from the exposed groups was 9- to 16-fold above the controls, as verified by the urinary output levels. Liver and kidney mercury levels (0.637 ± 0.11 μg/g liver and 2.688 ± 0.67 μg Hg/g kidney) in mice receiving HgS were 20 and 38 times greater, respectively, compared with those of control mice. Although toxicological assessments were not performed on any of the mice, the data show that mercuric sulfide undergoes limited absorption following short-term oral exposure.

In a more recent report by Yeoh et al. (1989), the aforementioned data were presented along with absorption data for two human subjects taking five mercuric sulfide pills (14.59 mg Hg/g) three times per day for a single day (total intake equivalent to 38.5 mg HgS). The urinary excretion of mercury was monitored for 3 days in one subject and 2 days in the other subject. First-day urinary mercury excretion for the subjects was 4.5-fold (20.34 μg Hg/day) and 3.3-fold (3.3 μg Hg/day) greater, respectively, than control outputs (4.51 μg Hg/day) prior to taking the pills. The urinary mercury declined over the monitoring period, but remained elevated relative to the control values. Based on the reported HgS intake (38.5 mg) and the total urinary mercury output over the 2- to 3-day monitoring period, mercury absorption by the human subjects was approximately 0.2% (based on 3-day monitoring) and 0.1% (based on 2-day monitoring). Because urinary mercury levels at the end of the monitoring period were still elevated above those of the control values, the actual mercury absorption was no doubt greater. A further analysis of the mouse data originally reported in Yeoh et al. (1986) showed that mice receiving the mercuric sulfide preparation received approximately 3.005 mg Hg per mouse per day, which represented 0.05% absorption of mercury.

Alternate reference dose derivation for mercury compounds

Noncancer risk assessment is based on a toxicity benchmark dose known as the RfD. The RfD is defined as an estimate (with uncertainty spanning perhaps an order of magnitude) of daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime (EPA 1992f).

The RfD is a chemical-specific toxicity parameter derived from evidences of systemic toxicity from epidemiological/experimental studies. The dose corresponding to the highest NOAEL or LOAEL in the absence of a NOAEL, for a critical adverse effect in a sensitive population is selected as the basis for the derivation of the RfD for a specific chemical. The RfD is then derived by dividing the NOAEL (or LOAEL) by appropriate factors to account for uncertainties in the toxicity data base and to protect sensitive human populations (Barnes and Dourson 1988; EPA, 1992f, 1989a).

No RfDs for inorganic mercury are currently available on IRIS (EPA 1992f). The EPA RfD work group on mercury is currently involved in the reassessment of the available evidence of mercury toxicity for its noncarcinogenic effect. However, HEAST, published annually by EPA's ORD, has listed a tentative dose of 0.0003 mg per kg per day as an interim RfD for inorganic mercury for both oral and inhalation routes (EPA 1992e).

The available interim RfD for inorganic mercury is based on the induction of glomerulonephritis, an autoimmune-type nephrotic disease in BN rats (EPA 1992f). Following the reports of induction of an immune-type glomerulonephritis in BN rats, various strains of rats were examined for susceptibility for $HgCl_2$-induced, immune-type adverse effect on the kidney. Although immune complex-type glomerulonephritis was induced in inbred strains of rats (Wistar, PVG/C), the extent and severity of response was lower in comparison to the response of BN rats. Wild and several other inbred strains of rats (Lewis, Wistar AG, August, PVG/c) were unresponsive to $HgCl_2$-induced glomerulonephritis under identical experimental conditions (Sapin et al. 1977; Hall et al. 1986). Studies with hybrids (F_1, F_2, and $F_2 \times$ LEW) indicated a genetic predisposition to primary immunological response, such as fixation of basement membranae antibodies in the induction of renal immune diseases. The response was found to depend on the presence of two or three genes, one of which was H-1 linked, whereas LBN congeneric rats devoid of these genetic loci were nonresponsive to $HgCl_2$ renal toxicities (Druet 1977).

Allergic reactions, following exposure to inorganic or organic mercurials involving the kidney or the skin, are not uncommon (Kazantzis 1978). Literature is replete with studies reporting proteinuria and nephrotic syndrome in humans following occupational or therapeutic exposures. Likewise, experimental studies on immunologically responsive strains of rats and rabbits exposed to $HgCl_2$ by subcutaneous, oral, or inhalation routes have yielded evidence of idiosyncratic reactions involving the kidney, lung, and liver. Since $HgCl_2$-induced adverse effects on the kidney are essentially an idiosyncratic response of some highly sensitive strains of rats, adoptability of glomerulonephritis as the toxicity basis for deriving the RfD is receiving considerable scrutiny and criticism by the scientific community in EPA and elsewhere.

A major consideration in the use of idiosyncratic effects as the basis for assessing toxicities at the population level is that the untoward effects may appear at a much lower level than those usually seen in the general population, thus influencing conservatively the dose-response relationships. Since the doses of $HgCl_2$ required to elicit glomerulonephritis in rats and rabbits appear to be in the range normally associated with sensitive immunologic effects, the available interim oral RfD for inorganic mercury is a highly conservative estimate of the potential oral toxicities of the more soluble inorganic mercurial compounds.

In order to address the deficiencies in the existing mercury oral RfD, an effort was made to identify plausible alternative RfDs for inorganic mercury. Instead of a single RfD for all of the inorganic species, the systemic toxicity data of inorganic mercury was classified as evidence of toxicities for more soluble mercury species, and evidence of toxicities for less soluble mercury species. Depending upon the extent and quality of the available data under each category, an effort was made to derive an alternative oral RfD for mercuric chloride as a typical soluble inorganic species and for mercuric sulfide as the typical insoluble form of mercury.

Rationale for Separate RfDs for Soluble and Insoluble Forms. Mercury exists in several oxidation states, including Hg^{o} (metallic), Hg_2^{2+} (mercurous mercury), and Hg^{2+} (mercuric mercury). Apart from elemental metallic mercury, mercury compounds present in the environment are of organic and inorganic types. Organic and inorganic forms are biotransformed and recycled in the environment with relative ease at a fairly rapid rate.

Mercury exists in both inorganic (e.g., mercuric and mercurous chloride, mercuric sulfide, and mercurous sulfate) and organic (e.g., methyl mercury, ethyl mercury, and phenyl mercury) forms, as well as elemental mercury vapor. Although all mercury-containing compounds are potentially toxic if absorbed (primarily by inhalation and dermal exposure), the severity and site of toxicity are often compound-specific. Organic mercurials and elemental mercury usually involve the central nervous system and inorganic mercurials involve the kidneys (Berlin 1986; Goyer 1991). Both human and animal studies have demonstrated histological and functional changes in the kidney at mercury concentrations of 10 to 49 μg/g kidney tissue (Fitz et al. 1952; Clennar and Lederer 1958). Mercury is a nonessential, cumulative toxic element for which the relationship between exposure and toxic response depends quantitatively and qualitatively on the chemical form involved in the exposure (Magos 1980). Therefore, the variability in the absorption of mercury compounds due to differences in solubility dictates the importance of the species, which determines the overall body burden and the associated risks (e.g., insoluble mercury compounds are poorly absorbed, and as a result contribute to a lesser extent to the body burden of mercury and toxicities).

Two characteristics, volatility and biotransformation, make mercury unique as an environmental toxicant. Volatilization is reduced by conversion of metallic mercury to complexed species, particularly biotransformation by bacteria into short-chain alkyl mercury compounds. However, conversion of mercury to methyl and dimethyl forms remobilizes mercury in the aquatic systems. Adsorption onto suspended and bed sediments is probably the most important process that determines the environmental fate of mercury in the aquatic environment.

Human health risk assessments involving exposure to mercury contamination in the soil must suitably account for the chemical species of mercurial compounds present in the environment, and other toxicity considerations. In a study on mercury in the waters, sediment, and benthonic organisms along Chai-I coastal areas, the presence of mercurial chlorides ($HgCl^+$, $HgCl_2O$, $HgCl_3$), bromides ($HgBr^+$, $HgBr_2O$, HgBrClO), and sulfates was detected at significant levels (Hung and Lin 1976). In a recent study, analysis of soil samples obtained from 30 sampling sites along the mercury-contaminated EFPC indicated that 88% of

the total mercury in the soil was present as the insoluble mercuric sulfide and 7% as elemental mercury (Revis et al. 1989, 1990).

Alternate RfD for Mercuric Chloride as Soluble Mercury. The studies by Druet et al. (1978) and Bernaudin et al. (1981) on the induction of immune-type GN in BN rats exposed to mercuric chloride were selected as the principal studies for the derivation of an oral RfD for mercuric chloride.

In the Druet et al. (1978) study, BN rats of either sex were administered mercuric chloride by subcutaneous route at doses of 0, 5, 10, 25, 50, 100 or 200 μg/100 g body weight, three times a week for periods ranging from 8 to 12 weeks (Druet et al. 1978). During the 24-hour exposure regimen, urinary protein levels were analyzed twice a week in 52 rats belonging to various dosed and control groups during the first 0 to 20 days, and then once a week. Histologic and immunologic examinations of the kidney were performed on a few rats belonging to various dosed and control groups (Druet et al. 1978).

Twenty-three out of 30 rats belonging to the 200 and 100 μg/100 g body weight dose groups died during the first month of the exposure regimen. The rats were anuric and had a serum creatinine level of 9.9 to 12 mg %. However, only 6 rats died among the 18 belonging to the 25, 10, and 5 μg/100 g body weight groups; all rats belonging to the 10 μg group survived up to the end of the experiment (Druet et al. 1978).

Groups exposed to 10 and 5 μg/100 g body weight were relatively free from the toxic symptoms observed in the higher dose groups. In most of the 10 and 5 μg/100 g groups, immunofluorescent analysis of the kidney samples indicated only a weak granular, mesangial pattern of anti-rat IgG anti-serum fixation, suggesting a low level of toxic response. Likewise, proteinuria was not detectable in the 5 μg/100 g group, although it was observed in most of the rats belonging to the higher dosed groups (Druet et al. 1978). Serum protein profiles of 5 μg/100 g groups for albumin, ($\alpha_1 + \alpha_2$), and creatinine were comparable to the background levels in the controls. Based on these observations, 0.021 mg per kg per day was identified as the LOAEL for mercuric chloride to induce immune-type GN in the sensitive BN rats. The LOAEL was calculated as estimated daily intake dose based on the 5 μg/100 g body weight three times a week regimen adopted in the study (Druet et al. 1978).

Supporting Evidences. In a related study, Bernaudin et al. (1981) reported for the first time induction of systemic immune GN in BN rats receiving low doses of mercurial compounds by inhalation and ingestion routes.

In this study, BN rats of either sex were administered mercuric chloride by intratracheal instillation or by aerosol at doses of 6, 11, 45, or 75 μg/100 g body weight, once a week for periods ranging from 2 to 20 weeks. Control groups received acid water by aerosolization or forcible feeding. Histologic and immunologic examinations and tests for proteinuria were conducted on few rats belonging to various dosed and control groups (Bernaudin et al. 1981).

After two weeks of the exposure regimen, a linear pattern of fixation of the fluorescent anti-rat IgG serum was observed along the glomerular capillary wall and mesangium in the

high-dosed groups. However, no fixation of anti-IgG was evident in the lowest dosed groups.

At the end of the exposure period (60 days), a granular or mixed pattern of fixation of anti-rat IgG conjugate was observed in all dosed groups, except the rats receiving the lowest doses of $HgCl_2$. No significant proteinuria was observed in groups exposed to the lowest doses of $HgCl_2$ by digestive and inhalation (aerosol) routes, whereas weak proteinuria was reported in groups receiving $HgCl_2$ by the subcutaneous route (Bernaudin et al. 1981).

Based on the evidence that groups receiving 6 μg/100 g throughout the entire experimental period did not demonstrate $HgCl_2$-induced autoimmune response as evidenced from fixation of anti-rat IgG antibodies, an adjusted dose of 9 μg per kg per day was identified as the NOAEL. Minimal fixation of IgG anti-bodies to the kidney, lung, and spleen was observed by the end of the exposure period in the 11 μg/100 g dosed groups. The adverse effects corresponding to the dose of 11 μg/100 g were considered as the LOAEL, and the adjusted dose of 16 μg per kg per day was identified as the LOAEL.

Discussion on the Confidence. The studies on the induction of immune-type GN by mercuric chloride in sensitive BN rats demonstrate the potential for renal toxicity in sensitive populations exposed to $HgCl_2$ (Druet et al. 1978; Bernaudin et al. 1981). A wide range of exposure doses was used in these studies and the group size was satisfactory. A well-defined, highly specific toxic end effect characteristic of mercurial compounds and other toxic heavy metals (i.e., immune-type GN) was measured using standard biochemical methods.

Allergic reactions of the skin and kidney in humans and experimental animals exposed to heavy metals are well-documented in the literature (Kazantzis et al. 1962, 1967; Mandema et al. 1963; Goyer 1991). Involvement of immunologic components is implicated in systemic autoimmune diseases of the kidney and skin induced by mercurial compounds in sensitive human subpopulations and various sensitive strains of experimental animals. The limitations in the principal studies are as follows:

- Immune-type GN is an autoimmune disease requiring an immunologic predisposition of the animal. Responsive strains of rats (such as BN rats used in Druet et al. [1978] and Bernaudin et al. [1981]) and rabbits (New Zealand) are more susceptible to mercuric chloride-induced GN, whereas this effect is not observed in nonresponsive strains (Lewis, Wistar, AG, PVG/c). For example, Druet et al. (1978) did not observe immune-type GN in the resistant LEWS rats exposed to mercuric chloride under similar experimental conditions. Absence of anti-GBM antibodies in response to mercuric chloride exposure in LEWS rats was implicated in the apparent resistance of this strain to immune-type GN (Sapin et al. 1977). Choosing data sets on mercuric chloride toxic effects from a sensitive strain is probably more advantageous to protect the sensitive human population, although there is no direct human evidence indicating a genetic sensitivity to mercuric chloride-induced renal effects.

- The experimental design in Druet et al. (1978) and Bernaudin et al. (1981) is limited to the measurement of immune-type GN. General toxic effects in the dosed and control groups are unavailable. Details of renal biopsies performed during the course

of study were not reported. Overall pathological and histopathological examinations were not conducted at the end of the study.

- Although the authors (Druet et al. 1978) refer to the 10 μg/100 g dose as the NOAEL, the stated dose is more appropriately a LOAEL, since fixation of rat anti-sera, albeit to a lesser extent, was observed during immunofluorescent analysis in the kidney samples obtained from this group. In addition, proteinuria was observed in the 10 μg/100 g group. However, the 5 μg/100 g group was devoid of toxic effects observed in the entire study. Accordingly, 5 μg/100 g was chosen as the NOAEL dose. Likewise, 6 μg/100 g was the NOAEL dose for $HgCl_2$ by the aerosol exposure (Bernaudin et al. 1981).

- The subcutaneous route adopted in the study by Druet et al. (1978) may not be critical, since bioavailability of mercurial compounds was found to be similar despite differences in the exposure routes (i.e., inhalation, parenteral, or oral) adopted (Friberg and Vostal 1972). The currently available oral RfD for mercury (0.0003 mg/kg/d) is based on data sets from an epidemiological study on the exposure of chlor-alkali workers to mercury fumes via inhalation (Piikivi 1989a,b; EPA 1991f). In addition, the NOAEL dose of 6 μg/100 g for aerosol exposure reported by Bernaudin et al. (1981) is comparable to the NOAEL dose for the subcutaneous route (Druet et al. 1978).

Uncertainty Factors and Reference Dose Derivation. In the derivation of the RfD for mercuric chloride, an uncertainty factor of 10 was included to account for interspecies extrapolation (× 10) of the animal data to assess human health effects. Normally, an uncertainty factor protecting sensitive human population is not included, since the end effect chosen in the derivation is of an idiosyncratic nature and the doses of $HgCl_2$ requiring to elicit this effect are protective of the sensitive human population. A factor of 2 was included for differences due to inter-route extrapolation of dose-response. Most of the dose-response studies on the systemic toxicities of $HgCl_2$ have adopted the subcutaneous route, except Bernaudin (1981), where the intratracheal route was adopted for the inhalation route. In addition, a single dose group received a 300 μg $HgCl_2$ oral dose, which was above the LOAEL dose. Since extrapolation of adverse effects due to the intratracheal route leads to a conservative oral RfD, a factor of 2 was considered sufficient to account for differences due to inter-route extrapolation of toxic effects. Thus, 0.001 mg per kg per day was considered to be an appropriate chronic oral RfD for more soluble inorganic mercuric species. Table N.2 summarizes the proposed oral RfD for mercuric chloride.

Table N.2. Oral RfD summary for mercuric chloride

Critical Effect	Experimental Doses	UF[a]	MF[a]	RfD
Induction of Glomerulonephritis	NOAEL: 0.021 mg $HgCl_2$/kg/d[b] LOAEL: 0.043 mg $HgCl_2$/kg/d[b]	20	None	0.001 mg $HgCL_2$/kg/d

[a] UF = uncertainty factor; MF = modifying factor
[b] NOAEL and LOAEL doses were based on the administered doses of 5 μg and 10 μg/100 g body weight, three times a week, respectively. The NOAEL and LOAEL doses represent exposure to $HgCl_2$ as mg $HgCl_2$ per kg per day.

Note: Study type is the BN rat.
Source: Druet et al. 1978.

Alternate RfD for Mercuric Sulfide as Insoluble Mercury. The study by Revis et al. (1989) used an exposure period of adequate duration and provided evidence that demonstrated no exposure-related adverse effects. Using the NOAEL of 13.3 mg HgS per kg per day derived from the Revis et al. (1989) study and applying an uncertainty factor of 300 (10 for interspecies extrapolation, 10 for protection of sensitive populations, and 3 for an incomplete data base) result in an RfD of 0.04 mg HgS per kg per day. Using the NOAEL of 2.2 mg HgS per kg per day from the Sin et al. (1983) study and applying an uncertainty factor of 1000 (10 for interspecies extrapolation, 10 for extrapolation from subchronic to chronic exposure, and 10 for protection of sensitive populations) result in an RfD of 0.002 mg HgS per kg per day. However, this value is of questionable usefulness because it is derived from a NOAEL, which provides no information regarding adverse effects.

No human data were available regarding the effects of mercuric sulfide following long-term oral exposure, and only limited data were available regarding the effects of oral administration of this compound to animals. Although mercuric sulfide is generally considered to be insoluble, and therefore, poorly absorbed, data from subchronic feeding studies using mice and limited short-term exposure data for two human subjects have demonstrated that limited absorption does occur. Additional studies have shown that subchronic (8 weeks) exposure to mercuric sulfide or chronic (2 years) exposure to mercury-contaminated soil (containing primarily insoluble mercurials, such as mercuric sulfide) in the diet resulted in no exposure-related adverse effects in mice.

In the chronic study by Revis et al. (1989), mice received dietary mercury from contaminated soil at doses as high as 13.07 mg Hg per kg per day and exhibited no significant signs of toxicity as determined by mortality, body weight, or litter sizes. Although no concurrent controls were used, the data showing only minimal proximal tubule degeneration (with no associated functional impairment) indicate this exposure to be a NOAEL. A study by Revis et al. (1990) showed that most of the mercury content of the soil from the contaminated sites was present as insoluble forms of mercury (88% mercuric sulfide and 7% elemental mercury) and that methyl mercury was detected in very small quantities (0.01%).

In addition, other soil contaminants are possible confounders in this study. The study by Sin et al. (1983) reported no observable toxic effects in mice administered mercuric sulfide (as cinnabar or as a purified medicinal preparation) by gavage at doses as high as 0.1 mg/mouse (discontinuous exposure-adjusted dose of 1.89 mg Hg per kg per day being considered a NOAEL) over an 8-week period. Both studies provided data indicating the detection tissue burdens of mercury, especially in the liver and kidney.

Both the Revis et al. (1989) and Sin et al. (1983) studies provided the animal dose data in terms of elemental mercury per kg body weight. Therefore, to derive an RfD for mercuric sulfide, an adjustment is needed to reflect the mercuric sulfide intake required to provide the elemental-equivalent mercury intake. Because the mercury-contaminated soil used in the Revis et al. (1989) study was reported to contain 88% mercuric sulfide (Revis et al. 1990), the contribution of mercuric sulfide to the NOAEL of 13.07 mg Hg per kg per day may be assumed to be 11.5 mg Hg per kg per day. Elemental mercury represents 86.22% of the molecular weight of mercuric sulfide; therefore, the NOAEL values for the Revis et al. (1989) and Sin et al. (1983) studies may be expressed as 13.3 and 2.2 mg HgS per kg per day, respectively.

In lieu of a no-data situation, an RfD of 0.04 mg HgS per kg per day for mercuric sulfide is recommended based on the absence of toxic effects in long-term feeding studies of mercuric sulfide-contaminated soil and sediment to male and female mice.

Discussion on the Confidence. The data base driving the RfD for mercuric sulfide consists of experimental results from animal studies that demonstrate an absence of biologically significant effects. The animal studies also provide some evidence showing minimal absorption of the com-pound following oral exposure. Limited human data also show that mercuric sulfide is absorbed to a limited extent. The absence of observed effects at the exposure levels tested may be the result of the minimal absorption and the consequent failure of the mercury to reach known target tissues (i.e., CNS, kidneys) at sufficient internal doses for the manifestation of toxic effects.

Based on the limited data available, the absorption kinetics for mercuric sulfide do not appear to differ significantly for humans and the tested laboratory species. Therefore, the use of an uncertainty factor for interspecies extrapolation may be unwarranted. However, this contention is somewhat tenuous pending availability of additional data, especially for human subjects. Because mercury poisoning in humans frequently involves neurobehavioral changes that are oftentimes very subtle and difficult to assess in laboratory animals, the deletion of the uncertainty factor for the protection of sensitive populations is not recommended.

Confidence in the principal study adopted in the derivation of the oral RfD for mercuric chloride is low. This is due to deficiencies in the experimental design, use of mercury-contaminated soil as the source of mercuric sulfide, and lack of information on control groups. The available data base on long-term toxicities of mercuric sulfide and the overall confidence in the recommended alternative RfD is rated as low.

Uncertainty Factors and Reference Dose Derivation. In the derivation of the RfD for mercuric sulfide, an uncertainty factor of 300 was included to account for interspecies

extrapolation (× 10) of the animal data to assess human health effects, protection of sensitive human population (× 10), and for an inadequate data base (× 3). Table N.3 summarizes the proposed oral RfD for mercuric sulfide.

Table N.3. Oral RfD summary for mercuric sulfide

Critical Effect	Experimental Doses	UF[a]	MF[a]	RfD
None	NOAEL: 19.06 mg HgS/kg/d (11.49 Hg/kg/d) LOAEL: None	300	None	0.04 mg HgS/kg/d

[a] UF = uncertainty factor; MF = modifying factor.

Note: Source type is Swiss mice, soil ingestion study.

Source: Revis et al. 1989

REFERENCES

Andres, P. 1984. IgA-IgG Disease in the Intestine of Brown-Norway Rats Ingesting Mercuric Chloride. *Clin. Immunol. Immunopathol., 30*:488-494.

Bariety, J., P. Druet, F. Laliberte, and C. Sapin. 1971. *Amer. J. Pathol., 65*:293.

Barnes, D.G., and M.L. Dourson. 1988. Reference Dose (RfD): Description and Use in Health Risk Assessment, *Reg. Toxicol. Pharmacol.*, 8:471-486.

Berlin, M. 1986. Mercury. In: Friberg, L., Nordberg, G.F., Vouk, V.B. (eds). Handbook on the Toxicology of Metals. Vol. 2, Specific Metals, 2nd ed. New York, New York: Elsevier; pp. 387-45.

Bernaudin, J.F., E. Druet, M.F. Belair, M.C. Pinchon, C. Sapin, and P. Druet. 1979. Extrarenal Immune Complex Type Deposits Induced by Mercuric Chloride in the Brown Norway Rat. *Clin. Exp. Immunol.*, 38:265-273.

Bernaudin, J.F., E. Druet, P. Druet, and R. Masse. 1981. Inhalation or Ingestion of Organic or Inorganic Mercurials Produce Autoimmune Disease in Rats. *Clin. Immunol. Immunopathol., 20*:129-135.

Carmignani, M. and P. Boscolo. 1984. Cardiovascular Homeostasis in Rats Chronically Exposed to Mercuric Chloride. *Arch. Toxicol.*, (Suppl), 7:383-38.

Clennar G. and H. Lederer. 1958. Mercurial Diuretics and Nephrosis. *Brit. Med. J.* 1:1544. (cited in Revis et al. 1989)

Conso, F., P. Carlier, M. Cohen, and A. Castot. 1980. Intoxication Mercurielle Chronique Par Laxatif a Base De Calomel. *Therapie, 35*:353-356.

Druckrey, H., H. Hamperl, and D. Schmahl. 1957. Carcinogenic Action of Metallic Mercury After Intraperitoneal Administration in Rats. *Z. Krebsforsch., 61*: 511-519.

Druet, E.; C. Sapin, E. Gunther, N. Feingold, and P. Druet. 1977. Mercurous Chloride Induced Anti-glomerular Basement Membrane Antibodies in the Rat. Genetic Control. *Europ. J. Immunol., 7*:348-351.

Druet, P., E. Druet, F. Potdevin, and C. Sapin. 1978. Immune Type Glomerulonephritis induced by $HgCl_2$ in the Brown Norway Rat. *Ann. Immunol. (Inst. Pasteur, Paris), 129(C)*:777-792.

Druet, P., P. Teychenne, C. Mandet, C. Bascou, and E. Druet. 1981. *Nephron, 28*:145.

EPA. 1989a. Risk Assessment Guidance for Superfund: Human Health Evaluation Manual Part A. Office of Solid Waste and Emergency and Remedial Response. OSWER Directive 9285.701A.

EPA. 1989b. Exposure Factors Handbook. Office of Health and Environmental Assessment. EPA/600/8-89/043.

EPA. 1989c. Risk Assessment Guidance for Superfund: Volume II Environmental Evaluation Manual. Office of Solid Waste and Emergency and Remedial Response. EPA/540/1-89/001.

EPA. 1991a. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. Office of Emergency and Remedial Response, OSWER Directive 9285.6-03.

EPA. 1991b. Health Effects Assessment Summary Tables, First Quarter FY 1991. Office of Research and Development. OERR 9200.6-303-(91-1).

EPA. 1991c. Risk Assessment Guidance for Superfund: Volume 1 - Human Health Evaluation Manual (Part B), Development of Risk-based Preliminary Remediation Goals. EPA Office of Emergency and Remedial Response. (ID)

EPA. 1991d. Interim Guidance for Dermal Exposure Assessment. Office of Health and Environmental Assessment. EPA/600/8-91/001A.

EPA. 1991f. Health Effects Assessment Summary Table (HEAST), FY 1991. Office of Research and Development.

EPA. 1992a. New Interim Region IV Guidance. February 11, 1992. Region IV, Atlanta, Georgia.

EPA. 1992b. Dermal Exposure Assessment: Principles and Applications. Office of Health and Environmental Assessment. EPA/600/8-91/001B. (IR)

EPA. 1992c. Supplemental Guidance to RAGS: Calculating the Concentration Term. Office of Emergency and Remedial Response, Hazardous Site Evaluation Division, Washington, DC. Interim Bulletin, Vol.1, No.1, OSWER 9285.7-081.

EPA. 1992d. Guidance for Exposure Assessment. 57 FR 22888, Washington, DC.

EPA. 1992e. Health Effects Assessment Summary Tables, Annual Update. Office of Research and Development. OHEA ECAO-821, March 1992.

EPA. 1992f. Integrated Risk Information System (IRIS). U.S. Environmental Protection Agency On-line Database of Toxicity Measures. Office of Research and Development, Environmental Criteria and Assessment Office, Cincinnati, Ohio. Electron Mail Account Information via TOXNET, National Library of Medicine, Bethesda, Maryland.

Fitz, O.G., A.A. Nelson, E.P. Laug, and F.M. Kunz. 1950. Chronic Oral Toxicities of Mercuri-phenyl and Mercuric Salts. *Industr. Hyg. Occup. Med.* 2:433. (cited in Revis et al., 1989)

Friberg, L. 1971. Mercury in the Environment — An Epidemiological and Toxicological Approach. Published earlier as NTIS (PB-205 000), U.S. Department of Commerce.

Friberg, L. and J. Vostal. 1972. In: Mercury in the Environment — An Epidemiological and Toxicological Approach. Chapter III. CRC Press, Cleveland, Ohio.

Goyer, R.A. 1991. Toxic Effects of Metals. In: Amdur, M.O., Doull, J., and Klassen, C.D., Eds. Casarett and Doulls' Toxicology. Fourth Edition, Pergamon Press: New York. pp. 623-680.

Gritzka, T.L. and B.F. Trump. 1968. Renal Tubular Lesions Caused by Mercuric Chloride. *Am. J. Pathol., 52*:1225-1277.

Hall, R.L., W.L. Wilke, and M.J. Fettman. 1986. Renal Resistance to Mercuric Chloride Toxicity During Prolonged Exposure in Rats. *Vet. Hum. Toxicol., 28(4)*:305-307.

Hung, T. and T. Lin. 1976. Study on Mercury in the Waters, Sediments, and Benthonic Organisms Along Chi-I Coastal Area. *Acta Oceanogr. (Taiwan), 6*:30-38.

Kazantzis, G. 1962. Albuminuria and the Nephrotoxic Syndrome Following Exposure to Mercury and Its Compounds. *Ouart. J. Med.*, 31:403.

Kazantzis, G. 1978. The Role of Hypersensitivity and the Immune Response in Influencing Susceptibility to Metal Toxicity. *Env. Health. Perspect.*, 25:111-118.

Knoflach, P., B. Albini, and M.M. Weiser. 1986. Autoimmune Disease Induced by Oral Administration of Mercuric Chloride in Brown-Norway Rats. *Toxicologic Pathology, 14*:188-193.

Magos, L. 1980. Factors Affecting the Neurotoxicity of Mercy and Mercurials. In: Manzo, L., N. Léry, Y. Lacasse, and L. Roche, Eds. Advances in Neurotoxicology. Pergamon Press: New York. pp. 17-25.

Mandema, E. et al. 1963. Mercury and Kidney. *Lancet*, 1:1266.

Piikivi, L. 1989. Cardiovascular Reflexes and Low Long-term Exposure to Mercury Vapor. *Int. Arch. Occup. Environ. Health, 61*:391-395.

Piikivi, L. and U. Tolonen. 1989. EEG Findings in Chlor-alkali Workers Subjected to Low Long-term Exposure to Mercury Vapor. *Br. J. Ind. Med., 46*:370-375.

Piikivi, L. and H. Hanninen. 1989. Subjective Symptoms and Psychological Performance of Chlorine-alkali Workers. *Scand. J. Work Environ. Health, 15*:69-74.

Revis, N., G. Holdsworth, G. Bingham, A. King, and J. Elmore. 1989. An Assessment of Health Risk Associated with Mercury in Soil and Sediment from East Fork Poplar Creek, Oak Ridge, Tennessee. Oak Ridge Research Institute. Final Report. pp. 1-58.

Revis, N., T.R. Osborne, G. Holdsworth, and C. Hadden. 1990. Mercury in Soil: A Method For Assessing Acceptable Limits. *Arch. Environ. Contamin. Toxicol., 19*:221-226.

Roberts, M.C., A.A. Seawright, and P.D. Norman. 1982. Some Effects of Chronic Mercuric Chloride Intoxication on Renal Function in a Horse. *Vet. Hum. Toxicol., 24(6)*:415-420.

Roman-Franco, A.L., M. Turiello, B. Albini, E. Ossi, F. Milgrom, and G.A. Andres. Anti-Basement Membrane Antibodies and Antigen-Antibody Complexes in Rabbits Injected with Mercuric Chloride. *Clin. Immunol. Immunopathol.*, 9:464-481.

Sapin, C., E. Druet, and P. Druet. 1977. Induction of Anti-glomerular Basement Membrane Antibodies in the Brown-Norway Rat by Mercuric Chloride. *Clin. Exp. Immunol., 28*:173-179.

Sin, Y.M., Y.F. Lim, and M.K. Wong. 1983. Uptake and Distribution of Mercury in Mice from Ingesting Soluble and Insoluble Mercury Compounds. *Bull. Environ. Contam. Toxicol.* 31:605-612.

Tylor, N. 1965. Histochemical Studies of Nephrotoxicity With Sublethal Doses of Mercury in Rats. *Am. J. Pathol., Vol XLVI*:I-21.

Wands, J.R., S.W. Weiss, J.H. Yardley, and W.C. Maddrey. 1974. Chronic Inorganic Mercury Poisoning Due to Laxative Abuse - A Clinical and Ultrastructural Study. *Am. J. Med., 57*:92-101.

Weening, J.J., G.J. Fleuren, and Ph.J. Hoedemaeker. Demonstration of Antinuclear Antibodies in Mercuric Chloride-Induced Glomerulopathy in the Rat. *Lab. Invest.*, 39:405-411.

Winship, K.A. 1985. Toxicity of Mercury and Its Inorganic Salts. *Adv. Drug React. Ac. Pois. Rev., 3*:129-160.

Yeoh, T.S., A.S. Lee, and H.S. Lee. 1986. Absorption of Mercuric Sulphide Following Oral Administration in Mice. *Toxicology* 41:107-111.

Yeoh, T.S., H.S. Lee, and A.S. Lee. 1989. Gastrointestinal Absorption of Mercury Following Oral Administration of Cinnabar in a Traditional Chinese Medicine. *Asia Pacific J. Pharmacol.* 4:69-73.

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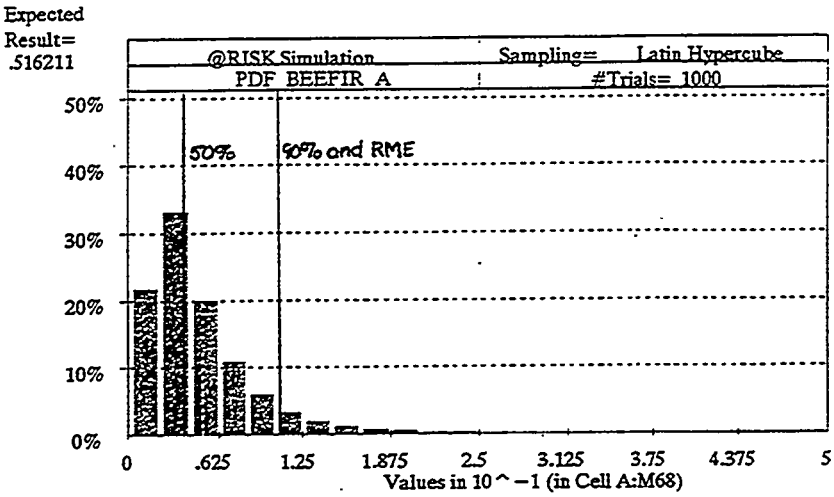
INPUT VARIABLES: PROBABILITY DENSITY FUNCTIONS

Figure O.1. EFPC probability density function: beef ingestion rate – adult



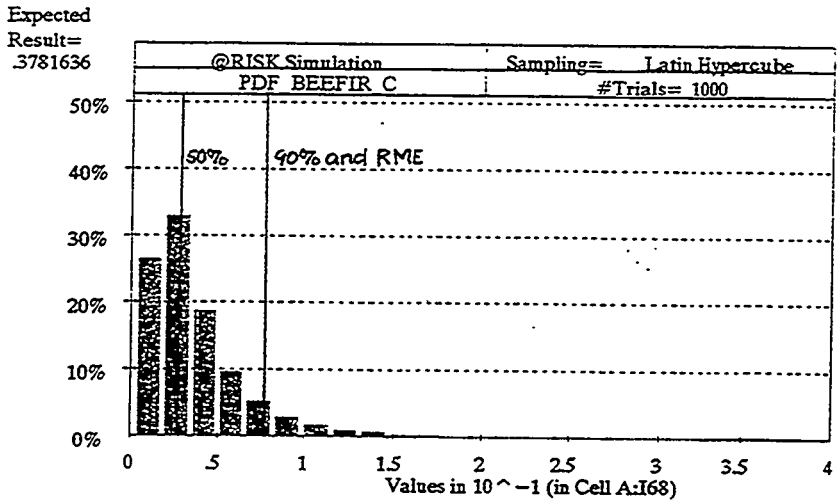
Units:	(kg beef tissue/day)
Distribution type:	Lognormal
Mean:	−3.22
Standard Deviation:	0.72
RME Point Estimate:	0.100
MLE Point Estimate:	0.040
Expected/Mean Result =	0.0516211
Maximum Result =	0.4126311
Minimum Result =	0.002245887
Range of Possible Results =	0.4103853
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.04198763
Skewness =	2.715572
Kurtosis =	15.49523
Variance =	0.001762961
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0022
5%	0.0122
10%	0.0159
15%	0.019
20%	0.0218
25%	0.0246
30%	0.0274
35%	0.0303
40%	0.0333
45%	0.0365
50%	0.0399
55%	0.0437
60%	0.0478
65%	0.0526
70%	0.0581
75%	0.0646
80%	0.0729
85%	0.0838
90%	0.0996
95%	0.1292
100%	0.4126

The presented mean and standard deviation are presented on the natural log scale and correspond to 0.040 and 2.05 kg/day, respectively on an untransformed scale.

Figure O.2. EFPC probability density function: beef ingestion rate – child



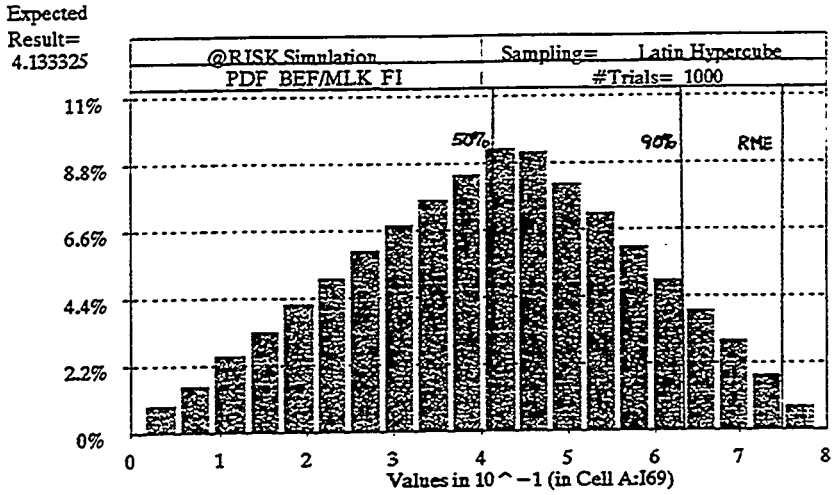
Units:	(kg beef tissue/day)
Distribution type:	Lognormal
Mean:	−3.54
Standard Deviation:	0.73
RME Point Estimate:	0.074
MLE Point Estimate:	0.030
Expected/Mean Result =	0.03781636
Maximum Result =	0.3218361
Minimum Result =	0.00230812
Range of Possible Results =	0.3195279
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.03134255
Skewness =	2.748419
Kurtosis =	15.86579
Variance =	0.0009823556
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0023
5%	0.0087
10%	0.0114
15%	0.0136
20%	0.0157
25%	0.0177
30%	0.0198
35%	0.0219
40%	0.0241
45%	0.0264
50%	0.029
55%	0.0318
60%	0.0349
65%	0.0384
70%	0.0425
75%	0.0474
80%	0.0535
85%	0.0617
90%	0.0736
95%	0.0961
100%	0.3218

The presented mean and standard deviation are presented on natural log scale and correspond to 0.029 and 2.08 kg/day, respectively on an untransformed scale.

Figure O.3. EFPC probability density function: fraction ingested from contaminated area – beef and dairy cows

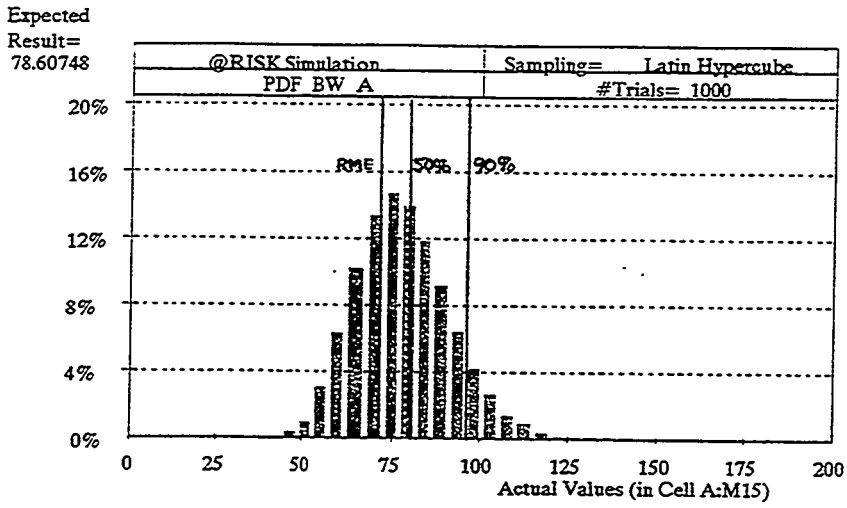


Units:	(percent)
Distribution type:	Triangular
Minimum:	0
Most likely:	0.44
Maximum:	0.8
RME Point Estimate:	0.75
MLE Point Estimate:	0.44
Expected/Mean Result =	0.4133325
Maximum Result =	0.7892558
Minimum Result =	0.01533155
Range of Possible Results =	0.7739242
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.1635449
Skewness =	−0.0973078
Kurtosis =	2.399024
Variance =	0.02674694
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0153
5%	0.1319
10%	0.1868
15%	0.2296
20%	0.265
25%	0.2963
30%	0.3245
35%	0.3505
40%	0.3751
45%	0.398
50%	0.4193
55%	0.4399
60%	0.4604
65%	0.4824
70%	0.5058
75%	0.5316
80%	0.5595
85%	0.5916
90%	0.6298
95%	0.6796
100%	0.7893

Figure O.4. EFPC probability density function: body weight – adult



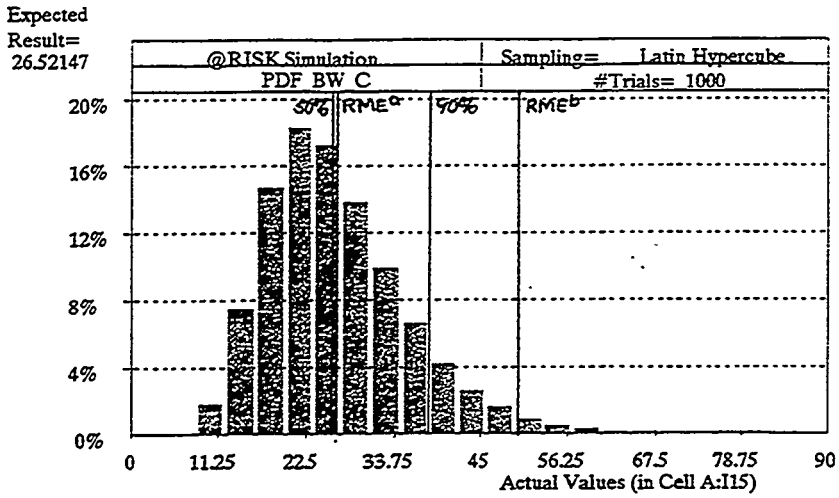
Units:	(kg)
Distribution type:	Lognormal
Mean:	4.35
Standard Deviation:	0.17
RME Point Estimate:	70
MLE Point Estimate:	70
Expected/Mean Result =	78.60443
Maximum Result =	132.6578
Minimum Result =	43.051
Range of Possible Results =	89.60677
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	13.45265
Skewness =	0.5077318
Kurtosis =	3.404869
Variance =	180.9737
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	43.051
5%	58.4908
10%	62.2811
15%	64.9588
20%	67.1463
25%	69.0779
30%	70.841
35%	72.5459
40%	74.2094
45%	75.8204
50%	77.4496
55%	79.1312
60%	80.8712
65%	82.6987
70%	84.6958
75%	86.8635
80%	89.3446
85%	92.3928
90%	96.2623
95%	102.4589
100%	132.6578

The presented mean and standard deviation are presented on natural log scale and correspond to 77.48 and 1.190 kg, respectively on an untransformed scale.

Figure O.5. EFPC probability density function: body weight – child



Units:	(kg)
Distribution type:	Lognormal
Mean:	3.22
Standard Deviation:	0.34
RME Point Estimate[a]:	26
RME Point Estimate[b]:	49
MLE Point Estimate[c]:	25
MLE Point Estimate[d]:	50.600
Expected/Mean Result =	26.51733
Maximum Result =	76.76105
Minimum Result =	7.552172
Range of Possible Results =	69.20889
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	9.276943
Skewness =	1.070017
Kurtosis =	4.940597
Variance =	86.06168
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	7.5522
5%	14.3013
10%	16.1573
15%	17.5944
20%	18.7843
25%	19.8812
30%	20.9256
35%	21.9407
40%	22.9557
45%	23.9787
50%	25.0245
55%	26.1079
60%	27.2791
65%	28.5151
70%	29.9009
75%	31.4739
80%	33.2839
85%	35.5989
90%	38.6348
95%	43.6705
100%	76.7611

The presented mean and standard deviation are presented on natural log scale and correspond to 25 and 1.41 kg, respectively on an untransformed scale.

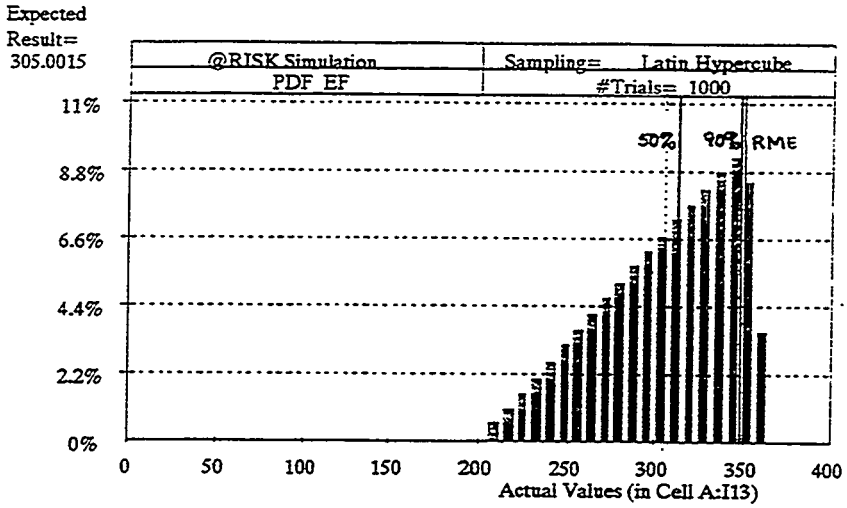
[a] RME point estimate for children ages 3 to 12 years (agricultural/homesteader and residential land use classifications) = 26 kg

[b] RME point estimate for children ages 9 to 18 years (open land use classification) = 49 kg

[c] MLE point estimate for children ages 6 to 9 years (agricultural/homesteader and residential land use classifications) = 25 kg

[d] RME point estimate for children ages 12 to 15 years (open land use classification) = 50.6 kg

Figure O.6. EFPC probability density function: exposure frequency

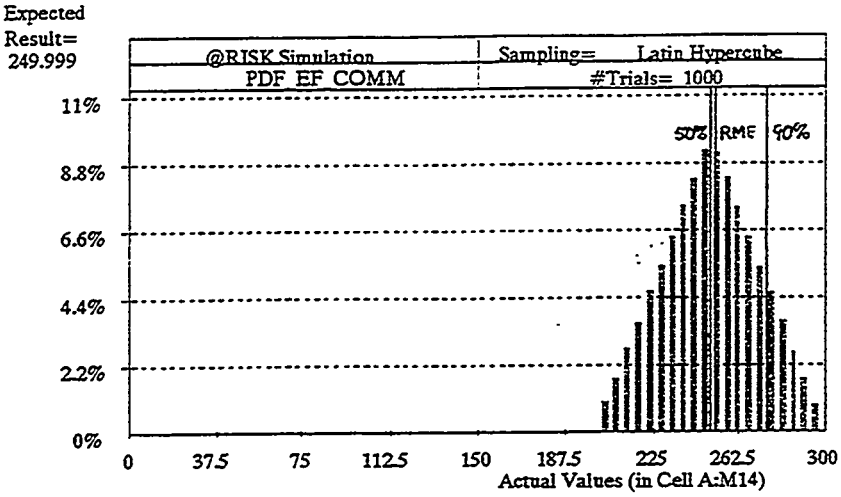


Units:	(days/year)
Distribution type:	Triangular
Minimum:	200
Most likely:	350
Maximum:	365
RME Point Estimate:	350
MLE Point Estimate:	350
Expected/Mean Result =	305.0008
Maximum Result =	364.4015
Minimum Result =	202.7075
Range of Possible Results =	161.694
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	37.25027
Skewness =	−0.5488943
Kurtosis =	2.401549
Variance =	1387.583
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	202.7075
5%	235.1055
10%	249.7085
15%	260.7282
20%	270.2132
25%	278.5542
30%	286.0451
35%	293.0015
40%	299.4472
45%	305.4532
50%	311.1571
55%	316.622
60%	321.8151
65%	326.8203
70%	331.5396
75%	336.1648
80%	340.6693
85%	345.0215
90%	349.1984
95%	353.8259
100%	364.4015

Figure O.7. EFPC probability density function: exposure frequency – groundwater ingestion (commercial land use)

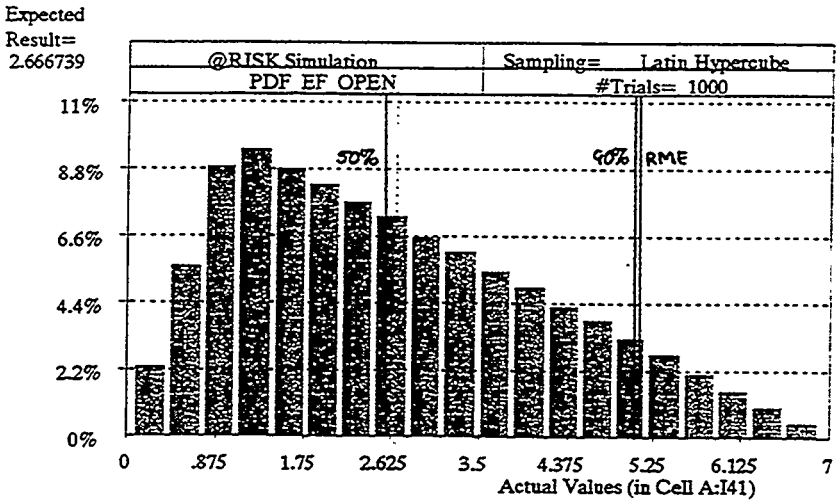


Units:	(days/year)
Distribution type:	Triangular
Minimum:	200
Most likely:	250
Maximum:	300
RME Point Estimate:	250
MLE Point Estimate:	250
Expected/Mean Result =	250.0004
Maximum Result =	299.1231
Minimum Result =	201.8719
Range of Possible Results =	97.25128
Chance of Positive Result =	100
Chance of Negative Result :	0
Standard Deviation =	20.41558
Skewness =	0.0003234875
Kurtosis =	2.401517
Variance =	416.7958
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	201.8719
5%	215.6881
10%	222.2641
15%	227.3824
20%	231.6154
25%	235.3015
30%	238.7252
35%	241.787
40%	244.7066
45%	247.3994
50%	249.9751
55%	252.5346
60%	255.265
65%	258.1515
70%	261.2546
75%	264.6413
80%	268.3102
85%	272.5626
90%	277.6001
95%	284.1481
100%	299.1231

Figure O.8. EFPC probability density function: exposure frequency – wading (open land use)

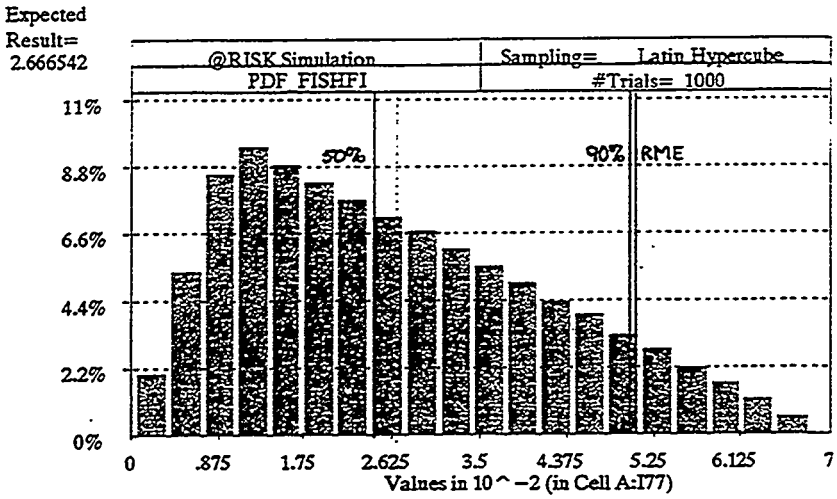


Units:	(days/year)
Distribution type:	Triangular
Minimum:	0
Most likely:	1
Maximum:	7
RME Point Estimate:	5
MLE Point Estimate:	1
Expected/Mean Result =	2.666668
Maximum Result =	6.854899
Minimum Result =	0.05227358
Range of Possible Results =	6.802625
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	1.545806
Skewness =	0.5221101
Kurtosis =	2.401358
Variance =	2.389516
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0523
5%	0.5913
10%	0.8331
15%	1.0215
20%	1.2009
25%	1.384
30%	1.5762
35%	1.7742
40%	1.9781
45%	2.1907
50%	2.4171
55%	2.6504
60%	2.897
65%	3.1646
70%	3.4486
75%	3.7581
80%	4.0967
85%	4.4848
90%	4.9432
95%	5.5453
100%	6.8549

Figure O.9. EFPC probability density function: fraction of fish ingested from contaminated area

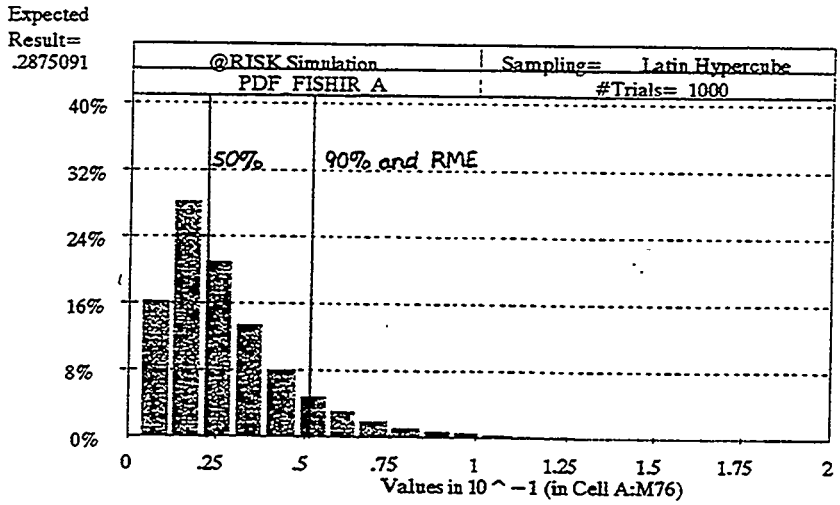


Units:	(percent)
Distribution type:	Triangular
Minimum:	0
Most likely:	0.01
Maximum:	0.07
RME Point Estimate:	0.05
MLE Point Estimate:	0.01
Expected/Mean Result =	0.02666542
Maximum Result =	0.06815225
Minimum Result =	0.0003510384
Range of Possible Results =	0.06780121
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.01545241
Skewness =	0.5201395
Kurtosis =	2.395345
Variance =	0.0002387768
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0004
5%	0.0059
10%	0.0083
15%	0.0102
20%	0.012
25%	0.0138
30%	0.0157
35%	0.0177
40%	0.0198
45%	0.0219
50%	0.0241
55%	0.0265
60%	0.029
65%	0.0316
70%	0.0345
75%	0.0376
80%	0.0409
85%	0.0449
90%	0.0494
95%	0.0554
100%	0.0682

Figure O.10. EFPC probability density function: human ingestion rate of fish tissue – adult



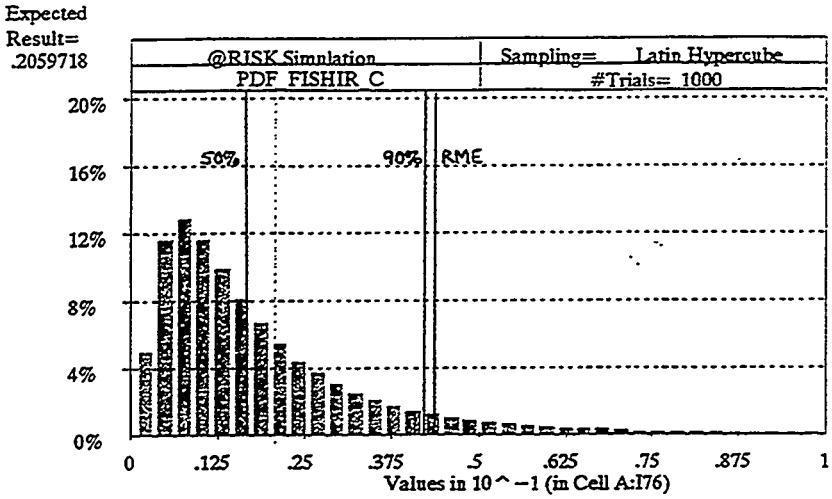
Units:	(kg fish tissue/day)
Distribution type:	Lognormal
Mean:	−3.77
Standard Deviation:	0.67
RME Point Estimate:	0.054
MLE Point Estimate:	0.023
Expected/Mean Result =	0.02875091
Maximum Result =	0.1824229
Minimum Result =	0.002925353
Range of Possible Results =	0.1794975
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.02117437
Skewness =	2.291914
Kurtosis =	11.43686
Variance =	0.0004483541
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0029
5%	0.0076
10%	0.0098
15%	0.0115
20%	0.0131
25%	0.0147
30%	0.0162
35%	0.0178
40%	0.0195
45%	0.0212
50%	0.023
55%	0.0251
60%	0.0273
65%	0.0298
70%	0.0327
75%	0.0361
80%	0.0404
85%	0.0459
90%	0.0542
95%	0.0687
100%	0.1824

The presented mean and standard deviation are presented on natural log scale and correspond to 0.023 and 1.954 kg/day, respectively on an untransformed scale.

Figure O.11. EFPC probability density function: human ingestion rate of fish tissue – child



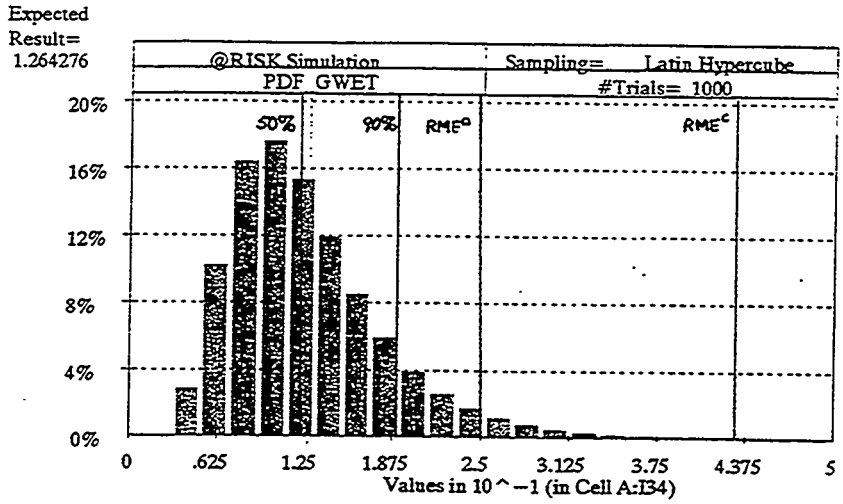
Units:	(kg fish tissue/day)
Distribution type:	Lognormal
Mean:	−4.25
Standard Deviation:	0.84
RME Point Estimate:	0.042
MLE Point Estimate:	0.014
Expected/Mean Result =	0.02059718
Maximum Result =	0.5480319
Minimum Result =	0.0008327048
Range of Possible Results =	0.5471992
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.02538899
Skewness =	10.14003
Kurtosis =	191.0688
Variance =	0.0006446008
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0008
5%	0.0036
10%	0.0049
15%	0.006
20%	0.007
25%	0.009
30%	0.0092
35%	0.0103
40%	0.0115
45%	0.0128
50%	0.0143
55%	0.0158
60%	0.0176
65%	0.0197
70%	0.0221
75%	0.0251
80%	0.0289
85%	0.034
90%	0.0418
95%	0.0567
100%	0.548

The presented mean and standard deviation are presented on natural log scale and correspond to 0.014 and 2.316 kg/day, respectively on an untransformed scale.

Figure O.12. EFPC probability density function: exposure time to vapors from groundwater while showering



Units:	(hours/day)
Distribution type:	Lognormal
Mean:	−2.16
Standard Deviation:	0.43
RME Point Estimate[a]:	0.25
MLE Point Estimate[b]:	0.12
RME Point Estimate[c]:	0.42
MLE Point Estimate[d]:	0.25
Expected/Mean Result =	0.126505
Maximum Result =	0.508986
Minimum Result =	0.02992806
Range of Possible Results =	0.4790579
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.05702985
Skewness =	1.43942
Kurtosis =	6.753843
Variance =	0.003252404
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

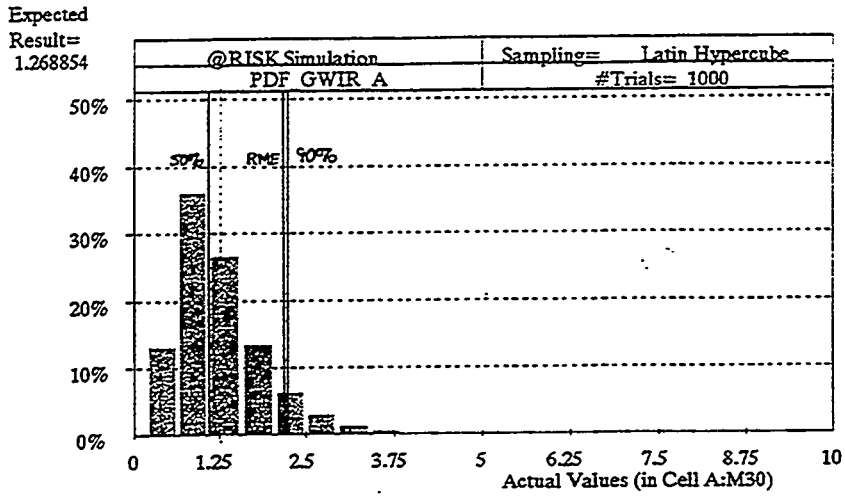
Percentile Probabilities
(Chance <= Shown Value)

0%	0.0299
5%	0.0566
10%	0.0664
15%	0.0738
20%	0.0802
25%	0.0862
30%	0.092
35%	0.0977
40%	0.1034
45%	0.1092
50%	0.1152
55%	0.1216
60%	0.1285
65%	0.1361
70%	0.1444
75%	0.1541
80%	0.1656
85%	0.1799
90%	0.1997
95%	0.2331
100%	0.509

The presented mean and standard deviation are presented on natural log scale and correspond to 0.115 and 1.5 hours/day, respectively on an untransformed scale.

[a] RME point estimate for adults
[b] MLE point estimate for adults
[c] RME point estimate for children
[d] MLE point estimate for children

Figure O.13. EFPC probability density function: groundwater ingestion rate – adult



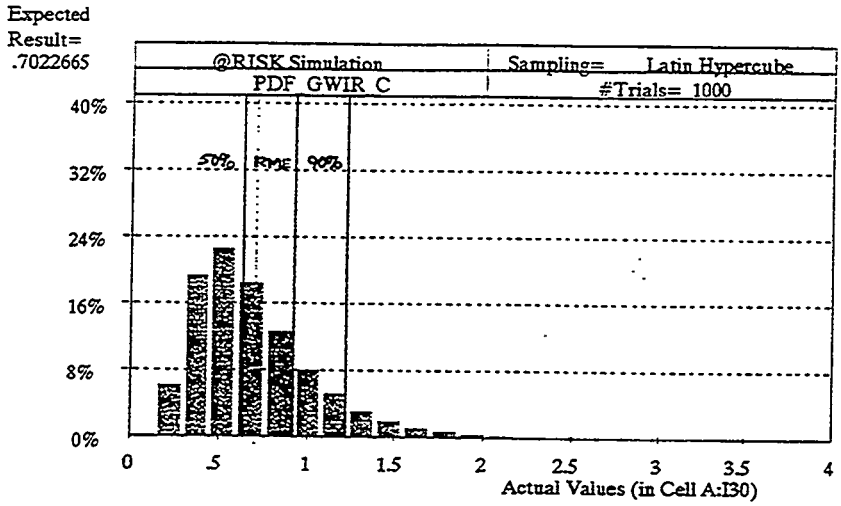
Units:	(L/day)
Distribution type:	Lognormal
Mean:	0.1151
Standard Deviation:	0.49
RME Point Estimate:	2.00
MLE Point Estimate:	1.40
Expected/Mean Result =	1.266812
Maximum Result =	7.652514
Minimum Result =	0.2246518
Range of Possible Results =	7.427862
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.6728923
Skewness =	2.081353
Kurtosis =	13.09194
Variance =	0.452784
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.2247
5%	0.5004
10%	0.598
15%	0.6749
20%	0.7422
25%	0.8058
30%	0.8669
35%	0.9283
40%	0.9909
45%	1.0541
50%	1.1213
55%	1.1928
60%	1.2699
65%	1.3548
70%	1.4493
75%	1.5603
80%	1.6919
85%	1.8606
90%	2.1015
95%	2.509
100%	7.6525

The presented mean and standard deviation are presented on natural log scale and correspond to 1.2 and 1.6 L/day, respectively on an untransformed scale.

Figure O.14. EFPC probability density function: groundwater ingestion rate – child



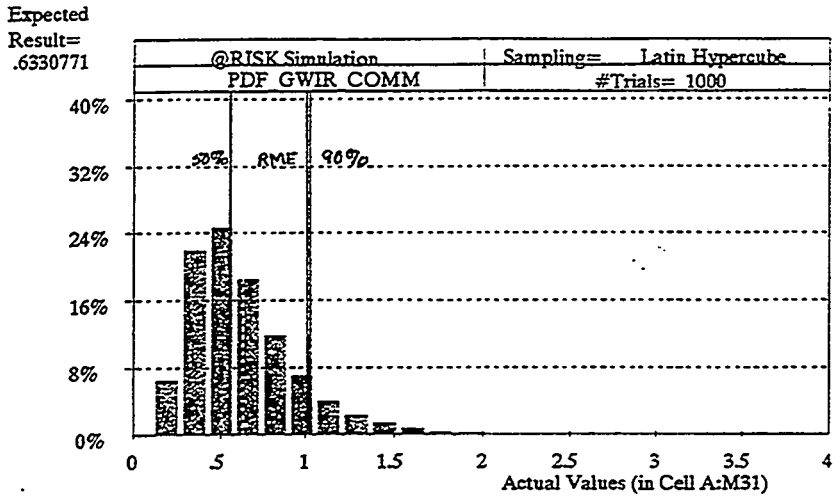
Units:	(L/day)
Distribution type:	Lognormal
Mean:	−0.478
Standard Deviation:	0.5
RME Point Estimate:	0.88
MLE Point Estimate:	0.52
Expected/Mean Result =	0.7022729
Maximum Result =	3.211835
Minimum Result =	0.1139289
Range of Possible Results =	3.097906
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.3721594
Skewness =	1.644777
Kurtosis =	7.556859
Variance =	0.1385026
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.1139
5%	0.2712
10%	0.3262
15%	0.369
20%	0.4066
25%	0.4425
30%	0.4768
35%	0.5114
40%	0.5462
45%	0.5817
50%	0.6195
55%	0.6595
60%	0.7033
65%	0.7514
70%	0.8058
75%	0.8678
80%	0.9436
85%	1.0397
90%	1.1752
95%	1.4069
100%	3.2118

The presented mean and standard deviation are presented on natural log scale and correspond to 0.62 and 1.65 L/day, respectively on an untransformed scale.

Figure O.15. EFPC probability density function: groundwater ingestion rate (commercial land use)



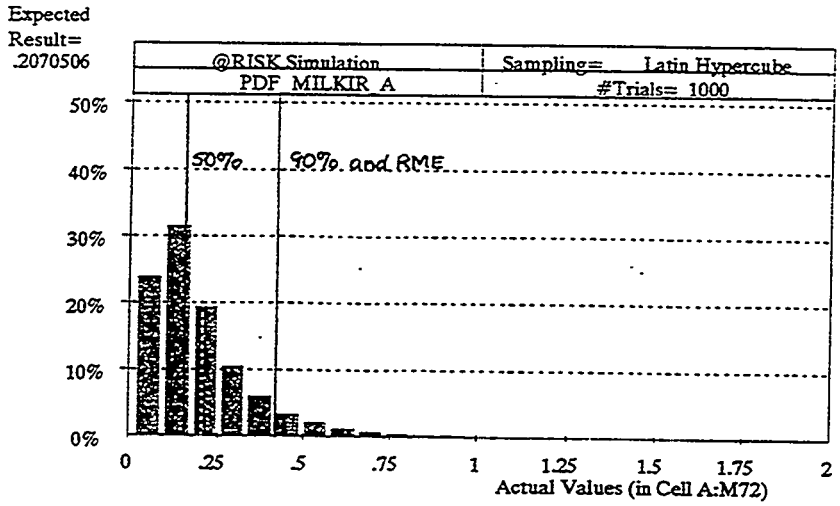
Units:	(L/day)
Distribution type:	Lognormal
Mean:	−0.5777
Standard Deviation:	0.49
RME Point Estimate:	1.00
MLE Point Estimate:	0.70
Expected/Mean Result =	0.6324658
Maximum Result =	2.613503
Minimum Result =	0.1113675
Range of Possible Results =	2.502135
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.3272994
Skewness =	1.578003
Kurtosis =	7.020896
Variance =	0.1071249
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.1114
5%	0.2499
10%	0.2991
15%	0.3371
20%	0.3712
25%	0.4027
30%	0.4334
35%	0.4644
40%	0.4952
45%	0.5276
50%	0.5606
55%	0.5967
60%	0.6352
65%	0.6771
70%	0.7252
75%	0.7799
80%	0.8472
85%	0.9321
90%	1.0487
95%	1.2512
100%	2.6135

The presented mean and standard deviation are presented on natural log scale and correspond to 0.56 and 1.6 L/day, respectively on an untransformed scale.

Figure O.16. EFPC probability density function: milk ingestion rate – adult



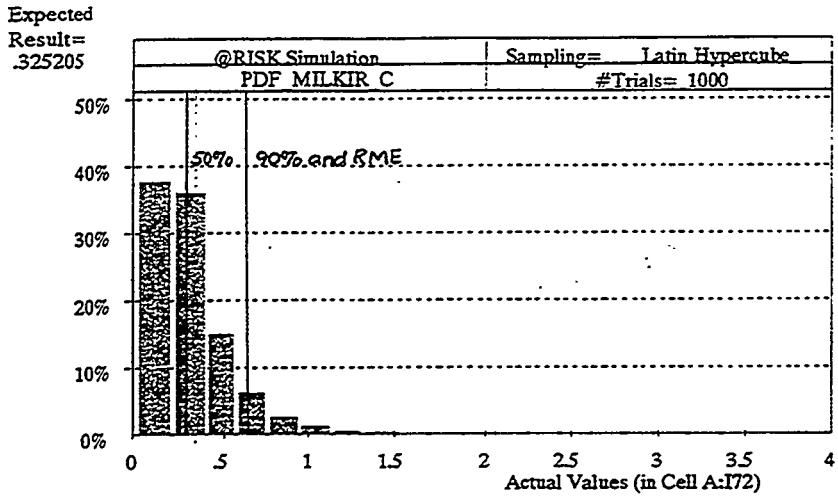
Units:	(kg dairy products/day)
Distribution type:	Lognormal
Mean:	−1.83
Standard Deviation:	0.72
RME Point Estimate:	0.4
MLE Point Estimate:	0.16
Expected/Mean Result =	0.2070506
Maximum Result =	1.607966
Minimum Result =	0.01647577
Range of Possible Results =	1.59149
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.1670303
Skewness =	2.593791
Kurtosis =	14.08035
Variance =	0.02789911
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0165
5%	0.0494
10%	0.0639
15%	0.0763
20%	0.0877
25%	0.0989
30%	0.1102
35%	0.1215
40%	0.1337
45%	0.1464
50%	0.1602
55%	0.1755
60%	0.1921
65%	0.2112
70%	0.2333
75%	0.2596
80%	0.2925
85%	0.3365
90%	0.401
95%	0.5192
100%	1.608

The presented mean and standard deviation are presented on natural log scale and correspond to 0.16 and 2.05 kg/day, respectively on an untransformed scale.

Figure O.17. EFPC probability density function: milk ingestion rate – child



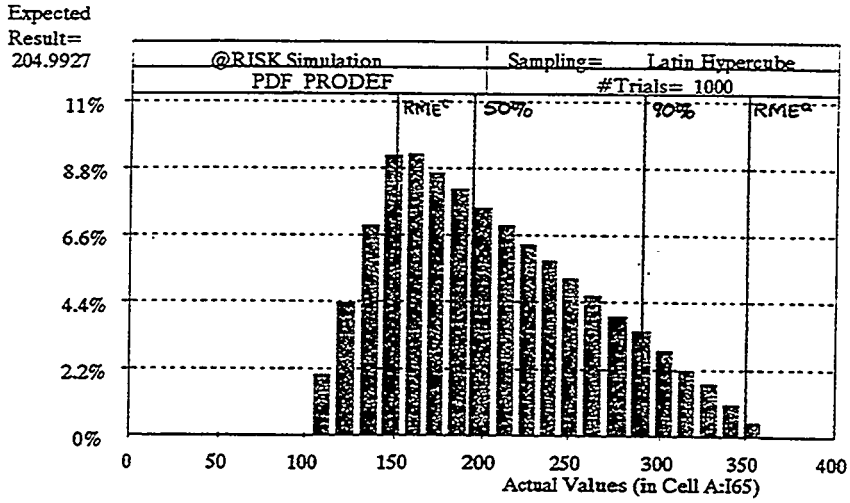
Units:	(kg dairy products/day)
Distribution type:	Lognormal
Mean:	−1.36
Standard Deviation:	0.68
RME Point Estimate:	0.614
MLE Point Estimate:	0.256
Expected/Mean Result =	0.325205
Maximum Result =	3.733959
Minimum Result =	0.02025313
Range of Possible Results =	3.713706
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.2617782
Skewness =	3.79805
Kurtosis =	35.51184
Variance =	0.06852785
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0203
5%	0.0831
10%	0.1069
15%	0.1262
20%	0.1442
25%	0.1619
30%	0.1791
35%	0.1971
40%	0.2156
45%	0.2353
50%	0.2564
55%	0.2796
60%	0.305
65%	0.3335
70%	0.3672
75%	0.4063
80%	0.4555
85%	0.5205
90%	0.615
95%	0.7892
100%	3.734

The presented mean and standard deviation are presented on natural log scale and correspond to 0.26 and 1.97 kg/day, respectively on an untransformed scale.

Figure O.18. EFPC probability density function: consumption of home–grown produce exposure frequency



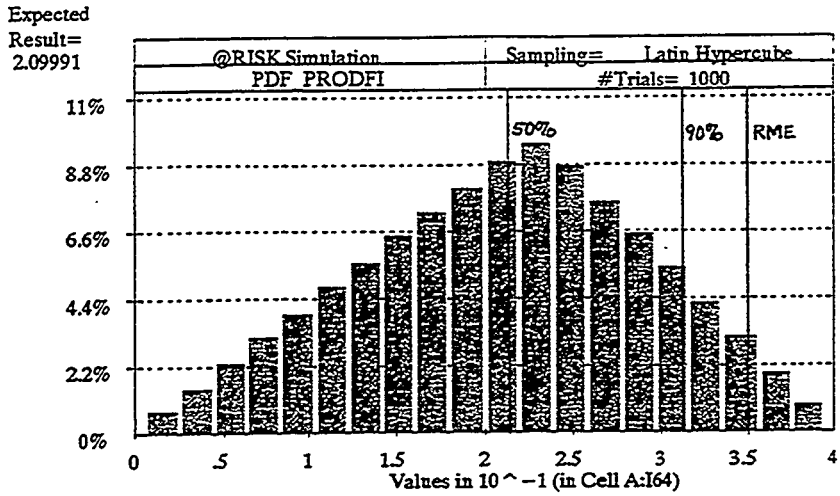
Units:	(days/year)
Distribution type:	Triangular
Minimum:	100
Most likely:	150
Maximum:	365
RME Point Estimate[a]:	350
MLE Point Estimate[b]:	150
RME Point Estimate[c]:	150
MLE Point Estimate[d]:	150
Expected/Mean Result =	204.9927
Maximum Result =	360.3855
Minimum Result =	103.0887
Range of Possible Results =	257.2968
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	57.47839
Skewness =	0.4861818
Kurtosis =	2.399065
Variance =	3303.766
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	103.0887
5%	125.5452
10%	136.3096
15%	144.4892
20%	151.3875
25%	158.1727
30%	165.1779
35%	172.5452
40%	180.0516
45%	187.9064
50%	196.1189
55%	204.7639
60%	213.9726
65%	223.591
70%	234.1796
75%	245.5961
80%	258.0316
85%	272.3017
90%	289.2172
95%	311.1278
100%	360.3855

[a] RME exposure frequency (agricultural/homesteader land use) is 350 days/year
[b] MLE exposure frequency (agricultural/homesteader land use) is 150 days/year
[c] RME exposure frequency (residential land use) is 150 days/year
[d] MLE exposure frequency (residential land use) is 150 days/year

Figure O.19. EFPC probability density function: fraction of home-grown produce ingested from contaminated area

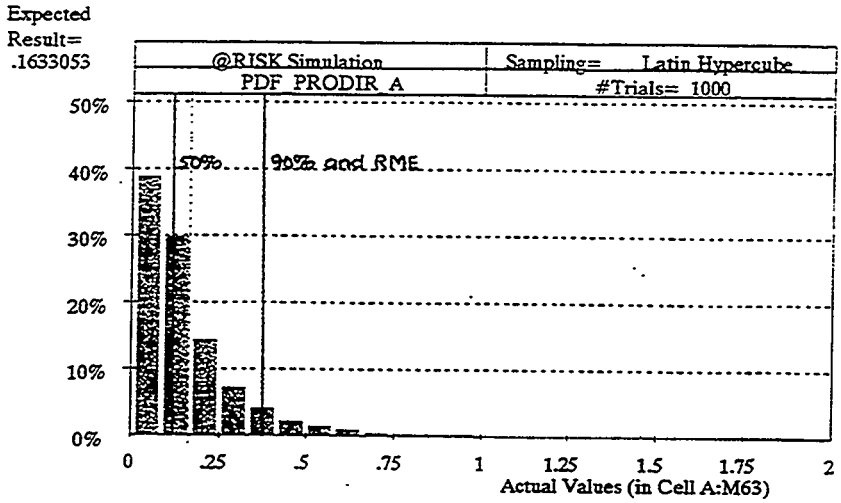


Units:	(percent)
Distribution type:	Triangular
Minimum:	0
Most likely:	0.23
Maximum:	0.4
RME Point Estimate:	0.35
MLE Point Estimate:	0.23
Expected/Mean Result =	0.209991
Maximum Result =	0.3940547
Minimum Result =	0.005452023
Range of Possible Results =	0.3886026
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.08196273
Skewness =	−0.1458289
Kurtosis =	2.401178
Variance =	0.00671789
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0055
5%	0.0677
10%	0.0954
15%	0.1171
20%	0.1354
25%	0.1515
30%	0.1661
35%	0.1794
40%	0.1918
45%	0.2033
50%	0.2143
55%	0.2248
60%	0.235
65%	0.2457
70%	0.2571
75%	0.2695
80%	0.2834
85%	0.2987
90%	0.3172
95%	0.3414
100%	0.3941

Figure O.20. EFPC probability density function: adult produce ingestion rate



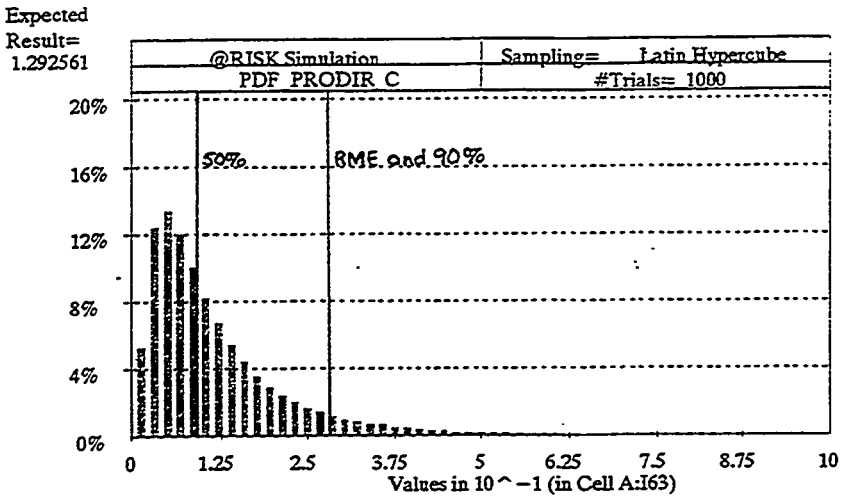
Units:	(kg plant tissue/day)
Distribution type:	Lognormal
Mean:	−2.18
Standard Deviation:	0.86
RME Point Estimate:	0.34
MLE Point Estimate:	0.113
Expected/Mean Result =	0.163
Maximum Result =	1.671
Minimum Result =	0.006
Range of Possible Results =	1.665
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.167
Skewness =	3.306
Kurtosis =	20.358
Variance =	0.028
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.006
5%	0.027
10%	0.038
15%	0.046
20%	0.055
25%	0.063
30%	0.072
35%	0.081
40%	0.091
45%	0.101
50%	0.113
55%	0.126
60%	0.140
65%	0.157
70%	0.177
75%	0.202
80%	0.233
85%	0.276
90%	0.340
95%	0.464
100%	1.671

The presented mean and standard deviation are presented on natural log scale and correspond to 0.113 and 2.36 kg/day, respectively on an untransformed scale.

Figure O.21. EFPC probability density function: children produce ingestion rate

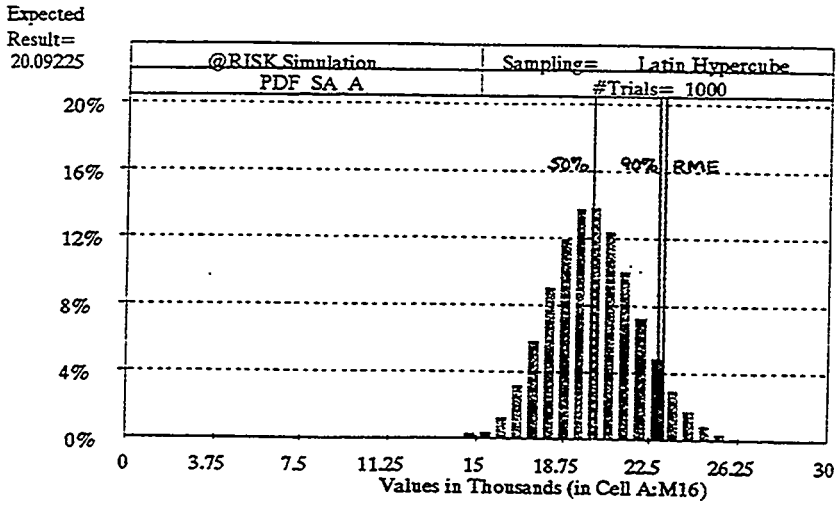


Units:	(kg plant tissue/day)
Distribution type:	Lognormal
Mean:	−2.41
Standard Deviation:	0.84
RME Point Estimate:	0.262
MLE Point Estimate:	0.09021
Expected/Mean Result =	0.128
Maximum Result =	2.410
Minimum Result =	0.006
Range of Possible Results =	2.403
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.139
Skewness =	6.103
Kurtosis =	80.696
Variance =	0.019
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities (Chance <= Shown Value)	
0%	0.006
5%	0.023
10%	0.031
15%	0.038
20%	0.045
25%	0.051
30%	0.058
35%	0.065
40%	0.073
45%	0.081
50%	0.090
55%	0.100
60%	0.111
65%	0.124
70%	0.139
75%	0.158
80%	0.181
85%	0.213
90%	0.261
95%	0.355
100%	2.410

The presented mean and standard deviation are presented on natural log scale and correspond to 0.090 and 2.32 kg/day, respectively on an untransformed scale.

Figure O.22. EFPC probability density function: total skin surface area – adult



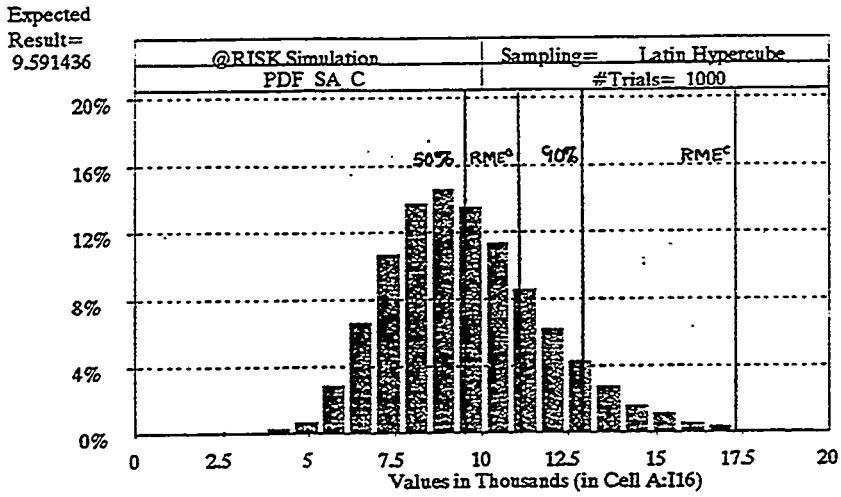
Units:	(cm^2)
Distribution type:	Lognormal
Mean:	9.903
Standard Deviation:	0.096
RME Point Estimate:	23000
MLE Point Estimate:	20000
Expected/Mean Result =	20093.64
Maximum Result =	28416.41
Minimum Result =	14692.6
Range of Possible Results =	13723.8
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	1935.991
Skewness =	0.31228
Kurtosis =	3.225209
Variance =	3748060
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	14692.6
5%	17078.16
10%	17679.05
15%	18099.91
20%	18443.89
25%	18742.46
30%	19015.26
35%	19269.32
40%	19517.72
45%	19759.96
50%	19997.74
55%	20238.4
60%	20490.37
65%	20749.99
70%	21029.85
75%	21334.97
80%	21680.32
85%	22087.35
90%	22609.9
95%	23404.39
100%	28416.41

The presented mean and standard deviation are presented on natural log scale and correspond to 19,990 and 1.1 cm^2, respectively on an untransformed scale.

Figure O.23. EFPC probability density function: total skin surface area – children



Units:	(cm^2)
Distribution type:	Lognormal
Mean:	9.14
Standard Deviation:	0.24
RME Point Estimate[a]:	11173
MLE Point Estimate[b]:	9310
RME Point Estimate[c]:	17333
MLE Point Estimate[d]:	14900
Expected/Mean Result =	9594.607
Maximum Result =	22371.84
Minimum Result =	4297.968
Range of Possible Results =	18073.87
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	2342.489
Skewness =	0.7788956
Kurtosis =	4.214163
Variance =	5487255
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities (Chance <= Shown Value)	
0%	4297.968
5%	6276.18
10%	6844.338
15%	7262.823
20%	7611.1
25%	7925.382
30%	8214.514
35%	8493.689
40%	8768.944
45%	9041.163
50%	9315.337
55%	9600.639
60%	9903.72
65%	10223
70%	10569.96
75%	10956.16
80%	11406.82
85%	11948.77
90%	12668.57
95%	13801.83
100%	22371.84

The presented mean and standard deviation are presented on natural log scale and correspond to 9,321 and 1.27 cm^2, respectively on an untransformed scale.

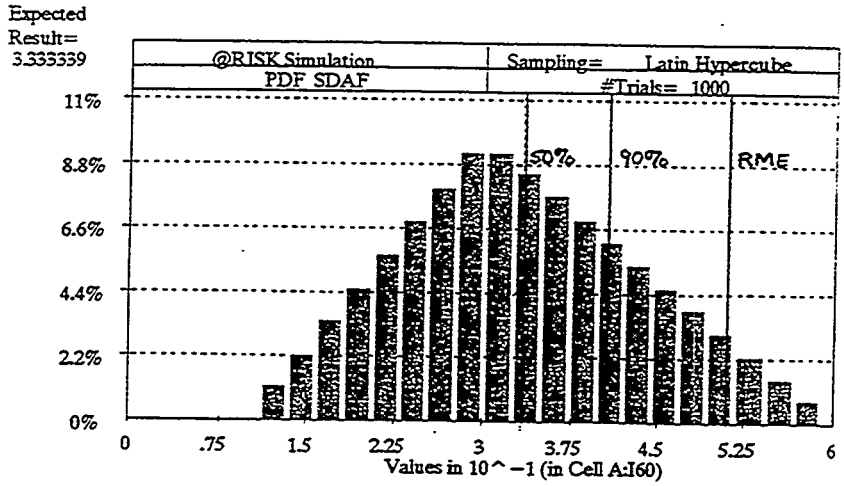
[a] RME point estimate for children ages 3 to 12 (agricultural/homesteader and residential land uses) is 11173 cm^2

[b] MLE point estimate for children ages 6 to 9 (agricultural/homesteader and residential land uses) is 9310 cm^2

[c] RME point estimate for children ages 9 to 18 (open land use) is 17333 cm^2

[d] MLE point estimate for children ages 12 to 15 (open land use) is 14910 cm^2

Figure O.24. EFPC probability density function: sediment adherence factor

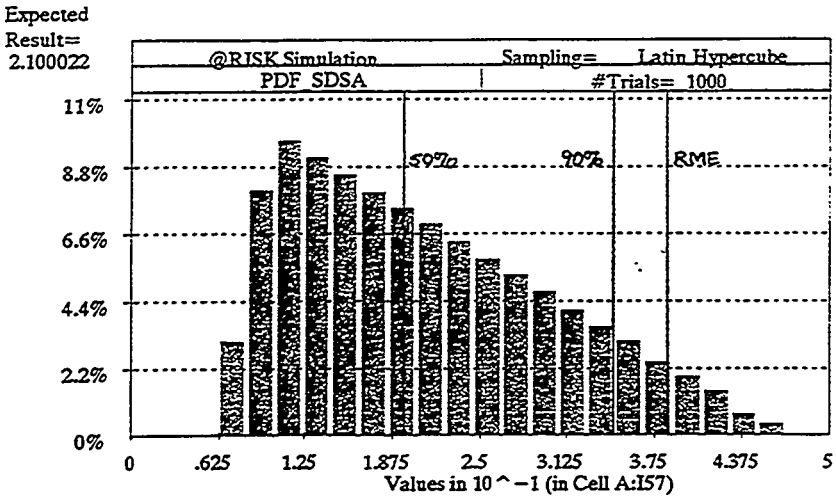


Units:	(mg sediment/cm^2 • day)
Distribution type:	Triangular
Minimum:	0.1
Most likely:	0.3
Maximum:	0.6
RME Point Estimate:	0.5
MLE Point Estimate:	0.3
Expected/Mean Result =	0.3333469
Maximum Result =	0.5937662
Minimum Result =	0.1083568
Range of Possible Results =	0.4854094
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.1027357
Skewness =	0.1924149
Kurtosis =	2.400483
Variance =	0.01055463
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.1084
5%	0.1705
10%	0.2
15%	0.2221
20%	0.2412
25%	0.2579
30%	0.2732
35%	0.2869
40%	0.2998
45%	0.3126
50%	0.3259
55%	0.34
60%	0.3549
65%	0.3708
70%	0.3876
75%	0.406
80%	0.4268
85%	0.4496
90%	0.477
95%	0.5127
100%	0.5938

Figure O.25. EFPC probability density function: fraction of skin surface area exposed to sediment while wading

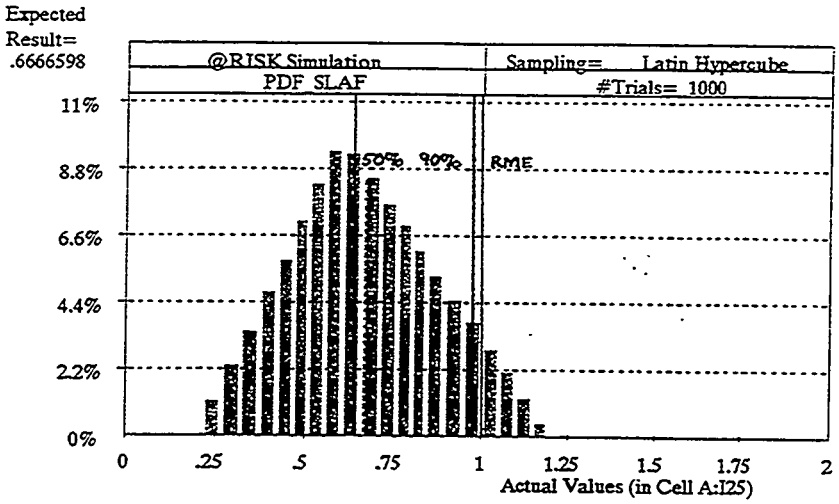


Units:	(percent)
Distribution type:	Triangular
Minimum:	0.06
Most likely:	0.1
Maximum:	0.47
RME Point Estimate:	0.38
MLE Point Estimate:	0.10
Expected/Mean Result =	0.2099976
Maximum Result =	0.4610108
Minimum Result =	0.06089244
Range of Possible Results =	0.4001184
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.09228928
Skewness =	0.5456701
Kurtosis =	2.400134
Variance =	0.008517311
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0609
5%	0.0885
10%	0.1004
15%	0.1108
20%	0.1215
25%	0.1325
30%	0.1439
35%	0.1558
40%	0.1682
45%	0.1811
50%	0.1944
55%	0.2087
60%	0.2237
65%	0.2393
70%	0.2565
75%	0.275
80%	0.2954
85%	0.319
90%	0.3462
95%	0.3828
100%	0.461

Figure O.26. EFPC probability density function: soil adherence factor

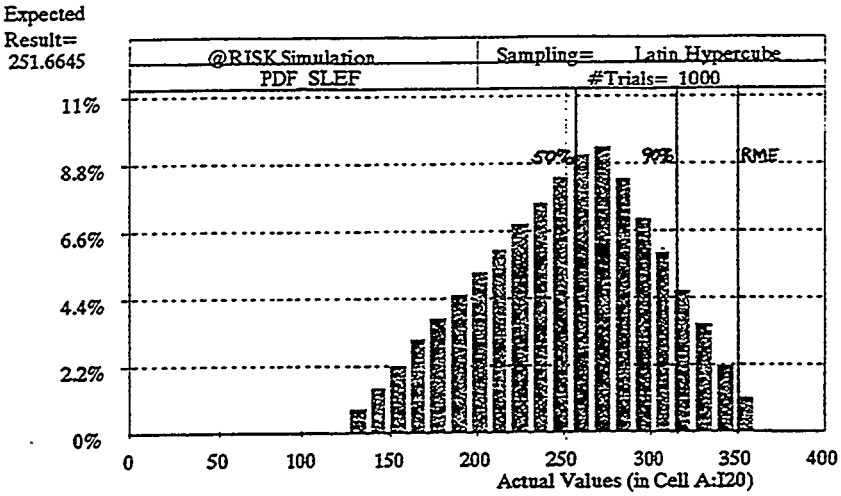


Units:	(mg soil/cm^2 • day)
Distribution type:	Triangular
Minimum:	0.2
Most likely:	0.6
Maximum:	1.2
RME Point Estimate:	1.0
MLE Point Estimate:	0.6
Expected/Mean Result =	0.6666328
Maximum Result =	1.176065
Minimum Result =	0.2122375
Range of Possible Results =	0.9638277
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.2054741
Skewness =	0.1901743
Kurtosis =	2.400134
Variance =	0.0422196
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.2122
5%	0.3412
10%	0.3992
15%	0.4449
20%	0.4827
25%	0.5161
30%	0.5464
35%	0.5736
40%	0.6
45%	0.6251
50%	0.6518
55%	0.6804
60%	0.7096
65%	0.7417
70%	0.7757
75%	0.8126
80%	0.8535
85%	0.9
90%	0.9549
95%	1.0265
100%	1.1761

Figure O.27. EFPC probability density function: soil exposure frequency (residential and agricultural/homesteader land uses)

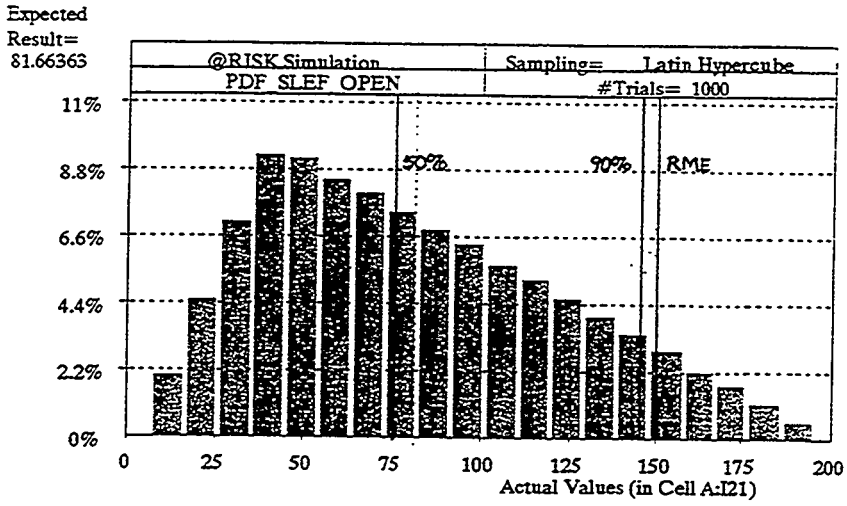


Units:	(days/year)
Distribution type:	Triangular
Minimum:	120
Most likely:	270
Maximum:	365
RME Point Estimate:	350
MLE Point Estimate:	270
Expected/Mean Result =	251.6611
Maximum Result =	361.4259
Minimum Result =	121.0417
Range of Possible Results =	240.3842
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	50.4407
Skewness =	−0.214816
Kurtosis =	2.403972
Variance =	2544.265
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	121.0417
5%	162.4467
10%	180.3594
15%	194.225
20%	205.5248
25%	215.77
30%	224.8551
35%	233.3421
40%	241.1952
45%	248.5445
50%	255.4243
55%	262.0434
60%	268.439
65%	274.6455
70%	281.3886
75%	288.5695
80%	296.6875
85%	305.9033
90%	316.5703
95%	330.8577
100%	361.4259

Figure O.28. EFPC probability density function: soil exposure frequency (open land use)

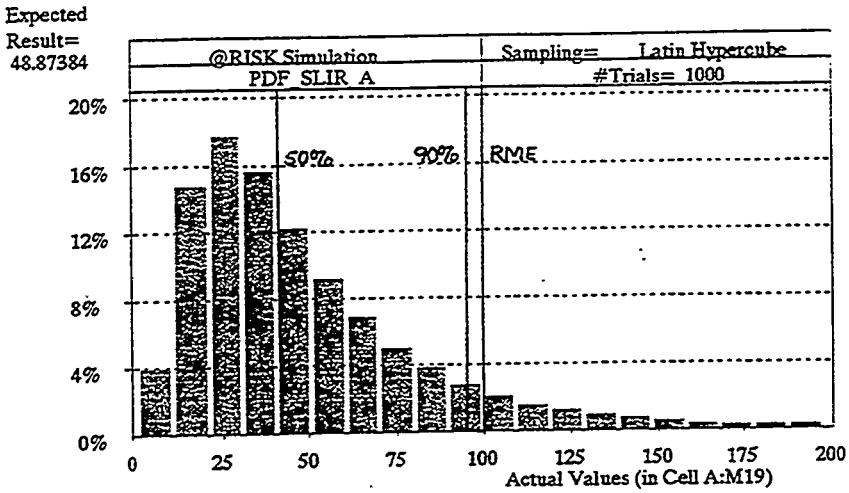


Units:	(days/year)
Distribution type:	Triangular
Minimum:	5
Most likely:	40
Maximum:	200
RME Point Estimate:	150
MLE Point Estimate:	40
Expected/Mean Result =	81.66737
Maximum Result =	195.1137
Minimum Result =	6.5224
Range of Possible Results =	188.5913
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	42.44164
Skewness =	0.4938379
Kurtosis =	2.398341
Variance =	1801.292
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	6.5224
5%	23.447
10%	31.0567
15%	36.9827
20%	41.9499
25%	46.9966
30%	52.2079
35%	57.5331
40%	63.1647
45%	68.9527
50%	75.0276
55%	81.4439
60%	88.1506
65%	95.4855
70%	103.1803
75%	111.5373
80%	120.9189
85%	131.5775
90%	144.1269
95%	160.2019
100%	195.1137

Figure O.29. EFPC probability density function: soil ingestion rate – adult



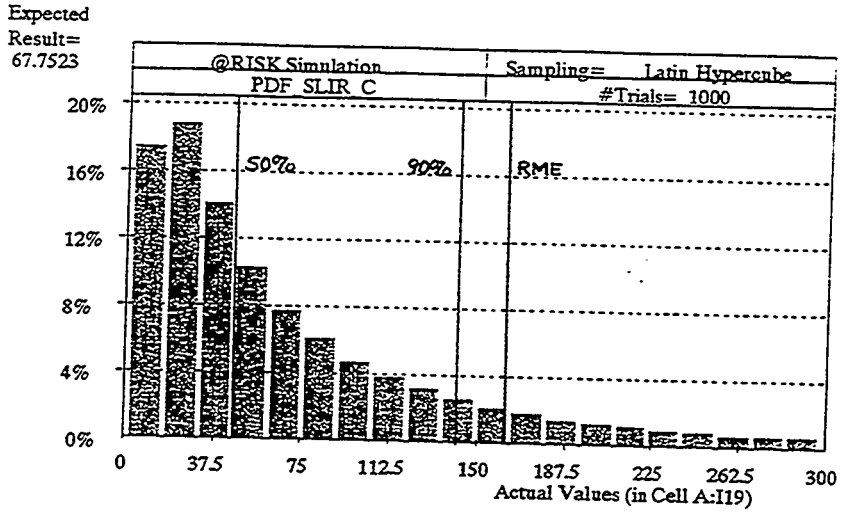
Units:	(mg soil/day)
Distribution type:	Truncated Lognormal
Mean:	3.69
Standard Deviation:	0.7
Minimum:	0
Maximum:	5.298
RME Point Estimate:	100
MLE Point Estimate:	40
Expected/Mean Result =	48.87384
Maximum Result =	197.0505
Minimum Result =	1.752792
Range of Possible Results =	195.2977
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	33.67449
Skewness =	1.512381
Kurtosis =	5.529535
Variance =	1133.971
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.7528
5%	12.5535
10%	16.1967
15%	19.265
20%	22.081
25%	24.7907
30%	27.5526
35%	30.3567
40%	33.2579
45%	36.3332
50%	39.6052
55%	43.2495
60%	47.2487
65%	51.7122
70%	56.8871
75%	62.9521
80%	70.5027
85%	80.4719
90%	94.5747
95%	118.5395
100%	197.0505

The presented mean, standard deviation, truncated minimum, and truncated maximum are presented on natural log scale and correspond to 40.04, 2.01, 1, and 200, respectively on an untransformed scale.

Figure O.30. EFPC probability density function: soil ingestion rate – child



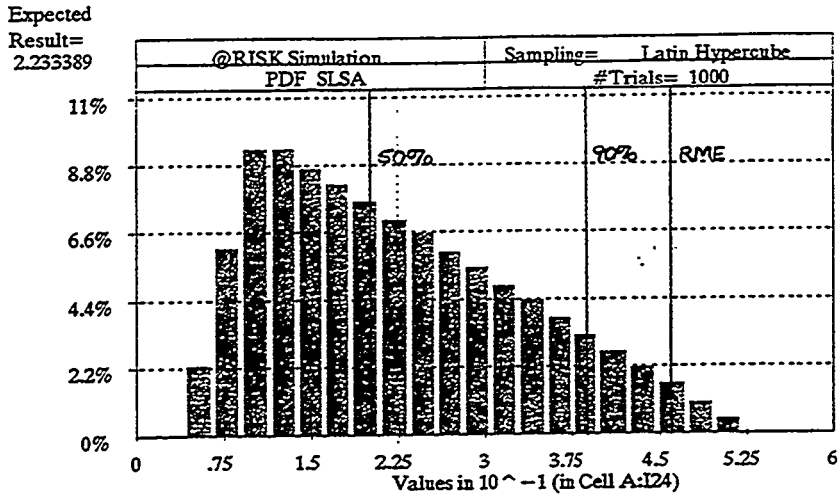
Units:	(mg soil/day)
Distribution type:	Lognormal
Mean:	3.91
Standard Deviation:	1.15
Minimum:	0
Maximum:	5.704
RME Point Estimate:	133
MLE Point Estimate:	50
Expected/Mean Result =	67.7523
Maximum Result =	297.3713
Minimum Result =	1.311951
Range of Possible Results =	296.0594
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	63.01981
Skewness =	1.487861
Kurtosis =	4.762822
Variance =	3971.496
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.312
5%	7.2295
10%	10.954
15%	14.4934
20%	18.03
25%	21.7183
30%	25.685
35%	30.0227
40%	34.7072
45%	39.9285
50%	45.784
55%	52.3944
60%	60.0726
65%	68.9602
70%	79.8053
75%	92.6343
80%	109.2307
85%	130.7776
90%	161.2134
95%	208.5163
100%	297.3713

The presented mean, standard deviation, truncated minimum, and truncated maximum are presented on natural log scale and correspond to 49.90, 3.16, 1, and 300, respectively on an untransformed scale.

Figure O.31. EFPC probability density function: fraction of skin surface area exposed to soil

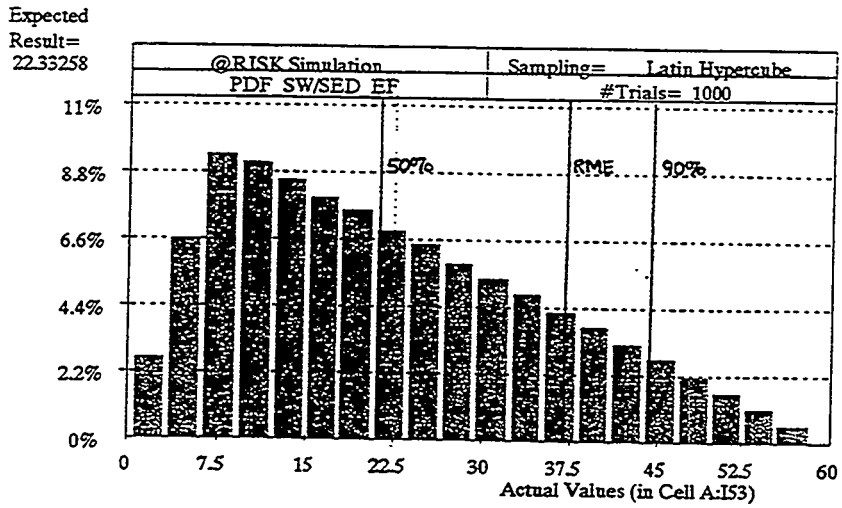


Units:	(percent)
Distribution type:	Triangular
Minimum:	0.04
Most likely:	0.10
Maximum:	0.53
RME Point Estimate:	0.47
MLE Point Estimate:	0.1
Expected/Mean Result =	0.2233343
Maximum Result =	0.5213047
Minimum Result =	0.04504246
Range of Possible Results =	0.4762622
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.1090967
Skewness =	0.5336259
Kurtosis =	2.39962
Variance =	0.0119021
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.045
5%	0.0782
10%	0.094
15%	0.1066
20%	0.1192
25%	0.1324
30%	0.1457
35%	0.1599
40%	0.1743
45%	0.1894
50%	0.2053
55%	0.2221
60%	0.2397
65%	0.2583
70%	0.2784
75%	0.3004
80%	0.3247
85%	0.3521
90%	0.3844
95%	0.4264
100%	0.5213

Figure O.32. EFPC probability density function: surface water/sediment while wading exposure frequency

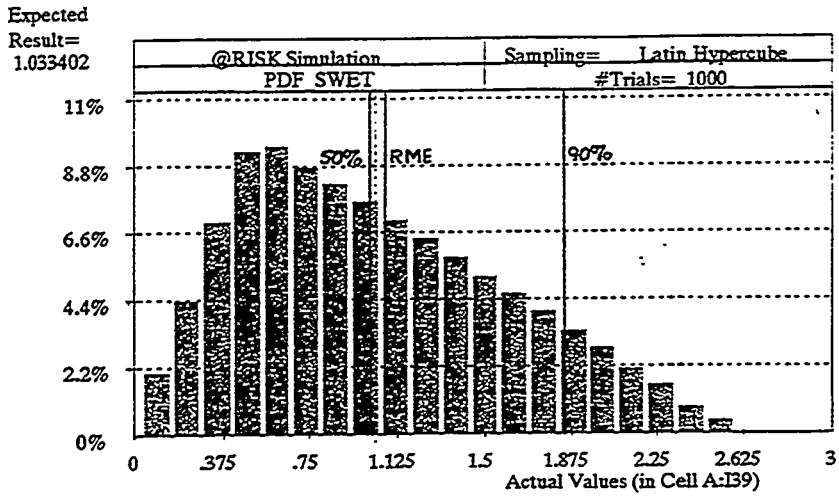


Units:	(days/year)
Distribution type:	Triangular
Minimum:	0
Most likely:	7
Maximum:	60
RME Point Estimate:	36
MLE Point Estimate:	7
Expected/Mean Result =	22.33312
Maximum Result =	59.04327
Minimum Result =	0.2451202
Range of Possible Results =	58.79815
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	13.39561
Skewness =	0.5368205
Kurtosis =	2.400576
Variance =	179.4424
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.2451
5%	4.5604
10%	6.473
15%	7.9878
20%	9.5481
25%	11.1549
30%	12.8094
35%	14.524
40%	16.2996
45%	18.1575
50%	20.1061
55%	22.1396
60%	24.2985
65%	26.6345
70%	29.0669
75%	31.7982
80%	34.7531
85%	38.0993
90%	42.0998
95%	47.3811
100%	59.0433

Figure O.33. EFPC probability density function: exposure time to surface water while swimming (open land use)

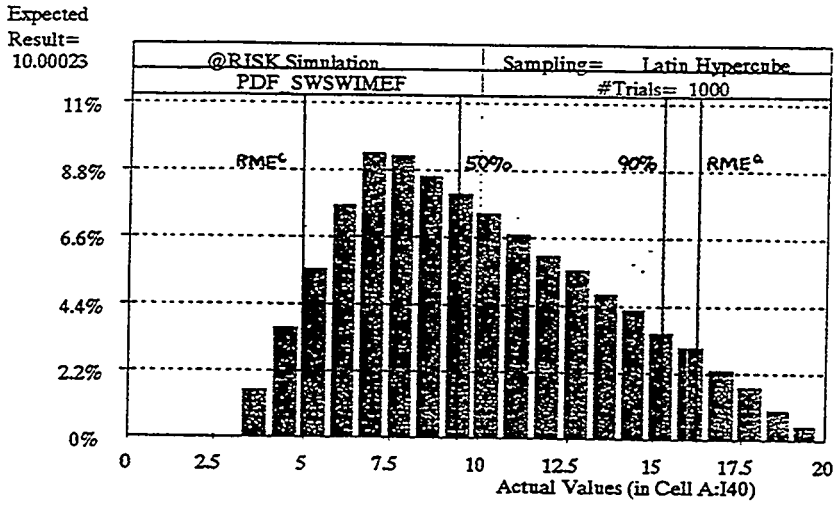


Units:	(hours/day)
Distribution type:	Triangular
Minimum:	0
Most likely:	0.5
Maximum:	2.6
RME Point Estimate:	1
MLE Point Estimate:	0.5
Expected/Mean Result =	1.033373
Maximum Result =	2.549265
Minimum Result =	0.02802975
Range of Possible Results =	2.521236
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.563291
Skewness =	0.48411
Kurtosis =	2.401693
Variance =	0.3172968
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.028
5%	0.2532
10%	0.3605
15%	0.4402
20%	0.5098
25%	0.5762
30%	0.6438
35%	0.7147
40%	0.7896
45%	0.8666
50%	0.9471
55%	1.0325
60%	1.1219
65%	1.2166
70%	1.3182
75%	1.4304
80%	1.5525
85%	1.6942
90%	1.8577
95%	2.0751
100%	2.5493

Figure O.34. EFPC probability density function: surface water while swimming exposure frequency



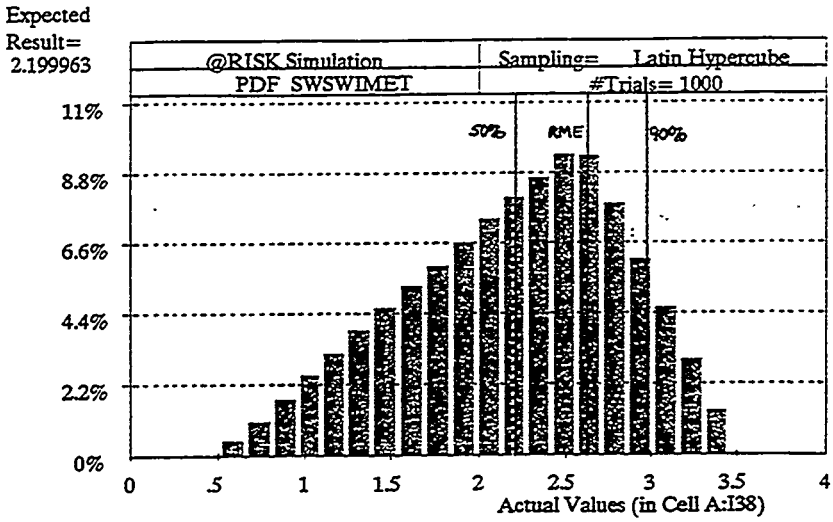
Units:	(days/year)
Distribution type:	Triangular
Minimum:	3
Most likely:	7
Maximum:	20
RME Point Estimate[a]:	16
MLE Point Estimate[b]:	7
RME Point Estimate[c]:	5
MLE Point Estimate[d]:	1
Expected/Mean Result =	10.00024
Maximum Result =	19.66564
Minimum Result =	3.241848
Range of Possible Results =	16.4238
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	3.628269
Skewness =	0.4401648
Kurtosis =	2.399744
Variance =	13.16434
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	3.2418
5%	4.8422
10%	5.5983
15%	6.1857
20%	6.6852
25%	7.1208
30%	7.5588
35%	8.0117
40%	8.4784
45%	8.9702
50%	9.4863
55%	10.0274
60%	10.5971
65%	11.1972
70%	11.8498
75%	12.558
80%	13.3432
85%	14.2421
90%	15.2885
95%	16.6591
100%	19.6656

[a] Surface water while swimming RME exposure frequency for agricultural/homesteader and residential land uses is 16 days/year
[b] Surface water while swimming MLE exposure frequency for agricultural/homesteader and residential land uses is 7 days/year
[c] Surface water while swimming RME exposure frequency for open land uses is 5 days/year
[d] Surface water while swimming MLE exposure frequency for open land uses is 1 day/year

Figure O.35. EFPC probability density function: exposure time to surface water while swimming (residential and agricultural/homesteader land uses)

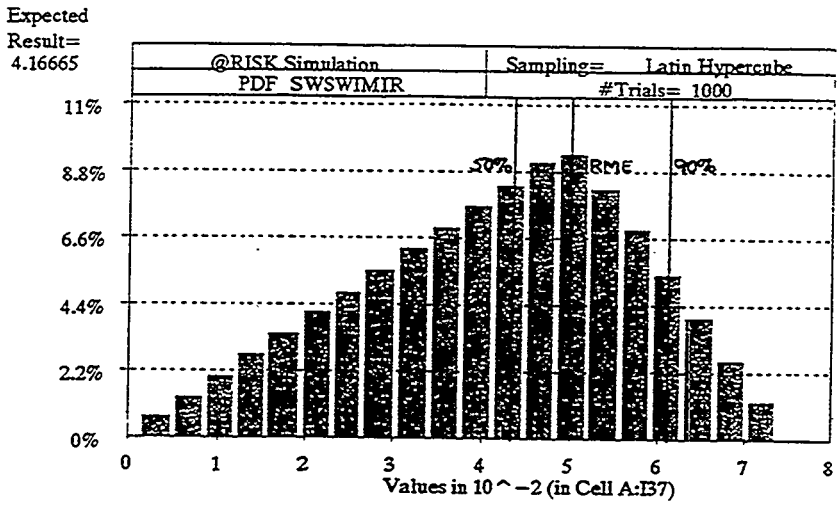


Units:	(hours/day)
Distribution type:	Triangular
Minimum:	0.5
Most likely:	2.6
Maximum:	3.5
RME Point Estimate:	2.6
MLE Point Estimate:	1
Expected/Mean Result =	2.199941
Maximum Result =	3.456115
Minimum Result =	0.5513433
Range of Possible Results =	2.904772
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.6285819
Skewness =	−0.3570481
Kurtosis =	2.402311
Variance =	0.3951153
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.5513
5%	1.0562
10%	1.291
15%	1.4712
20%	1.6219
25%	1.7547
30%	1.8725
35%	1.9846
40%	2.0861
45%	2.1819
50%	2.2737
55%	2.3599
60%	2.4427
65%	2.5226
70%	2.5994
75%	2.6782
80%	2.7649
85%	2.8625
90%	2.9796
95%	3.1321
100%	3.4561

Figure O.36. EFPC probability density function: incidential ingestion of surface water while swimming

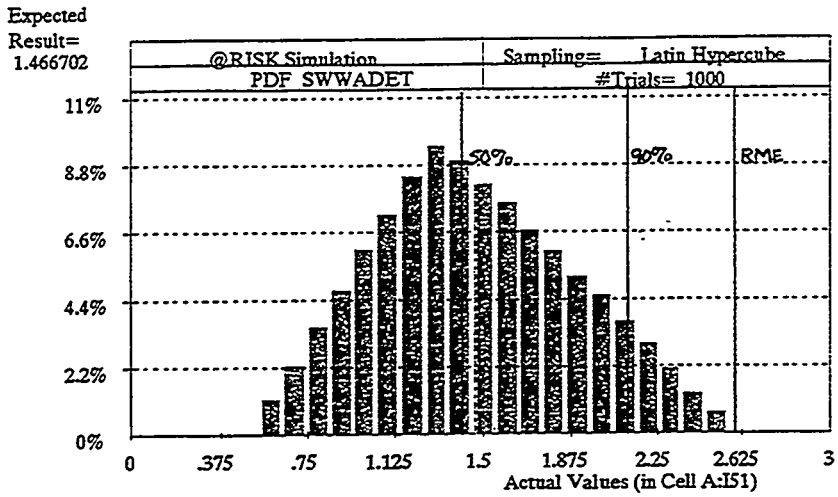


Units:	(L/hour)
Distribution type:	Triangular
Minimum:	0
Most likely:	0.05
Maximum:	0.075
RME Point Estimate:	0.05
MLE Point Estimate:	0.05
Expected/Mean Result =	0.04166739
Maximum Result =	0.07443535
Minimum Result =	0.001769671
Range of Possible Results =	0.07266568
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.015593
Skewness =	−0.3045936
Kurtosis =	2.40041
Variance =	0.0002431418
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0018
5%	0.0137
10%	0.0193
15%	0.0237
20%	0.0274
25%	0.0306
30%	0.0335
35%	0.0362
40%	0.0387
45%	0.0411
50%	0.0433
55%	0.0454
60%	0.0474
65%	0.0493
70%	0.0513
75%	0.0533
80%	0.0556
85%	0.0582
90%	0.0613
95%	0.0653
100%	0.0744

Figure O.37. EFPC probability density function: exposure time to surface water while wading (residential and agricultural/homesteader land uses)

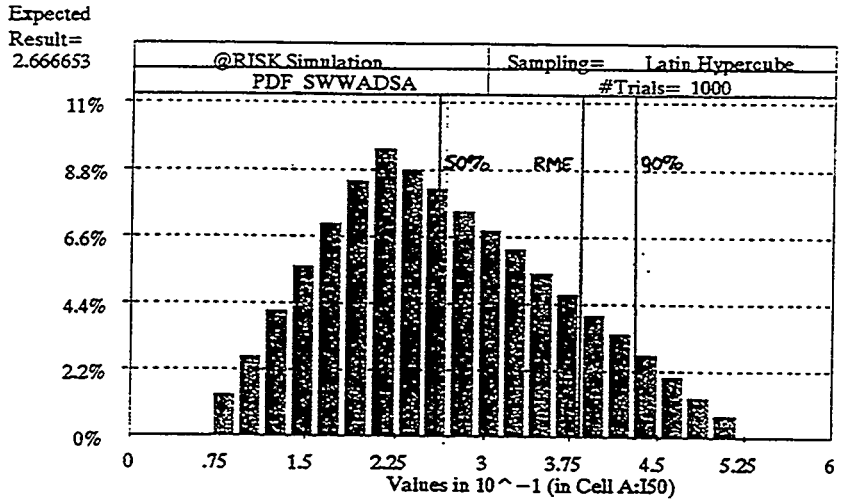


Units:	(hours/day)
Distribution type:	Triangular
Minimum:	0.5
Most likely:	1.3
Maximum:	2.6
RME Point Estimate:	2.6
MLE Point Estimate:	1
Expected/Mean Result =	1.466671
Maximum Result =	2.555583
Minimum Result =	0.5232427
Range of Possible Results =	2.03234
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.4327599
Skewness =	0.2249075
Kurtosis =	2.39998
Variance =	0.1872812
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.5232
5%	0.7889
10%	0.909
15%	1.0008
20%	1.0785
25%	1.1471
30%	1.2094
35%	1.2663
40%	1.3199
45%	1.3745
50%	1.4305
55%	1.4908
60%	1.5549
65%	1.6217
70%	1.6939
75%	1.7726
80%	1.8608
85%	1.9596
90%	2.0769
95%	2.2293
100%	2.5556

Figure O.38. EFPC probability density function: skin fraction exposed to surface water while wading

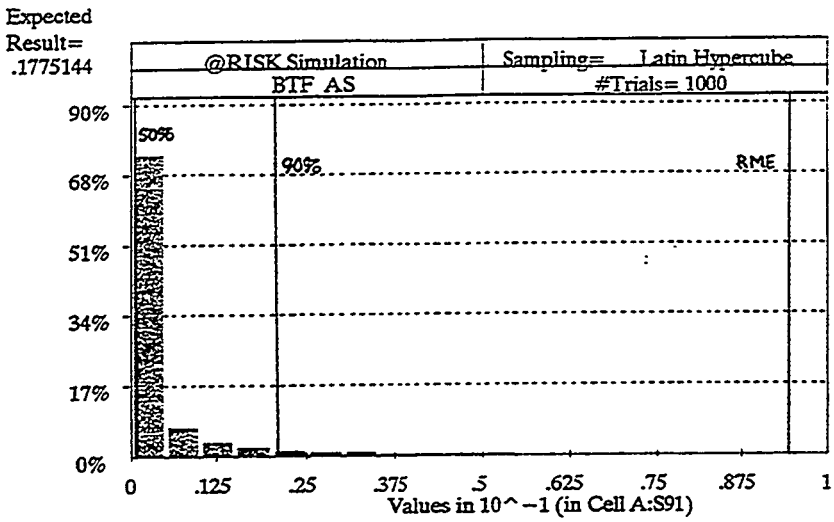


Units:	(percent)
Distribution type:	Triangular
Minimum:	0.06
Most likely:	0.21
Maximum:	0.53
RME Point Estimate:	0.38
MLE Point Estimate:	0.21
Expected/Mean Result =	0.2666689
Maximum Result =	0.5227576
Minimum Result =	0.0642879
Range of Possible Results =	0.4584697
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.09800959
Skewness =	0.3273174
Kurtosis =	2.399735
Variance =	0.009605879
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0643
5%	0.1188
10%	0.1436
15%	0.1626
20%	0.1787
25%	0.1926
30%	0.2054
35%	0.2172
40%	0.2294
45%	0.2424
50%	0.2558
55%	0.2696
60%	0.2845
65%	0.3003
70%	0.3172
75%	0.336
80%	0.3562
85%	0.3794
90%	0.4068
95%	0.4427
100%	0.5228

Figure O.39. EFPC probability density function: soil to plant biotransfer factor – Arsenic

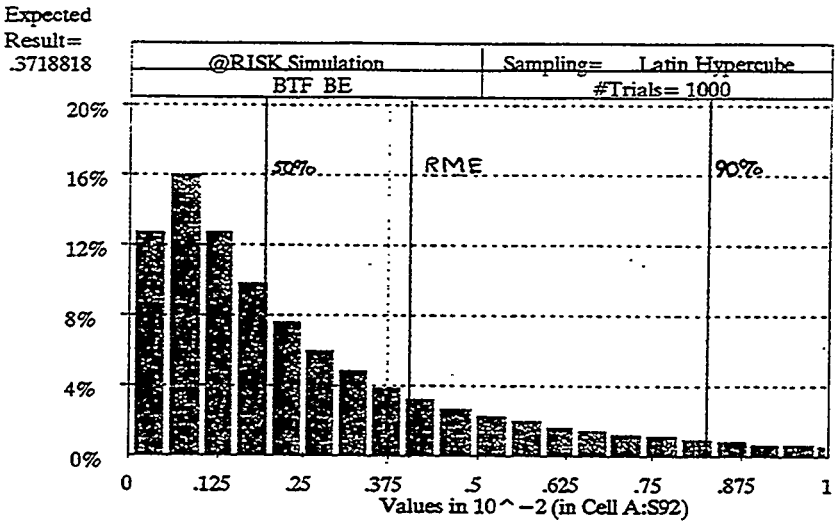


Units:	(mg As/kg plant WW)/(mg As/kg soil)
Distribution type:	Lognormal
Mean:	–7.195
Standard Deviation:	2.599
RME/MLE Point Estimate:	0.08
Expected/Mean Result =	0.01775144
Maximum Result =	2.453834
Minimum Result =	5.740886000000E–08
Range of Possible Results =	2.453834
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.1149809
Skewness =	14.83719
Kurtosis =	266.1835
Variance =	0.01322061
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	5.000000000000E–08
5%	0.00001
10%	0.00002
15%	0.00005
20%	0.00008
25%	0.0001
30%	0.0002
35%	0.0003
40%	0.0004
45%	0.0005
50%	0.0007
55%	0.001
60%	0.0014
65%	0.002
70%	0.0029
75%	0.0043
80%	0.0067
85%	0.011
90%	0.021
95%	0.0531
100%	2.4538

Figure O.40. EFPC probability density function: soil to plant biotransfer factor – Beryllium

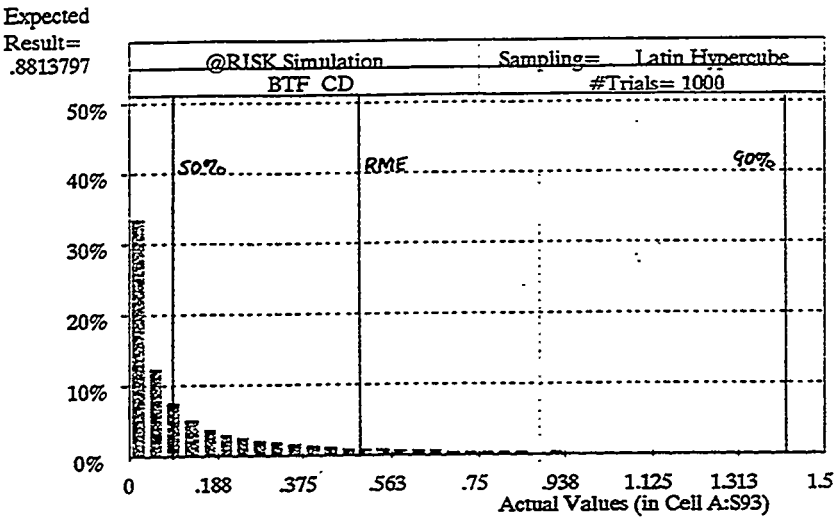


Units:	(mg Be/kg plant WW)/(mg Be/kg soil)
Distribution type:	Lognormal
Mean:	−6.244
Standard Deviation:	1.139
RME/MLE Point Estimate:	0.004
Expected/Mean Result =	0.003718818
Maximum Result =	0.09798896
Minimum Result =	0.00004015779
Range of Possible Results =	0.0979488
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.005975427
Skewness =	6.632453
Kurtosis =	78.03902
Variance =	0.00003570573
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.00004
5%	0.0003
10%	0.0004
15%	0.0006
20%	0.0007
25%	0.0009
30%	0.002
35%	0.0013
40%	0.0015
45%	0.0017
50%	0.0019
55%	0.0022
60%	0.0026
65%	0.003
70%	0.0035
75%	0.0042
80%	0.006
85%	0.0063
90%	0.0083
95%	0.0126
100%	0.098

Figure O.41. EFPC probability density function: soil to plant biotransfer factor – Cadmium

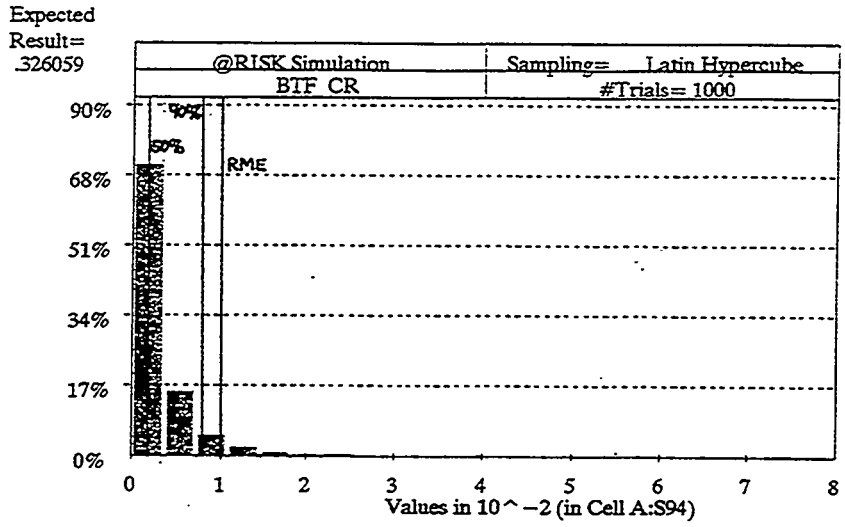


Units:	(mg Cd/kg plant WW)/(mg Cd/kg soil)
Distribution type:	Lognormal
Mean:	−2.358
Standard Deviation:	2.135
RME/MLE Point Estimate:	0.5
Expected/Mean Result =	0.8813797
Maximum Result =	126.5907
Minimum Result =	0.0001189627
Range of Possible Results =	126.5906
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	4.881291
Skewness =	18.89112
Kurtosis =	453.0102
Variance =	23.82701
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0001
5%	0.0028
10%	0.0061
15%	0.0103
20%	0.0156
25%	0.0224
30%	0.0309
35%	0.0414
40%	0.0549
45%	0.0722
50%	0.0945
55%	0.1231
60%	0.1625
65%	0.2145
70%	0.2893
75%	0.3981
80%	0.5691
85%	0.8581
90%	1.4521
95%	3.1338
100%	126.5907

Figure O.42. EFPC probability density function: soil to plant biotransfer factor – Chromium

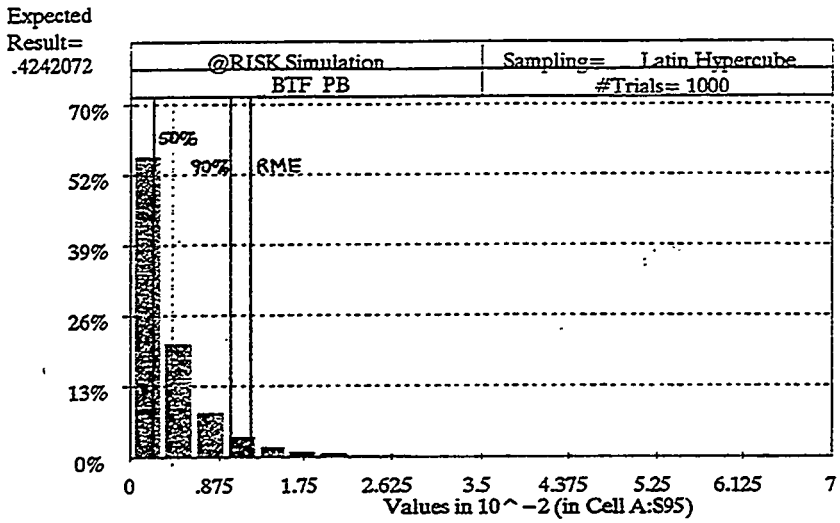


Units:	(mg Cr/kg plant WW)/(mg Cr/kg soil)
Distribution type:	Lognormal
Mean:	0.049
Standard Deviation:	0.071
RME/MLE Point Estimate:	0.01
Expected/Mean Result =	0.003260589
Maximum Result =	0.07221695
Minimum Result =	0.00006595514
Range of Possible Results =	0.072151
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.004658279
Skewness =	5.785355
Kurtosis =	62.05014
Variance =	0.00002169956
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.00006
5%	0.0003
10%	0.0005
15%	0.0006
20%	0.0008
25%	0.0009
30%	0.002
35%	0.0012
40%	0.0014
45%	0.0016
50%	0.0018
55%	0.0021
60%	0.0024
65%	0.0028
70%	0.0032
75%	0.0038
80%	0.0045
85%	0.0056
90%	0.0072
95%	0.0107
100%	0.0722

Figure O.43. EFPC probability density function: soil to plant biotransfer factor – Lead

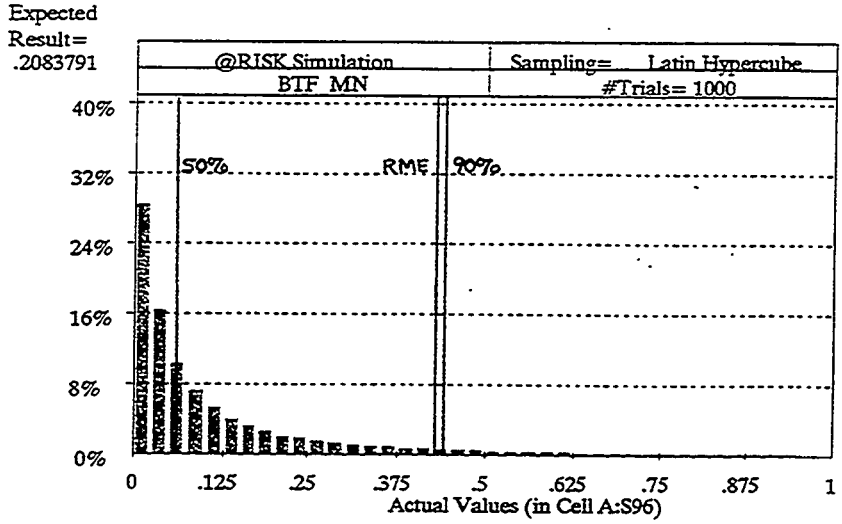


Units:	(mg Pb/kg plant WW)/(mg Pb/kg soil)
Distribution type:	Lognormal
Mean:	0.064
Standard Deviation:	0.086
RME/MLE Point Estimate:	0.01
Expected/Mean Result =	0.004242072
Maximum Result =	0.06280489
Minimum Result =	0.00009296777
Range of Possible Results =	0.06271192
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.005430153
Skewness =	4.250546
Kurtosis =	31.37087
Variance =	0.00002948656
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.00009
5%	0.0005
10%	0.0007
15%	0.0009
20%	0.002
25%	0.0013
30%	0.0015
35%	0.0017
40%	0.002
45%	0.0022
50%	0.0025
55%	0.0029
60%	0.0033
65%	0.0038
70%	0.0043
75%	0.005
80%	0.006
85%	0.0073
90%	0.0093
95%	0.0134
100%	0.0628

Figure O.44. EFPC probability density function: soil to plant biotransfer factor – Manganese

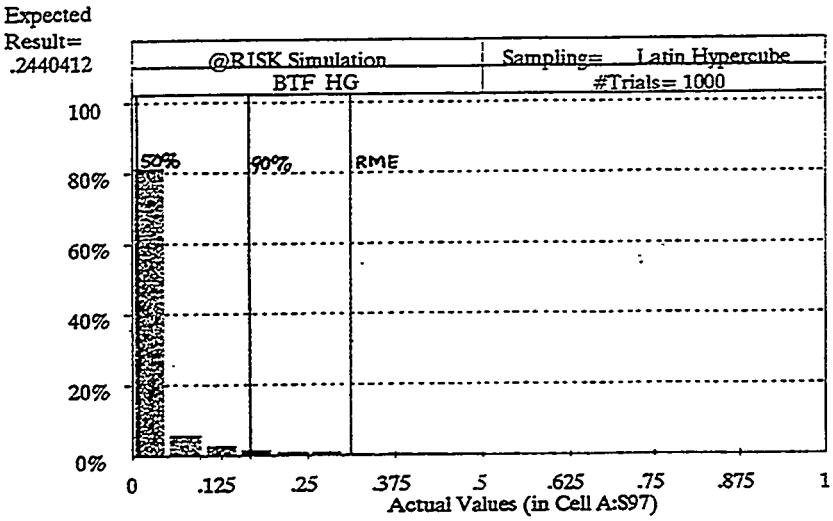


Units:	(mg Mn/kg plant WW)/(mg Mn/kg soil)
Distribution type:	Lognormal
Mean:	−2.778
Standard Deviation:	1.556
RME/MLE Point Estimate:	0.4
Expected/Mean Result =	0.2083791
Maximum Result =	10.98696
Minimum Result =	0.0004389836
Range of Possible Results =	10.98652
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.5797249
Skewness =	10.24834
Kurtosis =	152.9518
Variance =	0.336081
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0004
5%	0.0048
10%	0.0084
15%	0.0123
20%	0.0168
25%	0.0218
30%	0.0274
35%	0.034
40%	0.0418
45%	0.051
50%	0.062
55%	0.0756
60%	0.0919
65%	0.1129
70%	0.1405
75%	0.1772
80%	0.2302
85%	0.3112
90%	0.4535
95%	0.7919
100%	10.987

Figure O.45. EFPC probability density function: soil to plant biotransfer factor – Mercury

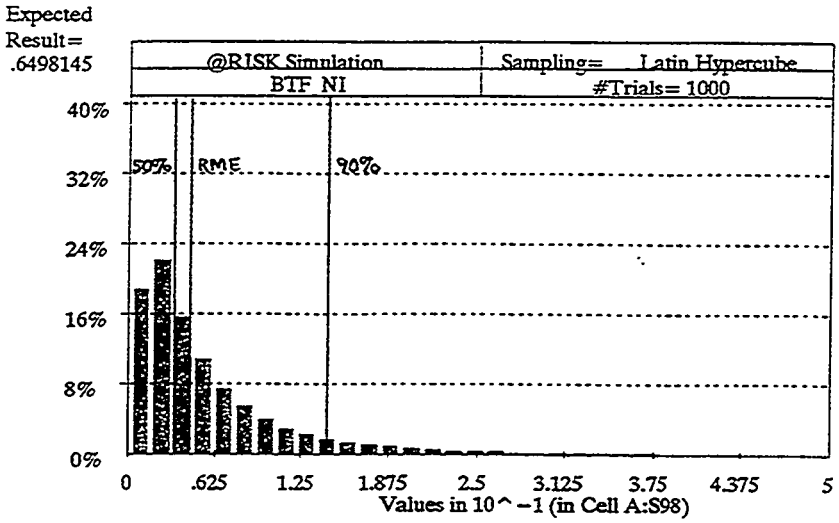


Units:	(mg Hg/kg plant WW)/(mg Hg/kg soil)
Distribution type:	Lognormal
Mean:	−5.624
Standard Deviation:	3.004
RME/MLE Point Estimate:	0.3
Expected/Mean Result =	0.2440412
Maximum Result =	71.96641
Minimum Result =	2.757325000000E−07
Range of Possible Results =	71.96641
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	2.537487
Skewness =	23.75243
Kurtosis =	646.4479
Variance =	6.438838
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	2.000000000000E−07
5%	0.00002
10%	0.00007
15%	0.0002
20%	0.0003
25%	0.0005
30%	0.0007
35%	0.0011
40%	0.0017
45%	0.0025
50%	0.0036
55%	0.0052
60%	0.0077
65%	0.0114
70%	0.0174
75%	0.0272
80%	0.0452
85%	0.0803
90%	0.1682
95%	0.4955
100%	71.9664

Figure O.46. EFPC probability density function: soil to plant biotransfer factor – Nickel

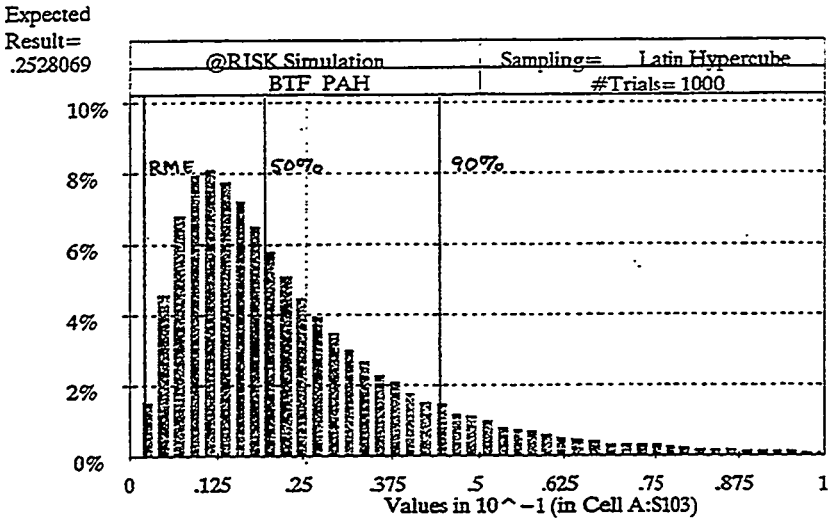


Units:	(mg Ni/kg plant WW)/(mg Ni/kg soil)
Distribution type:	Lognormal
Mean:	−3.22
Standard Deviation:	0.097
RME/MLE Point Estimate:	0.05
MLE Point Estimate:	0.040
Expected/Mean Result =	0.06498145
Maximum Result =	1.50001
Minimum Result =	0.00185335
Range of Possible Results =	1.498156
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.08664819
Skewness =	6.615259
Kurtosis =	85.70604
Variance =	0.007507909
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0019
5%	0.008
10%	0.0114
15%	0.0145
20%	0.0175
25%	0.0207
30%	0.0239
35%	0.0274
40%	0.0311
45%	0.0353
50%	0.0399
55%	0.0452
60%	0.0512
65%	0.0583
70%	0.0667
75%	0.0774
80%	0.0911
85%	0.1103
90%	0.1399
95%	0.1986
100%	1.5

Figure O.47. EFPC probability density function: soil to plant biotransfer factor – Benzo(a)pyrene

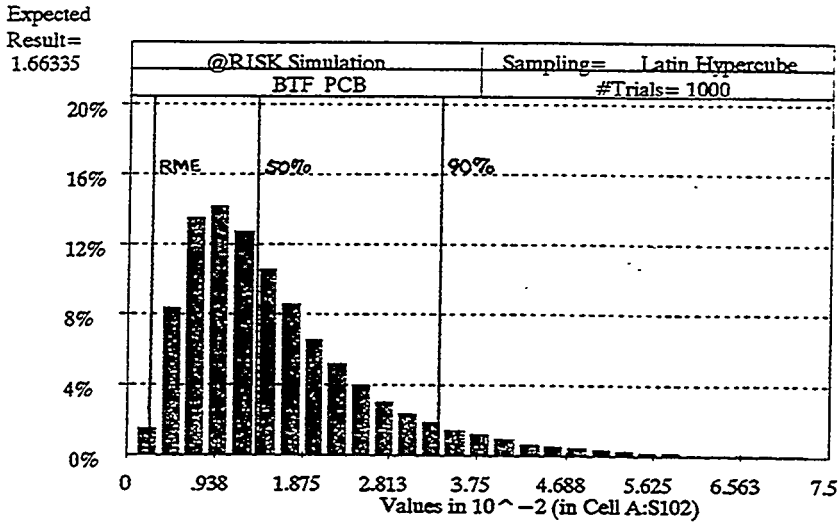


Units:	(mg BaP/kg plant WW)/(mg BaP/kg soil)
Distribution type:	Lognormal
Mean:	0.38
Standard Deviation:	0.33
RME/MLE Point Estimate:	0.002
Expected/Mean Result =	0.02528069
Maximum Result =	0.2219077
Minimum Result =	0.001536933
Range of Possible Results =	0.2203708
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.02168354
Skewness =	2.833089
Kurtosis =	16.49667
Variance =	0.0004701761
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0015
5%	0.0056
10%	0.0073
15%	0.0088
20%	0.0101
25%	0.0115
30%	0.0129
35%	0.0143
40%	0.0158
45%	0.0174
50%	0.0191
55%	0.03
60%	0.0231
65%	0.0255
70%	0.0283
75%	0.0317
80%	0.0359
85%	0.0414
90%	0.0498
95%	0.0652
100%	0.2219

Figure O.48. EFPC probability density function: soil to plant biotransfer factor – PCBs

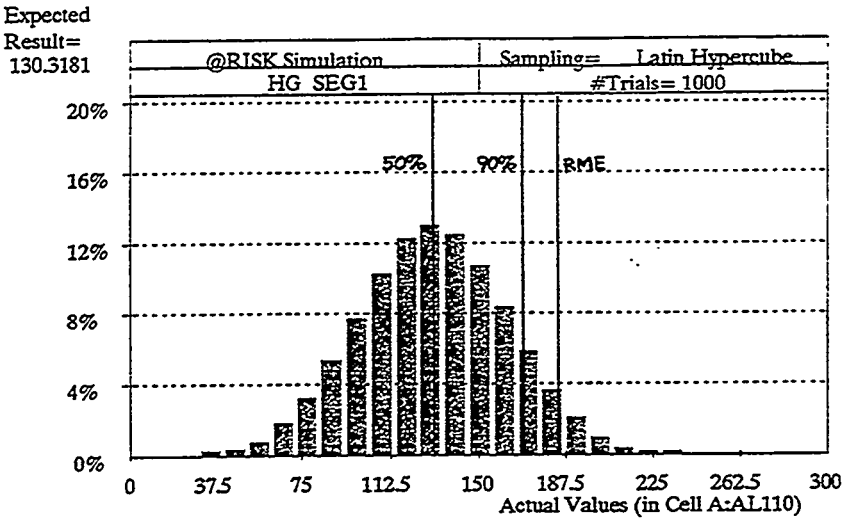


Units:	(mg PCBs/kg plant WW)/(mg PCBs/kg soil)
Distribution type:	Lognormal
Mean:	0.25
Standard Deviation:	0.18
RME/MLE Point Estimate:	0.002
Expected/Mean Result =	0.0166335
Maximum Result =	0.1030222
Minimum Result =	0.0007534524
Range of Possible Results =	0.1022687
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.01186764
Skewness =	2.267522
Kurtosis =	11.41009
Variance =	0.0001408408
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.0008
5%	0.0047
10%	0.0059
15%	0.0069
20%	0.0078
25%	0.0087
30%	0.0096
35%	0.0105
40%	0.0115
45%	0.0124
50%	0.0135
55%	0.0146
60%	0.0159
65%	0.0173
70%	0.0189
75%	0.0208
80%	0.0233
85%	0.0264
90%	0.0309
95%	0.0389
100%	0.103

Figure O.49. EFPC probability density function: Mercury exposure point concentration – Segment 1

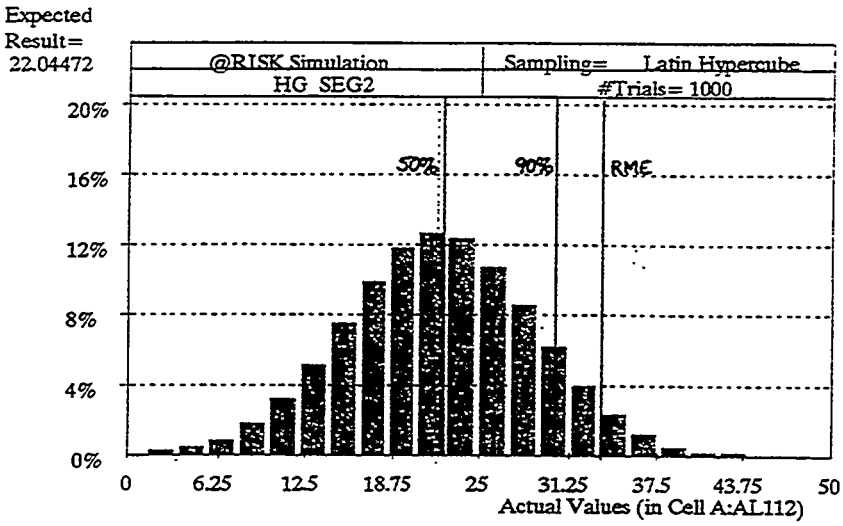


Units:	(mg Hg/kg soil)
Distribution type:	Truncated Normal
Mean:	130.3
Standard Deviation:	32.0
Truncated Minimum:	0.4
Truncated Maximum:	1590.0
RME Point Estimate:	183.4
MLE Point Estimate:	130.3
Expected/Mean Result =	130.3181
Maximum Result =	239.1221
Minimum Result =	29.68344
Range of Possible Results =	209.4386
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	31.93531
Skewness =	0.01200357
Kurtosis =	2.973954
Variance =	1019.864
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	29.6834
5%	77.5999
10%	89.341
15%	97.1052
20%	103.3103
25%	108.6925
30%	113.5281
35%	117.9203
40%	122.1922
45%	126.2704
50%	130.2623
55%	134.2419
60%	138.3205
65%	142.5517
70%	147.0232
75%	151.7712
80%	157.1619
85%	163.3442
90%	171.0944
95%	182.7081
100%	239.1221

Figure O.50. EFPC probability density function: Mercury exposure point concentration – Segment 2

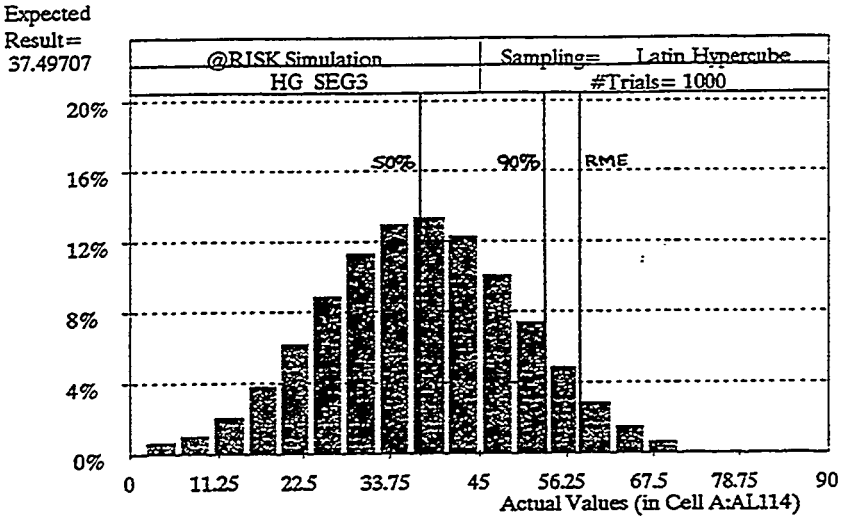


Units:	(mg Hg/kg soil)
Distribution type:	Truncated Normal
Mean:	22.0
Standard Deviation:	6.8
Truncated Minimum:	0.6
Truncated Maximum:	443.0
RME Point Estimate:	33.3
MLE Point Estimate:	22.0
Expected/Mean Result =	22.04472
Maximum Result =	44.08719
Minimum Result =	1.210959
Range of Possible Results =	42.87623
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	6.723321
Skewness =	0.01540135
Kurtosis =	2.925238
Variance =	45.20304
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.211
5%	10.9316
10%	13.3946
15%	15.0307
20%	16.338
25%	17.4757
30%	18.4825
35%	19.4292
40%	20.3147
45%	21.1756
50%	22.0349
55%	22.8749
60%	23.7351
65%	24.626
70%	25.5712
75%	26.5875
80%	27.7012
85%	29.014
90%	30.6739
95%	33.1296
100%	44.0872

Figure O.51. EFPC probability density function: Mercury exposure point concentration – Segment 3

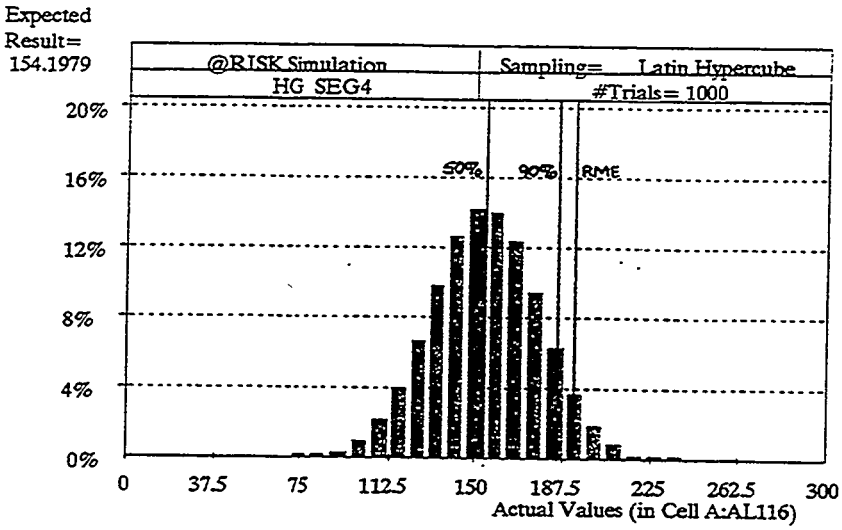


Units:	(mg Hg/kg soil)
Distribution type:	Truncated Normal
Mean:	37.4
Standard Deviation:	12.9
Truncated Minimum:	0.1
Truncated Maximum:	868.0
RME Point Estimate:	58.9
MLE Point Estimate:	37.4
Expected/Mean Result =	37.49707
Maximum Result =	88.30146
Minimum Result =	1.780198
Range of Possible Results =	86.52126
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	12.82583
Skewness =	0.06712653
Kurtosis =	2.977906
Variance =	164.5018
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.7802
5%	16.3766
10%	20.9579
15%	24.0679
20%	26.5681
25%	28.7527
30%	30.6774
35%	32.4703
40%	34.1584
45%	35.8022
50%	37.4116
55%	39.0345
60%	40.6951
65%	42.3912
70%	44.1835
75%	46.1097
80%	48.2865
85%	50.7828
90%	53.9706
95%	58.6169
100%	88.3015

Figure O.52. EFPC probability density function: Mercury exposure point concentration – Segment 4

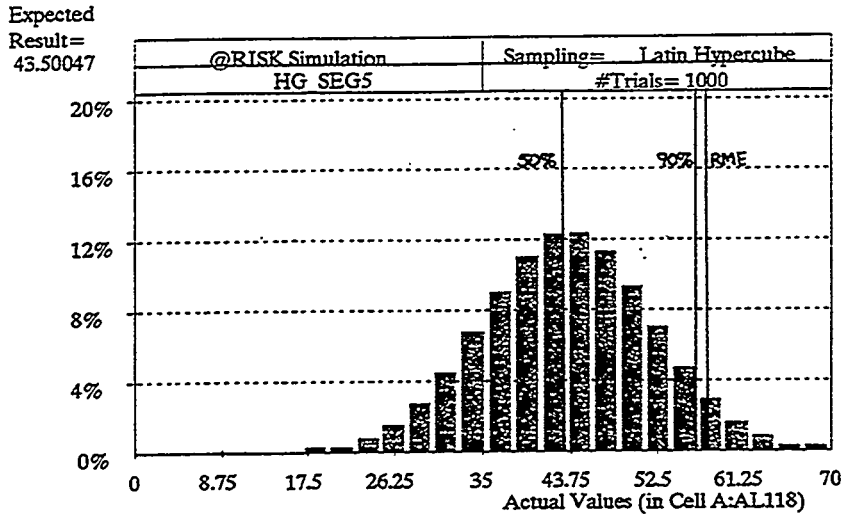


Units:	(mg Hg/kg soil)
Distribution type:	Truncated Normal
Mean:	154.2
Standard Deviation:	23.5
Truncated Minimum:	0.1
Truncated Maximum:	1290.0
RME Point Estimate:	193.2
MLE Point Estimate:	154.2
Expected/Mean Result =	154.1979
Maximum Result =	239.4918
Minimum Result =	70.07918
Range of Possible Results =	169.4127
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	23.5059
Skewness =	0.0004934763
Kurtosis =	3.040991
Variance =	552.5274
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	70.0792
5%	115.4563
10%	124.1066
15%	129.7945
20%	134.3588
25%	138.3343
30%	141.8502
35%	145.1148
40%	148.1994
45%	151.227
50%	154.1901
55%	157.1254
60%	160.1432
65%	163.246
70%	166.4554
75%	169.9805
80%	173.8997
85%	178.5138
90%	184.2486
95%	192.6823
100%	239.4918

Figure O.53. EFPC probability density function: Mercury exposure point concentration – Segment 5

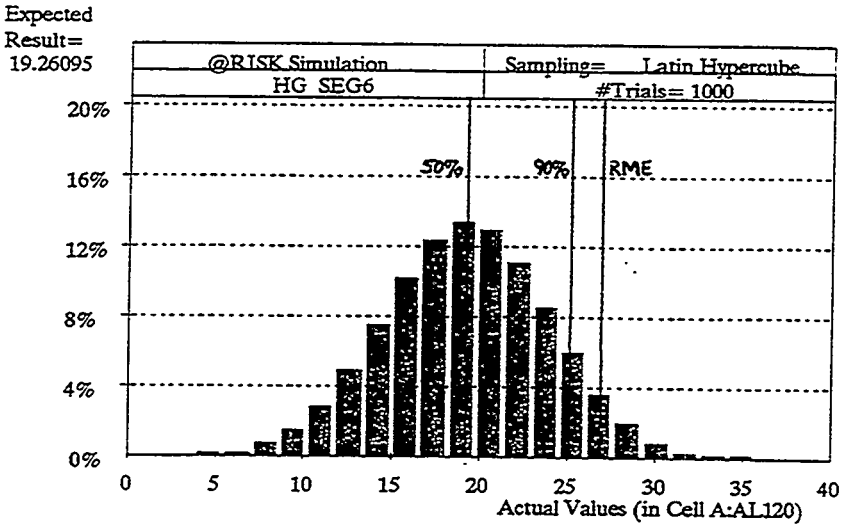


Units:	(mg Hg/kg soil)
Distribution type:	Truncated Normal
Mean:	43.5
Standard Deviation:	8.5
Truncated Minimum:	1.3
Truncated Maximum:	352.0
RME Point Estimate:	57.6
MLE Point Estimate:	43.5
Expected/Mean Result =	43.50047
Maximum Result =	69.81231
Minimum Result =	16.86305
Range of Possible Results =	52.94926
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	8.439201
Skewness =	0.002641589
Kurtosis =	2.945558
Variance =	71.22012
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	16.8631
5%	29.5483
10%	32.6484
15%	34.7101
20%	36.3627
25%	37.7916
30%	39.061
35%	40.2208
40%	41.3502
45%	42.4195
50%	43.4873
55%	44.5499
60%	45.6343
65%	46.7364
70%	47.9246
75%	49.1854
80%	50.5848
85%	52.2448
90%	54.3237
95%	57.4007
100%	69.8123

Figure O.54. EFPC probability density function: Mercury exposure point concentration – Segment 6

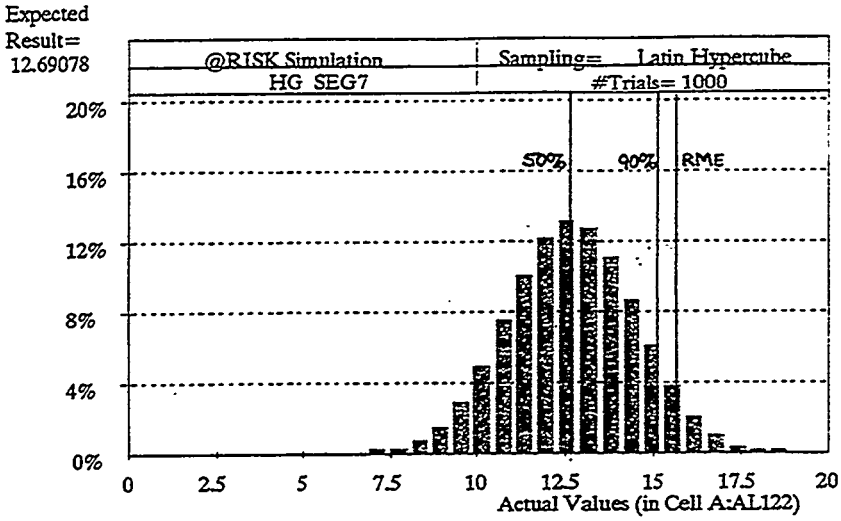


Units:	(mg Hg/kg soil)
Distribution type:	Truncated Normal
Mean:	19.3
Standard Deviation:	4.7
Truncated Minimum:	0.2
Truncated Maximum:	207.0
RME Point Estimate:	27.1
MLE Point Estimate:	19.3
Expected/Mean Result =	19.26095
Maximum Result =	35.63184
Minimum Result =	3.860335
Range of Possible Results =	31.77151
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	4.716915
Skewness =	0.006432428
Kurtosis =	2.993984
Variance =	22.24928
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	3.8603
5%	11.4818
10%	13.1951
15%	14.3565
20%	15.2859
25%	16.0742
30%	16.7851
35%	17.4319
40%	18.0623
45%	18.6667
50%	19.2579
55%	19.847
60%	20.4472
65%	21.0732
70%	21.7295
75%	22.4351
80%	23.2192
85%	24.1299
90%	25.3045
95%	26.9902
100%	35.6318

Figure O.55. EFPC probability density function: Mercury exposure point concentration — Segment 7

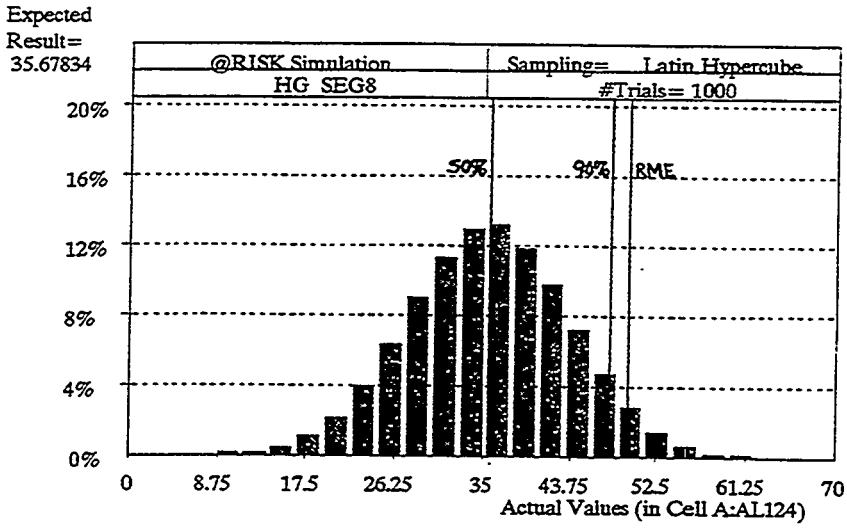


Units:	(mg Hg/kg soil)
Distribution type:	Truncated Normal
Mean:	12.7
Standard Deviation:	1.8
Truncated Minimum:	0.4
Truncated Maximum:	278.0
RME Point Estimate:	15.7
MLE Point Estimate:	12.7
Expected/Mean Result =	12.69078
Maximum Result =	18.90337
Minimum Result =	6.803591
Range of Possible Results =	12.09978
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	1.83032
Skewness =	0.009782814
Kurtosis =	2.99256
Variance =	3.350071
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	6.8036
5%	9.6651
10%	10.3402
15%	10.7876
20%	11.1439
25%	11.4518
30%	11.727
35%	11.9842
40%	12.2252
45%	12.4562
50%	12.6887
55%	12.917
60%	13.1529
65%	13.3936
70%	13.6464
75%	13.9226
80%	14.2265
85%	14.5805
90%	15.0316
95%	15.6893
100%	18.9034

Figure O.56. EFPC probability density function: Mercury exposure point concentration – Segment 8

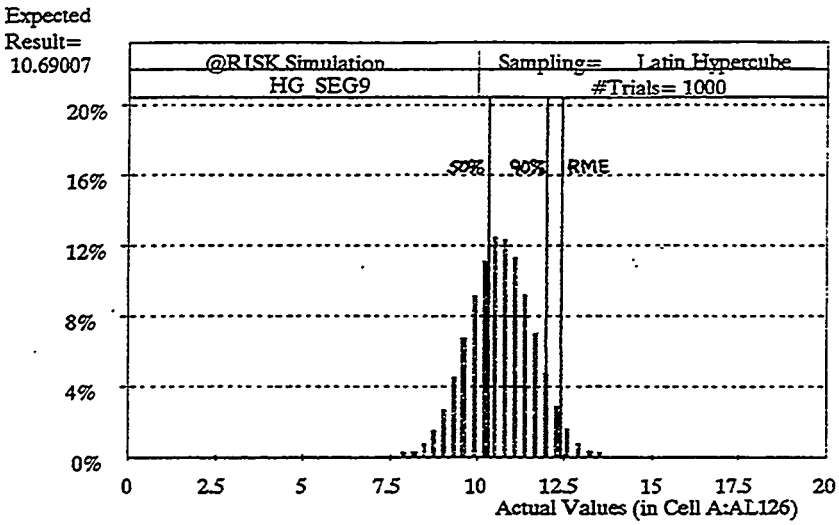


Units:	(mg Hg/kg soil)
Distribution type:	Truncated Normal
Mean:	35.7
Standard Deviation:	8.1
Truncated Minimum:	1.0
Truncated Maximum:	417.0
RME Point Estimate:	49.1
MLE Point Estimate:	35.7
Expected/Mean Result =	35.67834
Maximum Result =	62.02466
Minimum Result =	8.455139
Range of Possible Results =	53.56952
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	8.073888
Skewness =	−0.004455028
Kurtosis =	2.975927
Variance =	65.18767
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	8.4551
5%	22.3315
10%	25.2835
15%	27.2853
20%	28.8755
25%	30.2154
30%	31.4341
35%	32.5636
40%	33.633
45%	34.6594
50%	35.6733
55%	36.686
60%	37.7074
65%	38.782
70%	39.9133
75%	41.1057
80%	42.465
85%	44.0258
90%	46.005
95%	48.9513
100%	62.0247

Figure O.57. EFPC probability density function: Mercury exposure point concentration – Segment 9

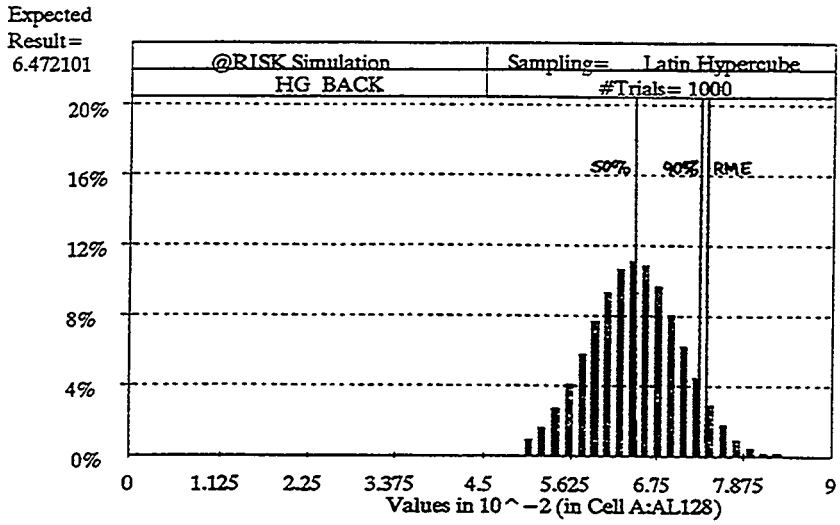


Units:	(mg Hg/kg soil)
Distribution type:	Truncated Normal
Mean:	10.7
Standard Deviation:	0.9
Truncated Minimum:	0.4
Truncated Maximum:	216.0
RME Point Estimate:	12.3
MLE Point Estimate:	10.7
Expected/Mean Result =	10.69007
Maximum Result =	13.659
Minimum Result =	7.696448
Range of Possible Results =	5.962549
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.9470975
Skewness =	0.000603557
Kurtosis =	2.957139
Variance =	0.8969936
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	7.6964
5%	9.1267
10%	9.4723
15%	9.7071
20%	9.8891
25%	10.0499
30%	10.191
35%	10.3236
40%	10.4474
45%	10.5692
50%	10.688
55%	10.8071
60%	10.9291
65%	11.0541
70%	11.1862
75%	11.327
80%	11.4872
85%	11.6726
90%	11.9042
95%	12.2431
100%	13.659

Figure O.58. EFPC probability density function: Mercury exposure point concentration – Background



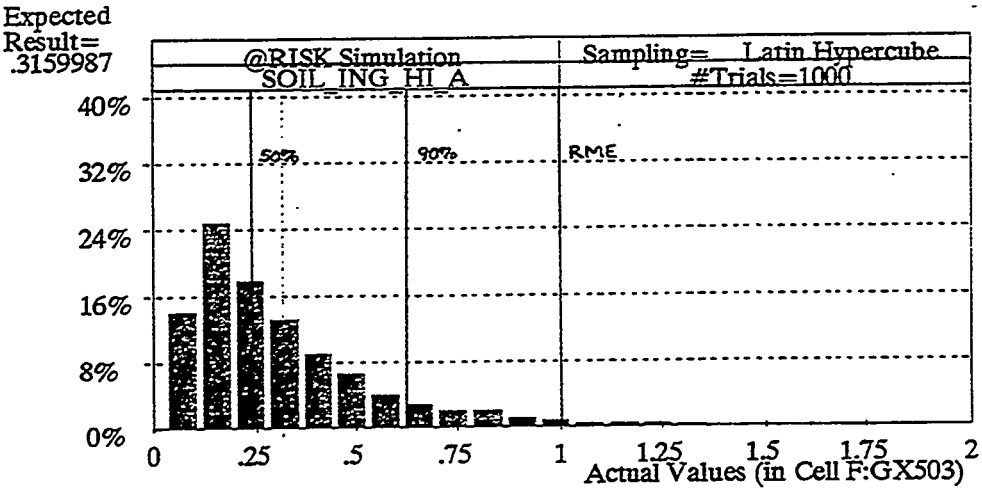
Units:	(mg Hg/kg soil)
Distribution type:	Truncated Normal
Mean:	0.065
Standard Deviation:	0.0061
Truncated Minimum:	0.05
Truncated Maximum:	0.13
RME Point Estimate:	0.076
MLE Point Estimate:	0.065
Expected/Mean Result =	0.06472101
Maximum Result =	0.08381846
Minimum Result =	0.05003893
Range of Possible Results =	0.03377953
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.005930415
Skewness =	0.1169238
Kurtosis =	2.783683
Variance =	0.00003516983
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.05
5%	0.055
10%	0.057
15%	0.0584
20%	0.0596
25%	0.0606
30%	0.0615
35%	0.0623
40%	0.0631
45%	0.0639
50%	0.0646
55%	0.0654
60%	0.0662
65%	0.067
70%	0.0678
75%	0.0687
80%	0.0697
85%	0.0709
90%	0.0724
95%	0.0746
100%	0.0838

MONTE CARLO ANALYSIS RESULTS

Figure O.59. Probabilistic risk estimate ingestion exposure of adults to soils results of Monte Carlo simulation: Hazard Index – Segment 4

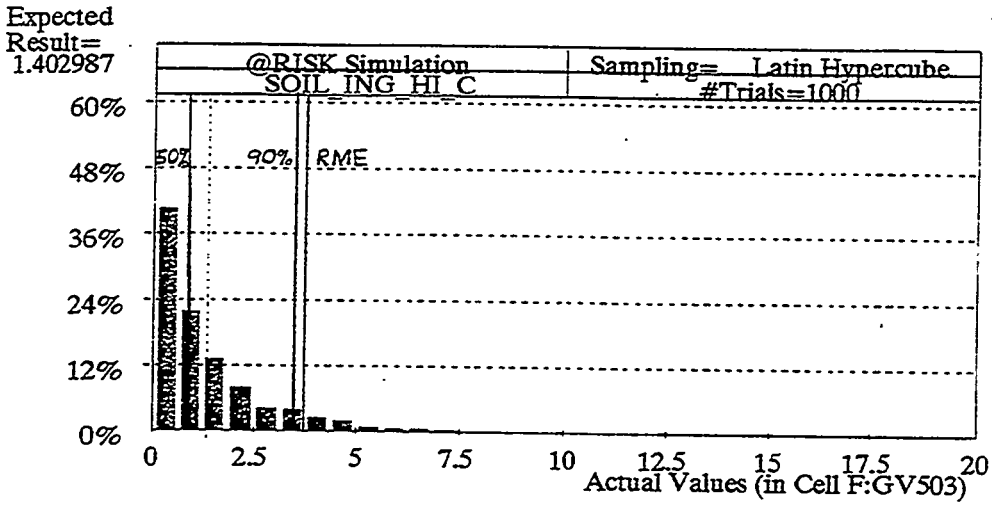


RME Point Estimate:	1.00E+00
MLE Point Estimate:	2.48E−01
Expected/Mean Result =	0.316
Maximum Result =	1.697
Minimum Result =	0.027
Range of Possible Results =	1.670
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	0.243
Skewness =	1.873
Kurtosis =	7.715
Variance =	0.059
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.027
5%	0.074
10%	0.093
15%	0.115
20%	0.133
25%	0.147
30%	0.164
35%	0.183
40%	0.199
45%	0.225
50%	0.246
55%	0.271
60%	0.298
65%	0.329
70%	0.366
75%	0.415
80%	0.462
85%	0.522
90%	0.629
95%	0.808
100%	1.697

Figure O.60. Probabilistic risk estimate ingestion exposure of children to soils results of Monte Carlo simulation: Hazard Index – Segment 4

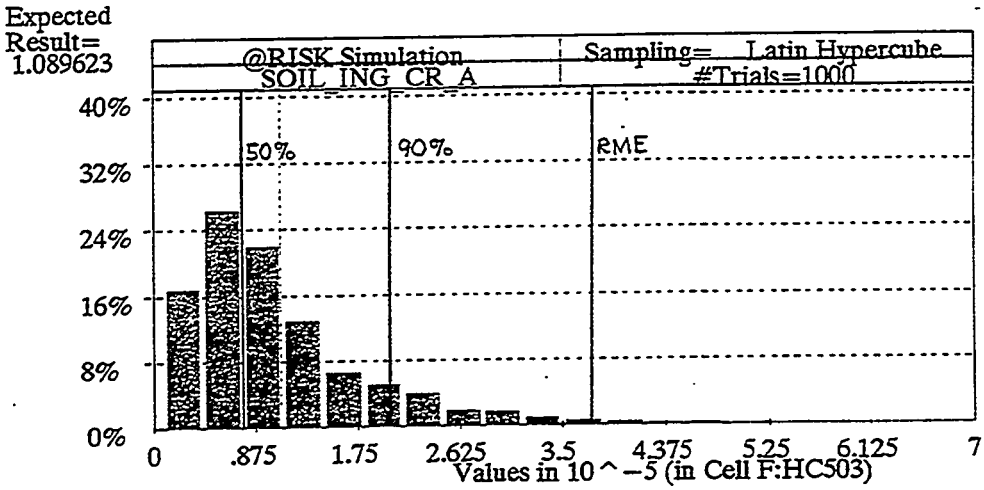


RME Point Estimate:	3.60E+00
MLE Point Estimate:	8.67E+00
Expected/Mean Result =	1.403
Maximum Result =	12.384
Minimum Result =	0.027
Range of Possible Results =	12.357
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	1.495
Skewness =	2.269
Kurtosis =	10.734
Variance =	2.235
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.027
5%	0.138
10%	0.187
15%	0.258
20%	0.325
25%	0.391
30%	0.463
35%	0.540
40%	0.636
45%	0.743
50%	0.873
55%	0.999
60%	1.159
65%	1.418
70%	1.568
75%	1.805
80%	2.246
85%	2.723
90%	3.444
95%	4.458
100%	12.385

Figure O.61. Probabilistic risk estimate ingestion exposure of adults to soils results of Monte Carlo simulation: Cancer Risk (chemicals) – Segment 4

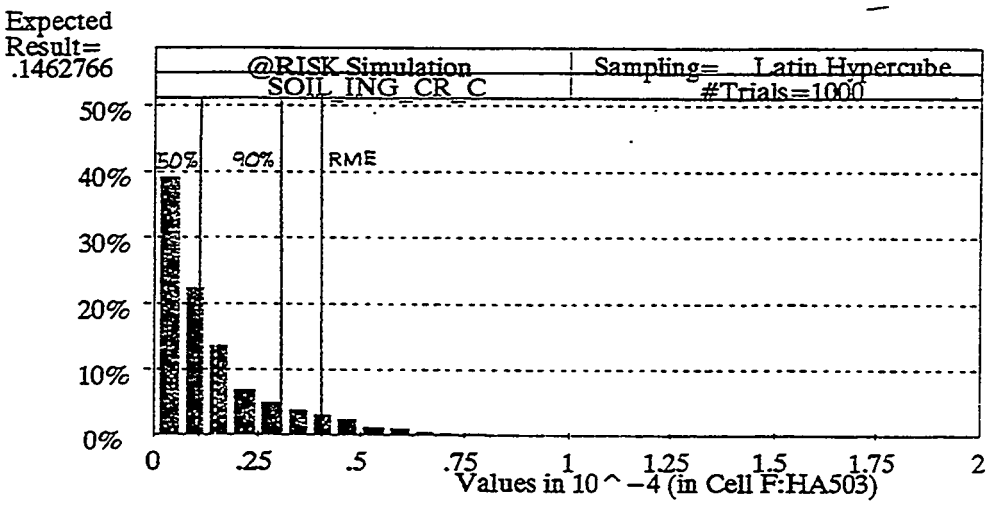


RME Point Estimate:	3.68E−05
MLE Point Estimate:	2.56E−06
Expected/Mean Result =	1.09E−05
Maximum Result =	6.93E−05
Minimum Result =	8.08E−07
Range of Possible Results =	6.85E−05
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	8.36E−06
Skewness =	2.00E+00
Kurtosis =	8.84E+00
Variance =	6.99E−11
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	8.00E−07
5%	2.00E−06
10%	3.00E−06
15%	4.00E−06
20%	4.00E−06
25%	5.00E−06
30%	5.00E−06
35%	6.00E−06
40%	7.00E−06
45%	7.00E−06
50%	8.00E−06
55%	9.00E−06
60%	1.00E−05
65%	1.00E−05
70%	1.00E−05
75%	1.00E−05
80%	1.00E−05
85%	1.00E−05
90%	2.00E−05
95%	2.00E−05
100%	6.00E−05

Figure O.62. Probabilistic risk estimate ingestion exposure of children to soils results of Monte Carlo simulation: Cancer Risk (chemicals) – Segment 4

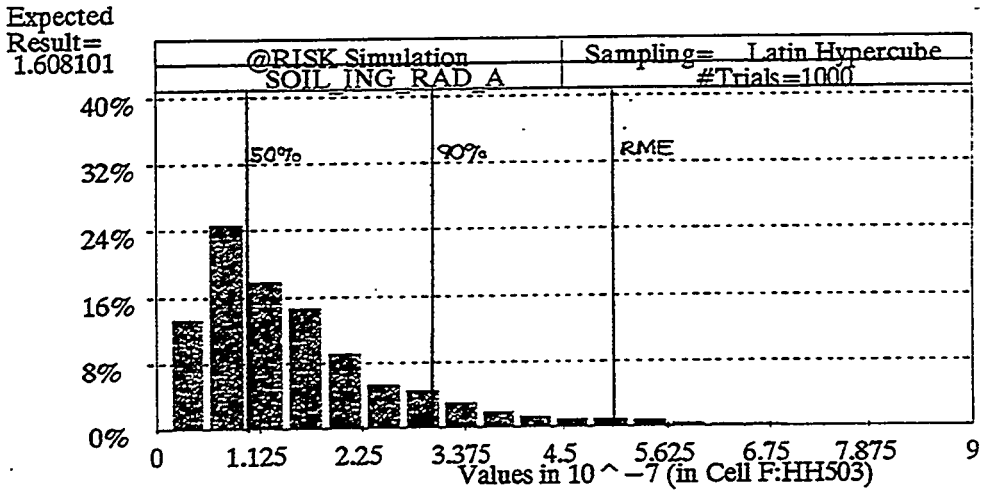


RME Point Estimate:	3.96E–05
MLE Point Estimate:	2.98E–06
Expected/Mean Result =	1.46E–05
Maximum Result =	1.24E–04
Minimum Result =	2.55E–07
Range of Possible Results =	1.23E–04
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	1.56E–05
Skewness =	2.18E+00
Kurtosis =	9.84E+00
Variance =	2.42E–10
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	2.00E–07
5%	1.00E–06
10%	2.00E–06
15%	2.00E–06
20%	3.00E–06
25%	4.00E–06
30%	4.00E–06
35%	5.00E–06
40%	6.00E–06
45%	7.00E–06
50%	9.00E–06
55%	1.00E–05
60%	1.00E–05
65%	1.00E–05
70%	1.00E–05
75%	1.00E–05
80%	2.00E–05
85%	2.00E–05
90%	3.00E–05
95%	4.00E–05
100%	1.00E–04

Figure O.63. Probabilistic risk estimate ingestion exposure of adults to soils results of Monte Carlo simulation: Cancer Risk (radionuclides) – Segment 4

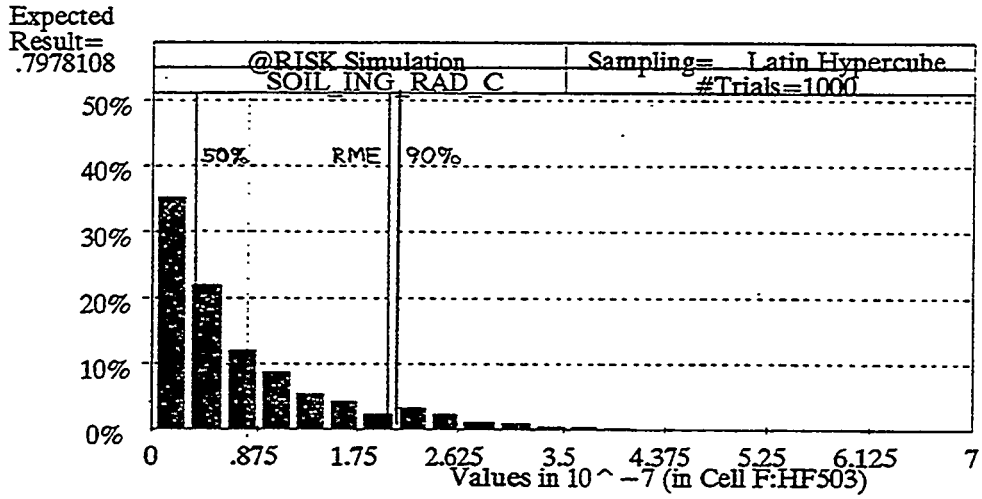


RME Point Estimate:	4.91E–07
MLE Point Estimate:	3.79E–08
Expected/Mean Result =	1.61E–07
Maximum Result =	8.62E–07
Minimum Result =	1.40E–08
Range of Possible Results =	8.48E–07
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	1.22E–07
Skewness =	1.86E+00
Kurtosis =	7.53E+00
Variance =	1.48E–14
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.00E–08
5%	3.00E–08
10%	4.00E–08
15%	6.00E–08
20%	6.00E–08
25%	7.00E–08
30%	8.00E–08
35%	9.00E–08
40%	1.00E–07
45%	1.00E–07
50%	1.00E–07
55%	1.00E–07
60%	1.00E–07
65%	1.00E–07
70%	1.00E–07
75%	2.00E–07
80%	2.00E–07
85%	2.00E–07
90%	3.00E–07
95%	4.00E–07
100%	8.00E–07

Figure O.64. Probabilistic risk estimate ingestion exposure of children to soils results of Monte Carlo simulation: Cancer Risk (radionuclides) – Segment 4

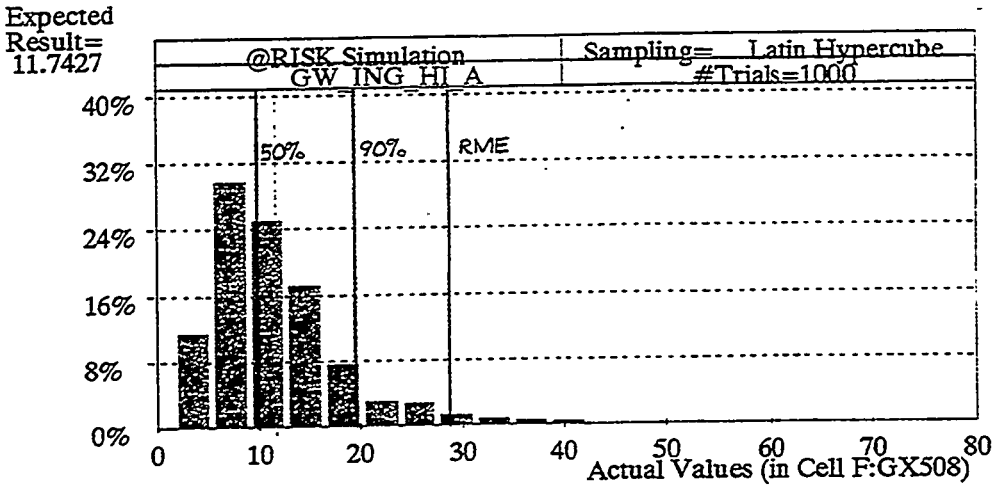


RME Point Estimate:	1.96E–07
MLE Point Estimate:	1.58E–08
Expected/Mean Result =	7.98E–08
Maximum Result =	5.89E–07
Minimum Result =	1.30E–09
Range of Possible Results =	5.87E–07
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	8.24E–08
Skewness =	1.89E+00
Kurtosis =	7.27E+00
Variance =	6.79E–15
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.00E–09
5%	8.00E–09
10%	1.00E–08
15%	1.00E–08
20%	1.00E–08
25%	2.00E–08
30%	2.00E–08
35%	3.00E–08
40%	3.00E–08
45%	4.00E–08
50%	4.00E–08
55%	5.00E–08
60%	6.00E–08
65%	7.00E–08
70%	9.00E–08
75%	1.00E–07
80%	1.00E–07
85%	1.00E–07
90%	2.00E–07
95%	2.00E–07
100%	5.00E–07

Figure O.65. Probabilistic risk estimate ingestion exposure of adults to groundwater results of Monte Carlo simulation: Hazard Index – Segment 4

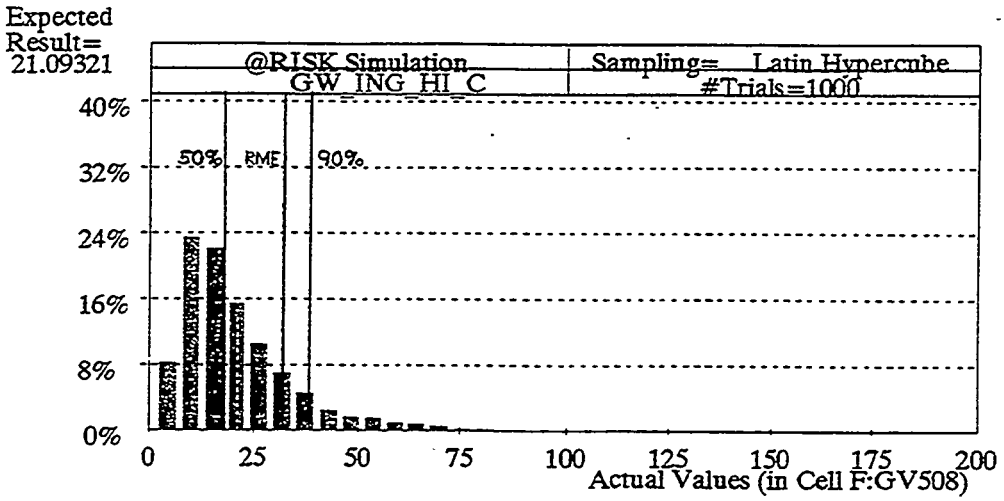


RME Point Estimate:	28.500
MLE Point Estimate:	16.200
Expected/Mean Result =	11.743
Maximum Result =	75.589
Minimum Result =	1.597
Range of Possible Results =	73.992
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	7.071
Skewness =	2.281
Kurtosis =	13.144
Variance =	50.002
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.597
5%	4.089
10%	5.122
15%	5.866
20%	6.441
25%	7.028
30%	7.673
35%	8.227
40%	8.888
45%	9.447
50%	10.079
55%	10.611
60%	11.452
65%	12.553
70%	13.580
75%	14.382
80%	15.719
85%	17.275
90%	19.741
95%	25.334
100%	75.589

Figure O.66. Probabilistic risk estimate ingestion exposure of children to groundwater results of Monte Carlo simulation: Hazard Index – Segment 4

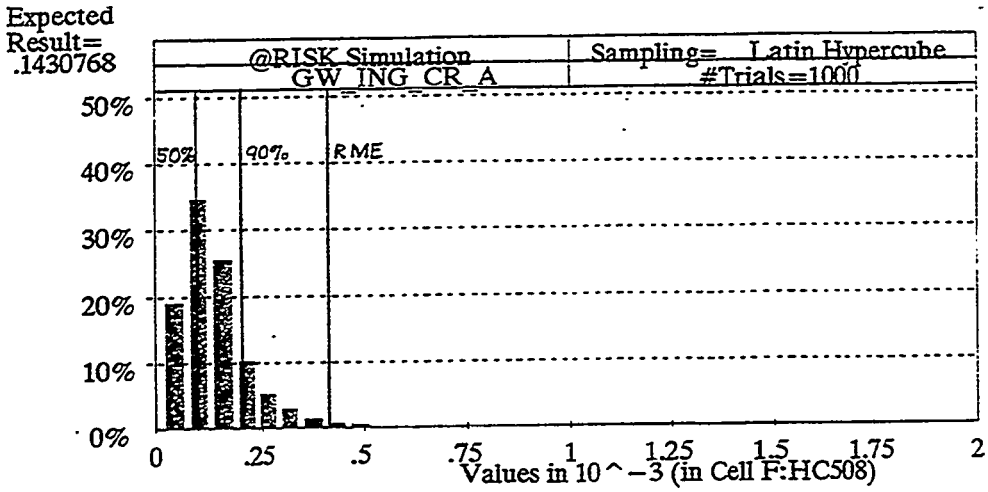


RME Point Estimate:	33.80
MLE Point Estimate:	16.90
Expected/Mean Result =	21.09
Maximum Result =	110.80
Minimum Result =	1.83
Range of Possible Results =	108.96
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	14.40
Skewness =	1.94
Kurtosis =	8.42
Variance =	207.41
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.83
5%	6.19
10%	7.84
15%	9.20
20%	10.20
25%	11.29
30%	12.41
35%	13.45
40%	14.79
45%	15.93
50%	17.21
55%	18.81
60%	20.25
65%	22.02
70%	24.05
75%	26.55
80%	29.35
85%	33.60
90%	38.86
95%	49.70
100%	110.80

Figure O.67. Probabilistic risk estimate ingestion exposure of adults to groundwater results of Monte Carlo simulation: Cancer Risk (chemicals) – Segment 4

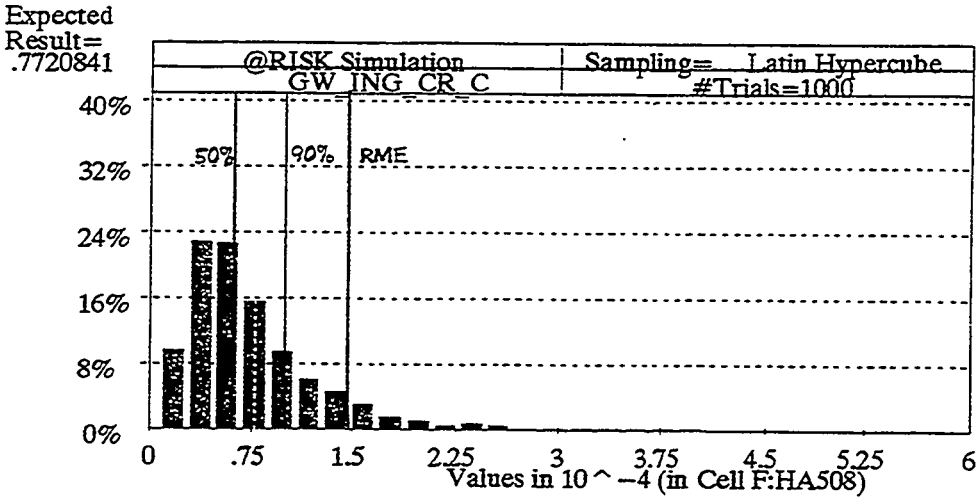


RME Point Estimate:	4.12E−04
MLE Point Estimate:	5.93E−05
Expected/Mean Result =	1.43E−04
Maximum Result =	1.13E−03
Minimum Result =	1.80E−05
Range of Possible Results =	1.11E−03
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	8.95E−05
Skewness =	2.67E+00
Kurtosis =	2.00E+01
Variance =	8.00E−09
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.00E−05
5%	4.00E−05
10%	5.00E−05
15%	6.00E−05
20%	7.00E−05
25%	8.00E−05
30%	9.00E−05
35%	9.00E−05
40%	1.00E−04
45%	1.00E−04
50%	1.00E−04
55%	1.00E−04
60%	1.00E−04
65%	2.00E−04
70%	2.00E−04
75%	2.00E−04
80%	2.00E−04
85%	2.00E−04
90%	2.00E−04
95%	3.00E−04
100%	1.10E−03

Figure O.68. Probabilistic risk estimate ingestion exposure of children to groundwater results of Monte Carlo simulation: Cancer Risk (chemicals) – Segment 4

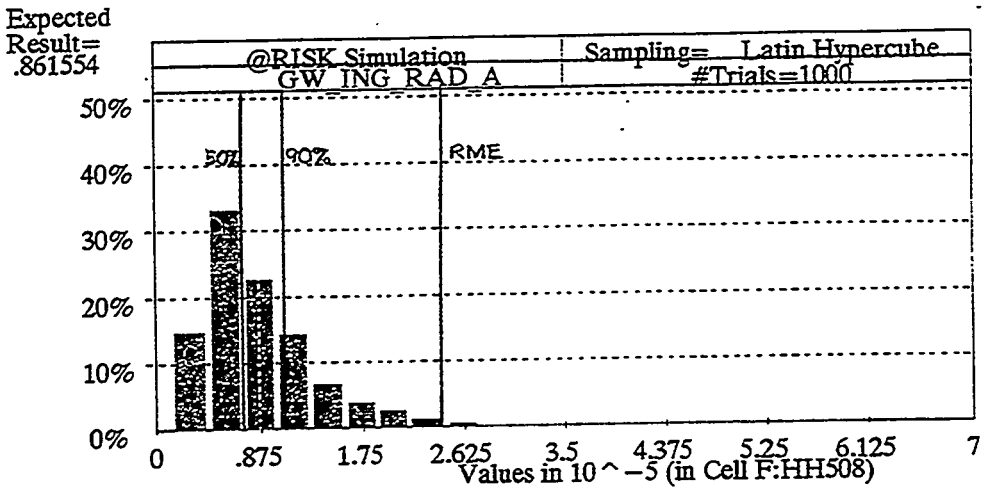


RME Point Estimate:	1.46E–04
MLE Point Estimate:	2.05E–05
Expected/Mean Result =	7.72E–05
Maximum Result =	4.07E–04
Minimum Result =	6.99E–06
Range of Possible Results =	4.00E–04
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	5.52E–05
Skewness =	2.15E+00
Kurtosis =	9.65E+00
Variance =	3.04E–09
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	6.00E–06
5%	2.00E–05
10%	2.00E–05
15%	3.00E–05
20%	3.00E–05
25%	4.00E–05
30%	4.00E–05
35%	4.00E–05
40%	5.00E–05
45%	5.00E–05
50%	6.00E–05
55%	6.00E–05
60%	7.00E–05
65%	7.00E–05
70%	8.00E–05
75%	9.00E–05
80%	1.00E–04
85%	1.00E–04
90%	1.00E–04
95%	2.00E–04
100%	4.00E–04

Figure O.69. Probabilistic risk estimate ingestion exposure of adults to groundwater results of Monte Carlo simulation: Cancer Risk (radionuclides) – Segment 4

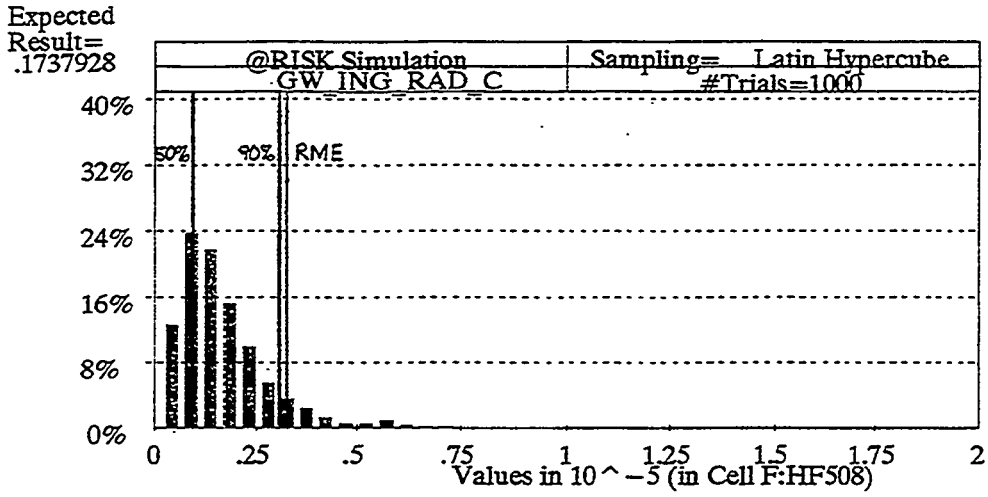


RME Point Estimate:	2.35E–05
MLE Point Estimate:	3.59E–06
Expected/Mean Result =	8.62E–06
Maximum Result =	5.94E–05
Minimum Result =	1.36E–06
Range of Possible Results =	5.80E–05
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	5.11E–06
Skewness =	2.23E+00
Kurtosis =	1.47E+01
Variance =	2.61E–11
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.00E–06
5%	2.00E–06
10%	3.00E–06
15%	4.00E–06
20%	4.00E–06
25%	5.00E–06
30%	5.00E–06
35%	5.00E–06
40%	6.00E–06
45%	6.00E–06
50%	7.00E–06
55%	7.00E–06
60%	8.00E–06
65%	9.00E–06
70%	1.00E–05
75%	1.00E–05
80%	1.00E–05
85%	1.00E–05
90%	1.00E–05
95%	1.00E–05
100%	5.00E–05

Figure O.70. Probabilistic risk estimate ingestion exposure of children to groundwater results of Monte Carlo simulation: Cancer Risk (radionuclides) – Segment 4

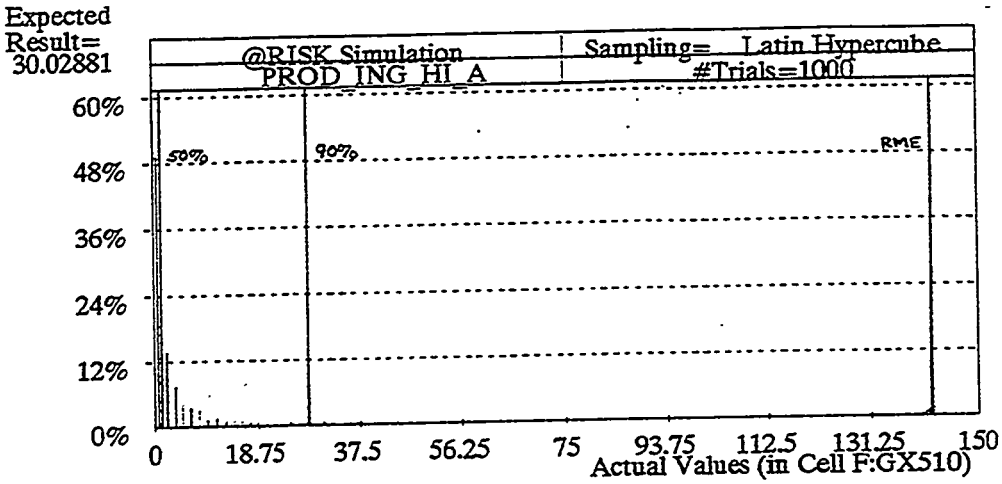


RME Point Estimate:	3.10E−06
MLE Point Estimate:	4.45E−07
Expected/Mean Result =	1.74E−06
Maximum Result =	9.74E−06
Minimum Result =	1.89E−07
Range of Possible Results =	9.55E−06
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	1.23E−06
Skewness =	2.10E+00
Kurtosis =	9.37E+00
Variance =	1.51E−12
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	1.00E−07
5%	4.00E−07
10%	6.00E−07
15%	7.00E−07
20%	8.00E−07
25%	9.00E−07
30%	1.00E−06
35%	1.00E−06
40%	1.00E−06
45%	1.00E−06
50%	1.00E−06
55%	1.00E−06
60%	1.00E−06
65%	1.00E−06
70%	1.00E−06
75%	2.00E−06
80%	2.00E−06
85%	2.00E−06
90%	3.00E−06
95%	4.00E−06
100%	9.00E−06

Figure O.71. Probabilistic risk estimate ingestion exposure of adults to produce results of Monte Carlo simulation: Hazard Index – Segment 4

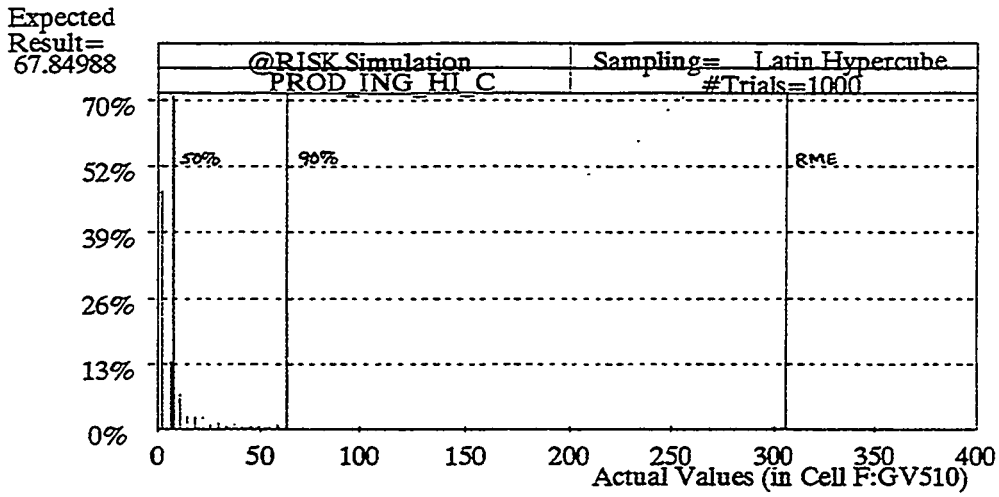


RME Point Estimate:	147.00
MLE Point Estimate:	25.50
Expected/Mean Result =	30.03
Maximum Result =	3775.99
Minimum Result =	0.01
Range of Possible Results =	3775.98
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	198.68
Skewness =	13.12
Kurtosis =	203.27
Variance =	39473.32
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.01
5%	0.09
10%	0.17
15%	0.24
20%	0.32
25%	0.43
30%	0.57
35%	0.71
40%	0.91
45%	1.24
50%	1.59
55%	2.10
60%	2.61
65%	3.45
70%	4.52
75%	6.35
80%	8.54
85%	15.22
90%	28.13
95%	73.90
100%	3775.99

Figure O.72. Probabilistic risk estimate ingestion exposure of children to produce results of Monte Carlo simulation: Hazard Index – Segment 4

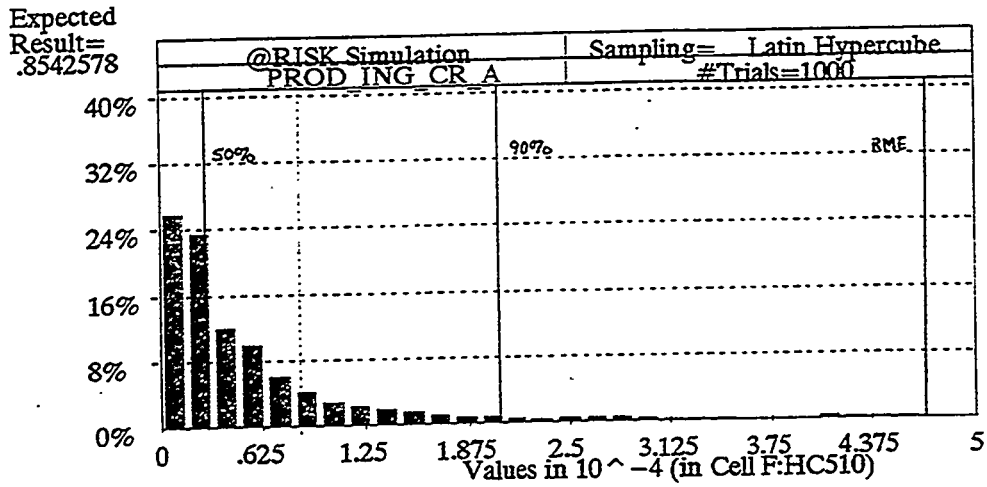


RME Point Estimate:	305.00
MLE Point Estimate:	56.90
Expected/Mean Result =	67.85
Maximum Result =	7282.64
Minimum Result =	0.02
Range of Possible Results =	7282.62
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	382.51
Skewness =	12.54
Kurtosis =	195.85
Variance =	146316.90
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	0.02
5%	0.21
10%	0.36
15%	0.55
20%	0.83
25%	1.07
30%	1.42
35%	1.82
40%	2.40
45%	3.06
50%	3.88
55%	4.95
60%	6.50
65%	8.16
70%	10.69
75%	15.39
80%	22.38
85%	38.69
90%	63.75
95%	266.98
100%	7282.64

Figure O.73. Probabilistic risk estimate ingestion exposure of adults to produce results of Monte Carlo simulation: Cancer Risk (chemicals) – Segment 4

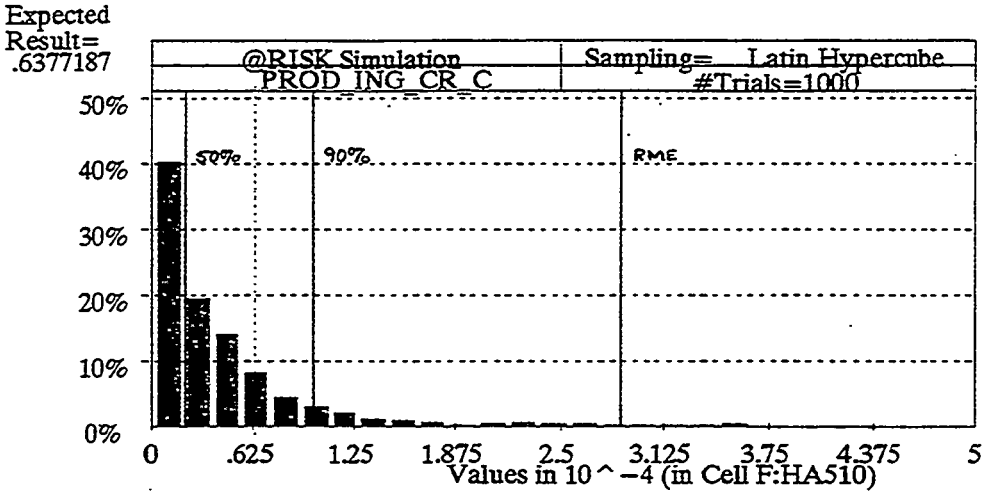


RME Point Estimate:	4.74E−04
MLE Point Estimate:	2.87E−05
Expected/Mean Result =	8.54E−05
Maximum Result =	3.22E−03
Minimum Result =	2.90E−07
Range of Possible Results =	3.22E−03
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	2.35E−04
Skewness =	9.77E+00
Kurtosis =	1.17E+02
Variance =	5.52E−08
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	2.00E−07
5%	4.00E−06
10%	7.00E−06
15%	1.00E−05
20%	1.00E−05
25%	1.00E−05
30%	1.00E−05
35%	2.00E−05
40%	2.00E−05
45%	2.00E−05
50%	3.00E−05
55%	3.00E−05
60%	4.00E−05
65%	5.00E−05
70%	6.00E−05
75%	7.00E−05
80%	9.00E−05
85%	1.00E−04
90%	2.00E−04
95%	3.00E−04
100%	3.20E−03

Figure O.74. Probabilistic risk estimate ingestion exposure of children to produce results of Monte Carlo simulation: Cancer Risk (chemicals) – Segment 4



RME Point Estimate:	2.95E–04
MLE Point Estimate:	2.13E–05
Expected/Mean Result =	6.38E–05
Maximum Result =	3.63E–03
Minimum Result =	7.46E–07
Range of Possible Results =	3.63E–03
Chance of Positive Result =	100
Chance of Negative Result =	0
Standard Deviation =	2.01E–04
Skewness =	1.25E+01
Kurtosis =	1.89E+02
Variance =	4.05E–08
ERRs Calculated =	0
Values Filtered =	0
Simulations Executed =	1
Iterations =	1000

Percentile Probabilities
(Chance <= Shown Value)

0%	7.00E–07
5%	3.00E–06
10%	5.00E–06
15%	7.00E–06
20%	9.00E–06
25%	1.00E–05
30%	1.00E–05
35%	1.00E–05
40%	1.00E–05
45%	2.00E–05
50%	2.00E–05
55%	3.00E–05
60%	3.00E–05
65%	4.00E–05
70%	4.00E–05
75%	5.00E–05
80%	7.00E–05
85%	8.00E–05
90%	1.00E–04
95%	2.00E–04
100%	3.60E–03

MULTIVARIABLE COMPARATIVE ANALYSIS

Figure O.75. Multivariable comparative analysis of uncertainty – ingestion exposure of adults to soils results of Monte Carlo simulation: Hazard Index – Segment 4

Soil ingestion (residential land use)
Hazard Index: soil ingestion – adult

Soil ingestion (residential land use)
Hazard Index: soil ingestion – adult

ALL TOGGLES ON

EXPOSURE POINT CONCENTRATION TOGGLE ON

CONTACT RATE TOGGLE ON

EXPOSURE FREQUENCY TOGGLE ON

BODY WEIGHT TOGGLE ON

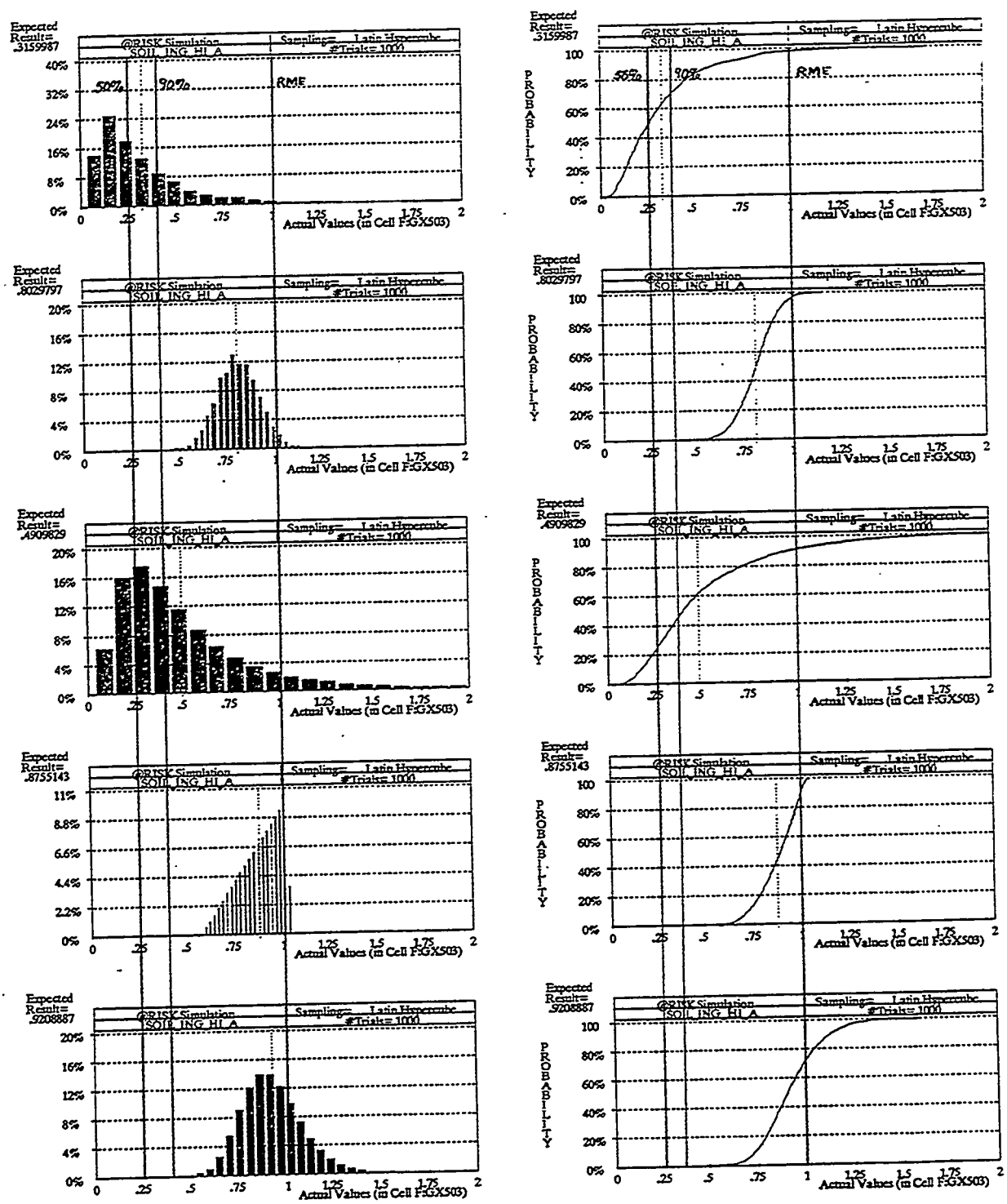


Figure O.76. Multivariable comparative analysis of uncertainty -- ingestion exposure of children to soils results of Monte Carlo simulation: Hazard Index -- Segment 4

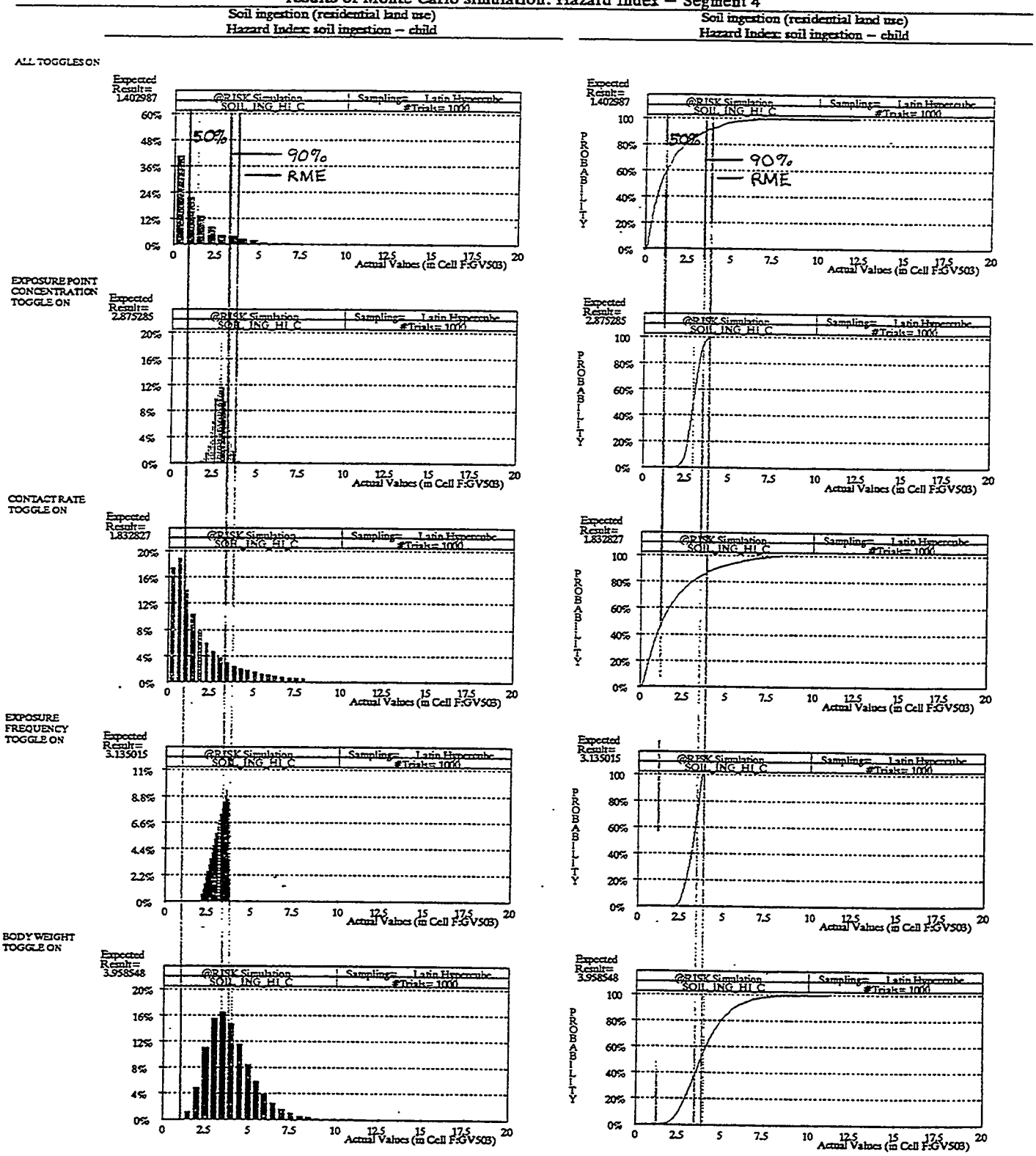


Figure O.77. Multivariable comparative analysis of uncertainty – ingestion exposure of adults to soils results of Monte Carlo simulation: Cancer Risk – Segment 4

Soil ingestion (residential land use)
Cancer Risk: soil ingestion – adult

Soil ingestion (residential land use)
Cancer Risk: soil ingestion – adult

ALL TOGGLES ON

EXPOSURE POINT CONCENTRATION TOGGLE ON

CONTACT RATE TOGGLE ON

EXPOSURE FREQUENCY TOGGLE ON

BODY WEIGHT TOGGLE ON

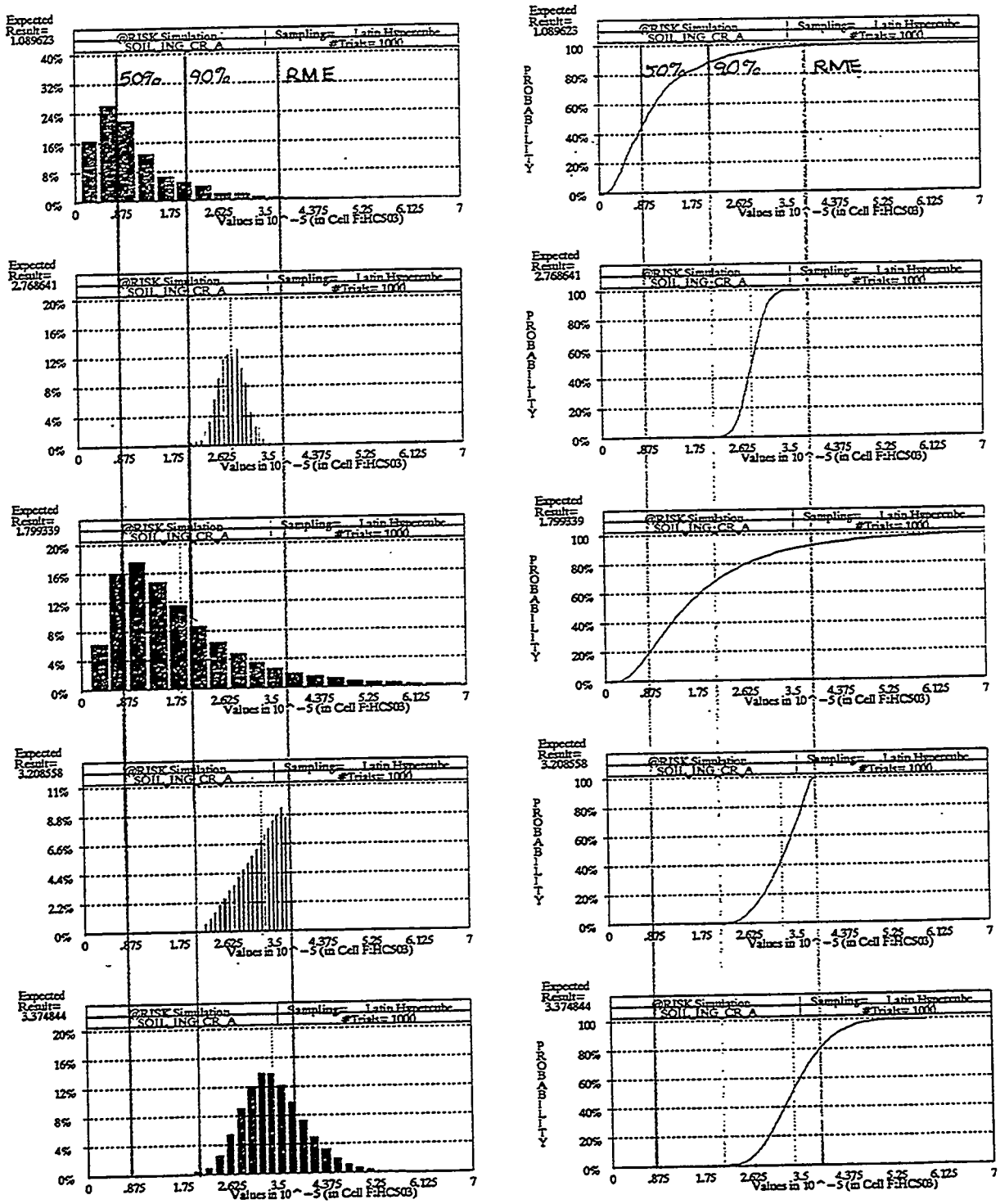


Figure O.78. Multivariable comparative analysis of uncertainty – ingestion exposure of children to soils results of Monte Carlo simulation: Cancer Risk – Segment 4

Soil ingestion (residential land use)
Cancer Risk: soil ingestion – child

Soil ingestion (residential land use)
Cancer Risk: soil ingestion – child

ALL TOGGLES ON

EXPOSURE POINT CONCENTRATION TOGGLE ON

CONTACT RATE TOGGLE ON

EXPOSURE FREQUENCY TOGGLE ON

BODY WEIGHT TOGGLE ON

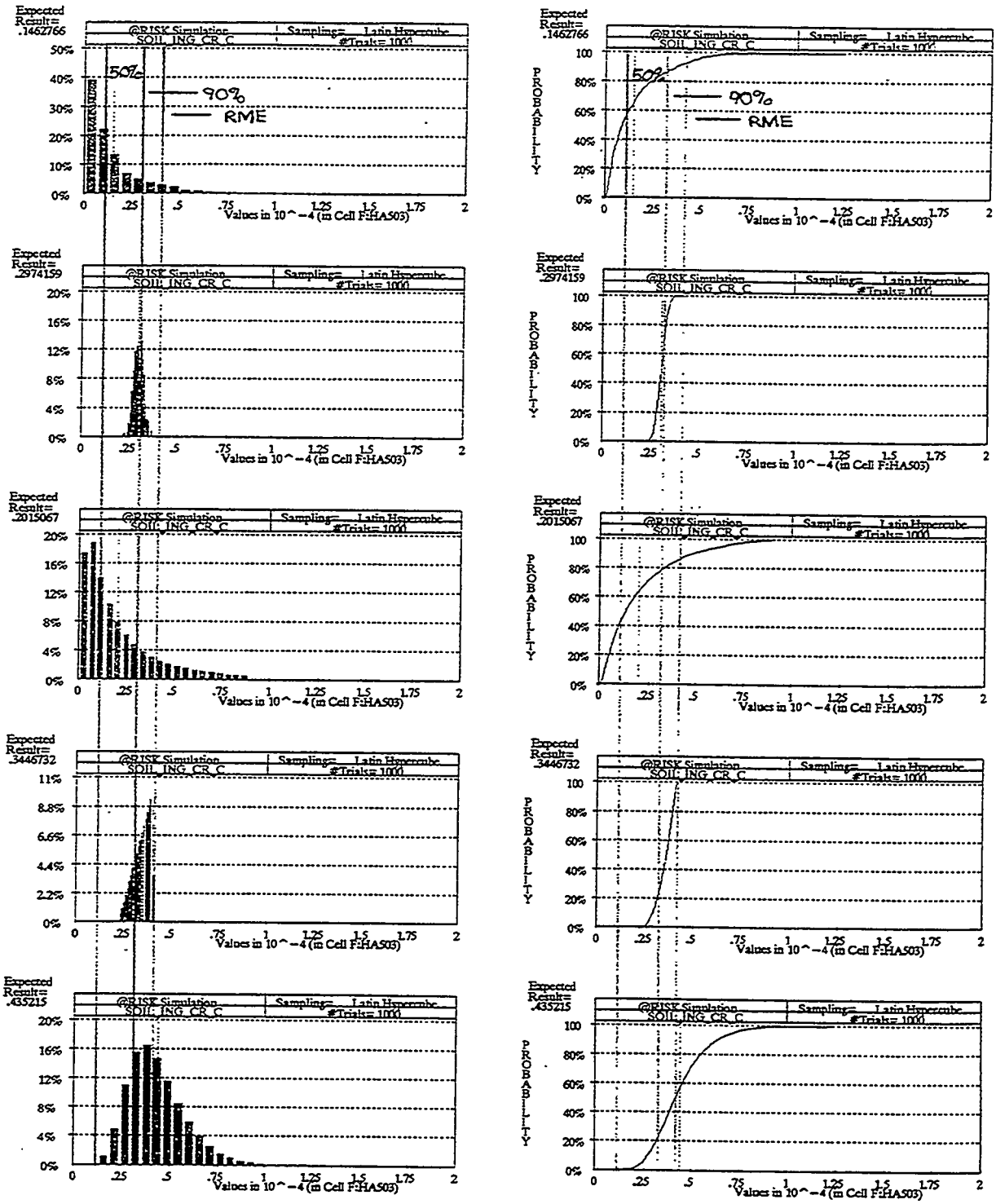


Figure O.79. Multivariable comparative analysis of uncertainty – ingestion exposure of adults to soils results of Monte Carlo simulation: Cancer Risk (radionuclides) – Segment 4

Soil ingestion (residential land use)
Cancer Risk: soil ingestion – adult

Soil ingestion (residential land use)
Cancer Risk: soil ingestion – adult

ALL TOGGLES ON

EXPOSURE POINT CONCENTRATION TOGGLE ON

CONTACT RATE TOGGLE ON

EXPOSURE FREQUENCY TOGGLE ON

BODY WEIGHT TOGGLE ON

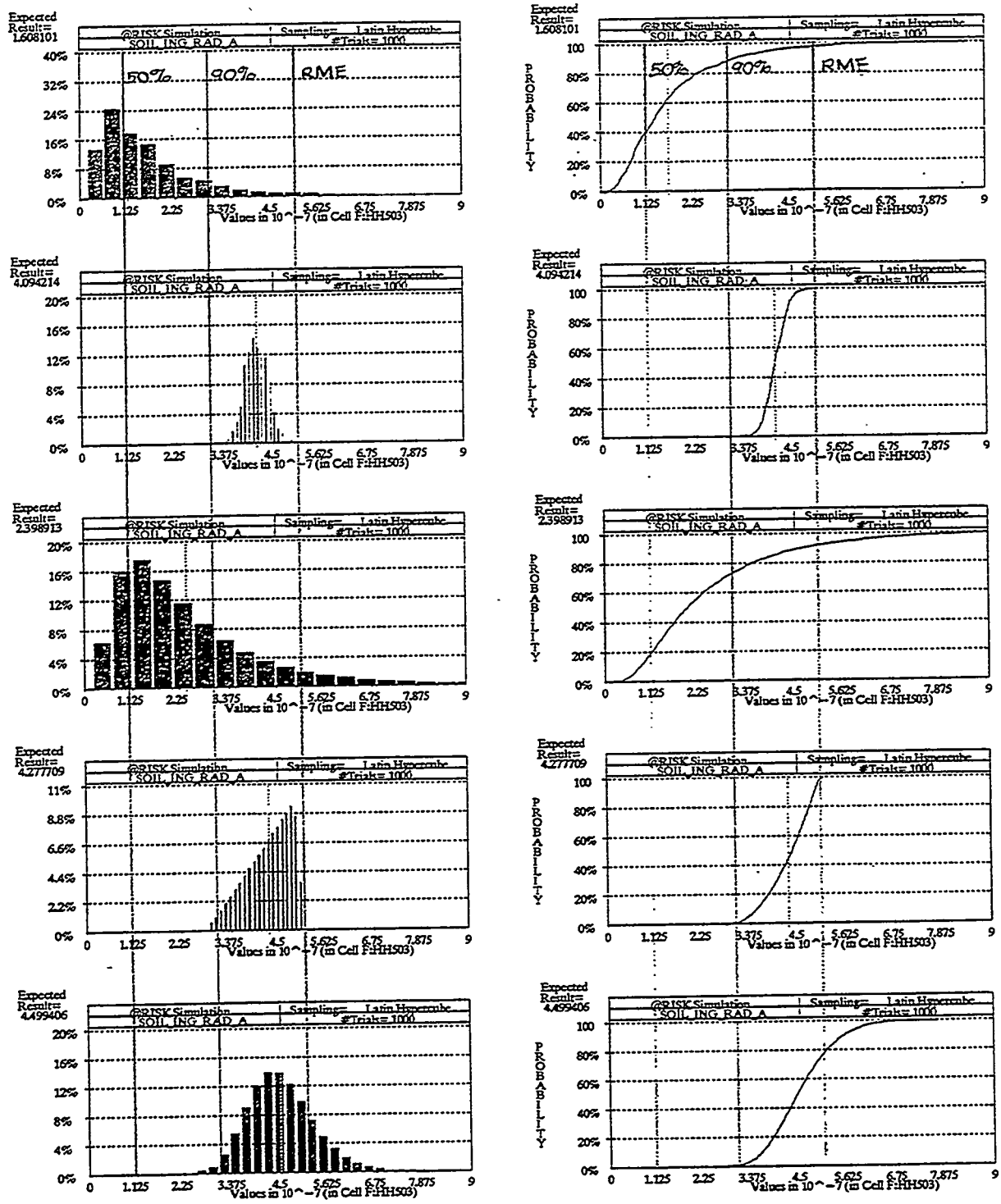


Figure O.80. Multivariable comparative analysis of uncertainty – ingestion exposure of children to soils results of Monte Carlo simulation: Cancer Risk (radionuclides) – Segment 4

Soil ingestion (residential land use)
Cancer Risk: soil ingestion – child

Soil ingestion (residential land use)
Cancer Risk: soil ingestion – child

ALL TOGGLES ON

EXPOSURE POINT CONCENTRATION TOGGLE ON

CONTACT RATE TOGGLE ON

EXPOSURE FREQUENCY TOGGLE ON

BODY WEIGHT TOGGLE ON

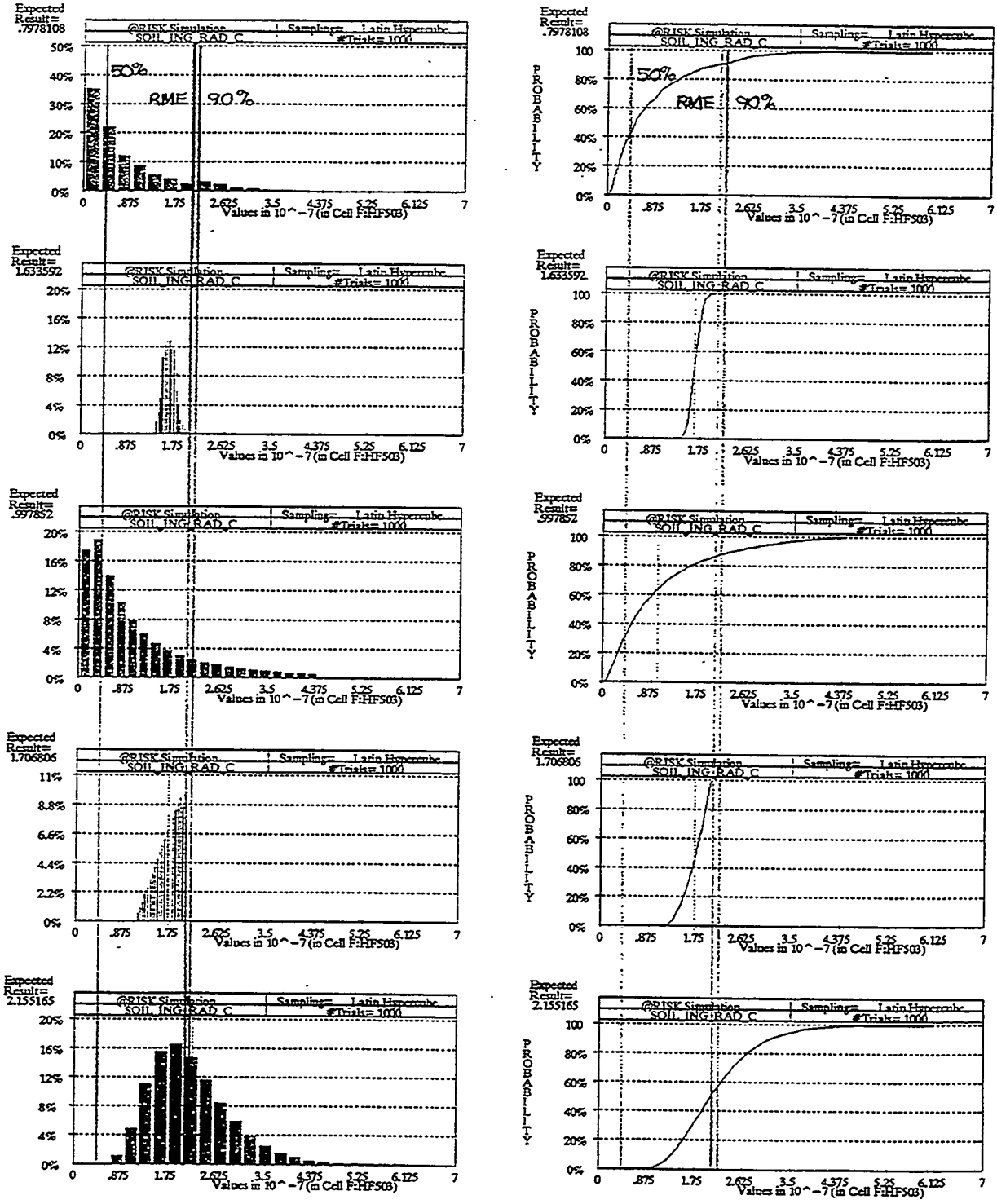


Figure O.81. Multivariable comparative analysis of uncertainty – ingestion exposure of adults to groundwater results of Monte Carlo simulation: Hazard Index – Segment 4

Groundwater ingestion (residential land use)
Hazard Index: Groundwater ingestion – adult

Groundwater ingestion (residential land use)
Hazard Index: Groundwater ingestion – adult

ALL TOGGLES ON

EXPOSURE POINT CONCENTRATION TOGGLE ON

CONTACT RATE TOGGLE ON

EXPOSURE FREQUENCY TOGGLE ON

BODY WEIGHT TOGGLE ON

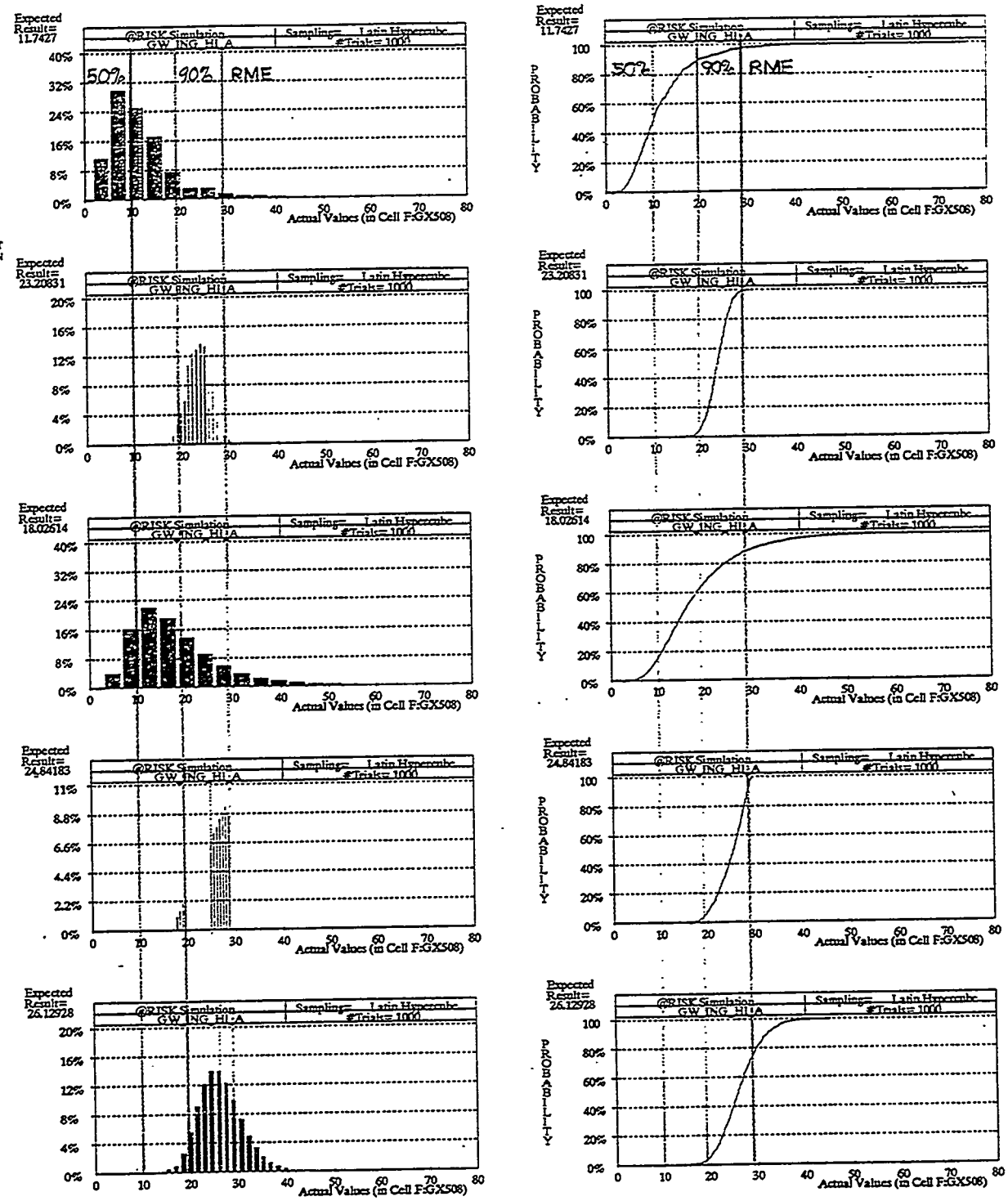


Figure O.82. Multivariable comparative analysis of uncertainty – ingestion exposure of children to groundwater results of Monte Carlo simulation: Hazard Index – Segment 4

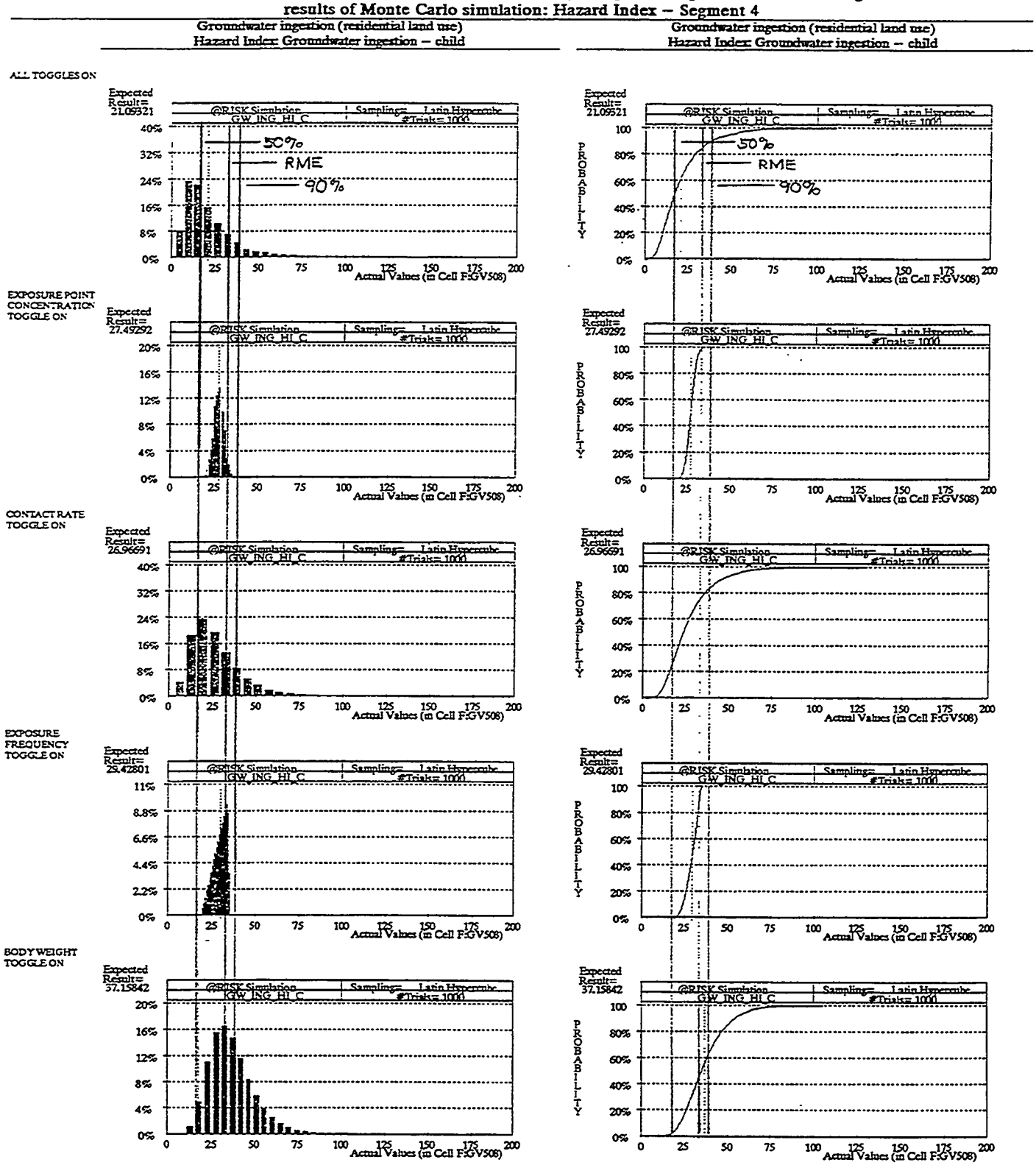
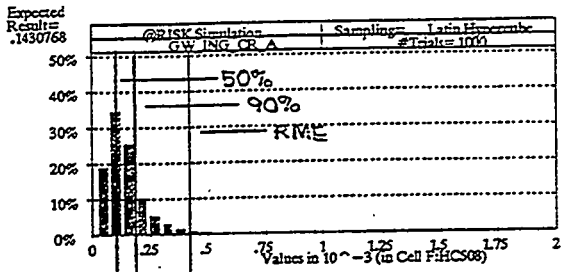


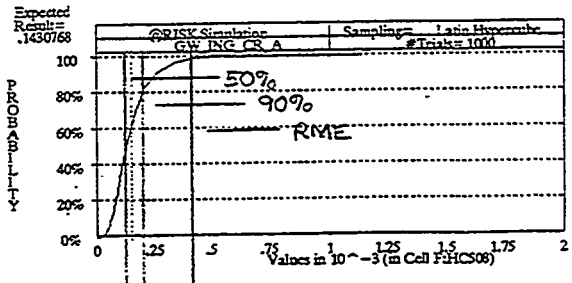
Figure O.83. Multivariable comparative analysis of uncertainty – ingestion exposure of adults to groundwater results of Monte Carlo simulation: Cancer Risk – Segment 4

Groundwater ingestion (residential land use)
Cancer Risk: Groundwater ingestion – adult

Groundwater ingestion (residential land use)
Cancer Risk: Groundwater ingestion – adult

ALL TOGGLES ON





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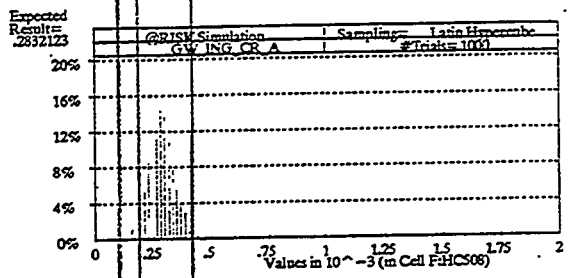
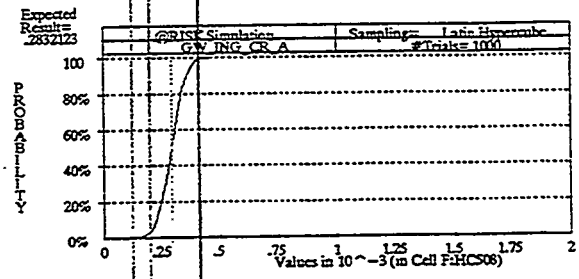
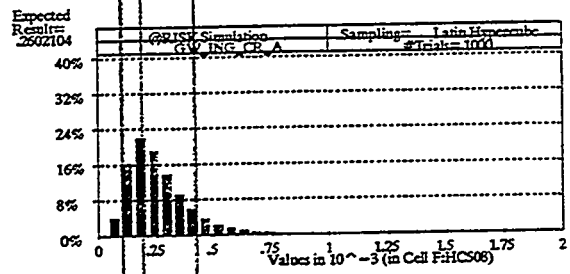
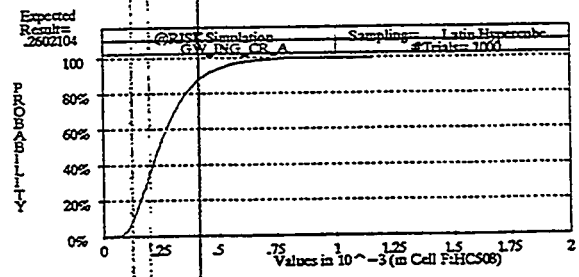


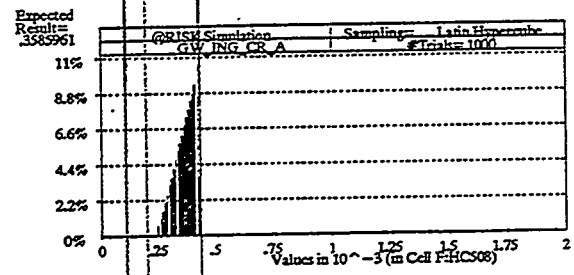


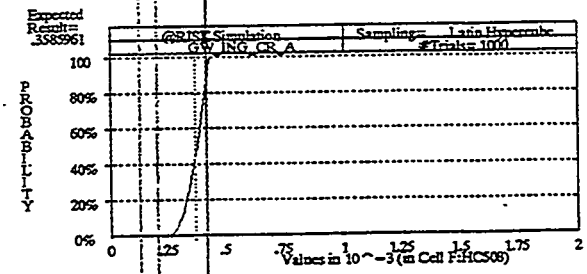
CONTACT RATE TOGGLE ON



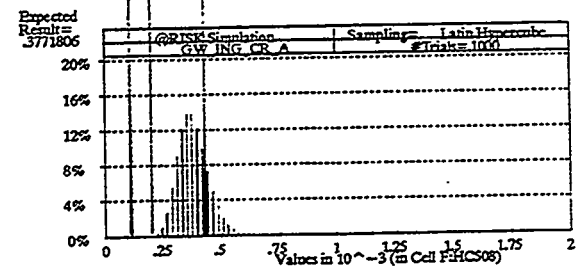


EXPOSURE FREQUENCY TOGGLE ON





BODY WEIGHT TOGGLE ON



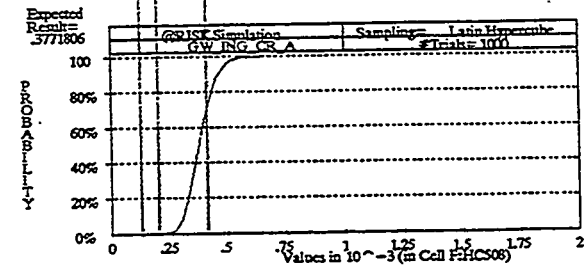


Figure 0.84. Multivariable comparative analysis of uncertainty – ingestion exposure of children to groundwater results of Monte Carlo simulation: Cancer Risk – Segment 4

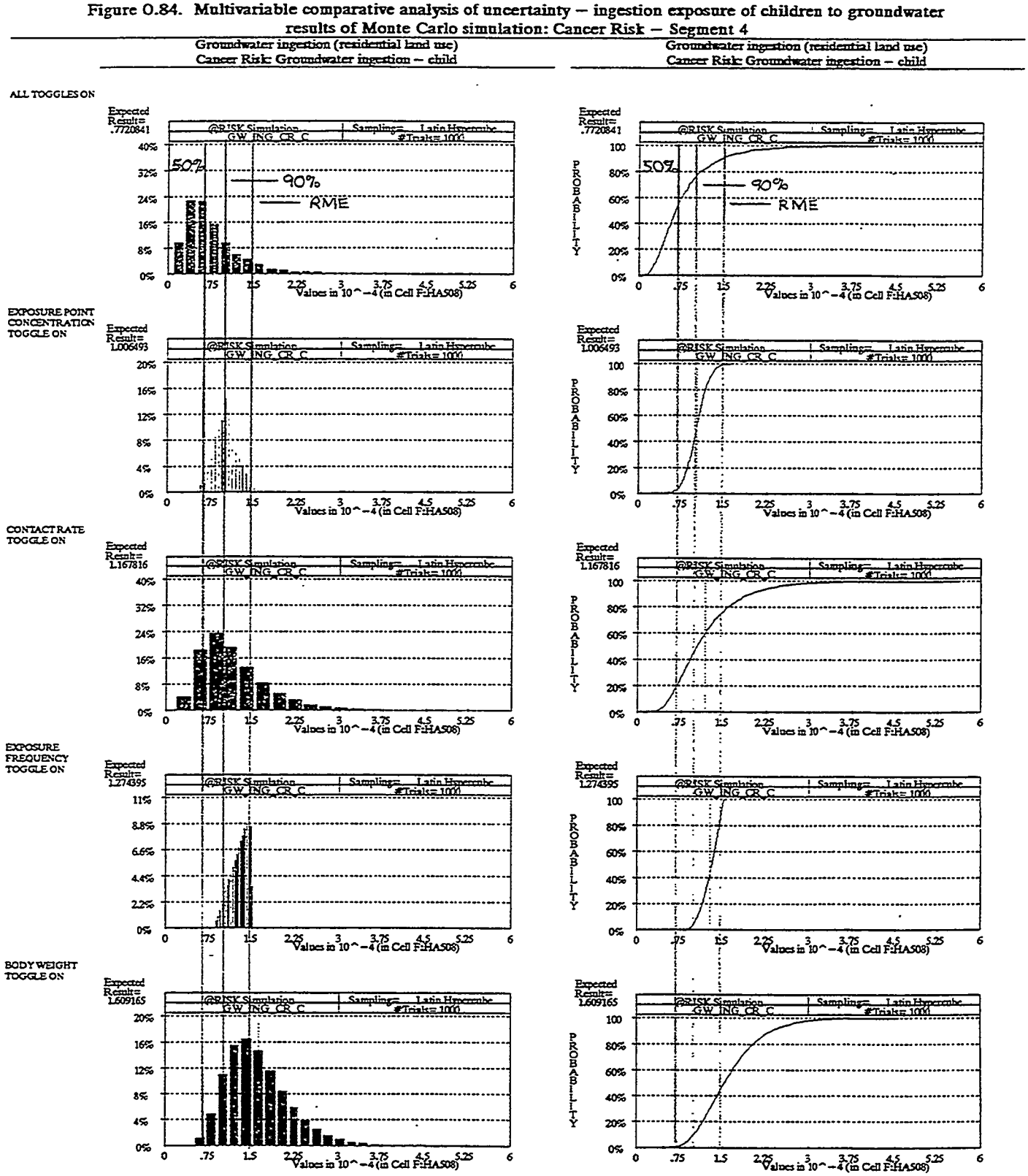


Figure O.85. Multivariable comparative analysis of uncertainty – ingestion exposure of adults to groundwater results of Monte Carlo simulation: Cancer Risk (radionuclides) – Segment 4

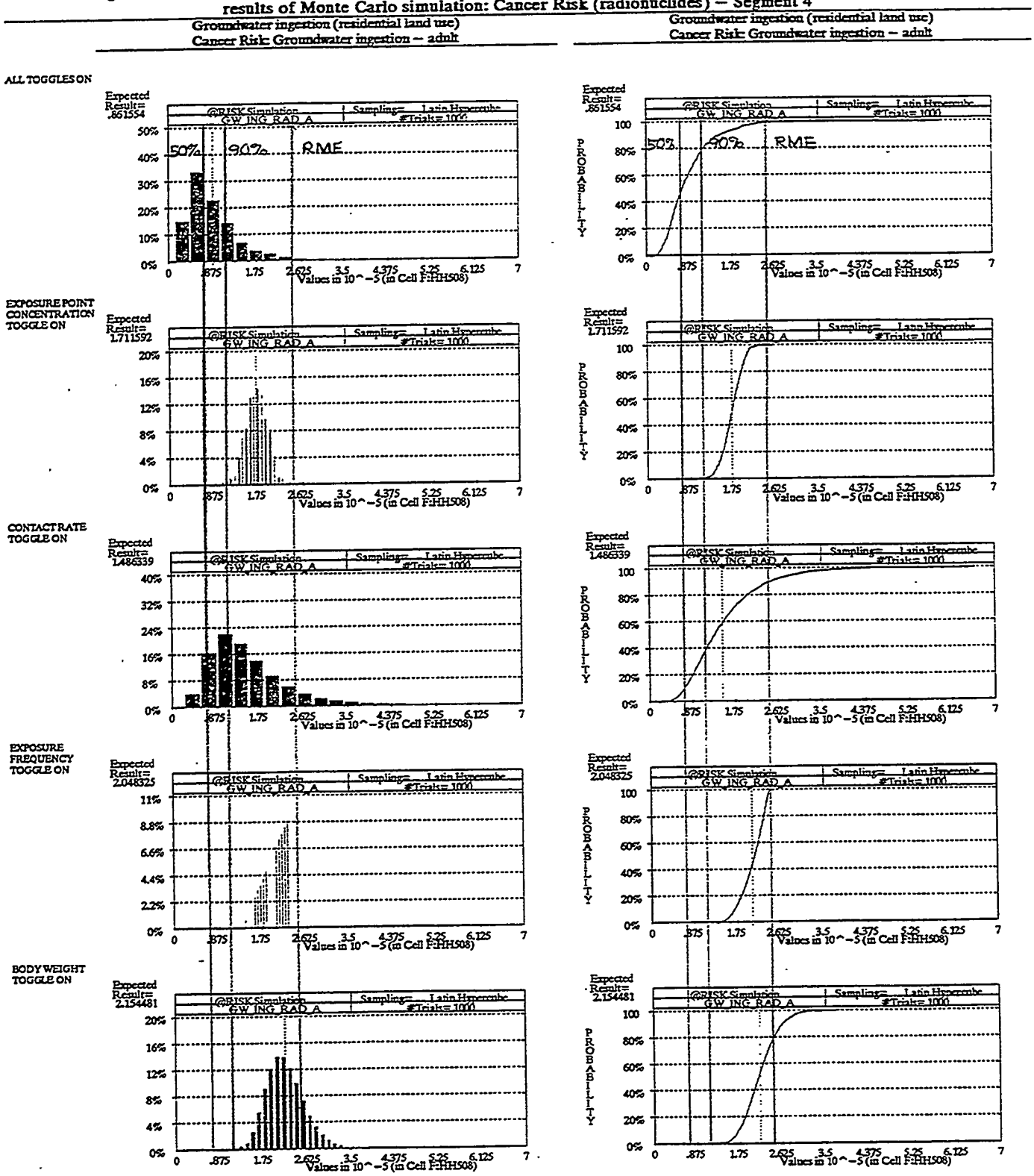


Figure O.86. Multivariable comparative analysis of uncertainty – ingestion exposure of children to groundwater results of Monte Carlo simulation: Cancer Risk (radionuclides) – Segment 4

Groundwater ingestion (residential land use)
Cancer Risk: Groundwater ingestion – child

Groundwater ingestion (residential land use)
Cancer Risk: Groundwater ingestion – child

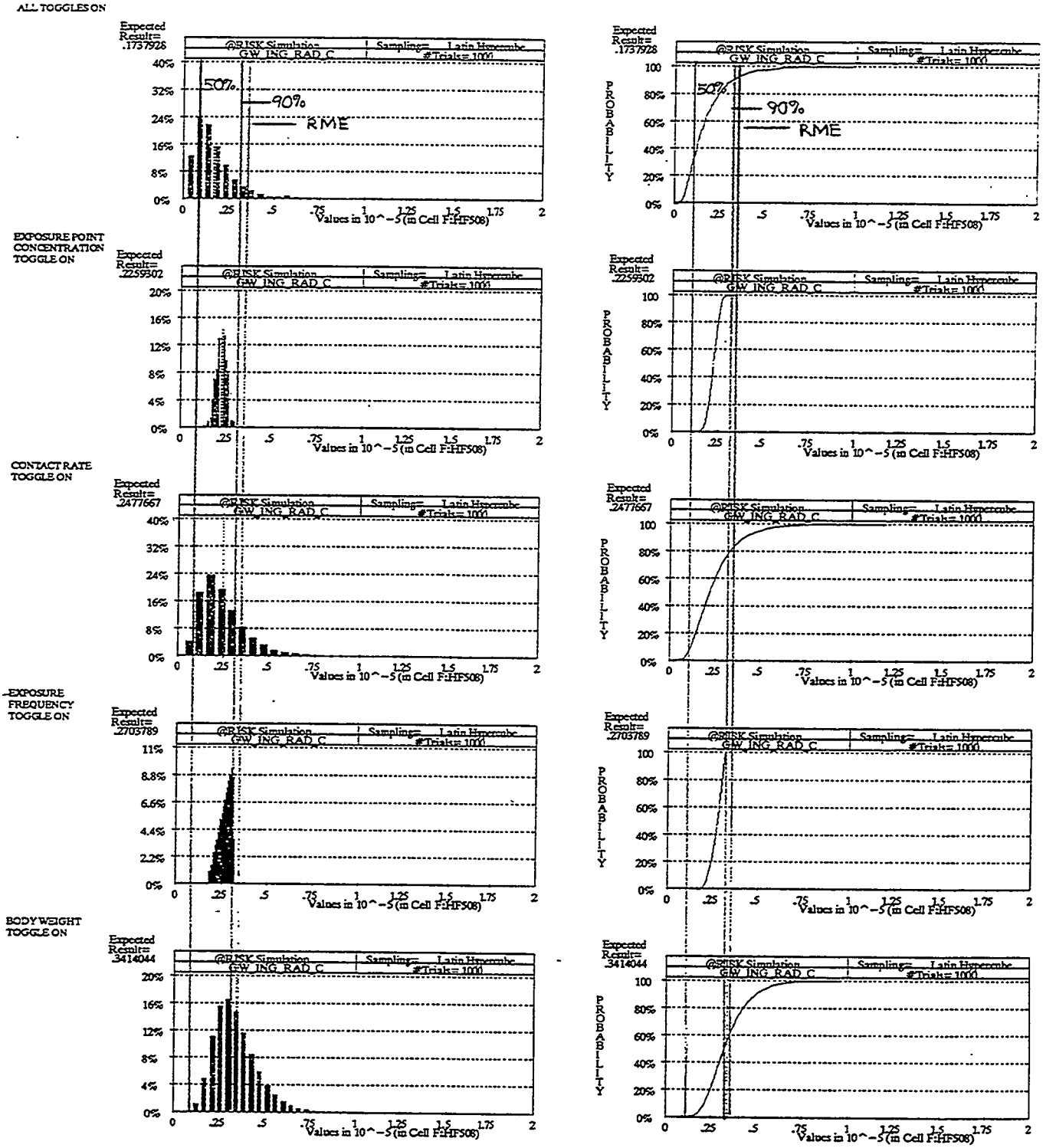


Figure O.87. Multivariable comparative analysis of uncertainty – ingestion exposure of adults to produce results of Monte Carlo simulation: Hazard Index – Segment 4

Produce ingestion (residential land use)
Hazard Index: Produce ingestion – adult

Produce ingestion (residential land use)
Hazard Index: Produce ingestion – adult

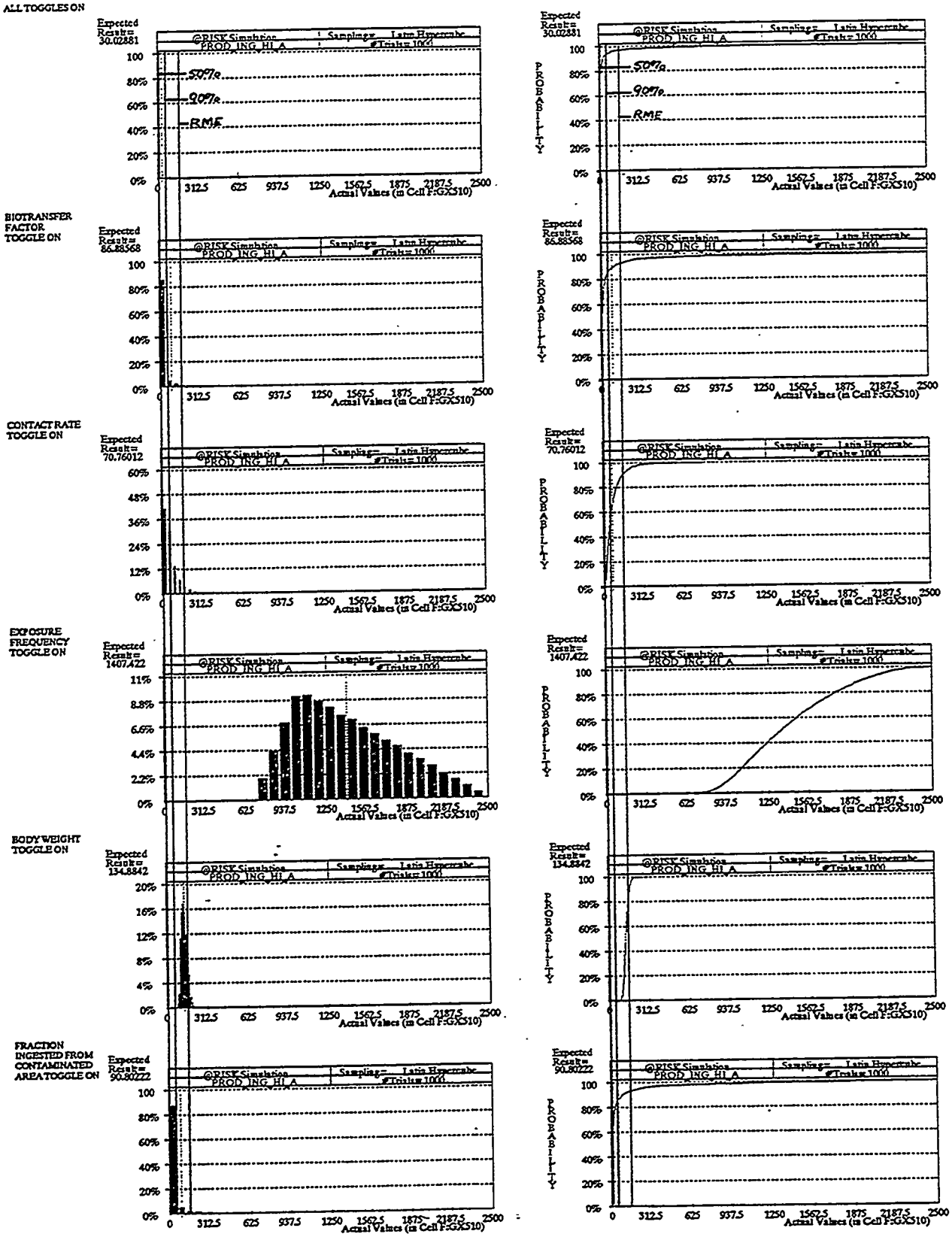


Figure O.88. Multivariable comparative analysis of uncertainty – ingestion exposure of children to produce results of Monte Carlo simulation: Hazard Index – Segment 4

Produce ingestion (residential land use)
Hazard Index: Produce ingestion – child

Produce ingestion (residential land use)
Hazard Index: Produce ingestion – child

ALL TOGGLES ON

BIOTRANSFER FACTOR TOGGLE ON

CONTACT RATE TOGGLE ON

EXPOSURE FREQUENCY TOGGLE ON

BODY WEIGHT TOGGLE ON

FRACTION INGESTED FROM CONTAMINATED AREA TOGGLE ON

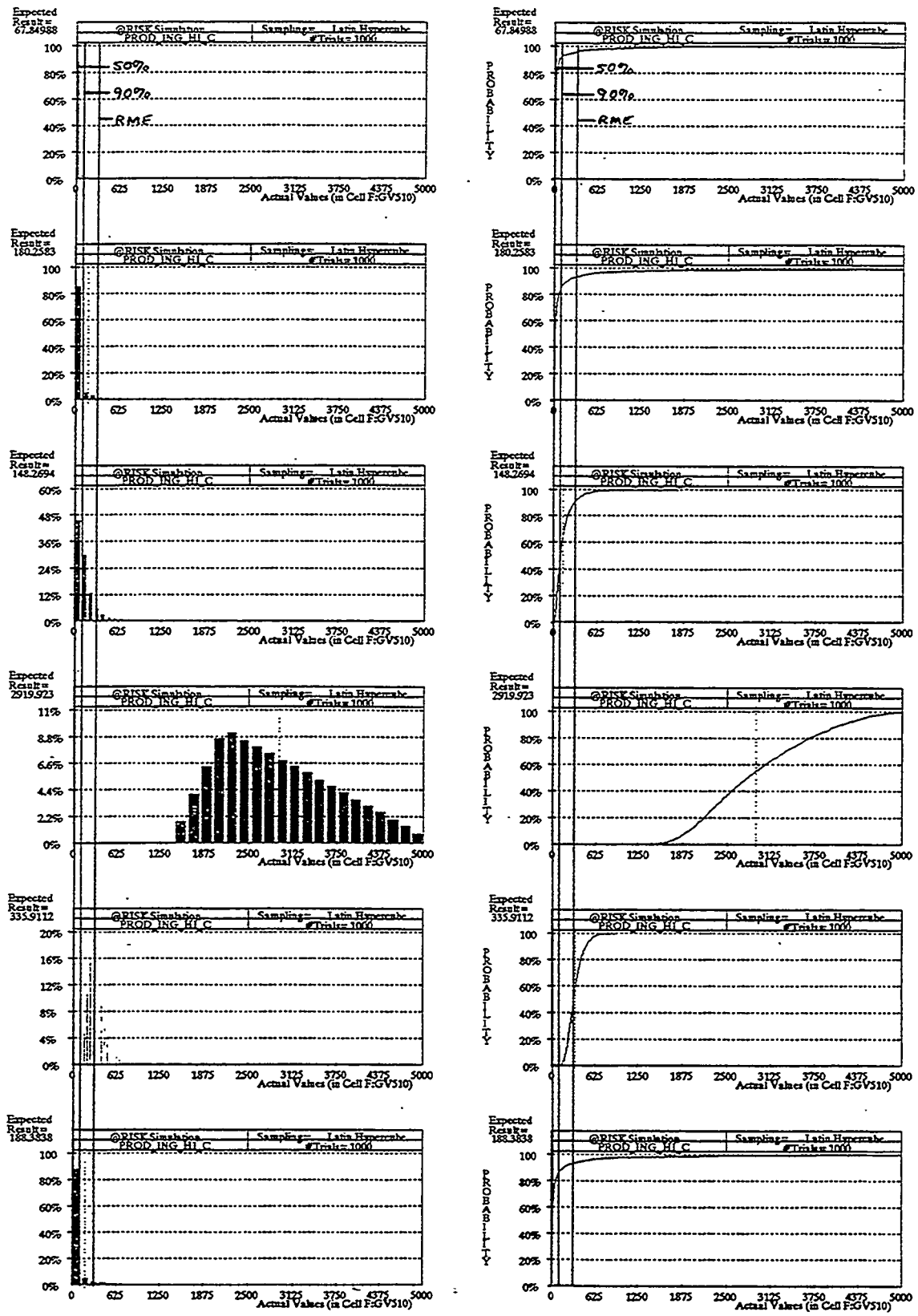


Figure O.89. Multivariable comparative analysis of uncertainty – ingestion exposure of adults to produce results of Monte Carlo simulation: Cancer Risk – Segment 4

Produce ingestion (residential land use)
Cancer Risk: Produce ingestion – adult

Produce ingestion (residential land use)
Cancer Risk: Produce ingestion – adult

ALL TOGGLES ON

BIOTRANSFER FACTOR TOGGLE ON

CONTACT RATE TOGGLE ON

EXPOSURE FREQUENCY TOGGLE ON

BODYWEIGHT TOGGLE ON

FRACTION INGESTED FROM CONTAMINATED AREA TOGGLE ON

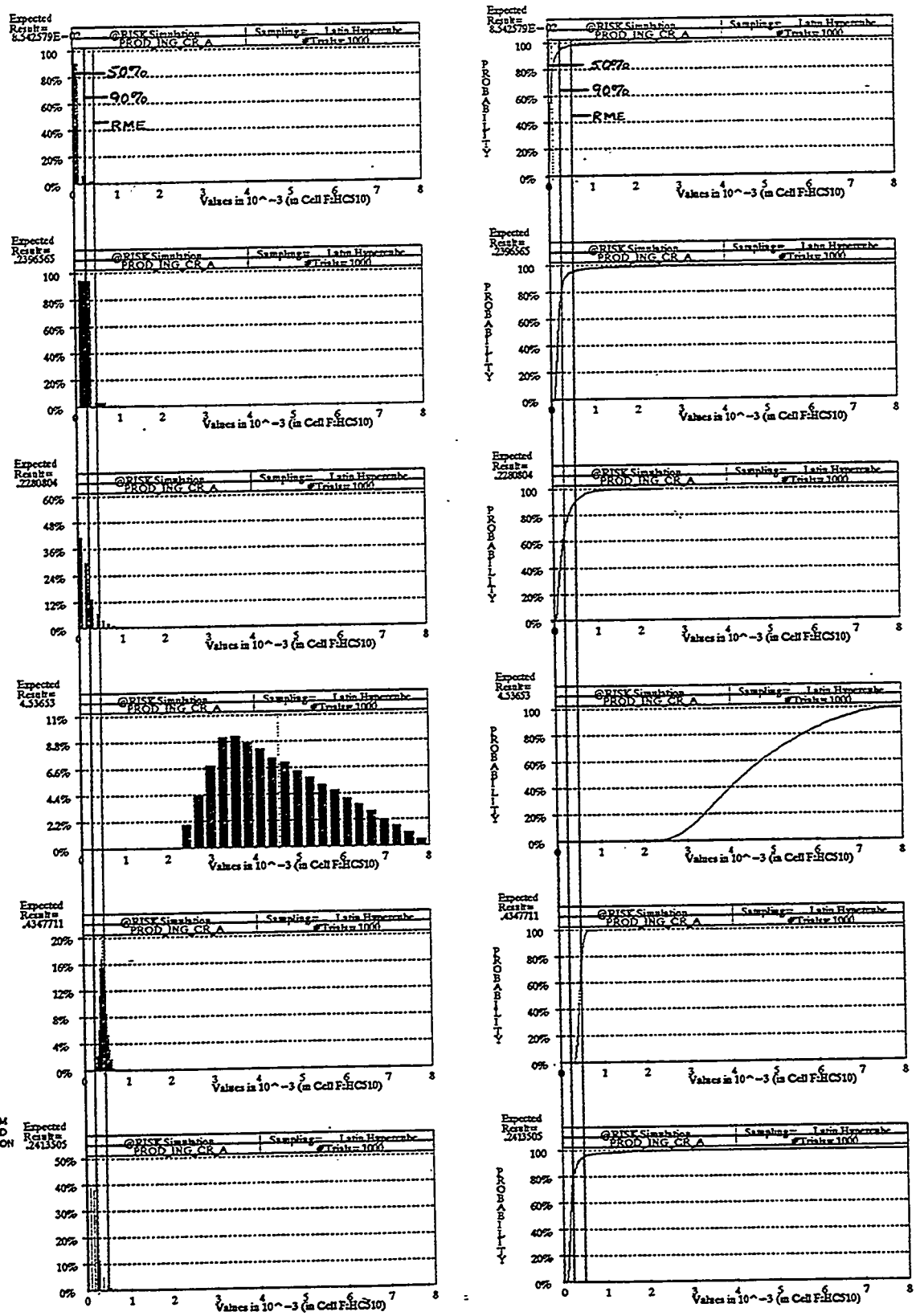
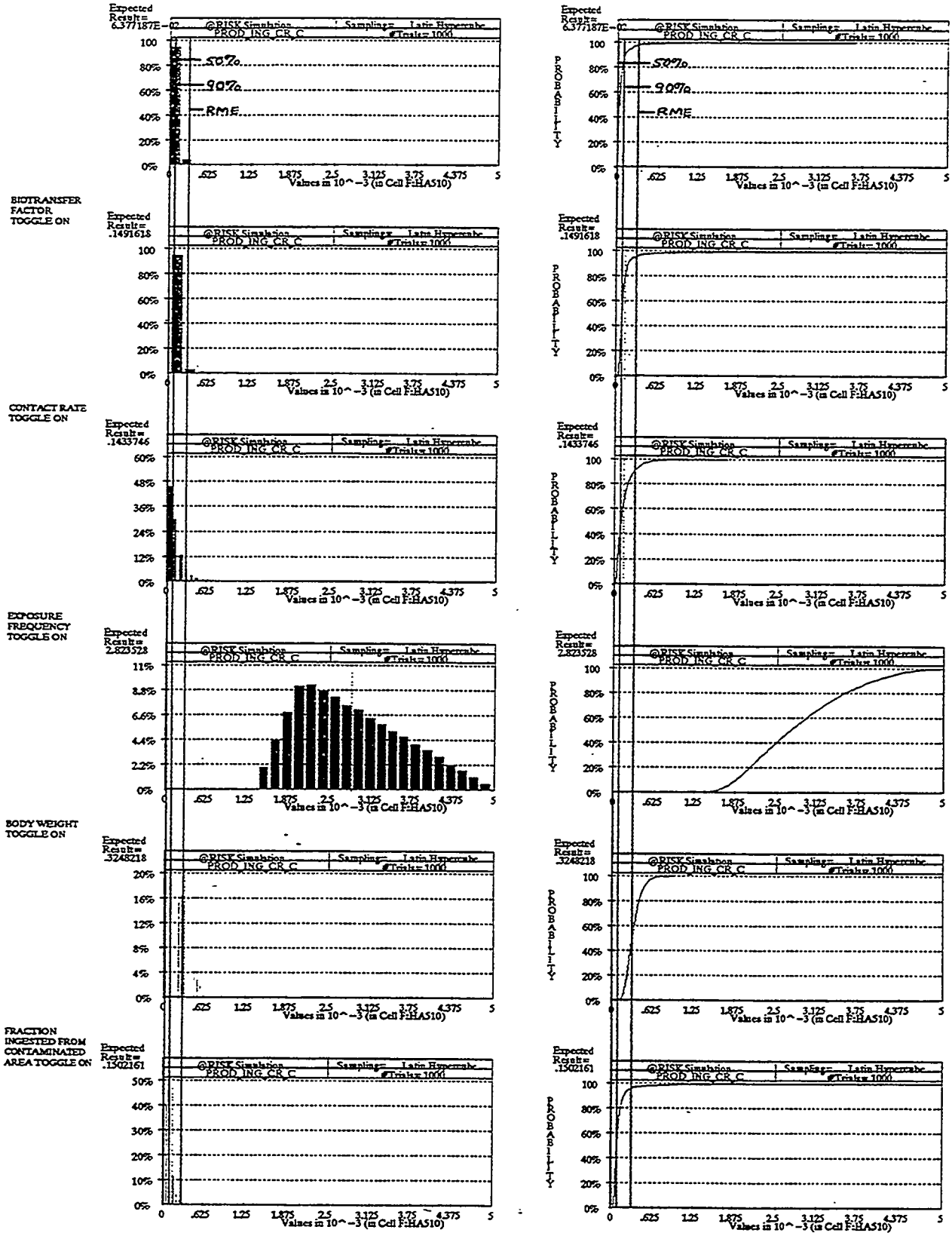


Figure O.90. Multivariable comparative analysis of uncertainty – ingestion exposure of children to produce results of Monte Carlo simulation: Cancer Risk – Segment 4

Produce ingestion (residential land use)
Cancer Risk: Produce ingestion – child

Produce ingestion (residential land use)
Cancer Risk: Produce ingestion – child



Appendix P - Background Data Comparison

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Table P.1. EFPC Phase 1A and 1B results for soil mean contaminant concentrations by creek segment

Creek Segment=' 1' Sample Media=Soil

PARAMTER	Measurement Units	Proportion of Results >Detection Limit	Minimum Result	Mean Result	Maximum Detected Result	Standard Deviation	Upper Tolerance Limit of Reference	Proportion of Results >Tolerance Limit	Radiation Counting Uncertainty of Mean
Aluminum	MG/KG	17/ 17	6640.00	14430.00	23200.00	4636.00	25400.00	0/ 17	.
Antimony	MG/KG	74/ 97	0.17	1.11	1.60	1.56	.		.
Arsenic	MG/KG	97/101	0.70	6.31	16.00	3.39	5.37	56/101	.
Barium	MG/KG	17/ 17	36.00	150.10	327.00	82.47	253.60	2/ 17	.
Beryllium	MG/KG	13/ 17	0.13	1.06	4.60	1.04	1.35	3/ 17	.
Cadmium	MG/KG	12/ 17	0.36	5.23	26.00	6.50	.		.
Chromium	MG/KG	91/ 91	9.40	64.63	117.00	25.21	39.96	75/ 91	.
Cobalt	MG/KG	16/ 17	1.80	11.61	25.70	5.99	17.08	3/ 17	.
Copper	MG/KG	17/ 17	4.10	80.12	176.00	56.28	15.30	13/ 17	.
Cyanide	MG/KG	7/ 12	0.30	0.64	1.30	0.32	.		.
Lead	MG/KG	17/ 17	10.60	40.24	66.20	17.55	21.87	14/ 17	.
Manganese	MG/KG	17/ 17	25.60	701.20	1560.00	468.20	2058.00	0/ 17	.
Mercury	MG/KG	51/ 94	0.40	130.30	1590.00	309.80	.		.
Nickel	MG/KG	17/ 17	3.70	41.12	97.20	31.00	32.44	9/ 17	.
Selenium	MG/KG	15/ 99	0.36	9.02	110.00	13.45	.		.
Silver	MG/KG	9/ 17	0.85	4.25	13.20	4.38	.		.
Thallium	MG/KG	1/ 14	0.24	1.70	19.30	5.07	.		.
Vanadium	MG/KG	17/ 17	13.50	24.48	36.30	6.20	34.22	1/ 17	.
Zinc	MG/KG	28/102	12.50	68.97	340.00	46.47	78.10	18/102	.
Americium-241	PCI/G	9/ 12	-0.16	-0.02	0.06	0.07	0.30	0/ 12	0.11420
Cesium-137	PCI/G	17/ 17	0.11	1.15	8.24	1.91	1.15	4/ 17	0.06071
Cobalt-60	PCI/G	15/ 15	-0.04	0.01	0.05	0.03	0.05	1/ 15	0.01444
Neptunium-237	PCI/G	12/ 12	-0.03	0.01	0.04	0.02	0.13	0/ 12	0.05102
Protactinium-233	PCI/G	5/ 5	-0.12	-0.02	0.10	0.08	.		0.11650
Thorium-228	PCI/G	1/ 1	2.54	2.54	2.54	.	.		0.18300
Thorium-230	PCI/G	1/ 1	4.58	4.58	4.58	.	.		0.24200
Thorium-232	PCI/G	1/ 1	1.90	1.90	1.90	.	.		0.16200
Uranium-234	PCI/G	85/ 88	0.31	6.57	28.45	6.49	0.35	84/ 88	0.29240
Uranium-235	PCI/G	99/ 99	0.01	0.33	1.82	0.37	0.05	94/ 99	0.00267
Uranium-238	PCI/G	83/ 86	0.21	7.19	32.63	6.48	0.31	82/ 86	0.15790

Results less than detection were set to 1/2 detection limit to compute means and standard deviations. Upper tolerance limit for the reference site was calculated only for analytes with 3 or more values greater than the detection limit.

SOURCE:EFPC PHASE 1A and 1B VALIDATED DATA FROM FILE SOIL ON 12NOV92 AT 16:50

Table P.1. EFPC Phase 1A and 1B results for soil mean contaminant concentrations by creek segment (continued)

Creek Segment=' 2' Sample Media=Soil

PARAMTER	Measurement Units	Proportion of Results >Detection Limit	Minimum Result	Mean Result	Maximum Detected Result	Standard Deviation	Upper Tolerance Limit of Reference	Proportion of Results >Tolerance Limit	Radiation Counting Uncertainty of Mean
Aluminum	MG/KG	6/ 6	10200.00	13700.00	18800.00	3927.00	25400.00	0/ 6	.
Antimony	MG/KG	83/ 95	0.10	0.83	1.40	0.94	.		.
Arsenic	MG/KG	98/ 98	1.40	8.74	50.00	7.24	5.37	83/ 98	.
Barium	MG/KG	6/ 6	65.50	146.50	254.00	69.53	253.60	1/ 6	.
Beryllium	MG/KG	6/ 6	0.65	0.90	1.10	0.20	1.35	0/ 6	.
Cadmium	MG/KG	6/ 6	1.50	4.83	8.10	2.73	.		.
Chromium	MG/KG	93/ 93	15.00	65.35	117.00	16.96	39.96	88/ 93	.
Cobalt	MG/KG	6/ 6	8.70	11.43	14.10	2.37	17.08	0/ 6	.
Copper	MG/KG	6/ 6	12.20	152.30	350.00	126.00	15.30	5/ 6	.
Lead	MG/KG	6/ 6	23.60	42.97	65.80	15.66	21.87	6/ 6	.
Manganese	MG/KG	6/ 6	721.00	814.70	882.00	55.28	2058.00	0/ 6	.
Mercury	MG/KG	27/ 83	0.55	22.03	443.00	61.52	.		.
Nickel	MG/KG	6/ 6	9.90	39.28	59.00	21.23	32.44	4/ 6	.
Selenium	MG/KG	32/ 98	0.47	12.62	59.00	13.28	.		.
Silver	MG/KG	3/ 6	1.15	2.33	3.80	1.23	.		.
Thallium	MG/KG	0/ 6	0.35	0.39	.	0.02	.		.
Vanadium	MG/KG	6/ 6	18.30	22.72	30.60	5.09	34.22	0/ 6	.
Zinc	MG/KG	40/ 98	14.00	538.60	7640.00	1538.00	78.10	35/ 98	.
Cesium-137	PCI/G	6/ 6	0.08	0.76	1.58	0.57	1.15	1/ 6	0.06994
Cobalt-60	PCI/G	6/ 6	-0.10	0.02	0.09	0.07	0.05	2/ 6	0.04035
Neptunium-237	PCI/G	6/ 6	0.00	0.02	0.06	0.02	0.13	0/ 6	0.01226
Protactinium-233	PCI/G	6/ 6	-0.09	0.02	0.15	0.08	.		0.08607
Thorium-228	PCI/G	3/ 3	1.14	1.52	2.11	0.52	.		0.08552
Thorium-230	PCI/G	3/ 3	3.40	4.56	6.51	1.70	.		0.14730
Thorium-232	PCI/G	3/ 3	0.92	1.31	1.74	0.41	.		0.07845
Uranium-234	PCI/G	81/ 88	0.58	3.09	11.41	2.81	0.35	81/ 88	0.18620
Uranium-235	PCI/G	93/ 93	0.03	0.14	0.54	0.13	0.05	84/ 93	0.00136
Uranium-238	PCI/G	79/ 86	0.47	3.40	11.32	2.54	0.31	79/ 86	0.10490

Results less than detection were set to 1/2 detection limit to compute means and standard deviations. Upper tolerance limit for the reference site was calculated only for analytes with 3 or more values greater than the detection limit.

SOURCE:EFPC PHASE 1A and 1B VALIDATED DATA FROM FILE SOIL ON 12NOV92 AT 16:50

Table P.1. EFPC Phase 1A and 1B results for soil mean contaminant concentrations by creek segment (continued)

Creek Segment=' 3' Sample Media=Soil

PARAMTER	Measurement Units	Proportion of Results >Detection Limit	Minimum Result	Mean Result	Maximum Detected Result	Standard Deviation	Upper Tolerance Limit of Reference	Proportion of Results >Tolerance Limit	Radiation Counting Uncertainty of Mean
Aluminum	MG/KG	14/ 14	8190.00	15560.00	27100.00	5820.00	25400.00	1/ 14	.
Antimony	MG/KG	56/ 65	0.22	1.48	11.00	1.89	.		.
Arsenic	MG/KG	69/ 70	1.25	8.79	24.00	3.62	5.37	64/ 70	.
Barium	MG/KG	14/ 14	60.80	99.86	173.00	33.65	253.60	0/ 14	.
Beryllium	MG/KG	8/ 14	0.39	0.69	0.95	0.18	1.35	0/ 14	.
Cadmium	MG/KG	8/ 14	0.48	2.30	7.40	2.28	.		.
Chromium	MG/KG	71/ 71	16.40	69.04	217.00	30.63	39.96	61/ 71	.
Cobalt	MG/KG	14/ 14	6.60	13.65	20.30	3.90	17.08	3/ 14	.
Copper	MG/KG	14/ 14	8.30	43.64	124.00	36.47	15.30	11/ 14	.
Cyanide	MG/KG	0/ 6	0.30	0.32	.	0.02	.		.
Lead	MG/KG	13/ 13	26.50	69.08	177.00	41.40	21.87	13/ 13	.
Manganese	MG/KG	14/ 14	398.00	1023.00	1910.00	358.70	2058.00	0/ 14	.
Mercury	MG/KG	36/ 72	0.07	37.41	868.00	109.60	.		.
Nickel	MG/KG	14/ 14	8.90	28.67	62.80	17.26	32.44	4/ 14	.
Selenium	MG/KG	26/ 71	0.36	12.79	60.00	13.76	.		.
Silver	MG/KG	5/ 14	0.48	2.44	8.50	2.70	.		.
Thallium	MG/KG	0/ 14	0.35	0.38	.	0.02	.		.
Vanadium	MG/KG	14/ 14	16.30	27.63	42.80	7.58	34.22	3/ 14	.
Zinc	MG/KG	42/ 71	18.00	565.30	6830.00	1559.00	78.10	35/ 71	.
Americium-241	PCI/G	23/ 23	-0.15	0.03	0.25	0.09	0.30	0/ 23	0.06520
Cesium-137	PCI/G	28/ 28	0.00	0.61	2.44	0.66	1.15	5/ 28	0.01689
Cobalt-60	PCI/G	29/ 29	-0.05	0.01	0.14	0.03	0.05	1/ 29	0.00959
Neptunium-237	PCI/G	24/ 24	-0.04	0.01	0.11	0.04	0.13	0/ 24	0.01504
Protactinium-233	PCI/G	6/ 6	-0.06	0.05	0.16	0.09	.		0.08485
Thorium-228	PCI/G	3/ 3	1.62	2.10	2.36	0.42	.		0.11610
Thorium-230	PCI/G	3/ 3	1.76	2.37	3.15	0.71	.		0.12220
Thorium-232	PCI/G	3/ 3	1.25	1.50	1.90	0.35	.		0.10160
Uranium-234	PCI/G	76/ 83	0.38	3.12	12.01	3.22	0.35	76/ 83	0.17850
Uranium-235	PCI/G	92/ 92	0.01	0.15	1.15	0.19	0.05	71/ 92	0.00248
Uranium-238	PCI/G	76/ 83	0.23	3.10	15.65	3.07	0.31	73/ 83	0.08891

Results less than detection were set to 1/2 detection limit to compute means and standard deviations. Upper tolerance limit for the reference site was calculated only for analytes with 3 or more values greater than the detection limit.

SOURCE:EFPC PHASE 1A and 1B VALIDATED DATA FROM FILE SOIL ON 12NOV92 AT 16:50

Table P.1. EFPC Phase 1A and 1B results for soil mean contaminant concentrations by creek segment (continued)

Creek Segment=' 4' Sample Media=Soil

PARAMTER	Measurement Units	Proportion of Results >Detection Limit	Minimum Result	Mean Result	Maximum Detected Result	Standard Deviation	Upper Tolerance Limit of Reference	Proportion of Results >Tolerance Limit	Radiation Counting Uncertainty of Mean
Aluminum	MG/KG	9/ 9	14400.00	19390.00	27900.00	4455.00	25400.00	1/ 9	.
Antimony	MG/KG	88/100	0.19	1.15	2.00	0.95	.		.
Arsenic	MG/KG	100/100	2.90	10.05	40.50	4.25	5.37	95/100	.
Barium	MG/KG	9/ 9	99.00	227.70	454.00	107.80	253.60	4/ 9	.
Beryllium	MG/KG	4/ 9	0.44	1.08	2.20	0.71	1.35	3/ 9	.
Cadmium	MG/KG	8/ 9	0.65	13.15	41.30	12.47	.		.
Chromium	MG/KG	104/104	9.80	82.40	180.00	33.48	39.96	99/104	.
Cobalt	MG/KG	9/ 9	13.10	15.47	18.40	1.71	17.08	1/ 9	.
Copper	MG/KG	9/ 9	28.20	183.80	397.00	126.20	15.30	9/ 9	.
Cyanide	MG/KG	6/ 9	0.32	3.27	17.10	5.53	.		.
Lead	MG/KG	7/ 7	34.10	103.40	155.00	43.63	21.87	7/ 7	.
Manganese	MG/KG	9/ 9	701.00	1143.00	1740.00	290.30	2058.00	0/ 9	.
Mercury	MG/KG	69/109	0.06	154.20	1290.00	245.10	.		.
Nickel	MG/KG	9/ 9	24.10	87.63	174.00	47.02	32.44	7/ 9	.
Selenium	MG/KG	13/103	0.37	7.39	17.00	3.50	.		.
Silver	MG/KG	7/ 9	0.85	12.42	29.70	8.93	.		.
Thallium	MG/KG	0/ 8	0.25	0.27	.	0.02	.		.
Vanadium	MG/KG	9/ 9	27.90	33.69	44.90	5.68	34.22	4/ 9	.
Zinc	MG/KG	34/104	19.50	102.50	392.00	81.22	78.10	30/104	.
Americium-241	PCI/G	7/ 8	-0.18	0.04	0.30	0.16	0.30	0/ 8	0.22110
Cesium-137	PCI/G	8/ 8	0.45	1.46	2.70	0.69	1.15	5/ 8	0.03509
Cobalt-60	PCI/G	7/ 7	-0.01	0.02	0.05	0.02	0.05	0/ 7	0.01421
Neptunium-237	PCI/G	7/ 7	-0.06	0.02	0.07	0.05	0.13	0/ 7	0.03774
Uranium-234	PCI/G	84/ 94	0.26	7.82	28.57	7.86	0.35	83/ 94	0.39150
Uranium-235	PCI/G	95/ 95	0.02	0.37	1.35	0.38	0.05	91/ 95	0.00184
Uranium-238	PCI/G	84/ 94	0.15	7.58	27.64	7.12	0.31	83/ 94	0.20400

Results less than detection were set to 1/2 detection limit to compute means and standard deviations. Upper tolerance limit for the reference site was calculated only for analytes with 3 or more values greater than the detection limit.

SOURCE:EFPC PHASE 1A and 1B VALIDATED DATA FROM FILE SOIL ON 12NOV92 AT 16:50

Table P.1. EFPC Phase 1A and 1B results for soil mean contaminant concentrations by creek segment (continued)

Creek Segment=' 5' Sample Media=Soil

PARAMTER	Measurement Units	Proportion of Results >Detection Limit	Minimum Result	Mean Result	Maximum Detected Result	Standard Deviation	Upper Tolerance Limit of Reference	Proportion of Results >Tolerance Limit	Radiation Counting Uncertainty of Mean
Aluminum	MG/KG	6/ 6	13000.00	14530.00	16200.00	1319.00	25400.00	0/ 6	.
Antimony	MG/KG	61/ 69	0.17	0.87	1.30	0.70	.		.
Arsenic	MG/KG	72/ 72	3.40	8.70	33.00	3.63	5.37	67/ 72	.
Barium	MG/KG	6/ 6	74.70	104.30	130.00	18.43	253.60	0/ 6	.
Beryllium	MG/KG	0/ 6	0.13	0.35	.	0.13	1.35	./ 6	.
Cadmium	MG/KG	5/ 6	0.40	4.27	8.40	3.34	.		.
Chromium	MG/KG	72/ 72	17.70	71.11	128.00	20.79	39.96	68/ 72	.
Cobalt	MG/KG	5/ 6	4.30	13.15	16.10	4.47	17.08	0/ 6	.
Copper	MG/KG	6/ 6	17.20	87.90	220.00	72.28	15.30	6/ 6	.
Cyanide	MG/KG	1/ 6	0.30	10.69	62.60	25.43	.		.
Lead	MG/KG	6/ 6	26.20	58.83	72.20	17.92	21.87	6/ 6	.
Manganese	MG/KG	6/ 6	602.00	1054.00	1300.00	236.40	2058.00	0/ 6	.
Mercury	MG/KG	35/ 72	1.30	43.50	352.00	71.72	.		.
Nickel	MG/KG	6/ 6	13.40	35.98	62.10	17.70	32.44	3/ 6	.
Selenium	MG/KG	20/ 72	0.35	9.66	25.00	6.07	.		.
Silver	MG/KG	4/ 6	0.80	3.87	9.10	3.17	.		.
Thallium	MG/KG	0/ 6	0.23	0.25	.	0.01	.		.
Vanadium	MG/KG	6/ 6	21.10	27.73	31.20	3.97	34.22	0/ 6	.
Zinc	MG/KG	16/ 72	26.00	81.86	389.00	70.91	78.10	13/ 72	.
Americium-241	PCI/G	6/ 6	-0.10	0.05	0.32	0.15	0.30	1/ 6	0.10760
Cesium-137	PCI/G	6/ 6	0.24	0.72	1.20	0.33	1.15	1/ 6	0.02279
Cobalt-60	PCI/G	6/ 6	-0.03	0.00	0.02	0.02	0.05	0/ 6	0.01027
Neptunium-237	PCI/G	6/ 6	-0.07	0.02	0.06	0.05	0.13	0/ 6	0.02421
Uranium-234	PCI/G	64/ 70	0.67	4.45	19.74	4.21	0.35	64/ 70	0.28000
Uranium-235	PCI/G	70/ 70	0.04	0.20	0.96	0.20	0.05	67/ 70	0.00207
Uranium-238	PCI/G	65/ 71	0.53	4.61	16.32	3.68	0.31	65/ 71	0.14680

Results less than detection were set to 1/2 detection limit to compute means and standard deviations. Upper tolerance limit for the reference site was calculated only for analytes with 3 or more values greater than the detection limit.

SOURCE:EFPC PHASE 1A and 1B VALIDATED DATA FROM FILE SOIL ON 12NOV92 AT 16:50

Table P.1. EFPC Phase 1A and 1B results for soil mean contaminant concentrations by creek segment (continued)

Creek Segment=' 6' Sample Media=Soil

PARAMTER	Measurement Units	Proportion of Results >Detection Limit	Minimum Result	Mean Result	Maximum Detected Result	Standard Deviation	Upper Tolerance Limit of Reference	Proportion of Results >Tolerance Limit	Radiation Counting Uncertainty of Mean
Aluminum	MG/KG	7/ 7	4550.00	12700.00	18200.00	4683.00	25400.00	0/ 7	.
Antimony	MG/KG	54/ 61	0.21	0.97	1.20	1.36	.		.
Arsenic	MG/KG	62/ 62	1.70	6.88	13.00	2.41	5.37	44/ 62	.
Barium	MG/KG	7/ 7	33.70	62.90	94.50	23.67	253.60	0/ 7	.
Beryllium	MG/KG	4/ 7	0.16	0.49	0.81	0.26	1.35	0/ 7	.
Cadmium	MG/KG	2/ 7	0.60	1.56	4.60	1.68	.		.
Chromium	MG/KG	63/ 63	11.40	64.30	112.00	21.46	39.96	57/ 63	.
Cobalt	MG/KG	5/ 7	2.55	10.74	27.10	8.70	17.08	1/ 7	.
Copper	MG/KG	6/ 7	3.35	25.02	78.00	26.49	15.30	2/ 7	.
Cyanide	MG/KG	2/ 3	0.30	0.97	1.50	0.61	.		.
Lead	MG/KG	7/ 7	11.30	23.76	41.20	11.59	21.87	4/ 7	.
Manganese	MG/KG	7/ 7	62.10	733.00	1990.00	671.80	2058.00	0/ 7	.
Mercury	MG/KG	28/ 63	0.21	19.26	207.00	37.44	.		.
Nickel	MG/KG	6/ 7	4.20	16.26	38.10	12.38	32.44	1/ 7	.
Selenium	MG/KG	32/ 63	0.35	22.21	58.00	19.86	.		.
Silver	MG/KG	1/ 7	0.80	1.29	2.90	0.73	.		.
Thallium	MG/KG	0/ 7	0.23	0.31	.	0.07	.		.
Vanadium	MG/KG	7/ 7	9.60	23.20	31.00	7.05	34.22	0/ 7	.
Zinc	MG/KG	36/ 63	13.50	80.24	393.00	75.36	78.10	16/ 63	.
Americium-241	PCI/G	1/ 1	0.00	0.00	0.00	.	0.30	0/ 1	0.58000
Cesium-137	PCI/G	5/ 5	0.01	0.50	1.08	0.52	1.15	0/ 5	0.06104
Cobalt-60	PCI/G	5/ 5	-0.04	0.01	0.06	0.04	0.05	1/ 5	0.03189
Neptunium-237	PCI/G	1/ 1	0.00	0.00	0.00	.	0.13	0/ 1	0.06000
Protactinium-233	PCI/G	4/ 4	-0.08	-0.01	0.02	0.05	.		0.09995
Thorium-228	PCI/G	2/ 2	1.19	2.23	3.26	1.47	.		0.15500
Thorium-230	PCI/G	1/ 1	7.91	7.91	7.91	.	.		0.40300
Thorium-232	PCI/G	2/ 2	0.62	1.80	2.98	1.66	.		0.14820
Uranium-234	PCI/G	55/ 60	0.46	3.69	18.52	3.54	0.35	55/ 60	0.27750
Uranium-235	PCI/G	59/ 59	0.02	0.17	0.88	0.17	0.05	57/ 59	0.00241
Uranium-238	PCI/G	54/ 59	0.36	3.87	17.65	3.13	0.31	54/ 59	0.14340

Results less than detection were set to 1/2 detection limit to compute means and standard deviations. Upper tolerance limit for the reference site was calculated only for analytes with 3 or more values greater than the detection limit.

SOURCE:EFPC PHASE 1A and 1B VALIDATED DATA FROM FILE SOIL ON 12NOV92 AT 16:50

Table P.1. EFPC Phase 1A and 1B results for soil mean contaminant concentrations by creek segment (continued)

Creek Segment=' 7' Sample Media=Soil

PARAMTER	Measurement Units	Proportion of Results >Detection Limit	Minimum Result	Mean Result	Maximum Detected Result	Standard Deviation	Upper Tolerance Limit of Reference	Proportion of Results >Tolerance Limit	Radiation Counting Uncertainty of Mean
Aluminum	MG/KG	8/ 8	7490.00	10120.00	13300.00	2118.00	25400.00	0/ 8	.
Antimony	MG/KG	263/283	0.10	0.73	3.60	0.43	.		.
Arsenic	MG/KG	289/291	0.90	7.77	21.00	2.52	5.37	257/291	.
Barium	MG/KG	8/ 8	44.20	105.70	208.00	52.02	253.60	0/ 8	.
Beryllium	MG/KG	8/ 8	0.51	0.75	1.10	0.17	1.35	0/ 8	.
Cadmium	MG/KG	4/ 8	0.60	3.10	9.30	3.48	.		.
Chromium	MG/KG	330/330	12.40	66.95	175.00	22.24	39.96	313/330	.
Cobalt	MG/KG	8/ 8	7.10	13.60	37.10	9.78	17.08	1/ 8	.
Copper	MG/KG	8/ 8	6.00	68.59	199.00	71.28	15.30	6/ 8	.
Lead	MG/KG	8/ 8	21.30	35.00	55.80	12.99	21.87	7/ 8	.
Manganese	MG/KG	8/ 8	537.00	1253.00	3390.00	888.20	2058.00	1/ 8	.
Mercury	MG/KG	84/326	0.39	12.69	278.00	33.04	.		.
Nickel	MG/KG	7/ 8	3.55	25.18	59.80	20.98	32.44	2/ 8	.
Selenium	MG/KG	166/331	0.46	13.41	68.00	13.96	.		.
Silver	MG/KG	2/ 8	1.15	1.92	4.40	1.33	.		.
Thallium	MG/KG	0/ 8	0.34	0.36	.	0.02	.		.
Vanadium	MG/KG	8/ 8	15.80	18.87	23.00	2.40	34.22	0/ 8	.
Zinc	MG/KG	125/330	18.00	209.70	7640.00	875.80	78.10	92/330	.
Cesium-137	PCI/G	7/ 7	0.08	0.69	2.08	0.73	1.15	2/ 7	0.06245
Cobalt-60	PCI/G	7/ 7	-0.01	0.02	0.06	0.02	0.05	1/ 7	0.03675
Neptunium-237	PCI/G	3/ 3	0.01	0.05	0.11	0.05	0.13	0/ 3	0.01543
Protactinium-233	PCI/G	7/ 7	-0.11	-0.01	0.13	0.07	.		0.08258
Thorium-228	PCI/G	2/ 2	1.08	1.54	2.00	0.66	.		0.09974
Thorium-230	PCI/G	2/ 2	1.77	7.38	12.98	7.92	.		0.20860
Thorium-232	PCI/G	2/ 2	0.35	1.01	1.67	0.93	.		0.08102
Uranium-234	PCI/G	279/308	0.35	3.19	19.74	3.64	0.35	279/308	0.11920
Uranium-235	PCI/G	335/335	0.03	0.15	0.96	0.18	0.05	310/335	0.00057
Uranium-238	PCI/G	290/319	0.28	3.29	24.31	3.15	0.31	290/319	0.05923

Results less than detection were set to 1/2 detection limit to compute means and standard deviations. Upper tolerance limit for the reference site was calculated only for analytes with 3 or more values greater than the detection limit.

SOURCE:EFPC PHASE 1A and 1B VALIDATED DATA FROM FILE SOIL ON 12NOV92 AT 16:50

Table P.1. EFPC Phase 1A and 1B results for soil mean contaminant concentrations by creek segment (continued)

Creek Segment=' 8' Sample Media=Soil

PARAMTER	Measurement Units	Proportion of Results >Detection Limit	Minimum Result	Mean Result	Maximum Detected Result	Standard Deviation	Upper Tolerance Limit of Reference	Proportion of Results >Tolerance Limit	Radiation Counting Uncertainty of Mean
Aluminum	MG/KG	8/ 8	9470.00	12970.00	18600.00	3136.00	25400.00	0/ 8	.
Antimony	MG/KG	69/ 77	0.14	0.65	1.30	0.25	.		.
Arsenic	MG/KG	85/ 85	2.00	7.25	13.00	2.33	5.37	69/ 85	.
Barium	MG/KG	8/ 8	74.50	115.90	186.00	37.15	253.60	0/ 8	.
Beryllium	MG/KG	8/ 8	0.67	0.81	1.00	0.14	1.35	0/ 8	.
Cadmium	MG/KG	6/ 8	0.60	3.29	9.30	3.04	.		.
Chromium	MG/KG	85/ 85	17.10	70.62	161.00	27.57	39.96	82/ 85	.
Cobalt	MG/KG	8/ 8	9.10	11.79	20.00	3.65	17.08	1/ 8	.
Copper	MG/KG	8/ 8	10.30	115.30	382.00	126.20	15.30	6/ 8	.
Lead	MG/KG	8/ 8	14.10	52.40	131.00	37.98	21.87	6/ 8	.
Manganese	MG/KG	8/ 8	503.00	857.50	1430.00	325.70	2058.00	0/ 8	.
Mercury	MG/KG	37/ 85	0.95	35.68	417.00	74.48	.		.
Nickel	MG/KG	8/ 8	11.80	33.49	72.30	22.17	32.44	3/ 8	.
Selenium	MG/KG	11/ 85	0.41	6.55	17.00	2.79	.		.
Silver	MG/KG	4/ 8	1.20	4.31	12.30	3.95	.		.
Thallium	MG/KG	0/ 8	0.31	0.38	.	0.03	.		.
Vanadium	MG/KG	8/ 8	17.10	22.60	34.80	6.00	34.22	1/ 8	.
Zinc	MG/KG	16/ 85	22.50	124.40	4160.00	447.00	78.10	11/ 85	.
Cesium-137	PCI/G	7/ 7	0.05	1.36	3.13	1.27	1.15	3/ 7	0.13150
Cobalt-60	PCI/G	7/ 7	0.01	0.04	0.07	0.02	0.05	2/ 7	0.02601
Neptunium-237	PCI/G	4/ 4	0.00	0.12	0.41	0.19	0.13	1/ 4	0.02322
Protactinium-233	PCI/G	7/ 7	-0.11	0.05	0.32	0.15	.		0.07697
Thorium-228	PCI/G	3/ 3	1.14	1.74	2.30	0.58	.		0.08178
Thorium-232	PCI/G	3/ 3	0.61	1.09	1.61	0.50	.		0.06138
Uranium-234	PCI/G	66/ 74	0.35	5.51	25.43	6.47	0.35	66/ 74	0.31060
Uranium-235	PCI/G	81/ 81	0.04	0.24	1.24	0.29	0.05	73/ 81	0.00228
Uranium-238	PCI/G	66/ 74	0.28	5.08	20.98	5.04	0.31	66/ 74	0.15830

Results less than detection were set to 1/2 detection limit to compute means and standard deviations. Upper tolerance limit for the reference site was calculated only for analytes with 3 or more values greater than the detection limit.

SOURCE:EFPC PHASE 1A and 1B VALIDATED DATA FROM FILE SOIL ON 12NOV92 AT 16:50

Table P.1. EFPC Phase 1A and 1B results for soil mean contaminant concentrations by creek segment (continued)

Creek Segment=' 9' Sample Media=Soil

PARAMTER	Measurement Units	Proportion of Results >Detection Limit	Minimum Result	Mean Result	Maximum Detected Result	Standard Deviation	Upper Tolerance Limit of Reference	Proportion of Results >Tolerance Limit	Radiation Counting Uncertainty of Mean
Aluminum	MG/KG	18/ 18	6880.00	11050.00	23300.00	3964.00	25400.00	0/ 18	.
Antimony	MG/KG	537/651	0.07	0.68	2.90	0.67	.		.
Arsenic	MG/KG	315/320	1.20	6.97	27.00	2.97	5.37	227/320	.
Barium	MG/KG	18/ 18	76.60	100.70	133.00	12.83	253.60	0/ 18	.
Beryllium	MG/KG	17/ 18	0.25	0.72	1.10	0.16	1.35	0/ 18	.
Cadmium	MG/KG	14/ 18	0.60	2.09	3.70	0.99	.		.
Chromium	MG/KG	690/690	6.90	59.74	182.00	17.69	39.96	642/690	.
Cobalt	MG/KG	18/ 18	8.80	10.95	14.30	1.25	17.08	0/ 18	.
Copper	MG/KG	18/ 18	7.40	41.96	63.50	14.07	15.30	17/ 18	.
Lead	MG/KG	18/ 18	21.20	35.44	66.80	11.74	21.87	17/ 18	.
Manganese	MG/KG	18/ 18	674.00	940.60	1180.00	133.50	2058.00	0/ 18	.
Mercury	MG/KG	153/697	0.40	11.16	216.00	26.64	.		.
Nickel	MG/KG	18/ 18	10.70	24.57	32.50	5.57	32.44	1/ 18	.
Selenium	MG/KG	112/699	0.45	7.15	66.00	6.79	.		.
Silver	MG/KG	3/ 18	1.15	1.59	3.20	0.65	.		.
Thallium	MG/KG	0/ 18	0.34	0.39	.	0.03	.		.
Vanadium	MG/KG	18/ 18	13.70	18.31	32.60	4.59	34.22	0/ 18	.
Zinc	MG/KG	112/676	7.00	56.64	321.00	35.70	78.10	66/676	.
Cesium-137	PCI/G	17/ 17	0.17	0.99	2.25	0.58	1.15	5/ 17	0.07050
Cobalt-60	PCI/G	17/ 17	-0.08	0.06	0.13	0.05	0.05	9/ 17	0.02171
Neptunium-237	PCI/G	7/ 7	0.00	0.10	0.57	0.21	0.13	1/ 7	0.04701
Protactinium-233	PCI/G	15/ 15	-0.13	0.01	0.29	0.12	.		0.05546
Thorium-228	PCI/G	8/ 8	0.73	1.59	2.35	0.48	.		0.05783
Thorium-230	PCI/G	6/ 6	1.28	2.72	3.81	0.95	.		0.08859
Thorium-232	PCI/G	8/ 8	0.66	1.01	1.68	0.38	.		0.04567
Uranium-234	PCI/G	514/682	0.40	2.88	21.30	3.36	0.35	514/682	0.09119
Uranium-235	PCI/G	722/722	0.03	0.13	1.03	0.16	0.05	688/722	0.00040
Uranium-238	PCI/G	521/689	0.32	3.11	20.31	3.03	0.31	521/689	0.05388

Results less than detection were set to 1/2 detection limit to compute means and standard deviations. Upper tolerance limit for the reference site was calculated only for analytes with 3 or more values greater than the detection limit.

SOURCE:EFPC PHASE 1A and 1B VALIDATED DATA FROM FILE SOIL ON 12NOV92 AT 16:50

Table P.1. EFPC Phase 1A and 1B results for soil mean contaminant concentrations by creek segment (continued)

Creek Segment=HC Sample Media=Soil

PARAMTER	Measurement Units	Proportion of Results >Detection Limit	Minimum Result	Mean Result	Maximum Detected Result	Standard Deviation	Upper Tolerance Limit of Reference	Proportion of Results >Tolerance Limit	Radiation Counting Uncertainty of Mean
Aluminum	MG/KG	12/ 12	7950.00	12410.00	19900.00	3486.00	25400.00	0/ 12	.
Antimony	MG/KG	0/ 7	3.60	3.74	.	0.09	.		.
Arsenic	MG/KG	12/ 12	1.50	2.54	3.90	0.71	5.37	0/ 12	.
Barium	MG/KG	12/ 12	69.20	112.20	165.00	36.03	253.60	0/ 12	.
Beryllium	MG/KG	12/ 12	0.40	0.68	0.95	0.17	1.35	0/ 12	.
Cadmium	MG/KG	0/ 12	0.35	0.37	.	0.01	.		.
Chromium	MG/KG	12/ 12	12.90	20.18	29.80	5.21	39.96	0/ 12	.
Cobalt	MG/KG	12/ 12	3.60	9.21	13.00	2.88	17.08	0/ 12	.
Copper	MG/KG	12/ 12	4.30	8.65	12.40	2.43	15.30	0/ 12	.
Cyanide	MG/KG	0/ 11	0.29	0.31	.	0.01	.		.
Lead	MG/KG	12/ 12	9.20	12.64	18.20	2.80	21.87	0/ 12	.
Manganese	MG/KG	12/ 12	138.00	509.20	1170.00	287.50	2058.00	0/ 12	.
Mercury	MG/KG	1/ 12	0.05	0.06	0.13	0.02	.		.
Nickel	MG/KG	12/ 12	7.20	13.94	20.50	4.26	32.44	0/ 12	.
Selenium	MG/KG	0/ 12	0.35	0.37	.	0.01	.		.
Silver	MG/KG	0/ 12	0.80	0.87	.	0.03	.		.
Thallium	MG/KG	0/ 12	0.23	0.25	.	0.01	.		.
Vanadium	MG/KG	12/ 12	13.20	19.47	25.50	4.08	34.22	0/ 12	.
Zinc	MG/KG	11/ 12	16.75	33.33	46.00	9.80	78.10	0/ 12	.
Americium-241	PCI/G	12/ 12	-0.12	0.00	0.25	0.10	0.30	0/ 12	0.08010
Cesium-137	PCI/G	12/ 12	0.06	0.31	1.06	0.28	1.15	0/ 12	0.02482
Cobalt-60	PCI/G	12/ 12	-0.03	-0.00	0.03	0.02	0.05	0/ 12	0.00866
Neptunium-237	PCI/G	12/ 12	-0.07	0.00	0.10	0.05	0.13	0/ 12	0.02028
Uranium-234	PCI/G	9/ 9	0.23	0.26	0.31	0.03	0.35	0/ 9	0.00916
Uranium-235	PCI/G	9/ 9	0.00	0.01	0.04	0.01	0.05	0/ 9	0.00378
Uranium-238	PCI/G	9/ 9	0.18	0.21	0.27	0.03	0.31	0/ 9	0.00831

Results less than detection were set to 1/2 detection limit to compute means and standard deviations. Upper tolerance limit for the reference site was calculated only for analytes with 3 or more values greater than the detection limit.

SOURCE:EFPC PHASE 1A and 1B VALIDATED DATA FROM FILE SOIL ON 12NOV92 AT 16:50

Table P.2. Human health risk characterization summary for EFPC agricultural/homesteader scenario: future land use, Hinds Creek RME estimates for long–term exposure – adults

Exposure Pathway	Hazard Index (HI):	Excess Lifetime Cancer Risk:
CHEMICALS		
SOIL PATHWAYS		
Ingestion	2.88E–02	4.92E–06
Dermal Contact	3.13E–03	5.35E–07
SURFACE WATER		
Ingestion	2.09E–03	3.22E–07
Dermal Contact	1.43E–03	1.81E–07
SEDIMENT		
Dermal Contact	2.01E–04	2.59E–08
GROUNDWATER		
Ingestion		
Inhalation (VOCs)		
FOOD CHAIN		
Produce	4.67E+00	2.94E–04
Beef	1.39E+01	2.87E–03
Dairy	2.94E+00	1.73E–04
Fish	1.32E–02	1.66E–05
AIR PATHWAY		
Particulates: Harvesting	9.02E–02	8.80E–07
RADIONUCLIDES		
SOIL PATHWAYS		
Ingestion		3.10E–08
SURFACE WATER		
Ingestion		7.01E–07
GROUNDWATER		
Ingestion		
FOOD CHAIN		
Produce		7.78E–07
Beef		1.25E–06
Dairy		1.88E–06
Fish		
AIR PATHWAY		
Particulates: Harvesting		2.15E–07
Chemical Hazards: Hazard Index (HI): Combined Exposure	2.2E+01	
Excess Lifetime Cancer Risk: Combined Exposure		3E–03
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure		5E–06

Table P.3. Human health risk characterization summary for EFPC agricultural/homesteader scenario: current land use, Hinds Creek RME estimates for long–term exposure – children

Exposure Pathway	Hazard Index (HI):	Excess Lifetime Cancer Risk:
CHEMICALS		
SOIL PATHWAYS		
Ingestion	1.03E–01	5.29E–06
Dermal Contact	4.10E–03	2.10E–07
SURFACE WATER		
Ingestion	5.62E–03	2.60E–07
Dermal Contact	1.86E–03	7.10E–08
SEDIMENT		
Dermal Contact	2.63E–04	1.01E–08
GROUNDWATER		
Ingestion		
Inhalation (VOCs)		
FOOD CHAIN		
Produce	9.69E+00	1.83E–04
Beef	2.77E+01	1.71E–03
Dairy	1.22E+01	2.15E–04
Fish	2.75E–02	1.04E–05
AIR PATHWAY		
Particulates: Harvesting		
RADIONUCLIDES		
SOIL PATHWAYS		
Ingestion		1.24E–08
SURFACE WATER		
Ingestion		7.01E–07
GROUNDWATER		
Ingestion		
FOOD CHAIN		
Produce		1.80E–07
Beef		2.76E–07
Dairy		8.64E–07
Fish		
AIR PATHWAY		
Particulates: Harvesting		
Chemical Hazards: Hazard Index (HI): Combined Exposure	5.0E+01	
Excess Lifetime Cancer Risk: Combined Exposure		2E–03
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure		2E–06

Table P.4. Risk characterization for soils: adult – ingestion exposure (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Aluminum	12410.00	14220.00	5.2E-03	6.7E-04	1.9E-02	8.3E-03									
Arsenic	2.54	2.91	1.0E-06	1.3E-07	3.9E-06	1.7E-06	3.5E-03	1.3E-02	46.2%	skin; keratosis, hyperpigmentation	3	2.4E-07	2.9E-06	60.7%	[A]
Barium	112.20	130.90	4.7E-05	6.1E-06	1.7E-04	7.6E-05	6.7E-04	2.5E-03	8.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.68	0.77	2.8E-07	3.6E-08	1.0E-06	4.4E-07	5.7E-05	2.1E-04	0.7%	no observed effects	100	1.5E-07	1.9E-06	39.2%	[B2]
Chromium (III)	20.18	22.89	8.5E-06	1.1E-06	3.1E-05	1.3E-05	8.5E-06	3.1E-05	0.1%	no observed effects	100				
Cobalt	9.21	10.70	3.8E-06	5.0E-07	1.4E-05	6.2E-06				--	--				
Copper	8.65	9.91	3.6E-06	4.7E-07	1.3E-05	5.8E-06	9.8E-05	3.6E-04	1.3%	Gastrointestinal system; irritation	--				[D]
Lead	12.64	14.09	5.3E-06	6.8E-07	1.9E-05	8.2E-06				CNS, blood	--				[B2]
Manganese	509.20	658.30	2.1E-04	2.7E-05	9.0E-04	3.8E-04	1.5E-03	6.4E-03	22.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	0.06	0.08	2.7E-08	3.5E-09	1.0E-07	4.4E-08	9.1E-05	3.4E-04	1.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	13.94	16.15	5.8E-06	7.5E-07	2.2E-05	9.4E-06	2.9E-04	1.1E-03	3.8%	dec. body and organ weight	300				
Vanadium	19.47	21.59	8.2E-06	1.0E-06	2.9E-05	1.2E-05	1.1E-03	4.2E-03	14.7%	no observed effects	100				
Zinc	33.33	38.41	1.4E-05	1.8E-06	5.2E-05	2.2E-05	4.7E-05	1.7E-04	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Benzoic Acid	0.86	1.14	3.6E-07	4.6E-08	1.5E-06	6.6E-07	9.1E-08	3.9E-07	0.0%	no observed effects	1				[D]
Bis(2-ethylhexyl)phthalate	0.25	0.30	1.0E-07	1.3E-08	4.1E-07	1.7E-07	5.2E-06	2.0E-05	0.1%	liver; weight inc.	1000	1.8E-10	2.4E-09	0.1%	[B2]
RADIONUCLIDES (pCi/g)															
Americium 241	0.00	0.05		8.1E-02		5.7E+01						1.9E-11	1.3E-08	44.1%	[A]
Cesium 137+D	0.31	0.45		2.9E+01		4.7E+02						8.3E-10	1.3E-08	42.6%	[A]
Cobalt 60	ND	0.01				7.4E+00							1.1E-10	0.4%	[A]
Neptunium 237+D	0.00	0.02		8.1E-02		2.6E+01						1.7E-11	5.7E-09	18.5%	[A]
Uranium 234	0.26	0.28		2.5E+01		2.9E+02						4.1E-10	4.7E-09	15.3%	[A]
Uranium 235+D	0.01	0.02		1.4E+00		2.2E+01						2.2E-11	3.6E-10	1.2%	[A]
Uranium 238+D	0.21	0.23		2.0E+01		2.4E+02						5.8E-10	6.8E-09	22.1%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.5E-03	2.8E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												4.0E-07	4.9E-06	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.8E-09	3.1E-08	100.0%	

Table P.5. Risk characterization for soils: children – ingestion exposure (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	IRIS UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRIS WOE
INORGANICS (mg/kg)															
Aluminum	12410.00	14220.00	1.84E-02	7.87E-04	6.98E-02	8.97E-03									
Arsenic	2.54	2.91	3.76E-06	1.61E-07	1.43E-05	1.84E-06	1.25E-02	4.76E-02	46.2%	skin; keratosis, hyperpigmentation	3	2.82E-07	3.21E-06	60.7%	[A]
Barium	112.20	130.90	1.66E-04	7.11E-06	6.42E-04	8.26E-05	2.37E-03	9.17E-03	8.9%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.68	0.77	9.99E-07	4.28E-08	3.75E-06	4.83E-07	2.00E-04	7.51E-04	0.7%	no observed effects	100	1.84E-07	2.07E-06	39.2%	[B2]
Chromium (III)	20.18	22.89	2.99E-05	1.28E-06	1.12E-04	1.44E-05	2.99E-05	1.12E-04	0.1%	no observed effects	100				
Cobalt	9.21	10.70	1.36E-05	5.84E-07	5.25E-05	6.75E-06				--	--				
Copper	8.65	9.91	1.28E-05	5.48E-07	4.86E-05	6.25E-06	3.46E-04	1.31E-03	1.3%	Gastrointestinal system; irritation	--				[D]
Lead	12.64	14.09	1.87E-05	8.01E-07	6.91E-05	8.89E-06				CNS, blood	--				[B2]
Manganese	509.20	658.30	7.53E-04	3.23E-05	3.23E-03	4.15E-04	5.38E-03	2.31E-02	22.4%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	0.06	0.08	9.55E-08	4.09E-09	3.71E-07	4.76E-08	3.18E-04	1.24E-03	1.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	13.94	16.15	2.06E-05	8.84E-07	7.92E-05	1.02E-05	1.03E-03	3.96E-03	3.8%	doc. body and organ weight	300				
Vanadium	19.47	21.59	2.88E-05	1.23E-06	1.06E-04	1.36E-05	4.11E-03	1.51E-02	14.7%	no observed effects	100				
Zinc	33.33	38.41	4.93E-05	2.11E-06	1.88E-04	2.42E-05	1.64E-04	6.28E-04	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Benzoic Acid	0.86	1.14	1.28E-06	5.47E-08	5.59E-06	7.19E-07	3.19E-07	1.40E-06	0.0%	no observed effects	1				[D]
Bis(2-ethylhexyl)phthalate	0.25	0.30	3.66E-07	1.57E-08	1.48E-06	1.91E-07	1.83E-05	7.42E-05	0.1%	liver; weight inc.	1000	2.20E-10	2.67E-09	0.1%	[B2]
RADIONUCLIDES (pCi/g)															
Americium 241	0.00	0.05		3.37E-02		2.27E+01						8.10E-12	5.46E-09	44.1%	[A]
Cesium 137+D	0.31	0.45		1.24E+01		1.89E+02						3.47E-10	5.28E-09	42.6%	[A]
Cobalt 60	ND	0.01				2.98E+00							4.47E-11	0.4%	[A]
Neptunium 237+D	0.00	0.02		3.37E-02		1.04E+01						7.42E-12	2.29E-09	18.5%	[A]
Uranium 234	0.26	0.28		1.07E+01		1.18E+02						1.71E-10	1.89E-09	15.3%	[A]
Uranium 235+D	0.01	0.02		5.85E-01		8.99E+00						9.36E-12	1.44E-10	1.2%	[A]
Uranium 238+D	0.21	0.23		8.66E+00		9.77E+01						2.43E-10	2.74E-09	22.1%	[A]
Chemical Hazards:															
Hazard Index (HI): Combined Exposure (d)							2.65E-02	1.03E-01	100.0%						
Excess Lifetime Cancer Risk:															
Combined Exposure (d)												4.66E-07	5.29E-06	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.76E-10	1.24E-08	100.0%	

Table P.6. Risk characterization for soils: adult – dermal exposure (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Aluminum	12410.00	14220.00	1.89E-04	2.43E-05	2.11E-03	9.02E-04									
Arsenic	2.54	2.91	3.87E-08	4.97E-09	4.31E-07	1.85E-07	1.29E-04	1.44E-03	45.9%	skin; keratosis, hyperpigmentation	3	8.70E-09	3.23E-07	60.5%	[A]
Barium	112.20	130.90	1.71E-06	2.20E-07	1.94E-05	8.31E-06	2.44E-05	2.77E-04	8.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.68	0.77	1.03E-08	1.32E-09	1.13E-07	4.86E-08	2.05E-06	2.27E-05	0.7%	no observed effects	100	5.68E-09	2.09E-07	39.0%	[B2]
Chromium (III)	20.18	22.89	3.07E-07	3.95E-08	3.39E-06	1.45E-06	3.07E-07	3.39E-06	0.1%	no observed effects	100				
Cobalt	9.21	10.70	1.40E-07	1.80E-08	1.58E-06	6.79E-07				--	--				
Copper	8.65	9.91	1.32E-07	1.69E-08	1.47E-06	6.29E-07	3.56E-06	3.97E-05	1.3%	Gastrointestinal system; irritation	--				[D]
Lead	12.64	14.09	1.92E-07	2.47E-08	2.09E-06	8.94E-07				CNS, blood	--				[B2]
Manganese	509.20	658.30	7.75E-06	9.96E-07	9.75E-05	4.18E-05	5.53E-05	6.96E-04	22.2%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	0.06	0.08	9.83E-10	1.26E-10	1.12E-08	4.79E-09	3.28E-06	3.73E-05	1.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	13.94	16.15	2.12E-07	2.73E-08	2.39E-06	1.02E-06	1.06E-05	1.20E-04	3.8%	dec. body and organ weight	300				
Vanadium	19.47	21.59	2.96E-07	3.81E-08	3.20E-06	1.37E-06	4.23E-05	4.57E-04	14.6%	no observed effects	100				
Zinc	33.33	38.41	5.07E-07	6.52E-08	5.69E-06	2.44E-06	1.69E-06	1.90E-05	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Benzoic Acid	0.86	1.14	1.31E-07	1.69E-08	1.69E-06	7.23E-07	3.28E-08	4.22E-07	0.0%	no observed effects	1				[D]
Bis(2-ethylhexyl)phthalate	0.25	0.30	3.70E-08	4.84E-09	4.48E-07	1.92E-07	1.88E-06	2.24E-05	0.7%	liver; weight inc.	1000	6.77E-11	2.69E-09	0.5%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							2.74E-04	3.13E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.44E-08	5.35E-07	100.0%	

Table P.7. Risk characterization for soils: children – dermal exposure (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration in Soils	RME Concentration in Soils	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDo UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDo WOE
INORGANICS (mg/kg)															
Aluminum	12410.00	14220.00	2.46E-04	1.05E-05	2.75E-03	3.54E-04									
Arsenic	2.54	2.91	5.04E-08	2.16E-09	5.64E-07	7.25E-08	1.68E-04	1.88E-03	45.9%	skin; keratosis, hyperpigmentation	3	3.78E-09	1.27E-07	60.5%	[A]
Barium	112.20	130.90	2.23E-06	9.54E-08	2.54E-05	3.26E-06	3.18E-05	3.62E-04	8.8%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	0.68	0.77	1.34E-08	5.74E-10	1.48E-07	1.91E-08	2.68E-06	2.96E-05	0.7%	no observed effects	100	2.47E-09	8.19E-08	39.0%	[B2]
Chromium (III)	20.18	22.89	4.00E-07	1.72E-08	4.43E-06	5.70E-07	4.00E-07	4.43E-06	0.1%	no observed effects	100				
Cobalt	9.21	10.70	1.83E-07	7.83E-09	2.07E-06	2.66E-07				--	--				
Copper	8.65	9.91	1.72E-07	7.35E-09	1.92E-06	2.47E-07	4.64E-06	5.19E-05	1.3%	Gastrointestinal system; irritation	--				[D]
Lead	12.64	14.09	2.51E-07	1.07E-08	2.73E-06	3.51E-07				CNS, blood	--				[B2]
Manganese	509.20	658.30	1.01E-05	4.33E-07	1.27E-04	1.64E-05	7.21E-05	9.11E-04	22.2%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	0.06	0.08	1.28E-09	5.49E-11	1.46E-08	1.88E-09	4.27E-06	4.88E-05	1.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	13.94	16.15	2.76E-07	1.18E-08	3.13E-06	4.02E-07	1.38E-05	1.56E-04	3.8%	dec. body and organ weight	300				
Vanadium	19.47	21.59	3.86E-07	1.66E-08	4.18E-06	5.36E-07	5.52E-05	5.97E-04	14.6%	no observed effects	100				
Zinc	33.33	38.41	6.61E-07	2.83E-08	7.44E-06	9.56E-07	2.20E-06	2.48E-05	0.6%	blood; anemia	3				[D]
ORGANICS (mg/kg)															
Benzoic Acid	0.86	1.14	1.71E-07	7.33E-09	2.21E-06	2.84E-07	4.28E-08	5.52E-07	0.0%	no observed effects	1				[D]
Bis(2-ethylhexyl)phthalate	0.25	0.30	4.90E-08	2.10E-09	5.86E-07	7.53E-08	2.45E-06	2.93E-05	0.7%	liver; weight inc.	1000	2.94E-11	1.05E-09	0.5%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.5E-04	4.1E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.2E-09	2.1E-07	100.0%	

Table P.8. Risk characterization for surface water: adult — ingestion exposure (swimming) (future land use — agricultural/homesteader) — Hinds Creek

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	IRIS UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (µg/L)															
Aluminum	4.6E+03	4.6E+03	6.4E-05	8.2E-06	3.8E-04	1.6E-04									
Arsenic	5.2E+00	5.2E+00	7.1E-08	9.1E-09	4.2E-07	1.8E-07	2.3E-04	1.4E-03	67.6%	skin; keratosis, hyperpigmentation	3	1.6E-08	3.1E-07	98.5%	[A]
Barium	1.2E+02	1.2E+02	1.6E-06	2.1E-07	9.8E-06	4.2E-06	2.3E-05	1.4E-04	6.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Chromium (III)	7.1E+00	7.1E+00	9.7E-08	1.2E-08	5.7E-07	2.4E-07	9.7E-08	5.7E-07	0.0%	no observed effects	100				
Cobalt	8.6E+00	8.6E+00	1.1E-07	1.5E-08	7.0E-07	3.0E-07				– –	– –				[D]
Copper	1.3E+01	1.3E+01	1.8E-07	2.3E-08	1.0E-06	4.6E-07	4.9E-06	2.9E-05	1.4%	Gastrointestinal system; irritation	– –				[D]
Manganese	6.4E+02	6.4E+02	8.8E-06	1.1E-06	5.2E-05	2.2E-05	6.2E-05	3.7E-04	17.9%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Vanadium	7.2E+00	7.2E+00	9.8E-08	1.2E-08	5.8E-07	2.5E-07	1.4E-05	8.3E-05	4.0%	no observed effects	100				
Zinc	3.1E+01	3.1E+01	4.2E-07	5.4E-08	2.5E-06	1.0E-06	1.4E-06	8.4E-06	0.4%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Bis(2-ethylhexyl)phthalate	1.0E+01	1.0E+01	1.3E-07	1.7E-08	8.1E-07	3.4E-07	6.8E-06	4.0E-05	1.9%	liver; weight inc.	1000	2.4E-10	4.8E-09	1.5%	[B2]
RADIONUCLIDES (pCi/L)															
Americium 241	ND	7.4E+00				4.6E+02							1.1E-07	15.8%	[A]
Cesium 137+D	5.5E+00	1.4E+01		1.7E+01		8.8E+02						4.8E-10	2.4E-08	3.5%	[A]
Cobalt 60	4.0E+00	3.3E+01		1.2E+01		2.0E+03						1.8E-10	3.0E-08	4.4%	[A]
Neptunium 237+D	1.7E+00	3.8E+01		5.4E+00		2.4E+03						1.2E-09	5.3E-07	76.2%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.5E-04	2.0E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.6E-08	3.2E-07	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.8E-09	7.0E-07	100.0%	

Table P.9. Risk characterization for surface water: children – ingestion exposure (swimming) (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (µg/L)															
Aluminum	4.6E+03	4.6E+03	1.8E-04	7.7E-06	1.0E-03	1.3E-04									
Arsenic	5.2E+00	5.2E+00	1.9E-07	8.5E-09	1.1E-06	1.4E-07	6.6E-04	3.8E-03	67.6%	skin; keratosis, hyperpigmentation	3	1.5E-08	2.5E-07	98.5%	[A]
Barium	1.2E+02	1.2E+02	4.6E-06	1.9E-07	2.6E-05	3.4E-06	6.6E-05	3.7E-04	6.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.1E+00	7.1E+00	2.7E-07	1.1E-08	1.5E-06	2.0E-07	2.7E-07	1.5E-06	0.0%	no observed effects	100				
Cobalt	8.6E+00	8.6E+00	3.3E-07	1.4E-08	1.8E-06	2.4E-07				– –	– –				
Copper	1.3E+01	1.3E+01	5.1E-07	2.2E-08	2.9E-06	3.7E-07	1.3E-05	7.9E-05	1.4%	Gastrointestinal system; irritation	– –				[D]
Manganese	6.4E+02	6.4E+02	2.4E-05	1.0E-06	1.4E-04	1.8E-05	1.7E-04	1.0E-03	17.9%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Vanadium	7.2E+00	7.2E+00	2.7E-07	1.1E-08	1.5E-06	2.0E-07	3.9E-05	2.2E-04	4.0%	no observed effects	100				
Zinc	3.1E+01	3.1E+01	1.1E-06	5.1E-08	6.8E-06	8.7E-07	3.9E-06	2.2E-05	0.4%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Bis(2-ethylhexyl)phthalate	1.0E+01	1.0E+01	3.8E-07	1.6E-08	2.1E-06	2.8E-07	1.9E-05	1.1E-04	1.9%	liver; weight inc.	1000	2.3E-10	3.9E-09	1.5%	[B2]
RADIONUCLIDES (pCi/L)															
Americium 241	ND	7.4E+00				1.3E+02									
Cesium 137+D	5.5E+00	1.4E+01		5.8E+00		2.6E+02							1.1E-07	15.8%	[A]
Cobalt 60	4.0E+00	3.3E+01		4.2E+00		6.1E+02						4.8E-10	2.4E-08	3.5%	[A]
Neptunium 237+D	1.7E+00	3.8E+01		1.8E+00		7.2E+02						1.8E-10	3.0E-08	4.4%	[A]
												1.2E-09	5.3E-07	76.2%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							9.8E-04	5.6E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.5E-08	2.6E-07	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.8E-09	7.0E-07	100.0%	

Table P.10. Risk characterization for surface waters: adult – dermal exposure (swimming and wading) (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	EPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	EPA WOE
INORGANICS (µg/L)															
Aluminum	4.69E+03	4.69E+03	4.98E-06	6.40E-07	5.21E-05	2.23E-05									
Arsenic	5.20E+00	5.20E+00	5.52E-09	7.09E-10	5.78E-08	2.48E-08	1.84E-05	1.93E-04	13.5%	skin; keratosis, hyperpigmentation	3	1.24E-09	4.33E-08	24.0%	[A]
Barium	1.21E+02	1.21E+02	1.28E-07	1.65E-08	1.34E-06	5.76E-07	1.83E-06	1.92E-05	1.3%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.10E+00	7.10E+00	7.53E-09	9.68E-10	7.89E-08	3.38E-08	7.53E-09	7.89E-08	0.0%	no observed effects	100				
Cobalt	8.60E+00	8.60E+00	9.12E-09	1.17E-09	9.56E-08	4.10E-08				– –	– –				[D]
Copper	1.34E+01	1.34E+01	1.42E-08	1.83E-09	1.49E-07	6.38E-08	3.84E-07	4.03E-06	0.3%	Gastrointestinal system; irritation	1				[D]
Manganese	6.43E+02	6.43E+02	6.82E-07	8.77E-08	7.15E-06	3.06E-06	4.87E-06	5.10E-05	3.6%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	100				[D]
Vanadium	7.20E+00	7.20E+00	7.64E-09	9.82E-10	8.00E-08	3.43E-08	1.09E-06	1.14E-05	0.8%	no observed effects	3				
Zinc	3.11E+01	3.11E+01	3.30E-08	4.24E-09	3.46E-07	1.48E-07	1.10E-07	1.15E-06	0.1%	blood; anemia					
ORGANICS (µg/L)															
Bis(2-ethylhexyl)phthalate	1.00E+01	1.00E+01	2.19E-06	2.81E-07	2.29E-05	9.82E-06	1.09E-04	1.15E-03	80.4%	liver; weight inc.	1000	3.94E-09	1.38E-07	76.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.36E-04	1.43E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.18E-09	1.81E-07	100.0%	

Table P.11. Risk characterization for surface waters: children – dermal exposure (swimming and wading) (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration in SW	RME Concentration in SW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (µg/L)															
Aluminum	4.69E+03	4.69E+03	6.48E-06	2.78E-07	6.82E-05	8.77E-06									
Arsenic	5.20E+00	5.20E+00	7.19E-09	3.08E-10	7.56E-08	9.72E-09	2.40E-05	2.52E-04	13.5%	skin; keratosis, hyperpigmentation	3	5.39E-10	1.70E-08	24.0%	[A]
Barium	1.21E+02	1.21E+02	1.67E-07	7.17E-09	1.76E-06	2.26E-07	2.39E-06	2.51E-05	1.3%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	7.10E+00	7.10E+00	9.82E-09	4.21E-10	1.03E-07	1.33E-08	9.82E-09	1.03E-07	0.0%	no observed effects	100				
Cobalt	8.60E+00	8.60E+00	1.19E-08	5.10E-10	1.25E-07	1.61E-08				– –	– –				
Copper	1.34E+01	1.34E+01	1.85E-08	7.94E-10	1.95E-07	2.51E-08	5.01E-07	5.26E-06	0.3%	Gastrointestinal system; irritation	– –				
Manganese	6.43E+02	6.43E+02	8.89E-07	3.81E-08	9.35E-06	1.20E-06	6.35E-06	6.68E-05	3.6%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Vanadium	7.20E+00	7.20E+00	9.96E-09	4.27E-10	1.05E-07	1.35E-08	1.42E-06	1.50E-05	0.8%	no observed effects	100				[D]
Zinc	3.11E+01	3.11E+01	4.30E-08	1.84E-09	4.52E-07	5.81E-08	1.43E-07	1.51E-06	0.1%	blood; anemia	3				[D]
ORGANICS (µg/L)															
Bis(2-ethylhexyl)phthalate	1.00E+01	1.00E+01	2.85E-06	1.22E-07	3.00E-05	3.85E-06	1.43E-04	1.50E-03	80.4%	liver; weight inc.	1000	1.71E-09	5.40E-08	76.0%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.77E-04	1.86E-03	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.25E-09	7.10E-08	100.0%	

Table P.12. Risk characterization for sediments: adult – dermal exposure (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI): CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Aluminum	13700.00	14400.00	2.25E-06	2.90E-07	8.87E-05	3.80E-05									
Arsenic	4.25	5.60	6.99E-10	8.98E-11	3.45E-08	1.48E-08	2.33E-06	1.15E-04	57.1%	skin; keratosis, hyperpigmentation	3	1.57E-10	2.59E-08	100.0%	[A]
Barium	166.50	184.00	2.74E-08	3.52E-09	1.13E-06	4.86E-07	3.91E-07	1.62E-05	8.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	28.75	29.40	4.73E-09	6.08E-10	1.81E-07	7.76E-08	4.73E-09	1.81E-07	0.1%	no observed effects	100				
Cobalt	12.35	13.30	2.03E-09	2.61E-10	8.19E-08	3.51E-08				--	--				
Copper	14.20	16.50	2.33E-09	3.00E-10	1.02E-07	4.35E-08	6.31E-08	2.75E-06	1.4%	Gastrointestinal system; irritation	--				[D]
Lead	6.15	7.40	1.01E-09	1.30E-10	4.56E-08	1.95E-08				CNS, blood	--				[B2]
Manganese	631.00	721.00	1.04E-07	1.33E-08	4.44E-06	1.90E-06	7.41E-07	3.17E-05	15.8%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Nickel	23.35	24.00	3.84E-09	4.94E-10	1.48E-07	6.33E-08	1.92E-07	7.39E-06	3.7%	dec. body and organ weight	300				
Vanadium	28.45	30.60	4.68E-09	6.01E-10	1.88E-07	8.07E-08	6.68E-07	2.69E-05	13.4%	no observed effects	100				
Zinc	54.80	55.10	9.01E-09	1.16E-09	3.39E-07	1.45E-07	3.00E-08	1.13E-06	0.6%	blood; anemia	3				[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							4.42E-06	2.01E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.57E-10	2.59E-08	100.0%	

Table P.13. Risk characterization for sediments: children – dermal exposure (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration in Sediment	RME Concentration in Sediment	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern/ Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg)															
Aluminum	13700.00	14400.00	2.94E-06	1.26E-07	1.16E-04	1.49E-05									
Arsenic	4.25	5.60	9.11E-10	3.90E-11	4.51E-08	5.80E-09	3.04E-06	1.50E-04	57.1%	skin; keratosis, hyperpigmentation	3	6.83E-11	1.01E-08	100.0%	[A]
Barium	166.50	184.00	3.57E-08	1.53E-09	1.48E-06	1.91E-07	5.10E-07	2.12E-05	8.0%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Chromium (III)	28.75	29.40	6.16E-09	2.64E-10	2.37E-07	3.04E-08	6.16E-09	2.37E-07	0.1%	no observed effects	100				
Cobalt	12.35	13.30	2.65E-09	1.13E-10	1.07E-07	1.38E-08				--	--				
Copper	14.20	16.50	3.04E-09	1.30E-10	1.33E-07	1.71E-08	8.22E-08	3.59E-06	1.4%	Gastrointestinal system; irritation	--				[D]
Lead	6.15	7.40	1.32E-09	5.65E-11	5.96E-08	7.66E-09				CNS, blood	--				[B2]
Manganese	631.00	721.00	1.35E-07	5.79E-09	5.81E-06	7.47E-07	9.66E-07	4.15E-05	15.8%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Nickel	23.35	24.00	5.00E-09	2.14E-10	1.93E-07	2.48E-08	2.50E-07	9.66E-06	3.7%	dec. body and organ weight	300				
Vanadium	28.45	30.60	6.10E-09	2.61E-10	2.46E-07	3.17E-08	8.71E-07	3.52E-05	13.4%	no observed effects	100				
Zinc	54.80	55.10	1.17E-08	5.02E-10	4.44E-07	5.71E-08	3.91E-08	1.48E-06	0.6%	blood; anemia	3				[D]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							5.70E-06	2.63E-04	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												6.83E-11	1.01E-08	100.0%	

Table P.14. Risk characterization for produce: adult – ingestion exposure (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	IRPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	IRPA WOE
INORGANICS (mg/kg PLANT TISSUE)															
Aluminum	4.96E+01	5.69E+01	7.57E-03	9.74E-04	9.27E-02	3.97E-02									
Arsenic	2.03E-01	2.33E-01	3.10E-05	3.99E-06	3.80E-04	1.63E-04	1.03E-01	1.27E+00	27.1%	skin; keratosis, hyperpigmentation	3	6.98E-06	2.85E-04	96.8%	[A]
Barium	1.12E+00	1.31E+00	1.71E-04	2.20E-05	2.13E-03	9.15E-04	2.45E-03	3.05E-02	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *Inhal.*–fetotoxicity	3				
Beryllium	2.70E-03	3.06E-03	4.12E-07	5.30E-08	4.99E-06	2.14E-06	8.24E-05	9.98E-04	0.0%	no observed effects	100	2.28E-07	9.19E-06	3.1%	[B2]
Chromium (III)	2.02E-01	2.29E-01	3.08E-05	3.96E-06	3.73E-04	1.60E-04	3.08E-05	3.73E-04	0.0%	no observed effects	100				
Cobalt	2.76E-01	3.21E-01	4.21E-05	5.42E-06	5.23E-04	2.24E-04				--	--				
Copper	4.33E-01	4.96E-01	6.60E-05	8.48E-06	8.08E-04	3.46E-04	1.78E-03	2.18E-02	0.5%	Gastrointestinal system; irritation	--				[D]
Lead	1.26E-01	1.41E-01	1.93E-05	2.48E-06	2.30E-04	9.84E-05				CNS, blood	--				[B2]
Manganese	2.04E+02	2.63E+02	3.11E-02	4.00E-03	4.29E-01	1.84E-01	2.22E-01	3.07E+00	65.7%	*oral*–CNS effects. *Inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.94E-02	2.27E-02	2.96E-06	3.80E-07	3.65E-05	1.56E-05	9.85E-03	1.23E-01	2.6%	*oral*–CNS; neurotoxicity. *Inhal.*–kidney effects	1000				[D]
Nickel	6.97E-01	8.08E-01	1.06E-04	1.37E-05	1.32E-03	5.64E-04	5.32E-03	6.58E-02	1.4%	dec. body and organ weight	300				
Vanadium	3.89E-02	4.32E-02	5.94E-06	7.64E-07	7.04E-05	3.02E-05	8.49E-04	1.01E-02	0.2%	no observed effects	100				
Zinc	1.33E+01	1.54E+01	2.03E-03	2.62E-04	2.50E-02	1.07E-02	6.78E-03	8.35E-02	1.8%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Benzoic Acid	6.93E-01	9.16E-01	1.06E-04	1.36E-05	1.49E-03	6.40E-04	2.64E-05	3.73E-04	0.0%	no observed effects	1				[D]
Bis(2-ethylhexyl)phthalate	8.94E-03	1.09E-02	1.36E-06	1.75E-07	1.78E-05	7.64E-06	6.82E-05	8.92E-04	0.0%	liver; weight inc.	1000	2.46E-09	1.07E-07	0.0%	[B2]
RADIONUCLIDES (pCi/kg PLANT TISSUE)															
Americium 241	8.33E-07	5.43E-05		2.92E-02		6.78E+01						7.02E-12	1.63E-08	2.1%	[A]
Cesium 137+D	9.17E-03	1.35E-02		3.22E+02		1.69E+04						9.01E-09	4.72E-07	60.7%	[A]
Cobalt 60		2.13E-04				2.67E+02							4.00E-09	0.5%	[A]
Neptunium 237+D	3.33E-05	9.96E-04		1.17E+00		1.24E+03						2.57E-10	2.74E-07	35.2%	[A]
Uranium 234	5.29E-04	5.64E-04		1.86E+01		7.05E+02						2.97E-10	1.13E-08	1.4%	[A]
Uranium 235+D	2.89E-05	4.29E-05		1.01E+00		5.36E+01						1.62E-11	8.58E-10	0.1%	[A]
Uranium 238+D	4.29E-04	4.67E-04		1.50E+01		5.83E+02						4.21E-10	1.63E-08	2.1%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.53E-01	4.67E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												7.21E-06	2.94E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												1.00E-08	7.78E-07	100.0%	

Table P.15. Risk characterization for produce: children – ingestion exposure (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration from Mean Concentration in Soil	RME Concentration from UCL Concentration in Soil	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS (mg/kg PLANT TISSUE)															
Aluminum	4.96E+01	5.69E+01	1.69E-02	7.26E-04	1.92E-01	2.47E-02									
Arsenic	2.03E-01	2.33E-01	6.94E-05	2.97E-06	7.88E-04	1.01E-04	2.31E-01	2.63E+00	27.1%	skin; keratosis, hyperpigmentation	3	5.20E-06	1.77E-04	96.8%	[A]
Barium	1.12E+00	1.31E+00	3.83E-04	1.64E-05	4.43E-03	5.69E-04	5.47E-03	6.32E-02	0.7%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.70E-03	3.00E-03	9.21E-07	3.95E-08	1.04E-05	1.33E-06	1.84E-04	2.07E-03	0.0%	no observed effects	100	1.70E-07	5.72E-06	3.1%	[B2]
Chromium (III)	2.02E-01	2.29E-01	6.88E-05	2.95E-06	7.74E-04	9.95E-05	6.88E-05	7.74E-04	0.0%	no observed effects	100				
Cobalt	2.76E-01	3.21E-01	9.42E-05	4.04E-06	1.09E-03	1.40E-04				– –	– –				
Copper	4.32E-01	4.96E-01	1.46E-04	6.32E-06	1.66E-03	2.15E-04	3.99E-03	4.53E-02	0.5%	Gastrointestinal system; irritation	– –				[D]
Lead	1.26E-01	1.41E-01	4.31E-05	1.85E-06	4.77E-04	6.13E-05				CNS, blood	– –				[B2]
Manganese	2.04E+02	2.63E+02	6.95E-02	2.98E-03	8.91E-01	1.14E-01	4.96E-01	6.36E+00	65.7%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	1.94E-02	2.27E-02	6.61E-06	2.83E-07	7.67E-05	9.86E-06	2.20E-02	2.56E-01	2.6%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	6.97E-01	8.08E-01	2.38E-04	1.02E-05	2.73E-03	3.51E-04	1.19E-02	1.37E-01	1.4%	dec. body and organ weight	300				[D]
Vanadium	3.89E-02	4.32E-02	1.33E-05	5.69E-07	1.46E-04	1.88E-05	1.90E-03	2.09E-02	0.2%	no observed effects	100				
Zinc	1.33E+01	1.54E+01	4.55E-03	1.95E-04	5.20E-02	6.68E-03	1.52E-02	1.73E-01	1.8%	blood; anemia	3				[D]
ORGANICS (mg/kg PLANT TISSUE)															
Benzoic Acid	6.93E-01	9.16E-01	2.36E-04	1.01E-05	3.10E-03	3.98E-04	5.91E-05	7.75E-04	0.0%	no observed effects	1				[D]
Bis(2-ethylhexyl)phthalate	8.94E-03	1.09E-02	3.05E-06	1.31E-07	3.70E-05	4.76E-06	1.53E-04	1.85E-03	0.0%	liver; weight inc.	1000	1.83E-09	6.66E-08	0.0%	[B2]
RADIONUCLIDES (pCi/g PLANT TISSUE)															
Americium 241	8.33E-07	5.43E-05		7.78E-03		1.57E+01						1.87E-12	3.76E-09	2.1%	[A]
Cesium 137+D	9.17E-03	1.35E-02		8.57E+01		3.90E+03						2.40E-09	1.09E-07	60.7%	[A]
Cobalt 60		2.13E-04				6.16E+01							9.25E-10	0.5%	[A]
Neptunium 237+D	3.33E-05	9.96E-04		3.11E-01		2.88E+02						6.85E-11	6.33E-08	35.2%	[A]
Uranium 234	5.29E-04	5.64E-04		4.94E+00		1.63E+02						7.90E-11	2.61E-09	1.4%	[A]
Uranium 235+D	2.89E-05	4.25E-05		2.70E-01		1.24E+01						4.31E-12	1.98E-10	0.1%	[A]
Uranium 238+D	4.29E-04	4.67E-04		4.00E+00		1.35E+02						1.12E-10	3.77E-09	2.1%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							7.88E-01	9.69E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.37E-06	1.83E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												2.66E-09	1.81E-07	100.0%	

Table P.16. Risk characterization for beef: adult – ingestion exposure (future land use – agricultural) – Hinds Creek

Chemical	MLE Concentration from Mean Concentration in Soil/SW	RME Concentration from UCL Concentration in Soil/SW	Chronic Daily Intake (CDI) CDI Noncanc. Effects (MLE)	CDI Canc. Effects (MLE)	CDI Noncanc. Effects (RME)	CDI Canc. Effects (RME)	Risk Estimates HQ Noncanc. Effects (CDI/RfD) (MLE)	HQ Noncanc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Canc. Risk	BPA WOE
INORGANICS (mg/kg BEEF TISSUE)															
Aluminum	8.70E+01	8.76E+01	2.10E-02	2.70E-03	9.00E-02	3.86E-02									
Arsenic	3.71E+00	3.72E+00	8.94E-04	1.15E-04	3.82E-03	1.64E-03	2.98E+00	1.27E+01	91.2%	skin; keratosis, hyperpigmentation	3	2.01E-04	2.86E-03	99.8%	[A]
Barium	8.66E-01	8.69E-01	2.09E-04	2.69E-05	8.93E-04	3.83E-04	2.98E-03	1.28E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.53E-03	2.87E-03	6.10E-07	7.85E-08	2.95E-06	1.26E-06	1.22E-04	5.90E-04	0.0%	no observed effects	100	3.37E-07	5.43E-06	0.2%	[B2]
Chromium (III)	7.80E+00	7.84E+00	1.88E-03	2.42E-04	8.00E-03	3.45E-03	1.88E-03	8.00E-03	0.1%	no observed effects	100				
Cobalt	9.56E+00	9.64E+00	2.31E-03	2.96E-04	9.91E-03	4.25E-03		--		--	--				
Copper	4.99E+00	5.03E+00	1.20E-03	1.55E-04	5.17E-03	2.21E-03	3.25E-02	1.40E-01	1.0%	Gastrointestinal system; irritation	--				[D]
Lead	7.22E-03	8.05E-03	1.74E-06	2.24E-07	8.27E-06	3.54E-06				CNS, blood	--				[B2]
Manganese	2.83E+01	2.99E+01	6.82E-03	8.76E-04	3.08E-02	1.32E-02	4.87E-02	2.20E-01	1.6%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.58E-03	3.01E-03	6.21E-07	7.99E-08	3.10E-06	1.33E-06	2.07E-03	1.03E-02	0.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	3.09E-02	3.55E-02	7.46E-06	9.59E-07	3.68E-05	1.58E-05	3.73E-04	1.84E-03	0.0%	dec. body and organ weight	300				
Vanadium	2.67E+00	2.69E+00	6.45E-04	8.29E-05	2.76E-03	1.18E-03	9.21E-02	3.95E-01	2.8%	no observed effects	100				
Zinc	1.22E+02	1.24E+02	2.95E-02	3.80E-03	1.28E-01	5.46E-02	9.84E-02	4.26E-01	3.1%	blood; anemia	3				[D]
ORGANICS (mg/kg BEEF TISSUE)															
Benzoic Acid	1.92E-05	2.54E-05	4.63E-09	5.96E-10	2.61E-08	1.12E-08	1.16E-09	6.52E-09	0.0%	no observed effects	1				[D]
Bis(2-ethylhexyl)phthalate	1.40E-01	1.40E-01	3.37E-05	4.33E-06	1.44E-04	6.16E-05	1.69E-03	7.18E-03	0.1%	liver; weight inc.	1000	6.07E-08	8.62E-07	0.0%	[B2]
RADIONUCLIDES (pCi/kg BEEF TISSUE)															
Americium 241	6.74E-06	5.64E-03		3.74E-04		4.44E+00						8.97E-14	1.07E-09	0.1%	[A]
Cesium 137+D	1.27E+01	2.51E+01		7.04E+02		1.97E+04						1.97E-08	5.53E-07	44.3%	[A]
Cobalt 60	4.22E+00	3.52E+01		2.34E+02		2.77E+04							4.16E-07	33.3%	[A]
Neptunium 237+D	6.15E-02	1.35E+00		3.41E+00		1.10E+03						7.51E-10	2.41E-07	19.3%	[A]
Uranium 234	1.13E+00	1.20E+00		6.24E+01		9.46E+02						9.99E-10	1.51E-08	1.2%	[A]
Uranium 235+D	6.15E-02	9.14E-02		3.41E+00		7.20E+01						5.46E-11	1.15E-09	0.1%	[A]
Uranium 238+D	9.13E-01	9.94E-01		5.06E+01		7.83E+02						1.42E-09	2.19E-08	1.8%	[A]
Chemical Hazards: Hazard Index (HI):							3.26E+00	1.39E+01	100.0%						
Excess Lifetime Cancer Risk:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.01E-04	2.87E-03	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												2.29E-08	1.29E-06	100.0%	

Table P.17. Risk characterization for beef: children – ingestion exposure (future land use – agricultural) – Hinds Creek

Chemical	MLE Concentration from Mean Concentration in Soil/SW	RME Concentration from UCL Concentration in Soil/SW	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	BPA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	BPA WOE
INORGANICS (mg/kg BEEF TISSUE)															
Aluminum	8.70E+01	8.70E+01	4.39E-02	1.88E-03	1.79E-01	2.30E-02									
Arsenic	3.72E+00	3.72E+00	1.87E-03	8.02E-05	7.57E-03	9.74E-04	6.24E+00	2.52E+01	91.2%	skin; keratosis, hyperpigmentation	3	1.40E-04	1.70E-03	99.8%	[A]
Barium	8.69E-01	8.69E-01	4.37E-04	1.87E-05	1.77E-03	2.28E-04	6.24E-03	2.53E-02	0.1%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	2.53E-03	2.87E-03	1.28E-06	5.47E-08	5.85E-06	7.52E-07	2.55E-04	1.17E-03	0.0%	no observed effects	100	2.35E-07	3.23E-06	0.2%	[B2]
Chromium (III)	7.80E+00	7.84E+00	3.94E-03	1.69E-04	1.60E-02	2.06E-03	3.94E-03	1.60E-02	0.1%	no observed effects	100				
Cobalt	9.56E+00	9.64E+00	4.82E-03	2.07E-04	1.97E-02	2.53E-03				-- --	--				
Copper	4.99E+00	5.03E+00	2.52E-03	1.08E-04	1.02E-02	1.32E-03	6.80E-02	2.77E-01	1.0%	Gastrointestinal system; irritation	--				[D]
Lead	7.22E-03	8.05E-03	3.64E-06	1.56E-07	1.64E-05	2.11E-06				CNS, blood	--				[B2]
Manganese	2.83E+01	2.99E+01	1.43E-02	6.11E-04	6.11E-02	7.85E-03	1.02E-01	4.36E-01	1.6%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	2.58E-03	3.01E-03	1.30E-06	5.57E-08	6.19E-06	7.96E-07	4.33E-03	2.05E-02	0.1%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	3.09E-02	3.59E-02	1.56E-05	6.69E-07	7.31E-05	9.40E-06	7.81E-04	3.65E-03	0.0%	dec. body and organ weight	300				
Vanadium	2.67E+00	2.69E+00	1.35E-03	5.78E-05	5.48E-03	7.05E-04	1.93E-01	7.83E-01	2.8%	no observed effects	100				
Zinc	1.22E+02	1.24E+02	6.18E-02	2.65E-03	2.54E-01	3.26E-02	2.06E-01	8.46E-01	3.1%	blood; anemia	3				[D]
ORGANICS (mg/kg BEEF TISSUE)															
Benzoic Acid	1.92E-05	2.54E-05	9.70E-09	4.16E-10	5.18E-08	6.66E-09	2.42E-09	1.29E-08	0.0%	no observed effects	1				[D]
Bis(2-ethylhexyl)phthalate	1.40E-01	1.40E-01	7.06E-05	3.02E-06	2.85E-04	3.67E-05	3.53E-03	1.43E-02	0.1%	liver; weight inc.	1000	4.23E-08	5.13E-07	0.0%	[B2]
RADIONUCLIDES (pCi/kg BEEF TISSUE)															
Americium 241	6.74E-06	5.64E-03		9.31E-05		9.83E-01						2.23E-14	2.36E-10	0.1%	[A]
Cesium 137+D	1.27E+01	2.51E+01		1.75E+02		4.37E+03						4.91E-09	1.22E-07	44.3%	[A]
Cobalt 60	4.22E+00	3.52E+01		5.83E+01		6.13E+03							9.19E-08	33.3%	[A]
Neptunium 237+D	6.15E-02	1.39E+00		8.50E-01		2.43E+02						1.87E-10	5.34E-08	19.3%	[A]
Uranium 234	1.13E+00	1.20E+00		1.56E+01		2.09E+02						2.49E-10	3.35E-09	1.2%	[A]
Uranium 235+D	6.15E-02	9.14E-02		8.50E-01		1.55E+01						1.36E-11	2.55E-10	0.1%	[A]
Uranium 238+D	9.13E-01	9.94E-01		1.26E+01		1.73E+02						3.53E-10	4.85E-09	1.8%	[A]
Chemical Hazards:															
Hazard Index (HI):							6.82E+00	2.77E+01	100.0%						
Excess Lifetime Cancer Risk:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.4E-04	1.7E-03	100.0%	
Radiological Hazards:															
Excess Lifetime Cancer Risk: Combined Exposure (d)												5.7E-09	2.7E-07	100.0%	

Table P.18. Risk characterization for milk: adult — ingestion exposure (future land use — agricultural) — Hinds Creek

Chemical	MLE Concentration from Mean Concentration in Soil/SW	RME Concentration from UCL Concentration in Soil/SW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	HQ Noncar. Effects (CDI/RfD) (MLE)	HQ Noncar. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Risk Estimates: Noncarcinogenic Effect of Concern: Target Tissue	RfDs UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfDs WOE
INORGANICS															
Aluminum	1.02E+02	1.02E+02	9.81E-02	1.26E-02	4.20E-01	1.80E-01									
Arsenic	5.50E-02	5.51E-02	5.31E-05	6.82E-06	2.27E-04	9.71E-05	1.77E-01	7.55E-01	25.7%	skin; keratosis, hyperpigmentation	3	1.19E-05	1.70E-04	98.1%	[A]
Barium	5.13E+00	5.14E+00	4.94E-03	6.36E-04	2.11E-02	9.05E-03	7.06E-02	3.02E-01	10.3%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.95E-06	2.21E-06	1.88E-09	2.42E-10	9.10E-09	3.90E-09	3.77E-07	1.82E-06	0.0%	no observed effects	100	1.04E-09	1.68E-08	0.0%	[B2]
Chromium (III)	1.52E+00	1.52E+00	1.46E-03	1.88E-04	6.26E-03	2.68E-03	1.46E-03	6.26E-03	0.2%	no observed effects	100				
Cobalt	1.88E+00	1.90E+00	1.82E-03	2.33E-04	7.79E-03	3.34E-03				--	--				
Copper	2.95E+00	2.98E+00	2.85E-03	3.66E-04	1.22E-02	5.24E-03	7.70E-02	3.31E-01	11.2%	Gastrointestinal system; irritation	--				[D]
Lead	5.09E-03	5.68E-03	4.91E-06	6.32E-07	2.33E-05	1.00E-05				CNS, blood	--				[B2]
Manganese	2.50E+01	2.64E+01	2.41E-02	3.10E-03	1.09E-01	4.65E-02	1.72E-01	7.75E-01	26.3%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				[D]
Mercury	3.48E-04	4.07E-04	3.36E-07	4.32E-08	1.67E-06	7.17E-07	1.12E-03	5.58E-03	0.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				[D]
Nickel	3.46E-02	4.01E-02	3.34E-05	4.29E-06	1.65E-04	7.07E-05	1.67E-03	8.24E-03	0.3%	dec. body and organ weight	300				
Vanadium	3.91E-01	3.97E-01	3.77E-04	4.84E-05	1.61E-03	6.91E-04	5.38E-02	2.30E-01	7.8%	no observed effects	100				
Zinc	3.61E+01	3.67E+01	3.48E-02	4.48E-03	1.51E-01	6.46E-02	1.16E-01	5.02E-01	17.1%	blood; anemia	3				[D]
ORGANICS															
Benzoic Acid	1.71E-05	2.27E-05	1.65E-08	2.13E-09	9.31E-08	3.99E-08	4.13E-09	2.33E-08	0.0%	no observed effects	1				[D]
Bis(2-ethylhexyl)phthalate	1.32E-01	1.32E-01	1.27E-04	1.63E-05	5.41E-04	2.32E-04	6.35E-03	2.71E-02	0.9%	liver; weight inc.	1000	2.29E-07	3.25E-06	1.9%	[B2]
RADIONUCLIDES															
Americium 241	1.50E-07	3.20E-04		3.34E-05		1.01E+00						8.01E-15	2.42E-10	0.0%	[A]
Cesium 137+D	8.16E+00	1.71E+01		1.81E+03		5.38E+04						5.07E-08	1.51E-06	80.3%	[A]
Cobalt 60	8.38E-01	6.98E+00		1.86E+02		2.20E+04							3.30E-07	17.6%	[A]
Neptunium 237+D	1.83E-03	4.13E-02		4.05E-01		1.30E+02						8.91E-11	2.86E-08	1.5%	[A]
Uranium 234	8.15E-02	8.69E-02		1.81E+01		2.74E+02						2.89E-10	4.38E-09	0.2%	[A]
Uranium 235+D	4.45E-03	6.61E-03		9.87E-01		2.06E+01						1.58E-11	3.33E-10	0.0%	[A]
Uranium 238+D	6.61E-02	7.19E-02		1.47E+01		2.27E+02						4.10E-10	6.34E-09	0.3%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							6.77E-01	2.94E+00	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.22E-05	1.73E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												5.15E-08	1.86E-06	100.0%	

Table P.19. Risk characterization for milk: children – ingestion exposure (future land use – agricultural) – Hinds Creek

Chemical	MLE Concentration from Mean Concentration in Soil/SW	RME Concentration from UCL Concentration in Soil/SW	Chronic Daily Intake (CDI) CDI Noncar. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncar. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS															
Aluminum	1.02E+02	1.02E+02	4.39E-01	1.88E-02	1.74E+00	2.23E-01									
Arsenic	5.50E-02	5.51E-02	2.38E-04	1.02E-05	9.36E-04	1.20E-04	7.92E-01	3.12E+00	25.7%	skin; keratosis, hyperpigmentation	3	1.78E-05	2.11E-04	98.1%	[A]
Barium	5.13E+00	5.14E+00	2.22E-02	9.49E-04	8.73E-02	1.12E-02	3.16E-01	1.25E+00	10.3%	*oral*–cardiovasc. sys.; inc. blood pressure. *inhal.*–fetotoxicity	3				
Beryllium	1.95E-06	2.21E-06	8.44E-09	3.62E-10	3.76E-08	4.83E-09	1.69E-06	7.52E-06	0.0%	no observed effects	100	1.56E-09	2.08E-08	0.0%	[B2]
Chromium (III)	1.52E+00	1.52E+00	6.50E-03	2.81E-04	2.59E-02	3.33E-03	6.50E-03	2.59E-02	0.2%	no observed effects	100				
Cobalt	1.88E+00	1.90E+00	8.14E-03	3.49E-04	3.22E-02	4.14E-03				– –	– –				
Copper	2.95E+00	2.98E+00	1.28E-02	5.47E-04	5.05E-02	6.50E-03	3.45E-01	1.37E+00	11.2%	Gastrointestinal system; irritation	– –				{D}
Lead	5.09E-03	5.68E-03	2.20E-05	9.43E-07	9.64E-05	1.24E-05				CNS, blood	– –				{B2}
Manganese	2.50E+01	2.64E+01	1.08E-01	4.63E-03	4.48E-01	5.77E-02	7.71E-01	3.20E+00	26.3%	*oral*–CNS effects. *inhal.*–respiratory, psychomotor disturb.	1				{D}
Mercury	3.46E-04	4.07E-04	1.50E-06	6.45E-08	6.92E-06	8.85E-07	5.01E-03	2.31E-02	0.2%	*oral*–CNS; neurotoxicity. *inhal.*–kidney effects	1000				{D}
Nickel	3.46E-02	4.01E-02	1.50E-04	6.41E-06	6.81E-04	8.76E-05	7.46E-03	3.41E-02	0.3%	dec. body and organ weight	300				
Vanadium	3.91E-01	3.92E-01	1.69E-03	7.23E-05	6.66E-03	8.56E-04	2.41E-01	9.52E-01	7.8%	no observed effects	100				
Zinc	3.61E+01	3.67E+01	1.56E-01	6.69E-03	6.23E-01	8.01E-02	5.20E-01	2.08E+00	17.1%	blood; anemia	3				{D}
ORGANICS															
Benzoic Acid	1.71E-05	2.27E-05	7.40E-08	3.17E-09	3.85E-07	4.95E-08	1.85E-08	9.62E-08	0.0%	no observed effects	1				{D}
Bis(2-ethylhexyl)phthalate	1.32E-01	1.32E-01	5.69E-04	2.44E-05	2.24E-03	2.88E-04	2.85E-02	1.12E-01	0.9%	liver; weight inc.	1000	3.42E-07	4.03E-06	1.9%	[B2]
RADIONUCLIDES															
Americium 241	1.50E-07	3.20E-04		1.78E-05		4.64E-01						4.27E-15	1.11E-10	0.0%	[A]
Cesium 137+D	8.16E+00	1.71E+01		9.65E+02		2.48E+04						2.70E-08	6.94E-07	80.3%	[A]
Cobalt 60	8.38E-01	6.98E+00		9.91E+01		1.01E+04							1.52E-07	17.6%	[A]
Neptunium 237+D	1.83E-03	4.13E-02		2.16E-01		5.99E+01						4.75E-11	1.32E-08	1.5%	[A]
Uranium 234	8.15E-02	8.69E-02		9.64E+00		1.26E+02						1.54E-10	2.02E-09	0.2%	[A]
Uranium 235+D	4.45E-03	6.61E-03		5.26E-01		9.59E+00						8.42E-12	1.53E-10	0.0%	[A]
Uranium 238+D	6.61E-02	7.19E-02		7.82E+00		1.04E+02						2.19E-10	2.92E-09	0.3%	[A]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							3.03E+00	1.22E+01	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.82E-05	2.15E-04	100.0%	
Radiological Hazards: Excess Lifetime Cancer Risk: Combined Exposure (d)												2.75E-08	8.64E-07	100.0%	

Table P.20. Risk characterization for fish: adult – ingestion exposure (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLE Concentration in Fish Tissue	RME Concentration in Fish Tissue	Chronic Daily Intake (CDI) CDI Noncarc. Effects (MLE)	CDI Carc. Effects (MLE)	CDI Noncarc. Effects (RME)	CDI Carc. Effects (RME)	Risk Estimates HQ Noncarc. Effects (CDI/RfD) (MLE)	HQ Noncarc. Effects (CDI/RfD) (RME)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfD UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLE)	Excess Lifetime Cancer Risk (CDI x CSF) (RME)	Percent of Total Carc. Risk	RfD WOE
INORGANICS															
Mercury	0.10	0.11	3.09E-07	3.97E-08	3.95E-06	1.69E-06	1.03E-03	1.32E-02	100.0%	*oral*-CNS; neurotoxicity. *inhal.*-kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.03	0.04	1.00E-07	1.29E-08	1.37E-06	5.85E-07						9.91E-08	4.51E-06	27.1%	[B2]
Aroclor-1260	0.06	0.10	1.77E-07	2.28E-08	3.67E-06	1.57E-06						1.76E-07	1.21E-05	72.9%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.03E-03	1.32E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												2.75E-07	1.66E-05	100.0%	

Table P.21. Risk characterization for fish: children – ingestion exposure (future land use – agricultural/homesteader) – Hinds Creek

Chemical	MLB Concentration in Fish Tissue	RMB Concentration in Fish Tissue	Chronic Daily Intake (CDI): CDI Noncarc. Effects (MLB)	CDI Carc. Effects (MLB)	CDI Noncarc. Effects (RMB)	CDI Carc. Effects (RMB)	Risk Estimates: HQ Noncarc. Effects (CDI/RfD) (MLB)	HQ Noncarc. Effects (CDI/RfD) (RMB)	HQ Percent of Total (HI)	Noncarcinogenic Effect of Concern: Target Tissue	RfDA UF	Excess Lifetime Cancer Risk (CDI x CSF) (MLB)	Excess Lifetime Cancer Risk (CDI x CSF) (RMB)	Percent of Total Carc. Risk	RfDA WOE
INORGANICS															
Mercury	0.10	0.11	5.38E-07	2.3 E-08	8.26E-06	1.06E-06	1.79E-03	2.75E-02	100.0%	*oral*-CNS; neurotoxicity. *inhal.*-kidney effects	1000				[D]
ORGANICS															
Aroclor-1254	0.03	0.04	1.75E-07	7.49E-09	2.85E-06	3.67E-07						5.76E-08	2.82E-06	27.1%	[B2]
Aroclor-1260	0.06	0.10	3.10E-07	1.33E-08	7.67E-06	9.86E-07						1.02E-07	7.59E-06	72.9%	[B2]
Chemical Hazards: Hazard Index (HI): Combined Exposure (d)							1.79E-03	2.75E-02	100.0%						
Excess Lifetime Cancer Risk: Combined Exposure (d)												1.60E-07	1.04E-05	100.0%	

Table P.22. EFPC Phase 1A chemical and radionuclide results: baseflow – background

PARAMETER	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Americium 241	PCI/L	2	2	8.200E+01	−2.413E+01	−1.379E+01	−3.450E+00	5.149E+01	−3.450E+00	1.034E+01
Barium	UG/L	2	2	1.000E+00	3.420E+01	3.500E+01	3.580E+01	4.005E+01	3.580E+01	8.000E−01
Cesium 137+D	PCI/L	2	2	3.192E+01	−4.730E+00	4.735E+00	1.420E+01	6.449E+01	1.420E+01	9.465E+00
Cobalt 60	PCI/L	2	2	2.769E+01	−1.802E+01	7.510E+00	3.304E+01	1.687E+02	3.304E+01	2.553E+01
Copper	UG/L	1	2	4.000E+00	1.500E+00	2.300E+00	3.100E+00	7.351E+00	3.100E+00	8.000E−01
Manganese	UG/L	2	2	1.000E+00	8.300E+00	1.570E+01	2.310E+01	6.242E+01	2.310E+01	7.400E+00
Neptunium 237+D	PCI/L	2	2	6.973E+01	−4.409E+01	−1.686E+01	1.037E+01	1.551E+02	1.037E+01	2.723E+01

Table P.23. EFPC Phase 1A chemical and radionuclide results: sediment – background

PARAMETER	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Aluminum	MG/KG	2	2	1.000E+01	1.300E+04	1.370E+04	1.440E+04	1.812E+04	1.440E+04	7.000E+02
Americium 241	PCI/G	2	2	1.733E−01	−4.000E−02	−2.500E−02	−1.000E−02	6.971E−02	−1.000E−02	1.500E−02
Arsenic	MG/KG	2	2	4.000E+00	2.900E+00	4.250E+00	5.600E+00	1.277E+01	5.600E+00	1.350E+00
Barium	MG/KG	2	2	5.000E−01	1.490E+02	1.665E+02	1.840E+02	2.770E+02	1.840E+02	1.750E+01
Cesium 137+D	PCI/G	2	2	2.500E−02	2.000E−02	3.500E−02	5.000E−02	1.297E−01	5.000E−02	1.500E−02
Chromium (III)	MG/KG	2	2	1.000E+00	2.810E+01	2.875E+01	2.940E+01	3.285E+01	2.940E+01	6.500E−01
Cobalt	MG/KG	2	2	1.000E+00	1.140E+01	1.235E+01	1.330E+01	1.835E+01	1.330E+01	9.500E−01
Cobalt 60	PCI/G	2	2	2.121E−02	−1.000E−02	−1.000E−02	−1.000E−02	−1.000E−02	−1.000E−02	0.000E+00
Copper	MG/KG	2	2	1.000E+00	1.190E+01	1.420E+01	1.650E+01	2.872E+01	1.650E+01	2.300E+00
Lead	MG/KG	2	2	5.000E−01	4.900E+00	6.150E+00	7.400E+00	1.404E+01	7.400E+00	1.250E+00
Manganese	MG/KG	2	2	5.000E−01	5.410E+02	6.310E+02	7.210E+02	1.199E+03	7.210E+02	9.000E+01
Neptunium 237+D	PCI/G	2	2	4.243E−02	−3.000E−02	1.000E−02	5.000E−02	2.626E−01	5.000E−02	4.000E−02
Nickel	MG/KG	2	2	1.000E+01	2.270E+01	2.335E+01	2.400E+01	2.745E+01	2.400E+01	6.500E−01
Uranium 234	PCI/G	2	2	1.414E−02	2.200E−01	2.300E−01	2.400E−01	2.931E−01	2.400E−01	1.000E−02
Uranium 235+D	PCI/G	2	2	0.000E+00	1.000E−02	1.000E−02	1.000E−02	1.000E−02	1.000E−02	0.000E+00
Uranium 238+D	PCI/G	2	2	1.414E−02	1.600E−01	1.700E−01	1.800E−01	2.331E−01	1.800E−01	1.000E−02
Vanadium	MG/KG	2	2	1.000E+00	2.630E+01	2.845E+01	3.060E+01	4.202E+01	3.060E+01	2.150E+00
Zinc	MG/KG	2	2	1.000E+00	5.450E+01	5.480E+01	5.510E+01	5.669E+01	5.510E+01	3.000E−01

Table P.24. EFPC Phase 1A chemical and radionuclide results: soil – background

PARAMETER	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Aluminum	MG/KG	12	12	1.000E+01	7.950E+03	1.241E+04	1.990E+04	1.422E+04	1.422E+04	1.006E+03
Americium 241	PCI/G	12	12	8.010E−02	−1.200E−01	8.333E−04	2.500E−01	5.428E−02	5.428E−02	2.976E−02
Arsenic	MG/KG	12	12	4.000E+00	1.500E+00	2.542E+00	3.900E+00	2.911E+00	2.911E+00	2.054E−01
Barium	MG/KG	12	12	5.000E−01	6.920E+01	1.122E+02	1.650E+02	1.309E+02	1.309E+02	1.040E+01
Benzoic Acid	MG/KG	2	11	1.600E+00	2.400E−02	8.625E−01	1.800E+00	1.140E+00	1.140E+00	1.533E−01
Beryllium	MG/KG	12	12	2.000E−01	4.000E−01	6.750E−01	9.500E−01	7.651E−01	7.651E−01	5.014E−02
Bis(2−ethylhexyl)phthalate	MG/KG	2	11	3.300E−01	1.950E−01	2.473E−01	5.300E−01	3.025E−01	3.025E−01	3.048E−02
Cesium 137+D	PCI/G	12	12	2.482E−02	6.000E−02	3.058E−01	1.060E+00	4.500E−01	4.500E−01	8.025E−02
Chromium (III)	MG/KG	12	12	1.000E+00	1.290E+01	2.018E+01	2.980E+01	2.289E+01	2.289E+01	1.505E+00
Cobalt	MG/KG	12	12	1.000E+00	3.600E+00	9.208E+00	1.300E+01	1.070E+01	1.070E+01	8.303E−01
Cobalt 60	PCI/G	12	12	8.660E−03	−3.000E−02	−3.333E−03	3.000E−02	7.113E−03	7.113E−03	5.817E−03
Copper	MG/KG	12	12	1.000E+00	4.300E+00	8.650E+00	1.240E+01	9.911E+00	9.911E+00	7.019E−01
Lead	MG/KG	12	12	5.000E−01	9.200E+00	1.264E+01	1.820E+01	1.409E+01	1.409E+01	8.081E−01
Manganese	MG/KG	12	12	5.000E−01	1.380E+02	5.092E+02	1.170E+03	6.583E+02	6.583E+02	8.299E+01
Mercury	MG/KG	1	12	1.000E−01	5.000E−02	6.458E−02	1.300E−01	7.555E−02	7.555E−02	6.107E−03
Neptunium 237+D	PCI/G	12	12	2.028E−02	−7.000E−02	8.333E−04	1.000E−01	2.489E−02	2.489E−02	1.340E−02
Nickel	MG/KG	12	12	1.000E+01	7.200E+00	1.394E+01	2.050E+01	1.615E+01	1.615E+01	1.230E+00
Uranium 234	PCI/G	9	9	9.162E−03	2.300E−01	2.644E−01	3.100E−01	2.820E−01	2.820E−01	9.444E−03
Uranium 235+D	PCI/G	9	9	2.940E−03	0.000E+00	1.444E−02	4.000E−02	2.145E−02	2.145E−02	3.768E−03
Uranium 238+D	PCI/G	9	9	8.315E−03	1.800E−01	2.144E−01	2.700E−01	2.333E−01	2.333E−01	1.015E−02
Vanadium	MG/KG	12	12	1.000E+00	1.320E+01	1.947E+01	2.550E+01	2.159E+01	2.159E+01	1.177E+00
Zinc	MG/KG	11	12	1.000E+00	1.675E+01	3.333E+01	4.600E+01	3.841E+01	3.841E+01	2.830E+00

Table P.25. Fish tissue chemical results used in the EFPC BRA: Hinds Creek [a]

CHEMICAL	UNITS	DETEC	TOTN	DL	MIN	MEAN	MAX	UCL	REC	STDERR
Mercury	UG/G-WW	122	122		3.000E-02	9.795E-02	3.100E-01	1.069E-01	1.069E-01	5.411E-03
Aroclor-1254	UG/G-WW	106	121	1.000E-02	5.000E-03	3.178E-02	1.700E-01	3.692E-02	3.692E-02	3.102E-03
Aroclor-1260	UG/G-WW	104	128	1.000E-02	0.000E+00	5.633E-02	3.200E+00	9.925E-02	9.925E-02	2.590E-02

[a] – chemical results used for the EFPC BRA were collected under the Biological Monitoring and Abatement Program (BMAP)

Table Q.1a. Numbers of samples to be taken for ecological risk assessment

Sample type	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Field QC Samples
Fish*								
Stoneroller	2	2	2	2	2	2	2	
Redbreast sunfish	2	2	2	2	2	2	2	
Redbreast sunfish fillets			1			1	1	1 field duplicate
Largemouth bass	2	2	2	2	2	2	2	
Benthic invertebrates								
Infaunal	1	1	1	1	1	1	1	1 field duplicate
Crayfish	1	1	1	1	1	1	1	1 field duplicate
Terrestrial invertebrates								
Subsurface invertebrate	1	1	1	1	1	1	1	1 field duplicate
Insect, terrestrial origin	1	1	1	1	1	1	1	
Insect, aquatic origin	1	1	1	1	1	1	1	
Terrestrial small mammals								
Shrew	1	1	1	1	1	1	1	1 field duplicate
Mouse	1	1	1	1	1	1	1	1 field duplicate
Vole	1	1	1	1	1	1	1	1 field duplicate
TOTAL BIOLOGICAL 108	14	14	15	14	14	15	15	Total duplicates 7
Surface Water								
Undisturbed water	1	1	1	1	1	1	1	1 field duplicate
Agitated water		1	1	1			1	1 field duplicate
TOTAL WATER 13	1	2	2	2	1	1	2	Total duplicates 2

* May not be present at all sites.

Table Q.1b. Number and Types of Vegetation and Soil Samples Required for EFPC Ecological and Human Health Risk Assessments[a].

	Location									
	Bruner site		Green site		Jackson site		Reference		TOTAL	
Sample Type	Plant	Soil	Plant	Soil	Plant	Soil	Plant	Soil	Plant	Soil
Onions, beets, or carrots	7[b]	7[b]					3	3	10	10
Kale roots	6	6					3	3	9	9
Kale leaves	7[b]						3		10	
Tomato roots	6	6					3	4[b]	9	10
Tomato fruit	7[b]						3		10	
Live grass	3[b]	1	2	1	2	2[b]	3[b]	1	10	5
Dead grass	2	1	2	1	2	1	1	1	7	4
Browse	2	1					1	1	3	2
TOTAL	40	22	4	2	4	3	20	13	68	40
Standard Reference Materials[c]	2		1		1		4		8	

[a] Duplicate samples of peach leaf standard reference material and oyster tissue standard reference material will be analyzed with each batch of vegetation samples submitted for analysis.
[b] Includes one pair of field duplicate samples.
[c] Peach leaves or oyster tissue.

Table Q.1c. Sample volumes, containers, and preservation for water and sediment samples

Analysis	Number	Container Type	Vol. (mL)	Preservative Type, Conditions
Water				
CLP Volatile organics	3	Glass	40	Cool, 4°C, HCl at lab
CLP Semivolatile organics, pesticides, PCBs	5	Amber Glass	1000	Cool, 4°C
Isotopic uranium	2	Glass	1000	HNO_3 to pH<2, 4°C
Gamma scan	2	Glass	1000	HNO_3 to pH<2, 4°C
CLP Metals, unfiltered	2	Plastic	500	HNO_3 to pH<2, 4°C
CLP Metals, filtered	2	Plastic	500	HNO_3 to pH<2, 4°C
Alkalinity, sulfate, chloride, total suspended solids	1	Glass	1000	Cool, 4°C
Total organic carbon	1	Glass	1000	H_2SO_4 to pH<2, 4°C
Dissolved organic carbon	1	Plastic	500	H_2SO_4 to pH<2, 4°C
Nitrate/nitrite	1	Plastic	500	H_2SO_4 to pH<2, 4°C
Biological oxygen demand	1	Glass	1000	Cool, 4°C
Dissolved orthophosphate	1	Plastic	500	Cool, 4°C
Sediment				
CLP Volatile organics	3	Glass	40	Cool, 4°C
CLP Semivolatile organics, pesticides, PCBs	1	Amber Glass	1000	Cool, 4°C
Isotopic uranium	2	Glass	1000	Cool, 4°C
Gamma scan	1	Plastic	1000	Cool, 4°C
CLP Metals	1	Amber Glass	1000	Cool, 4°C
Total organic carbon	1	Glass	1000	Cool, 4°C
Nitrate/nitrite	1	Plastic	500	Cool, 4°C

Table Q.1d. Holding times, preservation methods, and sample containers for biota samples

Sample type	Holding Time from Collection	Preservation Method	Container	Approximate Sample Size
Terrestrial arthropods				
• Metals by NAA[1]	6 mo	Freeze & ship with dry ice	Whirl-Pak bags, plastic[2]	1 g
• Semivolatile organics, pesticides/PCBs	6 mo	Freeze & ship with dry ice	Whirl-Pak bags	30 g
Terrestrial small mammals				
• Metals by NAA	6 mo	Freeze & ship with dry ice	Whirl-Pak bags, plastic[2]	1 g
• Semivolatile organics, pesticides/PCBs	6 mo	Freeze & ship with dry ice	Whirl-Pak bags	30 g[3]
Terrestrial subsurface invertebrates				
• Metals by NAA	6 mo	Freeze & ship with dry ice	Whirl-Pak bags, plastic[2]	1 g
• Semivolatile organics, pesticides/PCBs	6 mo	Freeze & ship with dry ice	Whirl-Pak bags	30 g[3]
Fish, crayfish				
• Metals by NAA	6 mo	Freeze & ship with dry ice	Foil, plastic[2]	1 g
• Semivolatile organics, pesticides/PCBs	6 mo	Freeze & ship with dry ice	Foil	30 g[3]
Benthic macroinvertebrates				
• Metals by NAA	6 mo	Freeze & ship with dry ice	Glass, plastic[2]	1 g
• Semivolatile organics, pesticides/PCBs	6 mo	Freeze & ship with dry ice	Glass	30 g[3]
Periphyton				
• Chlorophyll *a*	48 hr	Immerse in water, 4° C	Plastic	NA
• Biomass	96 hr	Immerse in water, 4° C	Plastic	NA

[1] Neutron Activation Analysis

[2] Intact organisms will be packaged in foil, glass jars, or Whirl-pak bags and frozen for transport to the laboratory. After the composite sample is ground and homogenized, subsamples will be packaged in chemically clean linear polyethylene jars for NAA.

[3] If yields are sufficient, samples of this matrix should contain at least 100 g of material to provide for matrix spikes and matrix spike duplicates at the frequency required by the EPA SW-846 methods for organics.

Table Q.1e. Sample containers for vegetation and soil sampling

Matrix	Analysis	Container	Number
Root crop	NAA	125 cc HDPE[a]	10
	Gammma scan	500 cc HDPE	10
Kale root	NAA	125 cc HDPE	9
Kale leaf	NAA	125 cc HDPE	10
Tomato root	NAA	125 cc HDPE	9
Tomato fruit	NAA	125 cc HDPE	10
	Gamma scan	500 cc HDPE	10
Live grass	NAA	125 cc HDPE	9
	Gamma scan	500 cc HDPE	9
Dead grass	NAA	125 cc HDPE	7
Browse	NAA	125 cc HDPE	3
Soil	CLP metals	1000 cc glass	39
	Gamma scan	500 cc HDPE	29

[a] High density polyethylene, I-Chem or equivalent.

Table Q.1f. Analytical methods and detection limits for water and sediment

Analyte	Method	Target Detection Limits Water	Sediment
INDICATORS			
Total Suspended Solids	160.2[a]	10.0 mg/L	--
Total Organic Carbon	415.1[a]	1.0 mg/L	
Dissolved Organic Carbon	415.1[a]	1.0 mg/L	--
Biological oxygen demand	405.1[a]	NA	--
Chloride	325.3[b] or 300[a]	1.0 mg/L	
Nitrate/nitrite	352.1[b] or 300[a]	1.0 mg/L	
Sulfate	375.4[b] or 300[a]	1.0 mg/L	
Orthophosphate	365.1[b]	1.0 mg/L	
Alkalinity	310.1[a]	NA	
INORGANICS			
Target Analyte List - Metals (μg/L)	EPA CLP SOW		
Aluminum		200	--
Antimony		60	--
Arsenic		10	--
Barium		200	--
Beryllium		5	--
Cadmium		5	--
Calcium		5000	--
Chromium		10	--
Cobalt		50	--
Copper		25	--
Iron		100	--
Lead		3	--
Magnesium		5000	--
Manganese		15	--
Mercury		0.2	--
Nickel		40	--
Potassium		5000	--
Selenium		5	--
Silver		10	--
Sodium		5000	--
Thallium		10	--
Vanadium		50	--
Zinc		20	--
Cyanide		10	--
Uranium		--	--

Table Q.1f (continued)

Analyte	Method	Target Detection Limits Water	Sediment
ORGANICS			
Target Compound List - Volatiles (μg/L)	EPA CLP SOW		
1,1-Dichloroethane		10	N/A
1,1-Dichloroethene		10	N/A
1,1,1-Trichloroethane		10	N/A
1,1,2-Trichloroethane		10	N/A
1,1,2,2-Tetrachloroethane		10	N/A
1,2-Dichloroethane		10	N/A
1,2-Dichloroethene		10	N/A
1,2-Dichloropropane		10	N/A
2-Butanone		10	N/A
2-Hexanone		10	N/A
4-Methyl-2-pentanone		10	N/A
Acetone		10	N/A
Benzene		10	N/A
Bromodichloromethane		10	N/A
Bromoform		10	N/A
Bromomethane		10	N/A
Carbon Disulfide		10	N/A
Carbon Tetrachloride		10	N/A
Chlorobenzene		10	N/A
Chloroethane		10	N/A
Chloroform		10	N/A
Chloromethane		10	N/A
cis-1,3-Dichloropropene		10	N/A
Dibromochloromethane		10	N/A
Ethyl Benzene		10	N/A
Methylene Chloride		10	N/A
Styrene		10	N/A
Tetrachloroethene		10	N/A
Toluene		10	N/A
trans-1,3-Dichloropropene		10	N/A
Trichloroethene		10	N/A
Vinyl Chloride		10	N/A
Xylenes		10	N/A

Table Q.1f (continued)

Analyte	Method	Target Detection Limits Water	Sediment
Target Compound List - Semivolatiles			
	EPA CLP SOW		
		(µg/L)	(µg/kg)
1,2-Dichlorobenzene		10	330
1,2,4-Trichlorobenzene		10	330
1,3-Dichlorobenzene		10	330
1,4-Dichlorobenzene		10	330
2-Methylnaphthalene		10	330
2-Nitrophenol		10	330
2-Chloronaphthalene		10	330
2-Nitroaniline		50	1700
2-Methylphenol		10	330
2-Chlorophenol		10	330
2,4-Dimethylphenol		10	330
2,4-Dichlorophenol		10	330
2,4-Dinitrophenol		50	1700
2,4-Dinitrotoluene		10	330
2,4,5-Trichlorophenol		50	1700
2,4,6-Trichlorophenol		10	330
2,6-Dinitrotoluene		10	330
3-Nitroaniline		50	1700
3,3'-Dichlorobenzidine		10	330
4-Chloroaniline		10	330
4-Chlorophenyl Phenyl Ether		10	330
4-Bromophenyl Phenyl Ether		10	330
4-Nitroaniline		50	1700
4-Chloro-3-methylphenol		10	330
4-Methylphenol		10	330
4-Nitrophenol		50	1700
4,6-Dinitro-2-methylphenol		50	1700
Acenaphthene		10	330
Acenaphthylene		10	330
Anthracene		10	330
Benzo(a)anthracene		10	330
Benzo(a)pyrene		10	330
Benzo(b)fluoranthene		10	330
Benzo(g,h,i)perylene		10	330
Benzo(k)fluoranthene		10	330
Benzoic Acid		10	330
Benzyl Alcohol		10	330
Bis(2-ethylhexyl)phthalate		10	330
Bis(2-chloroethoxy) Methane		10	330
Bis(2-chloroisopropyl) Ether		10	330
Bis(2-chloroethyl) Ether		10	330
Butyl Benzyl Phthalate		10	330
Chrysene		10	330

Table Q.1f (continued)

Analyte	Method	Target Detection Limits Water (μg/L)	Sediment (μg/kg)
Target Compound List - Semivolatiles (continued)			
Di-n-butyl phthalate	EPA CLP SOW	10	330
Di-n-octyl phthalate		10	330
Dibenzo(a,h)anthracene		10	330
Dibenzofuran		10	330
Diethyl phthalate		10	330
Dimethyl phthalate		10	330
Fluoranthene		10	330
Fluorene		10	330
Hexachlorobenzene		10	330
Hexachlorobutadiene		10	330
Hexachlorocyclopentadiene		10	330
Hexachloroethane		10	330
Indeno(1,2,3-cd)pyrene		10	330
Isophorone		10	330
N-Nitrosodiphenylamine		10	330
N-Nitroso-dipropylamine		10	330
Naphthalene		10	330
Nitrobenzene		10	330
Pentachlorophenol		50	1700
Phenanthrene		10	330
Phenol		10	330
Pyrene		10	330
Target Compound List - Pesticides			
4,4'-DDD	EPA CLP SOW	0.10	3.3
4,4'-DDT		0.10	3.3
4,4'-DDE		0.10	3.3
Aldrin		0.05	1.7
alpha-BHC		0.05	1.7
alpha-Chlordane		0.05	1.7
beta-BHC		0.05	1.7
delta-BHC		0.05	1.7
Dieldrin		0.10	3.3
Endosulfan I		0.05	1.7
Endosulfan II		0.10	3.3
Endosulfan sulfate		0.10	3.3
Endrin		0.10	3.3
Endrin ketone		0.10	3.3
gamma-Chlordane		0.05	1.7
gamma-BHC		0.05	1.7
Heptachlor		0.05	1.7

Table Q.1f (continued)

Analyte	Method	Target Detection Limits Water (μg/L)	Sediment (μg/kg)
Target Compound List - Pesticides			
Heptachlor epoxide		0.05	1.7
p,p'-Methoxychlor		0.50	17
Toxaphene		5.0	170
Target Compound List - PCBs			
Aroclor-1016	EPA CLP SOW	1.0	33
Aroclor-1221		1.0	33
Aroclor-1232		2.0	67
Aroclor-1242		1.0	33
Aroclor-1248		1.0	33
Aroclor-1254		1.0	33
Aroclor-1260		1.0	33

FIELD PARAMETERS (Water only)

	Method	Target Detection Limit	Precision Objective	Accuracy Objective
Temperature	TP-ESP-307-1	NA	±0.5°C	±1.0°C
pH	TP-ESP-307-2	NA	±0.1 unit	±0.2 unit
Dissolved Oxygen	TP-ESP-307-3		±0.1 mg/L	±0.2 mg/L
Conductivity	TP-ESP-307-8	10.0 μS/cm	±0.5%	±1.0%
Stream Flow	TP-ESP-301-5			

[a] EPA 1986.
[b] EPA 1983.

Table Q.1g. Analytical methods, detection limits, and precision and recovery objectives for tissues

Analyte	Method	Target Detection Limits[a] (μg analyte/g tissue)	Relative % Difference in Lab Duplicates	Percent Spike Recovery
METALS	NAA[b]			
Antimony		0.3	35	90-110
Arsenic		2.0	35	90-110
Cadmium		30	35	90-110
Chromium		20	35	90-110
Mercury		0.2	35	90-110
Selenium		30	35	90-110
^{235}Uranium		0.1	35	90-110
^{238}Uranium		3.0	35	90-110
Zinc		120	35	90-110
ORGANICS				
Polynuclear Aromatic Hydrocarbons	8310[c]	(ng analyte/g tissue)		
Benzo(a)anthracene		1.5	40	
Benzo(a)pyrene		2.5	40	
Benzo(b)fluoranthene		2.0	40	
Benzo(g,h,i)perylene		8.0	40	
Benzo(k)fluroanthene		2.0	40	35-140
Chrysene		15	40	
Dibenzo(a,h)anthracene		3.0	40	35-140
Indeno(1,2,3-cd)pyrene		5.0	40	
Pyrene		30	40	
Pesticides	8080[c]			
Aldrin		1.0	25	30-135
2-4'-DDE		5.0	50	
4-4'-DDE		1.0	50	
2-4'-DDT		5.0	50	
4-4'-DDT		2.0	50	25-135
Dieldrin		1.0	40	30-135
Heptachlor		1.0	35	35-130
Heptachlor Epoxide		1.0	35	
Toxaphene		50.0	50	
Polychlorinated Biphenyls	8080[c]			
Aroclor-1254		20.0	50	
Aroclor-1260		20.0	50	25-135

[a] Detection limits for tissue are based on wet weight (1 g for NAA, 10 g for organics).
[b] Tissues will be homogenized before analysis by procedures described in SW-846 Method 3550 (EPA 1986). Inorganics in tissue will be analyzed by neutron activation (Radian 1991b, Appendix A).
[c] Tissue extracts for organics will be analyzed in accordance with SW-846 methods (EPA 1986).

Table Q.1h. COCs, Detection Limits, and Precision and Spike Recovery Objectives for Soils and Vegetation.

Analyte	Matrix	Target detection limits[a]	Relative difference in lab duplicates (%)	Spike recovery (%)
METALS	Soil[b]	μg/kg soil		
Antimony		60	35	75 to 125
Arsenic		1.0	35	75 to 125
Cadmium		5	35	75 to 125
Chromium		10	35	75 to 125
Mercury		0.2	35	75 to 125
Selenium		2	35	75 to 125
Zinc		20	35	75 to 125
	Vegetation[c]	ng/g tissue		
Antimony		1	35	75 to 125
Arsenic		10	35	75 to 125
Cadmium		250	35	75 to 125
Chromium		50	35	75 to 125
Mercury		20	35	75 to 125
Selenium		60	35	75 to 125
Uranium		10	35	75 to 125
Zinc		200	35	75 to 125
RADIONUCLIDES[d]	Soil	pCi/g soil		
^{60}Co		0.03	35	75 to 125
^{137}Cs		0.03	35	75 to 125
^{233}Pa		0.03	35	75 to 125
	Vegetation	pCi/g tissue		
^{60}Co		0.015	35	75 to 125
^{137}Cs		0.015	35	75 to 125
^{233}Pa		0.015	35	75 to 125

[a] Detection limits for tissue are based on wet weight (g).
[b] Soil will be analyzed according to CLP procedures (Radian 1992b).
[c] Plant tissues will be homogenized before analysis by procedures described in TP-309-9. Metals in plant tissues will be analyzed by NAA at the Nuclear Services Center, North Carolina State University.
[d] Radionuclides will be analyzed by Oak Ridge Associated Universities, Oak Ridge, TN.

Table Q.2. EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

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Location=BACKGROUND Sample Media=AQUATIC HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	1/ 1	.	0.065	0.065	.	0.065
Arsenic	MG/KG	1/ 1	.	0.190	0.190	.	0.190
Cadmium	MG/KG	0/ 1	0.95430	0.477	0.477	.	0.477
Chromium	MG/KG	1/ 1	.	0.265	0.265	.	0.265
Mercury	MG/KG	0/ 1	0.16840	0.084	0.084	.	0.084
Selenium	MG/KG	1/ 1	.	0.577	0.577	.	0.577
Zinc	MG/KG	1/ 1	.	87.440	87.442	.	87.442

Location=BACKGROUND Sample Media=BENTHIC HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	1/ 1	.	0.048	0.048	.	0.048
Arsenic	MG/KG	1/ 1	.	4.559	4.559	.	4.559
Cadmium	MG/KG	0/ 1	2.32360	1.162	1.162	.	1.162
Chromium	MG/KG	1/ 1	.	14.770	14.775	.	14.775
Mercury	MG/KG	0/ 1	0.25290	0.127	0.126	.	0.126
Selenium	MG/KG	0/ 1	0.46280	0.231	0.231	.	0.231
Total Isotopic Uranium	MG/KG	0/ 1	0.32690	0.164	0.163	.	0.163
Zinc	MG/KG	1/ 1	.	27.320	27.325	.	27.325

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued)

EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

Location=BACKGROUND Sample Media=CRAYFISH HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Cadmium	MG/KG	0/ 2	2.02675	1.012	1.121	1.697	1.121
Chromium	MG/KG	2/ 2	.	2.247	3.406	9.569	3.406
Mercury	MG/KG	0/ 2	0.20130	0.101	0.110	0.158	0.110
Selenium	MG/KG	1/ 2	0.22470	0.202	0.291	0.766	0.291
Total Isotopic Uranium	MG/KG	0/ 2	0.28185	0.141	0.148	0.183	0.148
Zinc	MG/KG	2/ 2	.	20.730	23.271	36.760	23.271
Acenaphthene	MG/KG	2/ 2	.	0.076	0.140	0.480	0.140
Acenaphthylene	MG/KG	0/ 2	0.32000	0.160	0.160	0.160	0.160
Anthracene	MG/KG	2/ 2	.	0.008	0.008	0.008	0.008
Benzo(a)Anthracene	MG/KG	0/ 2	0.00220	0.001	0.001	0.001	0.001
Benzo(a)Pyrene	MG/KG	2/ 2	.	0.001	0.001	0.001	0.001
Benzo(b)Fluoranthene	MG/KG	0/ 2	0.00270	0.001	0.001	0.001	0.001
Benzo(g,h,i)Perylene	MG/KG	0/ 2	0.00720	0.004	0.004	0.004	0.004
Benzo(k)Fluoranthene	MG/KG	2/ 2	.	0.001	0.001	0.001	0.001
Chrysene	MG/KG	0/ 2	0.01800	0.009	0.009	0.009	0.009
Dibenzo(a,h)Anthracene	MG/KG	0/ 2	0.00270	0.001	0.001	0.001	0.001
Fluoranthene	MG/KG	0/ 2	0.03000	0.015	0.015	0.015	0.015
Fluorene	MG/KG	0/ 2	0.03300	0.017	0.017	0.017	0.017
Indeno(1,2,3-cd)Pyrene	MG/KG	0/ 2	0.00810	0.004	0.004	0.004	0.004
Naphthalene	MG/KG	2/ 2	.	0.047	0.058	0.117	0.058
Phenanthrene	MG/KG	0/ 2	0.09300	0.047	0.047	0.047	0.047
Pyrene	MG/KG	0/ 2	0.03600	0.018	0.018	0.018	0.018
4,4'-DDE	MG/KG	2/ 2	.	0.001	0.001	0.001	0.001
Aldrin	MG/KG	1/ 2	0.00630	0.002	0.003	0.009	0.003
Aroclor-1016	MG/KG	1/ 2	0.06000	0.051	0.073	0.187	0.073
Aroclor-1260	MG/KG	0/ 2	0.02000	0.010	0.010	0.010	0.010
Dieldrin	MG/KG	0/ 2	0.03900	0.020	0.020	0.020	0.020
Endrin aldehyde	MG/KG	1/ 2	0.05100	0.013	0.025	0.090	0.025
Endrin ketone	MG/KG	2/ 2	.	0.001	0.001	0.003	0.001
heptachlor epoxide	MG/KG	1/ 2	0.00900	0.002	0.004	0.016	0.004
alpha-BHC	MG/KG	1/ 2	0.01600	0.005	0.008	0.022	0.008
alpha-Chlordane	MG/KG	1/ 2	0.01700	0.004	0.009	0.030	0.009
delta-BHC	MG/KG	1/ 2	0.00750	0.003	0.004	0.010	0.004
gamma-BHC	MG/KG	1/ 2	0.01500	0.005	0.008	0.021	0.008
gamma-Chlordane	MG/KG	0/ 2	0.01400	0.007	0.007	0.007	0.007

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued) EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

Location=BACKGROUND Sample Media=EARTHWORM HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	1/ 1	-	0.375	0.375	-	0.375
Arsenic	MG/KG	1/ 1	-	1.053	1.053	-	1.053
Cadmium	MG/KG	0/ 1	1.90150	0.951	0.951	-	0.951
Chromium	MG/KG	1/ 1	-	8.453	8.453	-	8.453
Mercury	MG/KG	0/ 1	0.30530	0.153	0.153	-	0.153
Selenium	MG/KG	1/ 1	-	1.341	1.341	-	1.341
Total Isotopic Uranium	MG/KG	1/ 1	-	1.280	1.280	-	1.280
Zinc	MG/KG	1/ 1	-	51.340	51.344	-	51.344

Location=BACKGROUND Sample Media=MOUSE HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	0/ 1	0.01660	0.008	0.008	-	0.008
Cadmium	MG/KG	0/ 1	2.73600	1.368	1.368	-	1.368
Chromium	MG/KG	0/ 1	0.46820	0.234	0.234	-	0.234
Mercury	MG/KG	0/ 1	0.37590	0.188	0.188	-	0.188
Selenium	MG/KG	0/ 1	0.60820	0.304	0.304	-	0.304
Zinc	MG/KG	1/ 1	-	35.390	35.386	-	35.386
Acenaphthylene	MG/KG	0/ 1	1.00000	0.500	0.500	-	0.500
Anthracene	MG/KG	1/ 1	-	0.026	0.026	-	0.026
Benzo(a)Anthracene	MG/KG	0/ 1	0.00690	0.003	0.003	-	0.003
Benzo(a)Pyrene	MG/KG	1/ 1	-	0.002	0.002	-	0.002
Benzo(b)Fluoranthene	MG/KG	0/ 1	0.00850	0.004	0.004	-	0.004
Benzo(k)Fluoranthene	MG/KG	1/ 1	-	0.002	0.002	-	0.002
Fluoranthene	MG/KG	0/ 1	0.09500	0.048	0.048	-	0.048
Fluorene	MG/KG	0/ 1	0.10000	0.050	0.050	-	0.050
Indeno(1,2,3-cd)Pyrene	MG/KG	0/ 1	0.02600	0.013	0.013	-	0.013
Naphthalene	MG/KG	1/ 1	-	0.012	0.012	-	0.012
Phenanthrene	MG/KG	0/ 1	0.29000	0.145	0.145	-	0.145
4,4'-DDE	MG/KG	1/ 1	-	0.001	0.001	-	0.001
4,4'-DDT	MG/KG	1/ 1	-	0.009	0.009	-	0.009
Aldrin	MG/KG	0/ 1	0.00630	0.003	0.003	-	0.003
Aroclor-1260	MG/KG	0/ 1	0.02000	0.010	0.010	-	0.010
Dieldrin	MG/KG	0/ 1	0.03900	0.020	0.020	-	0.020
Endosulfan II	MG/KG	1/ 1	-	0.000	0.000	-	0.000
Heptachlor epoxide	MG/KG	1/ 1	-	0.003	0.003	-	0.003
alpha-BHC	MG/KG	1/ 1	-	0.001	0.001	-	0.001
alpha-Chlordane	MG/KG	1/ 1	-	0.001	0.001	-	0.001
beta-BHC	MG/KG	0/ 1	0.05400	0.027	0.027	-	0.027
delta-BHC	MG/KG	0/ 1	0.00750	0.004	0.004	-	0.004
gamma-BHC	MG/KG	1/ 1	-	0.002	0.002	-	0.002
gamma-Chlordane	MG/KG	0/ 1	0.01400	0.007	0.007	-	0.007

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued) EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

8

Location=BACKGROUND Sample Media=REDBREAST HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	0/ 1	0.05770	0.029	0.029	.	0.029
Chromium	MG/KG	1/ 1	.	1.260	1.260	.	1.260
Mercury	MG/KG	0/ 1	0.15090	0.075	0.075	.	0.075
Selenium	MG/KG	1/ 1	.	0.517	0.517	.	0.517
Zinc	MG/KG	1/ 1	.	21.390	21.395	.	21.395
Acenaphthene	MG/KG	1/ 1	.	0.008	0.008	.	0.008
Acenaphthylene	MG/KG	0/ 1	0.21000	0.105	0.105	.	0.105
Anthracene	MG/KG	0/ 1	0.00580	0.003	0.003	.	0.003
Benzo(a)Pyrene	MG/KG	0/ 1	0.00067	0.000	0.000	.	0.000
Benzo(b)Fluoranthene	MG/KG	0/ 1	0.00073	0.000	0.000	.	0.000
Benzo(k)Fluoranthene	MG/KG	0/ 1	0.00066	0.000	0.000	.	0.000
Dibenzo(a,h)Anthracene	MG/KG	0/ 1	0.00180	0.001	0.001	.	0.001
Fluorene	MG/KG	0/ 1	0.00300	0.002	0.002	.	0.002
Naphthalene	MG/KG	0/ 1	0.01700	0.009	0.009	.	0.009
Pyrene	MG/KG	0/ 1	0.00760	0.004	0.004	.	0.004
4,4'-DDD	MG/KG	1/ 1	.	0.001	0.001	.	0.001
4,4'-DDE	MG/KG	1/ 1	.	0.005	0.005	.	0.005
4,4'-DDT	MG/KG	1/ 1	.	0.000	0.000	.	0.000
Aroclor-1016	MG/KG	0/ 1	0.04000	0.020	0.020	.	0.020
Aroclor-1260	MG/KG	0/ 1	0.01400	0.007	0.007	.	0.007
Dieldrin	MG/KG	0/ 1	0.02600	0.013	0.013	.	0.013
Endrin ketone	MG/KG	1/ 1	.	0.000	0.000	.	0.000
Heptachlor	MG/KG	1/ 1	.	0.006	0.006	.	0.006
Heptachlor epoxide	MG/KG	1/ 1	.	0.004	0.004	.	0.004
alpha-BHC	MG/KG	0/ 1	0.00054	0.000	0.000	.	0.000
alpha-Chlordane	MG/KG	1/ 1	..	0.002	0.002	.	0.002
beta-BHC	MG/KG	1/ 1	.	0.007	0.007	.	0.007
gamma-BHC	MG/KG	0/ 1	0.01000	0.005	0.005	.	0.005
gamma-Chlordane	MG/KG	1/ 1	.	0.000	0.000	.	0.000

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued)

EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

9

Location=BACKGROUND Sample Media=STONE ROLLER HOMOGEN

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	1/ 2	0.01330	0.007	0.007	0.008	0.007
Arsenic	MG/KG	1/ 2	0.19060	0.214	0.334	0.967	0.334
Chromium	MG/KG	2/ 2	.	2.190	2.476	3.994	2.476
Mercury	MG/KG	1/ 2	0.18840	0.565	1.037	3.542	1.037
Selenium	MG/KG	2/ 2	.	0.467	0.504	0.698	0.504
Total Isotopic Uranium	MG/KG	0/ 2	0.18885	0.094	0.123	0.274	0.123
Zinc	MG/KG	2/ 2	.	57.420	61.435	82.790	61.435
Acenaphthene	MG/KG	1/ 2	0.07900	0.047	0.054	0.093	0.054
Acenaphthylene	MG/KG	1/ 2	0.11000	0.034	0.055	0.167	0.055
Anthracene	MG/KG	1/ 2	0.02900	0.008	0.015	0.047	0.015
Benzo(a)Anthracene	MG/KG	1/ 2	0.00073	0.003	0.006	0.021	0.006
Benzo(a)Pyrene	MG/KG	2/ 2	.	0.002	0.004	0.012	0.004
Benzo(b)Fluoranthene	MG/KG	1/ 2	0.00090	0.002	0.004	0.015	0.004
Benzo(g,h,i)Perylene	MG/KG	1/ 2	0.00240	0.001	0.001	0.002	0.001
Benzo(k)Fluoranthene	MG/KG	2/ 2	.	0.001	0.002	0.007	0.002
Chrysene	MG/KG	1/ 2	0.00600	0.006	0.009	0.024	0.009
Dibenzo(a,h)Anthracene	MG/KG	0/ 2	0.00090	0.000	0.000	0.000	0.000
Fluoranthene	MG/KG	1/ 2	0.01000	0.025	0.046	0.155	0.046
Fluorene	MG/KG	1/ 2	0.01100	0.005	0.005	0.009	0.005
Indeno(1,2,3-cd)Pyrene	MG/KG	2/ 2	.	0.001	0.003	0.008	0.003
Naphthalene	MG/KG	2/ 2	.	0.240	0.400	1.248	0.400
Phenanthrene	MG/KG	1/ 2	0.03100	0.021	0.026	0.054	0.026
Pyrene	MG/KG	1/ 2	0.01200	0.021	0.036	0.116	0.036
4,4'-DDD	MG/KG	1/ 2	0.00740	0.002	0.004	0.013	0.004
4,4'-DDE	MG/KG	2/ 2	.	0.005	0.005	0.007	0.005
4,4'-DDT	MG/KG	2/ 2	.	0.006	0.009	0.020	0.009
Aldrin	MG/KG	2/ 2	.	0.002	0.003	0.004	0.003
Aroclor-1260	MG/KG	0/ 2	0.00680	0.003	0.003	0.003	0.003
Dieldrin	MG/KG	0/ 2	0.01300	0.006	0.006	0.006	0.006
Endosulfan sulfate	MG/KG	2/ 2	.	0.008	0.011	0.026	0.011
Endrin	MG/KG	1/ 2	0.00820	0.002	0.004	0.014	0.004
Endrin aldehyde	MG/KG	2/ 2	.	0.002	0.002	0.003	0.002
Heptachlor	MG/KG	0/ 2	0.00530	0.003	0.003	0.003	0.003
Heptachlor epoxide	MG/KG	2/ 2	.	0.001	0.001	0.001	0.001
alpha-BHC	MG/KG	2/ 2	.	0.002	0.003	0.008	0.003
alpha-Chlordane	MG/KG	2/ 2	.	0.003	0.003	0.003	0.003
beta-BHC	MG/KG	1/ 2	0.01800	0.006	0.009	0.023	0.009
gamma-BHC	MG/KG	2/ 2	.	0.005	0.007	0.017	0.007
gamma-Chlordane	MG/KG	2/ 2	.	0.004	0.005	0.013	0.005

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued)

EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

10

Location=BACKGROUND Sample Media=TERRESTRIAL HOMOGENA

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	0/ 1	0.00270	0.001	0.001	.	0.001
Arsenic	MG/KG	0/ 1	0.05650	0.028	0.028	.	0.028
Chromium	MG/KG	0/ 1	0.26960	0.135	0.135	.	0.135
Mercury	MG/KG	0/ 1	0.09230	0.046	0.046	.	0.046
Selenium	MG/KG	0/ 1	0.32800	0.164	0.164	.	0.164
Zinc	MG/KG	1/ 1	.	58.160	58.155	.	58.155
Acenaphthylene	MG/KG	1/ 1	.	0.007	0.007	.	0.007
Anthracene	MG/KG	1/ 1	.	0.009	0.009	.	0.009
Benzo(a)Anthracene	MG/KG	0/ 1	0.00220	0.001	0.001	.	0.001
Benzo(a)Pyrene	MG/KG	1/ 1	.	0.001	0.001	.	0.001
Benzo(b)Fluoranthene	MG/KG	1/ 1	.	0.000	0.000	.	0.000
Benzo(g,h,i)Perylene	MG/KG	0/ 1	0.00720	0.004	0.004	.	0.004
Benzo(k)Fluoranthene	MG/KG	1/ 1	.	0.001	0.001	.	0.001
Chrysene	MG/KG	0/ 1	0.01800	0.009	0.009	.	0.009
Dibenzo(a,h)Anthracene	MG/KG	0/ 1	0.00270	0.001	0.001	.	0.001
Fluoranthene	MG/KG	0/ 1	0.03000	0.015	0.015	.	0.015
Fluorene	MG/KG	0/ 1	0.03300	0.017	0.017	.	0.017
Indeno(1,2,3-cd)Pyrene	MG/KG	1/ 1	.	0.001	0.001	.	0.001
Naphthalene	MG/KG	1/ 1	.	0.020	0.020	.	0.020
Phenanthrene	MG/KG	0/ 1	0.09300	0.047	0.047	.	0.047
Pyrene	MG/KG	0/ 1	0.03600	0.018	0.018	.	0.018
4,4'-DDE	MG/KG	1/ 1	.	0.002	0.002	.	0.002
Aldrin	MG/KG	1/ 1	.	0.004	0.004	.	0.004
Aroclor-1016	MG/KG	0/ 1	0.06000	0.030	0.030	.	0.030
Aroclor-1260	MG/KG	0/ 1	0.02000	0.010	0.010	.	0.010
Dieldrin	MG/KG	1/ 1	.	0.001	0.001	.	0.001
Endosulfan II	MG/KG	1/ 1	.	0.005	0.005	.	0.005
Endosulfan sulfate	MG/KG	1/ 1	.	0.001	0.001	.	0.001
Endrin aldehyde	MG/KG	0/ 1	0.05100	0.025	0.025	.	0.025
Endrin ketone	MG/KG	1/ 1	.	0.000	0.000	.	0.000
Heptachlor	MG/KG	1/ 1	.	0.008	0.008	.	0.008
Heptachlor epoxide	MG/KG	1/ 1	.	0.004	0.004	.	0.004
alpha-BHC	MG/KG	1/ 1	.	0.003	0.003	.	0.003
alpha-Chlordane	MG/KG	0/ 1	0.01700	0.009	0.009	.	0.009
beta-BHC	MG/KG	0/ 1	0.05400	0.027	0.027	.	0.027
delta-BHC	MG/KG	1/ 1	.	0.002	0.002	.	0.002
gamma-BHC	MG/KG	1/ 1	.	0.003	0.003	.	0.003
gamma-Chlordane	MG/KG	1/ 1	.	0.002	0.002	.	0.002

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued)

EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

11

Location=EFPC Sample Media=AQUATIC HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	4/ 6	0.00930	0.027	0.097	0.056	0.056
Arsenic	MG/KG	3/ 6	0.16397	0.196	0.621	0.372	0.372
Cadmium	MG/KG	1/ 6	1.15682	0.606	0.942	0.767	0.767
Chromium	MG/KG	6/ 6	.	0.753	1.385	1.038	1.038
Mercury	MG/KG	5/ 6	0.12610	0.611	0.703	0.587	0.587
Selenium	MG/KG	6/ 6	.	0.949	1.520	1.215	1.215
Zinc	MG/KG	6/ 6	.	86.520	112.830	99.890	99.891

Location=EFPC Sample Media=BASS HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Mercury	MG/KG	1/ 1	.	0.346	0.346	.	0.346
Selenium	MG/KG	1/ 1	.	0.310	0.310	.	0.310
Zinc	MG/KG	1/ 1	.	13.640	13.644	.	13.644

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued)

EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

12

Location=EFPC Sample Media=BENTHIC HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	1/ 5	0.01070	0.007	0.016	0.011	0.011
Arsenic	MG/KG	4/ 5	0.19720	0.629	1.918	1.330	1.330
Cadmium	MG/KG	1/ 5	2.02955	1.297	2.425	1.986	1.986
Chromium	MG/KG	5/ 5	.	15.100	31.711	24.910	24.909
Mercury	MG/KG	5/ 5	.	4.050	13.740	9.220	9.220
Selenium	MG/KG	4/ 5	0.57150	0.322	0.399	0.382	0.382
Total Isotopic Uranium	MG/KG	5/ 5	.	0.904	1.702	1.362	1.362
Zinc	MG/KG	5/ 5	.	44.790	71.450	68.660	68.659
Acenaphthylene	MG/KG	1/ 2	0.32000	0.108	0.160	0.434	0.160
Anthracene	MG/KG	2/ 2	.	0.016	0.019	0.038	0.019
Benzo(a)Anthracene	MG/KG	2/ 2	.	0.014	0.014	0.017	0.014
Benzo(a)Pyrene	MG/KG	2/ 2	.	0.010	0.013	0.027	0.013
Benzo(b)Fluoranthene	MG/KG	2/ 2	.	0.025	0.026	0.031	0.026
Benzo(g,h,i)Perylene	MG/KG	2/ 2	.	0.014	0.016	0.027	0.016
Benzo(k)Fluoranthene	MG/KG	2/ 2	.	0.011	0.011	0.014	0.011
Chrysene	MG/KG	2/ 2	.	0.039	0.042	0.058	0.042
Dibenzo(a,h)Anthracene	MG/KG	2/ 2	.	0.003	0.004	0.008	0.004
Fluoranthene	MG/KG	2/ 2	.	0.048	0.060	0.124	0.060
Fluorene	MG/KG	1/ 2	0.03300	0.013	0.017	0.034	0.017
Indeno(1,2,3-cd)Pyrene	MG/KG	2/ 2	.	0.014	0.016	0.029	0.016
Naphthalene	MG/KG	2/ 2	.	0.020	0.037	0.126	0.037
Phenanthrene	MG/KG	2/ 2	.	0.010	0.016	0.051	0.016
Pyrene	MG/KG	2/ 2	.	0.026	0.029	0.042	0.029
4,4'-DDE	MG/KG	1/ 3	0.02800	0.017	0.024	0.027	0.024
Aldrin	MG/KG	2/ 3	0.06300	0.012	0.032	0.040	0.032
Aroclor-1260	MG/KG	3/ 3	.	0.440	0.730	0.966	0.730
Dieldrin	MG/KG	2/ 3	0.03900	0.011	0.020	0.026	0.020
Heptachlor epoxide	MG/KG	2/ 3	0.00900	0.003	0.004	0.006	0.004
alpha-BHC	MG/KG	2/ 3	0.01600	0.006	0.008	0.012	0.008
beta-BHC	MG/KG	1/ 3	0.29700	0.101	0.270	0.348	0.270
delta-BHC	MG/KG	2/ 3	0.07500	0.014	0.037	0.049	0.037
gamma-BHC	MG/KG	3/ 3	.	0.004	0.008	0.010	0.008

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued)

EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

13

Location=EFPC Sample Media=CRAYFISH HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Cadmium	MG/KG	1/ 7	2.60082	1.513	2.791	1.999	1.999
Chromium	MG/KG	7/ 7	.	1.217	3.261	1.997	1.997
Mercury	MG/KG	7/ 7	.	2.898	6.577	4.747	4.747
Selenium	MG/KG	7/ 7	.	0.405	0.746	0.524	0.524
Total Isotopic Uranium	MG/KG	3/ 7	0.30668	0.382	0.770	0.594	0.594
Zinc	MG/KG	7/ 7	.	32.700	47.401	39.650	39.454
Acenaphthene	MG/KG	0/ 6	0.26667	0.133	0.170	0.151	0.151
Acenaphthylene	MG/KG	2/ 6	0.34000	0.132	0.200	0.182	0.182
Anthracene	MG/KG	6/ 6	.	0.015	0.021	0.019	0.019
Benzo(a)Anthracene	MG/KG	6/ 6	.	0.012	0.042	0.025	0.025
Benzo(a)Pyrene	MG/KG	6/ 6	.	0.012	0.041	0.024	0.024
Benzo(b)Fluoranthene	MG/KG	6/ 6	.	0.011	0.029	0.020	0.020
Benzo(g,h,i)Perylene	MG/KG	6/ 6	.	0.012	0.045	0.025	0.025
Benzo(k)Fluoranthene	MG/KG	6/ 6	.	0.013	0.048	0.027	0.027
Chrysene	MG/KG	6/ 6	.	0.016	0.049	0.030	0.030
Dibenzo(a,h)Anthracene	MG/KG	6/ 6	.	0.010	0.047	0.026	0.026
Fluoranthene	MG/KG	3/ 6	0.03700	0.022	0.034	0.027	0.027
Fluorene	MG/KG	4/ 6	0.03700	0.010	0.021	0.017	0.017
Indeno(1,2,3-cd)Pyrene	MG/KG	6/ 6	.	0.012	0.038	0.023	0.023
Naphthalene	MG/KG	6/ 6	.	0.028	0.060	0.045	0.045
Phenanthrene	MG/KG	3/ 6	0.11433	0.031	0.065	0.055	0.055
Pyrene	MG/KG	2/ 6	0.04200	0.018	0.025	0.023	0.023
4,4'-DDE	MG/KG	6/ 7	0.14000	0.015	0.070	0.033	0.033
Aldrin	MG/KG	2/ 7	0.04440	0.016	0.032	0.025	0.025
Aroclor-1016	MG/KG	1/ 7	0.32000	0.200	0.440	0.312	0.312
Aroclor-1260	MG/KG	7/ 7	.	0.336	0.750	0.509	0.509
Dieldrin	MG/KG	6/ 7	0.20000	0.019	0.100	0.045	0.045
Endrin aldehyde	MG/KG	0/ 7	0.27171	0.136	0.255	0.205	0.205
Endrin ketone	MG/KG	0/ 7	0.08457	0.042	0.080	0.064	0.064
Heptachlor epoxide	MG/KG	6/ 7	0.04500	0.005	0.022	0.011	0.011
alpha-BHC	MG/KG	3/ 7	0.12000	0.036	0.080	0.061	0.061
alpha-Chlordane	MG/KG	2/ 7	0.08780	0.033	0.085	0.054	0.054
delta-BHC	MG/KG	0/ 7	0.03986	0.020	0.037	0.030	0.030
gamma-BHC	MG/KG	4/ 7	0.12500	0.028	0.075	0.054	0.054
gamma-Chlordane	MG/KG	2/ 7	0.09800	0.035	0.070	0.056	0.056

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

Location=EFPC Sample Media=EARTHWORM HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	6/ 6	.	0.093	0.360	0.201	0.201
Arsenic	MG/KG	6/ 6	.	1.733	2.063	1.982	1.982
Cadmium	MG/KG	2/ 6	2.49365	5.681	17.098	11.490	11.488
Chromium	MG/KG	6/ 6	.	10.880	14.644	13.150	13.150
Mercury	MG/KG	6/ 6	.	19.440	33.213	29.130	29.130
Selenium	MG/KG	6/ 6	.	3.425	5.316	4.435	4.435
Total Isotopic Uranium	MG/KG	6/ 6	.	6.549	9.127	8.186	8.186
Zinc	MG/KG	6/ 6	.	89.180	107.360	103.100	103.129

Location=EFPC Sample Media=HERON BREAST FEATHER

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Chromium	MG/KG	1/ 1	.	7.993	7.993	.	7.993
Mercury	MG/KG	1/ 1	.	5.302	5.302	.	5.302
Zinc	MG/KG	1/ 1	.	116.200	116.200	.	116.200

Location=EFPC Sample Media=HERON LIVER

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Mercury	MG/KG	1/ 1	.	8.986	8.986	.	8.986
Selenium	MG/KG	1/ 1	.	3.475	3.475	.	3.475
Zinc	MG/KG	1/ 1	.	60.120	60.124	.	60.124

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued)

EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

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Location=EFPC Sample Media=HERON LIVER HOMOGENA

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Acenaphthylene	MG/KG	1/ 1	.	0.310	0.310	.	0.310
Anthracene	MG/KG	1/ 1	.	0.010	0.010	.	0.010
Benzo(a)Pyrene	MG/KG	1/ 1	.	0.001	0.001	.	0.001
Benzo(k)Fluoranthene	MG/KG	1/ 1	.	0.001	0.001	.	0.001
Indeno(1,2,3-cd)Pyrene	MG/KG	1/ 1	.	0.000	0.000	.	0.000
Naphthalene	MG/KG	1/ 1	.	0.010	0.010	.	0.010
4,4'-DDE	MG/KG	1/ 1	.	0.180	0.180	.	0.180
Aldrin	MG/KG	1/ 1	.	0.008	0.008	.	0.008
Aroclor-1260	MG/KG	1/ 1	.	1.400	1.400	.	1.400
Dieldrin	MG/KG	1/ 1	.	0.130	0.130	.	0.130
Heptachlor epoxide	MG/KG	1/ 1	.	0.041	0.041	.	0.041
alpha-BHC	MG/KG	1/ 1	.	0.004	0.004	.	0.004
alpha-Chlordane	MG/KG	1/ 1	.	0.012	0.012	.	0.012

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued)

EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

16

Location=EFPC Sample Media=MOUSE HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	10/ 11	0.01450	0.123	0.313	0.191	0.191
Cadmium	MG/KG	1/ 11	1.82357	1.253	4.669	1.889	1.889
Chromium	MG/KG	8/ 11	0.29120	0.773	2.109	1.168	1.168
Mercury	MG/KG	3/ 11	0.28636	0.588	3.550	1.152	1.152
Selenium	MG/KG	6/ 11	0.46500	0.454	1.039	0.608	0.608
Zinc	MG/KG	11/ 11	.	37.270	50.854	41.460	41.464
Acenaphthylene	MG/KG	2/ 10	0.64000	0.263	0.550	0.364	0.364
Anthracene	MG/KG	9/ 10	0.19000	0.027	0.095	0.042	0.042
Benzo(a)Anthracene	MG/KG	1/ 10	0.00479	0.002	0.004	0.003	0.003
Benzo(a)Pyrene	MG/KG	9/ 10	0.00870	0.002	0.004	0.003	0.003
Benzo(b)Fluoranthene	MG/KG	1/ 10	0.00590	0.003	0.004	0.004	0.004
Benzo(k)Fluoranthene	MG/KG	9/ 10	0.00410	0.001	0.002	0.002	0.002
Fluoranthene	MG/KG	1/ 10	0.06544	0.029	0.050	0.039	0.039
Fluorene	MG/KG	1/ 10	0.07267	0.033	0.055	0.043	0.043
Indeno(1,2,3-cd)Pyrene	MG/KG	1/ 10	0.01840	0.008	0.014	0.011	0.011
Naphthalene	MG/KG	5/ 10	0.58000	0.148	0.405	0.244	0.244
Phenanthrene	MG/KG	1/ 10	0.20211	0.091	0.155	0.121	0.121
4,4'-DDE	MG/KG	10/ 11	0.02800	0.004	0.025	0.009	0.009
4,4'-DDT	MG/KG	6/ 11	0.01440	0.008	0.017	0.010	0.010
Aldrin	MG/KG	7/ 11	0.00630	0.003	0.010	0.006	0.004
Aroclor-1260	MG/KG	11/ 11	.	0.465	2.900	0.914	0.914
Dieldrin	MG/KG	3/ 11	0.03900	0.018	0.038	0.023	0.023
Endosulfan II	MG/KG	0/ 11	0.03364	0.017	0.100	0.032	0.032
Heptachlor epoxide	MG/KG	11/ 11	.	0.007	0.028	0.011	0.011
alpha-BHC	MG/KG	8/ 11	0.07067	0.010	0.090	0.025	0.025
alpha-Chlordane	MG/KG	11/ 11	.	0.001	0.002	0.001	0.001
beta-BHC	MG/KG	2/ 11	0.11689	0.049	0.310	0.096	0.096
delta-BHC	MG/KG	2/ 11	0.00750	0.004	0.014	0.006	0.006
gamma-BHC	MG/KG	2/ 11	0.03222	0.014	0.065	0.027	0.027
gamma-Chlordane	MG/KG	3/ 11	0.03225	0.012	0.080	0.024	0.024

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued) EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

17

Location=EFPC Sample Media=REDBREAST FILLET NOM

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Chromium	MG/KG	2/ 2	.	0.331	0.352	0.465	0.352
Mercury	MG/KG	2/ 2	.	1.243	1.765	4.537	1.765
Selenium	MG/KG	2/ 2	.	0.390	0.498	1.074	0.498
Zinc	MG/KG	2/ 2	.	9.697	10.279	13.370	10.279
Acenaphthylene	MG/KG	1/ 1	.	0.010	0.010	.	0.010
4,4'-DDE	MG/KG	1/ 2	0.01900	0.005	0.010	0.032	0.010
Aroclor-1260	MG/KG	2/ 2	.	0.440	0.710	2.165	0.710
Dieldrin	MG/KG	2/ 2	.	0.009	0.011	0.023	0.011
Heptachlor	MG/KG	1/ 2	0.16000	0.041	0.080	0.286	0.080
Heptachlor epoxide	MG/KG	2/ 2	.	0.006	0.010	0.031	0.010
alpha-Chlordane	MG/KG	2/ 2	.	0.008	0.010	0.017	0.010
gamma-BHC	MG/KG	1/ 2	0.00062	0.001	0.003	0.009	0.003
gamma-Chlordane	MG/KG	2/ 2	.	0.002	0.003	0.006	0.003

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued) EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE 18
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

---------- Location=EFPC Sample Media=REDBREAST HOMOGENATE ----------

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	1/ 11	0.01538	0.008	0.048	0.016	0.015
Chromium	MG/KG	9/ 11	0.26535	0.402	0.775	0.523	0.523
Mercury	MG/KG	11/ 11	.	1.123	2.525	1.536	1.536
Selenium	MG/KG	8/ 11	0.48827	0.461	0.736	0.565	0.565
Zinc	MG/KG	11/ 11	.	24.980	33.108	28.340	28.337
Acenaphthene	MG/KG	9/ 10	0.07900	0.017	0.040	0.024	0.024
Acenaphthylene	MG/KG	7/ 10	0.11000	0.024	0.055	0.037	0.037
Anthracene	MG/KG	1/ 10	0.00380	0.002	0.003	0.002	0.002
Benzo(a)Pyrene	MG/KG	1/ 10	0.00083	0.000	0.002	0.001	0.001
Benzo(b)Fluoranthene	MG/KG	1/ 10	0.00133	0.001	0.003	0.001	0.001
Benzo(k)Fluoranthene	MG/KG	1/ 10	0.00099	0.000	0.003	0.001	0.001
Dibenzo(a,h)Anthracene	MG/KG	1/ 10	0.00080	0.001	0.006	0.002	0.002
Fluorene	MG/KG	1/ 10	0.00204	0.001	0.003	0.001	0.001
Naphthalene	MG/KG	1/ 10	0.02017	0.010	0.033	0.015	0.015
Pyrene	MG/KG	1/ 10	0.00508	0.003	0.006	0.004	0.004
4,4'-DDD	MG/KG	0/ 11	0.12082	0.060	0.090	0.074	0.074
4,4'-DDE	MG/KG	5/ 11	0.11667	0.046	0.095	0.062	0.062
4,4'-DDT	MG/KG	0/ 11	0.07655	0.038	0.060	0.047	0.047
Aroclor-1016	MG/KG	1/ 11	0.35000	0.174	0.250	0.202	0.202
Aroclor-1260	MG/KG	11/ 11	.	1.725	3.500	2.275	2.275
Dieldrin	MG/KG	10/ 11	0.04800	0.045	0.079	0.056	0.056
Endrin ketone	MG/KG	0/ 11	0.08809	0.044	0.065	0.054	0.054
Heptachlor	MG/KG	4/ 11	0.10000	0.034	0.065	0.048	0.048
Heptachlor epoxide	MG/KG	10/ 11	0.01100	0.041	0.080	0.055	0.055
alpha-BHC	MG/KG	1/ 11	0.09160	0.042	0.065	0.054	0.054
alpha-Chlordane	MG/KG	10/ 11	0.02100	0.043	0.083	0.054	0.054
beta-BHC	MG/KG	0/ 11	0.29245	0.146	0.225	0.179	0.179
gamma-BHC	MG/KG	9/ 11	0.05950	0.008	0.050	0.016	0.016
gamma-Chlordane	MG/KG	10/ 11	0.01700	0.022	0.037	0.027	0.027

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued) EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

19

Location=EFPC Sample Media=SHREW HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	2/ 2	.	0.076	0.116	0.330	0.116
Arsenic	MG/KG	2/ 2	.	0.555	0.766	1.888	0.766
Cadmium	MG/KG	1/ 2	2.02440	3.481	5.949	19.070	5.949
Chromium	MG/KG	2/ 2	.	0.546	0.567	0.678	0.567
Mercury	MG/KG	2/ 2	.	4.901	7.890	23.780	7.890
Selenium	MG/KG	2/ 2	.	1.087	1.240	2.053	1.240
Zinc	MG/KG	2/ 2	.	36.150	40.798	65.510	40.798
4,4'-DDE	MG/KG	2/ 2	.	0.016	0.017	0.025	0.017
Aldrin	MG/KG	1/ 2	0.01300	0.005	0.006	0.016	0.006
Aroclor-1260	MG/KG	2/ 2	.	1.175	1.400	2.596	1.400
Dieldrin	MG/KG	2/ 2	.	0.010	0.012	0.023	0.012
Heptachlor	MG/KG	1/ 2	0.04800	0.013	0.024	0.081	0.024
Heptachlor epoxide	MG/KG	2/ 2	.	0.024	0.028	0.052	0.028
alpha-Chlordane	MG/KG	1/ 2	0.05000	0.017	0.025	0.070	0.025
delta-BHC	MG/KG	2/ 2	.	0.003	0.004	0.007	0.004
gamma-BHC	MG/KG	1/ 2	0.03000	0.010	0.015	0.044	0.015

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OC192 AT 13:10

Table Q.2. (continued) EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

20

Location=EFPC Sample Media=STONE ROLLER HOMOGEN

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	3/ 10	0.02487	0.019	0.076	0.032	0.032
Arsenic	MG/KG	6/ 10	0.10835	0.211	0.370	0.291	0.291
Chromium	MG/KG	10/ 10	.	1.997	3.344	2.531	2.531
Mercury	MG/KG	10/ 10	.	2.538	8.362	3.962	3.962
Selenium	MG/KG	9/ 10	0.51140	0.715	0.916	0.826	0.826
Total Isotopic Uranium	MG/KG	8/ 10	0.13750	0.511	0.911	0.687	0.687
Zinc	MG/KG	10/ 10	.	57.080	85.579	67.030	67.027
Acenaphthene	MG/KG	6/ 9	0.16000	0.064	0.092	0.079	0.079
Acenaphthylene	MG/KG	6/ 9	0.21000	0.054	0.105	0.083	0.083
Anthracene	MG/KG	8/ 9	0.02900	0.007	0.015	0.009	0.009
Benzo(a)Anthracene	MG/KG	9/ 9	.	0.010	0.019	0.014	0.014
Benzo(a)Pyrene	MG/KG	9/ 9	.	0.013	0.024	0.018	0.018
Benzo(b)Fluoranthene	MG/KG	9/ 9	.	0.021	0.043	0.030	0.030
Benzo(g,h,i)Perylene	MG/KG	9/ 9	.	0.021	0.042	0.030	0.030
Benzo(k)Fluoranthene	MG/KG	9/ 9	.	0.007	0.014	0.010	0.010
Chrysene	MG/KG	9/ 9	.	0.023	0.051	0.034	0.034
Dibenzo(a,h)Anthracene	MG/KG	7/ 9	0.00090	0.001	0.002	0.001	0.001
Fluoranthene	MG/KG	9/ 9	.	0.058	0.120	0.084	0.084
Fluorene	MG/KG	7/ 9	0.01100	0.005	0.029	0.011	0.011
Indeno(1,2,3-cd)Pyrene	MG/KG	9/ 9	.	0.023	0.041	0.032	0.032
Naphthalene	MG/KG	9/ 9	.	0.102	0.380	0.175	0.175
Phenanthrene	MG/KG	6/ 9	0.03100	0.024	0.079	0.037	0.037
Pyrene	MG/KG	9/ 9	.	0.035	0.072	0.051	0.051
4,4'-DDD	MG/KG	0/ 9	0.22244	0.111	0.185	0.156	0.156
4,4'-DDE	MG/KG	8/ 9	0.48000	0.111	0.240	0.166	0.166
4,4'-DDT	MG/KG	0/ 9	0.14322	0.072	0.120	0.101	0.101
Aldrin	MG/KG	3/ 9	0.08067	0.038	0.050	0.046	0.046
Aroclor-1260	MG/KG	9/ 9	.	4.161	8.300	6.285	6.285
Dieldrin	MG/KG	9/ 9	.	0.055	0.095	0.076	0.076
Endosulfan sulfate	MG/KG	0/ 9	0.18511	0.093	0.155	0.130	0.130
Endrin	MG/KG	0/ 9	0.24511	0.123	0.205	0.172	0.172
Endrin aldehyde	MG/KG	0/ 9	0.51000	0.255	0.425	0.357	0.357
Heptachlor	MG/KG	3/ 9	0.21000	0.076	0.130	0.109	0.109
Heptachlor epoxide	MG/KG	9/ 9	.	0.028	0.046	0.037	0.037
alpha-BHC	MG/KG	3/ 9	0.21000	0.071	0.130	0.108	0.108
alpha-Chlordane	MG/KG	9/ 9	.	0.078	0.120	0.096	0.096
beta-BHC	MG/KG	0/ 9	0.54000	0.270	0.450	0.378	0.378
gamma-BHC	MG/KG	8/ 9	0.05000	0.006	0.025	0.011	0.011
gamma-Chlordane	MG/KG	9/ 9	.	0.079	0.130	0.105	0.105

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued) EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

Location=EFPC Sample Media=TERRESTRIAL HOMOGENA

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	5/ 6	0.00230	0.008	0.012	0.011	0.011
Arsenic	MG/KG	4/ 6	0.08830	0.139	0.291	0.233	0.233
Chromium	MG/KG	4/ 6	0.21640	0.320	0.730	0.511	0.511
Mercury	MG/KG	2/ 6	0.11885	0.604	3.189	1.646	1.646
Selenium	MG/KG	3/ 6	0.37460	0.342	0.572	0.498	0.498
Zinc	MG/KG	6/ 6	-	78.780	98.579	90.630	90.633
Acenaphthylene	MG/KG	3/ 5	0.32000	0.071	0.160	0.149	0.149
Anthracene	MG/KG	5/ 5	-	0.012	0.021	0.017	0.017
Benzo(a)Anthracene	MG/KG	2/ 5	0.00220	0.005	0.017	0.012	0.012
Benzo(a)Pyrene	MG/KG	5/ 5	-	0.003	0.012	0.008	0.008
Benzo(b)Fluoranthene	MG/KG	2/ 5	0.00270	0.004	0.014	0.009	0.009
Benzo(g,h,i)Perylene	MG/KG	1/ 5	0.00740	0.005	0.008	0.007	0.007
Benzo(k)Fluoranthene	MG/KG	5/ 5	-	0.004	0.014	0.009	0.009
Chrysene	MG/KG	2/ 5	0.01800	0.009	0.013	0.012	0.012
Dibenzo(a,h)Anthracene	MG/KG	2/ 5	0.00270	0.003	0.010	0.007	0.007
Fluoranthene	MG/KG	2/ 5	0.03000	0.014	0.015	0.015	0.015
Fluorene	MG/KG	2/ 5	0.03300	0.012	0.017	0.019	0.017
Indeno(1,2,3-cd)Pyrene	MG/KG	3/ 5	0.00810	0.006	0.017	0.012	0.012
Naphthalene	MG/KG	2/ 5	0.25000	0.079	0.135	0.139	0.135
Phenanthrene	MG/KG	2/ 5	0.09300	0.033	0.047	0.051	0.047
Pyrene	MG/KG	2/ 5	0.03600	0.012	0.018	0.020	0.018
4,4'-DDE	MG/KG	4/ 6	0.02800	0.016	0.051	0.031	0.031
Aldrin	MG/KG	3/ 6	0.00630	0.005	0.008	0.007	0.007
Aroclor-1016	MG/KG	2/ 6	0.06000	0.157	0.590	0.343	0.343
Aroclor-1260	MG/KG	5/ 6	0.02000	0.208	0.350	0.324	0.324
Dieldrin	MG/KG	3/ 6	0.03900	0.014	0.020	0.020	0.020
Endosulfan II	MG/KG	0/ 6	0.01700	0.009	0.009	0.009	0.009
Endosulfan sulfate	MG/KG	0/ 6	0.01900	0.010	0.010	0.010	0.010
Endrin aldehyde	MG/KG	1/ 6	0.05100	0.022	0.025	0.029	0.025
Endrin ketone	MG/KG	1/ 6	0.01600	0.007	0.008	0.009	0.008
Heptachlor	MG/KG	4/ 6	0.01600	0.009	0.018	0.013	0.013
Heptachlor epoxide	MG/KG	5/ 6	0.00900	0.009	0.022	0.014	0.014
alpha-BHC	MG/KG	4/ 6	0.01600	0.004	0.008	0.007	0.007
alpha-Chlordane	MG/KG	4/ 6	0.01700	0.008	0.025	0.015	0.015
beta-BHC	MG/KG	1/ 6	0.05400	0.024	0.027	0.031	0.027
delta-BHC	MG/KG	2/ 6	0.00750	0.003	0.004	0.004	0.004
gamma-BHC	MG/KG	5/ 6	0.01500	0.004	0.008	0.005	0.005
gamma-Chlordane	MG/KG	3/ 6	0.01400	0.006	0.011	0.009	0.009

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued) EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

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Location=EFPC Sample Media=VOLE HOMOGENATE

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	1/ 1	.	0.064	0.064	.	0.064
Chromium	MG/KG	1/ 1	.	1.265	1.265	.	1.265
Zinc	MG/KG	1/ 1	.	37.990	37.991	.	37.991
Acenaphthene	MG/KG	1/ 1	.	0.037	0.037	.	0.037
Acenaphthylene	MG/KG	1/ 1	.	0.006	0.006	.	0.006
Anthracene	MG/KG	1/ 1	.	0.019	0.019	.	0.019
Benzo(a)Anthracene	MG/KG	1/ 1	.	0.027	0.027	.	0.027
Benzo(a)Pyrene	MG/KG	1/ 1	.	0.050	0.050	.	0.050
Benzo(b)Fluoranthene	MG/KG	1/ 1	.	0.055	0.055	.	0.055
Benzo(g,h,i)Perylene	MG/KG	1/ 1	.	0.041	0.041	.	0.041
Benzo(k)Fluoranthene	MG/KG	1/ 1	.	0.030	0.030	.	0.030
Chrysene	MG/KG	1/ 1	.	0.073	0.073	.	0.073
Dibenzo(a,h)Anthracene	MG/KG	1/ 1	.	0.007	0.007	.	0.007
Fluoranthene	MG/KG	1/ 1	.	0.053	0.053	.	0.053
Indeno(1,2,3-cd)Pyrene	MG/KG	1/ 1	.	0.062	0.062	.	0.062
Naphthalene	MG/KG	1/ 1	.	0.063	0.063	.	0.063
Phenanthrene	MG/KG	1/ 1	.	0.006	0.006	.	0.006
4,4'-DDE	MG/KG	1/ 1	.	0.002	0.002	.	0.002
4,4'-DDT	MG/KG	1/ 1	.	0.007	0.007	.	0.007
Aroclor-1016	MG/KG	1/ 1	.	0.073	0.073	.	0.073
Aroclor-1260	MG/KG	1/ 1	.	0.046	0.046	.	0.046
Dieldrin	MG/KG	1/ 1	.	0.001	0.001	.	0.001
alpha-BHC	MG/KG	1/ 1	.	0.001	0.001	.	0.001
alpha-Chlordane	MG/KG	1/ 1	.	0.000	0.000	.	0.000
beta-BHC	MG/KG	1/ 1	.	0.023	0.023	.	0.023
delta-BHC	MG/KG	1/ 1	.	0.002	0.002	.	0.002
gamma-BHC	MG/KG	1/ 1	.	0.002	0.002	.	0.002

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

Table Q.2. (continued) EAST FORK POPLAR CREEK PHASE 1B RESULTS FOR TISSUE
MEAN CONTAMINANT CONCENTRATIONS BY LOCATION

---------- Location=EFPC Sample Media=WREN HOMOGENATE ----------

PARAMTR	Measurement Units	EFPC Proportion Detected	Detection Limit	Mean Result	Maximum Result	95% UCL of Mean	Exposure Concentration
Antimony	MG/KG	1/ 1	.	0.321	0.321	.	0.321
Chromium	MG/KG	1/ 1	.	0.604	0.604	.	0.604
Mercury	MG/KG	1/ 1	.	3.486	3.486	.	3.486
Selenium	MG/KG	1/ 1	.	0.696	0.696	.	0.696
Zinc	MG/KG	1/ 1	.	34.860	34.858	.	34.858
Acenaphthene	MG/KG	1/ 1	.	0.021	0.021	.	0.021
Anthracene	MG/KG	1/ 1	.	0.016	0.016	.	0.016
Benzo(a)Anthracene	MG/KG	1/ 1	.	0.001	0.001	.	0.001
Benzo(a)Pyrene	MG/KG	1/ 1	.	0.002	0.002	.	0.002
Benzo(b)Fluoranthene	MG/KG	1/ 1	.	0.001	0.001	.	0.001
Benzo(k)Fluoranthene	MG/KG	1/ 1	.	0.002	0.002	.	0.002
Naphthalene	MG/KG	1/ 1	.	0.004	0.004	.	0.004
4,4'-DDE	MG/KG	1/ 1	.	0.770	0.770	.	0.770
4,4'-DDT	MG/KG	1/ 1	.	0.095	0.095	.	0.095
Aroclor-1260	MG/KG	1/ 1	.	1.300	1.300	.	1.300
Heptachlor epoxide	MG/KG	1/ 1	.	0.260	0.260	.	0.260
alpha-Chlordane	MG/KG	1/ 1	.	0.030	0.030	.	0.030

Results less than detection were set to 1/2 DL (except for radionuclides).
SOURCE:EFPC PHASE 1B VALIDATED DATA FROM FILE TISSUE ON 26OCT92 AT 13:10

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AVAILABILITY OF SEDIMENT-BOUND MERCURY FOR METHYLATION AND BIOACCUMULATION IN UPPER EAST FORK POPLAR CREEK: PRELIMINARY RESULTS[1]

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ABSTRACT

Large-scale field enclosures (mesocosms) were used to examine the bioavailability of sediment-bound mercury in East Fork Poplar Creek (EFPC) downstream of the Oak Ridge Y-12 Plant during the period October 1991-February 1992. In concert with results from a continuation of this effort during June 1992-August 1992, these results will be used to guide appropriate remediation of the creek and to expand the understanding of the importance of water-borne versus sediment-bound mercury in limiting mercury methylation and bioaccumulation. In these experiments fish were maintained in enclosures representing the following treatments: (1) Hg-contaminated creek water [1 μg/L] flowing over Hg-contaminated creek sediment [100 μg/g], (2) clean local groundwater [0.02 μg/L) flowing over Hg-contaminated creek sediment, (3) Hg-contaminated creek water only, and (4) clean groundwater only. In addition to tracking mercury uptake by the fish, the fluxes and speciation of mercury were monitored in each enclosure. Preliminary results, summarized in this report for the cool period (October-December 1991), have shown significant bioaccumulation of mercury only in those treatments including water-borne mercury and thus support the hypothesis that sorption to sediment greatly limits bioavailability of mercury. However, mercury accumulation rates were too low to account for the observed degree of contamination in wild fish in EFPC. The low accumulation rates may have been attributable to insufficient food supply and/or low production of methylmercury due to seasonal low temperatures. Additional studies are addressing these issues.

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1. INTRODUCTION

Large historic releases (110 mT) of inorganic mercury from the Oak Ridge Y-12 Plant in the 1950s and early 1960s, along with continuing releases of approximately 10 kg/y, have contaminated East Fork Poplar Creek (EFPC) downstream of the facility. Efforts are currently underway to determine the most effective corrective actions for the site. The relative importance of water-borne versus sediment-bound mercury in sustaining unacceptable fish mercury concentrations is a central issue in selecting the corrective measures. The research described in this report directly supports the CERCLA RI/FS being conducted concurrently for East Fork Poplar Creek.

The need to apply corrective measures to sediment contamination in EFPC will be determined in part by the role of sediment in maintaining unacceptable levels of contamination in biota, especially fish. Earlier studies (Elwood et al. 1988, Hinzman 1992) have suggested that on-going releases of mercury from the Y-12 Plant are largely responsible for sustaining the elevated levels of this contaminant in biota. If this hypothesis is correct any corrective measure that considers only the sediments for remediation will fail to achieve complete success in eliminating unacceptable human health and ecological risks.

Enormous cost savings will be realized if corrective measures, such as dredging or creek relocation, do not have to be applied to the instream sediments of EFPC. The results of this project will help to resolve the issue of bioavailability of sediment-bound mercury. Because this project employed in situ water and sediments, no extrapolation from laboratory experiments to the field should be required. Nor should complex model predictions have to be used to suggest that a "no further action" alternative for instream sediments is acceptable. If, as predicted, significantly reducing the aqueous losses of mercury from the Y-12 Plant will significantly reduce both instream sediment concentrations of mercury and the bioaccumulation of mercury by fish, then corrective measures can be more effectively directed at the continuing releases and other important pathways.

2. METHODS

2.1 ENCLOSURE CONSTRUCTION AND OPERATION

Four 96-inch diameter concrete pipe sections were placed vertically in the lower end of the concrete trapezoidal inlet channel to Reality Lake on September 4, 1991 (Figure 1). The pipe sections effectively enclosed and isolated a circular area of the channel and the in situ sediment. Neoprene gaskets were placed on the lower edge of each pipe section to aid in forming a water-tight seal with the concrete floor of the inlet channel. Two of the enclosures received water from the inlet channel at a flow rate (1 gpm) sufficient to exchange the enclosure volume approximately twice per day. The other two enclosures received water from the nearby sump which is used to dewater the subsurface drain system beneath the inlet channel and Reality Lake. This water is thought to be primarily groundwater but may include local surface water which reaches the sump by conduit-type flow. Sump water was also pumped at a flow rate sufficient to exchange the enclosure volume twice per day. Chemical analyses had shown that this source of water was similar to upper East Fork Poplar Creek water except for mercury content, which is much lower (0.02 μg/L) compared with EFPC water (1 to 2 μg/L).

In addition to the enclosures placed in EFPC, two 500-gallon polytanks were installed next to Reality Lake. One polytank was placed next to the sump and used to equilibrate the groundwater prior to pumping to the enclosures. Multiple air stones connected to a diaphragm-type air pump were employed to aerate water in the groundwater polytank. The other polytank was placed adjacent to the inlet channel to Reality Lake and received water directly from the inlet channel. Water flow rates to each polytank was approximately 2 gpm, sufficient to exchange the water in the tanks about three times per day.

Water levels in the enclosures and polytanks were maintained at a constant height using vented overflow siphons or by direct pumpage. Average water level in the enclosures was 2.8 feet above the bottom of the channel, yielding a total wetted volume of about 1060 gallons per enclosure. Subtracting the average depth of sediment (6 inches) in each enclosure yields a free water volume of approximately 875 gallons per enclosure. Water meters (cumulative dial-type) were installed on the inflow and outflow of each enclosure and on the inflow of the polytanks. Water meter readings and water levels were recorded daily and flow rates adjusted as necessary. Accuracy of water meters was verified by bucket gauging.

After allowing the enclosures and tanks to stabilize for 41 days, 30 specimens (10 to 20 grams each) of a hatchery-reared bluegill-green sunfish hybrid were placed in each enclosure on October 16, 1991. Only 15 fish were placed in the polytanks due to the smaller volume of the tanks and expected absence of much natural fish food. Figure 2 illustrates the overall experimental design for this project. At three-week intervals thereafter five fish were removed from each enclosure and sacrificed for mercury analysis. During the fish exposure period water chemistry, including mercury speciation, and microbial activity were monitored on a weekly basis in the inflow and outflow of each enclosure. The mercury speciation measurements included total mercury, total dissolved mercury, total methylmercury, dissolved methylmercury, reactive mercury ($SnCl_2$-reducible), dissolved gaseous mercury, and dimethylmercury. In addition, a

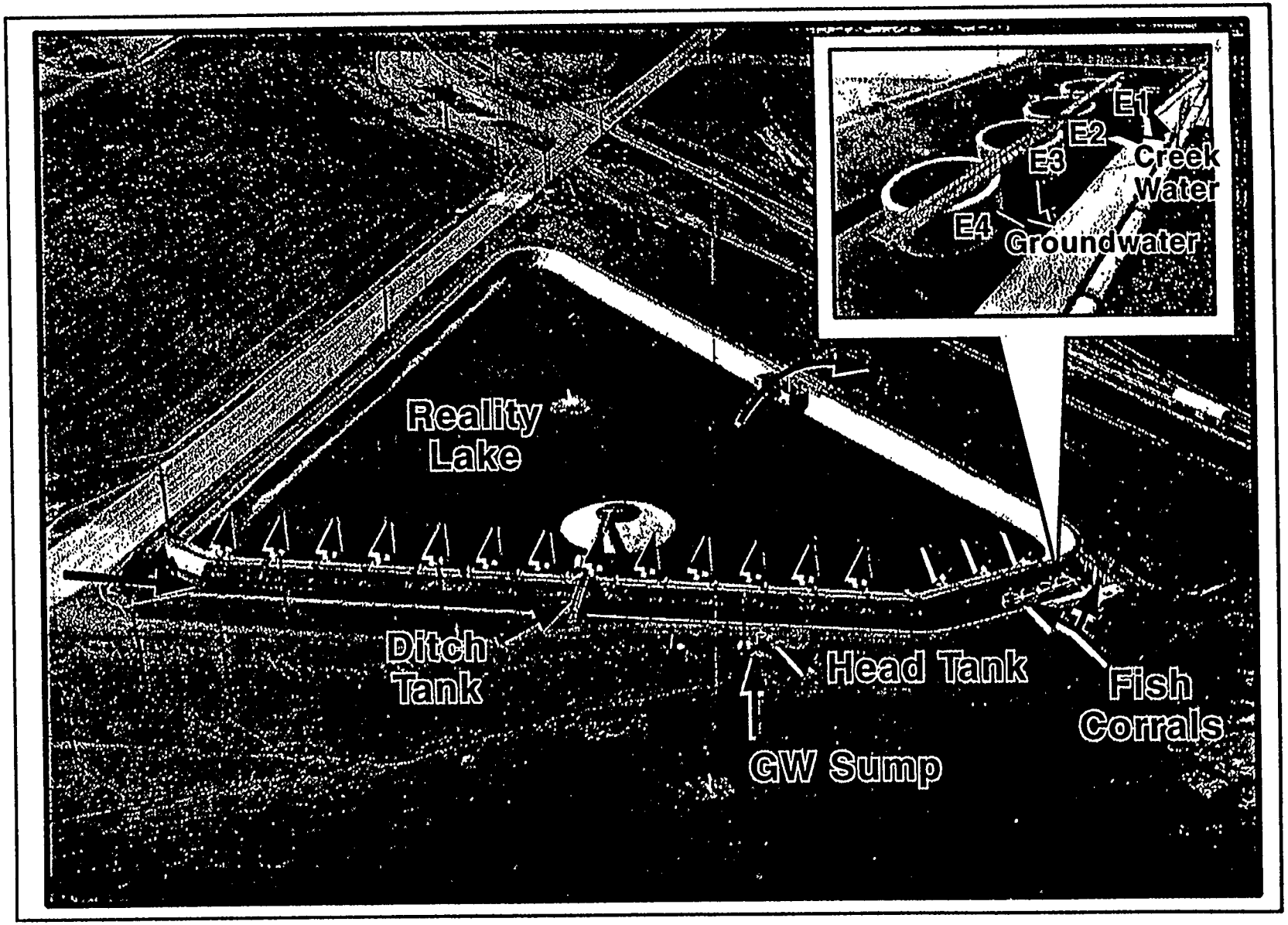

Fig. 1. Schematic of facilities at Reality Lake for fish enclosure study.

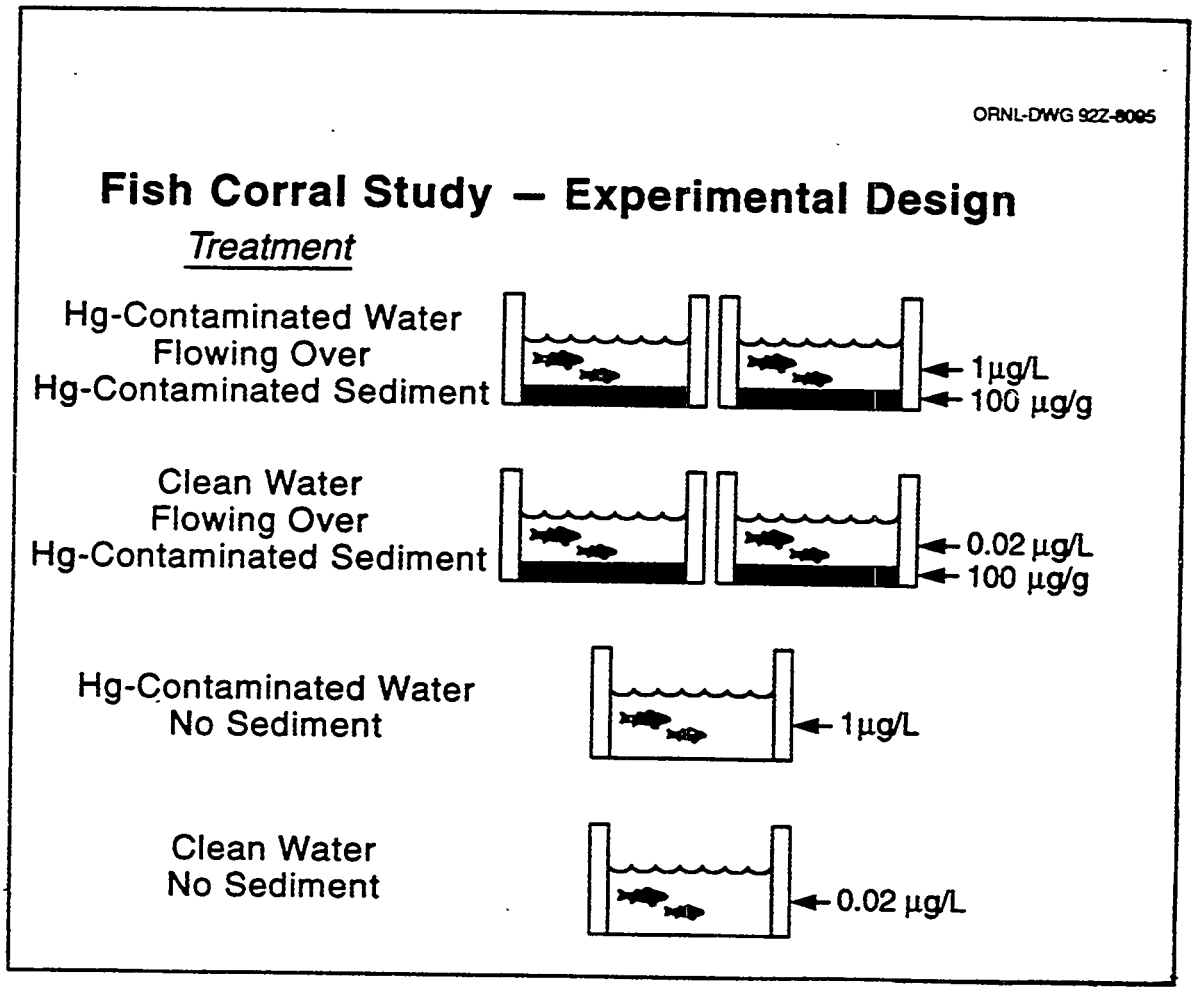

Fig. 2. Brief outline of experimental design of fish enclosure study.

limited number of samples were collected to characterize mercury in sediment, macrophytes, periphyton, and benthos in each enclosure.

2.2 MERCURY ACCUMULATION IN FISH

After completion of the stabilization period, the sunfish (bluegill/green sunfish (L. cyanellus) hybrid, were prepared for placement in the enclosures and tanks. Fish were weighed individually on an electronic balance but not marked before addition. Thirty fish, weighing 20 ± 5 g (mean ± SD), were placed in each sediment-containing enclosure;and 15 fish of the same size range were placed in each of the two smaller water-only enclosures (polytanks). The size range was restricted as much as possible and equalized among cells. Ten fish selected at random from the initial stocking were analyzed for total mercury. Thereafter, five fish from each enclosure were recaptured by hook and line for total mercury analysis at three-week intervals. Each fish was tagged with a unique four-digit jaw tag upon collection and placed on ice in a cooler until returned to the laboratory for analysis, where each was weighed, measured, skinned and filleted. Each fillet (total of two per fish) was wrapped in heavy duty aluminum foil and labelled with a permanent marker. One fillet from each fish was submitted for total mercury and one reserved for other analyses and archive. Samples were frozen at normal freezer temperatures (-20°C) until analyzed by the ORNL Analytical Chemistry Division or shipped on dry ice to a contract laboratory (Brooks Rand Ltd., Seattle, WA) for analysis. Routine chain-of-custody documentation accompanied collection, shipment, and analysis of the samples. A limited number of samples were analyzed for both total and methylmercury to verify that the total mercury measurement is a satisfactory index of methylmercury. As a quality assurance check, 20 replicate fish tissue samples were submitted for analysis of total mercury by both the contract laboratory and the ORNL Analytical Chemistry Division.

2.3 MERCURY IN INVERTEBRATES AND PERIPHYTON

The invertebrate fauna of the cells, which constituted food for the fish, was very limited due to the simplicity of the original fauna at the site and rapid consumption by the fish within the first few days. Damselfly larvae (Argia sp.) and snails (Physella sp.) were likely to be the predominant food organisms for the stocked fish. Estimates of the methylmercury content of these food organisms were made by collecting composite samples of the two organisms from each cell two or three times over the course of the experiment. Periphyton were sampled using artificial substrates. Samples of an abundant macrophyte (Potamogeton) and an algal sludge were also collected for analysis. Each composite sample of macrophytes, periphyton, algal matter and invertebrates was weighed, freeze-dried and reweighed, prior to analysis for total mercury and methylmercury. Invertebrate and periphyton samples were shipped to the contract laboratory for analysis.

2.4 MERCURY AND MERCURY SPECIATION IN WATER

Water samples were collected in glass and teflon bottles on a weekly basis for analyses of total mercury and selected chemical species of mercury. All teflon bottles were cleaned by initially boiling for 24 hours in concentrated hydrochloric acid and then stored prior to use filled with dilute hydrochloric acid. Glass bottles were cleaned by rinsing with dilute nitric acid and distilled water, and then baking in a forced air oven furnace at 450°C for 16 hours.Both the inlet and outlet of each enclosure were sampled to permit calculation of an instantaneous mass balance of mercury, including the areal release rates of methylmercury (ng/m^2/h) from the sediment. All samples were preserved (or not) as required for each form of mercury (see following discussion). Samples for total mercury were collected in glass bottles and preserved with a mixture of nitric acid and potassium dichromate (Feldman 1974). Samples for total methylmercury were collected in teflon bottles and frozen immediately on dry ice. Samples for total dissolved mercury and dissolved methylmercury were aliquoted from a filtered (0.2 μm pore) subsample and handled in the same way as their respective unfiltered portions. Samples for reactive mercury were collected in 500 mL teflon bottles and shipped overnight on gel ice (4°C) to the contract laboratory for analysis. Samples for dissolved gaseous mercury were collected in 1-L glass bottles and returned immediately in darkness to the laboratory for purging and trapping of the volatile forms of mercury. Dissolved gaseous mercury was trapped on gilded sand columns while dimethylmercury was trapped on Carbotrap (graphitized carbon) columns. Mercury trapped on the sand columns can be stored for several days prior to analysis without special treatment. The carbotrap columns were dried by passing dry helium through the traps immediately after sample collection.

The aqueous samples for methylmercury analysis and the traps containing the dimethylmercury, were shipped to the contract laboratory for analysis using protocols described in the analysis manual ("Determination of Mercury Speciation in Environmental Samples", November 1990) written by Nicolas Bloom (Frontier Geosciences, Seattle, Washington). Open literature descriptions of the analytical methods can also be found in Bloom and Fitzgerald (1987) and Bloom (1989). At the time of this investigation the contract laboratory was the only laboratory in the U.S. which offered routine analysis of mercury species. There are presently no "standard methods" or "EPA-approved" protocols for these kinds of analyses. However, the contract laboratory had performed numerous interlaboratory comparisons with research laboratories worldwide and routinely run standard reference materials for mercury in environmental media (water, tissue, sediment).

Aliquots of the water samples collected on three dates were submitted for analyses of major anions (EPA Method 300.0), major cations (EPA Methods 200.7, 258.1, and 350.3), alkalinity (EPA Method 310.1), DOC (EPA Method 415.1), and ICP/OES (EPA Method 200.7) or ICP/MS (EPA Method 200.8) scans for trace elements. In addition, temperature, pH (Orion Model SA520 with Ross 'Sure-Flow' electrode), specific conductance (YSI Model 33) and dissolved oxygen (YSI Model 57) were monitored weekly in each enclosure and tank. Some limited microbiological assays, including plate counts and AODCs, of water from the enclosures were also performed periodically during the experiment.

Laboratory quality assurance activities during this project included, but was not limited to, analysis of replicate field samples (10% of total, or one per sampling event), analysis of field blanks, regular matrix spikes, and analysis of standard reference materials.

2.5 CHARACTERISTICS OF SEDIMENT IN ENCLOSURES

Representative samples of the sediment in each enclosure were collected at the end of the experiment for miscellaneous physical and chemical analyses. Three 5-cm diameter cores were collected in each enclosure and depth-composited. Additional cores were collected in two enclosures (one creek-water treated and one groundwater-treated) and then cut into 2-cm depth increments. All sediment composites were transferred to Nalge disposable filter units to separate the interstitial water for analysis of total mercury, methylmercury and selected other metals. The vacuum-dewatered sediment was homogenized in the moist state and submitted for analysis of particle size distribution, total mercury and methylmercury. Moisture content was measured on separate aliquots to permit expression of the mercury results on a dry-weight basis. Separate aliquots were also air dried and pulverized in a porcelain mortar and pestle for analyses of total mercury (EPA Method 245.1), total carbon and total sulfur.

3. RESULTS AND DISCUSSION

3.1 COMPARISON OF WATER CHEMISTRY

The results of the weekly water chemistry monitoring are summarized in Tables 1 and 2. The data represent averages for the period October 16 through December 18, 1991. Some variables, such as temperature, exhibited distinct temporal trends over the study period. However, the similarities and differences apparent in the average values generally were constant over the study period.

With a few exceptions (e.g., suspended solids), the largest differences among the enclosures involved mercury concentrations and speciation. Suspended solids content of water samples may strongly affect mercury results (especially total mercury, total methylmercury, total particulate mercury, particulate methylmercury, total suspended mercury and suspended methylmercury) because of the high affinity of mercury for particles. As shown in Table 1, suspended solids were significantly higher (3.6 mg/L) in the enclosures receiving creek water than in the other enclosures and the polytanks. The increase in average suspended solids content between the inlets to the enclosures (columns labelled "Creek Water" and "Groundwater" in Table 1) and the outlets suggests that particulate matter was introduced into the water by the sediment-containing enclosures. This particulate matter could represent either autochthonous material produced by primary and secondary production in the enclosures or material (sediment) resuspended by biological activity (e.g., fish) in the enclosures. Both processes may have contributed to the net export of suspended matter from the enclosures. Reality Lake has exhibited a similar pattern between inlet and outlet concentrations of suspended matter (Turner, unpublished data).

Creek water and groundwater exhibited significantly different average concentrations of total mercury, dissolved mercury, particulate mercury, total methylmercury, reactive mercury and suspended mercury. In contrast, the average concentrations of dissolved methylmercury, particulate methylmercury and suspended methylmercury were not significantly different between these sources of water. Note that the creek water used to feed the polytank was collected somewhat upstream from the point where creek water was pumped into the enclosures and that the polytank inlet water was similar in most respects to creek water. Both total mercury and total dissolved mercury were higher in the polytank inlet water than in the creek water pumped into the enclosures.

As indicated in Table 2, the enclosures exhibited significant increases in the concentrations of particulate forms of mercury between the inlets and outlets, reflecting the pattern discussed above for total suspended matter. In contrast, only the enclosures receiving creek water showed significant differences in dissolved forms of mercury. Total dissolved mercury decreased between the inlet and outlet of creek water-treated enclosures, while dissolved methylmercury showed a slight increase between the inlet and outlet. These results suggest that the creek water-treated enclosures functioned as net sinks for total dissolved mercury and net sources for dissolved methylmercury. In effect the creek water-treated enclosures may have simply provided conditions favorable for transformation to other species of mercury. Thus, some

Table 1. Average (±SE) concentrations of aqueous constituents in the fish enclosures, October-December 1991. For each parameter means with the same letter ([a,b,c,d]) are not significantly different (Tukey's Range Test). Values in parentheses are number of observations.

Parameter	Units	Creek Water	Creek Water+ Sediment	Groundwater	Groundwater+ Sediment	Creek Water Polytank Inlet	Creek Water Polytank Outlet
Temperature	°C	17.7±1.0[a] (10)	15.3±0.8[a] (20)	17.9±0.6[a] (10)	15.1±0.7[a] (20)	-	16.4±1.2[a] (9)
Dissolved Oxygen	mg/L	10.6±0.6[a] (10)	7.5±0.2[c] (18)	7.7±0.2[c] (10)	7.3±0.2[c] (18)	-	9.1±0.3[b] (9)
Conductance	μS/cm	424±22[b] (10)	459±11[b] (20)	572±6.9[a] (10)	560±3.7[a] (20)	-	456±36[b] (9)
pH		8.5±0.1[a] (10)	8.1±0.1[b,c] (20)	7.9±0.05[c] (10)	7.9±0.04[c] (20)	8.4±0.13[b,c] (9)	8.2±0.10[a,b,c] (9)
Suspended Solids	mg/L	0.8±0.1[b] (10)	3.6±0.4[b,c] (20)	0.7±0.1[b] (10)	1.8±0.2[b] (20)	1.0±0.2[b] (9)	0.9±0.2[b] (9)
Soluble Reactive Phosphate	mg/L	0.22±0.01[a] (3)	0.21±0.02[a,b] (6)	0.14±0.02[a,b] (3)	0.12±0.02[b] (6)	0.20±0.02[a,b] (2)	0.20±0.02[a,b] (2)
Ammonia Nitrogen	mg/L	0.36±0.18[a] (3)	0.34±0.09[a] (6)	0.11±0.04[a] (3)	0.09±0.02[a] (6)	0.48±0.33[a] (2)	0.42±0.29[a] (2)
Dissolved Organic Carbon	mg/L	1.9±0.16[a] (3)	2.2±0.19[a] (6)	1.4±0.23[a] (3)	1.4±0.11[a] (6)	1.7±0.16[a] (2)	1.8±0.17[a] (2)
Chloride	mg/L	25±3.5[a] (3)	20±1.8[a] (6)	17±4.4[a] (3)	21±1.7[a] (6)	19±8.0[a] (2)	16±6.5[a] (2)
Fluoride	mg/L	0.71±0.20[a] (3)	0.90±0.12[a] (6)	0.73±0.14[a] (3)	0.51±0.10[a] (6)	0.64±0.01 (2)	0.62±0.04[a] (2)
Nitrate	mg/L	16±3.3[a,b] (3)	20±1.8[a] (6)	12±1.0[a,b] (3)	10±0.34[b] (6)	15±1.6[a,b] (2)	17±2.1[a,b] (2)
Sulfate	mg/L	46±19[a] (3)	64±5.4[a] (6)	47±6.9[a] (3)	60±3.2[a] (6)	90±51 (3)	67±32[a] (2)

Table 2. Average (±SE) concentrations of aqueous mercury species in the fish enclosures, October-December 1991. For each parameter means with the same superscript letter ([a,b,c,d]) are not significantly different (Tukey's Range Test). Values in parentheses are number of observations.

Parameter	Units	Creek Water	Creek Water+ Sediment	Groundwater	Groundwater+ Sediment	Creek Water Polytank Inlet	Creek Water Polytank Outlet
Total Mercury	μg/L	1.1±0.05[b] (11)	1.2±0.07[b] (22)	0.012±0.001[c] (11)	0.29±0.04[c] (22)	1.5±0.12[a] (9)	1.2±0.09[b] (9)
Dissolved Mercury	μg/L	0.48±0.06[b] (10)	0.16±0.01[c] (20)	0.006±0.001[c] (10)	0.023±0.017[c] (20)	0.76±0.10[a] (9)	0.64±0.08[a,b] (9)
Particulate Mercury	μg/L	0.62±0.06[b] (10)	1.1±0.08[a] (20)	0.006±0.001[d] (10)	0.28±0.05[c,d] (20)	0.76±0.13[a,b] (9)	0.57±0.07[b,c] (9)
Total Methylmercury	ng/L	0.20±0.03[b] (10)	0.46±0.04[a] (20)	0.034±0.006[c] (10)	0.21±0.02 (20)	0.22±0.05[b] (9)	0.15±0.03[b,c] (9)
Dissolved Methylmercury	ng/L	0.09±0.02[a,b] (5)	0.13±0.01[a] (10)	0.026±0.006[b] (5)	0.045±0.011[b] (9)	0.091±0.013[a,b] (4)	0.073±0.022[a,b] (3)
Particulate Methylmercury	ng/L	0.08±0.04[a,b] (5)	0.32±0.06[a] (10)	0.008±0.016[b] (5)	0.13±0.03[a,b] (9)	0.13±0.09[a,b] (4)	0.046±0.067[b] (3)
Total Reactive Mercury	μg/L	0.77±0.18[a] (5)	0.28±0.14[a,b] (10)	0.006±0.002[b] (5)	0.041±0.017[b] (10)	0.78±0.24[a] (4)	0.72±0.19[a] (4)
Suspended Mercury	μg/g	860±140[a] (10)	340±29[b] (20)	12±5.2[b] (10)	170±17[b] (18)	880±170[a] (9)	740±160[a] (9)
Suspended Methylmercury	μg/g	0.12±0.04[a] (4)	0.099±0.020[a] (10)	0.060±0.060[a] (2)	0.082±0.016[a] (8)	0.12±0.07[a] (4)	0.065±0.045[a] (2)
Total Mercury Log K_D	mL/g	6.24±0.10[b] (10)	6.31±0.04[b] (20)	6.09±0.25[b] (9)	7.44±0.11[a] (18)	6.03±0.12[b] (9)	6.03±0.09[b] (9)
Methylmercury Log K_D	mL/g	3.19±0.29[a] (4)	2.83±0.06[a] (10)	3.01±1.6[a] (2)	3.25±0.13[a] (8)	2.93±0.30[a] (4)	2.97±0.13[a] (2)

of the total dissolved mercury could have been converted to dissolved methylmercury during passage through the enclosures. Alternatively, the increased in dissolved methylmercury could have resulted from diffusion of methylmercury from the sediments into the overlying water. Clearly, most of the apparent retention of total dissolved mercury can be accounted for by the proportional increase in particulate mercury between the inlet and outlet.

The average concentrations of total dissolved mercury and dissolved methylmercury were higher in the outlets of the groundwater-treated enclosures than in the inlet but the difference was not statistically significant (5% level). This result suggests that the sediment in these enclosures may have been releasing dissolved mercury forms into the overlying water.

Concentrations of dimethylmercury were measured only twice (October 16 and November 20) with results reported as less than the detection limit (0.002 ng/L) in all samples on both occasions. Dissolved gaseous mercury concentrations (DGM) were also measured only sporadically. Typical creek water inlet concentrations were about 10 ng/L with outlet concentrations somewhat lower. Groundwater concentrations of DGM were less than 1 ng/L in inlet water and slightly higher in outlet water from the enclosures.

Overall, the results of the water chemistry monitoring indicate significant differences in mercury concentrations and speciation were achieved between creek water and groundwater treatments, with few significant differences (e.g., suspended solids) in other water quality parameters.

3.2 CHARACTERISTICS OF SEDIMENT AND SEDIMENT PORE WATER

Table 3 compares measured characteristics of depth-composited sediment in the enclosures. Sediment thickness in the enclosure varied considerably over the range between 6 to 15 cm. Most of the results for the composite samples are relatively uniform among the replicates and among the enclosures. Variability among the replicates was especially high (SE$\geq$mean) for total mercury (Contract Lab results only) in sediment in Enclosure E3, for total mercury in pore water in Enclosures E3 and E4, and for methylmercury in pore water for Enclosure E3. Particle size distributions yield a textural classification of clayey sandy silt, with sand and clay being in about equal proportions. The relatively high content of carbon (organic) suggests that the sediments are moderately high in organic matter content. However, the organic carbon content of lake and stream sediments can be quite variable (Brunskill et al. 1971; Mulholland and Elwood 1982) ranging from less than 1% to as much as 40%.

Average total mercury content of the sediment was very close to the expected 100 μg/g, and methylmercury accounted for about 0.04% of total sediment mercury. Pore water concentrations of total mercury were too variable among the replicates to distinguish if there was a significant difference between groundwater-treated enclosures and creek water-treated enclosures. Total mercury in pore water was slightly lower than dissolved mercury in the overlying water (Table 2) in the creek water-treated enclosures. In contrast, total mercury in pore water in the enclosures receiving groundwater was much higher (5-10X) than dissolved mercury concentrations in the overlying water in these enclosures. Methylmercury in pore water,

Table 3. Selected characteristics (mean±SE, N=3) of sediment (depth composites). For the same variable, means with the same letter ([a,b]) are not significantly different.

Variable	Enclosure E1 (Creek water)	Enclosure E2 (Creek water)	Enclosure E3 (Groundwater)	Enclosure E4 (Groundwater)
% Sand	9.3±2.5[a]	12±2.1[a]	15±0.72[a]	13±4.1[a]
% Silt	79±2.7[a]	76±3.6[a]	74±1.6[a]	76±3.5[a]
% Clay	11±0.32[a]	12±1.6[a]	11±1.0[a]	10±0.96[a]
% Carbon	7.5±0.78[a]	6.6±1.2[a]	6.1±0.44[a]	6.8±0.70[a]
% Sulfur	0.26±0.00[a]	0.27±0.01[a]	0.23±0.04[a]	0.27±0.01[a]
Total Hg (μg/g,DW) ORNL-ACD	90±4.0[a]	89±12[a]	82±7.4[a]	99±8.0[a]
Total Hg (μg/g,DW) Contract Lab	104±7.4[a,b]	92±5.1[a,b]	61±35[b]	126±24[a]
Methylmercury (μg/g,DW) Contract Lab	0.044±0.001[a]	0.037±0.008[a,b]	0.025±0.008[b]	0.042±0.002[a,b]
Total Hg in Pore Water (ng/L)	112±44[a]	123±81[a]	650±880[a]	136±154[a]
Methylmercury in Pore Water (ng/L)	1.4±0.31[a]	1.4±0.24[a]	2.1±4.4[a]	1.4±0.44[a]
Total Hg log K_D	6.0±0.23[a]	6.1±0.39[a]	5.4±0.45[a]	6.3±0.52[a]
Methylmercury log K_D	4.5±0.10[a]	4.4±0.04[a]	4.3±0.35[a]	4.5±0.13[a]

although exhibiting considerable variability among replicate composite cores, was likewise relatively uniform across all four enclosures and was slightly higher than dissolved methylmercury in overlying water (Table 2). Log distribution coefficients (K_Ds) for both total mercury and methylmercury was also relatively constant across all enclosures reflecting no apparent effect of the treatments on this index of partitioning of mercury between water and sediment. However, the K_Ds for total mercury were consistently higher than the K_Ds for methylmercury, suggesting that methylmercury was less tightly bound to sediment than total mercury. This finding contrasts with anecdotal reports from other mercury-contaminated and pristine sites where methylmercury seems to have a higher affinity for sediment than total mercury. No explanation for this observation is obvious at this time.

Results for the cores, which were cut into individual depth horizons are given in Figures 3 and 4. These graphs do not show any obvious differences between the groundwater treatment and the creek water treatment for total mercury in sediment, methylmercury in sediment, total mercury in pore water, dissolved iron in pore water or dissolved manganese in pore water. The high concentrations and depth profiles in dissolved iron and manganese indicate that reducing conditions prevailed in the sediment. The depth profiles in methylmercury in pore water indicate apparently higher methylmercury concentrations at all depths in the core from the enclosure receiving groundwater. Because this difference was not apparent in the replicate depth-composited cores (Table 3), this depth profile in methylmercury may be unrepresentative. On the other hand the profile maybe suggesting that methylation rates were higher (or demethylation rates were lower) in the enclosures receiving groundwater.

The sediment pore water data will be analyzed further, and additional data acquired, prior to the issuing final report on this project. Methylation of sediment-bound mercury would be the main, if not the only source of methylmercury in EFPC if the continuing releases of inorganic mercury from the Y-12 Plant are curtailed.

3.3 COMPARISON OF FISH UPTAKE RATES WITH MERCURY COMPARTMENTALIZATION

As discussed previously, aqueous phase mercury monitoring was terminated after nine weeks at the planned end of the experiment. Because of much lower than expected mortality in the experimental fish, fish sampling was continued for an additional nine weeks in the instream enclosures. Full collections of five fish per treatment were obtained on all but the final sampling date. Therefore, mercury uptake rates were calculated using 1) the original planned exposure period of nine weeks, 2) the longest complete data set containing five fish per treatment, and 3) the entire 18 week period, containing incomplete collections. Uptake rates were determined by linear regression of total mercury concentration in fish (μg/g, wet weight) versus time (hours). Results are presented in Table 4 and Figures 7 and 8.

The rates of mercury accumulation in fish were low in all treatments (Figures 7 and 8). Linear regressions of mercury concentration in fish versus time were statistically significant (slope$\neq$0, $p \leq 0.05$) for all treatments receiving creek water inputs, and not significant for all treatments receiving groundwater inputs, irrespective of which time periods were used for the

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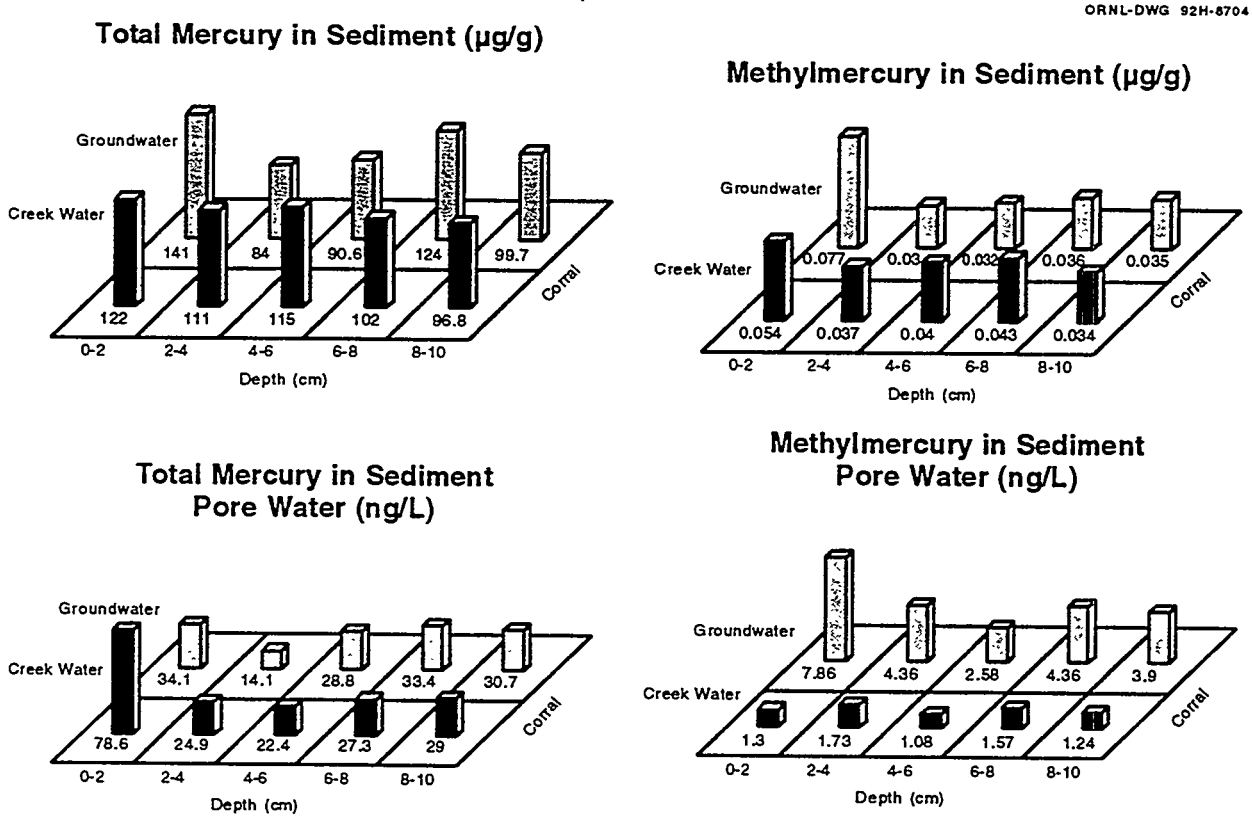

Fig. 3. Total mercury and methylmercury concentrations in sediment and pore water cores as a function of depth in sediment.

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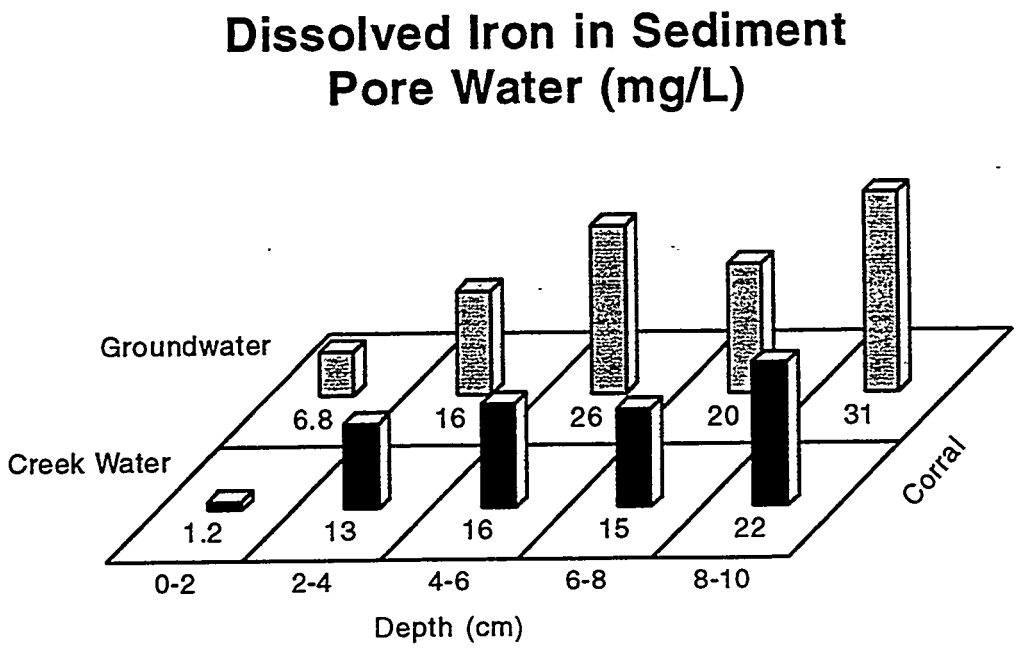

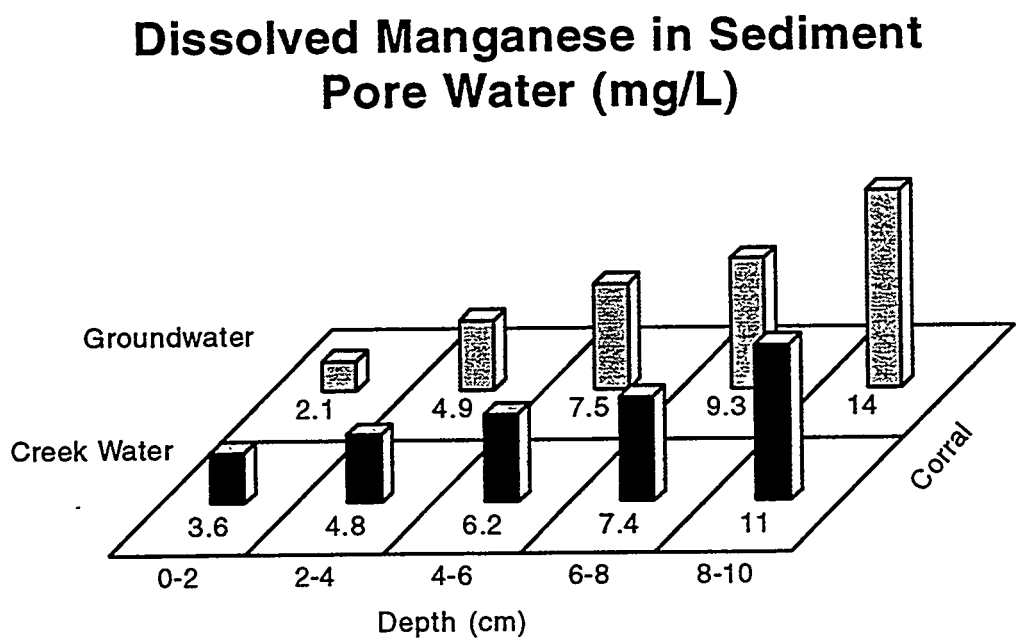

Fig. 4. Dissolved iron and manganese in pore water of sediment cores as a function of depth in sediment.

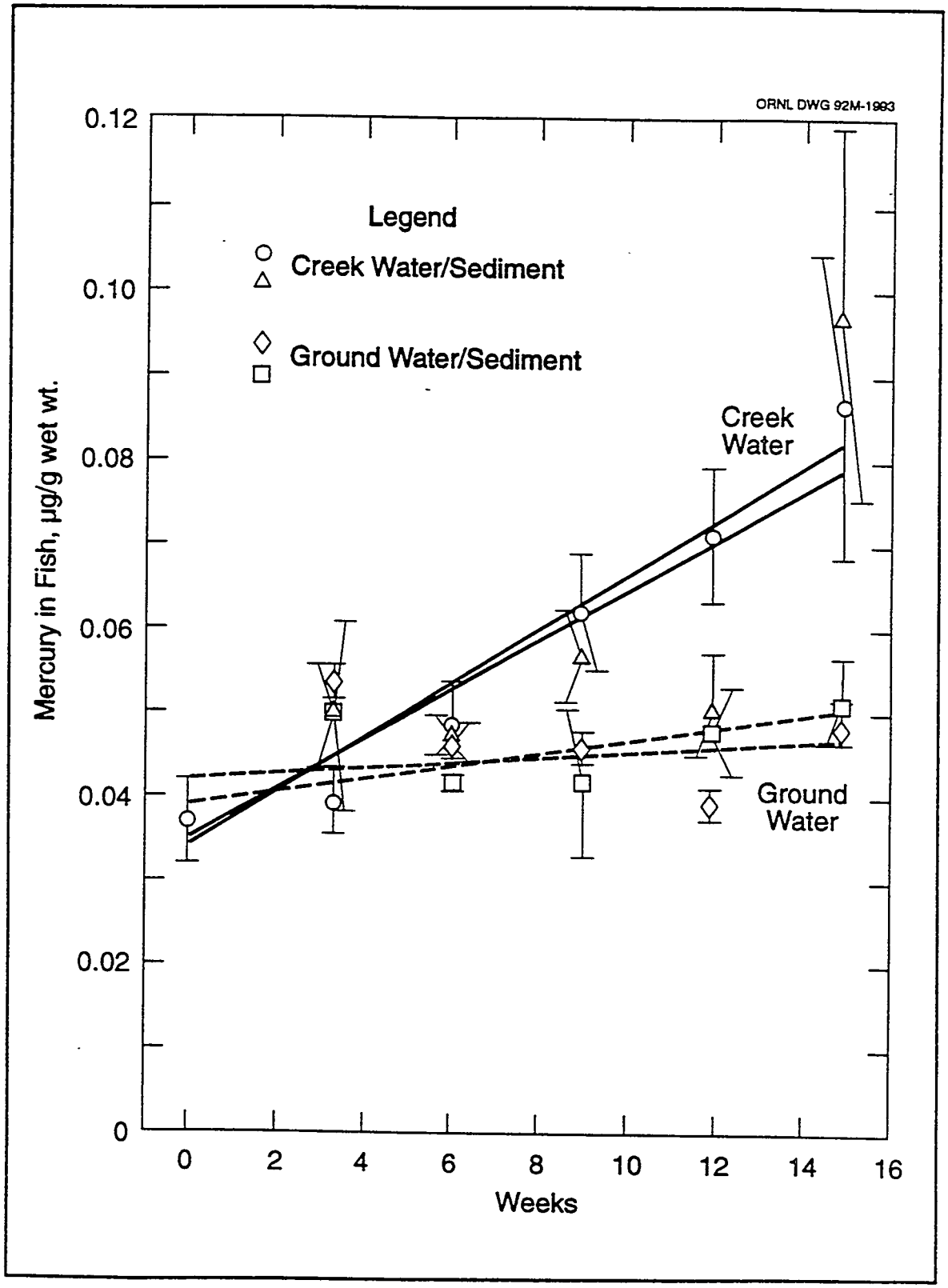

Fig. 5. Fish concentration of mercury as a function of exposure time for sediment-containing enclosures. Lines are best-fit regressions and standard errors.

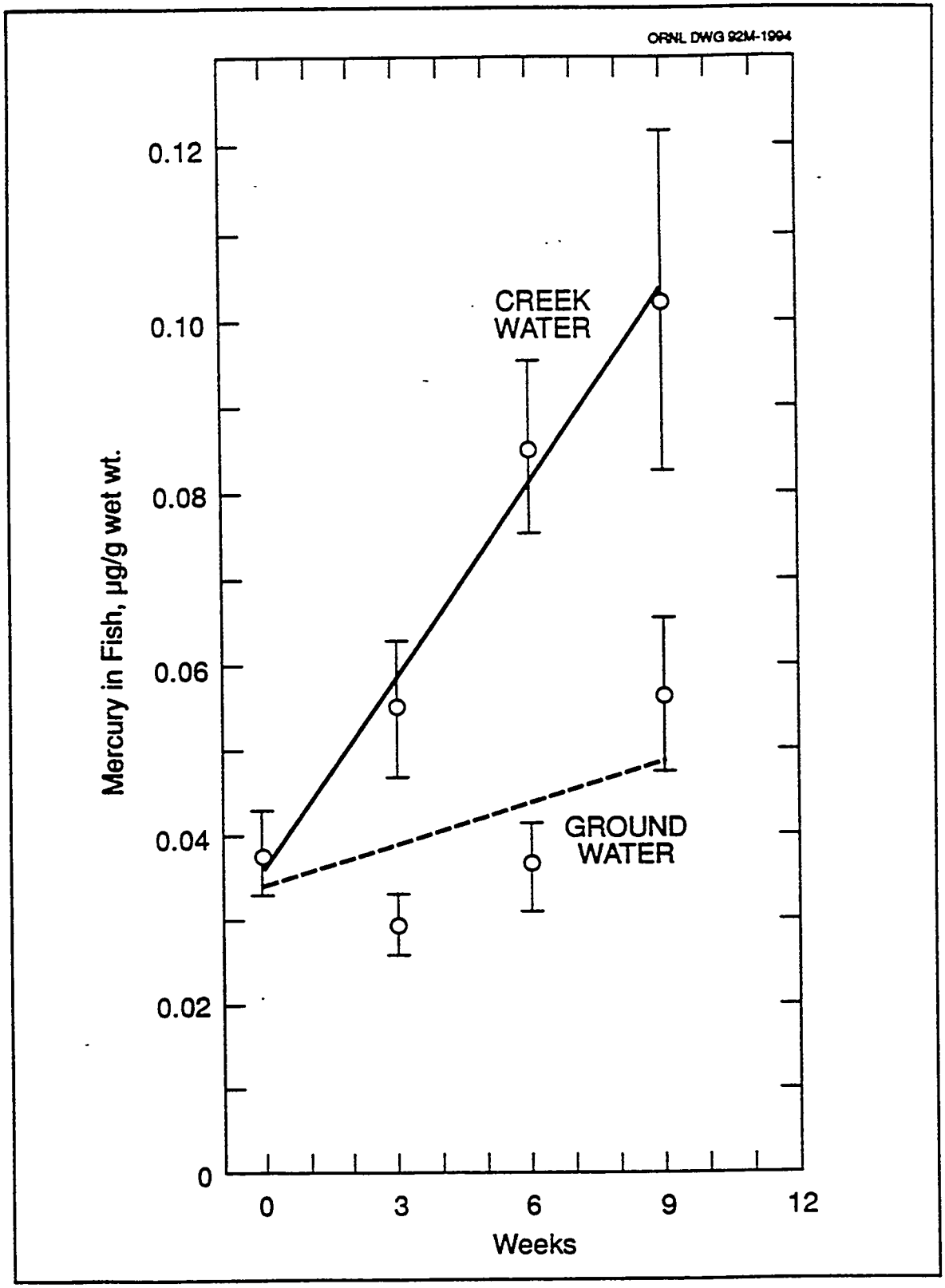

Fig. 6. Fish concentration of mercury as a function of exposure time for the water only treatments. Lines are the best-fit regressions and standard errors.

Table 4. Rates of Hg Accumulation in Hybrid Sunfish in Corrals
($\mu g\ g^{-1}\ h^{-1} \times 10^{-5}$)

Treatment	Exposure Period		
	9 Weeks	15 Weeks	18 Weeks
Groundwater + Sediment	0.26	0.39	0.38
Groundwater + Sediment	0.56	0.16	0.09
Creek Water + Sediment	1.5	1.9	1.5
Creek Water + Sediment	1.1	1.7	1.1
Groundwater Only	0.90	-	-
Creek Water Only	4.3	-	-
Elwood et al. 1987 (Creek Water + Sediment)		21	

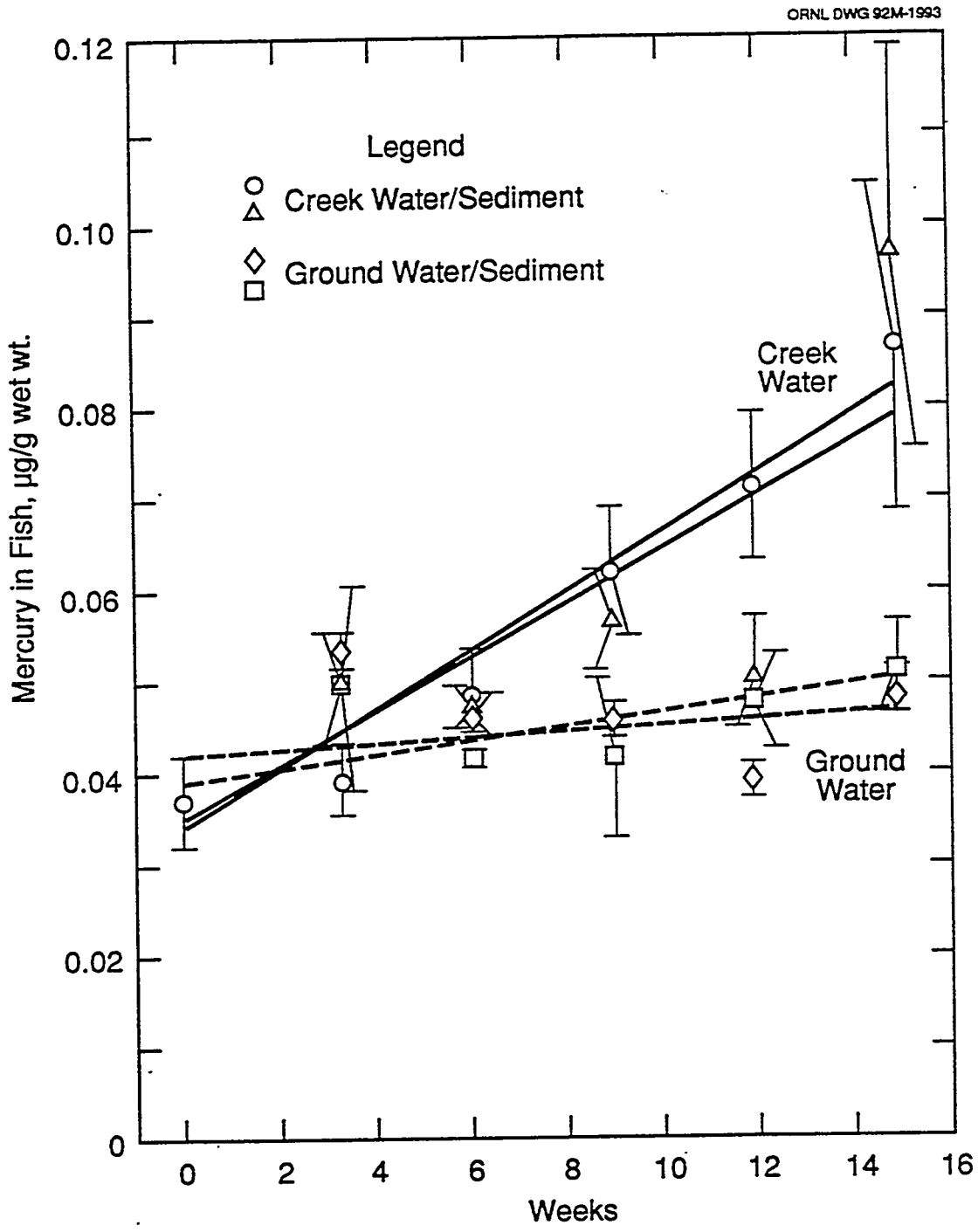

Fig. 7. Fish concentration of mercury as a function of exposure time for sediment-containing enclosures. Lines are best-fit regressions and standard errors.

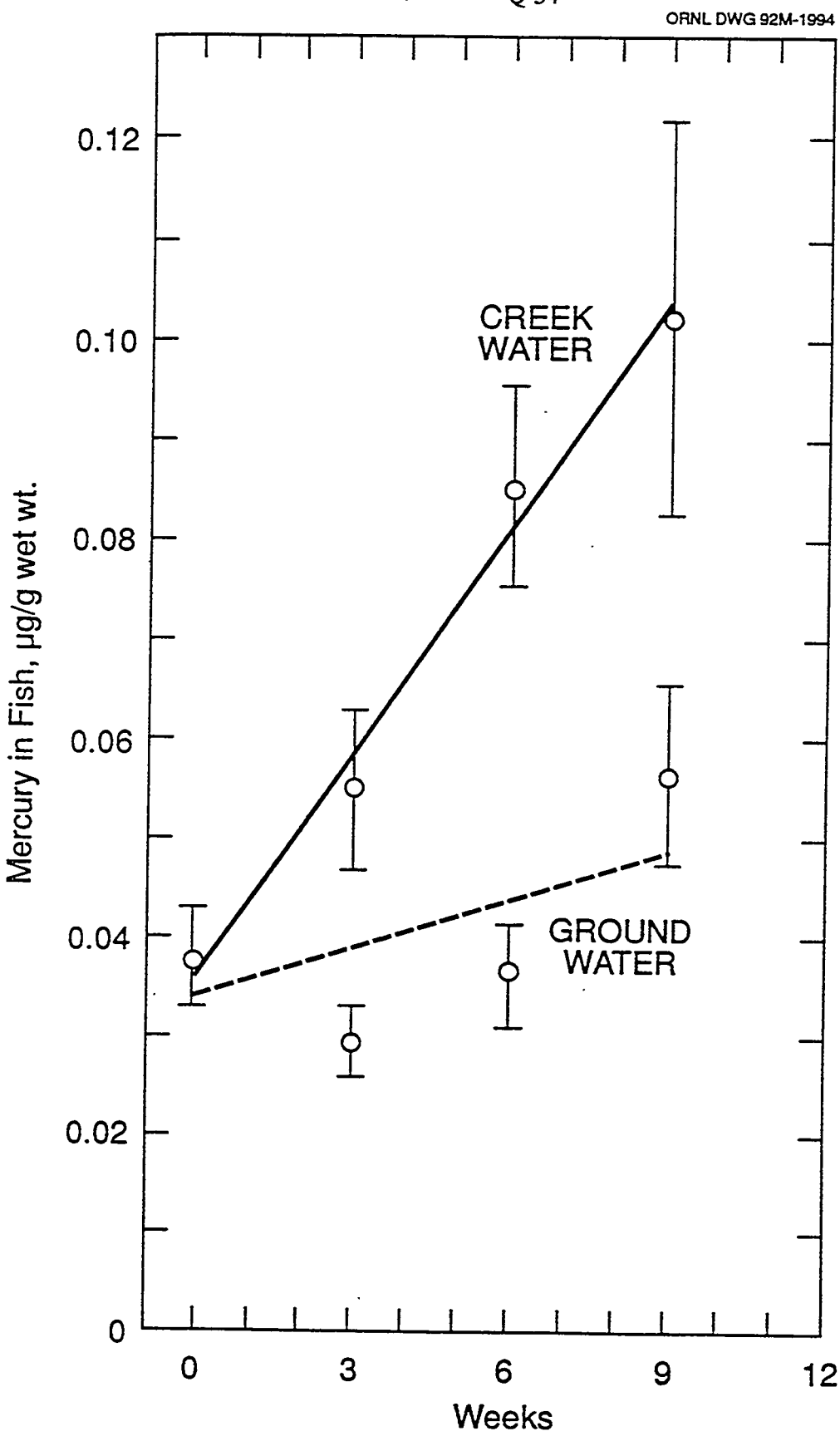

Figure 8. Fish concentration of mercury as a function of exposure time for the water only treatments. Lines are the best-fit regressions and standard errors.

comparisons. Mercury accumulation rates in the duplicate creek water/sediment enclosures (1.9 and 1.7×10^{-5} $\mu g\ g^{-1}\ h^{-1}$, 15-week exposure) were substantially higher than those measured in the groundwater/sediment enclosures (0.39 and 0.16×10^{-5} $\mu g\ g^{-1}\ h^{-1}$). The highest accumulation rate, 4.3×10^{-5} $\mu g\ g^{-1}\ h^{-1}$, was measured in the creek water only treatment. Surprisingly, mercury accumulation ($0.90 \times$ 10-5 $\mu g\ g^{-1}\ h^{-1}$) was also noted in fish in the groundwater only treatment.

Aqueous mercury species varied considerably among treatments (Table 4). Total waterborne mercury was highest in the treatments receiving mercury contaminated creek water, and lowest in the groundwater only treatment. Dissolved aqueous mercury was highest in the creek water only enclosure, and much lower in the creek water/sediment enclosures, reflecting the sequestering of dissolved mercury by particulate materials and plants. Dissolved mercury was very low in the treatments receiving groundwater inputs. Reactive (stannous chloride reducible) mercury roughly paralleled dissolved mercury, except for being somewhat higher in the groundwater/sediment treatments. Methylmercury (total, particulate, and dissolved) was highest in the creek water/sediment treatment, but the differences among treatments (except groundwater only) were not large.

Potential food materials contained substantial amounts of total mercury, but only animal prey items contained high concentrations of methylmercury (Table 5). Larger prey (snails, damselflies) were rapidly decimated by the sunfish after their introduction. Thereafter, sunfish fed extensively on rooted aquatic plants and algae, which were quite high in total mercury in all treatments except groundwater only but low in methylmercury (Table 6). October through January is not normally a period of substantial growth for sunfish, however water temperatures in upper EFPC are substantially warmer than natural streams at that time of year and may induce a longer than normal growing season. Fish in all treatments except groundwater+sediment exhibited little change in weight ($<10\%$) over the course of the study (Table 7). Those in the remaining treatment grew about 30% over the period.

3.4 SOURCES OF ACCUMULATED MERCURY

3.4.1 Pathways

The most likely pathways of mercury accumulation in this experiment were direct uptake of dissolved inorganic mercury and/or dissolved methylmercury from water and ingestion of food containing methylmercury and/or inorganic mercury. Estimates of the rates of mercury accumulation via a specific pathway can be made by multiplying the concentration of methylmercury (or inorganic mercury) in the media of concern (such as food) by an estimated rate coefficient (for food, an estimate of how much food a fish eats per day). By comparing estimated mercury accumulation rates for specific pathways, we can get some idea of the relative importance of various pathways of mercury bioaccumulation in the experimental system. Laboratory measurements of uptake rate coefficients (uptake rate, $\mu g\ g^{-1}\ h^{-1}$, divided by nominal dissolved mercury or methylmercury concentration, $\mu g\ g^{-1}$) have been measured for both methylmercury and inorganic mercuric salts in a variety of freshwater fish species. Observed rate coefficients for methylmercury range from 1.3 to 65 h^{-1} (Boudou et al. 1979, Burkett 1974,

Table 5. Mean (±SE) Aqueous Concentrations (ng/L) of Mercury Species In Fish Corrals, October-December 1991

	Treatment			
	Groundwater + Sediment	Creekwater + Sediment	Groundwater Only	Creekwater Only
Total Hg	290±40	1200±70	12±1	1200±90
Dissolved Hg	23±17	160±10	6±1	640±80
Total CH_3Hg	0.21±0.02	0.46±0.04	0.034±0.006	0.15±0.03
Dissolved CH_3Hg	0.045±0.011	0.13±0.01	0.026±0.006	0.073±0.022

Table 6. Mercury and methylmercury concentrations (μg/g dry wt) in sunfish food materials from each experimental treatment.

Sample	Treatment	Date Sampled	Total Mercury	Methylmercury
Macrophyte	Creek Water+Sediment	10/15/91	10.3	0.022
Macrophyte	Creek Water+Sediment	10/15/91	9.9	0.025
Macrophyte	Groundwater+Sediment	10/15/91	1.2	0.011
Macrophyte	Groundwater+Sediment	10/15/91	1.3	0.011
Macrophyte	Creek Water+Sediment	11/14/91	25.1	0.041
Macrophyte	Creek Water+Sediment	11/14/91	13.9	0.025
Macrophyte	Groundwater+Sediment	11/14/91	7.8	0.021
Macrophyte	Groundwater+Sediment	11/14/91	21.8	0.028
Macrophyte	Creek Water+Sediment	12/20/91	26.4	0.038
Macrophyte	Creek Water+Sediment	12/20/91	29.3	0.039
Macrophyte	Groundwater+Sediment	12/20/91	6.1	0.007
Macrophyte	Groundwater+Sediment	12/20/91	44.1	0.038
Algal Sludge	Creek Water/Polytank	12/20/91	39.7	0.010
Algal Sludge	Groundwater/Polytank	12/20/91	0.055	0.0006
Periphyton	Creek Water+Sediment	11/14/91	17.2	0.037
Periphyton	Creek Water+Sediment	11/14/91	7.7	0.026
Periphyton	Groundwater+Sediment	11/14/91	4.0	0.007
Periphyton	Groundwater+Sediment	11/14/91	19.8	0.026
Snails	Creek Water+Sediment	10/15/91	5.62	5.46
Snails	Creek Water+Sediment	10/15/91	5.70	5.57
Snails	Groundwater+Sediment	10/15/91	2.56	2.51
Snails	Groundwater+Sediment	10/15/91	2.51	2.41
Damselflies	Creek Water+Sediment	11/15/91	1.54	1.23
Damselflies	Creek Water+Sediment	11/15/91	1.46	1.20
Damselflies	Groundwater+Sediment	11/15/91	1.04	0.82
Damselflies	Groundwater+Sediment	11/15/91	0.67	0.48

Table 7. Change (±SE) in Fish Weight Over the Course of the Experiment

Treatment	Fish Weight, g		
	In	Out	Change
Creekwater + Sediment	19.8 ± 4.7	21.4 ± 5.4	+ 1.5
Groundwater + Sediment	18.8 ± 4.9	24.6 ± 7.3	+ 5.8
Creekwater Only*	21.5 ± 4.5	20.4 ± 4.5	- 1.1
Groundwater Only*	19.9 ± 4.1	21.5 ± 4.1	+ 1.6

* Mean exposure period 6 weeks vs 10.5 weeks for other treatments

Burrows and Krenkel 1973, Curtis et al. 1977, Elwood et al. 1988, Huckabee et al. 1976, Kramer and Neidhart 1975, Olson et al. 1973, Olson et al. 1975, Ribeyre and Boudou 1984) with the lower rates being measured in sunfish at 9°C (Curtis et al. 1977) and the higher rates in trout at warmer temperatures (Olson et al. 1973, Ribeyre and Boudou 1984). A value of 4 h^{-1} was observed for bluegill at 24°C (Burrows and Krenkel 1973). This value was conservatively assumed to be representative of this experiment. Uptake coefficients for inorganic mercury in fish ranged from 2.1 to 25 h^{-1} (Kramer and Neidhart 1975, Kudo 1976, Neuman and Doubet 1989, Olson et al. 1973, Ribeyre and Boudou 1984), but were 4 to 13 times lower than coefficients for methylmercury in experiments where both mercury species were studied by the same researchers on a single species of fish (Olson et al. 1973, Ribeyre and Boudou 1984, Kramer and Neidhart 1975). Therefore, a value of 0.4 h^{-1} was assumed to typify conditions in this experiment. If the assumed uptake rate coefficient for methylmercury (4 h^{-1}) is multiplied by the measured concentrations of dissolved methylmercury in the experimental enclosures, estimated uptake rates ranging from 0.01 to 0.05 $\times 10^{-5}$ $\mu g\ g^{-1}\ h^{-1}$ are obtained. (An example of uptake rate calculation is presented in Table 8). These values are far below the actual observed uptake rates (0.2 to 1.8 $\times 10^{-5}$ $\mu g\ g^{-1}\ h^{-1}$).

A similar estimation of uptake rates using dissolved inorganic mercury concentrations yields estimates closer to observed rates, and suggests that this pathway may account for some of the observed mercury accumulation. Uptake rates calculated in this way ranged from 0.2 to 26 $\times 10^{-5}$ $\mu g\ g^{-1}\ h^{-1}$, with the highest rate occurring in the creek water only treatment and the next highest rate (6.4 $\times 10^{-5}$ $\mu g\ g^{-1}\ h^{-1}$) in the creek water/ sediment treatment. The relative differences between estimated uptake rates in the creek water only, creek water/sediment, and the groundwater/sediment treatments (26 vs 6.4 vs 0.24 $\times 10^{-5}$ $\mu g\ g^{-1}\ h^{-1}$) were roughly comparable to those actually observed (4.3 vs 1.8 vs 0.28 $\times 10^{-5}$ $\mu g\ g^{-1}\ h^{-1}$). In the groundwater only treatment, the calculated uptake rate (0.24 $\times 10^{-5}$ $\mu g\ g^{-1}\ h^{-1}$) was lower than the observed rate (0.9 $\times 10^{-5}$ $\mu g\ g^{-1}\ h^{-1}$), unlike the other treatments, in which calculated rates exceeded observed rates. Thus while direct uptake of methylmercury from water by fish does not appear to account for the observed rates of mercury accumulation, it appears that the direct uptake of inorganic mercury can account for the experimental observations.

Most of the food ingested by the sunfish in this study appeared to be plant material and its associated microfauna. Relative high ingestion rates of such low value food would be required to maintain fish, therefore a daily ingestion rate of dry plant material equivalent to 5% of the fish's wet weight was used to calculated mercury accumulation from this source. Assuming an assimilation efficiency of 80% (Norstrom et al. 1976) and mean methylmercury contents of plant material from Table 6, this ingestion rate would yield mercury accumulation rates ranging from 6.0 $\times 10^{-5}$ $\mu g\ g^{-1}\ h^{-1}$ in the creek water/sediment treatment to 1.0 $\times 10^{-6}$ $\mu g\ g^{-1}\ h^{-1}$ in the groundwater only treatment. The six fold difference in measured uptake rates between the two sediment-containing treatments was not duplicated in the estimate based on the ingestion of plant material, in which the calculated rates (6.0 vs 3.8 $\times 10^{-5}$ $\mu g\ g^{-1}\ h^{-1}$) differed relatively little. A similar calculation using inorganic mercury concentrations in plants estimates very high uptake rates (3.3 - 6.6 $\times 10^{-2}$ $\mu g\ g^{-1}\ h^{-1}$) in all treatments except groundwater only. Apparently assimilation efficiency of mercury via this pathway must be very low. As was the case for methylmercury, the estimated uptake rates (3.0 vs 2.2 $\times 10^{-2}$ $\mu g\ g^{-1}\ h^{-1}$) do not differ between sediment containing treatments nearly to the degree they did experimentally.

Table 8. Example of Calculated Mercury Uptake Rates for Creekwater + Sediment Treatments ($\mu g\ g^{-1}\ h^{-1} \times 10^{-5}$)

Source	Concentration ($\mu g/g$)	Uptake Coefficient (assumed)	Uptake Rate	
			Predicted	Observed
CH_3Hg (dissolved)	0.13×10^{-6}	$4\ h^{-1}$	0.052	1.3
Hg (dissolved inorganic)	0.16×10^{-3}	$0.4\ h^{-1}$	6.4	1.3
CH_3Hg (plants)	0.032	$0.0021\ h^{-1}$	6.7	1.3
CH_3Hg (animals)	3.4	$0.00042\ h^{-1}$	142	1.3

Methylmercury concentrations in prey (snails and damselflies) differed by about a factor of two between creek water/sediment and groundwater/sediment treatments. An ingestion rate of 1/5 that used for plant material was used to estimate mercury uptake via this pathway. Methylmercury concentration of prey was estimated as the average of concentrations in snails and damselflies. Calculated mercury accumulation rates of 5.7 and 2.7×10^{-3} $\mu g\ g^{-1}\ h^{-1}$ were obtained for the two sediment treatments. These rates were far higher than observed and differed little between treatments. The populations of these prey species in the enclosures were rapidly decimated by the fish, and prey availability was certainly too low to sustain this accumulation rate. However, methylmercury in invertebrates has the potential to be a major source of mercury bioaccumulation in this study and in EFPC.

3.4.2 Speciation of Accumulated Mercury

Methylmercury accounted for more than 75% of the mercury in fish from all treatments except the creek water only treatment (Table 9). Methylmercury has been found to be the predominant form in which mercury occurs in wild fish in most studies (Huckabee 1979;Bloom 1992), thus these results are not atypical. Fish in the creek water only treatment accumulated mercury at the fastest rate observed in this study (Table 3), and were also exposed to the highest average concentrations of dissolved inorganic mercury in water (Table 4). Methylmercury comprised only 28% of the mercury accumulated by fish in the creek water only exposure. Thus, it would appear that much of the mercury accumulation observed in that particular treatment was a result of direct uptake of inorganic mercury from water. This pathway undoubtedly was also operating in the creek water/sediment treatment, but because of the lower dissolved inorganic mercury concentrations in water and the presumed greater availability of food-derived methylmercury, an atypical methylmercury/total mercury ratio did not develop in the fish.

3.4.3 Role of Sediments as Source

Despite very high concentrations of mercury in sediments in the enclosures, there was no evidence that mercury from that source was accumulated by fish in this experiment. Although much of the mercury associated with rooted vegetation and periphyton may have been from resuspended sediments or accumulated from sediments, if this had been a major source of mercury to fish uptake rates would have been similar in all sediment-containing enclosures. The observation that mercury accumulation rate was higher in the groundwater only treatment than in the groundwater/sediment enclosures suggests that the sediment and associated plant growth acted more as a sink for biologically available mercury than as a source.

3.4.4 Relationship of Observed Accumulation Rates to Actual Mercury Bioaccumulation in East Fork Poplar Creek

If the mercury accumulation rates observed in the enclosures that most closely mimic actual conditions in East Fork Poplar Creek (the creek water/sediment treatment) are extrapolated to a one year exposure, a mercury concentration of 0.15 $\mu g/g$ would be predicted. This is approximately 20% of the average mercury concentration of sunfish inhabiting the upper part of the creek (Kornegay et al. 1990). Mercury accumulation rates measured in caged hybrid sunfish held in upper East Fork Poplar Creek in summer 1987 were 10 fold higher than those observed

Table 9. Speciation of Mercury in Fish Muscle

Treatment	N	Total Hg (μg/g)	CH_3Hg (μg/g)	% CH_3Hg
Groundwater + Sediment	10	0.041	0.035	85
Creek Water + Sediment	10	0.052	0.040	76
Groundwater Only	2	0.032	0.028	88
Creek Water Only	5	0.094	0.027	28

in this study (Elwood et al. 1987). The low mercury accumulation rates observed in the 1991 enclosure study thus appear to underestimate average annual conditions in the stream. Possible reasons for this include a strong seasonal variation in rates of methylmercury production and bioaccumulation, with most of the mercury accumulation occurring during the summer months when water temperatures are higher. Another possibility is that the low availability of high quality food (animal prey) in the enclosures resulted in underrepresentation of the food chain pathway as a source of mercury to fish.

4. CONCLUSIONS

This experiment provided no evidence that sediment-associated mercury was either a direct or indirect source of mercury accumulation in fish. Little accumulation of mercury was observed in the ground water/sediment treatments, and accumulation rates were similar to that in the groundwater only treatment. The most likely sources of mercury accumulated by fish in this study were direct uptake of dissolved inorganic mercury, and ingestion of food containing methylmercury. In both cases, aqueous mercury inputs appeared to be the primary source of the mercury that was ultimately accumulated.

The concentrations of dissolved and total methylmercury in the water in all treatments was too low to account for the observed accumulation rates. Dissolved inorganic mercury concentrations were high enough to account for the observed rate of mercury accumulation, and varied among treatments in a pattern consistent with the observed variation in uptake rates. Thus, dissolved inorganic mercury was highest in the treatment having the highest mercury accumulation rate, and lowest in the treatment having the lowest accumulation rate. The concentrations of methylmercury in food were high enough to easily account for the observed rates of mercury accumulation in fish, but could not explain differences among treatments. Methylmercury concentrations in food differed only by a factor of two between creekwater/sediment and groundwater/sediment treatments, while accumulation rates differed by a factor of six.

If the low rates of mercury accumulation observed in all treatments in this study are not a consequence of insufficient food supply, the results imply that bioaccumulation of mercury by fish in upper EFPC is a highly seasonal process that is relatively insignificant during the winter. Extrapolation of the observed accumulation rates to a one year exposure predict concentrations of mercury in fish much lower than those found in wild fish in upper EFPC, and the accumulation rates measured in caged fish in summer in upper EFPC exceeded those in this study by ten fold. Aqueous methylmercury concentrations in the experimental enclosures were considerably lower throughout the study than were typical of Lake Reality in summer 1991. At higher temperatures, increased methylmercury production and higher fish metabolism may combine to result in substantially higher mercury accumulation rates than those observed in the Oct - Feb period.

The accumulation of inorganic mercury in fish has received little study, based on assumptions and observations that mercury in fish in EFPC was predominantly methylmercury. Results of this study indicate that such an assumption is unwarranted in EFPC upstream from Lake Reality, where fish have only recently been reintroduced, and inorganic mercury may make up a substantial fraction of the total mercury burden in fish.

5. FUTURE WORK

The experimental work completed in the period October 1991-February 1992 was repeated, with some minor modifications during the period June 1992-August 1992. The chief modifications involved: (1) reducing the initial biomass of fish placed in each enclosure to 100 to 300 grams, (2) adding two enclosures which will receive each water type but which will not receive fish, (3) increasing the volume of the polytanks to better match the enclosures containing sediment, and (4) relocating the polytank receiving creek water to a position adjacent to the enclosure. Reducing the number of fish increased the reality of the experiment by allowing more realistic survival of food organisms and reducing the bioturbation caused by overstocking. At 100 to 300 grams of fish per enclosure the stocking rate was close to fish biomass levels characteristic of ponds and reservoirs. Increasing the volume of the polytanks also increased the realism of the experiment and allowed more direct comparison between the water-only treatments and the water plus sediment treatments. Two enclosures were added both to allow some evaluation of the performance (e.g., production/transformation of mercury species) of the enclosures in the absence of fish and to allow cultivation fish food organisms for sampling without the pressure of predation. Placing the creek water only polytank adjacent to the enclosures permitted pumping water of identical composition through both this polytank and three of the enclosures.

REFERENCES

Bloom, N. S. and Fitzgerald 1987. "Determination of Volatile Mercury Species at the Picogram Level by Low-Temperature Gas Chromatography with Cold-Vapour Atomic Fluorescence Detection," *Anal. Chim. Acta*, 208:151-161.

Bloom, N. S. 1989. "Determination of Picogram Levels of Methylmercury by Aqueous Phase Ethylation, Followed by Cryogenic Gas Chromatography with Cold Vapor Atomic Fluorescence" *Can. J. Fish. Aq. Sci.*, 46:1131-1140.

Bloom, N. S. 1992. "On the Chemical Form of Mercury in Edible Fish and Marine Invertebrate Tissue," *Can. J. Fish. Aq. Sci.*, 49:1010-1017.

Brunskill, G. J., Povoledo, D., Graham, B. W. and Stainton, M. P., "Chemistry of Surface Sediments of Sixteen Lakes in the Experimental Lakes Area, Northwestern Ontario," *J. Fish. Res. Board Can.*, 28:277-294.

Boudou, A., Delarche, A., Ribeyre, F., and Marty, R. 1979. "Bioaccumulation and Biomagnification of Mercury Compounds in a Second Level Consumer, *Gambusia affinis* - Temperature Effects," *Bull. Environ. Contam. Toxicol.*, 22:813-818.

Burkett, R. D. 1974. "The Influence of Temperature on the Uptake of Methylmercury-203 by Bluntnose Minnows, *Pimephales notatus* (Rafinesque)," *Bull. Environ. Contam. Toxicol.*, 12:703-709.

Burrows, W. D. and Krenkel; P. A. 1973. "Studies on the Uptake and Loss of Methylmercury-203 by Bluegills (*Lepomis macrochirus* Raf.)," *Environ. Sci. Technol.*, 7:1127-1130.

Curtis, E. H., Beauchamp, J. J., and Blaylock, B. G. 1977. "Application of Various Mathematical Models to Data from the Uptake of Methylmercury in Bluegill Sunfish (*Lepomis macrochirus*)," *Ecological Modelling*, 3:273-284.

Elwood, J. W., Turner, R.R., Cook, R.B., and Bogle, M.A. 1988. "Behavior and Fish Uptake of Mercury in a Contaminated Stream," *Proceedings, 6th International Conference on Heavy Metals in the Environment*, New Orleans, La., Sept. 15-18, 1987, CEP Consultants Ltd., Edinburgh, U.K.

Feldman, C. 1974. "Perchloric Acid Procedure for Wet-ashing Organics for the Determination of Mercury (and Other Metals)," *Anal. Chem.*, 46:1606-??.

Hinzman, R. L., (ed.) 1992. "Second Report on the Y-12 Plant Biological Monitoring and Abatement Program for East Fork Poplar Creek." Draft ORNL/TM Report. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 391 pp.

Huckabee, J. W., Elwood, J. W., and Hildebrand, S. G. 1979. "Accumulation of mercury in freshwater biota", pp. 277-302 IN (Nriagu, J. O., ed.), *The Biogeochemistry of Mercury in the Environment*, Elsevier/North Holland Biomedical Press, NY.

Huckabee, J. W., Goldstein, R. A., Janzen, S. A., and Woock, S. E. 1976. "Methylmercury in a Freshwater Foodchain," *Symposium Proceedings: International Conference on Heavy Metals in the Environment. Vol. II, part 1*, Toronto, Ontario, Canada.

Kornegay, F. C., West, D. C., Goodpasture, S. T., Kimbrough, C. W., Tardiff, M. F., Jacobs, V. A., and Wilson, A. R. 1990. "Oak Ridge Reservation Environmental Report for 1989". ES/ESH-13/V1. Office of Environmental Compliance and Documentation, Oak Ridge National Laboratory, and Environmental Management Staff, Oak Ridge Y-12 Plant and Oak Ridge Gaseous Diffusion Plant, Martin Marietta Energy Systems, Inc., Oak Ridge, Tennessee.

Kramer, H. J. and Neidhart, B. 1975. "The Behaviour of Mercury in the System Water-Fish," *Bull. Environ. Contam. Toxicol.*, 14:699-704.

Kudo, A. 1976. "Mercury Transfer from Bed Sediments to Freshwater Fish (Guppies)," *J. Environ. Qual.*, 5:427-430.

Mulholland, P. J. and Elwood, J. W. 1982. "The Role of Lake and Reservoir Sediments as Sinks in the Perturbed Global Carbon Cycle," *Tellus*, 34:490-499.

Newman, M. C., and Doubet, D. K. 1989. "Size-dependence of Mercury (II) Accumulation Kinetics in the Mosquitofish, *Gambusia affinis* (Baird and Girard)," *Arch. Environ. Contam. Toxicol.*, 18:819-825.

Norstrom, R. J., McKinnon, A. E., and deFreitas, A. S. W. 1976. "A Bioenergetics Based Model for Pollutant Accumulation by Fish. Simulation of PCB and Methylmercury Residue Levels in Ottawa River Yellow Perch (*Perca flavescens*)," *J. Fish. Res. Board Can.*, 33:248-267.

Olson, K. R., Bergman, H. L., and Fromm, P. O. 1973. "Uptake of Methylmercuric Chloride and Mercuric Chloride by Trout: A Study of Uptake Pathways into the Whole Animal and Uptake by Erythrocytes in vitro," *J. Fish. Res. Board Can.*, 30:1293-1299.

Olson, G. F., Mount, D. I., Snarski, V. M., and Thorslund, T. W. 1975. "Mercury Residues in Fathead Minnows, *Pimephales promelas* Rafinesque, Chronically Exposed to Methylmercury in Water," *Bull. Environ. Contam. Toxicol.*, 14:129-134.

Ribeyre, F. and Boudou, A. 1984. "Bioaccumulation et Repartition Tisslaire du Mercure - $HgCl_2$ et CH_3HgCl -Chez *Salmo gairdneri* Apres Contamination Par Voie Directe," *Water, Air, and Soil Pollution*, 23:169-186.