#3259

Water Concentration

Y/TS-1610 MS

UNION CARBIDE CORPORATION
NUCLEAR DIVISION
P. O. BOX Y, OAK RIDGE, TENNESSEE 37830

December 10, 1982

Department of Energy
Oak Ridge Operations
Attention: Mr. H. D. Hickman
Post Office Box E
Oak Ridge, Tennessee 37830

Gentlemen:

FOI Request, Mercury Emissions

Reference is made to J. F. Wing's letter of November 30, 1982, requesting the subject information from the Y-12 Plant Environmental Coordinator, Merwyn Sanders. Enclosed are the mercury water analyses from the outfall of New Hope Pond, the headwaters of East Fork Poplar Creek, from 1954 through 1982.

Questions concerning the enclosed data can be addressed to Merwyn Sanders, telephone 4-3546.

Very truly yours,

Gordon Fee

Gordon G. Fee, Plant Manager
Oak Ridge Y-12 Plant

GGF:MS:eh

Enclosure: Mercury Water Analyses

cc: G. G. Fee
R. F. Hibbs
L. J. Peacock
J. C. White

cc/enc: H. D. Hickman
H. H. Stoner/M. Sanders - RC-[illegible]
J. F. Wing, DOE-ORO

APPROVED FOR PUBLIC RELEASE
O. L. McKenney 11/12/96
Technical Information Office Date

WATER SAMPLE RESULTS TAKEN FROM EAST FORK POPLAR CREEK

(Mercury Mg/L)

Up to 1957--Method of Analysis:
Colorimetric
Limit of Error: ± 50% at 10 mg/L

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1956	.38 .43 .32 .36	<.1 .27 .18 .34	.40 .46 .10 .78 .55	.44 .32 .55 .55	.74 .70 .42 .58	1.03 1.31 .37 .89 .45	1.17 .56 .96 1.32	1.17 .67 1.19 2.31 ~~3.60~~ 3.06	3.6 .8 .8 1.4 ~~3.6~~	.5 1.3 1.1 .48	.94 .74 .71 .79 .96 .94 .78 2.0 1.5 1.1	.74 .87 .71 1.2
1955	.15 Avg.	.59 Avg.	1.09 Avg.	1.48 Avg.	1.98 Avg.	1.93 Avg.	1.06 Avg.	1.05 Avg.	1.28 1.16 1.89 1.07 .84	.44 .33 .73 1.08 ~~.84~~	.74 .71 .79 .96	.23 .40 .57 1.48 .63
1954	-- .2	--	--	.28*	.10*	.23*	.23*	.13*	.54*	.25*	.191*	.14*
1953				← .13 →			← .21 →			← 1.07 →		

*Avg. monthly concentration in EPFC at east end of Y-12 expressed in Mg solvent/liter H_2O

During 1951-1963, water samples were obtained by a Tribullar proportional sampler for mercury in Y-12's industrial ditch. Since 1963, all other results were obtained from the effluent of New Hope Pond.

12-7-82
RTW/MS/eh

MERCURY WATER ANALYSES

WATER SAMPLE RESULTS TAKEN FROM EAST FORK POPLAR CREEK

(Mercury Mg/L)

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1962	--	.28	.26	.16	.10	.06	.01	.02	.01	.06	.06	.06
		.34	.21	.12	.27	.01	.02	.01	.04	.03	.20	.10
		.16	.13	.16	.04	.05	.03	<.01	.04	.04	.06	<1.0
			.20		.01	.02	.003	<.01	.06	.03	.08	<1.0
			.06			.01		<.01			.01	
1961	.05	.07	.16	.20	.12	.06	.26	.36	.42	.32	.10	.09
	.20	.16	.10	.15	.10	.09	~~.08~~ .68	.08	.10	.11	.15	.12
		.28	.09	.10	.09	.07	.05	.17	.18	.08	.13	.05
		.04	~~.18~~ 1.8		.07	.08	.16	.33	.29		.09	.08
									.51			.10
1960	.18	.09	.05	.23	.16	.21	.15	.23	.12	.22	.19	.10
	.04	.17	.51	.24	.12	.19	.16	.18	.14	.27	.27	.13
	.16	.18	.29	.34	.18	~~.15~~ .25	1.99	.16	.33	.15	.61	.15
	.24	.14		.13	.12	.27	.14	.09	.85	.40		.07
				.23			.12 ~~.13~~	.14	~~.14~~			.03
1959	.7	1.6	.68	.9	1.5	.4	~~1.3~~ 1.5	.6	.2	.24	.30	.33
	1.3	1.0	.9	.7	1.1	.3	1.4	1.7	.1	.22	.09	.13
	.7	.7	1.5	1.2	.5	.5	.9	.3	1.7	.21	.10	.14
	.8		.7	1.1	.3	.4	.6	.2	.2	.19	.30	.19
	1.3				.7		.4			.24		.08
1958	1.2	3.4	2.1	4.1	2.6	.9	2.4	.9	1.3	6.0	.75	1.2
	3.1	3.7	3.0	1.5	14.5	1.4	1.3	1.0	1.0	.49	.6	1.0
	2.9	3.2	5.8	3.9	2.10	1.3	2.0	.8	.6	.898	.6	2.4
	3.4		1.3	1.2	2.0	2.3	1.2	1.7	.6	1.67	1.3	.6
	10.7				2.0			1.4		.91		.7
1957	1.7	2.6	2.3	2.54	.920	1.6	3.4	~~4.3~~ 4.4	1.6	.53	1.60	1.40
	.51	1.9	1.7	2.2	3.2	4.12	1.7	5.0	2.0	1.0	2.80	2.80
	1.7	1.7	1.3	4.03	3.8	1.5	7.2	5.2	1.4	2.30	3.40	1.70
	1.17	1.20	1.74	2.0	1.2	2.1	3.8	1.5	1.4	1.30	1.24	2.30
			1.4		3.2	1.5 6/17		.7			1.10	

WATER SAMPLE RESULTS TAKEN FROM EAST FORK POPLAR CREEK
(Mercury Mg/L)

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1970	<.01 <.001	.01	.01 <.0002 <.01 <.0001	.01 <.0002 <.0002	<.01 <.1 <.001	<.01 <.10 <.1 <.0010	<.01 <.1 <.001	<.01 <.10 <.001	<.01 <.1 <.1 <.001	<.01 <.10 <.1	<.01 <.001 <.001 <.0001 <.001	<.01 <.001 <.0001
1969	<.01	<.01 <.0002 <.0004 <.0002	<.01	<.01 <.0002	<.01	<.01 <.0002	<.01 <.0002	.01 <.0002	<.01	<.01 <.01	<.01	<.01 <.0002
1968	<.01 .0002 .0002	<.01 <.002 <.0002	.01	.01 <.0002	<.01 <.0002	<.01 <.0002	<.01 <.0002 <.0002	<.01 <.0002	<.01 <.0002 <.002	<.01 <.0002 <.0002	<.01 .0002	<.01 <.0002 <.0002
1967	.05 .05	.05 <.05	.01	.049	.049	<.049 <.05 <.05	<.049	.049 .0002	<.01 <.05 <.0002	<.01 <.0002 <.0002	<.01	<.01 <.0002
1966	<.05	--	--	--	--	--	--	--	--	<.05	<.01	
1965	.	<.05	<.05	<.05		.4115	<.05		.05	<.05	<.05	
1964	.034 .33 .010 .026 .006 .11	.011 .12 .31 .10 .032 .027	.015 .05 .022 .10 .10	.013 <.05 <.050 .010 .010	.004 .013 .013 .021 .05	<.05 .008	.027 June		<.05	<.010	<.05	.05
1963	.016	--	--	--	--	--	--	--	.015 .022 .030 .043 .043 .015 .043 .043	.017 .033 .004 .014 .004 .004 .014 .004	.054 .014 .021 .014 .017 .033	.09 .06

I have reports thru July

I have all 12 reports

WATER SAMPLE RESULTS TAKEN FROM EAST FORK POPLAR CREEK

(Mercury Mg/L)

1957-1973--Method of Analysis:
Mercurometer
Limit of Error: ± 40% at 0.1 mg/L

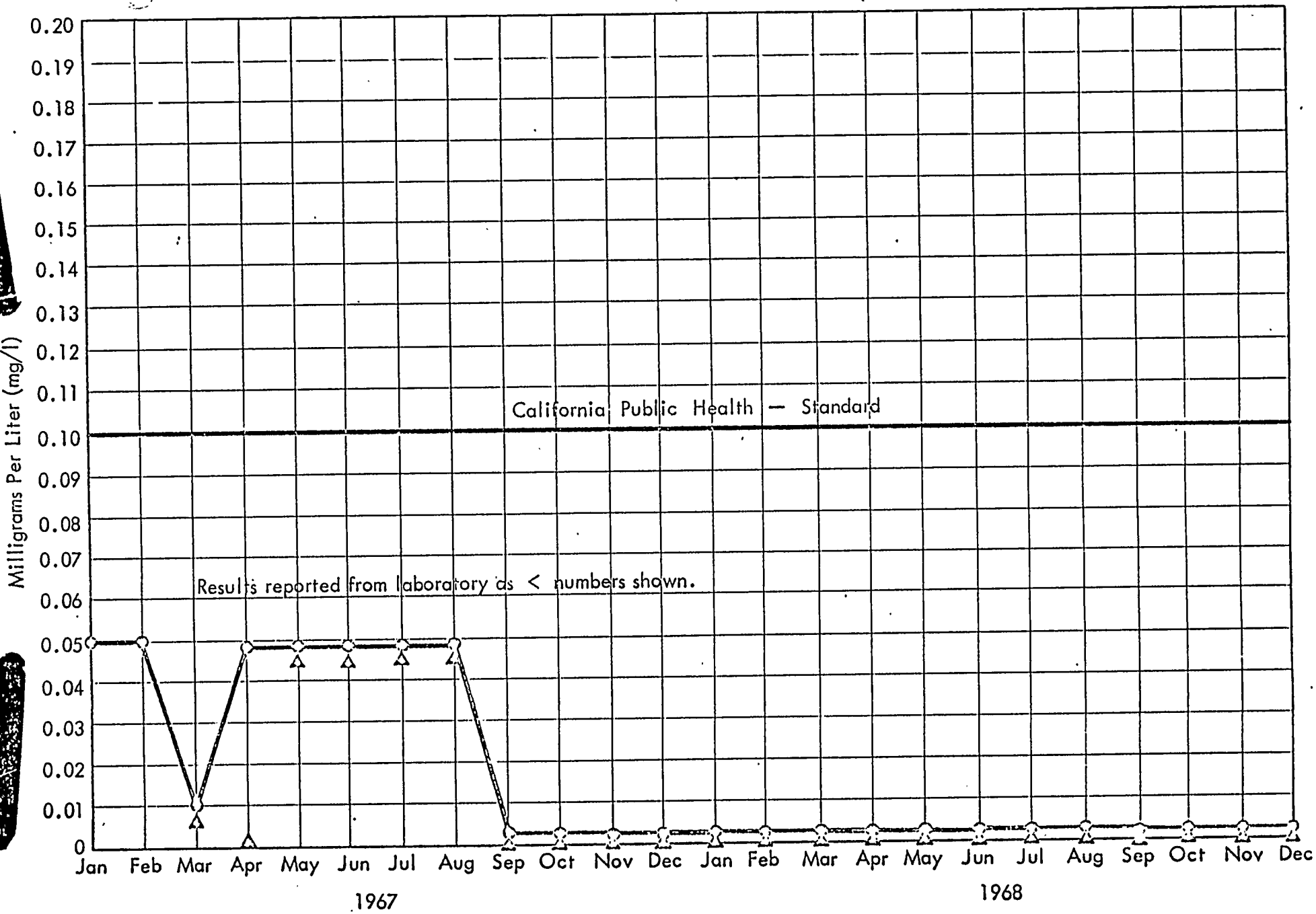
YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1977	.0005	.0013	<.001	<.001	.001	.002	.0015	.003	.0015	<.001	.0049	.0028 .0026 .0028 .0034 .0037
1976	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
1975	.0011 .0020 .0015	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
1974	<.005 <.0005	<.005 <.1	<.1 <.0005	<.0005 <.1	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	<.0005	
1973	--	<.0005 <.1	<.005	--	<.005 .0006	.0003 <.1	<.1	<.0004 .001 <1.0	.0002 <.1	<.0005	<.0005	<.0005 <.0005
1972	<.001 .0002 <.001 .0030 .0005	<.001 <.001	<.001 <.001	.0007 <.0002 .0003 <.0006 <.001 <.0005 <.001 <.0005 .001	.0006 <.001 <.0005 <.001 <.0005 <.001	<.0005 <.0005 <.0005	<.001 <.0005 <.001 <.001	<.0005 <.001 <.0005 <.001 <.0005 <.001	<.0005 <.0005 <.0005	<.0005 <.001 .0005 <.0005 <.001	<.0005 <.001 <.0005 <.001 <.0005 <.001	<.001
1971	<.001 <.001	.012	.039	<.015 <.001 <.001 <.001 <.001	<.01 <.001 <.001 <.001 <.001	<.01 <.0005 <.001 <.0005 <.005 <.001	<.01 .0025 <.0001 <.0001	<.01 <.001 <.001	<.01	<.01 <.001 <.001 <.001 <.001 <.001 <.001	<.01 <.0005 .0075 <.001	<.01 .0015 .0022 .0002 <.0005

WATER SAMPLE RESULTS TAKEN FROM EAST FORK POPLAR CREEK

(Mercury Mg/L)

1974-1982--Method of Analysis:
Flameless Atomic Absorption
Limit of Error: + 20% at 0.001 mg/L
Quality Control Program from 1979 to Present).

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1982	.003	.002	.04	<.001	.001	<.001	.002	.002	.003			
	.003	.002	.002	<.001	.001	<.001	.003	.001	.002			
	.002	.002	.001	.002	.001	.001	.002	.002	.001			
	.002	.002	.001	.001	.001	.001	.001	.001	.002			
			.002									
1981	.003	.003	.001	.002	.004	.001	.001	.002	.001	.001	.001	.001
	<.001	.003	.002	.002	<.001	<.001	.001	.001	.002	.001	.001	.001
	.003	.002	.002	.001	.001	<.001	.001	.002	.002	.001	.001	.001
	.004	.002	.002	.002	<.001	.001	<.001	<.001	.002	.001	.001	.001
			.001			.001			.001			
1980	.002	.002	.002	.002	.002	.002	.001	.001	.001	.002	.002	.002
	.002	.003	.003	.003	.002	.001	.001	.001	.002	.002	.002	.001
	.001	.006	.003	.001	.002	.003	.002	.001	.001	.002	.002	.002
	.002	.002	.001	.001	.002	.003	.004	.002	.001	<.001	.002	.002
	.003		<.001			.002			.001			.003
	.001		.002									
1979	.001	.001	.002	.001	.002	.002	.001	.002	<.001	<.001	.001	.002
	.002	.002	.001	.001	.001	.001	.002	.002	.001	.006	.002	<.001
	.002	.003	.002	.003	.001	.001	.001	.002	.002	.002	.001	.001
	.002		.002	<.001	<.001	.001	.002	<.001	.00118		<.001	.001
	.003		.003	.002			.002					.002
												.002
												.002
1978	.0033	.0038	.0023	.0023	.0008	.0008	.0008	.0015	.006	.0011	.0017	.0020
	.003	.0018	.0007	.0022	.0006	.0010	.0008	.0012	.0006		.0016	.0014
	.0031	.0042	.0010	.0028	<.0005	.0009	.0005	.0015	.0006		<.0005	.0011
	.0037	.0025	.0007	.0018	.0019	.0011	.0005	.0008	.0008		<.0005	.001.
	.0027	.0029					.0017				.0007	
	.0033	.0025										
	.0015	.0027										
		.0019										

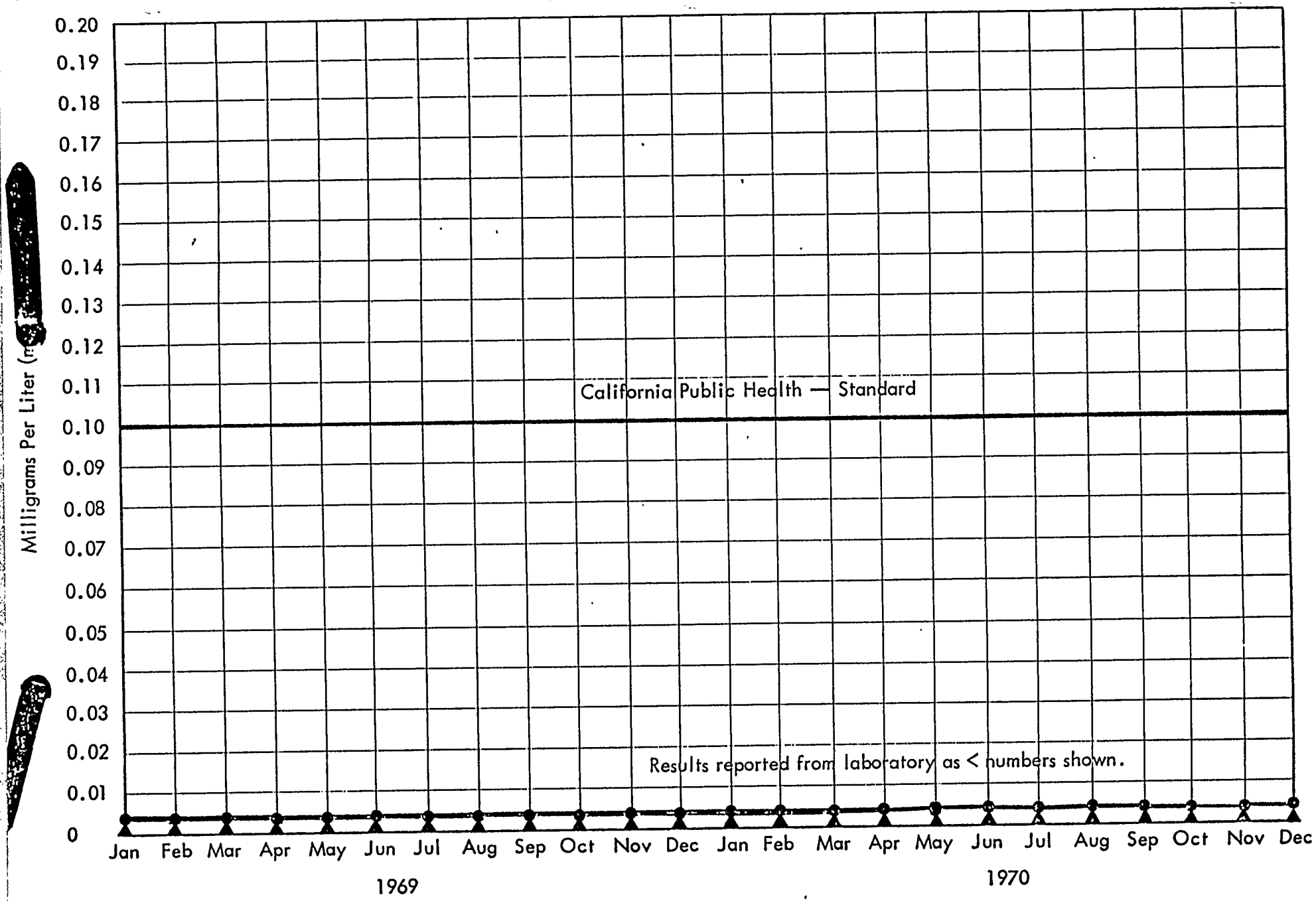


▲ Blank Controls

Poplar Creek

MERCURY

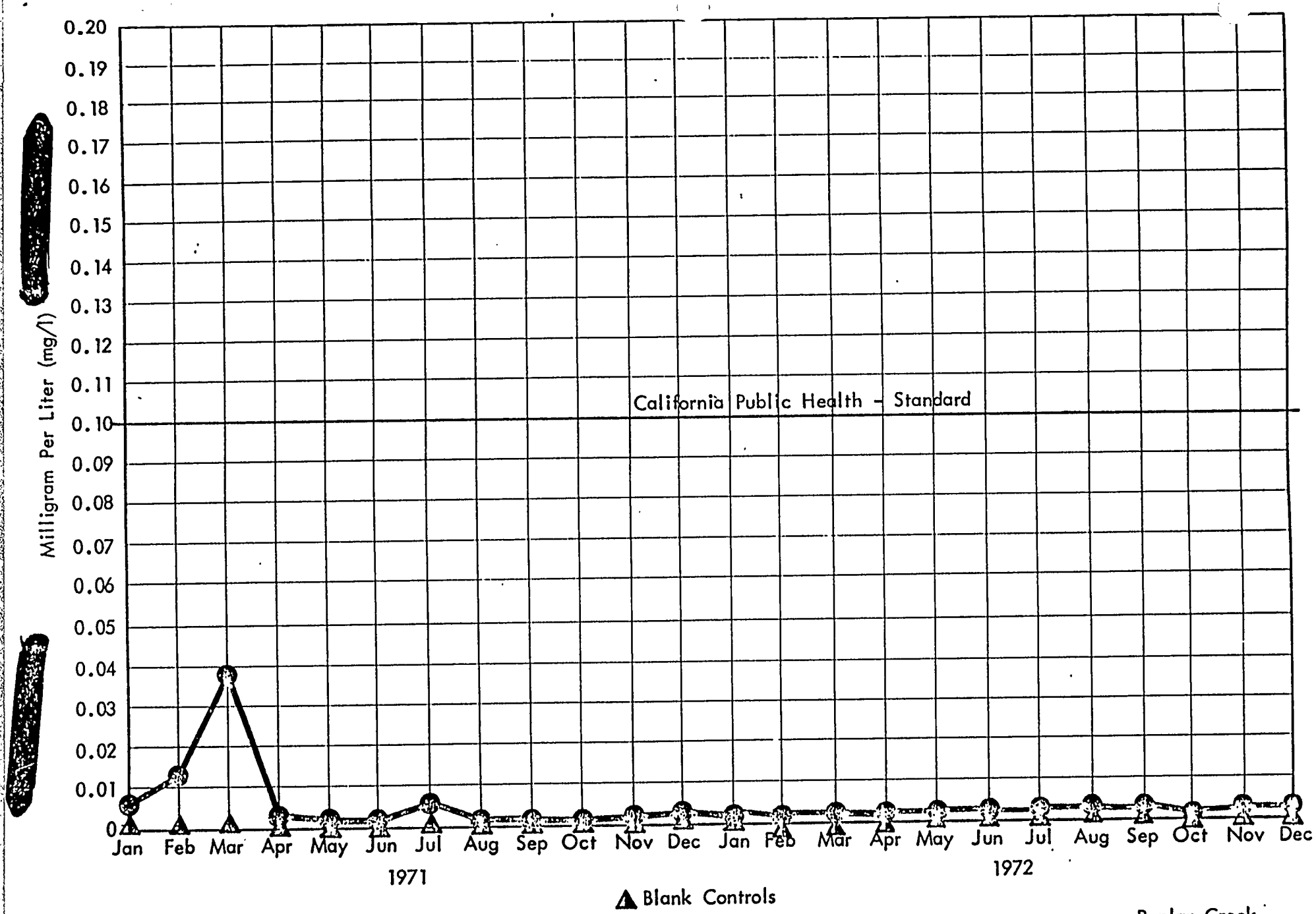
Y/TS-1610



Blank Controls

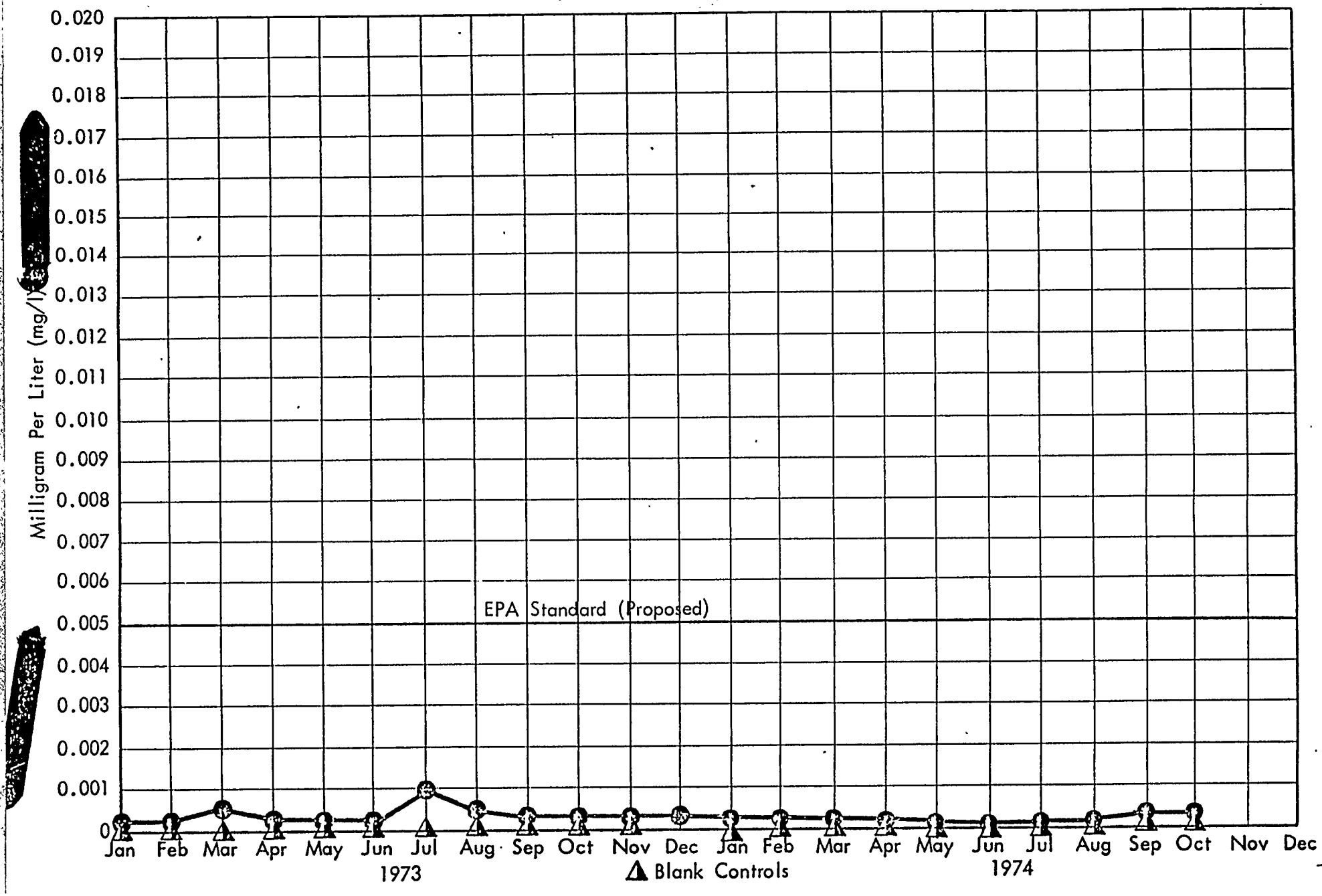
Poplar Creek

MERCURY



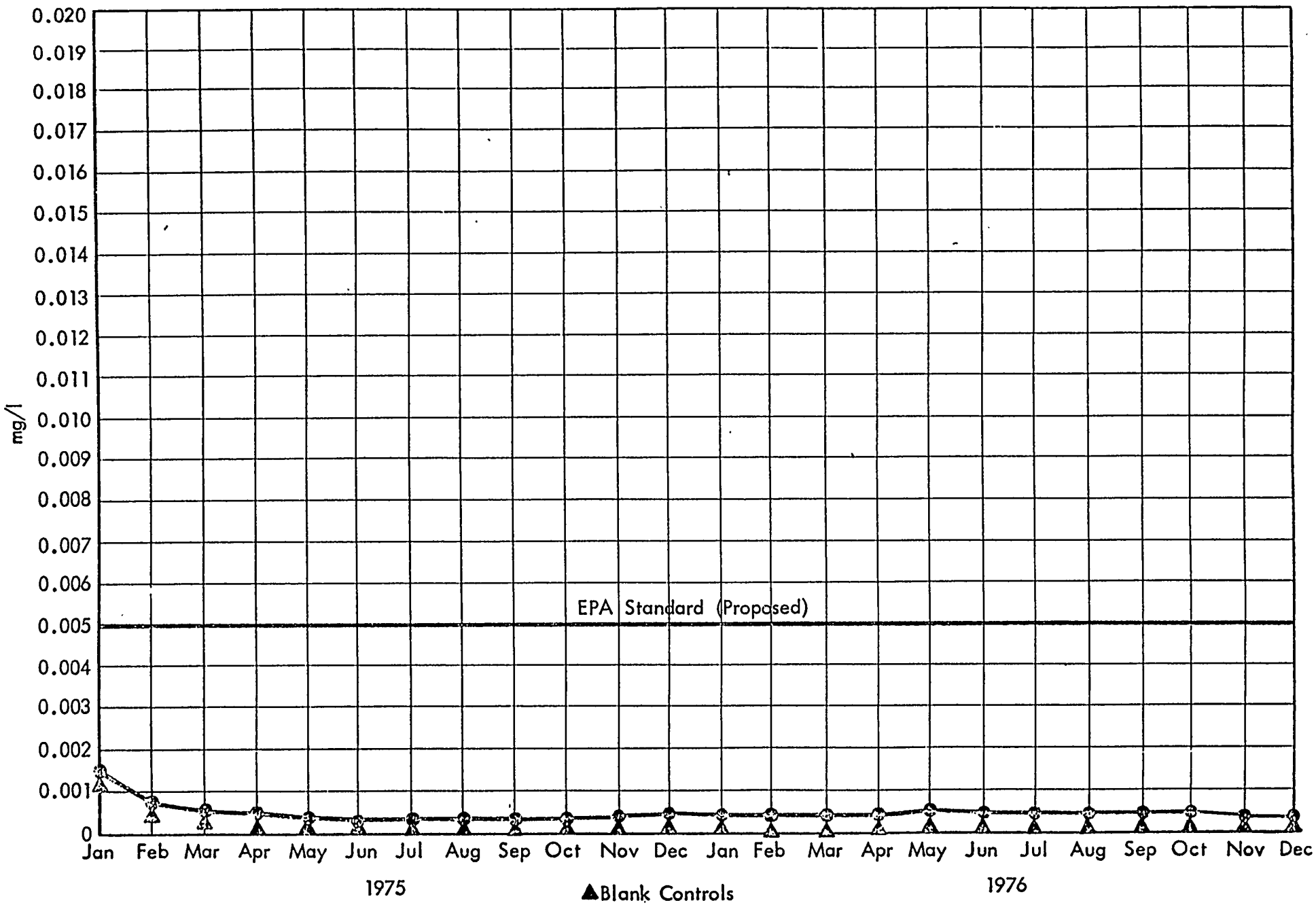
Poplar Creek

MERCURY



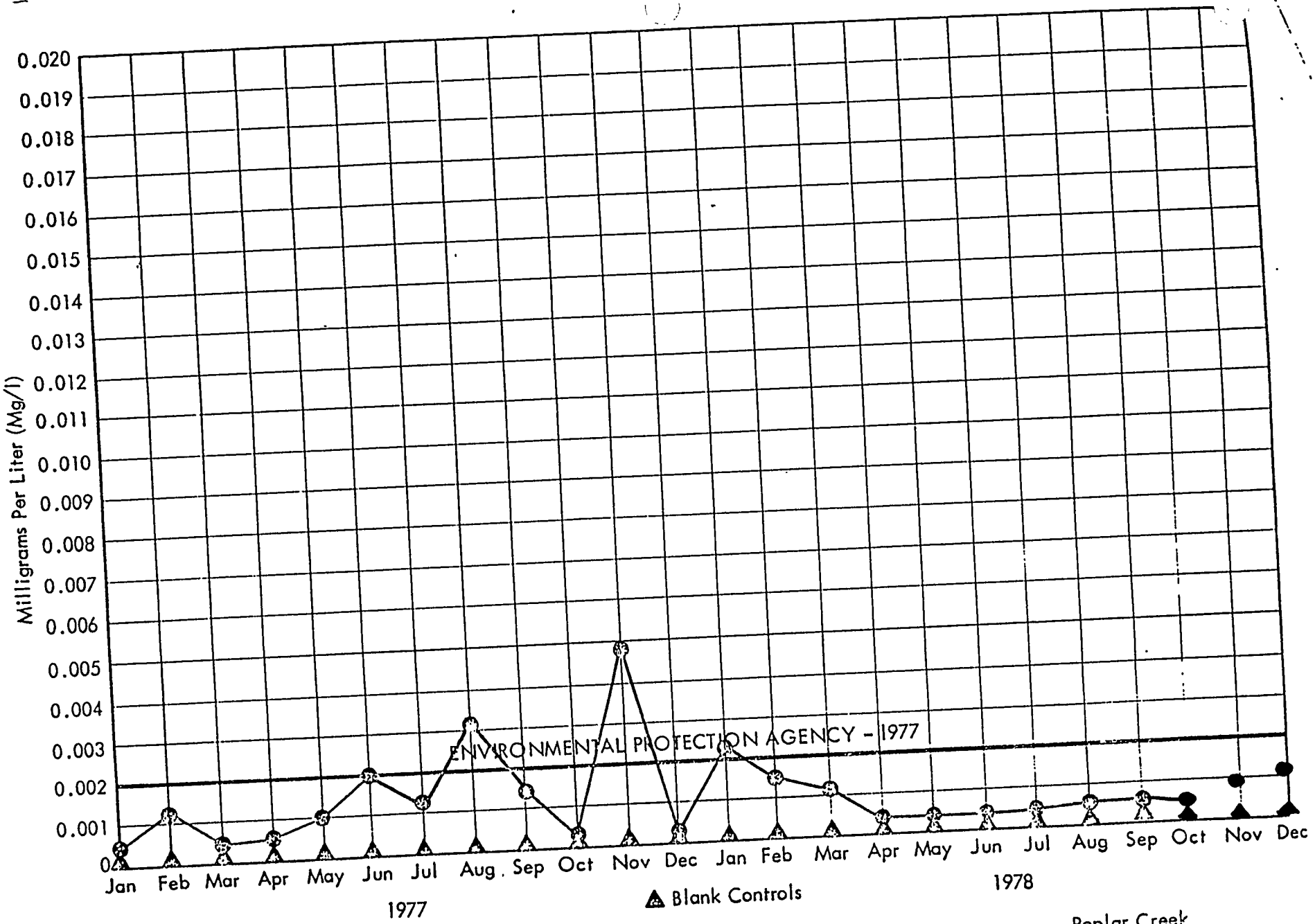
Poplar Creek

MERCURY



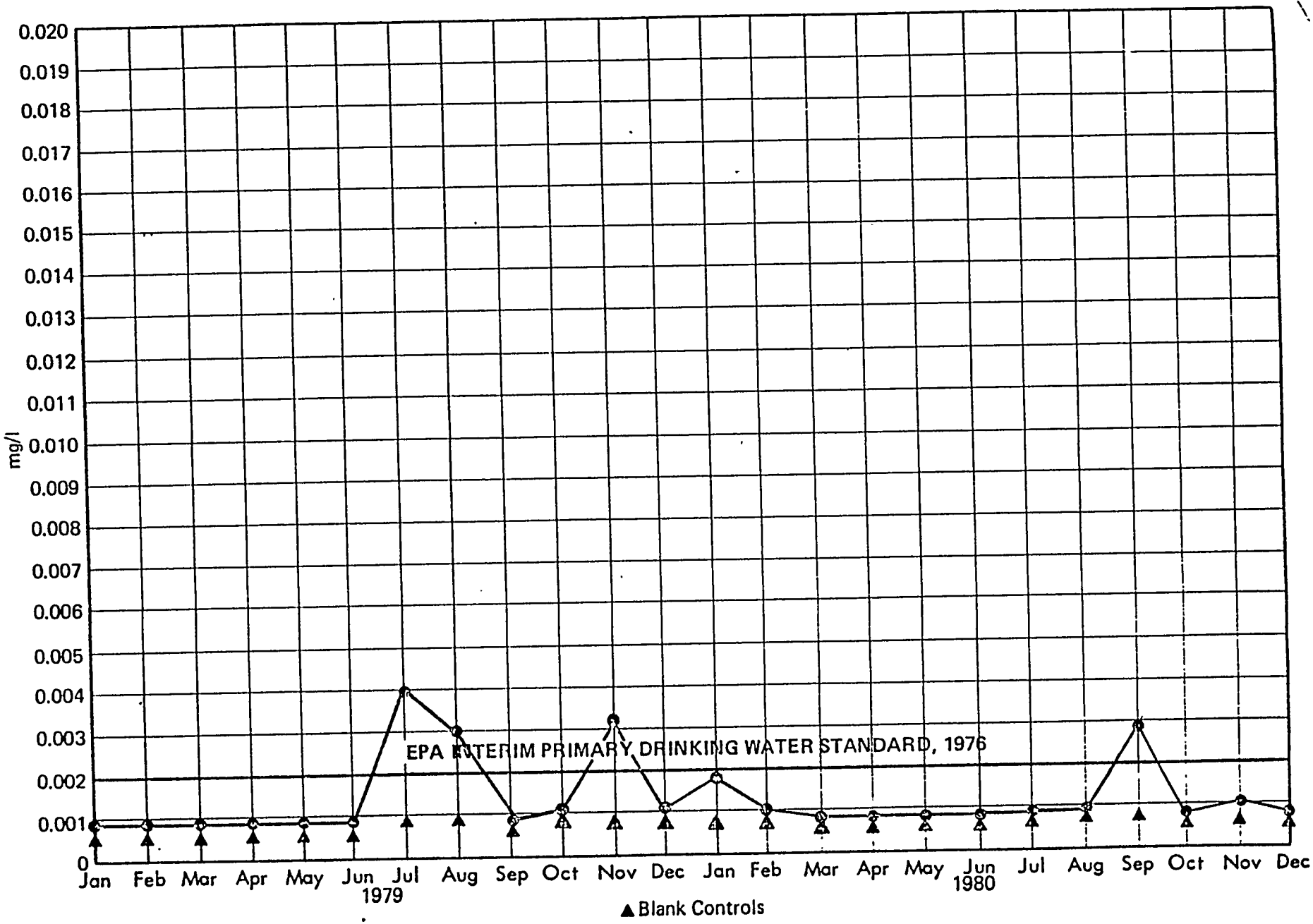
Poplar Creek

MERCURY



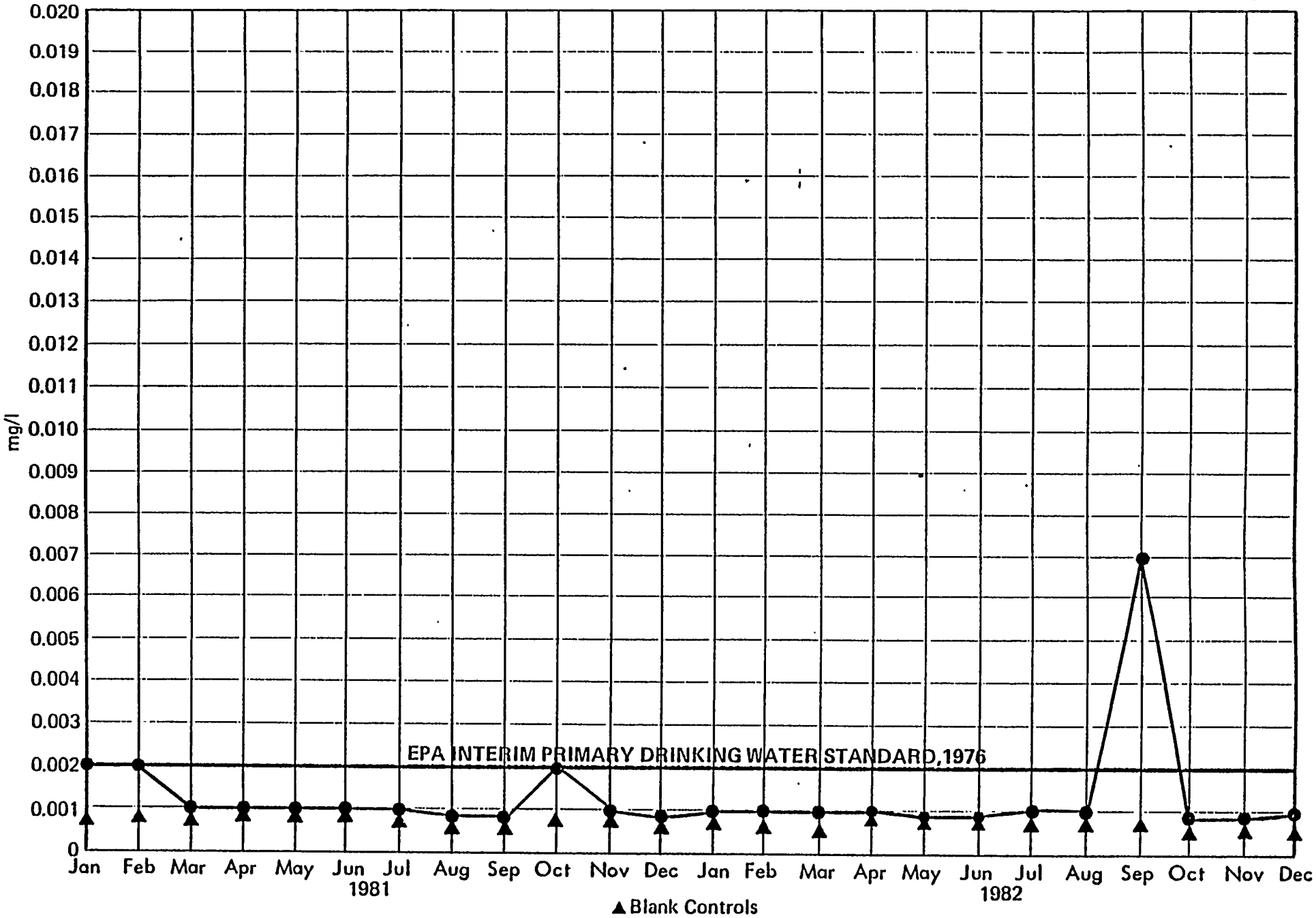
Poplar Creek

MERCURY



Poplar Creek

MERCURY



Poplar Creek

MERCURY

HSE/83J-0517-82

#50 17-M491

NUCLEAR DIVISION

INTERNAL CORRESPONDENCE

May 17, 1983

Y/HG-0116

wRy

M. L. Jones, 9106, MS-5

EF

Mercury Losses to East Fork Poplar Creek

Attached is a summary of measured mercury losses from the Y-12 Plant. From 1955 through 1962, the total soluble mercury measured in Poplar Creek was 234,486 pounds. Based on several samples, it was estimated that suspended mercury was equal to soluble mercury, hence, the total of 470,000 pounds.

In general, from 1963 to present, the maximum amount of soluble mercury listed is estimated by multiplying flow rate by laboratory detection limit for mercury. Currently, soluble mercury is less than 0.001 ppm and suspended is 0.002 to 0.003 ppm; thus, current loss rate is about <18 lb/year soluble mercury and from 36 to 54 lb/year suspended mercury measured during normal flow. In storm flow, the suspended mercury loss rate is greater, but insufficient data exists to quantify yearly estimated losses.

In recent years and prior to 1983 when special samples were collected, there is no data on suspended mercury because samples were filtered.

Data on the attached table was obtained from John Napier.

T. R. Butz

T. R. Butz, 9106, MS-5 (4-3647)

TRB:eh

Attachment

cc/att: G. E. Kamp, 9106, MS-5
J. M. Napier, 9202, MS-1
J. C. White, 9704-2, MS-19
File - TRB - RC

Soluble vs. Not Soluble?
Lab People Say No.

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4/13/94

Technical Information Office Date

MERCURY LOSSES TO EAST FORK POPLAR CREEK

1951, 52, 53, 54, 1955 — no preserv?

920-6 Maint. Dan Stond.

YEAR	MEASURED BLDG. LOSS IN LBS.	SOLUBLE Hg IN LBS. POPLAR CREEK	COMMENTS
1955	--	30,680	
1956	--	30,974	
1957	98,834	71,080	
1958	53,417	66,069	
1959	11,032	19,029	
1960	1,732	6,094	
1961	--	6,216	
1962		4,344	Σ234,486 lb through 1962
1963		932	
1964		<550	DL <.03 ppm ✓
1965		<1,450	DL <.03 ppm vs. 0.08?
1966		<910	DL <.05 ppm ✓
1967		<910	DL <.05 ppm ✓
1968		<91	DL <.005 ppm ✓
1969		<91	DL <.005 ppm ✓
1970		<91	DL <.005 ppm ✓
1971		182	DL <.01 ppm ✓
1972		<91	DL <.005 ppm ✓
1973		<18	DL <.001 ppm ✓
1974 Jan.		<18	DL <.001 ppm ✓
1975		<18	DL <.001 ppm ✓
1976		<18	DL <.001 ppm 0.001
1977 Jun.		<18	DL <.001 ppm 0.002
1978		<18	DL <.001 ppm 0.001
1979		<18	DL <.001 ppm 0.002
1980		<18	DL <.001 ppm 0.002
1981		<18	DL <.001 ppm 0.002
1982		<18	DL <.001 ppm 0.003

motorized scoop into glass carboy filled one carb/wk.

NHP Pumped out into collecting bottle. Use proportioning pump.

these were filtered & Sol. Hg meas. only

stopped filtering: started measuring total Hg (NPDES permit)

Helen Stepp, Ralph Kent, Ron Cabbree — all 3 insist they did not filter before 1973

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~~Business Conf.~~ XC: Wilcox then file H20-1

UNION CARBIDE

INTERNAL CORRESPONDENCE

NUCLEAR DIVISION

POST OFFICE BOX Y, OAK RIDGE, TENNESSEE 37830

To (Name) D. W. Smith

Division

Location

Date May 5, 1977

Originating Dept. Y/HG-0098

Answering letter date

Copy to G. B. Marrow
W. R. Martin
R. D. Williams
File (NoRC)

Subject Estimated Mercury Losses in Creek Waters - 1955 through 1975

Reviews of plant records and internal memoranda were made to determine the estimated amounts of mercury discarded in Poplar Creek waters. As a result, the amount of mercury which was discarded in creek waters from 1955 through 1962 was computed to be 235,000 pounds. Since 1962, the amount of mercury discarded in creek waters has been less than 5352 pounds. Since 1972, the creek waters have had a mercury level of less than 0.001 mg/ℓ (0.001 ppm) which is equivalent to less than 18 pounds per year.

Attached in Table 1 are a collection of estimated losses for record purposes. These data are also graphically shown in Figures 1 and 2.

J. M. Napier

J. M. Napier

tf

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Technical Information Office 4/7/94 Date

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over .35
under .23

Table 1

Summary of Estimated Mercury Losses in Poplar Creek

avg. of 4-Y4's from p. 121 (Y/EX-24 REV)

spills?

Calendar Year	Poplar Creek[1] Mercury Concentration (mg/ℓ)	Poplar Creek[1] Losses (lbs/Hg)	Building Losses[1] Mercury Concentration (mg/ℓ)	Building Losses[1] Losses (lbs/Hg)	Poplar Creek Concentration (ml/ℓ)	Poplar Creek Pounds (Hg)
1955	1.18	40,278	-	-	1.06 1.00	30,680
1956	0.88	28,695	-	-	0.90 1.00	30,974
1957	2.37	76,181	-	98,834	2.21 2.40	71,080
1958	2.01	56,605	-	53,417	2.35 2.20	60K 66,069
1959	0.67 0.67	19,029	-	11,032	-	-
1960[2,3]	0.25 0.20	6,094	-	1,732	-	-
1961[2,3]	-	4,767	-	-	0.15 0.21	6,216
1962	-	3,828	-	-	0.13 0.11	4,344
1963[3]	-	-	-	-	0.028 0.024	932
1964[3]	-	-	-	-	detection limit < 0.030 .046	< 550
1965[3]	-	-	-	-	< 0.080 .095	< 1450
1966[3]	-	-	-	-	< 0.050 .037	< 910
1967[3]	-	-	-	-	< 0.050 .031	< 910
1968[3]	-	-	-	-	< 0.005 .005	< 91
1969[3]	-	-	-	-	< 0.005 .006	< 91
1970[3]	-	-	-	-	< 0.005 .026	< 91
1971[3]	-	-	-	-	< 0.010 .007	< 182
1972[3]	-	-	-	-	< 0.005 .001	< 91
1973[3]	-	-	-	-	< 0.001 .050	< 18
1974[3]	-	-	-	-	< 0.001 .013	< 18
1975[3]	-	-	-	-	< 0.001 .001	< 18

[1]Data collected from internal letters contained in folder #Q9-10 entitled "Mercury Losses (Poplar Creek)" from D. W. Smith.

[2]Data collected from Plant Records —Reports Y-1112, Y-1131, Y-1171, Y-1228 through Y-1232.

[3]Data obtained from internal letters and published information obtained from M. Sanders.

[redacted] ≡ Y/HG-116 (1955-82) Σ• = 234,486

doesn't agree with p. 121 of Y/EX-24 esp. 1962-63 (too low)

NOTE: Creek flow estimate from 1961 through 1975 was 6 x 10^6 gallons per day. Prior to 1961, flow data were reported and were a nominal 10 x 10^6 gallons per day.

closer, per EX-24 (a little hi)

NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

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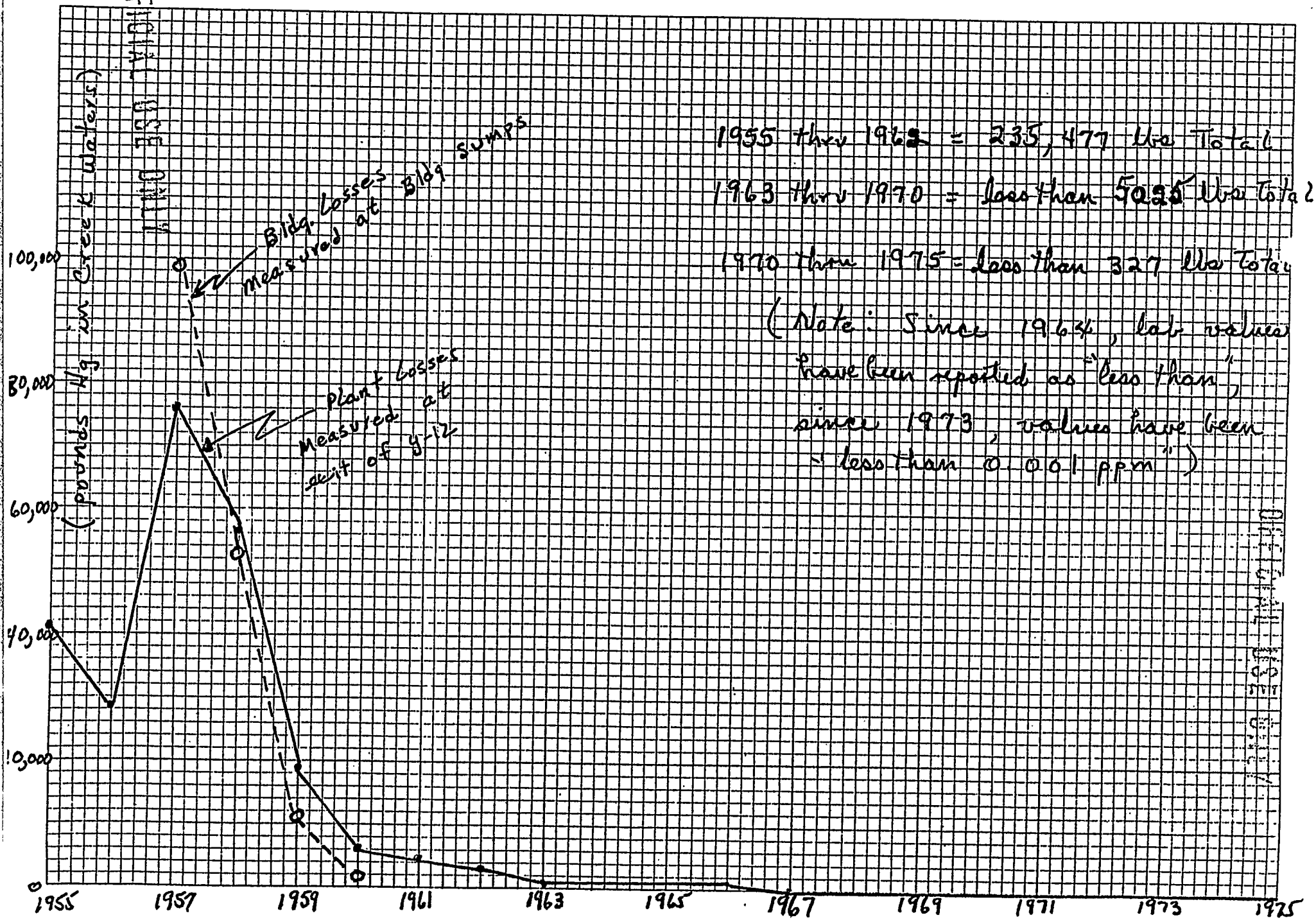

1955 thru 1962 = 235,477 lbs Total

1963 thru 1970 = less than 5025 lbs Total

1970 thru 1975 = less than 327 lbs Total

(Note: Since 1964, lab values have been reported as "less than", since 1973, values have been "less than 0.001 ppm")

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NO. 340-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

DIETZGEN CORPORATION
MADE IN U.S.A.

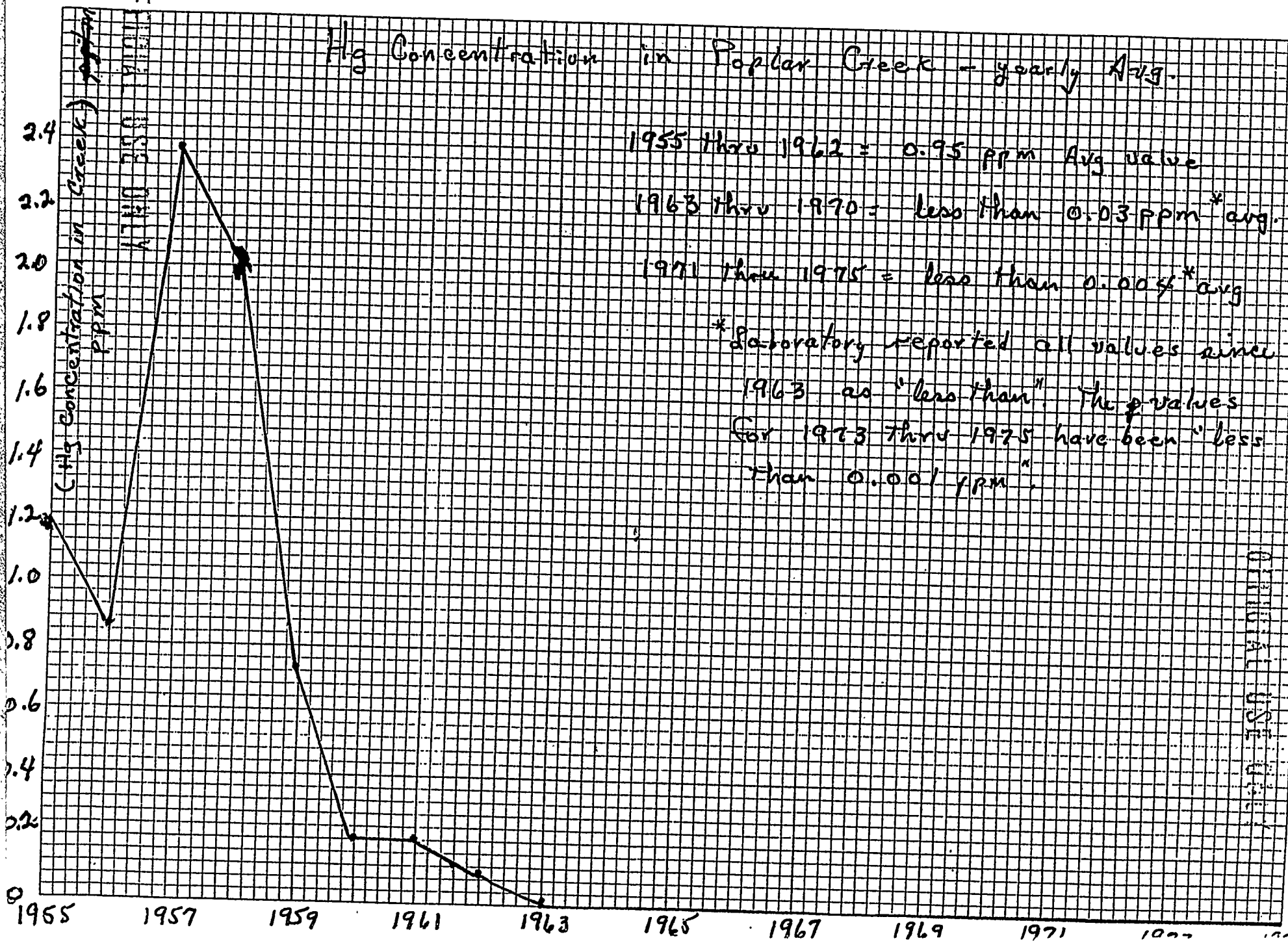
Hg Concentration in Poplar Creek – yearly Avg.

1955 thru 1962 = 0.95 ppm Avg value

1963 thru 1970 = less than 0.03 ppm* avg.

1971 thru 1975 = less than 0.005* avg

*Laboratory reported all values since 1963 as "less than". The values for 1973 thru 1975 have been "less than 0.001 ppm".



~~OFFICIAL USE ONLY~~ Ltr. No. 77F-0305-94 [illegible]

~~Business Conf.~~ XC: Wilcox
Ltr file H20-1

UNION CARBIDE

INTERNAL CORRESPONDENCE

NUCLEAR DIVISION

POST OFFICE BOX Y, OAK RIDGE, TENNESSEE 37830

To (Name) D. W. Smith
Division
Location

Date May 5, 1977

Originating Dept. Y/HG-0098

Answering letter date

Copy to G. B. Marrow
W. R. Martin
R. D. Williams
File (NoRC)

Subject Estimated Mercury Losses in Creek Waters - 1955 through 1975

Reviews of plant records and internal memoranda were made to determine the estimated amounts of mercury discarded in Poplar Creek waters. As a result, the amount of mercury which was discarded in creek waters from 1955 through 1962 was computed to be 235,000 pounds. Since 1962, the amount of mercury discarded in creek waters has been less than 5352 pounds. Since 1972, the creek waters have had a mercury level of less than 0.001 mg/ℓ (0.001 ppm) which is equivalent to less than 18 pounds per year.

Attached in Table 1 are a collection of estimated losses for record purposes. These data are also graphically shown in Figures 1 and 2.

J. M. Napier
J. M. Napier

tf

APPROVED FOR PUBLIC RELEASE
[signature] 4/7/94
Technical Information Office Date

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Table 1

Summary of Estimated Mercury Losses in Poplar Creek

Calendar Year	Poplar Creek[1] Mercury Concentration (mg/ℓ)	Poplar Creek[1] Losses (lbs/Hg)	Building Losses[1] Mercury Concentration (mg/ℓ)	Building Losses[1] Losses (lbs/Hg)	Poplar Creek Concentration (ml/ℓ)	Poplar Creek Pounds (Hg)
1955	1.18	40,278	-	-	1.00	30,680
1956	0.88	28,695	-	-	1.00	30,974
1957	2.37	76,181	-	98,834	2.40	71,080
1958	2.01	56,605	-	53,417	2.20	66,069
1959	0.67	19,029	-	11,032	-	-
1960[2,3]	0.20	6,094	-	1,732	-	-
1961[2,3]	-	4,767	-	-	0.21	6,216
1962	-	3,828	-	-	0.11	4,344
1963[3]	-	-	-	-	0.024	932
1964[3]	-	-	-	-	< 0.030	< 550
1965[3]	-	-	-	-	< 0.080	< 1450
1966[3]	-	-	-	-	< 0.050	< 910
1967[3]	-	-	-	-	< 0.050	< 910
1968[3]	-	-	-	-	< 0.005	< 91
1969[3]	-	-	-	-	< 0.005	< 91
1970[3]	-	-	-	-	< 0.005	< 91
1971[3]	-	-	-	-	< 0.010	< 182
1972[3]	-	-	-	-	< 0.005	< 91
1973[3]	-	-	-	-	< 0.001	< 18
1974[3]	-	-	-	-	< 0.001	< 18
1975[3]	-	-	-	-	< 0.001	< 18

[1]Data collected from internal letters contained in folder #Q9-10 entitled "Mercury Losses (Poplar Creek)" from D. W. Smith.

[2]Data collected from Plant Records —Reports Y-1112, Y-1131, Y-1171, Y-1228 through Y-1232.

[3]Data obtained from internal letters and published information obtained from M. Sanders.

NOTE: Creek flow estimate from 1961 through 1975 was 6×10^6 gallons per day. Prior to 1961, flow data were reported and were a nominal 10×10^6 gallons per day.

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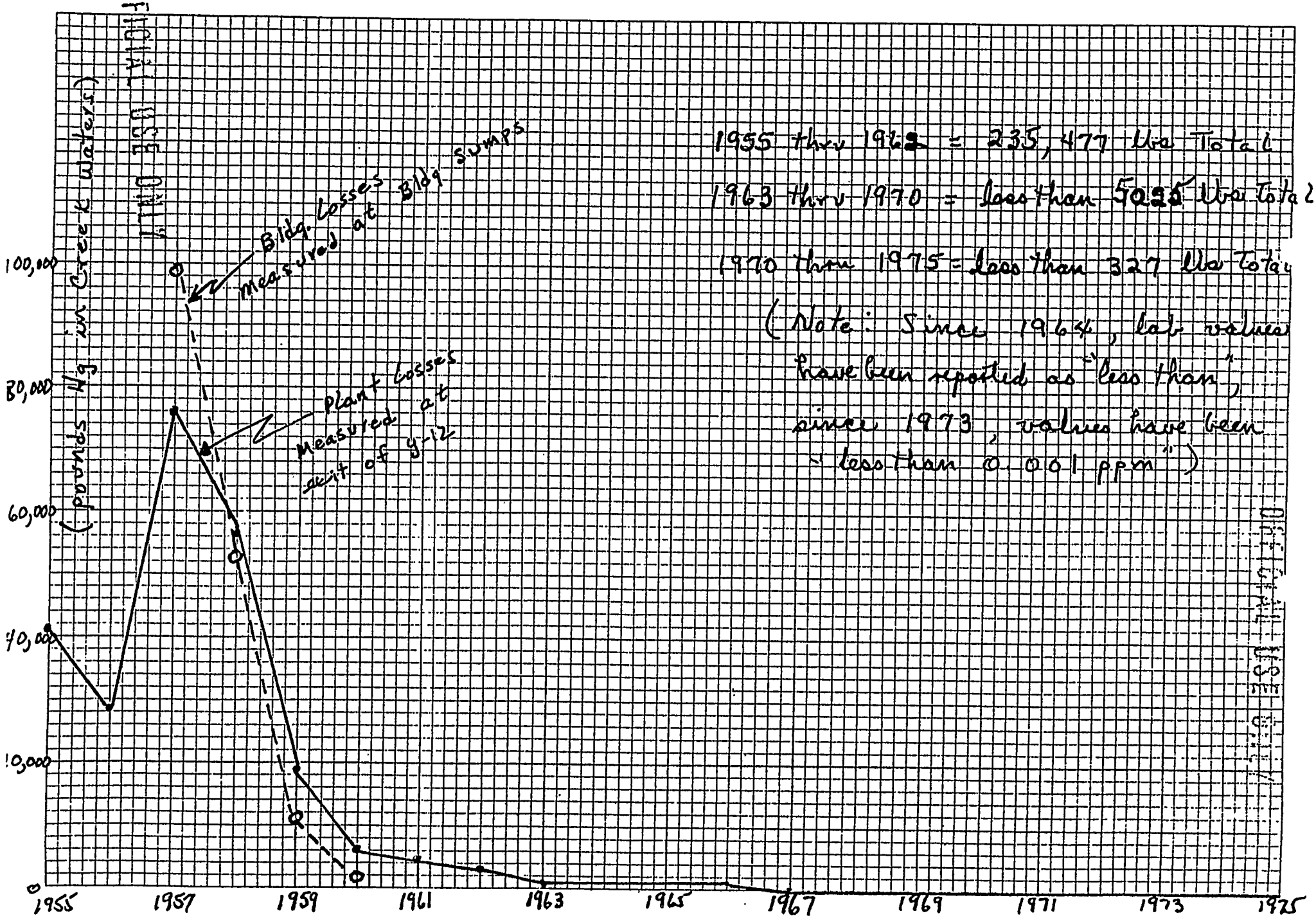

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NO. 340-10 DIETZGEN GRAPH PAPER
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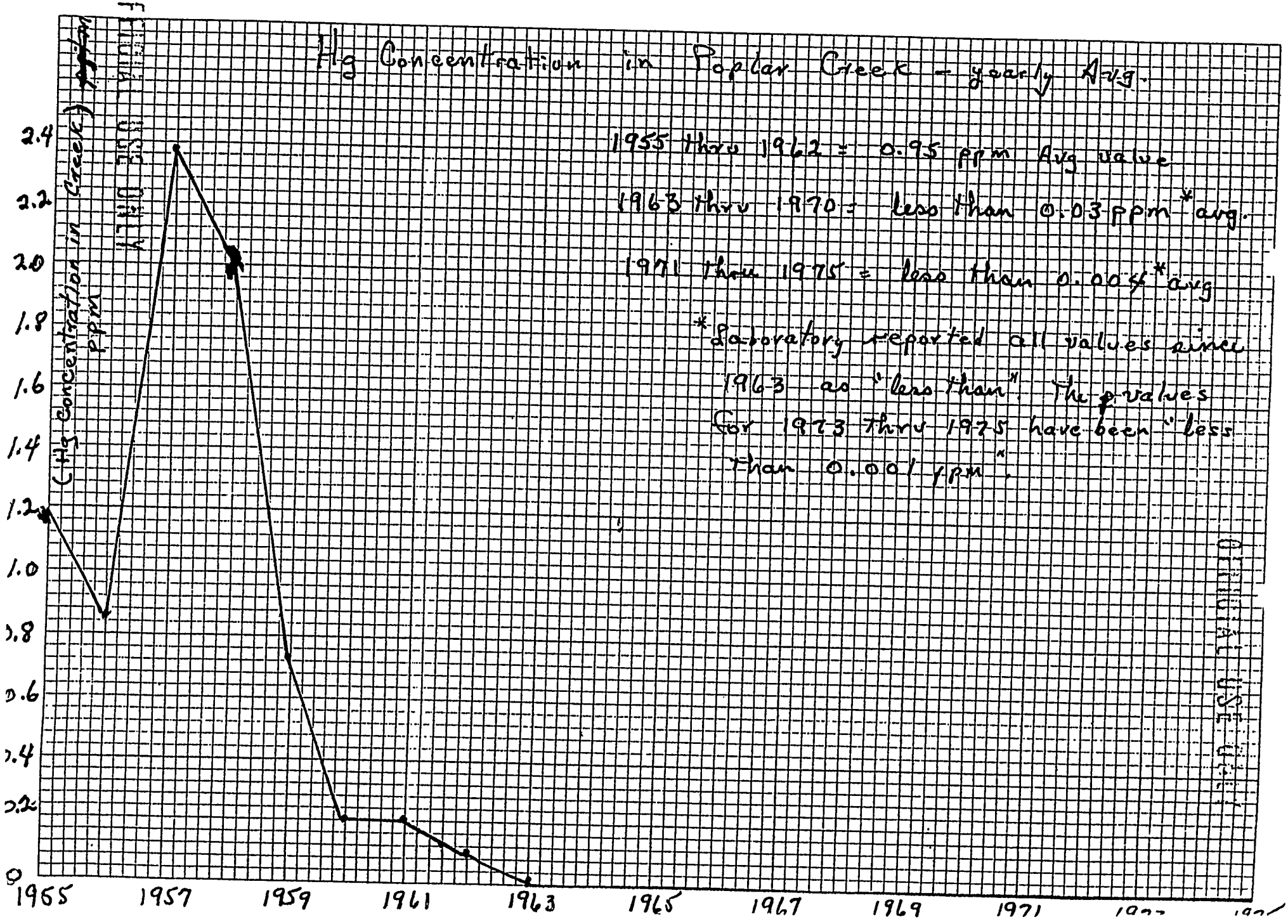

4/29

Losses

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. J. LaFrance
LOCATION Building 9706-2

DATE April 29, 1955

ANSWERING LETTER DATE

ATTENTION

COPY TO C. E. Sullivan, Jr., M. D.
L. C. Emerson, [illegible]
File

SUBJECT Poplar Creek Solvent Sampling

APPROVED FOR PUBLIC RELEASE

Y/HG-0055/2

Per Mr. L. J. LaFrance's request of March 15, 1955, water samples for solvent in Poplar Creek were taken daily at the following points and composited weekly for analyses over a period of one month.

Location	Week Ending	Solvent Conc. mg/liter
Beta 4 outlet	3-25-55	< .1
Beta 4 outlet	4-1-55	0.5
Beta 4 outlet	4-8-55	0.07
Beta 4 outlet	4-15-55	0.11
Alpha 5 outlet	3-25-55	0.64
Alpha 5 outlet	4-1-55	2.19
Alpha 5 outlet	4-8-55	1.56
Alpha 5 outlet	4-15-55	1.45
Alpha 2 outlet	3-25-55	0.79
Alpha 2 outlet	4-1-55	2.17
Alpha 2 outlet	4-8-55	0.68
Alpha 2 outlet	4-15-55	0.62
Laundry outlet	3-25-55	0.24
Laundry outlet	4-1-55	1.21
Laundry outlet	4-8-55	0.46
Laundry outlet	4-15-55	1.32
Weir (East end of Y-12)	3-25-55	0.42
Weir (East end of Y-12)	4-1-55	1.95
Weir (East end of Y-12)	4-8-55	0.85
Weir (East end of Y-12)	4-15-55	1.37

APPROVED FOR PUBLIC RELEASE
3/15/54
Technical Information Office Date

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-80 (6-54)

from MS/ChR2-0166

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. J. LaFrance
LOCATION Building 9706-2

DATE April 29, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO C. R. Sullivan, Jr., M. D.
L. C. Emerson, Y-12RC
File

SUBJECT Poplar Creek Solvent Sampling

Per Mr. L. J. LaFrance's request of March 15, 1955, water samples for solvent in Poplar Creek were taken daily at the following points and composited weekly for analyses over a period of one month.

Location	Week Ending	Solvent Conc. mg/liter
Beta 4 outlet	3-25-55	< .1
Beta 4 outlet	4-1-55	0.3
Beta 4 outlet	4-8-55	3.07
Beta 4 outlet	4-15-55	0.11
Alpha 5 outlet	3-25-55	0.64
Alpha 5 outlet	4-1-55	2.19
Alpha 5 outlet	4-8-55	1.56
Alpha 5 outlet	4-15-55	1.45
Alpha 2 outlet	3-25-55	0.79
Alpha 2 outlet	4-1-55	2.17
Alpha 2 outlet	4-8-55	0.68
Alpha 2 outlet	4-15-55	0.62
Laundry outlet	3-25-55	0.24
Laundry outlet	4-1-55	1.21
Laundry outlet	4-8-55	0.46
Laundry outlet	4-15-55	1.32
Weir (East end of Y-12)	3-25-55	0.42
Weir (East end of Y-12)	4-1-55	1.95
Weir (East end of Y-12)	4-8-55	0.85
Weir (East end of Y-12)	4-15-55	1.37

Merwyn Sanders
Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (3-55)

(Y/HG-055/2)

1954	April	0.28 mg/l	✓'d
	May	0.10 mg/l	
	June	0.23	
	July	0.23	
	Aug	0.14	
	Sept	0.54	1 high week 1.57 mg/l.
	Oct	0.25	
	Nov	0.19	
	Dec	0.14	
1955	Jan	0.15	
	Feb	0.59	
	March	1.09	

Special Locations

week ending	B-4 outlet	α-5 outlet	α-2 outlet	[illegible]
3/25/55	<.10 mg/l	.64	.79	[illegible]
4/1/55	0.30	2.19	2.17	1.2[illegible]
4/7/55	.07	1.56	.68	[illegible]
4/15/55	.11	1.45	.62	1.32

1954	April	0.28 mg/l	
	May	0.10 "	
	June	0.23	
	July	0.23	
	August	0.14	
	Sept.	0.54	1 high week 1.57 mg/l
	Oct.	0.25	
	Nov.	0.19	
	Dec.	0.14	
1955	Jan.	0.15	
	Feb.	0.59	
	March	1.09	

SPECIAL LOCATIONS

Week Ending	Beta-4 Outlet	Alpha-5 Outlet	Alpha-2 Outlet	Laundry Outlet
3-25-55	<.10 mg/l	.64	.79	.24
4-1-55	0.30	2.19	2.17	1.21
4-7-55	3.07	1.56	.68	.46
4-15-55	.11	1.45	.62	1.32

2C3
6/6

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION L. J. LaFrance Bldg. 9706-2

ATTENTION

COPY TO L. C. Emerson
File
~~NoY12RC~~

DATE June 6, 1955

ANSWERING LETTER DATE

SUBJECT Results of Analyses Taken in Poplar Creek on June 3, 1955

APPROVED FOR PUBLIC RELEASE
3/15/54
Technical Information Office Date

Y/HG-0055/3

Listed below are the results of the analyses of the samples taken in Poplar Creek on June 3, 1955.

Location of Sampled Points	pH	Na Conc. µg/ml	Alloy µg/ml
1. Beta-4 outlet	9.1	2.5	1.0
2. First outlet Alpha-5	10.8	195	56
3. Opposite East end Alpha-5	10.5	15	39
4. East of New Steam Plant	11.5	668	104
5. North side of stream-Southeast of Beta-3	12.2	331	41
6. South side of Creek - Southeast of Beta-4	12.1	31	68
7. East end of Beta-1	12.1	168	60
8. South side of Alpha-1	12.1	153	57
9. Just below Alpha-2 drain	11.2	182	62
10. Southeast end of Alpha-3	12.1	144	59
11. Due south, East Portal	11.5	144	33
12. East of Y-12 Area out Culvert	11.3	144	30

C. M. West

CS

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-80 (6-54)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. J. LaFrance
LOCATION Bldg. 9706-2

ATTENTION
COPY TO L. C. Emerson
File
NoY12RC

DATE June 6, 1955

ANSWERING LETTER DATE

SUBJECT Results of Analyses Taken in Poplar Creek on June 3, 1955

Listed below are the results of the analyses of the samples taken in Poplar Creek on June 3, 1955.

Location of Sampled Points	pH	Na Conc. µg/ml	Alloy µg/ml
1. Beta-4 outlet	9.1	2.5	1.0
2. First outlet Alpha-5	10.8	195	56
3. Opposite East end Alpha-5	10.5	15	39
4. East of New Steam Plant	11.5	668	104
5. North side of stream-Southeast of Beta-3	12.2	331	41
6. South side of Creek - Southeast of Beta-3	12.1	81	68
7. East end of Beta-1	12.1	168	60
8. South side of Alpha-1	12.1	153	57
9. Just below Alpha-2 drain	11.2	182	62
10. Southeast end of Alpha-3	12.1	144	59
11. Due south, East Portal	11.5	144	33
12. East of Y-12 Area at Culvert	11.5	144	30

C. M. West

C. M. West

CS

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (3-55)

K-25 wk 4/24 Hi-Basic
Andy.

801-891 Pump Houses --

wk of 5/3 - 7.7
" " 5/11 - 7.7
5/25 - 7.5
26 - 7.4 Am 7pm 7.8 11pm 7.9
27 - 7.9 - 8.2
28 - 8.5
29 - 8.6
30 - 8.7
31 - 8.6
6/1 8.6
2 8.2 - 9.4
3 9.4 - low 9.1
4) 9.2 - " 9.0
5 8.9

6/3
Am East Fork Poplar Creek 10
" " 8
" " 8
Clinch 8.2
Sanitary Hwy 7.7

Pm East Fork at Turnpike 10.4
" " " Golf Course 9.5
" " Jefferson Ave & Turnpike 11.2
9-12 security gate 11.0

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO W. K. Whitson
LOCATION Bldg. 9201-4

ATTENTION

COPY TO G. A. Strasser
G.W. Evans
F.V. Tilson
Roy Williams
George Jasny
File

DATE June 16, 1955

ANSWERING LETTER DATE

SUBJECT East Fork of Poplar Creek Water Samples

The sampling points are as follows:

(1) First outlet to creek South East of 9204-4
(2) Second outlet to creek South of 9201-5
(3) Third outlet to creek South East of new steam plant behind 9201-4
(4) Outlet to creek South East of 9204-3
(5) At East end plant South of Shipping & Receiving Warehouse
(6) West end of plant prior to entry of culvert from 9204-4

All results are expressed in P.P.M. except the stream pH.

Date	Location	(1)	(2)	(3)	(4)	(5)	(6)
6/3	Ay	1	56	104	41	30	
	Na	2.5	195	668	331	144	
	K	Not Run					
	Ca	Not Run					
	pH	9.1	10.8	11.5	12.2	11.5	
6/6	Ay	15	80	14	15	4	
	Na	3	13	180	200	120	
	K	5	5	4	3	5	
	Ca	2	15	20	10	20	
	pH	10.6	11.5	9.7	11.3	10.1	
6/8	Ay	2	6	12	5	4	
	Na	7	5	8	96	35	
	K	4	3	2	3	2	
	Ca	25	20	18	17	15	
	pH	8.5	9.8	10.8	10.9	10.0	
6/9	Ay	2	22	8	10	12	0
	Na	5	2	19	160	142	90
	K	3	3	3	4	4	8
	Ca	50	20	17	23	24	220
	pH	7.7	10.5	10.2	10.2	9.2	7.4

vs. 10.6

(Cont'd on page 2)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO
LOCATION

ATTENTION
COPY TO

DATE

ANSWERING LETTER DATE

SUBJECT

Page 2

Date	Location	(1)	(2)	(3)	(4)	(5)	(6)
6/10	Ay	5	18	10	6	10	
	Na	7	6	180	160	76	
	K	3	4	8	4	1	
	Ca	42	13	50	41	14	
	pH	8.9	10.5	3.6	9.5	9.8	vs. 8.6
6/13	Ay	3	10	1	54	16	
	Na	10	10	8	180	98	
	K	2	3	1	2	1	
	Ca	46	34	30	29	25	
	pH	8.7	10	9	11.7	11.1	vs. 10.2
6/14	Ay	3	40	16	27	12	
	Na	20	32	20	188	182	
	K	2	10	2	2	2	
	Ca	50	26	15	19	20	
	pH	8.5	11.3	10.8	11.2	10.3	vs. 10.7

In the future these results will be reported on a weekly basis until further notice.

*These results were obtained from the lab in Bldg. 9995. All other results are from the Process Control lab in Bldg. 9201-4.

Leo J. LaFrance
Industrial Hygienist
Medical Department

LJL/dai

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-80 (6-54)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION W. K. Whitson Bldg. 9201-4

ATTENTION

COPY TO G. A. Strasser
G. W. Evans
F. V. Tilson
Roy Williams
George Jasny
File ✓

DATE June 24, 1955

ANSWERING LETTER DATE

SUBJECT Water Samples in the East Fork of Poplar Creek

All results are in PPM except pH.

(1) First outlet to creek South East of 9204-4

	6/15	6/16	6/20	6/22	6/23
Ay	1	12	1	1	1
Na	10	12	5	4	35
K	2	2	1.4	2	1
Ca	30	10	30	20	20
pH	7.2	9.6	8.2	7.9	7.85

(2) Second outlet to creek South of 9201-5

	6/15	6/16	6/20	6/22	6/23
Ay	22	8	13	82	26
Na	16	14	5	5	4
K	1	1	2	2	3
Ca	10	30	31	15	15
pH	10.8	9.9	10.15	11.1	10.7

(3)

	6/15	6/16	6/20	6/22	6/23
Ay	14	4	29	3	10
Na	35	26	3	4	5
K	3	1	2	2	2
Ca	5	10	15	20	20
pH	10.9	9.8	11	9.4	9.7

(Continued on Page 2)

(4) Outlet to Creek South East of 9204-3

	6/15	6/16	6/20	6/22	6/23
Ay	14	7	13	24	18
Na	260	297	220	140	58
K	2	2	2.3	2	3
Ca	22	20	25	15	15
pH	11.2	11.2	11.1	10.6	8.5

(5) At East end of plant South of Shipping & Receiving Warehouse

	6/15	6/16	6/20	6/22	6/23
Ay	7	8	7	160	7
Na	240	150	82	70	60
K	1.5	3	1.5	4	1
Ca	15	15	23	10	30
pH	11.4	10.6	10.2	11.5	10

Leo J. LaFrance
Industrial Hygienist
Medical Department

LJL:dai

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION W. K. Whitson Bldg. 9201-4

ATTENTION

COPY TO J. A. Strasser
H. C. McBirney
F. V. Tilson
J. W. Evans
George Jasny
Files ✓

DATE June 24, 1955

ANSWERING LETTER DATE

SUBJECT Creek Results following Tank Rupture at 9201-4 on 6-17-55

Samples were taken at various points beyond the plant on 6-17-55 and every 4 hours at the raw water intake for K-25 cooling water. The results are as follows:

6/17/55

Location	Time	Al	Na	K	Ca	pH
		(PPM)				
East end of plant at warehouse	10:05 am	540	136	3	17	12.2
Illinois Ave. at Garden Apt. Rd.	11:55 am	5	106	3	17	10
O.R. Turnpike at Jefferson Ave.	12:00 noon	4	102	2	20	9.4
Golf Course Road	12:05 pm	15	96	2	17	10
K-25 Rd. at Roane Bridge	12:10 pm	6	136	2	17	9.7
Poplar Creek at Blair Bridge	12:25 pm	1	14	1	15	8.4
K-25 Water Intake	5:00 pm	1	14	1.6	15	8.2
K-25 Water Intake	9:00 pm	1	14	1.7	18	8.1
	6/18/55					
K-25 Water Intake	1:00 am	0	17	2	18	7.6
	5:00 am	1	16	2	24	7.7
	9:00 am	1	20	3.5	22	7.85
	1:00 pm	1	18	2	20	7.85
	5:00 pm	1	18	1.7	19	7.8
	9:00 pm	2	20	1.8	24	7.9
	6/19/55					
K-25 Water Intake	1:00 am	2	17	3.8	17	7.95
	5:00 am	1	20	2	22	7.9
	9:00 am	1	21	1.9	24	8.1
	1:00 pm	1	24	2	20	8.2
	5:00 pm	1	25	2.3	28	8.3
	9:00 pm	1	8	2	26	8.2

(Continued on page 2)

Location	Time	Ay	Na	K	Ca (PM)	pH
	6/20/55					
K-25 Water Intake	1:00 am	1	24	2	22	8.8
	5:00 am	1	22	1.9	25	8.6
	9:00 am	1	26	2	25	8.5
	1:00 pm	1	19	3	20	8.3
	5:00 pm	4.5	43	1	15	9
	9:00 pm	4	34	3	22	9.1
	6/21/55					
K-25 Water Intake	1:00 am	4	28	2	15	9.1
	5:00 am	6	30	4	13	9.3
	9:00 am	10	42	3	15	9.6
	1:00 pm	7	34	3	10	9.4

From the above data it apparently takes 96 hours after a spill of this size to reach a peak concentration at the K-25 cooling water intake on Poplar Creek.

Certain of these samples have been run for Solvent Concentration and the results are as follows:

K-25 Water Intake	6/17/55	5:00 pm	0.17 mg/liter
" " "	6/18/55	1:00 pm	0.16 mg/liter
" " "	6/19/55	1:00 pm	0.36 mg/liter
" " "	6/20/55	5:00 am	0.20 mg/liter

There are still 2 other samples for which Solvent results are not available at this time.

Leo J. LaFrance
Industrial Hygienist
Medical Department

LJL:dai

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION W. K. Whitson Bldg. 9201-4

ATTENTION

COPY TO G. A. Strasser
G. W. Evans
F. V. Tilson
Roy Williams
George Jasny
D. H. Rader
File

DATE July 5, 1955

ANSWERING LETTER DATE

SUBJECT Water Samples in East Fork of Poplar Creek

All results are in P.P.M. except pH.

(1) First outlet to creek South East of 9204-4

	6/24	6/27	6/28	6/29	6/30	7/1
Ag	[illegible]	3	0	0	3.4	0.9
Ba	4	10	3	4	8	5
K	2	1.5	1	1	1.2	1
Na	45	25	20	20	38	35
pH	8.0	7.6	7.35	8.4	6.5	7.2

(2) Second outlet to creek South of 9201-5

	6/24	6/27	6/28	6/29	6/30	7/1
Ag	19	14.3	9	22	6.5	9
Ba	5	18	5	6	6	4.6
K	2.5	1.7	3	3	1.5	1
Na	30	20	10	5	[illegible]	[illegible]
pH	10.3	9.5	9.5	10.6	8.8	8.5

(continued on page 2)

(3) Third outlet to creek South East of New Steam Plant

	6/24	6/27	6/28	6/29	6/30	7/1
Ay	16	1.5	0	0	<1	0.7
Na	6	14	5	5	5	2
K	1.8	1.5	1	1	1.5	0.9
Ca	10	20	15	15	29	29
pH	10.4	8.4	8.5	8.6	7.8	8.0

(4) Outlet to Creek South East of 9204-3

	6/24	6/27	6/28	6/29	6/30	7/1
Ay	46	7	7	4	6.8	5.5
Na	182	250	220	235	280	80
K	21	1.8	1	1.5	2	3
Ca	12	20	10	30	20	20
pH	11.4	10.8	10.8	11.1	10.3	9.95

(5) At East end of plant South of Shipping & Receiving Warehouse

	6/24	6/27	6/28	6/29	6/30	7/1
Ay	14	10	8	11	9.5	7.5
Na	71	105	105	175	176	160
K	3.8	1.5	1	2	2.6	1.9
Ca	15	15	15	25	56	14
pH	10.5	10.2	10.2	10.75	9.2	10.1

The samples for Solvent taken at X-25 Cooling Water Intake at 9:00 A.M. and 1:00 P.M. on 6/21/55 were 0.30 and 0.28 mg/l. respectively.

Lee J. LaFrance
Industrial Hygienist
Medical Department

LJL:dal

The following series of samples were taken at five different locations in the creek during the times mentioned. These figures are an average of daily samples at each location.

(1) Creek just below Beta 4 outlet
(2) Creek just below Alpha 5 outlet
(3) Creek just below Alpha 4 outlet
(4) Creek at road South East of Beta 3
(5) At East end of plant South of Shipping & Receiving Warehouse

ALLOY (PPM)

1955?

	6/6-6/10	6/13-6/17	6/20-6/24	6/27-7/1
1	6	5	1	1.5
2	31	20	28	15
3	11	9	15	<1
4	9	20	25	6
5	8	11	47	9

SODIUM (PPM)

1	6	13	12	6
2	4	18	5	7
3	97	22	5	6
4	154	231	150	213
5	93	152	71	144

POTASSIUM (PPM)

1	4	2	1.5	1.1
2	4	3	2.5	2
3	4	2	2	1.1
4	4	2	5	2
5	3	2	4	2

CALCIUM (PPM)

1	30	34	19	27
2	17	20	20	19
3	26	15	16	22
4	23	22	17	20
5	20	19	19	25

pH

1	9.0	8.5	8.0	7.4
2	10.6	10.5	10.6	9.3
3	8.5	10.1	10.1	8.2
4	10.5	11.4 vs. 11.1	10.4	10.6
5	9.8 ✓	11.8	10.6 ✓	10.1 ✓
		vs. 10.6	vs. 11.1	vs. 10.3

Limits of various materials in Potable Water or Potable Water Supplies as suggested by United States Public Health Service.

Material	Concentration	
Lead	0.10 ppm	
Fluoride	1.50 ppm	
Arsenic	0.05 ppm	
Selenium	0.05 ppm	
Chromium (Hexa-valent)	0.05 ppm	
Chromium (Trivalent)	0.10 ppm	
Copper	3.00 ppm	
Iron plus manganese	0.30 ppm	
Magnesium	125.0 ppm	
Zinc	15.0 ppm	
Chloride	250.0 ppm	
Sulphate	250.0 ppm	
Phenolics	0.001ppm	(as phenol)
Solids	500 ppm	
Total Alkalinity	15 ppm	(pH should not exceed 10.6)
Carbonates	120 ppm	

Barium salts and other heavy metals should not be added for water treatment.

C O P Y

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

COPY TO L. J. LaFrance
LOCATION Building 9995

DATE June 17, 1955

ANSWERING LETTER DATE

ATTENTION

COPY TO

SUBJECT Drainage of Solvent Conte in Beta-4

In order to check the solvent content of water leaving Beta-4, please take a 25 cc water sample once each shift at the following points and make a composite of each point which will be sent in for analysis at a later date. There are 6 labeled one-gallon bottles in B-4 lab for the composite sample. There are 6 small labeled bottles in B-4 lab for collecting the 25 cc samples. Sample points are as follows:

Sample place "A" is located west of Beta-4 and south of the Extract Building. This pit has four points to be sampled which are A-2, A-3, A-4, the highest pipes on the east wall of the pit and are numbered clockwise. A-5 is the lowest pipe on the east wall of the pit. A-1 comes from Extract Area. A-6 is from west of pit. No sample from A-1 or A-6.

Sample place "B" is located downstream south of sample place "A". This pit has one point (B-3) which is the second pipe on the east wall going clockwise. B-3 will probably be the only 4" pipe which has a flow. B-1 comes from Pit A. B-2 is small line. No sample from B-1 or B-2.

Sample place "C" is just south of center of rear of Beta-4 at north side of road. One sample shall be dipped from this pit which is C-1.

The sampling should begin today and continue until further notice.

/s/ Neal Dow, Jr.

JFG/bfg
Copy made 7-14-55/bfg

C O P Y

5 day [illegible]

B-3 .8 ug Hg/ml South of Exit
2.0 ppm Hg

C-1 1.2 ug Hg/ml South of B-4
14 ppm Hg

A-2 3.2 ug/ml
7.6 ppm Hg

A-3 .4 ug/ml Extract
22.4 ppm Hg

A 4 0.2 ug/Hg ml
10.6 ppm Hg

A 5 <.1 ug/ml Hg
41.5 ppm Hg

Solvent in mg/liter * No sample
X too high for method? or cond dry

α-5

	C	D	E	F	G	H	F-1150
[illegible]	0.2[illegible]	0.27	0.20	[illegible]	[illegible]	[illegible]	
7/14	0.3[illegible]		0.4[illegible]	2.[illegible]	0.5[illegible]	0.[illegible]	
[illegible]	0.3[illegible]	0.33	X	3.[illegible]	[illegible]	0.[illegible]	0.8[illegible]
7/16	0.13	0.86	0.79	0.[illegible]	0.84		1.38
7/17	0.28	0.11	8.30	1.07	0.12	0.21	0.79
7/18	<0.10	0.10	2.29	0.38	0.23	0.19	
7/19	<0.10	0.15	4.04	0.88	0.90	1.80	0.56
7/20	X	0.29	*	0.25	0.13	3.00	0.16

α-4

	A	B	C	D	E	F	G	H	F1150
Week Comp. 8/7-14	0.82	0.32	1.90	0.77	1.22	0.27	0.46	0.12	0.62

7/17 Comp. Sump 2.13

785518 F1100 #1 0.46
" " #2 <0.10
785519 F1101 #1 <0.10
" " #2 0.22

4th Q 55

327.175
11.817
11.416
11.368

29 | 361.756
9
31 | 289.832
279

63
12.474
29 | 361.756
29
71
58
137
116
215
203
126
116
10

3 | 32418
10.800

.44
33
73
1.08
74
71
79
96
63
23
40
57
1.48
13 | 909
.70 mg/l
63#/day

Oct	11.4	$\times 10^6$
Nov	11.028	$\times 10^6$
Dec	9.990	$\times 10^6$
Jan	10.720	$\times 10^6$
Feb	12.474	$\times 10^6$

23194
11597

1st Q 56

10.806 $\times 10^6$ av for 4th Q 55
11.597 $\times 10^6$ 2nd 1st Q.

3.79 l/gal

10,806,000
3.79
97254000
75642000
32418000
40,954,740.00

11,600,000
3.79
104400000
81200000
34800000
43,964,000

38
43
32
36
05
27
18
34 Thru 2/24
8 | 2373
.29 mg/l
44
3
13,200 gm

30#/day

41,000,000
.70
28,700,000 mg.
63
454 | 28,700 gms
27 24
1460
1362

Location	7/11	7/12	7/13	7/14	7/15	7/19	7/20
Beta 4 outlet		0.11	<0.10	0.33	<0.10	<0.10	0.36
Alpha 5 outlet		0.92	2.22	0.71	8.44	2.81	1.33
Alpha 4 outlet		<0.10	<0.10	<0.10	<0.10	0.18	<0.10
Beta 2 outlet		0.16	<0.10	0.36	0.16	0.61	<0.10
Alpha 2 outlet		1.32	2.12	2.32	13.13	2.82	0.87
Lt open Hole halfway from Laundry to Creek		<0.10	<0.10	0.18	<0.10	<0.10	<0.10
Stream from 5207-9211, and Laundry to Creek		<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
East End of Plant		0.30	1.21	1.31	1.85	1.21	1.80

Solin Hypochlorite

[illegible] 1.85 [illegible] [illegible] Strain

NaOH 3 gals 50% / kg Alloy metal reduced 10,000 kg

	max	min
N Hypochlide	1.85	.6
Chlorate	1.85	.4
Cloud	3	1
Cumulative NaOH	6.55	1.66

30,000 gals NaOH per month

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: Mr. W. C. Moore

Plant: Y-12

Date: March 20, 1957

Subject: Poplar Creek Contaminants

Copies To: G. J. Angele
R. F. Hibbs
L. J. LaFrance [redacted]
R. C. Olson
D. H. Rader
G. A. Strasser
J. W. Strohecker
R. A. Walker
J. L. Waters
W. K. Whitson, Jr.
H. T. Kite (Y-12RC)

Reference is made to Mr. G. J. Angele's report of February 18, 1957 and Mr. L. J. LaFrance's letter to Mr. G. A. Strasser of December 28, 1956 concerning the subject of Poplar Creek Contaminants.

Our interpretation of the data contained in these two documents is as follows:

1. The present pH range occasionally exceeds that recommended;

2. Radiation levels are not in excess of recommendations - if the source of such radiation is considered;

3. Mercury contamination greatly exceeds the recommended value;

4. Turbidity resulting from carbon and coal dusts is high, but probably of no serious consequence; and

5. Levels of other contaminants are below the maximum limits.

Our comments relative to these conclusions are:

1. The pH range can possibly be easily reduced by either one or a combination of the following:

   a. More uniform control of discharge of acids and bases into the creek;
   b. Providing a lagoon to permit mixing of acids and bases (as suggested as a possibility by Mr. Angele for carbon reduction) and,
   c. Control of stream pH at the point where it leaves the plant area by the addition of suitable neutralizing agents.

Further investigation as to the desirability of doing something about such pH variations is therefore suggested.

2. Since radiation level appears acceptable, no further investigations should be made. The stream should continue to be monitored, however.

3. The Cascade Development Department has been concerned with loss of mercury from both the economical and pollution viewpoints for several years. It must be admitted that no great emphasis has been placed upon the minimization of stream pollution, however. It does not appear feasible to use evaporation-seepage from ponds for such large volumes of water ($\sim$0.5 million gallons per day). Evaporation would be practical only if a spray pond or a covered pond were used since the annual precipation rate exceeds the evaporation rate. The best solution is probably to attack the problem at its source, since no easy means of removing trace quantities of mercury from water are known. The solution does not appear in any case to be cheap. Further studies are continuing in the Department.

4. Control of carbon dust should be achieved at the source, as suggested by Mr. Angele. Control of coal dust may be difficult, and may require lagoons as suggested. Further studies of the necessity of such actions should be made.

5. Stream water should be routinely monitored for the presence of other undesirable contaminants which may have an opportunity to enter the water.

It is, therefore, the writer's opinion that a committee be set up to study the situation as it exists and to recommend specific engineering or development action on the basis of the existing contamination as it violates legal, moral, ethical and economic principals.

It is further recommended that the committee be composed of the Y-12 Plant Industrial Hygienist, who should act as Chairman, the Y-12 Plant Sanitary Engineer, one representative from each of the Production Divisions, a representative from the Utilities Department, and a representative from the Development Division. Other groups and individuals should be used in connection with the problem.

H. T. Kite

H. T. Kite

HTK/vb

CN-429
2 1-59)

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) H. R. Gwinn
Company
Location Bldg. 9995

Date September 16, 1959
Originating Dept. Industrial Hygiene
Answering letter date
Subject Poplar Creek Water Analysis

Copy to E. E. McCombs
T. P. Hamrick
File

The Industrial Hygiene Department requests that a Semi-Quan analysis be performed on the weekly composite Poplar Creek water samples. This analysis should begin with samples presently found in the Bio-Analysis Laboratory for the month of September.

The charge for these samples is 2108 and the results are to be submitted to the Industrial Hygiene Department.

James F. Morehead
James F. Morehead
Industrial Hygiene Department

Fr:emh

APPROVED FOR PUBLIC RELEASE
P. L. McKenney 8/17/95
Technical Information Office Date

UNCLASSIFIED

DOCUMENT DESCRIPTION (Completed By Requesting Division)

Document No	Author's Telephone No.	Acct. No	Date of Request
TMS/CHR2-0166/DEL REV	6-0263	23660003	8/7/95

Unclassified Title: POPLAR CREEK, ANALYSIS FOR FLOW; Hg, Na, K, Li, AND pH

Author(s) Requestor: Steve Wiley

TYPE: ☐ Formal Report ☐ Informal Report ☐ Progress/Status Report ☐ Co-Op Report ☐ Thesis/Term Paper

☐ Oral Presentation (identify meeting, sponsor, location, date):

☐ Journal Article (Identify Journal):

☒ Other (Specify): To Be Released to ChemRisk, Phase II

Document will be published in proceedings ☑ No ☐ Yes

Document will be distributed at meeting ☑ No ☐ Yes

Document has patent or invention significance ☑ No ☐ Yes (Identify)

Document has been previously released ☑ No ☐ Yes (Reference)

DIVISION REVIEW AND APPROVAL (Completed By Requesting Division)

TECHNICAL CLASSIFICATION REVIEW (Divisional Classification Representative)

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J Rowan 8-15-95
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Weapons Data – Sigma –

[signature] 8/16/95
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P. R. McKenney 8/17/95
Technical Information Office Date

Conditions/Remarks:

[redacted]

[redacted]

[redacted]

Authority: [redacted]
Date:

[redacted]

[redacted]RRESPONDENCE

[redacted]S COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

Y/HG-0436
M-840

[redacted] M. Smiley
[redacted]TION Bldg. K-1401, K-25

DATE July 25, 1955

ANSWERING LETTER DATE

ATTENTION

COPY TO Mr. J. P. Murray
Mr. G. A. Strasser
Mr. W. C. Moore
Mr. L. P. Twichell
Mr. L. J. LaFrance
file (Y-12 HoRC)

SUBJECT Wastes from Y-12 to Poplar Creek

[redacted]

~~Y/HG-0436~~
Y/HG-0436/DEL REV

The additions to the stream are given essentially in order. Many of the figures are approximations. The values are based on June operations with corrections made for unusual conditions.

APPROVED FOR PUBLIC RELEASE
P. R. McKenney 8/25/95
Technical Information Office Date

Beta-4

Solvent additions to this sytem are about 2,000 lbs. per month. Effluent analysis from the building accounts for only a small part of this. About one-third may be lost by evaporation. Some of the evaporated solvent may be reaching the stream through the ground water. This building also discharges alloy sulfate and alloy hydroxide equivalent to 2,000 lbs. per month of H_2SO_4 and 12,000 lbs. of $AyOH \cdot H_2O$.

Alpha-4 and -5

The solvent loss from these buildings has not been established as yet. Based on the plant design and the results for the Beta-4 installation, these are expected to be of the order, 5,000 to 10,000 lbs. per month. There is no information as to the fraction which may be reaching the stream.

The demineralized water units in Alpha-4 supply Alpha-5 and Beta-4 as well. This system can use as much as 22,000 lbs. per month of H_2SO_4 and 27,000 lbs. per month of NaOH.

There has been considerable methanol added to the brine systems in these buildings and as much as 5,000 lbs. per month may be entering the stream.

The alloy lost from these buildings has been excessive. Under present operating conditions it should not amount to more than 150,000 lbs. per month of $AyOH \cdot H_2O$. As soon as some of the equipment difficulties are overcome, this should decrease to only a few thousand pounds per month.

9212

This building has its own waste pond. Discharges to the sewer are, for the most part, solutions of NaOH partly reacted with aluminum and silica. This is equivalent to about 8,000 lbs. per month of NaOH. There is also of HF discharged as a solution of NH_4HF_2.

[redacted]

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

[redacted]

Beta-2

9206

The amounts of chemicals from this building vary widely. Most of the discharge is a slightly acid solution of nitrate salts containing F^- complexed with aluminum.

The other cations involved are mostly NH_4^+, Mg^{++}, Ca^{++}, and Na^+ in about that order.

The total F^- will amount to [ ] is vented to the air and may not reach the creek.

[ ] per month of tuballoy and oralloy are present in the solutions.

There are a few hundred pounds per month of organic solvents and cutting oils discharged to the stream.

9211

These solutions are a mixture of sulfates, chlorides and fluorides in ammoniacal solution. About 70,000 pounds of H_2SO_4 is used per month.

The relative amounts of the halides discharged to the air and the stream is not known. tuballoy is also discharged.

SUMMARY

It should be remembered that these numbers are only approximations. There are large amounts of alkali not listed because they are not known in many cases. All streams leaving the plant are nearly neutral or basic so all of the acids listed here enter the stream as salts of various kinds. Some discharged to the air may not reach the stream.

Chemical	Pounds per Month
H_2SO_4	94,000
$AyOH \cdot H_2O$	160,000
ADP Solvent	10,000

[redacted]

J. M. Googin

J. M. Googin

am

DOE PLEASANT INFORMATION CONTROL FORM

DOCUMENT DESCRIPTION (Completed By Requesting Division)

Document No	Author's Telephone No.	Acct. No.	Date of Request
Y/HG-0436/DEL REV	6-0263	23660003	8/7/95

Unclassified Title: WASTES FROM Y-12 POPLAR CREEK (M-840)

Author(s) Requestor: Steve Wiley

TYPE: ☐ Formal Report ☐ Informal Report ☐ Progress/Status Report ☐ Co-Op Report ☐ Thesis/Term Paper

☐ Oral Presentation (identify meeting, sponsor, location, date):

☐ Journal Article (Identify Journal):

☒ Other (Specify): To Be Released to ChemRisk, Phase II

Document will be published in proceedings ☑ No ☐ Yes

Document will be distributed at meeting ☑ No ☐ Yes

Document has patent or invention significance ☐ No ☐ Yes (Identify)

Document has been previously released ☐ No ☐ Yes (Reference)

DIVISION REVIEW AND APPROVAL (Completed By Requesting Division)

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Level U (w/Del) Category –

Weapons Data – Sigma –

[signature] 8-23-95

Y-12 Classification Office Date

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☐ Disclaimer ☐ Copyright ☐ Patent Caution ☐ Other

P.L. McKenney 8/25/95

Technical Information Office Date

Conditions/Remarks:

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO V. C. Jackson
LOCATION Bldg. 9995

ATTENTION
COPY TO L. J. LaFrance [redacted]
File

DATE October 26, 1955

ANSWERING LETTER DATE

SUBJECT Special H_2O Samples Submitted by V. C. Jackson

Listed below are the results:

Sample	Mercury mg/liter
Sump F-1150 7/15	0.83
830618 R ~~Sed~~ & ~~7/28~~ 7/28	<0.10
C 7/19	<0.10
D 7/19	0.15
75594 E 7/19	4.04
66370 F 7/19	0.88
15482 G 7/19	0.90
05325 H 7/19	1.80
F-1150 7/19	0.56
785518 F-1100 No. 1	0.46
785518 F-1100 No. 2	<0.10
785519 F-1101 No. 1	<0.10
785519 F-1101 No. 2	0.22
II G-2330 7-19-55	0.59
No. 2 E-2330 7-19-55	0.45
No. 2 C-2330 7-19-55	0.39
880462	11.27
880464	0.16
880466	1.42
Big Bottle F	0.27
H-2330 7-19-55	0.99
880467	1.62
II C 40207 7/17	0.28
No. 2 F-2330 7-19-55	2.26
D 592416 7/17	0.11
E 75587 7-17-55	8.30
F 66093 7-17-55	1.07
G 15480 7-17-55	0.12
H 05320 7-17-55	0.21
Waste Dis. 23:00	
F-1150 7-17-55	0.79

Napier Creek

Weldon

Napier Creek

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

Sample	Mercury mg/liter
7-17-55 Comp. Sump.	2.13
RGO 830617	
7-28-55 14 A-4	<0.10
Group 3 7-15-55	
2230 C 7/15	0.36
2230 D 7/15	0.33
2230 E 7/15	Either too high or too cruddy to analyze by this method
2230 F 7/15	3.66
2230 G 7/15	0.36
2230 H 7/15	0.17
F 1150 7-16-55	1.38
7-16-55 30166 C	0.13
7-16-55 D-59245	0.86
E 75585 7/16	0.79
F 56015 7/16	0.90
G 15479 7/16	0.84
Group I 7-13-55	
C-0030 7/13	0.29
ID-0030 7-13-55	0.27
IE-0030 7/13	0.20
IG-0030 7/13	<0.10
IH-0030 7/13	0.13
C 7/20	Either too high or too cruddy to analyze by this method
D 7/20	0.29
F 7-20-55	0.25
G 7-20-55 15482	0.13
H 7-20-55 05324	3.00
Comp. 7-20-55 F 1150	0.16
G-2024-6 7/18	<0.10
D-59214 7/18	0.10
E-75591 7-18-55	2.29
F-66189 7-18-55	0.38
G-15481 7-18-55	0.23
H-05322 7-18-55	0.19
Big Bottle A	0.82
Big Bottle B	0.32
Big Bottle C	1.90
Big Bottle D	0.17
Big Bottle E	1.22
Big Bottle G	0.46
Big Bottle H	0.12
Big Bottle F-1150	0.62
F-0030 7-13-55	No Sample
E 75601 7-20-55	No Sample

Fred Williams

FW/:

MERCURY URINALYSIS

Date: 9-14-55

SPECIAL WATER SAMPLES

No.	Name	Badge No.	Date Specimen Submitted	Mercury mg/liter	Remarks
	GROUP II #1		7-13-55	<0.10	
	2			2.22	
	3			<0.10	
	4			<0.10	
	5			2.12	
	6			<0.10	
	7			<0.10	
	8			1.21	
	COMP. IV #1		7-15-55	<0.1	
	2			8.44	
	3			<0.1	
	4			0.16	
	5			13.13	
	6			<0.1	
	7			<0.10	
	8			1.85	
	~~GROUP II 7-20~~ #1		7-20-55	0.36	
	2			1.33	
	3			<0.10	
	4			<0.10	
	5			0.87	
	6			<0.10	
	7			<0.10	
	8			1.80	

MERCURY URINALYSIS

Date: Aug. 24, 1955

No.	Sample	Badge No.	Date Specimen Submitted	Mercury mg/liter	Remarks
	Group I -1 7/12			0.11	
	-2			0.92	
	-3			<0.1	
	-4			0.16	
	-5			1.32	
	-6			<0.1	
	-7			<0.1	
	-8			0.30	
	Group III-1 7/14			0.33	
	-2			0.71	
	-3			<0.1	
	-4			0.36	
	-5			2.32	
	-6			0.18	
	-7			<0.1	
	-8			1.31	
	Group V-1 7/19			<0.1	
	-2			2.81	
	-3			0.18	
	-4			0.61	
	-5			2.82	
	-6			<0.1	
	-7			<0.1	
	-8			1.21	

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

Y/HG-0101

To: Mr. R. A. Walker

Plant: Y-12

Date: October 24, 1957

Copies To: File

Subject: Suggested Studies for Development Division

The following items are suggested for intensive study by the Development Division for the Alloy Division:

1. Mercury Losses

This item includes the study of practical methods for reducing mercury losses to the creek and has implications from both the monetary standpoint and the contamination standpoint of the creek. With regard to the mercury losses in 81-10 to the creek such studies might involve re-cycling of water from the sump for re-use with intermittent settling of the sump, permitting the mercury flow effluent to be pumped to the creek. It might also include recommendations for control of water use, that is, procedural and/or equipment changes.

Further applications of the mercury loss study would involve the 1150 sumps for both Alpha-4 and Alpha-5 with possible procedures for settling methods to be involved.

2. Lithium Recovery

This item involves study of planned waste streams as well as study of points where losses are inadvertently incurred. Plans are now under way for recovery of planned waste streams in Auxiliary and efforts should be intensified on this item.

3. Reduction of Water Usage

The entire water use, and re-use, where feasible, should be studied through the Auxiliary and Cascades Departments with a view to reduction of water use to a minimum. The value of such a study and application of recommendations is a monetary consideration in that minimized usage of make-up water would reduce steam requirements in the evaporators with a resultant savings.

APPROVED FOR PUBLIC RELEASE

OK Lee 4/5/54

Technical Information Office Date

4. It would appear that a study of maximum practical absorber re-cycle solution temperatures should result in a probable lowering of power requirement.

5. The value of an insured constant molarity feed to the Cascades should be studied.

6. A continuing study of decomposer packing should be made along the lines of obtaining a packing which is cheaper, has a longer life, and is subject to less physical break-up, resulting in less sludge to be handled in settling basins, filters, sludge burners, etc.

John S. Reese

JSR/bg

RESTRICTED DATA
"This document contains restricted data as defined in the Atomic Energy Act of 1954. Its transmittal or the disclosure of its contents in any manner to an unauthorized person is prohibited."

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: G. A. Strasser
Bldg. 9704-2

M-840

Plant:

Date: December 28, 1956

~~Y/HG-0437~~ M-840

Copies To: G. J. Angele
File

Subject: Poplar Creek Contaminants

Y/HG-0437

The following tables summarize the available data on Poplar Creek contaminants.

The appended list of limits as suggested by the United States Public Health Service for potable water or potable water supplies are from a recent compilation. They do not include a limit for mercury, but from literature searches etc., the limit of 0.05 ppm has been suggested since concentrations higher than this are apparently injurious to aquatic life.

Limits for Alpha and Beta Activity are variable depending on the material.

According to Handbook 52 (National Bureau of Standards) any unknown source of activity should be limited to 2.22×10^2 d/m/liter whether it is Alpha, Beta or Gamma.

However, the Alpha limit for uranium would be in the order of 3.3×10^5 d/m/liter and for plutonium 3.3×10^3 d/m/liter. A Beta limit for thorium would be 6.66×10^9 d/m/liter.

It would seem that these last limits would be more applicable in the case of Poplar Creek, since the sources of activity are fairly well defined.

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Technical Information Office Date 12/19/94

DEPARTMENT OF ENERGY DECLASSIFICATION REVIEW

1st Reviewer: Rowan (Name)	Determination 4, 2 (Insert Number(s))
Authority: ☒ ADC ☐ ADD	1. Classification Retained
Date: 8-31-94	2. Classification Changed To: U
2nd Reviewer: D. K. McConnell, (Name)	3. Contains No DOE Classified Information
Authority: ☒ ADD	4. Classification Cancelled
Date: 9-2-94	5. Classified Information Bracketed
	6. Other (Specify)

Leo J. LaFrance
Industrial Hygienist
Medical Department

LJL:emm

MMES QA
Y-12 Classification Office
Name: LSMurrill
Date: 91-29-94

Classification changed to Unclassified
(Insert appropriate classification level and category)

by authority of YICG-590 9-2-94
(Authority for change in classification) (Date)

by Audrey Windham 9-14-94
(Signature of person making change) (Date)

Verified by RJ Fraser 9-15-94
(Signature of person verifying change) (Date)

UNCLASSIFIED

WCX-163 (8-55)

This form for Inter-Company Corre

Flow Rate and Concentrations of Various Materials in Poplar Creek Averaged on a Quarterly Calender Year Basis

Calender Quarter	Flow Rate in million gals/day	Mercury mg/l	Lithium ppm	Sodium ppm	Potassium ppm	pH	Alpha Activity d/m/liter	Beta Activity d/m/liter
3rd. 1954		0.32						
4th.	8.3*	0.19					209	15,260
1st. 1955		0.61					253	15,050
2nd.	11.0	1.80	23	87	14	10.6	340	3,910
3rd.	11.6	1.13	20	82	8	10.0	465	1,784
4th.	10.8	0.70	17	69	6	9.4	286	1,500
1st. 1956	11.7	0.37	15	53	10	8.7	135	1,340
2nd.	11.3	0.66	13	57	5	8.8	275	3,260
3rd.	10.8	1.53	11	54	8	8.8	395	1,460
4th.	8.1	1.26	9	66	8	8.7	240	3,031

* Estimate based on survey by TVA Geodetic Group.

≡ new numbers not in EX-24

UNCLASSIFIED

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~~RESTRICTED DATA~~
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~~CONFIDENTIAL~~

~~RESTRICTED DATA~~

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Average Concentrations in Poplar Creek Water of Various Elements as Determined by Spectrographic Analysis on Daily Samples from July 12-20, 1955.

Lead	< 0.03 ppm	Indium	< 0.05 ppm
Chromium	0.03	Potassium	6.00
Copper	0.05	Lithium	15.00
Iron	2.30	Magnesium	17.00
Manganese	0.07	Molybdenum	< 0.02
Zinc	< 0.40	Sodium	113.00
Silver	< 0.02	Nickel	0.30
Aluminum	5.00	Phosphorus	< 3.00
Gold	< 0.02	Palladium	< 0.10
Boron	< 0.10	Rubidium	< 0.20
Barium	0.05	Antimony	< 0.30
Beryllium	< 0.01	Silica	6.00
Bismuth	< 0.05	Tin	< 0.05
Calcium	43.00	Platinum	< 0.10
Cadmium	< 0.40	Titanium	0.20
Cobalt	< 0.02	Tantalum	< 0.80
Cesium	< 0.80	Vanadium	0.03
Niobium	< 0.20	Tungsten	< 0.40
Hafnium	< 0.20	Zirconium	< 0.10

Limits of Various Materials in Potable Water or Potable Water Supplies as Suggested by United States Public Health Service.

Material	Concentration	
Lead	0.10 ppm	
Fluoride	1.50	
Arsenic	0.05	
Selenium	0.05	
Chronium (Hexa-valent)	0.05	
Chronium (Trivalent)	0.10	
Copper	3.00	
Iron plus manganese	0.30	
Magnesium	125.0	
Zinc	15.0	
Chloride	250.0	
Sulphate	250.0	
Phenolics	0.001	(as phenol)
Solids	500	
Total Alkalinity	15	(pH should not exceed 10.6)
Carbonates	120	

Barium salts and other heavy metals should not be added for water treatment.

UNCLASSIFIED

from MS\CLR2-0166

Ave. monthly concentration in East Fork Poplar Creek at East end of Y-12 expressed in mg solvent/liter water.

	1954	1955
January		0.15
February		0.59
March		1.09
April	0.28	1.48
May	0.10	1.98
June	0.23	1.93
July	0.23	1.06
August	0.13	1.05
September	0.54	
October	0.25	
November	0.19	
December	0.14	

Special Study Daily Samples composited each week expressed in mg solvent/liter water.

Location	Week Ending 3-25-55	Week Ending 4-1-55	Week Ending 4-8-55	Week Ending 4-15-55
Beta 4 Outlet to creek	0.1	0.3	3.07	0.11
Alpha 5 - ditto	0.64	2.19	1.56	1.45
Alpha 2 - ditto	0.79	2.17	0.68	0.62
Laundry - ditto	0.24	1.21	0.46	1.32
Weir (East End of Y-12 Plant)	0.42	1.95	0.85	1.37

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN

TO
LOCATION

ATTENTION
COPY TO

DATE

ANSWERING LETTER DATE

SUBJECT

Creek Flow

An estimated flow in the East Fork of Poplar Creek was made last October at end of dry spell the TVA and Geodetic Survey group. This flow at that time was estimated at 8.3 x 10^6 gallons per day.

A calibrated weir and guaging station was put in service in April of 1955 and the following average daily flow rates are indicated.

Month	Average daily flow in Gallons
May	10.45×10^6
June	11.46×10^6
July ~~1-10~~	11.30×10^6
August	11.62×10^6
Sept ~~1-11~~	~~11.20×10^6~~ 11.7

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

	1954	1955	1956				
Jan		0.15	0.37			9/28	1.40
Feb		0.59	0.22			10/5	0.50
Mar		1.09	0.46			10/12	1.30
April	0.28	1.48	0.47			10/19	1.10
May	0.10	1.98	0.61			10/26	0.48
June	0.23	1.93	0.81			11/2	0.94
July	—	1.06	1.00			11/9	0.78
Aug	0.14	1.05	1.70			11/16	2.00
Sept	0.54	1.28	1.65				
Oct	0.25	0.65	0.86				
Nov	0.19	0.77	[illegible]				
Dec	0.14	0.67					

ave rate 1 mg/l for 1955-56

assume 10×10^6 gals/bo per day

this would be equivalent to 83.25# per day

13.53 × 8.32 = 112.57 #/gal wtg

30,356 #/yr = 270 gals/yr

or 22 gals/Month

WCX-885 (Jan'48) Y-12 DATA SHEET

NY/HG-0437

Flow Rate and Concentrations of Various materials in Poplar Creek averaged on a Quarterly Calendar year Basis

Calendar Quarter	Flowrate in millions gal/day	mercury mg/l	Lithium ppm	Sodium ppm	Potassium ppm	pH	Alpha Activity d/m/liter	Beta Activity d/m/liter
3rd 1954		0.32						
4th	8.3*	0.19					209	15,260
1st 1955		0.61					253	15,050
2nd	11.0	1.80	23	87	14	10.6	340	3,910
3rd	11.6	1.13	20	82	8	10.0	465	1,784
4th	10.8	0.70	17	69	6	9.4	286	1,500
1st 1956	11.7	0.37	15	53	10	8.7	135	1,340
2nd	11.3	0.66	13	57	5	8.8	275	3,260
3rd	10.8	1.53	11	54	8	8.8	395	1,460
4th	8.1	1.26	9	66	8	8.7	240	3,031

* Estimate based on survey by TVA Geodetic group

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO LOCATION L. C. Emerson
Building 9202

ATTENTION

COPY TO G. S. Hill, Bldg. K-1001, K-25
W. H. Baumann
File

DATE June 23, 1954

ANSWERING LETTER DATE

SUBJECT Results of Special Mud and Water Samples from Poplar Creek

On May 4, 1954 special mud and water samples were taken from Poplar Creek at points outside of the Y-12 area and analyzed for total alpha and total beta activity. The location of sampling points and the activity of each sample are shown in the table below:

Sampling Point (Going down stream)	Mud Alpha c/m/g	Mud Beta c/m/g	Water Alpha c/m/l	Water Beta c/m/l
At Bridge on Bear Creek Rd.	0.17	120.00	117.0	180.0
At Bridge on Gamble Valley Rd.	86.25	6368.75	100.0	640.0
Near Tennis Courts in W. Vil.	4.37	495.57	83.0	100.0
Near W. -End Service Station	3.27	579.04	133.0	520.0
W. of Sewage Disposal Plant	0.27	82.80	100.0	520.0
At Riding Academy	No Sample	No Sample	33.0	460.0
At Bridge on Turnpike	0.80	216.90	50.0	360.0
At Bridge on Quarry Road	0.55	17.50	67.0	600.0
At Junction of E. and W. Forks	1.27	0.14	33.0	280.0
At Bridge at "Y" Intersection	0.08	6.00	33.0	740.0

Signed By
Paul C. McRee

Paul C. McRee
Health Physics Department

PCM:mcm

Task 6?
Task 7?

POPLAR CREEK WATER RESULTS

Date	Normal U in ug/l	Enriched U in d/m/l	Pu in d/m/l	Hg in mg/l
5-7-54	18.02	6.7	17.86	.136
5-14-54	10.9	228	5124	.098
5-21-54	32.65	546.7	435.5	.06
5-28-54	18.71	258.3	126.6	.09
6-4-54	In significant	161.7	203	.44
6-11-54	16.48	10.13	234.4	.039
6-18-54	29.68	9.26	76.54	.073
6-25-54	83.2	43.6	10.46	.171
7-2-54	16032.5	250	669	.232

7-9
7-16

Date	Alpha in d/m/l	Beta in d/m/l	Hg in mg/l
7-23-54	80,000	400	-
7-30-54	100	0	-
8-6-54	400	0	Not run
8-13-54	2,000	0	Not run
8-20-54	600	24,000	0.17
8-27-54	600	13,000	0.114
9-3-54	1,000	44,000	0.146
9-10-54	1,000	34,000	1.57
9-17-54	1,400	9,000	0.28
9-24-54	Not run	Not run	0.15
10-1-54	Not run	Not run	0.40
10-8-54	600	11,000	0.25
10-15-54	0	0	0.14
10-22-54	400	3,000	0.22

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION L. C. Emerson

DATE November 9, 1954

ANSWERING LETTER DATE

ATTENTION

COPY TO W. A. Pfeiler
L. J. LaFrance
File

SUBJECT Activity in Poplar Creek Water

Attached are the analytical results showing the activity in Poplar Creek water from May, 1954 through October 22, 1954. You will note that during July the analysis was changed from normal uranium, enriched uranium, plutonium and mercury to total alpha, total beta and mercury.

Signed By
Paul C. McRee

Paul C. McRee
Health Physics Department

PCM:ej

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-80 (6-54)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO LOCATION L. C. Emerson Y12RC Bldg. 9202

ATTENTION

COPY TO W. H. Baumann File

DATE June 1, 1954

ANSWERING LETTER DATE

SUBJECT Poplar Creek Water Analysis for April

1954-1963

Following is the average activity in the East Fork of Poplar Creek during the month of April as determined from daily samples composited and analyzed weekly:

Normal Uranium	43.7	μgm/l
Enriched Uranium	58.5	d/m/l
Plutonium	310.3	d/m/l
Mercury	0.28	mg/l

Paul C. McRee
Health Physics Department

PCM:mc

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN

TO LOCATION L. C. Emerson

DATE November 2, 1954

ANSWERING LETTER DATE

ATTENTION

COPY TO Leo J. LaFrance
File

SUBJECT Results of Poplar Creek Water Analyses

Following is the average activity in the east fork of Poplar Creek during the month of September as determined from daily water samples composited and analyzed weekly.

Alpha Activity	1134 d/m/liter
Beta Activity	29000 d/m/liter
Mercury	0.54 mg/liter

Signed By
Paul C. McRee

Paul C. McRee
Health Physics Department

PCM:ej

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-80 (6-54)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION L. C. Emerson Building 9995

ATTENTION

COPY TO W. A. Pfeiler
L. J. LaFrance
File

DATE December 1, 1954

ANSWERING LETTER DATE

SUBJECT Results of Poplar Creek Water Analyses for November

Following is the average activity in the east fork of Poplar Creek during the month of November as determined from daily water samples composited and analyzed weekly:

Alpha Activity	175 d/m/liter
Beta Activity	3500 d/m/liter
Mercury	0.191 mg/liter

Signed By
Paul C. McRee

PCM/j

Paul C. McRee
Health Physics Department

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-80 (6-54)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION: L. C. Emerson, Building 9995

ATTENTION: W. A. Pfeiler

COPY TO: L. J. LaFrance, File

DATE: January 18, 1955

ANSWERING LETTER DATE:

SUBJECT: Results of Poplar Creek Water Analyses for December 1954

Following is the average activity in the east fork of Poplar Creek during the month of December 1954, as determined from daily water samples composited and analyzed weekly:

Alpha Activity	151 d/m/liter
Beta Activity	37,800 d/m/liter
Mercury	0.14 mg/liter

Signed By
Paul C. McRee

Paul C. McRee
Health Physics Department

PCM/j

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson
LOCATION Building 9995

DATE February 3, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

SUBJECT Results of Poplar Creek Water Analyses for January 1955

Following is the average activity in the east fork of Poplar Creek during the month of January 1955, as determined from daily water samples composited and analyzed weekly:

Alpha Activity	259 d/m/liter
Beta Activity	23,500 d/m/liter
Mercury	0.15 mg/liter

Signed By
Paul C. McRee

Paul C. McRee
Health Physics Department

PCM/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

INTER-COMPANY CORRESPONDENCE

INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

O L. C. Emerson
LOCATION Building 9995

ATTENTION W. A. Pfeiler
COPY TO C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

DATE March 7, 1955

ANSWERING LETTER DATE

SUBJECT Results of Poplar Creek Water Analyses for February, 1955

Following is the average activity in the east fork of Poplar Creek during the month of February, 1955, as determined from daily water samples composited and analyzed weekly:

Alpha Activity	332 d/m/liter
Beta Activity	4,250 d/m/liter
Mercury	0.59 mg/liter

Signed By
Paul C. McRee

Paul C. McRee
Health Physics Department

PCM/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION L. C. Emerson
Building 9995

ATTENTION

COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

DATE April 7, 1955

ANSWERING LETTER DATE

SUBJECT Results of Poplar Creek Water Analyses for March, 1955

Following is the average activity in the East fork of Poplar Creek during the month of March, 1955, as determined from daily water samples composited and analyzed weekly:

Alpha Activity	173.4 d/m/liter
Beta Activity	1,7400 d/m/liter
Mercury	1.09 mg/liter

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION L. C. Em rson, Y12RC
Building 9995

ATTENTION

COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFranc
File

DATE May 12, 1955

ANSWERING LETTER DATE

SUBJECT Results of Poplar Creek Water Analyses for April, 1955

Following is the average activity in the east fork of Poplar Creek during the month of April, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity	398.2	d/m/liter
Beta Activity	0	d/m/liter
Mercury	1.48	mg/liter

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION L. C. Emerson, Y12RC Bldg. 0005

ATTENTION

COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M.D.
L. J. LaFrance
File

DATE June 3, 1955

ANSWERING LETTER DATE

SUBJECT Results of Poplar Creek Water Analyses for May, 1955

Following is the average activity in the east fork of Poplar Creek during the month of May, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity	221 d/m/liter
Beta Activity	2900 d/m/liter
Solvent	1.98 mg/liter

SIGNED - MERWYN SANDERS

Merwyn Sanders

cs

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO
LOCATION L. C. Emerson, Y-12RC
Building 9995
ATTENTION
COPY TO
W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

DATE
July 13, 1955
ANSWERING LETTER DATE

SUBJECT
Results of Poplar Creek Water Analyses for June, 1955

Following is the average activity in the east fork of Poplar Creek during the month of June, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity	401	d/m/liter
Beta Activity	8840	d/m/liter
Solvent	1.93	mg/liter

SIGNED - MERWYN SANDERS

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-80 (6-54)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION L. C. Emerson, Y-12RC Building 9995

ATTENTION

COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

DATE August 11, 1955

ANSWERING LETTER DATE

SUBJECT Results of Poplar Creek Water Analyses for July, 1955

Following is the average activity in the east fork of Poplar Creek during the month of July, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity	423	d/m/liter
Beta Activity	2857	d/m/liter
Solvent	1.06	mg/liter

SIGNED - C. M. WEST for

Merwyn Sanders
Health Physics Department

CMW/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-80 (6-54)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO
LOCATION L. C. Emerson, Y-12RC
Building 9995

ATTENTION

COPY TO

W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

DATE
September 14, 1955

ANSWERING LETTER DATE

SUBJECT
Results of Poplar Creek Water Analyses for August, 1955

Following is the average activity in the east fork of Poplar Creek during the month of August, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity	445.8	d/m/liter
Beta Activity	1,739.0	d/m/liter
Solvent	1.05	mg/liter

SIGNED - MERWYN SANDERS

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-80 (6-54)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION L. C. Emerson, Y12RC Building 9995

ATTENTION

COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

DATE October 11, 1955

ANSWERING LETTER DATE

SUBJECT Results of Poplar Creek Water Analyses for September, 1955

The following is a listing of the average activity in the east fork of Poplar Creek during the month of September, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
9-11-55	363
9-18-55	1,373
9-25-55	93
10-2-55	280

Beta Activity

Week Ending	Results d/m/liter
9-11-55	900
9-18-55	0
9-25-55	175
10-2-55	1,950

Mercury Concentrations

Week Ending	Results mg/liter
9-11-55	1.16
9-18-55	1.89
9-25-55	1.07
10-2-55	.84
	4.96
	1.28

1.24 $\bar{x}$

SIGNED - MERWYN SANDERS

Merwyn Sanders
Health Physics Department

MS/j THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-80 (6-54)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y-12RC
LOCATION Building 9995

DATE November 8, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., [illegible] D.
L. J. LaFrance [redacted]
L. C. Johnson
File

SUBJECT Results of Poplar Creek Water Analyses for October, 1955

The following is a listing of the average activity in the east fork of Poplar Creek during the month of October, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
10-9-55	393
10-16-55	110
10-23-55	153
10-30-55	663

Beta Activity

Week Ending	Results d/m/liter
10-9-55	8,933
10-16-55	433
10-23-55	0
10-30-55	733

Mercury Concentrations

Week Ending	Results mg/liter
10-9-55	.44
10-16-55	.33
10-23-55	.73
10-30-55	1.08

4265

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Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y-12RC
LOCATION Building 9995

DATE December 9, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

SUBJECT Results of Poplar Creek Water Analyses for November, 1955

The following is a listing of the average activity in the east fork of Poplar Creek during the month of November, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
11-6-55	116
11-13-55	473
11-20-55	150
11-27-55	347
12-4-55	306

Beta Activity

Week Ending	Results d/m/liter
11-6-55	0
11-13-55	0
11-20-55	0
11-27-55	7,617
12-4-55	613

Mercury Concentrations

Week Ending	Results mg/liter
11-6-55	.74
11-13-55	.71
11-20-55	.79
11-27-55	.96
12-4-55	.63

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Merwyn Sanders
Health Physics Department

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INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y-12RC
LOCATION Building 9995

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance [redacted]
L. C. Johnson
File

DATE January 10, 1956

ANSWERING LETTER DATE

SUBJECT Results of Poplar Creek Water Analyses for December, 1955

The following is a listing of the average activity in the east fork of Poplar Creek during the month of December, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
12-9-55	220
12-16-55	20
12-23-55	530
12-30-55	246

Beta Activity

Week Ending	Results d/m/liter
12-9-55	0
12-16-55	0
12-23-55	500
12-30-55	616

Mercury Concentrations

Week Ending	Results mg/liter
12-9-55	.23
12-16-55	.40
12-23-55	.57
12-30-55	1.48
	2.68

67

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Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION: L. C. Emerson, Y12RC
Building 9995

DATE: February 1, 1956

ANSWERING LETTER DATE

ATTENTION: W. A. Pfeiler

COPY TO: C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

SUBJECT: Results of Poplar Creek Wate
Analyses for January, 1956

The following is a listing of the average activity in the east fork of Poplar Creek during the month of January, 1956, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
1-6-56	163
1-13-56	133
1-20-56	70
1-27-56	150

Beta Activity

Week Ending	Results d/m/liter
1-6-56	1,433
1-13-56	1,967
1-20-56	412
1-27-56	650

Mercury Concentrations

Week Ending	Results mg/liter
1-6-56	.38
1-13-56	.43
1-20-56	.32
1-27-56	.36

SIGNED - MERWYN SANDERS

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (3-55)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y12RC
LOCATION Building 9995

DATE March 9, 1956

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

SUBJECT Results of Poplar Creek Water Analyses for February, 1956

The following is a listing of the average activity in the east fork of Poplar Creek during the month of February, 1956, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
2-3-56	70
2-10-56	106
2-17-56	163
2-24-56	273

Beta Activity

Week Ending	Results d/m/liter
2-3-56	950
2-10-56	433
2-17-56	2,933
2-24-56	3,600

Mercury Concentrations

Week Ending	Results mg/liter
2-3-56	<0.1
2-10-56	.27
2-17-56	.18
2-24-56	.34

SIGNED - MERWYN SANDERS

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y-12RC
LOCATION Building 9995

DATE April 9, 1956

ANSWERING LETTER DATE

ATTENTION
COPY TO T. A. Pfeiler
C. E. Sullivan, Jr., M.D.
L. J. LaFrance
L. C. Johnson
File

SUBJECT Results of Poplar Creek Water Analyses for March, 1956.

The following is a listing of the average activity in the east fork of Poplar Creek during the month of March, 1956, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
3-2-56	116
3-9-56	83
3-16-56	120
3-23-56	100
3-29-56	200

Beta Activity

Week Ending	Results d/m/liter
3-2-56	0
3-9-56	2,166
3-16-56	0
3-23-56	1,383
3-29-56	1,183

Mercury Concentrations

Week Ending	Results mg/liter
3-2-56	.40
3-9-56	.46
3-16-56	.10
3-23-56	.78
3-29-56	.55

Plutonium Activity *

Date	Results d/m/liter
3-22-56	315

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

* This sample was taken, per X-10 Health Physics request, during the disposal of plutonium waste products in Poplar Creek.

E.F.

SIGNED - MERWYN SANDERS

Merwyn Sanders
Health Physics Department

MS/eb

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: L. J. Emerson, Y12 RC
Building 9995

Plant: Y-12

Date: May 9, 1956

Subject: Results of Poplar Creek Water Analyses for April, 1956

Copies To: W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

The following is a listing of the average activity in the east fork of Poplar Creek as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
4-6-56	226
4-13-56	180
4-20-56	34
4-27-56	250

Beta Activity

Week Ending	Results d/m/liter
4-6-56	0
4-13-56	2,817
4-20-56	833
4-27-56	1,280

Mercury Concentrations

Week Ending	Results mg/liter
4-6-56	.44
4-13-56	.32
4-20-56	.55
4-27-56	.55
	1.86
	47

SIGNED - MERWYN SANDERS

M. Sanders

MS:mw

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: L. C. Emerson, Y12RC
Building 9995

Plant: Y-12

Date: June 12, 1956

Copies To: W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

Subject: Results of Poplar Creek Water Analyses for May, 1956

The following is a listing of the average activity in the east fork of Poplar Creek as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
5-4-56	207
5-11-56	383
5-18-56	240
5-25-56	513

Beta Activity

Week Ending	Results d/m/liter
5-4-56	67
5-11-56	33
5-18-56	1,183
5-25-56	1,400

Mercury Concentration

Week Ending	Results mg/liter
5-4-56	.74
5-11-56	.70
5-18-56	.42
5-25-56	.58
	2.44
	.61

SIGNED - MERWYN SANDERS

M. Sanders

MS:mw

WCX-163 (8-55)

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INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: L. C. Emerson, Y12RC
Building 9995

Plant: Y-12

Date: July 6, 1956

Copies To: W. A. Pfeiler
C. R. Sullivan, Jr., M.D.
L. J. LaFrance
L. C. Johnson
File

Subject: Results of Poplar Creek Water Analyses for June, 1956.

The following is a listing of the average activity in the east fork of Poplar Creek as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
6-1-56	143
6-8-56	183
6-15-56	916
6-22-56	50
6-29-56	246

Beta Activity

Week Ending	Results d/m/liter
6-1-56	817
6-8-56	100
6-15-56	1,817
6-22-56	483
6-29-56	31,733

Mercury Concentration

Week Ending	Results mg/liter
6-1-56	1.03
6-8-56	1.31
~~6-15-56~~	~~.37~~ .37
6-22-56	.89
6-29-56	.45
	5.05

yeh 856

15157

SIGNED - MERWYN SANDERS

M. Sanders

MS/eb

WCX-163 (8-55)

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INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: L. C. Emerson
Building 9995

Plant: Y-12

Date: August 22, 1956

Copies To: W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
G. J. Angele
L. J. LaFrance
L. C. Johnson
File

Subject: Results of Poplar Creek Water Analyses for July, 1956.

The following is a listing of the average activity in the east fork of Poplar Creek as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
7- 6-56	190
7-13-56	613
7-20-56	573
7-27-56	440

Beta Activity

Week Ending	Results d/m/liter
7- 6-56	9,000
7-13-56	4,900
7-20-56	1,333
7-27-56	0

Mercury Concentration

Week Ending	Results mg/liter
7- 6-56	1.17
7-13-56	.56
7-20-56	.96
7-27-56	1.32
	4.01

SIGNED - MERWYN SANDERS

M. Sanders

MS/eb

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon
Building 9711-5

Plant: Y-12

Date: September 21, 1956

Copies To: C. R. Sullivan, Jr., M. D.
G. J. Angele
L. J. LaFrance
L. C. Johnson
File

Subject: Results of Poplar Creek Water Analyses for August, 1956.

The following is a listing of the average activity in the east fork of Poplar Creek as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
8-3-56	433
8-10-56	713
8-17-56	683
8-24-56	270
8-31-56	347

Beta Activity

8-3-56	2,866
8-10-56	0
8-17-56	450
8-24-56	567
8-31-56	0

Mercury Concentration

	Results mg./liter
8-3-56	1.17
8-10-56	.67
8-17-56	1.19
8-24-56	2.31
8-31-56	3.06
9-7	3.60
9-14	0.80
9-21	
9-28	

5840
170

M. Sanders
Health Physics Department

MS/eb

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9711-5

Plant: Y-12

Date: October 16, 1956

Copies To: C. R. Sullivan, Jr., M.D.
G. J. Angele
L. J. LaFrance
L. C. Johnson
File

Subject: Surface Water Sampling - September, 1956

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits and Burial Pit.

Location	Date	Alpha d/m/liter	Beta d/m/liter	Mercury mg/liter
Poplar Creek	9-7-56	287	0	? 3.6
	9-14-56	190	0	.8
	9-21-56	273	0	.8
	9-28-56	150	0	1.4
				1.65
Bear Creek	9-4-56	73	983	~~1.65~~
	9-12-56	109	0	---
	9-18-56	44	3,496,586	---
	9-25-56	57	0	---
North West Settling Pit	9-4-56	1,214	24,978	---
	9-12-56	1,041	15,444	---
	9-19-56	1,192	18,850	---
	9-25-56	1,870	6,571	---
North East Settling Pit*	9-4-56	8,722	221,998	---
	9-12-56	13,477	316,895	---
	9-18-56	14,615	283,487	---
	9-25-56	10,058	132,895	---

* Pit now being used for waste product.

Burial Pit	9-4-56	30,482	5,476	---
	9-12-56	Insufficient water in pit for sample.		
	9-18-56	Insufficient water in pit for sample.		
	9-25-56	20,953	7,745	---

SIGNED - MERWYN SANDERS

M. Sanders
Health Physics Department

MS/eb

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon
Building 9711-5

Plant: Y-12

Date: September 18, 1956

Copies To: C. R. Sullivan, Jr., M. D.
G. J. Angele
L. J. LaFrance
L. C. Johnson
File

Subject: Results of Bear Creek Water Analyses for August, 1956.

The following gives a listing of water sample results taken from Bear Creek. These samples were collected approximately one mile down stream from Y-12 burial pit and disposal area. The samples were analyzed for alpha and beta activity.

Date of Sample	Alpha d/m/liter	Beta d/m/liter
8-8-56	54	192
8-13-56	68	0
8-23-56	25	0
8-29-56	23	0

SIGNED - MERWYN SANDERS

M. Sanders
Health Physics Department

MS/eb

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9711-5

Plant: Y-12

Date: December 10, 1956

Copies To: C. R. Sullivan, Jr., M. D.
G. J. Angele
L. J. LaFrance
File

Subject: Surface Water Sampling
October, 1956

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit:

Location	Date	Alpha d/m/liter	Beta d/m/liter	Mercury mg/liter	Total Flow gal/week
Poplar Creek	10-5-56	530	2,883	.5	78.3×10^6
	10-12-56	197	13,833	1.3	82.9×10^6
	10-19-56	210	320,021	1.1	80.1×10^6
	10-26-56	177	1,183	.48	78.8×10^6
	11-2-56	220	3,233	.94	81.2×10^6
Bear Creek	10-1-56	19	3,065	----	
	10-10-56	224	711	----	
	10-16-56	12	0	----	
	10-22-56	0	0	----	
	10-29-56	26	1,500	----	
North West Settling Pit	10-1-56	923	6,221	----	
	10-10-56	2,833	23,532	----	
	10-16-56	2,977	24,371	----	
	10-22-56	2,341	15,366	----	
	10-29-56	3,076	32,611	----	
North East Settling Pit *	10-1-56	12,233	189,933	----	
	10-10-56	22,084	392,518	----	
	10-16-56	4,037	273,039	----	
	10-22-56	27,046	273,650	----	
	10-29-56	19,740	33,834	----	

* Pit now being used for waste product.

Location	Date	Alpha d/m/liter	Beta d/m/liter	Mercury mg/liter
Burial Pit	10-1-56	Insufficient water in pit for sample.		
	10-8-56	Insufficient water in pit for sample.		
	10-15-56	Insufficient water in pit for sample.		
	10-22-56	Insufficient water in pit for sample.		
	10-29-56	Sample lost by Lab.		

C. M. West

MS/eb

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9711-5

Plant: Y-12

Date: December 18, 1956

Copies To: C. R. Sullivan, Jr., M.D.
G. J. Angele
L. J. LaFrance
File

Subject: Surface Water Sampling
November, 1956

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits and Burial Pit.

Location	Date	Alpha d/m/liter	Beta d/m/liter	Mercury mg/liter	Total Flow gal/week
Poplar Creek	11-2-56	220	3,233	.94	81.2 x 10^6 gal.
	11-9-56	197	733	.78	82.2
	11-16-56	140	167	2.0	81.7
	11-23-56	180	1,383	1.5	81.7
	11-30-56	330	3,667	1.1	80.0
				5.32	
Bear Creek	11-5-56	0	0	--- 1.26	---
	11-12-56	341	0	---	---
	11-19-56	0	0	---	---
	11-26-56	37	0	---	---
NW Settling Pit	11-5-56	1,826	14,420	---	---
	11-12-56	138,714	17,421	---	---
	11-19-56	1,962	24,962	---	---
	11-26-56	1,098	26,932	---	---
NE Settling Pit	11-5-56	24,430	310,143	---	---
	11-12-56	178,150	257,250	---	---
	11-19-56	22,476	442,103	---	---
	11-26-56	19,667	395,833	---	---
Burial Pit	11-1-56	54,000	167,000	---	---
	11-7-56	35,100	209,000	---	---
	11-14-56	114,483	139,000	---	---
	11-20-56	76,823	94,852	---	---
	11-28-56	36,500	12,458	---	---

SIGNED - C. M. WEST

C. M. West

MS:cs

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9704-2

Plant: Y-12

Date: January 15, 1957

Copies To: C. R. Sullivan, Jr., M.D.
G. J. Angele
L. J. LaFrance
L. C. Johnson
File

Subject: Surface Water Sampling
December, 1956

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l
Poplar Creek	12-7-56	127	0	.74
	12-14-56	73	1,367	.37
	12-21-56	170	3,900	.71
	12-29-56	137	900	1.2

Note: Flow data for Poplar Creek will not be reported for the month of December due to mechanical failure of the creek level recorder.

Bear Creek	12-3-56	35	0
	12-10-56	25	0
	12-17-56	63	357
	12-26-56	88	583
NW Settling Pit	12-3-56	2,558	46,784
	12-10-56	2,172	27,038
	12-17-56		
	12-26-56	691	5,000
NE Settling Pit	12-3-56	14,697	33,535
	12-10-56	19,146	[illegible],964
	12-17-56	22,570	111,327
	12-26-56	4,195	1,643
Burial Pit	12-3-56	66,448	83,146
	12-17-56	13,830	864
	12-26-56	24,810	120,200

SIGNED - C. M. WEST

C. M. West

163 (8-55) MS:cs This form for Inter-Company Correspondence only

(56)

Y/HG-0055/1

M-488

Results Of Poplar Creek
Water Analysis

Letter Reports
~~January 1955~~ - December 1955
December 1954

P. C. McRee/M. Sanders
To
L. C. Emerson

January 18, 1955 to

January 10, 1956

APPROVED FOR PUBLIC RELEASE
3/15/94
Technical Information Office Date

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO L. C. Emerson
LOCATION Building 9995

ATTENTION
COPY TO W. A. Pfeiler
L. J. LaFrance
File

DATE January 18, 1955

ANSWERING LETTER DATE

SUBJECT Results of Poplar Creek Water Analyses for December 1954

Following is the average activity in the east fork of Poplar Creek during the month of December 1954, as determined from daily water samples composited and analyzed weekly:

Alpha Activity	151 d/m/liter
Beta Activity	37,800 d/m/liter
Mercury	0.14 mg/liter

Paul C. McRee
Health Physics Department

PCM/j

RCE
1/4/55

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO L. C. Emerson
LOCATION Building 9995

DATE February 3, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

SUBJECT Results of Poplar Creek Water Analyses for January 1955

Following is the average activity in the east fork of Poplar Creek during the month of January 1955, as determined from daily water samples composited and analyzed weekly:

Alpha Activity	259 d/m/liter
Beta Activity	23,500 d/m/liter
Mercury	0.15 mg/liter

Paul

Paul C. McRee
Health Physics Department

PCM/j

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box P OAK RIDGE, TENN.

TO LOCATION L. C. Emerson
Building 9995

DATE March 7, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

SUBJECT Results of Poplar Creek Water Analyses for February, 1955

Following is the average activity in the east fork of Poplar Creek during the month of February, 1955, as determined from daily water samples composited and analyzed weekly:

Alpha Activity	332 d/m/liter
Beta Activity	4,250 d/m/liter
Mercury	0.59 mg/liter

Paul

Paul C. McRee
Health Physics Department

PCM/j

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

xCE
4/13

TO LOCATION L. C. Emerson
Building 9995

DATE April 7, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

SUBJECT Results of Poplar Creek Water Analyses for March, 1955

Following is the average activity in the east fork of Poplar Creek during the month of March, 1955, as determined from daily water samples composited and analyzed weekly:

Alpha Activity	173.4 d/m/liter
Beta Activity	? 1,7400 d/m/liter
Mercury	1.09 mg/liter

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (6-54)

LCE
5/1

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION L. C. Emerson, Y12RC Building 9995

DATE May 12, 1955

ANSWERING LETTER DATE

ATTENTION COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

SUBJECT Results of Poplar Creek Water Analyses for April, 1955

Following is the average activity in the east fork of Poplar Creek during the month of April, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity	398.2	d/m/liter
Beta Activity	0	d/m/liter ← ? Impossible
Mercury	1.48	mg/liter

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (3-55)

LEE
6/3/55

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y12RC
LOCATION Bldg. 9995

DATE June 3, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M.D.
L. J. LaFrance
File

SUBJECT Results of Poplar Creek Water Analyses for May, 1955

Following is the average activity in the east fork of Poplar Creek during the month of May, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity	221 d/m/liter
Beta Activity	2900 d/m/liter
Solvent	1.98 mg/liter

this says about 135-# per day is lost

Merwyn Sanders

CS

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (3-55)

LEE
11/13

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y-12RC
LOCATION Building 9995

DATE July 13, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

SUBJECT Results of Poplar Creek Water Analyses for June, 1955

Following is the average activity in the east fork of Poplar Creek during the month of June, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity	401	d/m/liter
Beta Activity	8840	d/m/liter
Solvent	1.93	mg/liter

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

ACX-163 (3-55)

RCC
8/11

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y-12RC
LOCATION Building 9995

DATE August 11, 1955

ANSWERING LETTER DATE

ATTENTION

COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

SUBJECT Results of Poplar Creek Water Analyses for July, 1955

Following is the average activity in the east fork of Poplar Creek during the month of July, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity	423	d/m/liter
Beta Activity	2857	d/m/liter
Solvent	1.06	mg/liter

C. M. West
Merwyn Sanders
Health Physics Department

CMW/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

KCX-165 (3-55)

LCE
7/19

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION: L. C. Emerson, Y-12RC
Building 9995

DATE: September 14, 1955

ANSWERING LETTER DATE

ATTENTION

COPY TO: W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

SUBJECT: Results of Poplar Creek Water Analyses for August, 1955

Following is the average activity in the east fork of Poplar Creek during the month of August, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity	445.8	d/m/liter	
Beta Activity	1,739.0	d/m/liter	
Solvent	1.05	mg/liter	vs. 0.82 from 9-55 Tech Div Monthly

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (3-55)

LCE
10/21

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y12RC
LOCATION Building 9995

DATE October 11, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
File

SUBJECT Results of Poplar Creek Water Analyses for September, 1955

The following is a listing of the average activity in the east fork of Poplar Creek during the month of September, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
9-11-55	363
9-18-55	1,373
9-25-55	93
10-2-55	280

Beta Activity

Week Ending	Results d/m/liter
9-11-55	900
9-18-55	0
9-25-55	175
10-2-55	1,950

Mercury Concentrations

Week Ending	Results mg/liter
9-11-55	1.16
9-18-55	1.89
9-25-55	1.07
10-2-55	.84

1.37 avg.

Merwyn Sanders
Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (3-55)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO LOCATION: L. C. Emerson, Y-12RC Building 9995

DATE: November 8, 1955

ANSWERING LETTER DATE:

ATTENTION COPY TO: W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

SUBJECT: Results of Poplar Creek Water Analyses for October, 1955

The following is a listing of the average activity in the east fork of Poplar Creek during the month of October, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
10-9-55	393
10-16-55	110
10-23-55	153
10-30-55	663

Beta Activity

Week Ending	Results d/m/liter
10-9-55	8,933
10-16-55	433
10-23-55	0
10-30-55	733

Mercury Concentrations

Week Ending	Results mg/liter
10-9-55	.44
10-16-55	.33
10-23-55	.73
10-30-55	1.08

0.64 avg.

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (3-55)

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y-12RC
LOCATION Building 9995

DATE December 9, 1955

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File.

SUBJECT Results of Poplar Creek Water Analyses for November, 1955

The following is a listing of the average activity in the east fork of Poplar Creek during the month of November, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
11-6-55	116
11-13-55	473
11-20-55	150
11-27-55	347
12-4-55	306

Beta Activity

Week Ending	Results d/m/liter
11-6-55	0
11-13-55	0
11-20-55	0
11-27-55	7,617
12-4-55	613

Mercury Concentrations

Week Ending	Results mg/liter
11-6-55	.74
11-13-55	.71
11-20-55	.79
11-27-55	.96
12-4-55	.63

0.77 avg

Merwyn Sanders
Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCY-163 (3-55)

INTER-COMPANY CORRESPONDENCE

M-68

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y-12RC
LOCATION Building 9995

DATE January 10, 1956

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

SUBJECT Results of Poplar Creek Water Analyses for December, 1955

The following is a listing of the average activity in the east fork of Poplar Creek during the month of December, 1955, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
12-9-55	220
12-16-55	20
12-23-55	530
12-30-55	246

Beta Activity

Week Ending	Results d/m/liter
12-9-55	0
12-16-55	0
12-23-55	500
12-30-55	616

Mercury Concentrations

Week Ending	Results mg/liter
12-9-55	.23
12-16-55	.40 0.67
12-23-55	.57
12-30-55	1.48

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

WCX-163 (3-55)

MS\CRR2-0163

[illegible]-6 [illegible] 1956

Daniel Creek Water Analyses

[illegible] Mthly

LCE
2/5

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y12RC
LOCATION Building 9995

DATE February 1, 1956

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

SUBJECT Results of Poplar Creek Water Analyses for January, 1956

The following is a listing of the average activity in the east fork of Poplar Creek during the month of January, 1956, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
1-6-56	163
1-13-56	133
1-20-56	70
1-27-56	150

Beta Activity

Week Ending	Results d/m/liter
1-6-56	1,433
1-13-56	1,967
1-20-56	412
1-27-56	650

Mercury Concentrations

Week Ending	Results mg/liter
1-6-56	.38
1-13-56	.43
1-20-56	.32
1-27-56	.36

.37 X

Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

LCE
3/12

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. Emerson, Y12RC
LOCATION Building 9995

DATE March 9, 1956

ANSWERING LETTER DATE

ATTENTION
COPY TO W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

SUBJECT Results of Poplar Creek Water Analyses for February, 1956

The following is a listing of the average activity in the east fork of Poplar Creek during the month of February, 1956, as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
2-3-56	70
2-10-56	106
2-17-56	163
2-24-56	273

Beta Activity

Week Ending	Results d/m/liter
2-3-56	950
2-10-56	433
2-17-56	2,933
2-24-56	3,600

Mercury Concentrations

Week Ending	Results mg/liter
2-3-56	used→<0.1 (½ LOD?, $\frac{LOD}{\sqrt{2}}$?)
2-10-56	.27
2-17-56	.18
2-24-56	.34

.22 $\bar{x}$

Merwyn Sanders
Merwyn Sanders
Health Physics Department

MS/j

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

LCE
4/23

INTER-COMPANY CORRESPONDENCE

(INSERT NAME) COMPANY CARBIDE AND CARBON CHEMICALS COMPANY LOCATION Post Office Box Y OAK RIDGE, TENN.

TO L. C. [illegible], [illegible]
LOCATION [illegible] 995

DATE [illegible], 1[illegible]

ANSWERING LETTER DATE

ATTENTION
COPY TO [illegible] Pfeiler
[illegible]
L. [illegible]
L. C. Johnson
File

SUBJECT [illegible] Creek Water Analyses for March, 1956.

[illegible] Poplar [illegible] March, 195[illegible], [illegible] water samples composited [illegible].

[illegible] Activity

Week Ending	Results d/m/liter
3-2-56	[illegible]
3-9-56	[illegible]3
3-16-56	[illegible]
3-23-56	100
3-29-56	200

Beta Activity

Week Ending	Results [illegible]/liter
3-2-56	0
3-9-56	[illegible]
3-16-56	0
3-23-56	1,353
3-29-56	1,[illegible]

Mercury Concentrations

Week Ending	Results mg/liter
3-2-56	.40
3-9-56	.46
3-16-56	.10
3-23-56	.78
3-29-56	.55

.46 $\bar{x}$

Plutonium Activity *

Date	Results d/m/liter
3-22-56	315

THIS FORM FOR INTER-COMPANY CORRESPONDENCE ONLY

per Y-12 request

* This sample was taken, ~~per Y-12 Health Physics request~~, during the disposal of plutonium waste products in Poplar Creek.

Merwyn Sanders
Health Physics Department

MS/eb

7E3
5/11

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: L. C. Emerson, Y12RC
Building 9995

Plant: Y-12

Date: May 9, 1956

Copies To: W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

Subject: Results of Poplar Creek Water Analyses for April, 1956

The following is a listing of the average activity in the east fork of Poplar Creek as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
4-6-56	226
4-13-56	180
4-20-56	34
4-27-56	250

Beta Activity

Week Ending	Results d/m/liter
4-6-56	0
4-13-56	2,817
4-20-56	833
4-27-56	1,280

Mercury Concentrations

Week Ending	Results mg/liter
4-6-56	.44
4-13-56	.32
4-20-56	.55
4-27-56	.55

.465 X

M. Sanders

MS:mw

WCX-163 (8-55)

This form for Inter-Company Correspondence only

LCC
0114

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: L. C. Emerson, Y12RC
Building 9995

Plant: Y-12

Date: June 12, 1956

Copies To: W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
L. J. LaFrance
L. C. Johnson
File

Subject: Results of Poplar Creek Water Analyses for May, 1956

The following is a listing of the average activity in the east fork of Poplar Creek as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
5-4-56	207
5-11-56	383
5-18-56	240
5-25-56	513

Beta Activity

Week Ending	Results d/m/liter
5-4-56	67
5-11-56	33
5-18-56	1,183
5-25-56	1,400

Mercury Concentration

Week Ending	Results mg/liter
5-4-56	.74
5-11-56	.70
5-18-56	.42
5-25-56	.58

.61 ✗

M. Sanders

MS:mw

WCX-163 (8-55) This form for Inter-Company Correspondence only

ICE
7/7

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: L. C. Emerson, Y12RC
Building 9995

Plant: Y-12

Date: July 6, 1956

Copies To: W. A. Pfeiler
C. R. Sullivan, Jr., M.D.
L. J. LaFrance
L. C. Johnson
File

Subject: Results of Poplar Creek Water Analyses for June, 1956.

The following is a listing of the average activity in the east fork of Poplar Creek as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
6-1-56	143
6-8-56	183
6-15-56	916
6-22-56	50
6-29-56	246

Beta Activity

Week Ending	Results d/m/liter
6-1-56	817
6-8-56	100
6-15-56	1,817
6-22-56	483
6-29-56	31,733

Mercury Concentration

Week Ending	Results mg/liter
6-1-56	1.03
6-8-56	1.31
6-15-56	.37
6-22-56	.89
6-29-56	.45

.81 X

M. Sanders

MS/eb

WCX-163 (8-55)

This form for Inter-Company Correspondence only

LPE
8/22

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: L. C. Emerson
Building 9995

Plant: Y-12

Date: August 22, 1956

Copies To: W. A. Pfeiler
C. R. Sullivan, Jr., M. D.
G. J. Angele
L. J. LaFrance
L. C. Johnson
File

Subject: Results of Poplar Creek Water Analyses for July, 1956.

The following is a listing of the average activity in the east fork of Poplar Creek as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
7- 6-56	190
7-13-56	613
7-20-56	573
7-27-56	440

Beta Activity

Week Ending	Results d/m/liter
7- 6-56	9,000
7-13-56	4,900
7-20-56	1,333
7-27-56	0

Mercury Concentration

Week Ending	Results mg/liter
7- 6-56	1.17
7-13-56	.56
7-20-56	.96
7-27-56	1.32

1.00 K

M. Sanders

MS/eb

WCX-163 (8-55) This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon 1/2 KC
Building 9711-5

Plant: Y-12

Date: September 21, 1956

Copies To: C. R. Sullivan, Jr., M. D.
G. J. Angele
L. J. LaFrance
L. C. Johnson
File

Subject: Results of Poplar Creek Water Analyses for August, 1956.

The following is a listing of the average activity in the east fork of Poplar Creek as determined from daily water samples composited and analyzed weekly.

Alpha Activity

Week Ending	Results d/m/liter
8-3-56	433
8-10-56	713
8-17-56	683
8-24-56	270
8-31-56	347

Beta Activity

8-3-56	2,866
8-10-56	0
8-17-56	450
8-24-56	567
8-31-56	0

Mercury Concentration

	Results mg./liter
8-3-56	1.17
8-10-56	.67
8-17-56	1.19
8-24-56	2.31
8-31-56	3.06

1.68 X

APPROVED FOR PUBLIC RELEASE
P. L. McKenney 8/11/95
Technical Information Office Date

M. Sanders
Health Physics Department

MS/eb

MS\CRR2-0164

Surface Water Sampling
No (Monthly)

Remington Rand

CATALOG NO. 50429R 1/3 IF FASTENERS
ARE TO BE INCLUDED PLEASE SPECIFY

REMCRAFT FOLDER

MADE IN U.S.A.

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9711-5

Plant: Y-12

Date: December 10, 1956

Copies To: C. R. Sullivan, Jr., M. D.
G. J. Angele
L. J. LaFrance
File

Subject: Surface Water Sampling
October, 1956

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit:

Location	Date	Alpha d/m/liter	Beta d/m/liter	Mercury mg/liter	Total Flow gal/week
Poplar Creek	10-5-56	530	2,883	.5 $\bar{x}$	78.3×10^6 ÷7?
	10-12-56	197	13,833	1.3 .86	82.9×10^6
	10-19-56	210	320,021	1.1	80.1×10^6
	10-26-56	177	1,183	.48	78.8×10^6
	11-2-56	220	3,233	.94	81.2×10^6
					$\bar{x} \div 7 = 11.46$
Bear Creek	10-1-56	19	3,065	----	
	10-10-56	224	711	----	
	10-16-56	12	0	----	
	10-22-56	0	0	----	
	10-29-56	26	1,500	----	
North West Settling Pit	10-1-56	923	6,221	----	
	10-10-56	2,833	23,532	----	
	10-16-56	2,977	24,371	----	
	10-22-56	2,341	15,366	----	
	10-29-56	3,076	32,611	----	
North East Settling Pit *	10-1-56	12,233	189,933	----	
	10-10-56	22,084	392,518	----	
	10-16-56	4,037	273,039	----	
	10-22-56	27,046	273,650	----	
	10-29-56	19,740	33,834	----	

* Pit now being used for waste product.

APPROVED FOR PUBLIC RELEASE
P. L. McEnaney 8/11/95
Technical Information Office Date

Location	Date	Alpha d/m/liter	Beta d/m/liter	Mercury mg/liter
Burial Pit	10-1-56	Insufficient water in pit for sample.		
	10-8-56	Insufficient water in pit for sample.		
	10-15-56	Insufficient water in pit for sample.		
	10-22-56	Insufficient water in pit for sample.		
	10-29-56	Sample lost by Lab.		

C. M. West

C. M. West

MS/eb

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9711-5

Plant: Y-12

Date: December 16, 1956

Copies To: C. R. Sullivan, Jr., M.D.
G. J. Angele
L. J. LaFrance
File

Subject: Surface Water Sampling
November, 1956

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits and Burial Pit.

Location	Date	Alpha d/m/liter	Beta d/m/liter	Mercury mg/liter	Total Flow gal/week
Poplar Creek	11-2-56	220	3,233	.94	81.2 x 10^6 gal.
	11-9-56	197	733	.78 $\bar{x}$	82.2
	11-16-56	140	167	2.0 1.26	81.7 $\bar{x} \div 7$
	11-23-56	180	1,383	1.5	81.7
	11-30-56	330	3,667	1.1	80.0 = 11.62
Bear Creek	11-5-56	0	0	---	---
	11-12-56	341	0	---	---
	11-19-56	0	0	---	---
	11-26-56	37	0	---	---
NW Settling Pit	11-5-56	1,826	14,420	---	---
	11-12-56	138,714	17,421	---	---
	11-19-56	1,962	24,962	---	---
	11-26-56	1,098	26,932	---	---
NE Settling Pit	11-5-56	24,430	310,143	---	---
	11-12-56	178,150	257,250	---	---
	11-19-56	22,476	442,103	---	---
	11-26-56	19,667	395,833	---	---
Burial Pit	11-1-56	54,000	167,000	---	---
	11-7-56	35,100	209,000	---	---
	11-14-56	114,483	130,000	---	---
	11-20-56	76,623	94,852	---	---
	11-28-56	36,500	12,458	---	---

C. M. West

C. M. West

MS:cs

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9704-2

Plant: Y-12

Date: January 15, 1957

Copies To: C. R. Sullivan, Jr., M.D.
G. J. Angele
L. J. LaFrance
L. C. Johnson
File

Subject: Surface Water Sampling
December, 1956

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l
Poplar Creek	12-7-56	127	0	.74
	12-14-56	73	1,367	.87
	12-21-56	170	3,900	.71 .887
	12-29-56	137	900	1.2

Note: Flow data for Poplar Creek will not be reported for the month of December due to mechanical failure of the creek level recorder.

Bear Creek	12-3-56	35	0
	12-10-56	25	0
	12-17-56	63	357
	12-26-56	88	583
NW Settling Pit	12-3-56	2,558	46,784
	12-10-56	2,172	27,038
	12-17-56		
	12-26-56	691	5,000
NE Settling Pit	12-3-56	14,697	33,535
	12-10-56	19,146	306,964
	12-17-56	22,570	111,327
	12-26-56	4,195	1,643
Burial Pit	12-3-56	66,448	83,146
	12-17-56	13,830	864
	12-26-56	24,810	120,200

C. M. West

C. M. West

MS:cs

WCX-163 (8-55) This form for Inter-Company Correspondence only

Location	Date	Alpha d/m/liter	Beta d/m/liter	Mercury mg/liter
Burial Pit	10-1-56	Insufficient water in pit for sample.		
	10-8-56	Insufficient water in pit for sample.		
	10-15-56	Insufficient water in pit for sample.		
	10-22-56	Insufficient water in pit for sample.		
	10-29-56	Sample lost by Lab.		

C. M. West

C. M. West

MS/eb

from 110/CHR2-0166

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9704-4

Plant: Y-12

Date: February 18, 1957

Copies To: C. R. Sullivan, Jr., M. D.
G. J. Angele
L. J. LaFrance
L. C. Johnson
File

Subject: Surface Water Sampling
January, 1957

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week*
Poplar Creek	1-4-57	147	883	1.7	-----
	1-11-57	10	167	.51	-----
	1-18-57	153	2,700	1.7	-----
	1-25-57	30	0	1.17	-----
	2-1-57	230	0	1.20	114.8×10^6

* Flow data for Poplar Creek will not be reported for the first four weeks of January due to mechanical failure of the creek level recorded.

Bear Creek	12-31-57	172	217
	1-7-57	0	996
	1-14-57	118	0
	1-21-57	39	0
	1-28-57	39	0
NW Settling Pit	12-31-57	430	2,791
	1-7-57	0	0
	1-14-57	1,855	3,050
	1-21-57	333	4,280
	1-28-57	723	1,325

Location	Date	Alpha d/m/l	Beta d/m/l
NE Settling Pit	12-31-57	96	55,801
	1-7-57	362	8,375
	1-14-57	24,700	59,300
	1-21-57	2,600	44,200
	1-28-57	8,670	18,350
Burial Pit	12-31-57	6,250	64,300
	1-7-57	Lost in Lab	
	1-14-57	2,070	71,200
	1-21-57	Lost in Lab	
	1-28-57	18,550	10,550

SIGNED - C. M. WEST

C. M. West

MS:cs

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9704-2

Plant: Y-12

Date: March 14, 1957

Copies To: C. R. Sullivan, Jr., M.D.
G. J. Angele
L. J. LaFrance ✓
L. C. Johnson
File

Subject: Surface Water Sampling
February, 1957

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week*
Poplar Creek	2-8-57	33	0	2.6	95.9×10^6
	2-15-57	53	312	1.9	78.2
	2-22-57	140	0	1.7	77.3
	3-1-57	100	0	1.4	82.8
Bear Creek	2-5-57	24	0	----	--------
	2-11-57	4	0	----	--------
	2-18-57	25	0	----	--------
	2-26-57	40	0	----	--------
	3-4-57	140	0	----	--------
NW Settling Pit	2-5-57	2,890	3,530	----	--------
	2-11-57	1,655	935	----	--------
	2-18-57	3,000	20,000	----	--------
	2-26-57	7,080	15,416	----	--------
	3-4-57	2,190	15,300	----	--------
NE Settling Pit	2-5-57	8,880	4,260	----	--------
	2-11-57	10,560	22,600	----	--------
	2-18-57	28,200	3,030	----	--------
	2-26-57	7,500	165,500	----	--------
	3-4-57	20,000	235,000	----	--------
Burial Pit	2-5-57	5,290	6,440	----	--------
	2-11-57	15,250	14,050	----	--------
	2-18-57	37,700	26,200	----	--------
	2-26-57	---Lost in Laboratory---			

SIGNED - C. M. WEST

MS:cs

WCX-163 (8-55) This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9704-2

Plant: Y-12

Date: April 12, 1957

Copies To: C. R. Sullivan, Jr., M. D.
G. J. Angele
L. J. LaFrance ✓
L. C. Johnson
File

Subject: Surface Water Sampling
March, 1957

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week*
Poplar Creek	3-8-57	200	0	2.3	31.5×10^6
	3-15-57	73	0	1.7	74.5
	3-22-57	133	433	1.3	73.5
	3-29-57	660	0	1.74	72.3
Bear Creek	3-4-57	25	0	----	-----
	3-11-57	333	2,000	----	-----
	3-18-57	44	0	----	-----
	3-25-57	7	833	----	-----
NW Settling Pit	3-4-57	1,760	1,833	----	-----
	3-11-57	1,295	8,900	----	-----
	3-18-57	3,780	53,800	----	-----
	3-25-57	700	1,000	----	-----
NE Settling Pit	3-4-57	24,900	4,000	----	-----
	3-11-57	8,260	89,000	----	-----
	3-18-57	11,750	55,700	----	-----
	3-25-57	21,000	150,500	----	-----
Burial Pit	3-4-57	Plates lost by Laboratory			
	3-11-57	Plates lost by Laboratory			
	3-18-57	11,430	9,060	----	-----
	3-25-57	416	151,000	----	-----

SIGNED - C. M. WEST

C. M. West

MS:cs

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. Molendon, Y12RC
Building 9704-2

Plant: Y-12

Date: May 16, 1957

Copies To: C. R. Sullivan, Jr., M.D.
G. J. Angele
L. J. LaFrance ✓
L. C. Johnson
File

Subject: Surface Water Sampling
April, 1957

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week*
Poplar Creek	4-5-57	53	0	2.54	84.1×10^6
	4-12-57	5,000	0	2.2	83.6
	4-19-57	320	4,330	4.03	70.6
	4-26-57	100	3,100	2.0	71.1
	5-3-57	127	0	3.2	72.6
Bear Creek	4-8-57	100	0	---	---
	4-16-57	62	0	---	---
	4-23-57	702	3,500	---	---
	5-2-57	100	0	---	---
NE Settling Pit	4-10-57	27,800	134,000	---	---
	4-16-57	1,035	245,000	---	---
	4-23-57	22,000	55,000	---	---
	5-3-57	36,200	58,800	---	---
NW Settling Pit	4-10-57	1,250	25,000	---	---
	4-16-57	29,420	110,000	---	---
	4-23-57	1,915	1,895	---	---
	5-3-57	2,070	5,180	---	---
Burial Pit	4-4-57	33,000	33,000	---	---
	4-10-57	55,200	10,000	---	---
	4-16-57	47,700	10,000	---	---
	4-23-57	82,500	3,140	---	---
	5-3-57	176,000	46,600	---	---

SIGNED - C. M. WEST

C. M. West

MS:cs

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9704-2

Plant: Y-12

Date: June 18, 1957

Copies To: C. R. Sullivan, Jr., M.D.
G. J. Angele
J. F. Morehead
L. C. Johnson
File

Subject: Surface Water Sampling
May, 1957

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha (d/m/l)	Beta (d/m/l)	Mercury mg/l	Total Flow gal/week
Poplar Creek	5-10-57	160	2,000	.920	67.7×10^6
	5-17-57	57	333	3.2	74.5
	5-24-57	150	800	3.8	79.5
	5-31-57	100	500	1.2	66.8
	6-17			1.5	
Bear Creek	5-8-57	165	0		
	5-14-57	0	500		
	5-21-57	20	0		
	5-28-57	18	400		
NE Settling Pit	5-8-57	27,200	127,000		
	5-14-57	20,000	293,600		
	5-21-57	27,000	368,400		
	5-28-57	37,000	54,700		
NW Settling Pit	5-8-57	3,320	3,950		
	5-14-57	1,760	11,000		
	5-21-57	16,667	2,500		
	5-28-57	3,000	10,500		
Burial Pit	5-8-57	SAMPLE LOST IN LABORATORY			
	5-14-57	86,200	42,100		
	5-21-57	16,667	41,667		
	5-28-57	38,000	23,000		

SIGNED - C. M. WEST
C. M. West

MS:cs

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9704-2

Plant: Y-12

Date: July 28, 1957

Copies To: D. R. Sullivan, Jr., M. D.
E. T. Kite
G. J. Angele
J. F. Morehead
L. D. Johnson
File

Subject: Surface Water Sampling
June 1957

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha (d/m/l)	Beta (d/m/l)	Mercury mg/l	Total Flow gal/week
Poplar Creek	6-7-57	320	800	1.6	74.6×10^8
	6-14-57	440	0	4.12	71.4
	6-21-57	180	800	1.5	72.4
	6-28-57	167	333	2.1	70.6
Bear Creek	6-6-57	50	625	---	---
	6-11-57	116	0	---	---
	6-18-57	56	2,500	---	---
	6-25-57	57	833	---	---
NE Settling Pit	6-6-57	20,000	67,500	---	---
	6-11-57	20,700	63,500	---	---
	6-18-57	29,700	67,700	---	---
	6-25-57	36,300	93,500	---	---
NW Settling Pit	6-6-57	2,300	80	---	---
	6-11-57	25,000	91,600	---	---
	6-18-57	3,870	9,000	---	---
	6-25-57	2,730	8,070	---	---
Burial Pit	6-6-57	6,420	3,770	---	---
	6-11-57	7,380	5,160	---	---
	6-18-57	8,750	7,650	---	---
	6-25-57	12,900	8,360	---	---

SIGNED - C. M. WEST

C. M. West

MS:cs

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12-RC
Building 3704-2

Plant: Y-12

Date: August 21, 1957

Copies To: J. R. Sullivan, Jr., M.D.
H. T. Kite
G. J. Angele
J. F. Morehead ✓
L. C. Johnson
File

Subject: Surface Water Sampling
July, 1957

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha (d/m/l)	Beta (d/m/l)	Mercury mg/l	Total Flow gal/week
Poplar Creek	7-5-57	17	1,000	3.4	38.7×10^6
	7-12-57	53	0	1.7	70.8
	7-19-57	100	0	7.2	69.4
	7-26-57	100	0	3.8	70.4
Bear Creek	7-2-57	167	0	---	---
	7-9-57	27	833	---	---
	7-16-57	11	0	---	---
	7-30-57	120	0	---	---
NE Settling Pit	7-2-57	42,200	141,000	---	---
	7-9-57	16,900	181,000	---	---
	7-16-57	23,700	200,000	---	---
	7-23-57	42,400	149,500	---	---
	7-30-57	26,300	34,600	---	---
NW Settling Pit	7-2-57	3,130	6,210	---	---
	7-9-57	15,500	47,000	---	---
	7-16-57	15,300	79,500	---	---
	7-23-57	2,800	22,000	---	---
	7-30-57	33,300	24,700	---	---
Burial Pit	7-2-57	10,900	8,080	---	---
	7-9-57	219,000	16,667	---	---
	7-16-57	40,600	43,750	---	---
	7-23-57	44,000	30,000	---	---
	7-30-57	49,500	7×10^6	---	---

SIGNED - C. M. WEST

C. M. West

MS:cs

WCX-163 (8-55) This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9704-4

Plant: Y-12

Date: September 13, 1957

Copies To: C. R. Sullivan, Jr., M. D.
H. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson
File

Subject: Surface Water Sampling
August, 1957

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	8-2-57	233	3,000	4.4	69.0×10^6
	8-9-57	167	0	5.0	66.5
	8-16-57	273	0	5.2	63.0
	8-23-57	400	1,333	1.5	66.2
	8-30-57	67	1,000	1.7	64.6
Bear Creek	8-6-57	38	0	---	---
	8-13-57	138	0	---	---
	8-20-57	153	0	---	---
	8-27-57	15	0	---	---
NE Settling Pit	8-6-57	29,050	199,500	---	---
	8-13-57	36,800	220,000	---	---
	8-20-57	28,000	110,400	---	---
	8-27-57	51,670	252,900	---	---
NW Settling Pit	8-6-57	3,475	22,500	---	---
	8-13-57	4,900	20,000	---	---
	8-20-57	1,100	16,700	---	---
	8-27-57	5,490	25,411	---	---
Burial Pit	8-6-57	26,600	29,500	---	---
	8-13-57	38,642	234,259	---	---
	8-20-57	Insufficient water in pit for sample.			
	8-27-57	Insufficient water in pit for sample.			

SIGNED - MERWYN SANDERS
C. M. West

MS:cs

WCX-163 (8-55) This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9704-2

Plant: Y-12

Date: October 24, 1957

Copies To: C. R. Sullivan, Jr., M.D.
H. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson
File

Subject: Surface Water Sampling
September, 1957

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	9-6-57	200	1,000	1.6	62.9×10^6
	9-13-57	150	0	2.0	61.6×10^6
	9-20-57	250	1,000	1.4	73.1×10^6
	9-27-57	133	1,150	1.4	60.9×10^6
Bear Creek	9-4-57	222	0	---	
	9-10-57	33	10	---	
	9-17-57	247	0	---	
	9-25-57	84	0	---	
NE Settling Pit	9-4-57	35,000	215,000	---	
	9-10-57	20,000	30,487	---	
	9-17-57	28,469	48,641	---	
	9-25-57	40,700	197,000	---	
NW Settling Pit	9-4-57	5,370	29,400	---	
	9-10-57	4,212	5,490	---	
	9-17-57	6,951	35,370	---	
	9-25-57	3,720	17,100	---	
Burial Pit	9-4-57	SAMPLE LOST IN LABORATORY			
	9-10-57	1,630	88,330	---	
	9-17-57	129,904	43,493	---	
	9-25-57	144,500	0	---	

Signed By
~~Paul C. McBee~~
C. M. West

PCM:cs

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y-12RC
Building 9704-2

Plant: Y-12

Date: January 21, 1958

Copies To: C. R. Sullivan, Jr., A. D.
J. S. Reece
H. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson
File

Subject: Surface Water Sampling October, November, and December, 1957

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	10-4-57	230	1,200	0.53	73.3×10^6
	10-11-57	53	1,600	1.00	57.0×10^6
	10-18-57	277	750	2.30	57.7×10^6
	10-25-57	220	283	1.30	59.6×10^6
	11-1-57	400	0	1.60	59.7×10^6
	11-8-57	200	1,000	2.80	62.0×10^6
	11-15-57	280	0	3.40	121.1×10^6
	11-22-57	130	533	1.24	98.0×10^6
	11-29-57	413	0	1.10	76.3×10^6
	12-6-57	187	0	1.40	94.5×10^6
	12-13-57	300	0	2.80	77.0×10^6
	12-20-57	300	2,467	1.70	78.1×10^6
	12-27-57	233	0	2.30	69.2×10^6
Bear Creek	10-1-57	54	0		
	10-8-57	307	0		
	10-15-57	167	0		
	10-22-57	12	0		
	10-29-57	87	2,123		
	11-6-57	119	0		
	11-12-57	189	568		
	11-21-57	36	0		
	11-26-57	0	0		

-continued-

Location	Date	Alpha d/m/l	Beta d/m/l
Bear Creek (continued)	12-4-57	16	0
	12-10-57	185	0
	12-17-57	119	0
	12-26-57	83	0
	12-31-57	100	0
NE Settling Pit	10-1-57	37,957	83,371
	10-8-57	34,048	58,333
	10-15-57	34,024	38,795
	10-22-57	40,927	84,873
	10-29-57	42,225	147,792
	11-6-57	51,626	30,081
	11-12-57	22,727	119,555
	11-21-57	13,815	35,520
	11-26-57	34,222	131,770
	12-4-57	29,970	71,705
	12-10-57	36,803	96,989
	12-17-57	44,381	36,786
	12-26-57	40,080	75,100
	12-31-57	30,750	41,600
NW Settling Pit	10-1-57	4,714	13,095
	10-8-57	8,542	12,000
	10-15-57	9,205	24,096
	10-22-57	3,724	16,092
	10-29-57	2,965	13,725
	11-6-57	4,690	129,849
	11-12-57	3,300	9,295
	11-21-57	1,496	5,656
	11-27-57	5,556	10,853
	12-4-57	2,675	6,049
	12-10-57	3,451	5,765
	12-17-57	7,126	10,192
	12-26-57	2,087	83,333
	12-31-57	41,380	0
Burial Pit	10-1-57	128,200	125,667
	10-8-57	165,833	40,238
	10-15-57	147,435	49,412
	10-22-57	128,121	42,198
	10-29-57	98,754	36,787

-continued-

Location	Date	Alpha d/m/l	Beta d/m/l
Burial Pit (continued)	11-6-57	103,743	45,904
	11-12-57	91,000	46,098
	11-21-57	75,879	8,715
	11-26-57	51,270	34,045
	12-10-57	39,349	7,182
	12-17-57	39,756	12,296
	12-26-57	39,187	20,000
	12-31-57	37,800	14,400

SIGNED - C. M. WEST

C. M. West

PCMics

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y-12RC
Building 9704-2

Plant: Y-12

Date: February 11, 1958

Subject: Surface Water Sampling
January, 1958

Copies To: C. P. Sullivan, Jr., M. D.
J. S. Reece
H. T. Kite
G. J. Angele
J. F. Morehead ✓
L. C. Johnson
File

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	1-3-58	3,167	833	1.2	64.3×10^6
	1-10-58	227	1,467	3.1	64.9×10^6
	1-17-58	300	0	2.9	67.4×10^6
	1-24-58	567	0	3.4	71.0×10^6
	1-31-58	480	2,067	10.7	66.3×10^6
Bear Creek	1-8-58	60	0	—	
	1-15-58	52	1,370	—	
	1-23-58	230	0	—	
	1-28-58	98	1,373	—	
Burial Pit	1-15-58	22,471	3,843	—	
	1-23-58	46,739	12,391	—	
	1-28-58	48,000	14,483	—	
NE Settling Pit	1-8-58	61,459	225,882	—	
	1-15-58	62,481	82,597	—	
	1-23-58	53,959	146,829	—	
	1-28-58	35,388	134,353	—	
NW Settling Pit	1-8-58	46,141	128,235	—	
	1-15-58	2,375	2,414	—	
	1-23-58	33,701	94,943	—	
	1-28-58	34,923	71,207	—	

SIGNED - C. M. WEST

C. M. West

PCM:cs

This form for Inter-Company Correspondence only

WCX-163 (8-55)

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

Division of Union Carbide Corporation

To: J. D. McLendon, Y-12RC
Building 9704-2

Plant: Y-12

Date: March 20, 1958

Subject: Surface Water Sampling
February, 1958

Copies To: C. R. Sullivan, Jr., M. D.
J. S. Reece
M. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	2-7-58	347	0	3.4	70.6×10^6
	2-14-58	2,707	0	3.7	64.2×10^6
	2-21-58	-----	---	---	62.3×10^6
	2-28-58	387	1,800	3.2	69.2×10^6
Bear Creek	2-5-58	160	433		
	2-11-58	109	0		
	2-19-58	498	0		
	2-26-58	80	0		
Burial Pit	2-5-58	54,500	8,826		
	2-11-58	66,460	11,839		
	2-26-58	348	0		
NE Settling Pit	2-5-58	77,060	176,948		
	2-11-58	63,868	108,817		
	2-19-58	89,510	161,847		
	2-26-58	39,183	186,882		
NW Settling Pit	2-5-58	33,483	70,583		
	2-11-58	38,522	35,060		
	2-19-58	29,600	87,686		
	2-28-58	32,950	99,604		

SIGNED - C. M. WEST

C. M. West

FCMics

WCX-163 (5-57) This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

Division of Union Carbide Corporation

To: J. D. McLendon, Y-12RC
Building 9704-2

Plant: Y-12

Date: April 14, 1958

Copies To: C. R. Sullivan, Jr., M. D.
J. S. Reece
H. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson

Subject: Surface Water Sampling
March, 1958

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	3-7-58	400	800	2.1	67.5×10^6
	3-14-58	340	0	3.0	68.5
	3-21-58	133	0	5.8	68.6
	3-28-58	1,200	500	1.3	67.9
Bear Creek	3-4-58	2,345	1,092		
	3-11-58	172	0		
	3-19-58	882	2,353		
	3-27-58	73	0		
Burial Pit	3-4-58	72,652	184,831		
	3-11-58	91,455	61,509		
	3-19-58	58,217	11,542		
	3-27-58	104,423	60,000		
NE Settling Pit	3-4-58	59,432	31,705		
	3-11-58	52,742	20,504		
	3-19-58	61,318	222,727		
	3-27-58	95,205	129,697		
NW Settling Pit	3-4-58	29,930	60,736		
	3-11-58	37,712	55,341		
	3-19-58	33,917	84,777		
	3-27-58	443,678	99,272		

SIGNED - C. M. WEST

C. M. West

PCM:cs

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. L. McLenson, Y-12RC
Building 9704-2

Plant: Y-12

Date: May 12, 1958

Copies To: S. F. Sullivan, Jr., M. D.
J. S. Reece
H. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson

Subject: Surface Water Sampling
April, 1958

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	4-3-58	267	333	4.1	66.5×10^6
	4-11-58	360	0	1.5	68.8
	4-18-58	433	0	3.9	66.1
	4-25-58	107	1,500	1.2	84.1
Bear Creek	4-1-48	140	298		
	4-8-58	423	609		
	4-16-58	5,461	0		
	4-23-58	127	598		
	4-30-58	284	9		
Burial Pit	4-1-58	80,485	44,982		
	4-8-58	113,678	53,569		
	4-16-58	59,566	523,256		
	4-23-58	116,989	77,753		
	4-30-58	123,953	21,373		
NW Settling Pit	4-1-58	34,276	61,762		
	4-8-48	15,739	16,207		
	4-16-58	27,101	72,247		
	4-23-58	38,333	38,889		
	4-30-58	33,735	46,366		
NE Settling Pit	4-1-58	70,964	330,254		
	4-8-58	54,645	407,419		
	4-16-58	44,444	132,444		
	4-23-58	44,379	327,789		
	4-30-58	55,004	178,774		

SIGNED - C. M. WEST

C. M. West

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y-12 RC
Building 9704-2

Plant: Y-12

Date: July 2, 1958

Copies To: C. R. Sullivan, Jr., M. D.
J. S. Reece
H. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson

Subject: Surface Water Sampling
May, 1958

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	5-2-58	500	1,167	2.8	78.6×10^6
	5-9-58	687	0	14.5	71.1
	5-16-58	640	667	2.10	61.4
	5-23-58	400	733	2.0	62.6
	5-29-58	240	0	2.0	58.4
Bear Creek	5-7-58	3,094	0		
	5-13-58	630	0		
	5-20-58	721	2,234		
	5-27-58	369	0		
Burial Pit	5-7-58	1,244,000	181,556		
	5-13-58	121,298	54,823		
	5-20-58	132,996	159,387		
	5-27-58	141,703	175,502		
NW Settling Pit	5-8-58	26,540	95,604		
	5-13-58	116,279	165,801		
	5-20-58	18,603	57,024		
	5-27-58	30,327	48,275		
NE Settling Pit	5-8-58	68,610	148,298		
	5-13-58	23,196	186,594		
	5-20-58	799,787	148,298		
	5-27-58	68,235	250,588		

6-6 = 58.9
6-13 = 59.8
6-20 = 63.1
6-27 - /

AVE = 65.7
daily = 9.4

SIGNED - C. M. WEST

C. M. West

WCX-163 (8-55) csm

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y-12RC
Building 9704-2

Plant: Y-12

Date: July 16, 1958

Subject: Surface Water Sampling
June, 1958

Copies To: C. R. Sullivan, Jr., M. D.
J. S. Reece
H. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	6-6-58	80	400	0.9	58.7×10^6
	6-13-58	400	0	1.4	59.1
	6-20-58	753	3,433	1.3	63.1
	6-27-58	867	8,500	2.3	56.1
Bear Creek	6-4-58	167	0		
	6-10-58	1,377	0		
	6-19-58	76	0		
	6-25-58	281	0		
	7-1-58	174	1,196		
Burial Pit	6-4-58	214,958	125,824		
	6-10-58	119,622	96,481		
	6-19-58	143,742	316,408		
	6-25-58	143,333	43,536		
NW Settling Pit	6-4-58	18,749	62,921		
	6-10-58	24,400	67,704		
	6-19-58	28,248	86,316		
	6-25-58	21,118	79,479		
	7-1-58	22,833	67,045		
NE Settling Pit	6-4-58	81,624	294,118		
	6-10-58	77,992	301,379		
	6-19-58	80,778	399,741		
	6-25-58	93,397	418,532		
	7-1-58	52,688	434,624		

SIGNED: C. M. WEST

csm

This form for Inter-Company Correspondence only — C. M. West

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Divison of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC
Building 9720-2

Plant: Y-12

Date: August 6, 1958

Copies To: C. R. Sullivan, Jr., M. D.
J. E. Reece
H. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson

Subject: Surface Water Sampling
July, 1958

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	7-3-58	480	0	2.4	54.7×10^6
	7-11-58	527	2,000	1.3	57.6
	7-18-58	667	833	2.0	64.0
	7-25-58	1,000	0	1.2	58.7
Bear Creek	7-9-58	237	0		
	7-17-58	126	0		
	7-23-58	67	268		
	7-29-58	81	0		
Burial Pit	7-17-58	62,933	57,556		
	7-23-58	68,052	15,778		
	7-29-58	57,126	22,111		
NE Settling Pit	7-9-58	85,305	464,922		
	7-17-58	82,644	38,404		
	7-23-58	73,783	370,000		
	7-29-58	57,522	578,043		
NW Settling Pit	7-9-58	19,909	35,954		
	7-17-58	15,372	65,977		
	7-23-58	11,783	422,174		
	7-28-58	10,209	32,717		

SIGNED - C. M. WEST
C. M. West

WCX-163 (8-55) cam

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INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Divison of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12-RC
Building 9704-2

Plant: Y-12

Date: September 15, 1958

Copies To: C. R. Sullivan, Jr., A.D.
J. S. Reece
H. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson

Subject: Surface Water Sampling
August, 1958

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	8- 3-58	547	0	0.8	60.7×10^6
	8-10-58	800	400	1.0	54.1
	8-17-58	573	3,300	0.8	55.7
	8-24-58	533	0	1.7	55.5
	8-31-58	500	0	1.4	53.5
Bear Creek	8- 6-58	289	0		
	8-13-58	272	0		
	8-19-58	190	119		
Burial Pit	8- 5-58	80,170	33,191		
	8-13-58	179,141	82,680		
	8-19-58	164,550	59,946		
NE Settling Pit	8- 5-58	14,084	278,105		
	8-13-58	129,885	52,490		
	8-19-58	68,548	8,815		
	8-29-58	52,941	351,294		
NW Settling Pit	8- 5-58	34,022	1,872		
	8-13-58	10,526	10,716		
	8-19-58	20,994	71,960		
	8-29-58	34,885	29,660		

SIGNED - C. M. West

C. M. West

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WCX-163 (8-55)

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Divison of Union Carbide and Carbon Corporation

To: J. D. McLenson, Y12RC

Plant: Y-12

Date: October 17, 1958

Copies To: C. R. Sullivan, Jr., A. D.
J. S. Reece
H. T. Kite
G. J. Angele
J. F. Morehead
L. C. Johnson

Subject: Surface Water Sampling September, 1958

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	9- 5-58	513	767	1.3	52.5×10^6
	9-12-58	667	5,200	1.0	52.3
	9-19-58	980	4,067	0.6	55.8
	9-26-58	300	3,533	0.6	51.6
Bear Creek	9- 5-58	502	0		
	9-10-58	65	2,065		
	9-16-58	207	0		
	9-24-58	1,197	220		
	9-30-58	88	1,402		
Burial Pit	9-10-58	51,958	22,431		
	9-24-58	43,565	28,478		
NE Settling Pit	9- 5-58	1,817	10,753		
	9-10-58	67,165	20,613		
	9-16-58	101,126	526,000		
	9-24-58	117,563	673,477		
	9-30-58	81,250	360,120		
NW Settling Pit	9- 5-58	113,420	461,718		
	9-10-58	11,765	68,788		
	9-16-58	12,917	47,576		
	9-24-58	11,118	153,704		
	9-30-58	29,186	29,070		

SIGNED - C. M. WEST

C. M. West

csm

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Divison of Union Carbide and Carbon Corporation

To: J. D. McLendon, Y12RC

Plant: Y-12

Date: November 12, 1958

Subject: Surface Water Sampling October, 1958

Copies To: G. J. Angele
L. C. Johnson
H. T. Kite
J. F. Morehead
J. S. Reece
C. R. Sullivan, Jr., M. D.

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	10- 3-58	740	3,367	6.0	55.4×10^6
	10-10-58	567	0	.49	54.3
	10-17-58	667	116	.898	56.0
	10-24-58	2,327	2,433	1.67	51.9
	10-31-58	620	1,000	.91	53.5
Bear Creek	10- 7-58	4	0		
	10-14-58	63	439		
	10-21-58	52	0		
	10-28-58	158	0		
Burial Pit	10- 7-58	435,818	19,189		
	Insufficient Water				
NE Settling Pit	10- 7-58	113,720	460,066		
	10-14-58	48,530	0		
	10-21-58	89,250	838,522		
	10-28-58	45,407	0		
NW Settling Pit	10- 7-58	25,273	24,318		
	10-14-58	1,660	66,667		
	10-21-58	16,535	33,000		
	10-28-58	15,122	0		

SIGNED - C. M. WEST

C. M. West

MS:csm

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon

Plant: Y-12

Date: December 29, 1958

Copies To: G. J. Angele
L. C. Johnson
H. T. Kite
J. F. Morehead
J. S. Reece
C. R. Sullivan, Jr., M.D.
File, Y12RC

Subject: Surface Water Sampling
November, 1958

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	11- 7-58	1,067	2,400	.75	53.3×10^6
	11-14-58	160	0	.6	55.0×10^6
	11-21-58	1,000	0	.6	52.6×10^6
	11-28-58	860	0	1.3	65.7×10^6
Bear Creek	11- 4-58	105	1,333		
	11-11-58	211	0		
	11-18-58	288	0		
	11-25-58	1,020	0		
Burial Pit	Insufficient Water				
NE Settling Pit	11- 4-58	30,493	35,254		
	11-11-58	202,747	65,183		
	11-18-58	41,118	242,581		
	11-25-58	49,356	21,185		
NW Settling Pit	11- 4-58	12,007	52,876		
	11-11-58	30,365	45,697		
	11-18-58	3,333	11,193		
	11-25-58	15,054	38,746		

Norwyn Sanders for
C. M. West

MS:csm

WCX-163 (8-55)

This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Division of Union Carbide and Carbon Corporation

To: J. D. McLendon
Building 9704-2

Plant: Y-12

Date: January 14, 1959

Subject: Surface Water Sampling
December, 1958

Copies To:
G. J. Angele
L. C. Johnson
H. T. Kite
J. F. Morehead
J. S. Reece
C. R. Sullivan, Jr., M. D.
File, Y12RC

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	12- 5-58	440	0	1.2	53.2×10^6
	12-12-58	320	0	1.0	51.9×10^6
	12-19-58	740	0	2.4	52.7×10^6
	12-26-58	500	3,133	0.6	58.6×10^6
	1 - 2-59	533	1,233	0.7	53.7×10^6
Bear Creek	12- 4-58	144	0		
	12-9-58	632	0		
	12-17-58	189	0		
	12-23-58	326	0		
	12-31-58	112	0		
Burial Pit	12-31-58	114,855	54,348		
NE Settling Pit	12- 4-58	37,113	229,278		
	12- 9-58	34,337	243,970		
	12-17-58	50,817	50,000		
	12-23-58	40,742	291,960		
	12-31-58	116,386	13,105		
NW Settling Pit	12- 4-58	10,473	54,659		
	12- 9-58	12,035	61,894		
	12-17-58	15,312	39,391		
	12-23-58	15,326	35,056		
	12-31-58	28,314	14,706		
9510-5 Pit	12-29-58	185	0		

SIGNED - C. M. WEST

C. M. West

MS:csm

WCX-163 (8-55) This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Divison of Union Carbide and Carbon Corporation

To: J. D. McLendon
Building 9704-2

Plant: Y-12

Date: March 4, 1959

Copies To: G. J. Angele
L. C. Johnson
H. T. Kite
J. F. Morehead
J. S. Reece
C. R. Sullivan, Jr., M. D.
File, Y12RC

Subject: Surface Water Sampling
January, 1959

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	1-09-59	1,000	7,533	1.3	53.4×10^6
	1-16-59	660	3,633	0.7	53.6×10^6
	1-23-59	1,100	1,300	0.8	74.5×10^6
	1-30-59	1,000	0	1.3	50.8×10^6
Bear Creek	1-07-59	108	0		
	1-13-59	237	0		
	1-27-59	78	0		
Burial Pit	1-07-59	500	2,500		
	1-13-59	1,115	2,530		
	1-21-59	48,800	133,000		
	1-27-59	2,800	2,670		
NE Settling Pit	1-07-59	77,200	313,000		
	1-13-59	52,700	472,000		
	1-21-59	55,300	305,000		
	1-27-59	48,200	128,000		
NW Settling Pit	1-07-59	17,700	67,500		
	1-13-59	14,500	55,600		
	1-21-59	47,500	144,500		
	1-27-59	14,100	31,900		

SIGNED - C. M. WEST

C. M. West

csm

WCX-163 (8-55) This form for Inter-Company Correspondence only

INTER-COMPANY CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY

A Divison of Union Carbide and Carbon Corporation

To: J. D. McLendon
Building 9704-2

Plant: Y-12

Date: March 24, 1959

Copies To: G. J. Angele
L. C. Johnson
H. T. Kite
J. F. Morehead
J. S. Reece
C. R. Sullivan, Jr., M. D.
File, Y12RC

Subject: Surface Water Sampling
February, 1959

over →

March 6	.68	53.3×10^6
13	.9	57.7
20	1.5	62.5
29	.7	72.9

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	2-06-59	480	2,800	1.6	54.3×10^6
	2-13-59	1,000	0	1.0	$72.8^* \times 10^6$
	2-20-59	1,000	2,033	0.7	58.8×10^6
	2-27-59	(Equipment Failure)			54.0×10^6
Bear Creek	2-05-59	628	542		
	2-11-59	235	0		
	2-17-59	90	0		
	2-25-59	257	0		
Burial Pit	2-05-59	23,800	15,100		
	2-11-59	19,250	16,667		
	2-17-59	19,850	16,800		
	2-25-59	12,400	12,333		
NE Settling Pit	2-05-59	4,150	249,000		
	2-11-59	4,230	172,500		
	2-17-59	112,000	290,000		
	2-25-59	44,900	209,000		
NW Settling Pit	2-05-59	6,040	17,900		
	2-11-59	14,750	823		
	2-17-59	15,150	36,700		
	2-25-59	9,640	35,800		

* This data assumes that the rate for the other two days is the same as the five days recorded.

csm

Signed: C. M. West
C. M. West

WCX-163 (8-55)

This form for Inter-Company Correspondence only

JCN-429
2 1-59)

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon

Company

Location Building 9704-2

Date April 20, 1959

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele
L. C. Johnson
H. T. Kite
J. F. Morehead
J. S. Reece
C. R. Sullivan, Jr., M. D.
File, Y12RC

Subject Surface Water Sampling
March, 1959

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek	3-06-59	---	---	.68	53.3×10^6
	3-13-59	840	0	0.9	57.7×10^6
	3-20-59	880	800	1.5	62.5×10^6
	3-26-59	720	4,800	0.7	72.9×10^6
Bear Creek	3-04-59	1,030	2,370		
	3-10-59	319	0		
	3-17-59	114	0		
	3-24-59	105	0		
	3-31-59	463	35		
Burial Pit	3-04-59	492,000	301,000		
	3-10-59	88,000	51,200		
	3-17-59	85,600	69,800		
	3-24-59	90,787	31,064		
NE Settling Pit	3-04-59	32,600	233,000		
	3-10-59	48,300	333,000		
	3-17-59	22,831	301,299		
	3-24-59	55,833	371,917		
NW Settling Pit	3-04-59	15,900	31,000		
	3-10-59	9,450	27,800		
	3-17-59	14,230	34,023		
	3-24-59	13,907	31,630		

SIGNED - C. M. WEST
C. M. West

cwm

CN-429
2 1-59)

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon
Company
Location Building 9704-2

Date June 5, 1959
Originating Dept. Health Physics Group
Answering letter date
Subject Surface Water Sampling April, 1959

Copy to
G. J. Angele
L. E. Burkhart
L. C. Johnson
H. T. Kite
J. F. Morehead
J. S. Reece
C. R. Sullivan, Jr., M. D.
File, Y12RC

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek*	4-03-59	720	0	0.9	56.6×10^6
	4-10-59	580	3,000	0.7	64.8×10^6
	4-17-59	533	333	1.2	92.9×10^6
	4-24-59	560	2,000	1.1	71.4×10^6
Bear Creek*	4-07-59	100	0		
	4-15-59	159	1,740		
	4-22-59	227	1,136		
	4-28-59	189	0		
Burial Pit	3-31-59	285,000	266,000		
	4-07-59	76,674	66,977		
	4-15-59	93,084	204,854		
	4-22-59	71,904	44,074		
	4-28-59	151,716	60,851		

* The permissible limit for uranium alpha in drinking water outside of controlled areas is 15,500 d/m/l.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
NE Settling Pit	3-31-59	6,120	364,000		
	4-07-59	36,030	336,296		
	4-15-59	41,962	341,591		
	4-22-59	32,932	312,083		
	4-28-59	108,412	545,000		
NW Settling Pit	3-31-59	86,000	16,800		
	4-07-59	14,261	79,022		
	4-15-59	13,841	68,182		
	4-22-59	20,000	34,889		
	4-28-59	56,930	195,349		

SIGNED - MERWYN SANDERS

M. Sanders

MS:csm

UCN-429
(2 1-59)

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon
Company
Location Building 9704-2

Date June 17, 1959
Originating Dept. Health Physics Group
Answering letter date
Subject Surface Water Sampling May, 1959

Copy to
J. J. Angele
L. E. Burkhart
L. C. Johnson
H. T. Kite
J. F. Morehead
J. S. Reece
C. R. Sullivan, Jr., M. D.
File, Y12RC

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek*	5-01-59	400	1267	1.5	63.4×10^6
	5-08-59	340	283	1.1	63.9×10^6
	5-15-59	820	4600	0.5	66.8×10^6
	5-22-59	1100	7300	0.3	62.2×10^6
	5-28-59	1267	2900	0.7	74.6×10^6
NE Settling Pit	5-06-59	35014	229,783		
	5-06-59	3801	27,433		
	5-12-59	79457	554,801		
	5-19-59	52953	70,233		
	5-26-59	44877	531,232		
NW Settling Pit	5-12-59	24556	52,407		
	5-19-59	12322	75,862		
	5-26-59	12618	20,842		
Burial Pit	Insufficient Water				

.6 mg/l
35 lbs/day

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 15,500 d/m/l.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Bear Creek[a]	5-05-59[1]	329	1,294		
	5-05-59[2]	147			
	5-05-59[3]	302			
	5-05-59[4]	77			
	5-05-59[5]	35			
	5-12-59[1]	109			
	5-12-59[2]	156			
	5-12-59[3]	217			
	5-12-59[4]	108			
	5-12-59[5]	65	1,413		
	5-19-59[1]	484	2,857		
	5-19-59[2]	63			
	5-19-59[3]	[illegible]1	[illegible]		
	5-19-59[4]	171			
	5-19-59[5]	80	2,239		
	5-26-59[1]	125	1,250		
	5-26-59[2]	128	709		
	5-26-59[3]	1333			
	5-26-59[4]	136	1,023		
	5-26-59[5]	118	1,294		

[a]The permissible limit for uranium alpha in drinking water outside of controlled areas is 15,500 d/m/l.

[1]One mile west of Y-12.

[2]One and a half miles west of Y-12.

[3]Two and a half miles west of Y-12.

[4]Three and a half miles south and west of Y-12.

[5]Six miles south and west of Y-12.

SIGNED - MERWYN SANDERS
M. Sanders

MS:rj

N-429
1-59)

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon
Company
Location Building 9704-2

Date July 7, 1959
Originating Dept. Health Physics Group
Answering letter date
Subject Surface Water Sampling June, 1959

Copy to
C. J. Angela
L. E. Burkhart
L. C. Johnson
M. T. Kite
J. F. Morehead
J. C. Rasco
C. E. Sullivan, Jr., M. D.
File, H2EC

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek*	6-5-59	1,867	7,833	0.4	70.4×10^6
	6-12-59	1,340	3,[illegible]	0.3	67.1×10^6
	6-19-59	1,000	3,767	0.5	61.9×10^6
	6-26-59	4,450	6,300	0.4	70.6×10^6
Burial Pit	6-3-59	200,696	80,471		
	6-8-59	55,310	36,941		
	6-24-59	24,906	86,109		
NE Settling Pit	6-3-59	76,953	473,682		
	6-8-59	41,109	391,550		
	6-16-59	45,529	108,700		
	6-24-59	41,965	64,842		
	6-30-59	64,910	106,745		
NW Settling Pit	6-8-59	12,112	77,684		
	6-16-59	11,101	337,174		
	6-24-59	11,011	49,247		
	6-30-59	5,224	10,588		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 15,500d/m/l.

Location	Date	Alpha d/m/l	Beta d/m/l
Bear Creek*	6-3-59[1]	232	3,474
	6-3-59[2]	356	3,556
	6-3-59[3]	637	1,575
	6-3-59[4]	156	3,741
	6-3-59[5]	87	3,696
	6-8-59[6]	178	5,000
	6-16-59[6]	136	0
	6-24-59[6]	222	370
	6-30-59[6]	63	0

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 15,500 d/m/l.

[1]One mile west of Y-12.

[2]One and a half miles west of Y-12.

[3]Two and a half miles west of Y-12.

[4]Three and a half miles south and west of Y-12.

[5]Six miles south and est of Y-12.

[6]One mile west of Burial Pit.

SIGNED - MERWYN SANDERS

M. Sanders

MS:rj

UCN-429
(2 1-59)

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC

Company

Location Building 9704-2

Date August 18, 1959

Originating Dept. Health Physics Group

Answering letter date

Copy to
G. J. Angele
L. E. Burkhart
Neal Dow
L. C. Johnson
H. T. Kite
J. F. Morehead
C. R. Sullivan, Jr., M.D.
File

Subject Surface Water Sampling
July, 1959

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek Settling Pits, and Burial Pit.

Location	Date	Alpha d/m/l	Beta d/m/l	Mercury mg/l	Total Flow gal/week
Poplar Creek*	7-2-59	320	4,667	1.3	68.3 x 10^6
	7-10-59	1,800	1,400	1.4	62.2 x 10^6
	7-17-59	3,667	15,067	0.9	64.7 x 10^6
	7-24-59	1,700	4,100	0.6	64.8 x 10^6
	7-31-59	2,240	0	0.4	64.5 x 10^6
Burial Pit		Insufficient Amount of Water			
NE Settling Pit	7-7-59	56,966	134,193		
	7-15-59	40,298	863,684		
	7-21-59	45,471	122,739		
	7-28-59	66,766	1,079,770		
NW Settling Pit	7-7-59	56,667	85,356		
	7-15-59	12,860	82,093		
	7-21-59	25,747	140,195		
NW Settling Pit	7-28-59	82,977	182,963		
SE Settling Pit	7-15-59	97,996	3,207,730		
	7-21-59	136,842	2,010,000		
	7-28-59	63,140	1,382,605		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 15,500 d/m/l.

Location	Date	Alpha d/m/l	Beta d/m/l
Bear Creek*	7-7-59[1]	191	0
	7-15-59[2]	152	689
	7-21-59[3]	1,634	7,312
	7-28-59[4]	932	9,621

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 15,500 d/m/l.

[1]One mile west of Y-12.

[2]One and a half miles west of Y-12.

[3]Two and a half miles west of Y-12.

[4]Three and a half miles south and west of Y-12.

Signed By
Paul C. McRee
M. Sanders

MS:rj

JCN-429
2 1-59)

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. [illegible] McLendon

Company

Location Building 9704-[illegible]

Date October 1, 1959

Originating Dept. Health Physics Group

Answering letter date

Subject Surface Water Sampling, August, 1959

Copy to
[illegible] J. Angele
[illegible] Burkhart
Neal Dow
[illegible] Johnson
[illegible] Kite
J. [illegible] Morehead
[illegible] R. Sullivan, Jr., M.D.
File, Y12RC

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, Burial Pit, Springs, and X-10 Quarry.

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	8-07-59	6×10^{-7}	1×10^{-6}	0.6	91.0×10^{6}
	8-14-59	6×10^{-7}	3×10^{-6}	1.7	65.1×10^{6}
	8-21-59	5×10^{-7}	3×10^{-6}	.3	64.7×10^{6}
	8-28-59	5×10^{-7}	3×10^{-6}	.2	67.4×10^{6}
Bear Creek*	8-04-59	2×10^{-7}	0	9-4 0.2	65.5×10^{6}
	8-11-59	1×10^{-7}	6×10^{-7}	9-11 0.1	61.7
	8-18-59	2×10^{-7}	0	9-18 0.2	61.0
	8-25-59	1×10^{-7}	7×10^{-7}	9-25 0.2	63.9
SE Settling Pit	8-04-59	9×10^{-5}	2×10^{-3}		
	8-11-59	7×10^{-4}	5×10^{-3}		
	8-18-59	3×10^{-5}	2×10^{-4}		
	8-25-59	7×10^{-6}	4×10^{-4}		

13)856.6(65.9

9)65.9 = 9.4

* The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter).

J. D. McLendon - - - October 1, 1959

Location	Date	Alpha μc/cc	Beta μc/cc
[illegible] Settling Pit	8-04-59	[illegible] x 10^{-5}	[illegible] x 10^{-4}
	8-11-59	[illegible] x 10^{-9}	1 x 10^{-7}
	8-18-59	[illegible] x 10^{-6}	8 x 10^{-7}
	8-25-59	3 x 10^{-6}	8 x 10^{-4}
NW Settling Pit	8-04-59	3 x 10^{-6}	[illegible] x 10^{-5}
	8-11-59	3 x 10^{-8}	[illegible] x 10^{-6}
	8-18-59	7 x 10^{-8}	[illegible] x 10^{-5}
	8-25-59	9 x 10^{-8}	[illegible] x 10^{-5}
#1 Spring	8-25-59	8 x 10^{-9}	0
[illegible] Spring	8-25-59	[illegible] x 10^{-8}	0
#3 Spring	8-25-59	0	0
X-10 Quarry	8-11-59	0	9 x 10^{-7}
	8-18-59	3 x 10^{-8}	0
	8-25-59	8 x 10^{-9}	0
Burial Pit	Insufficient water		

SIGNED - MERWYN SANDERS

M. Sanders

MSteam

CN-429
2 1-59)

UNION ARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon
Company
Location Building 9704-2

Date November 2, 1959
Originating Dept. Health Physics
Answering letter date
Subject Surface Water Sampling, September, 1959

Copy to
G. J. Angele
L. E. Burkhart
Neal Dow
L. C. Johnson
H. T. Kite
J. F. Morehead
C. R. Sullivan, Jr., M. D.
File, Y12RC

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, Burial Pit, Springs, and K-10 Quarry.

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	9-04-59	5×10^{-7}	3×10^{-6}	0.2	65.5×10^{6}
	9-11-59	2×10^{-7}	5×10^{-7}	0.1	61.7×10^{6}
	9-18-58	2×10^{-7}	2×10^{-6}	1.7	61.0×10^{6}
	9-25-59	5×10^{-7}	5×10^{-6}	0.2	63.9×10^{6}
Bear Creek*	9-01-59	2×10^{-8}	7×10^{-7}		
	9-09-59	4×10^{-8}	0		
	9-15-59	2×10^{-8}	0		
	9-22-59	6×10^{-8}	0		
	9-29-59	2×10^{-7}	7×10^{-7}		
SE Settling Pit	9-01-59	5×10^{-5}	2×10^{-3}		
	9-09-59	4×10^{-5}	2×10^{-3}		
	9-15-59	6×10^{-5}	3×10^{-4}		
	9-21-59	4×10^{-5}	2×10^{-3}		
	9-29-59	6×10^{-5}	2×10^{-3}		

* The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-6} μc/cc (microcurie per cubic centimeter).

Location	Date	Alpha μc/cc	Beta μc/cc
NE Settling Pit	9-01-59	3×10^{-5}	6×10^{-7}
	9-09-59	$[illegible] \times 10^{-5}$	$3 \times 10^{[illegible]}$
	9-15-59	3×10^{-5}	3×10^{-4}
	9-22-59	2×10^{-7}	4×10^{-4}
	9-29-59	1×10^{-5}	4×10^{-4}
NW Settling Pit	9-01-59	7×10^{-6}	3×10^{-5}
	9-09-59	6×10^{-6}	7×10^{-5}
	9-15-59	5×10^{-6}	5×10^{-5}
	9-22-59	8×10^{-6}	8×10^{-5}
	9-29-59	3×10^{-6}	3×10^{-5}
#1 Spring	9-01-59	7×10^{-8}	0
	9-09-59	1×10^{-8}	1×10^{-6}
#2 Spring	9-01-59	7×10^{-9}	1×10^{-7}
	9-09-59	3×10^{-8}	3×10^{-8}
#3 Spring	9-01-59	1×10^{-8}	0
	9-09-59	0	1×10^{-7}
X-10 Quarry	9-01-59	1×10^{-8}	6×10^{-7}
Burial Pit	Insufficient Water		

SIGNED - MERWYN SANDERS

M. Sanders

MSpcam

CN-429
2 1-59)

UNION ARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLondon

Company Location Building 9711-1

Date December 23, 1959

Originating Dept. Health Physics Group

Answering letter date

Subject Surface Water Sampling, October, 1959

Copy to
G. J. Angele
L. E. Burkhart
Neal Dow
L. L. Johnson
H. T. Kite
G. B. Marrow
J. F. Morehead, Jr.
J. R. Sullivan, Jr., M. D.
File, Y12RC

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, Burial Pit, and Springs.

	Gram U/Gram	AT
Poplar Creek - Monthly composite	.0000283	2.08 % of X

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	10-02-59	5×10^{-7}	2×10^{-6}	.24	60.6×10^{6}
	10-09-59	3×10^{-8}	2×10^{-6}	.22	63.9×10^{6}
	10-16-59	5×10^{-7}	3×10^{-6}	.21	67.2×10^{6}
	10-23-59	5×10^{-7}	3×10^{-6}	.19	66.4×10^{6}
	10-30-59	3×10^{-7}	3×10^{-6}	.24	69.0×10^{6}
Bear Creek*	10-07-59	6×10^{-8}	5×10^{-7}		
	10-13-59	1×10^{-8}	0		
	10-20-59	1×10^{-8}	1×10^{-6}		
	10-27-59	4×10^{-8}	1×10^{-7}		

Corrected by

* The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} μc/cc (microcuria per cubic centimeter).

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flo gal/ gal
SE Settling Pit	10-07-59	4×10^{-5}	4×10^{-3}		
	10-13-59	7×10^{-5}	5×10^{-3}		
	10-20-59	7×10^{-5}	10×10^{-4}		
	10-27-59	5×10^{-5}	3×10^{-3}		
NE Settling Pit	10-07-59	4×10^{-5}	3×10^{-4}		
	10-13-59	2×10^{-5}	3×10^{-4}		
	10-20-59	2×10^{-5}	5×10^{-4}		
	10-27-59	2×10^{-5}	6×10^{-5}		
NW Settling Pit	10-07-59	9×10^{-6}	5×10^{-5}		
	10-13-59	8×10^{-6}	7×10^{-5}		
	10-20-59	5×10^{-6}	2×10^{-5}		
	10-27-59	7×10^{-6}	2×10^{-4}		
#1 Spring	10-20-59	1×10^{-8}	4×10^{-7}		
#2 Spring	10-20-59	1×10^{-7}	1×10^{-6}		
#3 Spring	10-20-59	0 (None detected)	0		

SIGNED - M. SANDERS

M. Sanders

M:cem

CN-429
2 1-59

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. L. McLendon
Company
Location Building 4711-1

Date January [illegible], 1960
Originating Dept. Radiation Safety
Answering letter date
Subject Surface Water Sampling, November, 1959

Copy to
G. J. Angele
L. M. Burkhart
Neal Dow
L. C. Johnson
H. E. Kite
G. B. Marrow
J. J. Morehead, Jr.
C. [illegible] Sullivan, Jr., M. [illegible]
File, Y12RC

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, Burial Pit:

	Gram U/Gram[1]	ΔT
Poplar Creek - Monthly composite	.0000.0106	1.50% of X

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	11-6-59	2×10^{-7}	2×10^{-6}	.30	67.9×10^{6}
	11-13-59	4×10^{-8}	10×10^{-7}	.09	67.4×10^{6}
	11-20-59	5×10^{-7}	8×10^{-7}	.10	69.0×10^{6}
	11-27-59	4×10^{-7}	1×10^{-6}	.30	96.5×10^{6}
Bear Creek*	11-3-59	3×10^{-7}	None		
	11-10-59	6×10^{-8}	None		
	11-17-59	None	1×10^{-6}		

* The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} μc/cc (microcurie per cubic centimeter).

1 The gram U/gram results for the report period of October should be corrected to .0000013 grams U/gram.

Location	Date	Alpha μc/cc	Beta μc/cc
[illegible] settling [illegible]	11-3-[illegible]	[illegible] x 10^{-6}	1 x 10^{-3}
	11-10-[illegible]	3 x 10^{-6}	[illegible] x 10^{-4}
	11-17-[illegible]	3 x 10^{-6}	4 x 10^{-4}
[illegible] settling [illegible]	11-3-[illegible]	[illegible] x 10^{-6}	[illegible] x 10^{-4}
	11-10-[illegible]	1 x 10^{-6}	1 x 10^{-4}
	11-17-[illegible]	3 x 10^{-6}	[illegible] x 10^{-4}
[illegible] settling [illegible]	11-3-[illegible]	[illegible] x 10^{-6}	[illegible] x 10^{-5}
	11-10-[illegible]	6 x 10^{-6}	7 x 10^{-5}
	11-17-[illegible]	7 x 10^{-6}	3 x 10^{-5}

SIGNED - MERWYN SANDERS

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon
Company
Location Building 6711-1

Date February 12, 1960
Originating Dept. Radiation Safety
Answering letter date

Copy to
G. J. Angele
L. T. Burkhart
Neal Cow
L. C. Johnson
H. T. Kite
G. B. Murrow
J. F. Morehead
C. P. Sullivan, Jr., M. D.

Subject Surface Water Sampling, December, 1959

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, Settling Pits, and Sludge Burner:

				Gram U/Gram	AT
Poplar Creek - Monthly composite				.00000186	1.90% of X
Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	12-4-59	5×10^{-7}	3×10^{-6}	.33	76.4×10^{6}
	12-11-59	None	None	.13	77.7×10^{6}
	12-18-59	4×10^{-7}	None	.14	100.6×10^{6}
	12-24-59	6×10^{-7}	5×10^{-7}	.19	71.7×10^{6}
	12-31-59	5×10^{-7}	2×10^{-6}	.08	77.4×10^{6}
Bear Creek*	12-1-59	3×10^{-7}	4×10^{-6}		
	12-8-59	7×10^{-9}	5×10^{-7}		
	12-15-59	None	3×10^{-7}		
	12-22-59	8×10^{-8}	None		
	12-29-59	2×10^{-7}	None		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-6} uc/cc (microcurie per cubic centimeter).

UNCLASSIFIED

Location	Date	Alpha uc/cc	Beta uc/cc
SE Settling Pit	12-1-59	5×10^{-5}	3×10^{-6}
	12-8-59	1×10^{-4}	1×10^{-4}
	12-15-59	5×10^{-5}	4×10^{-4}
	12-22-59	1×10^{-5}	8×10^{-5}
	12-29-59	4×10^{-5}	4×10^{-4}
NE Settling Pit	12-1-59	8×10^{-8}	9×10^{-8}
	12-8-59	4×10^{-5}	4×10^{-4}
	12-15-59	2×10^{-5}	1×10^{-4}
	12-22-59	9×10^{-6}	8×10^{-5}
	12-29-59	2×10^{-5}	4×10^{-4}
NW Settling Pit	12-1-59	4×10^{-8}	1×10^{-8}
	12-8-59	5×10^{-8}	5×10^{-5}
	12-15-59	3×10^{-8}	4×10^{-5}
	12-22-59	3×10^{-8}	10×10^{-6}
	12-29-59	2×10^{-8}	5×10^{-8}
Sludge Burner	12-9-59	No analysis	

M. Sanders

MS:mw

UCN-429
(2 1-59)

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) Company: J. D. McLendon

Building 3711-1

Date: April 13, 1960

Radiation Safety

Answering letter date:

Copy to:
G. J. Angele
L. E. Burkhart
Neal Dow
L. C. Johnson
[illegible]
J. F. Morehead
C. R. Sullivan, Jr., M. D.
F. S. Patton, Jr.

Subject: Surface Water Sampling, January, 1960

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits.

	Gram U/Gram	ΔT
Poplar Creek - Monthly Composite	.00000131	1.54% of X

Location	Date	Alpha [illegible]/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	1-8-60	3×10^{-7}	2.9×10^{-6}	.18	84.5×10^{6}
	1-15-60	3×10^{-7}	2.9×10^{-6}	.04	67.9×10^{6}
	1-22-60	7×10^{-8}	7×10^{-7}	.16	68.1×10^{6}
	1-29-60	3×10^{-7}	7×10^{-7}	.24	67.3×10^{6}
Bear Creek*	1-5-60	1×10^{-7}	None		
	1-12-60	1×10^{-8}	5×10^{-7}		
	1-20-60	1×10^{-7}	0		
	1-26-60	1×10^{-8}	0		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcurie per cubic centimeter).

Location	Date	Alpha μc/cc	Beta μc/cc
E Settling Pit	1-5-60	4×10^{-5}	2×10^{-4}
	1-12-60	1×10^{-5}	3×10^{-5}
	1-20-60	3×10^{-5}	1×10^{-4}
	1-26-60	15×10^{-5}	6×10^{-5}
NE Settling Pit	1-5-60	6×10^{-6}	3×10^{-5}
	1-12-60	2×10^{-6}	16×10^{-5}
	1-20-60	2×10^{-4}	1×10^{-4}
	1-26-60	4×10^{-5}	9×10^{-5}
NW Settling Pit	1-5-60	2×10^{-6}	5×10^{-7}
	1-12-60	10×10^{-7}	1×10^{-5}
	1-20-60	4×10^{-6}	1×10^{-5}
	1-26-60	3×10^{-7}	7×10^{-6}

SIGNED MERWYN SANDERS

M. Sanders

MS:mw

Hg Poplar Creek

Bob

1-8 .18

1-15 .05 1.98 lbs/wk

1-22 .17

1-29 .124

.109

2-12 .17

2-19 .18

2-26 .14

3-4 .06

3-11 .15

3-18 .51 — 19.8 lbs/wk

3-25 .29

4-1 .23

N.P. had not put out their Jan-report as yet.

4-13-60. H

UCN-429
(2 1-59)

UNION CARBIDE

INTERNAL CORRESPONDENCE

NION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC
Company
Building 9711-1

Date April 25, 1960

Originating Dept. Radiation Safety

Answering letter date

Copy to
G. J. Angelo
L. E. Burkhart
Neal Dow
L. C. Johnson
H. T. Kite
J. F. Morehead ✓
F. S. Patton, Jr.
C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling, February, 1960

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits.

	Gram U/Gram	AT
Poplar Creek - Monthly Composite	0.0000139	1.91% of X

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	2-5-60	4×10^{-7}	3×10^{-6}	.09	68.8×10^{6}
	2-12-60	6×10^{-7}	4×10^{-6}	.17	75.7×10^{6}
	2-19-60	3×10^{-7}	1×10^{-6}	.18	85.5×10^{6}
	2-26-60	2×10^{-7}	3×10^{-6}	.14	69.3×10^{6}
Bear Creek*	2-2-60	8×10^{-7}	6×10^{-6}		
	2-9-60	6×10^{-8}	0		
	2-16-60	1×10^{-7}	0		
	2-24-60	8×10^{-8}	0		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} μc/cc (microcurie per cubic centimeter).

April 25, 1960

Location	Date	Alpha uc/cc	Beta uc/cc
SE Settling Pit	2-2-60	2×10^{-5}	1×10^{-3}
	2-9-60	4×10^{-5}	1×10^{-4}
	2-16-60	3×10^{-5}	2×10^{-4}
	2-24-60	3×10^{-5}	9×10^{-5}
NE Settling Pit	2-2-60	7×10^{-6}	3×10^{-5}
	2-9-60	1×10^{-5}	2×10^{-4}
	2-16-60	1×10^{-5}	9×10^{-5}
	2-24-60	8×10^{-6}	3×10^{-5}
NW Settling Pit	2-2-60	2×10^{-5}	4×10^{-4}
	2-9-60	4×10^{-6}	2×10^{-6}
	2-16-60	4×10^{-6}	2×10^{-5}
	2-24-60	3×10^{-6}	4×10^{-6}

SIGNED - MERWYN SANDERS

MS:mw

UCN-429
(2 1-59)

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) T. D. McLendon, Y12RC

Company

Location Building 9711-1

Date June 6, 1960

Originating Dept. Radiation Safety

Answering letter date

Subject Surface Water Sampling, March and April, 1960

[illegible] Angele
L. E. Burkhart
[illegible]
George Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead
C. R. Sullivan, Jr., M. D.

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits.

		Gram U/Gram
Poplar Creek - Monthly Composite -	March	.00000129
	April	.00000049

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	3-4-60	2×10^{-7}	0	.05	80.5×10^{6}
	3-18-60	7×10^{-8}	4×10^{-7}	.51	77.4×10^{6}
	3-7-60				75.6×10^{6}
	3-25-60	8×10^{-8}	5×10^{-8}	.29	64.2×10^{6}
	4-1-60	3×10^{-7}	6×10^{-8}	.23	$[illegible] \times 10^{6}$
	4-8-60	2×10^{-7}	2×10^{-7}	.24	66.8×10^{6}
	4-14-60	2×10^{-7}	5×10^{-7}	.24	63.0×10^{6}
	4-22-60	2×10^{-7}	2×10^{-8}	.13	67.4×10^{6}
	4-29-60	2×10^{-7}	2×10^{-7}	.23	67.4×10^{6}

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcuric per cubic centimeter).

June 6, 1960

Location	Date	Alpha uc/cc	Beta uc
Bear Creek*	3-1-60	4×10^{-8}	0
	3-8-60	None detected	
	3-15-60	2×10^{-7}	3×10^{-7}
	3-22-60	6×10^{-8}	0
	[illegible]	10×10^{-8}	5×10^{-7}
	4-5-60	2×10^{-7}	0
	4-12-60	4×10^{-8}	0
	4-19-60	10×10^{-8}	3×10^{-7}
	4-26-60	1×10^{-7}	1×10^{-6}
Southeast Settling Pit	3-1-60	4×10^{-8}	[illegible]
	3-8-60	4×10^{-8}	4×10^{-5}
	3-15-60	2×10^{-5}	7×10^{-5}
	3-22-60	2×10^{-5}	1×10^{-4}
	3-29-60	2×10^{-5}	6×10^{-5}
	4-5-60	3×10^{-5}	3×10^{-4}
	4-12-60	2×10^{-5}	7×10^{-4}
	4-19-60	8×10^{-4}	4×10^{-3}
	4-26-60	4×10^{-5}	3×10^{-4}
Northeast Settling Pit	3-1-60	2×10^{-6}	2×10^{-4}
	3-8-60	3×10^{-6}	1×10^{-5}
	3-15-60	2×10^{-5}	9×10^{-5}
	3-22-60	1×10^{-5}	1×10^{-4}
	3-29-60	3×10^{-5}	10×10^{-5}
	4-5-60	2×10^{-5}	2×10^{-4}
	4-12-60	4×10^{-5}	3×10^{-5}
	4-19-60	4×10^{-5}	9×10^{-6}
	4-26-60	4×10^{-5}	3×10^{-4}
Northwest Settling Pit	3-1-60	4×10^{-6}	1×10^{-5}
	3-8-60	9×10^{-7}	1×10^{-6}
	3-15-60	4×10^{-6}	2×10^{-5}
	3-22-60	9×10^{-8}	5×10^{-5}
	3-29-60	2×10^{-4}	5×10^{-5}

- continued -

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcurie per cubic centimeter).

Location	Date	Alpha uc/cc	Beta uc/cc
Northwest Jet (continued)	4-5-60	10×10^{-7}	4×10^{-5}
	4-12-60	10×10^{-6}	8×10^{-5}
	4-19-60	1×10^{-5}	5×10^{-5}
	4-26-60	1×10^{-5}	7×10^{-5}

SIGNED - MERWYN SANDERS

M:mw

G.-429
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UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name)
Company J. D. McLendon
Location
Building 9711-1

Date
June 23, 1960

Originating Dept.
Radiation Safety

Answering letter date

Copy to
C. J. Auguis
L. E. Burkhart

George Jasny
L. C. Johnson
H. T. Kue
J. F. Morehead
--, ---, M. D.

Subject
Surface Water Sampling - May, 1960

The following gives a listing of water sample results taken from Poplar Creek Bear Creek, and Settling Pits.

Poplar Creek - Monthly Composite - Gram U/Gram = .0000011

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury	Total Flow gal./week
Poplar Creek*	5-6-60	8×10^{-7}	2×10^{-6}	.16	66.8×10^{6}
	5-13-60	2×10^{-7}	3×10^{-7}	.12	69.3×10^{6}
	5-20-60	4×10^{-7}	5×10^{-7}	.12	67.5×10^{6}
	5-27-60	5×10^{-8}	4×10^{-6}	.12	67.5×10^{6}
Bear Creek*	5-3-60	None detected			
	5-10-60	6×10^{-8}	0		
	5-17-60	10×10^{-8}	0		
	5-24-60	2×10^{-7}	0		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} μc/cc (microcurie per cubic centimeter).

J. D. Mc[illegible]

June 23, 1960

Location	Date	Alpha µc/cc	Beta µc/cc
3E Settling Pit	5-3-60	5×10^{-5}	7×10^{-5}
	5-10-60	1×10^{-5}	2×10^{-3}
	5-17-60	3×10^{-5}	2×10^{-5}
	5-24-60	4×10^{-5}	3×10^{-4}
		3×10^{-5}	14×10^{-5}
	5-10-60	3×10^{-5}	4×10^{-5}
	5-17-60	2×10^{-5}	3×10^{-4}
	5-24-60	3×10^{-5}	10×10^{-6}
NW [illegible] Pit	5-3-60	1×10^{-5}	3×10^{-5}
	5-10-60	3×10^{-6}	5×10^{-5}
	5-17-60	2×10^{-6}	1×10^{-4}
	5-24-60	3×10^{-6}	6×10^{-5}

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y1...
Company

...711-1

Date August 12, 1960

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele
...

Neal Dow
George Jasny

H. T. Kite

C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - June, 1960

The following gives a listing of water sample results taken from Poplar Creek, ... Settling Pits.

... Comp... U/Gram = .0000032

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	6-3-60	2×10^{-7}	2×10^{-7}	.21	81.7×10^{6}
	6-10-60	4×10^{-7}	8×10^{-7}	.19	86.1×10^{6}
	6-17-60	2×10^{-7}	0	.15	75.1×10^{6}
	6-24-60	4×10^{-7}	2×10^{-6}	.27	90.8×10^{6}
	7-1-60	2×10^{-7}	2×10^{-6}	.13	71.9×10^{6}
Bear Creek*	6-1-60	2×10^{-7}	0		
	6-7-60	2×10^{-7}	0		
	6-14-60	2×10^{-7}	2×10^{-7}		
	6-21-60	2×10^{-7}	0		
	6-28-60	6×10^{-7}	2×10^{-7}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter).

Location	Date	Gamma μc/cc	Beta μc/cc
SE Settling Pit		2×10^{-5}	3×10^{-4}
	6-7-60	4×10^{-5}	6×10^{-5}
	6-14-60	2×10^{-5}	5×10^{-5}
	6-21-60	4×10^{-5}	2×10^{-4}
	6-29-60	6×10^{-5}	5×10^{-5}
	6-1-60	5×10^{-5}	2×10^{-4}
	6-7-60	2×10^{-6}	0
	6-14-60	3×10^{-5}	3×10^{-5}
	6-21-60	5×10^{-5}	5×10^{-4}
	6-29-60	3×10^{-5}	3×10^{-4}
NW Settling Pit	6-1-60	8×10^{-6}	8×10^{-3}
	6-7-60	3×10^{-5}	7×10^{-5}
	6-14-60	7×10^{-6}	4×10^{-5}
	6-21-60	3×10^{-5}	3×10^{-5}
	6-29-60	2×10^{-5}	6×10^{-5}

SIGNED MERWYN SANDERS
M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name)
Company J. D. Y12RC
Location
Building [illegible]

Date
September 13, 1960
Radiation Safety
Answering letter date

G. J. [illegible]
L. E. Burkhart
[illegible]
George Jasny
L. C. Johnson
H. [illegible] Kite
J. F. Morehead ✓
[illegible]

Surface Water San
July, 1960

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek and settling pits.

Poplar Creek - Monthly Composite - Gram U/Gram = .0000009

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	7-8-60	2×10^{-7}	2×10^{-7}	.15	68.5×10^{6}
	7-15-60	4×10^{-7}	5×10^{-8}	.16	71.9×10^{6}
	7-22-60	5×10^{-8}	6×10^{-7}	1.99	63.3×10^{6}
	7-29-60	2×10^{-7}	0	.14	64.6×10^{6}
Bear Creek*	7-6-60	2×10^{-7}	0		
	7-12-60	4×10^{-7}	10×10^{-7}		
	7-13-60	2×10^{-7}	4×10^{-8}		
	7-26-60	6×10^{-7}	0		

* The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcuria per cubic centimeter).

Location	Date	Alpha μc/cc	Beta μc/cc
NW Settling Pit	7-6-60	10×10^{-6}	9×10^{-6}
	7-12-60	2×10^{-5}	8×10^{-5}
	7-13-60	2×10^{-5}	1×10^{-3}
	7-26-60	3×10^{-5}	5×10^{-5}
NE Settling Pit	7-6-60	3×10^{-5}	6×10^{-4}
	7-12-60	5×10^{-5}	1×10^{-4}
	7-13-60	3×10^{-5}	6×10^{-4}
	7-26-60	5×10^{-5}	3×10^{-4}
SE Settling Pit	7-6-60	5×10^{-5}	7×10^{-4}
	7-12-60	4×10^{-5}	2×10^{-4}
	7-26-60	4×10^{-5}	1×10^{-4}
	7-26-60	7×10^{-5}	4×10^{-4}

SIGNED -

M. Sanders

MSmw

UNION CARBIDE

INTERNAL CORRESPONDENCE

[illegible]IDE NUCLEAR COMPANY POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC

Company

Location Building 9711-1

Date [illegible] October 10, 1960

Originating Dept. Radiation Safety

Answering letter date

Subject Surface Water Sampling - August 1960

[illegible]
L. E. Burkhart
Neal Dow
George Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead ✓

[illegible]

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits.

Poplar Creek - Monthly Composite - [illegible]

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury [illegible]	Total Flow [illegible]
Poplar Creek*	8-5-60	2×10^{-7}	1×10^{-6}	.22	70.2×10^{6}
	8-12-60	[illegible]	[illegible]	.18	74.7×10^{6}
	8-19-60	2×10^{-7}	0	.16	53.8×10^{6}
	8-26-60	3×10^{-7}	0	.09	51.0×10^{6}
	9-2-60	[illegible]	[illegible]	.14	53.1×10^{6}
Bear Creek*	8-2-60	10×10^{-8}	0	[illegible]	
	8-9-60	2×10^{-7}	0		
	8-16-60	2×10^{-7}	[illegible]		
	[illegible]	[illegible]	[illegible]		
	8-30-60	1×10^{-7}	3×10^{-6}		

*The permissible limit for uranium [illegible] outside of controlled areas is 3×10^{-5} uc/cc (microcurie [illegible]

Location	Date	Alpha $\mu c/cc$	Beta
NW Settling Pit	8-2-60	3×10^{-5}	1×10^{-4}
	8-9-60	2×10^{-5}	6×10^{-5}
	8-16-60	3×10^{-5}	10×10^{-5}
	8-23-60	3×10^{-5}	8×10^{-4}
	8-30-60	3×10^{-5}	7×10^{-5}
NE Settling Pit	8-2-60	4×10^{-5}	2×10^{-4}
	8-9-60	3×10^{-5}	3×10^{-4}
	8-16-60	2×10^{-5}	4×10^{-4}
	8-23-60	3×10^{-5}	5×10^{-4}
	8-30-60	2×10^{-5}	4×10^{-5}
SE Settling Pit	8-2-60	2×10^{-5}	7×10^{-5}
	8-9-60	5×10^{-5}	1×10^{-4}
	8-16-60	3×10^{-5}	5×10^{-5}
	8-23-60	2×10^{-5}	1×10^{-5}
	8-30-60	3×10^{-5}	5×10^{-4}

SIGNED - MERWYN SANDERS

M. Sanders

MS:mw

#14-11-3

UNION CARBIDE

INTERNAL CORRESPONDENCE

NION CARBIDE NUCLEAR COMPANY

POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC

Company

Location Building 0711-1

Date November 14, 1960

Originating Dept.

Answering letter date

Copy to G. J. Angele
L. E. Burkhart
Neal Dow
George Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead ✓
C. D. Gillman, Jr., M. D.

Subject Surface Water Sampling - September, 1960

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits.

Poplar Creek - Monthly Composite - Gram U/Gram = .0000024

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	9-9-60	4×10^{-7}	1×10^{-7}	.12	66.4×10^{6}
	9-16-60	7×10^{-7}	6×10^{-7}	.14	58.8×10^{6}
	9-23-60	2×10^{-7}	4×10^{-7}	.33	53.9×10^{6}
	9-30-60	3×10^{-7}	9×10^{-7}	.85	56.7×10^{6}
Bear Creek*	9-6-60	8×10^{-8}	5×10^{-8}		
	9-13-60	1×10^{-7}	0		
	9-20-60	2×10^{-7}	6×10^{-7}		
	9-27-60	1×10^{-7}	0		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter).

Location	Date	Alpha µc/cc	Beta µc/cc
NW Settling Pit	9-6-60	2×10^{-5}	10×10^{-5}
	9-13-60	9×10^{-6}	9×10^{-5}
	9-20-60	1×10^{-5}	8×10^{-5}
	9-27-60	2×10^{-5}	7×10^{-5}
NE Settling Pit	9-6-60	3×10^{-5}	4×10^{-4}
	9-13-60	2×10^{-5}	5×10^{-4}
	9-20-60	1×10^{-5}	5×10^{-4}
	9-27-60	2×10^{-5}	4×10^{-4}
[illegible]	[illegible]	5×10^{-5}	3×10^{-4}
	9-13-60	3×10^{-5}	7×10^{-5}
	9-20-60	2×10^{-5}	1×10^{-4}
	9-27-60	2×10^{-5}	4×10^{-4}

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date December 21, 1960

Originating Dept. Radiation Safety

Answering letter date

Subject Surface Water Sampling - October, 1960

Copies to
L. E. Burkhart
Neal Dow
George Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead
C. R. Sullivan, Jr., M. D.

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits.

Poplar Creek - Monthly Composite - Gram U/Gram = .0000002

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	10-7-60	4×10^{-7}	8×10^{-8}	.22	63.8×10^{6}
	10-14-60	4×10^{-7}	1×10^{-7}	.37	59.3×10^{6}
	10-21-60	5×10^{-8}	7×10^{-8}	.15	63.9×10^{6}
	10-28-60	2×10^{-7}	None	.40	65.9×10^{6}
Bear Creek*	10-4-60	5×10^{-8}	None		
	10-11-60	1×10^{-7}	[illegible]		
	10-18-60	1×10^{-7}	[illegible]		
	10-25-60	2×10^{-7}	None		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcurie per cubic centimeter).

Location	Date	Alpha uc/cc	Beta uc/cc
[illegible]	10-4-60	1×10^{-5}	5×10^{-5}
	10-11-60	2×10^{-5}	2×10^{-4}
	10-18-60	3×10^{-5}	3×10^{-4}
	10-25-60	4×10^{-5}	3×10^{-4}
SE Settling Pit	10-4-60	1×10^{-5}	6×10^{-5}
	10-11-60	3×10^{-5}	1×10^{-4}
	10-18-60	1×10^{-5}	2×10^{-4}
	10-25-60	4×10^{-5}	4×10^{-4}
NW Settling Pit	10-4-60	7×10^{-6}	8×10^{-5}
	10-11-60	2×10^{-5}	6×10^{-5}
	10-18-60	10×10^{-6}	8×10^{-5}
	10-25-60	2×10^{-5}	7×10^{-5}

SIGNED - MERWYN SANDERS

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

(Name) J. D. McLendon, YIERC

Date December 28, 1960

Location Building 9711-1

Originating Dept. Radiation Safety

Answering letter date

Copy to
G. Z. Angelo
L. E. Burkhart
Neal Dow
George Jenny
L. C. Johnson
H. T. Kite
J. F. Moreland
C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - November, 1960

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits.

Poplar Creek - Monthly Composite - Gram U/Gram = .0000008

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow Gal/week
Poplar Creek*	11-4-60	1×10^{-8}	5×10^{-8}	.19	58.6×10^{6}
	11-11-60	6×10^{-8}	8×10^{-8}	.27	57.8×10^{6}
	11-18-60	2×10^{-7}	2×10^{-8}	.61	56.4×10^{6}
	11-25-60	1×10^{-7}	1×10^{-7}	No anal.	52.7×10^{6}
	12-2-60	3×10^{-7}	1×10^{-8}	.03	65.0×10^{6}
Bear Creek*	11-1-60	1×10^{-7}	0		
	11-8-60	8×10^{-8}	0		
	11-15-60	5×10^{-8}	3×10^{-8}		
	11-22-60	9×10^{-8}	0		
	11-29-60	8×10^{-7}	6×10^{-7}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-8} μc/cc (microcurie per cubic centimeter).

Location	Date	Alpha uc/cc	Beta uc/cc
NE Settling Pit	11-1-60	2×10^{-5}	3×10^{-4}
	11-8-60	2×10^{-5}	3×10^{-4}
	11-15-60	4×10^{-6}	2×10^{-5}
	11-22-60	2×10^{-5}	4×10^{-4}
	11-29-60	2×10^{-5}	4×10^{-4}
NW Settling Pit	11-1-60	10×10^{-6}	1×10^{-4}
	11-8-60	1×10^{-5}	8×10^{-5}
	11-15-60	2×10^{-6}	5×10^{-6}
	11-22-60	10×10^{-6}	1×10^{-4}
	11-29-60	1×10^{-5}	1×10^{-4}
SE Settling Pit	11-1-60	1×10^{-5}	3×10^{-4}
	11-8-60	3×10^{-5}	[illegible]
	11-15-60	9×10^{-6}	7×10^{-5}
	11-22-60	3×10^{-5}	4×10^{-4}
	11-29-60	2×10^{-5}	3×10^{-4}

MGmw

DIVISION	DEPARTMENT	SECTION/PERSON	BLDG.-ROOM
Technical	Radiation Safety	Industrial Hygiene	9711-1

DESCRIPTION OF RECORDS	DATES FROM	DATES THROUGH	CODE NO.	RETENTION PERIOD
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DOCUMENT DESCRIPTION (Completed By Requesting Division)

Document No	Author's Telephone No.	Acct. No	Date of Request
MS/ChRZ-0245	6-0263	23660003	1/10/96

Unclassified Title: SURFACE WATER SAMPLING RESULTS TAKEN FROM POPLAR CREEK, BEAR CREEK AND SETTLING PITS CY 1960

Author(s) Requestor: Steve Wiley

TYPE: ☐ Formal Report ☐ Informal Report ☐ Progress/Status Report ☐ Co-Op Report ☐ Thesis/Term Paper

☐ Oral Presentation (identify meeting, sponsor, location, date):

☐ Journal Article (Identify Journal):

☒ Other (Specify): To Be Released to ChemRisk, Phase II

Document will be published in proceedings ☑ No ☐ Yes

Document will be distributed at meeting ☑ No ☐ Yes

Document has patent or invention significance ☑ No ☐ Yes (Identify)

Document has been previously released ☑ No ☐ Yes (Reference)

23 pp.

DIVISION REVIEW AND APPROVAL (Completed By Requesting Division)

TECHNICAL CLASSIFICATION REVIEW (Divisional Classification Representative)

Title(s): UNC Abstract: NA

DOCUMENT: Level UNC Category NA

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Signature Date

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UNION CARBIDE

INTERNAL CORRESPONDENCE

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UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon Y12RC

Company

Location Building 9711-1

Date March 6, 1961

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele
L. E. Burkhart
Neal Dow
George Jasny
L. C. Johnson
H. T. Kite 10 copies
J. F. Morehead
C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - January, 1961

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits.

Poplar Creek - Monthly Composite - ~~Sample misplaced in lab.~~ .0000006

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	1-6-61	8×10^{-7}	0	No analysis	65.6×10^{6} ÷7
	1-13-61	1×10^{-7}	0	.05	62.7×10^{6} ÷7
	1-20-61	3×10^{-7}	1×10^{-6}	.20	64.0×10^{6} ÷7
	1-27-61	No sample. Creek was frozen.			
Bear Creek*	1-5-61	1×10^{-7}	0		
	1-10-61	1×10^{-7}	5×10^{-6}		
	1-17-61	7×10^{-7}	1×10^{-7}		
	1-24-61	2×10^{-7}	None detected		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcurie per cubic centimeter).

APPROVED FOR PUBLIC RELEASE
P. R. McKenney 9/22/85
Technical Information Office Date

Location	Date	Alpha uc/cc	Beta uc/cc
NW Settling Pit	1-5-61	10×10^{-6}	9×10^{-5}
	1-10-61	5×10^{-6}	6×10^{-5}
	1-17-61	2×10^{-7}	1×10^{-7}
	1-24-61	1×10^{-5}	8×10^{-5}
NE Settling Pit	1-5-61	1×10^{-5}	2×10^{-4}
	1-10-61	5×10^{-6}	2×10^{-4}
	1-17-61	2×10^{-7}	2×10^{-7}
	1-24-61	2×10^{-5}	1×10^{-4}
SE Settling Pit	1-5-61	3×10^{-5}	3×10^{-5}
	1-10-61	3×10^{-5}	2×10^{-4}
	1-17-61	3×10^{-5}	8×10^{-5}
	1-24-61	4×10^{-5}	3×10^{-5}

SIGNED - MERWYN SANDERS

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

Fontin Company

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date March 21, 1961
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele
L. E. Burkhart
Neal Dow
George Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead
C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - February, 1961

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits:

Poplar Creek - Monthly Composite - .0000006

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	2-3-61	2×10^{-7}	2×10^{-5}	.07	62.3×10^{6} 77.7
	2-10-61	2×10^{-7}	none detected	.16	70.8×10^{6} 90.0
	2-17-61	1×10^{-7}	7×10^{-7}	.28	63.7×10^{6} 68.2
	2-24-61	2×10^{-7}	1×10^{-6}	.04	123.0×10^{6} 61.9
Bear Creek*	1-31-61	2×10^{-8}	none		
	2-8-61	2×10^{-7}	none detected		
	2-14-61	7×10^{-8}	none detected		
	2-21-61	5×10^{-8}	1×10^{-7}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcurie per cubic centimeter).

Location	Date	Alpha uc/cc	Beta uc/cc
SE Settling Pit	1-31-61	2×10^{-5}	1×10^{-4}
	2-8-61	2×10^{-5}	2×10^{-4}
	2-14-61	3×10^{-5}	9×10^{-5}
	2-21-61	10×10^{-6}	1×10^{-4}
NW Settling Pit	1-31-61	5×10^{-5}	1×10^{-5}
	2-8-61	2×10^{-5}	5×10^{-5}
	2-14-61	4×10^{-6}	1×10^{-5}
	2-21-61	2×10^{-5}	9×10^{-5}
NE Settling Pit	1-31-61	2×10^{-5}	1×10^{-4}
	2-8-61	2×10^{-5}	1×10^{-4}
	2-14-61	3×10^{-5}	5×10^{-5}
	2-21-61	7×10^{-6}	5×10^{-5}

SIGNED - MERWYN SANDERS

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY · POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC

Company

Location Building 9711-1

Date May 17, 1961

Originating Dept. Radiation Safety

Answering letter date

Subject Surface Water Sampling - March, 1961

Copy to G. J. Angele
L. E. Burkhart
Neal Dow
G. R. Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead
C. R. Sullivan, Jr., M. D.

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits;

Poplar Creek - Monthly Composite - .0000011 grams/U gram

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	3-3-61	1×10^{-7}	None	.16	77.7×10^{6}
	3-10-61	1×10^{-7}	8×10^{-7}	.10	90.4×10^{6}
	3-17-61	3×10^{-7}	1×10^{-7}	.09	68.2×10^{6}
	3-24-61	1×10^{-7}	0	1.80	61.9×10^{6}
Bear Creek*	2-28-61	1×10^{-7}	3×10^{-7}		
	3-7-61	6×10^{-8}	None		
	3-14-61	3×10^{-8}	0		
	3-29-61	1×10^{-7}	1×10^{-5}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter).

Location	Date	Alpha µc/cc	Beta µc/cc
NE Settling Pit	2-28-61	2×10^{-5}	1×10^{-4}
	3-7-61	2×10^{-5}	5×10^{-5}
	3-14-61	2×10^{-5}	10×10^{-5}
	3-29-61	1×10^{-5}	7×10^{-5}
SE Settling Pit	2-28-61	3×10^{-5}	2×10^{-6}
	3-7-61	2×10^{-5}	1×10^{-4}
	3-14-61	2×10^{-5}	5×10^{-5}
	3-29-61	2×10^{-5}	1×10^{-4}
NW Settling Pit	2-28-61	7×10^{-6}	3×10^{-5}
	3-7-61	1×10^{-5}	6×10^{-5}
	3-14-61	1×10^{-5}	4×10^{-5}
	3-29-61	1×10^{-5}	7×10^{-4}

SIGNED - MERWYN SANDERS

Merwyn Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date July 20, 1961

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele
L. E. Burkhart
T. Hall Bow
G. R. Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead
H. G. P. Snyder
C. R. Sullivan, Jr., M. D.

J. W. Strucker

Blank Copy

Subject Surface Water Sampling - April, May, and June, 1961

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits. Flow information, normally reported with sample results, is not available due to major maintenance on the sampling station.

Location	Date	Alpha µc/cc	Mercury mg/l
Poplar Creek*	4-14-61	8×10^{-8}	.20
	4-21-61	2×10^{-7}	.15
	4-28-61	2×10^{-7}	.10
	5-5-61	6×10^{-7}	.12
	5-12-61	1×10^{-7}	.10
	5-19-61	3×10^{-7}	.09
	5-26-61	3×10^{-7}	.07
	6-2-61	2×10^{-7}	.06
	6-8-61	3×10^{-7}	.09
	6-16-61	2×10^{-7}	.07
	6-23-61	2×10^{-7}	
	6-30-61	2×10^{-7}	.08
Bear Creek*	4-11-61	4×10^{-7}	
	4-18-61	5×10^{-7}	
	4-25-61	4×10^{-8}	
	5-2-61	10×10^{-8}	

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter).

Location	Date	Alpha μc/cc
Bear Creek*	5-9-61	8×10^{-8}
	5-16-61	4×10^{-8}
	5-23-61	4×10^{-8}
	5-30-61	5×10^{-8}
	6-6-61	6×10^{-8}
	6-13-61	1×10^{-7}
	6-20-61	1×10^{-7}
	6-27-61	5×10^{-8}
SE Settling Pit	4-11-61	1×10^{-5}
	4-18-61	3×10^{-5}
	4-25-61	2×10^{-5}
	5-2-61	3×10^{-5}
	5-9-61	2×10^{-5}
	5-16-61	2×10^{-5}
	5-23-61	2×10^{-5}
	5-30-61	2×10^{-5}
	6-6-61	2×10^{-5}
	6-13-61	2×10^{-5}
	6-20-61	2×10^{-5}
	6-27-61	2×10^{-5}
NW Settling Pit	4-11-61	8×10^{-6}
	4-18-61	2×10^{-5}
	4-25-61	1×10^{-5}
	5-2-61	1×10^{-5}
	5-9-61	2×10^{-5}
	5-16-61	1×10^{-5}
	5-23-61	1×10^{-5}
	5-30-61	1×10^{-5}
	6-6-61	1×10^{-5}
	6-13-61	1×10^{-5}
	6-20-61	2×10^{-5}
	6-27-61	1×10^{-5}
NE Settling Pit	4-11-61	9×10^{-6}
	4-18-61	2×10^{-5}
	4-25-61	2×10^{-5}
	5-2-61	2×10^{-5}
	5-9-61	2×10^{-5}
	5-16-61	3×10^{-5}
	5-23-61	2×10^{-5}
	5-30-61	2×10^{-5}

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} μc/cc (microcurie per cubic centimeter).

Location	Date	Alpha μc/cc
NE Settling Pit (continued)	6-6-61	2×10^{-5}
	6-13-61	2×10^{-5}
	6-20-61	4×10^{-5}
	6-27-61	2×10^{-5}

Merwyn Sanders

MS:mw

Poplar Creek Monthly Composite Analysis.

Uranium = .0000014 g/g

Cation Determination

F = 25 ppm

SO_4 = 1900 ppm

Cl = 2300 ppm

NO_3 = 770 ppm

M Sanders

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date August 23, 1961

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele
L. E. Burkhart
Neal Dow
G. R. Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead
H. G. P. Snyder
J. W. Strohecker
C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - July, 1961

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits. Flow information, normally reported with sample results, is not available due to major maintenance on the sampling station.

Location	Date	Alpha µc/cc	Mercury mg/l
Poplar Creek*	7-7-61	2×10^{-7}	.26
	7-14-61	3×10^{-7}	.68
	7-21-61	5×10^{-8}	.05
	7-28-61	2×10^{-7}	.16
Bear Creek*	7-5-61	2×10^{-8}	
	7-11-61	4×10^{-8}	
	7-18-61	9×10^{-8}	
	7-25-61	7×10^{-7}	
SE Settling Pit	7-5-61	2×10^{-5}	
	7-11-61	3×10^{-5}	
	7-18-61	3×10^{-5}	
	7-25-61	3×10^{-5}	

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter).

Location	Date	Alpha µc/cc
NW Settling Pit	7-5-61	2×10^{-5}
	7-11-61	1×10^{-5}
	7-18-61	1×10^{-5}
	7-25-61	2×10^{-5}
NE Settling Pit	7-5-61	2×10^{-5}
	7-11-61	2×10^{-5}
	7-18-61	2×10^{-5}
	7-25-61	2×10^{-5}

Poplar Creek monthly composite analyses:

Uranium = .0000014 g/g

Cation Determination

F = 25 ppm
SO_4 = 1900 ppm
Cl = 2300 ppm
NO_3 = 770 ppm

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date October 16, 1961
Originating Dept. Radiation Safety
Answering letter date
Subject Surface Water Sampling - August, 1961

Copy to
G. J. Angele
L. E. Burkhart
Neal Dow
G. R. Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead
H. G. P. Snyder
J. W. Strohecker
C. R. Sullivan, Jr., M. D.

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits. Flow information, normally reported with sample results, is not available due to major maintenance on the sampling station.

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l
Poplar Creek*	8-4-61	2×10^{-7}		.36
	8-11-61	2×10^{-7}		.08
	8-18-61	2×10^{-7}		.17
	8-25-61	3×10^{-7}	7×10^{-5}	.33
	9-1-61	4×10^{-7}	3×10^{-7}	.51
Bear Creek*	8-1-61	3×10^{-7}		
	8-8-61	4×10^{-8}		
	8-15-61	4×10^{-7}		
	8-22-61	9×10^{-8}		
	8-29-61	3×10^{-8}	7×10^{-5}	

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter).

Location	Date	Alpha µc/cc	Beta µc/cc
NE Settling Pit	8-8-61	2×10^{-5}	
	8-15-61	2×10^{-5}	
	8-22-61	2×10^{-5}	
	8-29-61	2×10^{-5}	1×10^{-4}
SE Settling Pit	8-1-61	3×10^{-5}	
	8-8-61	3×10^{-5}	
	8-15-61	3×10^{-5}	
	8-22-61	3×10^{-5}	
	8-29-61	2×10^{-5}	1×10^{-4}
NW Settling Pit	8-1-61	1×10^{-5}	
	8-8-61	2×10^{-5}	
	8-15-61	2×10^{-5}	
	8-22-61	2×10^{-5}	
	8-29-61	2×10^{-5}	5×10^{-5}

M. Sanders

MS:mw

Poplar Creek monthly composite analyses

Uranium : 7.9 µg/g

Assay : 1.04 %

Cation determination

SO_4 = 58 ppm

Cl = 41 ppm

F = 1.5 ppm

NO_3 = 20 ppm

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESS

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date November 15, 1961

Originating Dept. Radiation Safety

Answering letter date

Subject Surface Water Sampling - ~~September~~, 1961

Copy to
G. J. Angele
L. E. Burkhart
Neal Dow
G. R. Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead
H. G. P. Snyder
J. W. Strohecker
C. R. Sullivan, Jr., M. D.

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits:

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	9-8-61	5×10^{-7}	5×10^{-6}	.42	67.9×10^{6}
	9-15-61	2×10^{-7}	1×10^{-6}	.10	83.5×10^{6}
	9-22-61	2×10^{-7}	1×10^{-6}	.18	72.1×10^{6}
	9-29-61	6×10^{-7}	1×10^{-5}	.29	65.3×10^{6}
Bear Creek*	9-6-61	1×10^{-7}	1×10^{-5}		
	9-12-61	10×10^{-8}	0		
	9-20-61	8×10^{-8}	0		
	9-26-61	8×10^{-8}	2×10^{-6}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} μc/cc (microcurie per cubic centimeter).

Location	Date	Alpha µc/cc	Beta µc/cc
NE Settling Pit	9-6-61	2×10^{-5}	3×10^{-4}
	9-12-61	2×10^{-5}	4×10^{-4}
	9-20-61	2×10^{-5}	8×10^{-5}
	9-26-61	2×10^{-6}	3×10^{-5}
NW Settling Pit	9-6-61	2×10^{-5}	1×10^{-4}
	9-12-61	1×10^{-5}	1×10^{-4}
	9-20-61	1×10^{-5}	1×10^{-4}
	9-26-61	1×10^{-5}	8×10^{-5}
SE Settling Pit	9-6-61	3×10^{-5}	8×10^{-4}
	9-12-61	3×10^{-5}	6×10^{-4}
	9-20-61	9×10^{-6}	3×10^{-5}
	9-26-61	1×10^{-5}	4×10^{-4}

Poplar Creek monthly composite analyses:

Uranium = ~~7.9 µg/g~~ 6.0 µg/g
Assay = ~~1.04%~~

Uranium g/g and assay of Poplar Creek monthly composite was ~~misplaced~~ lost by Laboratory.

Cation determination:

SO_4 = 58 ppm 36
Cl = 41 ppm 37
F = 1.5 ppm 1
NO_3 = 20 ppm 15

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date November 15, 1961
Originating Dept. Radiation Safety
Answering letter date

Copy to
G. J. Angele
L. E. Burkhart
Neal Dow
G. R. Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead
H. G. P. Snyder
J. W. Strohecker
C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - ~~September~~, 1961
OCT

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits:

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	9-8-61	3×10^{-7}	5×10^{-6}	.42	68.5 67.9×10^6
	9-15-61	2×10^{-7}	1×10^{-6}	.10	71.9 83.5×10^6
	9-22-61	2×10^{-7}	1×10^{-6}	.18	76.2 72.1×10^6
	9-29-61	6×10^{-7}	1×10^{-6}	.29	76.4 65.3×10^6
Bear Creek*	9-6-61	1×10^{-7}	1×10^{-5}	Sept.?	
	9-12-61	10×10^{-8}	0		
	9-20-61	8×10^{-8}	0		
	9-26-61	8×10^{-8}	2×10^{-6}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} μc/cc (microcurie per cubic centimeter).

Location	Date	Alpha µc/cc	Beta µc/cc
NE Settling Pit	9-6-61	2×10^{-5}	3×10^{-4}
	9-12-61	2×10^{-5}	4×10^{-4}
	9-20-61	2×10^{-5}	8×10^{-5}
	9-26-61	2×10^{-6}	3×10^{-5}
NW Settling Pit	9-6-61	2×10^{-5}	1×10^{-4}
	9-12-61	1×10^{-5}	1×10^{-4}
	9-20-61	1×10^{-5}	1×10^{-4}
	9-26-61	1×10^{-5}	8×10^{-5}
SE Settling Pit	9-6-61	3×10^{-5}	8×10^{-4}
	9-12-61	3×10^{-5}	6×10^{-4}
	9-20-61	9×10^{-6}	3×10^{-5}
	9-26-61	1×10^{-5}	4×10^{-4}

Poplar Creek monthly composite analyses:

Uranium = ~~7.9 µg/g~~ 6.0 µg/g uranium g/g and assay of Poplar Creek monthly composite was
Assay U_{235} = ~~1.04%~~ 4.7 ~~[illegible]~~ last of Laboratory

Cation determination:

SO_4 = ~~58 ppm~~ 36
Cl = ~~41 ppm~~ 37
F = ~~1.5 ppm~~ 4
NO_3 = ~~20 ppm~~ 15

M. Sanders
M. Sanders

MS:mw

UCN-7721B
(2 8/96)

11/14

OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM ChemRisk

DOCUMENT DESCRIPTION (Completed by Requesting Division)

Document No.	Date of Request	Requested Date of Release (Allow 5 to 10 Days)	Page Count
MS/ChRZ-0282			32

nclassified Title: WATER SAMPLE RESULTS FROM POPLAR CREEK, BEAR CREEK, AND SETTLING PITS (1961-63) (FROM BUILDING 9207 DATA CENTER)

Author's / Requestor's Name	Telephone No., Pager No. and Plant Address	Account Number
S. W. Wiley	6-0263, 417-5417, Bldg. 9106, MS-8023	2366-0003

INTENDED AUDIENCE: ☐ Public ☐ Environmental Regulators ☐ NWC ☐ DOE Contractors ☒ Other ChemRisk

TYPE: ☐ Abstract ☐ Brochure ☐ Co-op Report ☐ Formal Report ☐ Informal Report
☐ Invention Disclosure ☐ Journal Article ☐ News Release ☐ Photograph/Visuals ☐ Technical Progress Report
☐ Thesis/Term Paper ☐ Videotape ☐ Other
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PATENT OR INVENTION SIGNIFICANCE ☐ Yes ☐ No (Identify) Document will be published in proceedings ☐ Yes ☐ No
Document has been previously released ☐ Yes ☐ No (Reference) Document will be distributed at meeting ☐ Yes ☐ No

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DOCUMENT: Level UNC Category NA

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UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon Y12RG
Company
Location Building 9711-1

Date March 6, 1961

Originating Dept. Radiation Safety

Answering letter date

Subject Surface Water Sampling - January, 1961

Copy to G. J. Angele
L. E. Burkhart
Neal Dow
George Jasny
L. C. Johnson
H. T. Kite
J. F. Morehead
C. R. Sullivan, Jr., M. D.

10 copies

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits.

Poplar Creek - Monthly Composite - ~~Sample misplaced in lab.~~ .0000006

Location	Date	Alpha pc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	1-6-61	2×10^{-7}	0	No analysis	66.6×10^{6}
	1-13-61	1×10^{-7}	0	.05	62.7×10^{6}
	1-20-61	2×10^{-7}	1×10^{-8}	.30	[illegible]
	1-27-61	No sample. Creek was frozen.			
Bear Creek*	1-5-61	1×10^{-7}	0		
	1-10-61	1×10^{-7}	5×10^{-8}		
	1-17-61	7×10^{-7}	1×10^{-7}		
	1-24-61	2×10^{-7}	None detected		

*The permissible limit for uranium alpha in drinking water outside of controlled areas 1 [illegible] ubic centimeter).

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P. R. McKenney 11/12/96
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INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSE

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date January 19, 1962
Originating Dept. Radiation Safety
Answering letter date
Subject Surface Water Sampling - November, 1961

Copy to G. J. Angele
L. E. Burkhart
Neal Dow
G. R. Jasny ← Delete from mailing
L. C. Johnson
H. T. Kite
J. F. Morehead
H. G. P. Snyder
J. W. Strohecker
C. R. Sullivan, Jr., M. D.
Extra copy

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and Settling Pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	11-3-61	3×10^{-7}	1×10^{-6}	.10	76.0×10^{6}
	11-10-61	3×10^{-7}	6×10^{-7}	.15	74.8×10^{6}
	11-17-61	3×10^{-7}	5×10^{-7}	.13	85.7×10^{6}
	11-24-61	1×10^{-7}	3×10^{-7}	.09	76.3×10^{6}
	12-1-61	7×10^{-7}	2×10^{-7}	.10	77.1×10^{6}
Bear Creek*	10-31-61	2×10^{-8}	0		
	11-7-61	6×10^{-8}	0		
	11-14-61	2×10^{-8}	0		
	11-21-61	4×10^{-7}	0		
	11-28-61	1×10^{-7}	5×10^{-6}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter).

Location	Date	Alpha µc/cc	Beta µc/cc
NE Settling Pit	10-31-61	3×10^{-5}	9×10^{-5}
	11-7-61	2×10^{-5}	4×10^{-4}
	11-14-61	7×10^{-6}	4×10^{-5}
	11-21-61	2×10^{-5}	3×10^{-4}
	11-28-61	2×10^{-5}	2×10^{-4}
NW Settling Pit	10-31-61	1×10^{-5}	6×10^{-5}
	11-7-61	1×10^{-5}	1×10^{-4}
	11-14-61	1×10^{-5}	8×10^{-5}
	11-21-61	8×10^{-5}	1×10^{-4}
	11-28-61	9×10^{-5}	1×10^{-4}
SE Settling Pit	10-31-61	3×10^{-5}	5×10^{-4}
	11-7-61	2×10^{-5}	5×10^{-4}
	11-14-61	9×10^{-6}	3×10^{-4}
	11-21-61	3×10^{-5}	4×10^{-4}
	11-28-61	1×10^{-5}	4×10^{-5}

Uranium g/g and assay of Poplar Creek monthly composite were lost in the laboratory

Cation determination:

SO_4	=	68 ppm
Cl	=	52 ppm
F	=	2 ppm
NO_3	=	371 ppm

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY · POST OFFICE BOX Y. OAK RIDGE. TENNESS

To (Name) J. D. McLendon, Y12RC

Company

Location Building 9711-1

Date April 3, 1962

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, L. E. Burkhart, Neal Dow, L. C. Johnson, H. T. Kite, J. F. Morehead, H. G. P. Snyder, J. W. Strohecker, C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - January, 1962

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	1-5-62	2×10^{-7}	None detected	.07	84.2×10^{6}
	1-12-62	2×10^{-7}	5×10^{-7}	.06	85.6×10^{6}
	1-18-62	1×10^{-7}	3×10^{-7}	.15	79.8×10^{6}
	1-26-62	2×10^{-7}	1×10^{-7}	.20	103.7×10^{6}
	2-2-62	2×10^{-7}	8×10^{-8}	.20	78.9×10^{6}
Bear Creek*	1-4-62	7×10^{-8}	None detected		
	1-9-62	3×10^{-7}	None detected		
	1-16-62	2×10^{-8}	None detected		
	1-23-62	9×10^{-8}	None detected		
	1-30-62	3×10^{-8}	None detected		
NE Settling Pit	1-4-62	2×10^{-5}	3×10^{-4}		
	1-9-62	1×10^{-5}	4×10^{-4}		
	1-16-62	2×10^{-5}	2×10^{-4}		
	1-23-62	9×10^{-5}	2×10^{-5}		
	1-30-62	2×10^{-5}	3×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

Location	Date	Alpha µc/cc	Beta µc/cc
SE Settling Pit	1-4-62	2×10^{-5}	3×10^{-4}
	1-9-62	2×10^{-5}	3×10^{-4}
	1-16-62	5×10^{-6}	1×10^{-5}
	1-23-62	2×10^{-5}	6×10^{-5}
	1-30-62	2×10^{-5}	1×10^{-4}
NW Settling Pit	1-4-62	10×10^{-6}	6×10^{-5}
	1-9-62	1×10^{-5}	3×10^{-5}
	1-23-62	9×10^{-5}	2×10^{-5}
	1-30-62	1×10^{-5}	5×10^{-5}

Cation determination:

SO_4 = 44 ppm
Cl = 25 ppm
F = 1.5ppm
NO_3 = 19 ppm

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC

Company

Location Building 9711-1

Date April 6, 1962

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, L. E. Burkhart, Neal Dow, G. R. Jasny, L. C. Johnson, H. T. Kite, J. F. Morehead, H. G. P. Snyder, J. W. Strohecker, C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - February, 1962

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	2-9-62	1×10^{-7}	None	.28	76.3×10^{6}
	2-16-62	9×10^{-5}	5×10^{-6}	.34	71.4×10^{6}
	2-23-62	2×10^{-7}	6×10^{-7}	.16	113.9×10^{6}
	3-2-62	1×10^{-7}	6×10^{-7}	.06	109.8×10^{6}
Bear Creek*	2-6-62	8×10^{-8}	5×10^{-7}		
	2-13-62	9×10^{-8}	2×10^{-7}		
	2-20-62	8×10^{-8}	6×10^{-6}		
	2-27-62	4×10^{-7}	7×10^{-7}		
NE Settling Pit	2-6-62	2×10^{-5}	2×10^{-4}		
	2-13-62	9×10^{-5}	3×10^{-4}		
	2-20-62	2×10^{-5}	4×10^{-5}		
	2-27-62	2×10^{-5}	4×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside controlled areas is 3×10^{-5} μc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} μc/cc.

Location	Date	Alpha μc/cc	Beta μc/cc
NW Settling Pit	2-6-62	1×10^{-5}	6×10^{-5}
	2-13-62	2×10^{-5}	5×10^{-5}
	2-20-62	1×10^{-5}	3×10^{-5}
	2-27-62	1×10^{-5}	5×10^{-5}
SE Settling Pit	2-6-62	1×10^{-5}	3×10^{-4}
	2-13-62	8×10^{-6}	1×10^{-4}
	2-20-62	3×10^{-5}	2×10^{-4}
	2-27-62	2×10^{-5}	1×10^{-4}

Cation determination:

SO_4	=	32	ppm
Cl	=	37	ppm
F	=	2	ppm
NO_3	=	25	ppm

M. Sanders

MS:mw

From Box# 14-11-3 3-18 12 of

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY . POST OFFICE BOX Y. OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date May 16, 1962
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele, L. E. Burkhart, Neal Dow, L. C. Johnson, H. T. Kite, J. F. Morehead, H. G. P. Snyder, J. W. Strohecker, C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - March, 1962

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/wk.
Poplar Creek*	3-9-62	4×10^{-7}	5×10^{-7}	.26	97.6×10^{6}
	3-16-62	2×10^{-7}	5×10^{-7}	.21	86.2×10^{6}
	3-23-62	2×10^{-7}	6×10^{-7}	.13	115.4×10^{6}
	3-30-62	1×10^{-7}	6×10^{-7}	.20	93.7×10^{6}
Bear Creek*	3-6-62	8×10^{-8}	4×10^{-7}		
	3-13-62	7×10^{-8}	2×10^{-7}		
	3-20-62	3×10^{-7}	5×10^{-7}		
	3-27-62	1×10^{-7}	8×10^{-7}		
NW Settling Pit	3-6-62	1×10^{-5}	5×10^{-5}		
	3-12-62	1×10^{-6}	4×10^{-5}		
	3-20-62	1×10^{-5}	5×10^{-5}		
	3-27-62	1×10^{-5}	4×10^{-5}		
SE Settling Pit	3-6-62	3×10^{-5}	1×10^{-4}		
	3-13-62	2×10^{-5}	1×10^{-4}		
	3-20-62	8×10^{-5}	4×10^{-5}		
	3-27-62	1×10^{-5}	4×10^{-4}		
NE Settling Pit	3-6-62	2×10^{-5}	2×10^{-4}		
	3-13-62	2×10^{-5}	1×10^{-4}		
	3-20-62	2×10^{-5}	8×10^{-5}		
	3-27-62	1×10^{-5}	6×10^{-5}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY · POST OFFICE BOX Y. OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date June 5, 1962

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, L. E. Burkhart, Neal Dow, L. C. Johnson, H. T. Kite, J. F. Morehead, H. G. P. Snyder, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling - April, 1962

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/wk.
Poplar Creek*	4-6-62	2×10^{-7}	None	.16	87.0×10^{6}
	4-13-62	2×10^{-7}	2×10^{-7}	.12	110.1×10^{6}
	4-20-62	No sample taken	----------	----------	75.9×10^{6}
	4-27-62	4×10^{-7}	6×10^{-7}	.16	84.6×10^{6}
Bear Creek*	4-3-62	2×10^{-7}	5×10^{-7}		
	4-10-62	1×10^{-8}	None		
	4-17-62	No sample taken			
	4-24-62	8×10^{-8}	None		
NE Settling Pit	4-3-62	1×10^{-5}	9×10^{-5}		
	4-10-62	9×10^{-7}	1×10^{-6}		
	4-17-62	No sample taken			
	4-24-62	4×10^{-6}	8×10^{-6}		
SW Settling Pit	4-3-62	2×10^{-5}	5×10^{-5}		
	4-10-62	1×10^{-5}	3×10^{-5}		
	4-17-62	No sample taken			
	4-24-62	3×10^{-6}	6×10^{-6}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-9} μc/cc (microcurie per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} μc/

Location	Date	Alpha μc/cc	Beta μc/cc
NW Settling Pit	4-3-62	1×10^{-5}	4×10^{-5}
	4-10-62	9×10^{-7}	8×10^{-7}
	4-17-62	No sample taken	
	4-24-62	3×10^{-6}	4×10^{-6}
SE Settling Pit	4-3-62	2×10^{-5}	5×10^{-4}
	4-10-62	2×10^{-5}	6×10^{-5}
	4-17-62	No Sample taken	
	4-24-62	1×10^{-5}	4×10^{-5}

Cation determination:

SO_4	=	23 ppm
Cl	=	30 ppm
F	=	2 ppm
NO_3	=	24 ppm

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSE

To (Name) J. D. McLendon

Company

Location Building 9711-1

Date July 2, 1962

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, L. E. Burkhart, Neal Dow, L. C. Johnson, H. T. Kite, J. F. Morehead, H. G. P. Snyder, J. W. Strohecker, C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - May, 1962

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/wk.
Poplar Creek*	5-4-62	4×10^{-7}	1×10^{-6}	.10	87.7×10^{6}
	5-11-62	2×10^{-6}	4×10^{-6}	.27	83.3×10^{6}
	5-18-62	5×10^{-7}	1×10^{-6}	.04	88.8×10^{6}
	5-25-62	2×10^{-7}	None detected	.01	95.6×10^{6}
	6-1-62	1×10^{-7}	None detected	.01	94.7×10^{6}
Bear Creek*	5-1-62	No sample taken			
	5-8-62	No sample taken			
	5-15-62	No sample taken			
	5-22-62	4×10^{-7}	1×10^{-6}		
	5-29-62	6×10^{-9}	None detected		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSEE

To (Name) J. D. McLendon

Company

Location Building 9711-1

Date July 30, 1962

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, L. E. Burkhart, Neal Dow, L. C. Johnson, H. T. Kite, J. F. Morehead, H. G. P. Snyder, J. W. Strohecker, C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - June, 1962

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow - gal/wk.
Poplar Creek*	6-8-62	2×10^{-7}	1×10^{-7}	.06	99.3×10^{6}
	6-14-62	8×10^{-7}	2×10^{-6}	.01	112.1×10^{6}
	6-22-62	2×10^{-7}	9×10^{-8}	.05	86.9×10^{6}
	6-29-62	8×10^{-7}	1×10^{-6}	.02	89.7×10^{6}
Bear Creek*	6-5-62	4×10^{-7}	1×10^{-7}		
	6-12-62	1×10^{-7}	4×10^{-7}		
	6-19-62	2×10^{-7}	5×10^{-7}		
	6-26-62	2×10^{-7}	None detected		
SE Settling Pit	6-5-62	1×10^{-5}	3×10^{-5}		
	6-12-62	10×10^{-6}	4×10^{-5}		
	6-19-62	1×10^{-5}	5×10^{-5}		
	6-26-62	1×10^{-5}	7×10^{-5}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcurie per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

Location	Date	Alpha μc/cc	Beta μc/cc
NE Settling Pit	6-5-62	5×10^{-6}	2×10^{-5}
	6-12-62	5×10^{-6}	1×10^{-5}
	6-19-62	7×10^{-6}	2×10^{-5}
	6-26-62	8×10^{-6}	3×10^{-5}
NW Settling Pit	6-5-62	3×10^{-6}	8×10^{-6}
	6-12-62	3×10^{-6}	7×10^{-6}
	6-19-62	7×10^{-7}	1×10^{-5}
	6-26-62	4×10^{-6}	1×10^{-5}
SW Settling Pit	6-5-62	No sample	
	6-12-62	3×10^{-6}	5×10^{-6}
	6-19-62	4×10^{-6}	1×10^{-5}
	6-26-62	4×10^{-6}	8×10^{-6}

Cation determination

NO_3	=	20 ppm
Cl	=	35 ppm
SO_4	=	13 ppm
F	=	2 ppm

M. Sanders

MS:mw

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE, TENNESSE

To (Name) J. D. McLendon, Y12RC
Company
Location Building 9711-1

Date October 3, 1962
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele
Neal Dow
L. C. Johnson
H. T. Kite
J. F. Morehead
J. W. Strohecker
C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling
August, 1962

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	8-3-62	2×10^{-7}	8×10^{-8}	.02	91.6×10^{6}
	8-10-62	2×10^{-7}	9×10^{-9}	.01	84.9×10^{6}
	8-17-62	2×10^{-10}	9×10^{-10}	< .01	79.1×10^{6}
	8-24-62	1×10^{-10}	1×10^{-9}	< .01	77.4×10^{6}
	8-31-62	6×10^{-10}	3×10^{-11}	< .01	76.3×10^{6}
Bear Creek*	7-31-62	9×10^{-8}	None detected		
	8-7-62	6×10^{-8}	8×10^{-9}		
	8-14-62	2×10^{-7}	8×10^{-7}		
	8-21-62	1×10^{-10}	9×10^{-10}		
	8-28-62	2×10^{-11}	2×10^{-10}		
SW Settling Pit	7-31-62	3×10^{-8}	1×10^{-7}		
	8-7-62	1×10^{-8}	4×10^{-8}		
	8-14-62	1×10^{-8}	4×10^{-8}		
	8-21-62	2×10^{-8}	5×10^{-8}		
	8-28-62	5×10^{-8}	2×10^{-7}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

Location	Date	Alpha µc/cc	Beta µc/cc
SE Settling Pit	7-31-62	6×10^{-8}	3×10^{-7}
	8-7-62	1×10^{-7}	5×10^{-7}
	8-14-62	1×10^{-7}	4×10^{-7}
	8-21-62	2×10^{-7}	4×10^{-7}
	8-28-62	9×10^{-8}	7×10^{-7}
NW Settling Pit	7-31-62	3×10^{-7}	1×10^{-7}
	8-7-62	1×10^{-8}	3×10^{-7}
	8-14-62	2×10^{-8}	6×10^{-8}
	8-21-62	1×10^{-9}	6×10^{-9}
	8-28-62	3×10^{-8}	7×10^{-8}
NE Settling Pit	7-31-62	9×10^{-8}	7×10^{-7}
	8-7-62	3×10^{-8}	1×10^{-7}
	8-14-62	6×10^{-8}	2×10^{-7}
	8-21-62	3×10^{-8}	1×10^{-7}
	8-28-62	6×10^{-8}	4×10^{-7}

Cation determination:

SO_4	=	21.5 ppm
Cl	=	19.5 ppm
F	=	2.7 ppm
NO_3	=	88.7 ppm

M. Sanders

MS:mw

Blind Copy

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon, Y-12RC
Company
Location Building 9711-1

Date December 5, 1962

Originating Dept. Radiation Safety

Answering letter date

Copy to C. J. Angelo
Neal Dow
H. C. Francke
L. C. Johnson
H. T. Kite
J. F. Morehead
J. W. Stroheeker
C. R. Sullivan, Jr., M. D.

Subject Surface Water Sampling - October, 1962

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	10-04-62	4×10^{-7}	1×10^{-6}	.06	82.5×10^{6}
	10-12-62	4×10^{-7}	6×10^{-7}	.03	74.3×10^{6}
	10-19-62	7×10^{-8}	9×10^{-7}	.04	70.4×10^{6}
	10-26-62	1×10^{-7}	3×10^{-7}	.03	70.3×10^{6}
	11-02-62	1×10^{-6}	8×10^{-7}	.06	70.9×10^{6}
Bear Creek*	10-02-62	2×10^{-7}	8×10^{-8}		
	10-09-62	2×10^{-8}	5×10^{-7}		
	10-10-62	6×10^{-8}	4×10^{-7}		
	10-11-62	6×10^{-8}	4×10^{-7}		
	10-12-62	3×10^{-7}	None detected		
	10-15-62	4×10^{-8}	3×10^{-7}		
	10-16-62	7×10^{-8}	3×10^{-7}		
	10-23-62	5×10^{-8}	2×10^{-5}		
	10-30-62	4×10^{-8}	3×10^{-6}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-9} μc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} μc/cc.

Location	Date	Alpha μc/cc	Beta μc/cc
NE Settling Pit	10-02-62	2×10^{-4}	6×10^{-4}
	10-09-62	1×10^{-5}	4×10^{-5}
	10-16-62	1×10^{-5}	4×10^{-5}
	10-23-62	3×10^{-5}	4×10^{-4}
	10-30-62	3×10^{-5}	4×10^{-4}
SE Settling Pit	10-02-62	2×10^{-4}	1×10^{-3}
	10-09-62	2×10^{-5}	6×10^{-5}
	10-16-62	2×10^{-5}	7×10^{-5}
	10-23-62	2×10^{-4}	1×10^{-3}
	10-30-62	1×10^{-4}	7×10^{-4}
SW Settling Pit	10-02-62	4×10^{-5}	1×10^{-4}
	10-09-62	1×10^{-5}	3×10^{-5}
	10-16-62	5×10^{-6}	1×10^{-5}
	10-23-62	7×10^{-5}	2×10^{-4}
	10-30-62	4×10^{-5}	1×10^{-4}
NW Settling Pit	10-02-62	3×10^{-5}	1×10^{-4}
	10-09-62	5×10^{-6}	10×10^{-6}
	10-16-62	3×10^{-5}	1×10^{-5}
	10-23-62	4×10^{-5}	1×10^{-4}
	10-30-62	5×10^{-5}	10×10^{-5}

Poplar Creek

Cation determination: monthly [illegible]

SO_4	=	61.5 ppm
Cl	=	19.3 ppm
F	=	2.8 ppm
NO_3	=	33.5 ppm

SIGNED - MERWIN SANDERS

M. Sanders

MS:mw Standards
Potable H_2O
Nitrates - 4.5 mg/l
Sulfate 250 "
Chloride 25
Fluoride 1.5

7/24

DOCUMENT DESCRIPTION (Completed By Requesting Division)

Document No.	Author's Telephone No.	Acct. No.	Date of Request
Y/TS-1561	6-0263	23366-0002	7/23/96

Unclassified Title: APPENDIX A TABULATION OF PLANT WASTES FOR BUILDINGS 9212, 9206, (9201-4) AND 9995 FOR (1962) lb/mo. Hg to EFPC

Author(s) Requested by Steve Wiley (BOX # 43-1-1)

TYPE: ☐ Formal Report ☐ Informal Report ☐ Progress/Status Report ☐ Co-Op Report ☐ Thesis/Term Paper

☐ Oral Presentation (identify meeting, sponsor, location, date):

☐ Journal Article (Identify Journal):

☒ Other (Specify): To Be Released for Phase II of HSA

Document will be published in proceedings ☑ No ☐ Yes

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Document has patent or invention significance ☑ No ☐ Yes (Identify)

Document has been previously released ☑ No ☐ Yes (Reference)

DIVISION REVIEW AND APPROVAL (Completed By Requesting Division)

TECHNICAL CLASSIFICATION REVIEW (Divisional Classification Representative)

Title(s): U Abstract: NA

DOCUMENT: Level U Category —

R J Fraser 7/23/96

Signature Date

DOCUMENT REQUEST APPROVED (Division or Department)

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Signature Date

Signature Date

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☒ Warren [signature] Patent Office Date

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R.F. Grigh 24 July 1996

Y-12 Classification Office Date

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[signature] 7/24/96

Technical Information Office Date

Conditions/Remarks:

43-1-1

[Appendix A Tabulation of Plant Wastes] (COMPILED IN 1962)

BUILDING 9212

DISPOSED TO ER

GROUP 1 - POPLAR CREEK

Principal Contaminant	Flow Rate Gal./Month	Disposal Method	Remarks
1. Caustic Filtrate 255 M NaOH 7.4 M Ba	11,000	35 gal.batch	Caustic Fusion Proc.; 5 ppm U; 10% NaOH; 1.0% Ba; & Si & AL.
2. Caustic Filtrate 108 M NaOH 1.7 M BaO 55 M $NaNO_3$	3,500		From C-1 U-AL dissolv.; 13% NaOH; 0.8% BaO; 18% $NaNO_3$; 2% AL; & < 20 ppm U.
3. Caustic Scrubber Solution 1.61 M NaOH 2.41 M $NaNO_3$	150	50 gal.batch	C-1 Proc. & Vac.Scrubbers 5% NaOH; 15% $NaNO_3$
4. Glove Wash Rinse 0.5 M Na_2CO_3	3,000	30 gal.batch	0.2% Na_2CO_3
5. SRO Tk.Pit Rain H_2O TANK ?	1,000		Neutral; < 5 ppm U.
6. Mop H_2O and Detergent	9,000	20 gal.batch	Trace amounts of U, W, Pb, Al, Cu, Fe, Da ?
7. Machine Coolant	9,000	50 gal.batch	Rust Lic 288c; 1% lube oil ?
8. Mop H_2O and Detergent	2,000	20 gal.batch	U, Pb, W
9. HNO_3 Pickling Solu.	1,000 1000 x .188 lb/gal / 63 = 14 lb M/mo	500 gal.batch	H-1 Foundry; to S-3 Pond
10. Mop H_2O and Detergent	1,500	20 gal.batch	Sanitary Sewer, U, AL H-2 Foundry
11. Coolant	5,000	50 gal.batch	Rust-lic, 1% Lube Oil, U, AL Creek
12. Sheet Quench & Rinse		Continuous	U
Na_2CO_3	500 lb/mo	$\frac{500}{106}$ = 5 M Na_2CO_3	
K_2CO_3	500 lb/mo	$\frac{500}{138.2}$ = 3.6 M K_2CO_3	
KCl	500 lb/mo	$\frac{500}{74.55}$ = 6.7 M KCl	
Water	30,000 gal/mo		

Relph, Ford 48653 Johnson

2:1

What do underlines mean?

For topical report - disregard all notations in pencil except this one

APPROVED FOR PUBLIC RELEASE

Technical Information Office 7/24/96 Date

BUILDING 9206

Principal Contaminant	Gal./Mo.	pH	Uran. Conc.	Disposal	Remarks
Fertilizer 1. Evap'r.cond.	13,000 13000 gal/mo	<1 X 0.88 lbs/gal HNO_3 / 63 = 182 lb M HNO_3	5 ppm	Cont.	use 10%. 5-15% HNO_3 trace carbitol decomp'n products
2. Extraction Raffinate *	15,000 15000 gal/mo	<1 X 0.34 lbs/gal HNO_3 / 63 = 81 lb M HNO_3	10	Cont.	use 4 ~~8~~-5% HNO_3 trace carbitol, $Al(NO_3)_3$ and comp' fluorides
3. Basic Solns	500 500 gal/mo	>13 X 0.44 lbs/gal / 40. = 5.5 lb M NaOH	20	Cont.	use 5% NaOH $NaOH$, NH_4OH & NH_4F
Neutral 4. U Chip Wash H_2O	40,000	8	1-2	Cont.	Nacconol and Water Soluble oil

BUILDING 9201-4

Principal Contaminant	M.W.	Gal/Mo.	Lb/Mo.	Disposal	Remarks
1. $LiOH \cdot H_2O$	41.96		3,300 3300/42 = 78.6 lb M/mo.	Cont.	Solution
2. Mercury 9201-4 81 - 10			50 75	Cont. "	Solution & Entrained Solids
3. *H_2SO_4	98.08	5500 5500 X 0.34 lb/gal / 98 = 19.1 lb M/mo.	1,900	Single Batch	4% solution
4. *NaOH		9300 9300 X 0.1794 lb/gal / 40 = 39.5 lb M/mo	1,600	Single Batch	2% solution
5. Lab. Reagents			Test Tube Amounts.	Cont.	

* Demineralizer Reagents

BUILDING 9995

Principal Contaminant	Gal/day	Disposal	Remarks
1. H_2SO_4 (36N) 100%	4.10 X 30	X Cont. 15.28 lbs/gal / 98.08 = 19 lb M/	
2. HNO_3 (16N) 71%	7.75 X 30	X" 8.399 " / 63 = 31 lb M/	
3. HCl (12N) 7%	2.00 X 30	" 0.6 / 36.5 = 10 lb M/	

23400

*

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon (Y-12RC)
Company
Location Building 9711-1

Date March 19, 1963
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling - February, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	2-08-63	4×10^{-7}	1×10^{-6}	.03	91.2×10^{6}
	2-15-63	1×10^{-7}	4×10^{-7}	.015	97.4×10^{6}
	2-21-63	9×10^{-8}	5×10^{-7}	.045	92.5×10^{6}
	3-01-63	2×10^{-7}	6×10^{-7}	.06	108.7×10^{6}
Bear Creek*	2-05-63	1×10^{-7}	3×10^{-7}		
	2-12-63	4×10^{-7}	1×10^{-6}		
	2-20-63	1×10^{-7}	5×10^{-7}		
	2-26-63	6×10^{-8}	2×10^{-8}		
SE Settling Pit	2-05-63	4×10^{-5}	3×10^{-4}		
	2-12-63	5×10^{-5}	4×10^{-4}		
	2-20-63	8×10^{-5}	5×10^{-4}		
	2-26-63	8×10^{-5}	5×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} μc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} μc/cc.

Location	Date	Alpha µc/cc	Beta µc/cc
NE Settling Pit	2-05-63	2×10^{-5}	1×10^{-4}
	2-12-63	4×10^{-5}	2×10^{-4}
	2-20-63	5×10^{-5}	2×10^{-4}
	2-26-63	4×10^{-5}	2×10^{-4}
SW Settling Pit	2-05-63	4×10^{-5}	1×10^{-4}
	2-12-63	6×10^{-5}	3×10^{-4}
	2-20-63	3×10^{-5}	9×10^{-5}
	2-26-63	4×10^{-5}	2×10^{-4}
NW Settling Pit	2-05-63	8×10^{-6}	2×10^{-5}
	2-12-63	2×10^{-5}	9×10^{-5}
	2-20-63	10×10^{-6}	3×10^{-5}
	2-26-63	2×10^{-5}	6×10^{-5}

Cation determination - Poplar Creek monthly composite:

SO_4 = 69.7 ppm
NO_3 = 14.0 ppm
Cl^- = 18.7 ppm
F = 1.7 ppm

M. Sanders

MS:mw

12 1-86) OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM AM

DOCUMENT DESCRIPTION (Completed By Requesting Division)

Document No.	Author's Telephone No.	Acct. No	Date of Request
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Y-12 Plant Classification Office

DOCUMENT REQUEST APPROVED (Division or Department)

[signature] 9/15/95

Signature Date

Signature Date

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MS/CHR2-0185

Smead.

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. McLendon (Y-12RC) Date March 7, 1963

Company

Location Building 9711-1 Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling - January, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l
Poplar Creek	1-05-63	No sample		
	1-11-63	2×10^{-8}	1×10^{-7}	.09
	1-18-63	3×10^{-7}	10×10^{-7}	.03
	1-25-63	No sample		
	2-01-63	No sample		
Bear Creek	1-02-63	2×10^{-7}	5×10^{-7}	
	1-08-63	9×10^{-8}	1×10^{-8}	
	1-15-63	2×10^{-8}	1×10^{-7}	
	1-22-63	2×10^{-8}	4×10^{-7}	
	1-29-63	3×10^{-8}	5×10^{-8}	
SE Settling Pit	1-02-63	7×10^{-5}	4×10^{-4}	
	1-08-63	7×10^{-5}	5×10^{-4}	
	1-15-63	5×10^{-5}	3×10^{-4}	
	1-22-63	6×10^{-5}	3×10^{-4}	
	1-29-63	7×10^{-5}	4×10^{-4}	

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

NOTE: Flow data is not available for this report period due to recorder breakdown. Spare parts have been ordered for proper repair of this installation. For all practical purposes, the average flow of Poplar Creek is 85.0×10^{6} gal/wk.

Location	Date	Alpha μc/cc	Beta μc/cc
SW Settling Pit	1-02-63	No sample	
	1-08-63	4×10^{-5}	2×10^{-4}
	1-15-63	4×10^{-5}	1×10^{-4}
	1-22-63	4×10^{-5}	2×10^{-4}
	1-29-63	4×10^{-5}	1×10^{-4}
NE Settling Pit	1-02-63	5×10^{-5}	4×10^{-4}
	1-08-63	6×10^{-5}	4×10^{-4}
	1-15-63	5×10^{-5}	4×10^{-4}
	1-22-63	5×10^{-5}	3×10^{-4}
	1-29-63	5×10^{-5}	3×10^{-4}
NW Settling Pit	1-02-63	3×10^{-5}	1×10^{-4}
	1-08-63	3×10^{-5}	1×10^{-4}
	1-15-63	2×10^{-5}	7×10^{-5}
	1-22-63	3×10^{-5}	9×10^{-5}
	1-29-63	3×10^{-5}	1×10^{-4}

Poplar Creek - Monthly Average Cation Determination:

SO_4 = 40.0 ppm
NO_3 = 28.0 ppm
Cl = 16.5 ppm
F = 1.4 ppm

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon (Y-12RC)
Company
Location Building 9711-1

Date March 19, 1963
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling - February, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	2-08-63	4×10^{-7}	1×10^{-6}	.03	91.2×10^{6}
	2-15-63	1×10^{-7}	4×10^{-7}	.015	97.4×10^{6}
	2-21-63	9×10^{-8}	5×10^{-7}	.045	92.5×10^{6}
	3-01-63	2×10^{-7}	6×10^{-7}	.06	108.7×10^{6}
Bear Creek*	2-05-63	1×10^{-7}	3×10^{-7}		
	2-12-63	4×10^{-7}	1×10^{-6}		
	2-20-63	1×10^{-7}	5×10^{-7}		
	2-26-63	6×10^{-8}	2×10^{-8}		
SE Settling Pit	2-05-63	4×10^{-5}	3×10^{-4}		
	2-12-63	5×10^{-5}	4×10^{-4}		
	2-20-63	8×10^{-5}	5×10^{-4}		
	2-26-63	8×10^{-5}	5×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

Location	Date	Alpha µc/cc	Beta µc/cc
NE Settling Pit	2-05-63	2×10^{-5}	1×10^{-4}
	2-12-63	4×10^{-5}	2×10^{-4}
	2-20-63	5×10^{-5}	2×10^{-4}
	2-26-63	4×10^{-5}	2×10^{-4}
SW Settling Pit	2-05-63	4×10^{-5}	1×10^{-4}
	2-12-63	6×10^{-5}	3×10^{-4}
	2-20-63	3×10^{-5}	9×10^{-5}
	2-26-63	4×10^{-5}	2×10^{-4}
NW Settling Pit	2-05-63	8×10^{-6}	2×10^{-5}
	2-12-63	2×10^{-5}	9×10^{-5}
	2-20-63	10×10^{-6}	3×10^{-5}
	2-26-63	2×10^{-5}	6×10^{-5}

Cation determination - Poplar Creek monthly composite:

SO_4 = 89.7 ppm
NO_3 = 14.0 ppm
Cl = 18.7 ppm
F = 1.7 ppm

M. Sanders

MS:mw

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSEE

To (Name) J. D. McLendon (Y-12 RC)
Company
Location Building 9711-1

Date May 1, 1963
Originating Dept. Radiation Safety
Answering letter date
Subject Surface Water Sampling March, 1963

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead ✓, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek *	3-8-63	1×10^6	5×10^6	.09	No results
	3-15-63	6×10^7	3×10^6	.05	108.5×10^6
	3-22-63	3×10^7	5×10^7	.14	109.1×10^6
	3-29-63	5×10^7	2×10^6	.16	98.7×10^6
Bear Creek *	3-05-63	2×10^7	3×10^7		
	3-12-63	6×10^7	3×10^6		
	3-19-63	2×10^8	4×10^7		
	3-26-63	2×10^9	5×10^7		
NE Settling Pit	3-05-63	4×10^5	3×10^4		
	3-12-63	1×10^4	5×10^4		
	3-19-63	6×10^5	3×10^4		
	3-26-63	6×10^5	3×10^4		

* The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^5 uc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^5 uc/cc.

Location	Date	Alpha uc/cc	Beta uc/cc
NW Settling Pit	3-05-63	2×10^5	6×10^5
	3-12-63	4×10^5	1×10^4
	3-19-63	3×10^5	6×10^5
	3-26-63	3×10^5	6×10^5
SE Settling Pit	3-05-63	7×10^5	4×10^4
	3-12-63	5×10^5	2×10^4
	3-19-63	5×10^5	2×10^4
	3-26-63	7×10^5	4×10^4
SW Settling Pit	3-05-63	4×10^5	2×10^4
	3-12-63	2×10^6	2×10^5
	3-19-63	4×10^5	1×10^4
	3-26-63	1×10^5	2×10^5

Cation determination - Poplar Creek monthly composite:

SO_4 = 56.5 ppm
NO_3 = 36.0 ppm
Cl = 22.0 ppm
F = 3.0 ppm

M. Sanders

MS:ep

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon
Company
Location Building 9711-1

Date June 4, 1963
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling April, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	4-5-63	7×10^{-7}	3×10^{-6}	.03	97.3×10^{6}
	4-11-63	6×10^{-7}	2×10^{-6}	.08	25.5×10^{6}
	4-18-63				No Results
	4-26-63	1×10^{-7}	1×10^{-6}	.025	93.4×10^{6}
Bear Creek*	4-2-63	None det.	None det.		
	4-9-63	5×10^{-6}	2×10^{-5}		
	4-16-63	1×10^{-7}	None det.		
	4-23-63	9×10^{-8}	None det.		
	4-30-63	7×10^{-8}	9×10^{-7}		
NE Settling Pit	4-2-63	6×10^{-5}	3×10^{-4}		
	4-9-63	1×10^{-4}	7×10^{-4}		
	4-16-63	6×10^{-5}	3×10^{-4}		
	4-23-63	9×10^{-5}	7×10^{-4}		
	4-30-63	7×10^{-5}	3×10^{-4}		

* The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} uc/cc.

Location	Date	Alpha uc/cc	Beta uc/cc
NW Settling Pit	4-2-63	1×10^{-5}	3×10^{-5}
	4-9-63	6×10^{-5}	2×10^{-4}
	4-16-63	3×10^{-5}	8×10^{-5}
	4-23-63	2×10^{-5}	8×10^{-5}
	4-30-63	5×10^{-5}	1×10^{-4}
SE Settling Pit	4-2-63	1×10^{-4}	6×10^{-4}
	4-9-63	2×10^{-4}	1×10^{-3}
	4-16-63	8×10^{-5}	5×10^{-4}
	4-23-63	1×10^{-4}	5×10^{-4}
	4-30-63	8×10^{-5}	6×10^{-4}
SW Settling Pit	4-2-63	4×10^{-5}	2×10^{-4}
	4-9-63	1×10^{-4}	3×10^{-4}
	4-16-63	5×10^{-5}	1×10^{-4}
	4-23-63	4×10^{-5}	1×10^{-4}
	4-30-63	3×10^{-5}	9×10^{-5}

Caution determination - Poplar Creek monthly composite:

SO_4 = 32.3 ppm
NO_3 = 26.3 ppm
Cl = 16.8 ppm
F = 2.0 ppm

J. S. Brown
for M. Sanders

MS:ep

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To Name: J. D. McLendon
Company
Location: Building 9711-1

Date: June 17, 1963
Originating Dept.: Radiation Safety
Answering letter date

Copy to: G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject: Surface Water Sampling May, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	5-3-63	3×10^{-7}	1×10^{-6}	.126	114.3×10^{6}
	5-10-63	6×10^{-7}	1×10^{-6}	.358	86.1×10^{6}
	5-17-63	3×10^{-7}	6×10^{-7}	.943	91.1×10^{6}
	5-24-63	3×10^{-7}	9×10^{-7}	.016	90.1×10^{6}
	5-31-63	6×10^{-7}	1×10^{-6}	.007	
Bear Creek*	5-7-63	2×10^{-7}	3×10^{-7}		
	5-14-63	None det.	3×10^{-7}		
	5-21-63	None det.	2×10^{-7}		
	5-28-63	2×10^{-7}	4×10^{-7}		
NE Settling Pit	5-7-63	6×10^{-5}	3×10^{-4}		
	5-14-63	6×10^{-5}	4×10^{-4}		
	5-21-63	4×10^{-5}	3×10^{-4}		
	5-28-63	4×10^{-5}	3×10^{-4}		

* The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} uc/cc.

Location	Date	Alpha uc/cc	Beta uc/cc
NE Settling Pit	5-7-63	4×10^{-5}	9×10^{-5}
	5-14-63	2×10^{-5}	8×10^{-5}
	5-21-63	3×10^{-5}	9×10^{-5}
	5-28-63	4×10^{-5}	9×10^{-5}
SE Settling Pit	5-7-63	6×10^{-5}	5×10^{-4}
	5-14-63	5×10^{-5}	6×10^{-4}
	5-21-63	8×10^{-5}	6×10^{-4}
	5-28-63	8×10^{-5}	5×10^{-4}
SW Settling Pit	5-7-63	5×10^{-5}	1×10^{-4}
	5-14-63	4×10^{-5}	1×10^{-4}
	5-21-63	4×10^{-5}	1×10^{-4}

Cation determination - Poplar Creek monthly composite:

SO_4 = 28.5 ppm

NO_3 = 4.8 ppm

Cl = 78.5 ppm

F = 2.3 ppm

M. Sanders

MS:ep

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon
Company
Location Building 9711-1

Date July 22, 1963
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling June, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	6-7-63	3×10^{-7}	6×10^{-7}	.30	91.5×10^{6}
	6-14-63	2×10^{-7}	1×10^{-7}	.79	95.2×10^{6}
	6-21-63	2×10^{-7}	6×10^{-7}	.012	92.7×10^{6}
	6-28-63	4×10^{-7}	9×10^{-7}	.015	No results
Bear Creek*	6-4-63	2×10^{-7}	2×10^{-7}		
	6-11-63	2×10^{-7}	2×10^{-7}		
	6-18-63	3×10^{-7}	5×10^{-7}		
	6-25-63	5×10^{-7}	6×10^{-7}		
NE Settling Pit	6-4-63	7×10^{-5}	3×10^{-4}		
	6-11-63	8×10^{-5}	4×10^{-4}		
	6-18-63	7×10^{-5}	3×10^{-4}		
	6-25-63	5×10^{-5}	4×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} uc/cc.

Location	Date	Alpha uc/cc	Beta uc/cc
NW Settling Pit	6-4-63	4×10^{-5}	9×10^{-5}
	6-11-63	3×10^{-5}	9×10^{-5}
	6-18-63	4×10^{-5}	10×10^{-5}
	6-25-63	3×10^{-5}	9×10^{-5}
SE Settling Pit	6-4-63	9×10^{-5}	5×10^{-4}
	6-11-63	9×10^{-5}	5×10^{-4}
	6-18-63	10×10^{-5}	5×10^{-4}
	6-25-63	7×10^{-5}	5×10^{-4}
SW Settling Pit	6-4-63	No Results	No Results
	6-11-63	No Results	No Results
	6-18-63	5×10^{-5}	1×10^{-4}
	6-25-63	5×10^{-5}	2×10^{-4}

Cation determination - Poplar Creek monthly composite:

SO_4 = 20.3 ppm
NO_3 = 10 ppm
Cl = 10 ppm
F = 2.5 ppm

M. Sanders

MS:ep

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSEE

To (Name) J. D McLendon
Company
Location Building 9711-1

Date August 23. 1963
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D

Subject Surface Water Sampling July, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	7-5-63	2×10^{-7}	None Det.	.008	108.7×10^{6}
	7-12-63	5×10^{-7}	2×10^{-6}	.004	78.8×10^{6}
	7-19-63	7×10^{-7}	9×10^{-7}	.010	92.2×10^{6}
	7-26-63	2×10^{-7}	2×10^{-7}	.007	77.2×10^{6}
Bear Creek*	7-2-63	2×10^{-7}	5×10^{-7}		
	7-9-63	4×10^{-8}	8×10^{-8}		
	7-16-63	2×10^{-7}	2×10^{-7}		
	7-23-63	6×10^{-7}	8×10^{-8}		
	7-30-63	2×10^{-7}	2×10^{-7}		
NE Settling Pit	7-2-63	8×10^{-5}	4×10^{-4}		
	7-9-63	5×10^{-5}	3×10^{-4}		
	7-16-63	7×10^{-5}	4×10^{-4}		
	7-23-63	7×10^{-5}	4×10^{-4}		
	7-30-63	7×10^{-5}	3×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} uc/cc.

Location	Date	Alpha	Beta
NW Settling Pit	7-2-63	3×10^{-5}	6×10^{-5}
	7-9-63	3×10^{-5}	9×10^{-5}
	7-16-63	3×10^{-5}	1×10^{-4}
	7-23-63	4×10^{-5}	1×10^{-4}
	7-30-63	3×10^{-5}	10×10^{-5}
SE Settling Pit	7-2-63	1×10^{-4}	6×10^{-4}
	7-9-63	6×10^{-5}	2×10^{-4}
	7-16-63	10×10^{-5}	6×10^{-4}
	7-23-63	1×10^{-4}	6×10^{-4}
	7-30-63	1×10^{-4}	5×10^{-4}
SW Settling Pit	7-2-63	6×10^{-5}	2×10^{-4}
	7-9-63	7×10^{-5}	4×10^{-4}
	7-16-63	4×10^{-5}	2×10^{-4}
	7-23-63	9×10^{-5}	5×10^{-4}
	7-30-63	9×10^{-5}	4×10^{-4}

Anion determination - Poplar Creek monthly composite

SO_4 = 85.5 ppm

NO_3 = 18.0 ppm

Cl = 8.8 ppm

F = 1.8 ppm

M. Sanders

MS:ep

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSEE

To (Name) J. D. McLendon

Company

Location Building 9711-1

Date September 20, 1963

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling August, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	8-2-63	7×10^{-8}	4×10^{-7}	.003	73.8×10^{6}
	8-16-63	6×10^{-7}	8×10^{-7}	.008	75.8×10^{6}
	8-23-63	2×10^{-7}	9×10^{-8}	.008	54.6×10^{6}
	8-30-63	2×10^{-7}	1×10^{-7}	.008	68.7×10^{6}
Bear Creek*	8-6-63	1×10^{-7}	3×10^{-7}		
	8-14-63	2×10^{-7}	None Det.		
	8-20-63	7×10^{-7}	2×10^{-7}		
	8-27-63	1×10^{-7}	5×10^{-7}		
NE Settling Pit	8-6-63	6×10^{-5}	3×10^{-4}		
	8-14-63	6×10^{-5}	4×10^{-4}		
	8-20-63	6×10^{-5}	4×10^{-4}		
	8-27-63	8×10^{-5}	2×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5}uc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} uc/cc.

Location	Date	Alpha	Beta
NW Settling Pit	8-6-63	3×10^{-5}	1×10^{-4}
	8-14-63	3×10^{-5}	1×10^{-4}
	8-20-63	3×10^{-5}	1×10^{-4}
	8-27-63	3×10^{-5}	1×10^{-4}
SE Settling Pit	8-6-63	8×10^{-5}	5×10^{-4}
	8-14-63	10×10^{-5}	6×10^{-4}
	8-20-63	7×10^{-5}	6×10^{-4}
	8-27-63	1×10^{-4}	7×10^{-4}
SW Settling Pit	8-6-63	5×10^{-5}	2×10^{-4}
	8-14-63	4×10^{-5}	2×10^{-4}
	8-20-63	5×10^{-5}	2×10^{-4}
	8-27-63	5×10^{-5}	2×10^{-4}

Anion determination - Poplar Creek monthly composite

SO_4 = 24.3 ppm

NO_3 = 11 ppm

Cl = 25 ppm

F = 1.4 ppm

M. Sanders

MS:ep

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSEE

To (Name) J. D. McLendon

Company

Location Building 9711-1

Date October 15, 1963

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling September, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*	9-06-63	4×10^{-8}	3×10^{-7}	.043	58.1×10^{6}
Upstream	9-13-63	5×10^{-7}	6×10^{-7}	.043	49.4×10^{6}
	9-20-63	1×10^{-7}	4×10^{-7}	.030	58.1×10^{6}
	9-27-63	2×10^{-6}	2×10^{-6}	.022	62.2×10^{6}
Downstream	9-13-63	3×10^{-7}	1×10^{-7}	.043	49.4×10^{6}
	9-20-63	1×10^{-7}	5×10^{-7}	.030	58.1×10^{6}
	9-27-63	1×10^{-7}	5×10^{-7}	.015	62.2×10^{6}
Bear Creek*	9-13-63	1×10^{-7}	5×10^{-8}		
	9-19-63	None Det.	2×10^{-7}		
	9-26-63	8×10^{-7}	2×10^{-6}		
NE Settling Pit	9-13-63	6×10^{-5}	4×10^{-4}		
	9-19-63	6×10^{-5}	5×10^{-4}		
	9-26-63	3×10^{-5}	6×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} uc/cc.

Location	Date	Alpha uc/cc	Beta uc/cc
NW Settling Pit	9-13-63	3×10^{-5}	9×10^{-5}
	9-19-63	3×10^{-5}	1×10^{-4}
	9-26-63	4×10^{-5}	1×10^{-4}
SE Settling Pit	9-13-63	8×10^{-5}	4×10^{-4}
	9-19-63	9×10^{-5}	7×10^{-4}
	9-26-63	5×10^{-5}	9×10^{-4}
SW Settling Pit	9-13-63	2×10^{-5}	1×10^{-4}
	9-19-63	5×10^{-5}	2×10^{-4}
	9-26-63	4×10^{-5}	2×10^{-4}

Cation determination - Poplar Creek monthly composite:

SO_4 = 25.6 ppm
NO_3 = 13.5 ppm
Cl = 23.9 ppm
F = 1 ppm

M. Sanders

MS:ep

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSEE

To (Name) J. D. McLendon

Company

Location Building 9711-1

Date November 11, 1963

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling October, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha uc/cc	Beta uc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*					
Upstream	10-4-63	1×10^{-6}	2×10^{-6}	.015	54.6×10^{6}
	10-11-63	2×10^{-7}	10×10^{-7}	.014	52.5×10^{6}
	10-18-63	3×10^{-7}	4×10^{-7}	.007	49.0×10^{6}
Downstream	10-4-63	1×10^{-6}	1×10^{-6}	.004	54.6×10^{6}
	10-11-63	7×10^{-8}	4×10^{-7}	.004	52.5×10^{6}
	10-18-63	2×10^{-7}	5×10^{-7}	None Det.	49.0×10^{6}
Bear Creek*	10-4-63	9×10^{-7}	1×10^{-6}		
	10-10-63	None Det.	3×10^{-7}		
	10-18-63	4×10^{-8}	3×10^{-7}		
	10-24-63	1×10^{-7}	5×10^{-8}		
	10-29-63	2×10^{-7}	5×10^{-7}		
NE Settling Pit	10-4-63	7×10^{-5}	5×10^{-4}		
	10-10-63	10×10^{-5}	4×10^{-4}		
	10-18-63	6×10^{-5}	6×10^{-4}		
	10-24-63	1×10^{-4}	5×10^{-4}		
	10-29-63	7×10^{-5}	5×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} uc/cc (microcuries per cubic centimeter)

*The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} uc/cc.

Location	Date	Alpha	Beta
NW Settling Pit	10-4-63	3×10^{-5}	1×10^{-4}
	10-10-63	3×10^{-5}	9×10^{-5}
	10-18-63	6×10^{-6}	2×10^{-5}
	10-24-63	2×10^{-5}	6×10^{-5}
	10-29-63	4×10^{-5}	1×10^{-4}
SE Settling Pit	10-4-63	1×10^{-4}	8×10^{-4}
	10-10-63	1×10^{-4}	8×10^{-4}
	10-18-63	10×10^{-5}	9×10^{-4}
	10-24-63	1×10^{-4}	8×10^{-4}
	10-29-63	1×10^{-4}	8×10^{-4}
SW Settling Pit	10-4-63	4×10^{-5}	1×10^{-4}
	10-10-63	4×10^{-5}	2×10^{-4}
	10-18-63	4×10^{-5}	1×10^{-4}
	10-24-63	3×10^{-5}	7×10^{-5}
	10-29-63	5×10^{-5}	1×10^{-4}

Cation determination - Poplar Creek monthly composite:

Upstream			Downstream		
Cl	=	14.8 ppm	Cl	=	17.2 ppm
SO_4	=	44.4 ppm	SO_4	=	38.8 ppm
F	=	2.2 ppm	F	=	1.7 ppm
NO_3	=	11.0 ppm	NO_3	=	10.2 ppm

M. Sanders

MS:ep

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSEE

To (Name) J. D. McLendon

Company

Location Building 9711-1

Date December 26, 1963

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling November, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*					
Upstream	11-8-63	4×10^{-7}	None Det.	.054	51.1×10^{6}
	11-15-63	1×10^{-7}	2×10^{-6}	.014	51.5×10^{6}
	11-22-63	4×10^{-7}	8×10^{-7}	.014	56.2×10^{6}
	11-29-63	3×10^{-7}	1×10^{-7}	.023	64.7×10^{6}
Downstream	11-8-63	5×10^{-7}	None Det.	.043	51.1×10^{6}
	11-15-63	None Det.	2×10^{-6}	.014	51.5×10^{6}
	11-22-63	6×10^{-8}	4×10^{-7}	.014	56.2×10^{6}
	11-29-63	6×10^{-7}	8×10^{-7}	.030	64.7×10^{6}
Bear Creek*	11-5-63	2×10^{-8}	2×10^{-7}		
	11-12-63	1×10^{-7}	None Det.		
	11-21-63	None Det.	6×10^{-8}		
NE Settling Pit	11-5-63	1×10^{-4}	4×10^{-4}		
	11-12-63	5×10^{-5}	5×10^{-4}		
	11-20-63	8×10^{-5}	5×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

Location	Date	Alpha	Beta
NW Settling Pit	11-5-63	6×10^{-6}	2×10^{-5}
	11-12-63	4×10^{-5}	1×10^{-4}
	11-20-63	3×10^{-5}	1×10^{-4}
SE Settling Pit	11-5-63	1×10^{-4}	6×10^{-4}
	11-12-63	9×10^{-5}	7×10^{-4}
	11-20-63	9×10^{-5}	6×10^{-4}
SW Settling Pit	11-5-63	4×10^{-5}	8×10^{-5}
	11-12-63	3×10^{-5}	1×10^{-4}
	11-20-63	4×10^{-5}	2×10^{-4}

Cation Determination - Poplar Creek monthly conposite:

Upstream			Downstream		
Cl	=	18.2	Cl	=	17.0
SO_4	=	43.8	SO_4	=	55.3
F	=	2.8	F	=	1.1
NO_3	=	10.4	NO_3	=	9.2

C. M. West

CMW:ep

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSEE

To (Name) J. D. McLendon
Company
Location Building 9711-1

Date January 21, 1964
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele, J. F. Morehead, Neal Dow, M. F. Schwenn, H. C. Francke, J. W. Strohecker, L. C. Johnson, C. R. Sullivan, Jr., M.D., H. T. Kite

Subject Surface Water Sampling December, 1963

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*					
Upstream	12-06-63				57.5×10^6
	12-13-63	1×10^{-6}	1×10^{-6}	.06	48.8×10^6
	12-20-63	4×10^{-7}	5×10^{-7}		47.0×10^6
	12-27-63	5×10^{-7}	3×10^{-7}	.008	79.0×10^6
Downstream	12-06-63				57.5×10^6
	12-13-63	2×10^{-7}	6×10^{-7}	.09	48.8×10^6
	12-20-63	3×10^{-7}	6×10^{-7}		47.0×10^6
	12-27-63	3×10^{-7}	None Det.	.016	79.0×10^6
Bear Creek*	12-04-63	None Det.	5×10^{-8}		
	12-18-63	2×10^{-7}	3×10^{-7}		
NE Settling Pit					
	12-04-63	8×10^{-5}	4×10^{-4}		
	12-18-63	7×10^{-5}	3×10^{-4}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

Location	Date	Alpha	Beta
NW Settling Pit	12-04-63	5×10^{-5}	2×10^{-4}
	12-18-63	4×10^{-5}	1×10^{-4}
SE Settling Pit	12-04-63	1×10^{-4}	7×10^{-4}
	12-18-63	1×10^{-4}	4×10^{-4}
SW Settling Pit	12-04-63	1×10^{-4}	4×10^{-4}
	12-18-63	4×10^{-5}	1×10^{-4}

Cation Determination - Poplar Creek monthly composite:

Upstream			Downstream		
Cl	=	23.3	Cl	=	25.3
SO_4	=	49.5	SO_4	=	44.0
F	=	1.2	F	=	1.1
NO_3	=	9.0	NO_3	=	14.0

C. M. West

C. M. West

CMW:ep

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSEE

To (Name) J. D. McLendon

Company

Location Building 9711-1

Date February 25, 1964

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, J. F. Morehead, Neal Dow, M. F. Schwenn, H. C. Francke, J. W. Strohecker, L. C. Johnson, C. R. Sullivan, Jr.,M.D., H. T. Kite

Subject Surface Water Sampling January, 1964

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*					
Upstream	1-03-64	5×10^{-7}	8×10^{-7}	.33	76.0×10^{6}
	1-10-64	2×10^{-7}	None Det.	.010	67.0×10^{6}
	1-17-64	Sample Spilled			54.6×10^{6}
	1-24-64	2×10^{-6}	2×10^{-6}	.026	66.4×10^{6}
	1-31-64	4×10^{-7}	7×10^{-7}	.034	58.9×10^{6}
Downstream	1-03-64	5×10^{-7}	4×10^{-7}	.11	76.0×10^{6}
	1-10-64	5×10^{-7}	None Det.	.016	67.0×10^{6}
	1-17-64	3×10^{-7}	3×10^{-7}	.018	54.6×10^{6}
	1-24-64	9×10^{-7}	1×10^{-6}	.026	66.4×10^{6}
	1-31-64	2×10^{-7}	2×10^{-7}	.006	58.9×10^{6}
Bear Creek*	1-22-64	9×10^{-8}	1×10^{-7}		
	1-29-64	1×10^{-7}	4×10^{-7}		
NE Settling Pit	1-22-64	1×10^{-5}	2×10^{-5}		
	1-29-64	5×10^{-5}	1×10^{-4}		

*The Permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

J. D. McLendon

Location	Date	Alpha	Beta
NW Settling Pit	1-22-64	6×10^{-6}	2×10^{-5}
	1-29-64	3×10^{-5}	5×10^{-5}
SE Settling Pit	1-22-64	7×10^{-5}	2×10^{-4}
	1-29-64	10×10^{-5}	3×10^{-4}
SW Settling Pit	1-22-64	3×10^{-5}	6×10^{-5}
	1-29-64	4×10^{-6}	7×10^{-6}

Cation Determination - Poplar Creek monthly composite:

Upstream				Downstream			
Cl	=	26.4	ppm	Cl	=	22.5	ppm
SO_4	=	36.9	ppm	SO_4	=	48.5	ppm
F	=	1.2	ppm	F	=	1.1	ppm
NO_3	=	24.7	ppm	NO_3	=	14.3	ppm

C. M. West

CMW:ep

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX P, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon
Company
Location Building 9711-1

Date March PM 2:17
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, M. F. Schwenn, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling February, 1964

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek, and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*					
Upstream	2-07-64	5×10^{-7}	5×10^{-7}	.31	64.2×10^{6}
	2-14-64	3×10^{-7}	6×10^{-7}	.027	81.8×10^{6}
	2-20-64	5×10^{-7}	5×10^{-7}	.032	65.1×10^{6}
	2-28-64	9×10^{-7}	5×10^{-7}	.10	72.6×10^{6}
Downstream	2-07-64	1×10^{-7}	1×10^{-7}	.12	64.2×10^{6}
	2-14-64	2×10^{-7}	1×10^{-7}	.011	81.8×10^{6}
	2-20-64	7×10^{-8}	2×10^{-7}	.022	65.1×10^{6}
	2-28-64	5×10^{-7}	3×10^{-7}	.05	72.6×10^{6}
Bear Creek*	2-05-64	1×10^{-7}	8×10^{-8}		
	2-19-64	7×10^{-8}	2×10^{-7}		
	2-27-64	3×10^{-7}	3×10^{-7}		
NE Settling Pit	2-05-64	1×10^{-5}	2×10^{-5}		
	2-19-64	2×10^{-5}	6×10^{-5}		
	2-27-64	4×10^{-5}	8×10^{-5}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

Location	Date	Alpha	Beta
NW Settling Pit	2-05-64	2×10^{-5}	3×10^{-5}
	2-19-64	2×10^{-5}	3×10^{-5}
	2-27-64	3×10^{-5}	4×10^{-5}
SE Settling Pit	2-05-64	10×10^{-5}	2×10^{-4}
	2-19-64	8×10^{-5}	2×10^{-4}
	2-27-64	1×10^{-4}	4×10^{-4}
SW Settling Pit	2-05-64	2×10^{-5}	2×10^{-5}
	2-19-64	3×10^{-5}	7×10^{-5}
	2-27-64	4×10^{-5}	8×10^{-5}

Cation Determination - Poplar Creek monthly composite:

Upstream			Downstream		
Cl	=	33.3 ppm	Cl	=	32.3 ppm
SO_4	=	42.8 ppm	SO_4	=	45.0 ppm
F	=	1.3 ppm	F	=	1.2 ppm
NO_3	=	15.3 ppm	NO_3	=	12.9 ppm

C. M. West

CMW:ep

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE. TENNESSEE

To (Name) J. D. McLendon

Company

Location Building 9711-1

Date April 15,1964

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, Neal Dow, H. C. Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, R. D. Williams, J. W. Strohecker, C. R. Sullivan, Jr.,M.D.

Subject Surface Water Sampling March, 1964

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek* Upstream	3-06-64	3×10^{-7}	2×10^{-7}	None Det.	54.9×10^{6}
	3-13-64	4×10^{-7}	9×10^{-7}	None Det.	82.3×10^{6}
	3-20-64	3×10^{-7}	None Det.	.010	76.8×10^{6}
	3-26-64	3×10^{-7}	4×10^{-7}	.010	60.1×10^{6}
Downstream	3-06-64	9×10^{-8}	3×10^{-7}	None Det.	54.9×10^{6}
	3-13-64	4×10^{-8}	5×10^{-7}	None Det.	82.3×10^{6}
	3-20-64	7×10^{-7}	3×10^{-7}	None Det.	76.8×10^{6}
	3-26-64	6×10^{-7}	5×10^{-7}	.015	60.1×10^{6}
Bear Creek*	3-05-64	4×10^{-7}	1×10^{-7}		
	3-12-64	1×10^{-7}	None Det.		
	3-19-64	3×10^{-7}	None Det.		
NE Settling Pit	3-05-64	3×10^{-5}	8×10^{-5}		
	3-12-64	4×10^{-5}	1×10^{-4}		
	3-19-64	4×10^{-5}	8×10^{-5}		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

Location	Date	Alpha μc/cc	Beta μc/cc
NW Settling Pit	3-05-64	2×10^{-5}	3×10^{-5}
	3-12-64	2×10^{-5}	4×10^{-5}
	3-19-64	2×10^{-5}	3×10^{-5}
SE Settling Pit	3-05-64	10×10^{-5}	3×10^{-4}
	3-12-64	1×10^{-4}	4×10^{-4}
	3-19-64	7×10^{-5}	2×10^{-4}
SW Settling Pit	3-05-64	4×10^{-5}	9×10^{-5}
	3-12-64	4×10^{-5}	1×10^{-4}
	3-19-64	5×10^{-5}	8×10^{-5}

Cation Determination - Poplar Creek monthly composite:

Upstream			Downstream		
Cl	=	27.0 ppm	Cl	=	22.0 ppm
SO_4	=	40.5 ppm	SO_4	=	45.5 ppm
F	=	1.2 ppm	F	=	1.1 ppm
NO_3	=	25.5 ppm	NO_3	=	21.5 ppm

C. M. West

CMW:ep

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y, OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon

Company

Location Building 9711-1

Date May 26, 1964

Originating Dept. Radiation Safety

Answering letter date

Copy to G. J. Angele, Neal Dow, H. C Francke, L. C. Johnson, H. T. Kite, J. F. Morehead, R. D. Williams, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling April, 1964

The following gives a listing of water sample results taken from Poplar Creek, Bear Creek and settling pits:

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek*					
Upstream	4-03-64	4×10^{-7}	4×10^{-6}	None Det.	83.3×10^{6}
	4-10-64	1×10^{-6}	2×10^{-6}	< .050	69.2×10^{6}
	4-17-64	1×10^{-6}	1×10^{-6}	< .05	55.8×10^{6}
	4-24-64	3×10^{-6}	8×10^{-7}	.013	110.3×10^{6}
Downstream	4-03-64	6×10^{-8}	6×10^{-7}	.010	83.3×10^{6}
	4-10-64	3×10^{-7}	6×10^{-7}	< .050	69.2×10^{6}
	4-17-64	3×10^{-7}	5×10^{-7}	< .05	55.8×10^{6}
	4-24-64	2×10^{-7}	4×10^{-7}	.013	110.3×10^{6}
Bear Creek	4-01-64	None Det.	$.6 \times 10^{-8}$		

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} µc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} µc/cc.

Location	Date	Alpha µc/cc	Beta
NW Settling Pit	4-01-64	2×10^{-5}	3×10^{-5}
NE Settling Pit	4-01-64	6×10^{-5}	1×10^{-4}
SW Settling Pit	4-01-64	8×10^{-5}	1×10^{-4}
SE Settling Pit	4-01-64	1×10^{-4}	4×10^{-4}

Cation Determination - Poplar Creek monthly composite:

Upstream	Downstream
Cl = 20.5	Cl = 17.7
SO_4= 46.0	SO_4= 42.7
F = .5	F = .5
NO_3= 20.5	NO_3= 18.0

M. Sanders

MS:ep

UNION CARBIDE

INTERNAL CORRESPONDENCE

UNION CARBIDE NUCLEAR COMPANY • POST OFFICE BOX Y. OAK RIDGE, TENNESSEE

To (Name) J. D. McLendon (Y-12RC)
Company
Location Building 9711-1

Date September 16, 1964
Originating Dept. Radiation Safety
Answering letter date

Copy to G. J. Angele, Neal Dow, D. A. Jennings, L. C. Johnson, J. F. Morehead, R. D. Williams, J. W. Strohecker, C. R. Sullivan, Jr., M.D.

Subject Surface Water Sampling May, June and July, 1964

The following gives a listing of water sample results taken from Poplar Creek and Bear Creek:

Location	Date	Alpha μc/cc	Beta μc/cc	Mercury mg/l	Total Flow gal/week
Poplar Creek* Upstream	5-01-64	3×10^{-6}	1×10^{-6}	.021	64.9×10^{6}
	5-08-64	3×10^{-6}	8×10^{-6}	None Det.	54.9×10^{6}
	5-15-64	1×10^{-5}	2×10^{-6}	.013	55.4×10^{6}
	5-22-64	3×10^{-5}	1×10^{-6}	.008	66.7×10^{6}
	5-28-64	5×10^{-7}	2×10^{-6}	.05	66.1×10^{6}
Downstream	5-01-64	10×10^{-7}	4×10^{-7}	.013	64.9×10^{6}
	5-08-64	3×10^{-6}	7×10^{-7}	None Det.	54.9×10^{6}
	5-15-64	1×10^{-6}	6×10^{-7}	.004	55.4×10^{6}
	5-22-64	4×10^{-7}	5×10^{-7}	.008	66.7×10^{6}
	5-28-64	7×10^{-7}	3×10^{-7}	.05	66.1×10^{6}

*The permissible limit for uranium alpha in drinking water outside of controlled areas is 3×10^{-5} μc/cc (microcuries per cubic centimeter). The permissible limit for unidentified beta emitters in drinking water outside of controlled areas is 2×10^{-5} μc/cc.

Location	Date	Alpha µc/cc	Beta µc/cc	Mercury mg/l	Total Flow gal/week
Downstream Monthly Composite	June 1964	4×10^{-6}	2×10^{-6}	.027	260.3×10^{6}
Downstream Monthly Composite	July 1964	3×10^{-7}	7×10^{-7}	None Det.	263.6×10^{6}
Bear Creek Monthly Composite	July 1964	4×10^{-7}	1×10^{-7}		

Cation Determination - Poplar Creek monthly composite:

Date	Cl	SO_4	F	NO_3
May, 1964	31.0 ppm	44.0 ppm	1.12 ppm	17.5 ppm
June, 1964	19.1 ppm	51.5 ppm	1.3 ppm	19.8 ppm
July, 1964	20.0 ppm	48.0 ppm	1.0 ppm	6.1 ppm

M. Sanders

MS:ep

DIVISION	DEPARTMENT	SECTION	BLDG.-ROOM
Technical	Radiation Safety		9711-1

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General correspondence and report file	....	12/31/68	2108-1	Indef.

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OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM ChemRisk

DOCUMENT DESCRIPTION (Completed by Requesting Division)

Document No	Date of Request	Requested Date of Release (Allow 5 to 10 Days)	Page Count
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Unclassified Title: SURFACE WATER SAMPLING FOR POPLAR CREEK, BEAR CREEK, AND SETTLING PITS (1963/1964) (FROM BOX # 22-6-7)

Author / Requestor's Name	Telephone No., Pager No and Plant Address	Account Number
S. W. Wiley	6-0263, 417-5417, Bldg. 9106, MS-8023	2366-0003

INTENDED AUDIENCE: ☐ Public ☐ Environmental Regulators ☐ NWC ☐ DOE Contractors ☒ Other ChemRisk

TYPE: ☐ Abstract ☐ Brochure ☐ Co-op Report ☐ Formal Report ☐ Informal Report
☐ Invention Disclosure ☐ Journal Article ☐ News Release ☐ Photograph/Visuals ☐ Technical Progress Report
☐ Thesis/Term Paper ☐ Videotape ☐ Other
☐ Oral Presentation (identify meeting, sponsor, location, date).

PATENT OR INVENTION SIGNIFICANCE ☐ Yes ☒ No (Identify) Document will be published in proceedings ☐ Yes ☒ No
Document has been previously released ☐ Yes ☒ No (Reference) Document will be distributed at meeting ☐ Yes ☒ No

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DIVISION REVIEW AND APPROVAL (Completed by Requesting Division)

CLASSIFICATION REVIEW (Authorized Derivative Classifier (ADC))

Classification of: Title: U Abstract: NA

DOCUMENT: Level U Category –

R.J. FRASER — R.J. Fraser — 10/17/96
Print Name — Signature — Date

DOCUMENT REQUEST APPROVED (Division/Department Mgr.)

S. W. Wiley TOA/HS Coordinator
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S. W. Wiley — 10/14/96
Signature — Date

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CLASSIFICATION OFFICE:

Title: Unclassified Abstract: –

DOCUMENT: Level Unclassified Category –

Weapons Data – Sigma –

R.T. Quigh — 17 Oct 1996
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OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM ChemRisk

DOCUMENT DESCRIPTION (Completed by Requesting Division)

Document No.	Date of Request	Requested Date of Release (Allow 5 to 10 Days)	Page Count
MS/ChR2-0273	OCT 14, 1996	OCT 24, 1996	7

Unclassified Title: Y-12 PLANT EFFLUENTS (1965) AND A STUDY OF AEC-ORO CHROMATE DISCHARGES (FROM BOX # 22-6-7) 1964-5 Hg concs.

Author's / Requestor's Name	Telephone No., Pager No. and Plant Address	Account Number
S. W. Wiley	6-0263, 417-5417, Bldg. 9106, MS-8023	2366-0003

INTENDED AUDIENCE: ☐ Public ☐ Environmental Regulators ☐ NWC ☐ DOE Contractors ☒ Other ChemRisk

TYPE: ☐ Abstract ☐ Brochure ☐ Co-op Report ☐ Formal Report ☐ Informal Report
☐ Invention Disclosure ☐ Journal Article ☐ News Release ☐ Photograph/Visuals ☐ Technical Progress Report
☐ Thesis/Term Paper ☐ Videotape ☐ Other
☐ Oral Presentation (identify meeting, sponsor, location, date):

PATENT OR INVENTION SIGNIFICANCE ☐ Yes ☑ No (Identify) Document will be published in proceedings ☐ Yes ☑ No
Document has been previously released ☐ Yes ☑ No (Reference) Document will be distributed at meeting ☐ Yes ☑ No

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DIVISION REVIEW AND APPROVAL (Completed by Requesting Division)

CLASSIFICATION REVIEW (Authorized Derivative Classifier (ADC))

Classification of: Title: U Abstract: NA

DOCUMENT: Level U Category —

R.J. FRASER — Print Name; R.J. Fraser — Signature; 10/17/96 — Date

DOCUMENT REQUEST APPROVED (Division/Department Mgr.)

S. W. Wiley TOA/HS Coordinator — Please Print Name and Title

S. W. Wiley — Signature; 10/14/96 — Date

APPROVAL AND RELEASE (Completed by the Classification/Technical Information Control Office)

CLASSIFICATION OFFICE:

Title: Uncl. Abstract: —

DOCUMENT: Level Uncl. Category —

Weapons Data — Sigma —

R.F. Leigh — Y-12 Classification Office; 17 Oct 1996 — Date

☐ Waived/NA — Patent Office — Date
☐ — Date
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Box 22-6-7

Y-12 PLANT EFFLUENTS

:SAL TO EAST FORK OF POPLAR CREEK

:MINANTS	LOCATION	FLOW RATE GAL/MO	ORIGIN	REMARKS
:ic Solutions	9212	14500	Filtrate	5 ppm U; 10% NaOH; 1% Ba; Si and Al
	9212	150	Scrubber	5% NaOH
	9204-2	7900	Scrubber	NaOH 3 - 5% NaOCl 8.3%; < 5 ppm Li Cl
	9201-4	9300	Demineralizer Reagent	NaOH - 2%
	9401-2	5500	Degreasing Solution	NaOH - 8%
	9401-3	225000	Water Softener	NaCl; 3 - 4%
	9727-3	3000	Scrubber	5% NaOH
	9204-3	5000	Neutralization	
	9207	30000	Disinfectant	$Ca(ClO)_2$
.i Solution	9204-4	5000	Pickling	HNO_3
	9204-2	800	KCl (15%)	pH = 3 - 4
	9201-4	5500	Demineralizer Reagent	H_2SO_4 - 4%
	9204-1	390	Laboratory Reagents	H_2SO_4, HNO_3, HCl (12-36 Normal)
	9202	2200	Pickling	NH_3 HF = 1 - 2%
	9401-2	3500	Pickling	HCl - 30%; 2% HF, HNO_3 - 15%
	9401-3	225000	Regeneration Process	H_2SO_4 - 1.75%
	9731	1000	Laboratory Reagents	HNO_3 2 - 5% NH_4HF_2 = 0.5%
:se Water	9212	3000	Glove Wash	Na_2CO_3 = 0.2%
	9215	22000	Mill Wash	Tap H_2O = < 20 ppm U
	Y-12	16000	Mop Water	
	9401-2	50000	Plating Shop	Hot Water
	9212	5000	Filter Wash	Trace U
	9401-3	540000	Steam Plant	Acid Softener Wash
	9401-3	300000	Steam Plant	Sodium Softener Wash
:3 Ponds Disposal	9206	10000	Evaporator Condensate	5 to 15% HNO_3
		7500	Raffinate	2 to 5% HNO_3 Carbital $Al(NO_3)$ Fluoride pH < 1 10 ppm
	9401-2	500	Cyanide Strip Solution	4.2% Na_4 $Fe^3(CN)_6$
	9212	55000	Raffinates	13% HNO_3; > 100 ppm F, Al, Ca^3, and Mg
		60000	Condensate	~ 10% HNO_3
		100	Ferro Cyanide Slurries	Dumped from bottles

BURIAL GROUND AREAS

A.	Burn Yard	5052	Tons	FY	1965	< 150,000 d/m/100cm^2
B.	Low Level Radioactive Waste	11058	"	"	"	< 150,000 d/m/gram
C.	Intermediate Radioactive Waste	718	"	"	"	< 1.5 x 10^6 d/m/gram
D.	High Level (ORNL)	95	"	"	"	No Upper Level
E.	Oils and Solutions	58000	"	"	"	
F.	Quarry (Non Radioactive)	5	"	"	"	< 40 d/m/gram
G.	Uranium Burial	458	"	"	"	

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10/17/94
Technical Information Office Date

EAST FORK POPLAR CREEK ANALYSES

OF MONTHLY COMPOSITES

1964

	F	SO_4	NO_3	Cl	Cn	Cu	Cr^{+6}	Mg	Mn	Pb	Zn	Hg
USPHS 1961 Drinking Water Standards	1.0	250	45	250	.2	3	.05	125	.3	.05	.5	--
Maximum Value	1.5	88	31	40	.1	.2	.8	28	.25	1.0	6	.12
Minimum Value	< .01	20	6	14	< .01	< .01	< .02	6	< .05	< .1	< .8	< .01
Year Average	1.1	44	13	25	< .1	< .1	.2	14	.07	.1	.5	.01

1965

Maximum Value	1.4	60	20	39	< .01	.1	.4	12	.1	.1	< .8	.4
Minimum Value	.3	29	5	16	< .01	< .05	.07	5	.05	< .1	< .8	< .05
Year Average (Including August)	1.0	47	12	23	< .01	< .1	.17	8	.05	.06	< .8	.07

Year	Conc 1 calc'd if data	Conc 2 rpt'd 1/4ly source chkd	Conc 3 rpt'd Y/EX-21 source unverified	Flow Rate calc'd if data, or Y/EX-21	conversion factor	lbs 1 calc'd [conc x flow x CF]	lbs 2 calc'd	lbs 3 calc'd	sum of 1/4ly lbs lb3, lb rptd	lbs reported Y/EX-21	[lbs rpt'd - lbs 3]	% annual rpt'd lbs	conc back calc'd
4Q			0.001	7.4	7.61E+02			6		6	0	25	0.001
1976			**0.001**	**8.3**	3.04E+03			25	25	**25**	0	100	0.001
1Q			0.001	8.6	7.61E+02			7	26	7	0	28	0.001
2Q			0.001	7.6	7.61E+02			6		6	0	24	0.001
3Q			0.001	8.4	7.61E+02			6		6	0	24	0.001
4Q			0.001	8.7	7.61E+02			7		7	0	28	0.001
1977			**0.002**	**8.8**	3.04E+03			47	47	**51**	4	100	0.002
1Q			0.001	8	7.61E+02			6	50	5	-1	10	0.001
2Q			0.001	9.5	7.61E+02			7		9	2	18	0.001
3Q			0.002	8.5	7.61E+02			13		13	0	25	0.002
4Q			0.003	9.1	7.61E+02			21		23	2	45	0.003
1978			**0.001**	**7.8**	3.04E+03			30	31	**38**	8	100	0.002
1Q			0.002	9.8	7.61E+02			15	37	17	2	45	0.002
2Q			0.001	7.5	7.61E+02			6		7	1	18	0.001
3Q			0.001	6.9	7.61E+02			5		7	2	18	0.001
4Q			0.001	6.9	7.61E+02			5		6	1	16	0.001
1979			**0.002**	**7.7**	3.04E+03			41	41	**41**	0	100	0.002
1Q			0.002	8.1	7.61E+02			12	41	12	0	29	0.002
2Q			0.001	7.5	7.61E+02			6		8	2	20	0.001
3Q			0.002	7.9	7.61E+02			12		10	-2	24	0.002
4Q			0.002	7.3	7.61E+02			11		11	0	27	0.002
1980		<0.002	**0.002**	**8.5**	3.04E+03			45	46	**51**	6	100	0.002
1Q			0.002	9.7	7.61E+02			15	51	17	2	33	0.002
2Q			0.002	8.4	7.61E+02			13		13	0	25	0.002
3Q			0.001	7.5	7.61E+02			6		9	3	18	0.002
4Q			0.002	8.4	7.61E+02			13		12	-1	24	0.002
1981			**0.002**	**7.2**	3.04E+03			33	33	**34**	1	100	0.002
1Q			0.002	7.5	7.61E+02			11	34	13	2	38	0.002
2Q			0.002	7.6	7.61E+02			12		9	-3	26	0.002
3Q			0.001	6.9	7.61E+02			5		7	2	21	0.001
4Q			0.001	6.6	7.61E+02			5		5	0	15	0.001
1982		<0.002	**0.003**	**8.8**	3.04E+03			71	55	**53**	-18	100	0.002
1Q			0.005	9.2	7.61E+02			35	53	33	-2	62	0.005
2Q			0.001	8	7.61E+02			6		7	1	13	0.001
3Q			0.002	9.1	7.61E+02			14		13	-1	25	0.002
4Q			~.001										
1983		<0.002											
1Q													

E-1 (N=12)

Stn E-1 avg'd monthlys N=12

SMJ Clark

	Year	Conc 1 calc'd if data	Conc 2 rpt'd 1/4ly source chkd	Conc 3 rpt'd Y/EX-21 source unverified	Flow Rate calc'd if data, or Y/EX-21	conversion factor	lbs 1 calc'd	lbs 2 calc'd	lbs 3 calc'd	sum of 1/4ly lbs lb3, lb rptd	lbs reported Y/EX-21	[lbs rpt'd - lbs 3]	% annual rpt'd lbs	conc back calc'd
							[conc x flow x CF]							
	2Q													
	3Q													
	4Q													
E-1 (monthlys avg'd N=12)	1984		<0.0016											
	1Q													
	2Q													
	3Q													
	4Q													
W-35 (N=12) outfall 303	1985		~~W-24/0.0018~~ daily avg. limit exceeded 9% of time =0.0035											
	1Q													
	2Q													
	3Q													
	4Q													
NHP W-45 outfall 303 NPDES	1986													
	1Q													
	2Q													
	3Q													
	4Q													
NHP influent	1987	0.0082												
	1Q													
	2Q													
	3Q													
	4Q													
#17 (N=? Nov+Dec 88 only)	1988	<0.0019												
	1Q													
	2Q													
	3Q													
	4Q													
	1989													
#17 (N=441)	1Q	0.0017												
	2Q													
	3Q													
	4Q													
#17 (N=508)	1990	0.0017												
	1Q													
	2Q													
	3Q													
	4Q													

	Year	Conc 1	Conc 2	Conc 3	Flow Rate	conversion	lbs 1	lbs 2	lbs 3	sum of	lbs	[lbs rpt'd	% annual	conc
		calc'd	rpt'd 1/4ly	rpt'd Y/EX-21	calc'd if data,	factor	calc'd	calc'd	calc'd	1/4ly lbs	reported	- lbs 3]	rpt'd lbs	back calc'd
		if data	source chkd	source unverified	or Y/EX-21		[conc x flow x CF]			lb3, lb rptd	Y/EX-21			
#17 (N=729)														
	1991	0.0014												
	1Q													
	2Q													
	3Q													
	4Q													
#17 EFPC23.4 (N=248)	1992	0.0017												
	1Q													
	2Q													
	3Q													
	4Q													
#17 (N=203)	1993	<0.0016												
	1Q													
	2Q													
	3Q													
	4Q													
	1994													
	1Q													
	2Q													
	3Q													
	4Q													
	1995													
	1Q													
	2Q													
	3Q													
	4Q													

E-1 becomes D-35 in 1985

↓

NHP Outfall
#303

1986: ~~East Sanitary Sewer Discharge~~
~~West " " "~~

1987: NHP influent - look for NHP discharge
~~East SSE~~
~~West SSE~~

look for Surveillance Section

POST 1990
STA 17 = 9422-1

REPORT NUMBER Y/UB-15
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TITLE: ENVIRONMENTAL MONITORING REPORT, USDOE, OAK RIDGE FACILITIES, CALENDAR YEAR 1980
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NUCLEAR DIVISION

UNION CARBIDE

ENVIRONMENTAL MONITORING REPORT
UNITED STATES DEPARTMENT OF ENERGY
OAK RIDGE FACILITIES

Calendar Year 1980

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DEPARTMENT OF ENERGY

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Y/UB-15

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ENVIRONMENTAL MONITORING REPORT

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE FACILITIES

Calendar Year 1980

UNION CARBIDE CORPORATION – NUCLEAR DIVISION
Oak Ridge Gaseous Diffusion Plant
Oak Ridge National Laboratory
Oak Ridge Y-12 Plant

Office of Health, Safety, and Environmental Affairs
Post Office Box Y
Oak Ridge, Tennessee 37830

External Gamma Radiation Monitoring

External gamma radiation background measurements are made routinely at the perimeter air monitoring stations and at the remote monitoring stations using calcium fluoride thermoluminescent dosimeters suspended one meter above the ground. Dosimeters at the perimeter stations are collected and analyzed monthly. Those at the remote stations are collected and analyzed semiannually.

Data on the average external gamma radiation background are given in Table 10. A considerable variation in background levels is normally experienced in East Tennessee depending upon elevation, topography, and geological character of the surrounding soil.(3)

External gamma radiation measurements were performed along the stream course of East Fork Poplar Creek to evaluate radioactivity which might be contained in the sediments as a result of effluent releases. Additionally, measurements were made along the bank of the Clinch River from the mouth of White Oak Creek several hundred yards downstream to evaluate gamma radiation levels resulting from effluent releases and "sky shine" from an experimental ^{137}Cs plot located near the river bank. Measurements were made using scintillation detectors and/or thermoluminescent dosimeters suspended one meter above the ground surface. The average background level determined at the remote stations was subtracted from the measured gamma radiation levels to determine the incremental increases resulting from plant operations.

Gamma levels long East Fork Poplar Creek ranged from 0 to 12 μR/hr above background. The external gamma radiation levels along the bank of the Clinch River ranged from 5 to 23 μR/hr above background. Potential doses to individuals in the environment from these elevated gamma radiation levels were calculated and are included, where significant, in the dose assessment section of the report.

Water Monitoring

Radioactive – Water samples are collected in the Clinch River for radioactivity analyses at Melton Hill Dam (Station C-2) 3.7 kilometers above White Oak Creek outfall, at the ORGDP sanitary water intake (Station C-3) 10 kilometers downstream from the entry of White Oak Creek, at the ORGDP recirculating water intake (Station C-4) downstream from the Poplar Creek outfall, near Brashear Island (Station C-6), and at Center's Ferry (Station C-5) near Kingston, Tennessee, Figure 3. Samples are collected continuously at all locations except for Station C-5 and Station C-6 which are collected on a daily and monthly grab-sample basis, respectively. Samples are composited for monthly or quarterly analysis depending upon location.

Water samples also are collected for radioactivity analyses at White Oak Dam (Station W-1), at the outlet of New Hope Pond on East Fork Poplar Creek (Station E-1), in Bear Creek (Station B-1), and in Poplar Creek (Stations P-1 and P-2), Figure 3. The samples collected at Stations W-1, E-1, and B-1 are continuous proportional samples. Grab samples are collected at Stations P-1 and P-2 on a weekly basis. Water samples were collected also at the juncture of White Oak Creek and the Clinch River. All samples are composited for monthly analysis.

The concentrations of fission product radionuclides present in detectably significant amounts are determined by specific radionuclide analysis and gamma spectrometry. Uranium analysis is by the fluorometric method. Transuranic alpha emitters are determined by ion exchange and alpha range analysis. The concentration of each radionuclide is compared with its respective concentration guide (CG) value as specified in the DOE Manual, Appendix 0524, and percent of concentration guide for a known mixture of radionuclides is calculated in accordance with the method given in Appendix 0524.

Data on the concentrations of radionuclides measured in the Clinch River are given in Table 11. Data on the concentrations of uranium in surface streams and the quantities of radioactivity release to surface streams are given in Tables 12 and 13.

Analysis of water samples collected at the juncture of White Oak Creek and the Clinch River indicated that the yearly average concentration of radionuclides was approximately 20 percent of the applicable concentration guide for uncontrolled areas. The calculated average concentration of radionuclides in the Clinch River, based on the analysis of water samples collected at White Oak Dam (Station W-1) and the dilution afforded by the river, was determined to be 0.2 percent of the applicable concentration guide for uncontrolled areas assuming complete mixing. The average dilution factor for 1980, based on the flow of White Oak Creek and the Clinch River, was 1130. The measured average concentrations of radionuclides in the Clinch River upstream and downstream of White Oak Creek outfall were less than 0.2 percent of the applicable concentration guide.

The calculated average concentration of transuranic alpha emitters in the Clinch River resulting from effluent releases was 4×10^{-12} μCi/ml, which is less than 0.01 percent of the concentration guide for water containing a known mixture of radionuclides.

Trends in water discharges and calculated percent concentration guide levels in the Clinch River are presented in Figures 4 and 5. Discharges of ^{90}Sr and ^{3}H are shown in Figure 4 as these nuclides contribute the majority of the radiological dose downstream.

ORNL DWG 77 7445

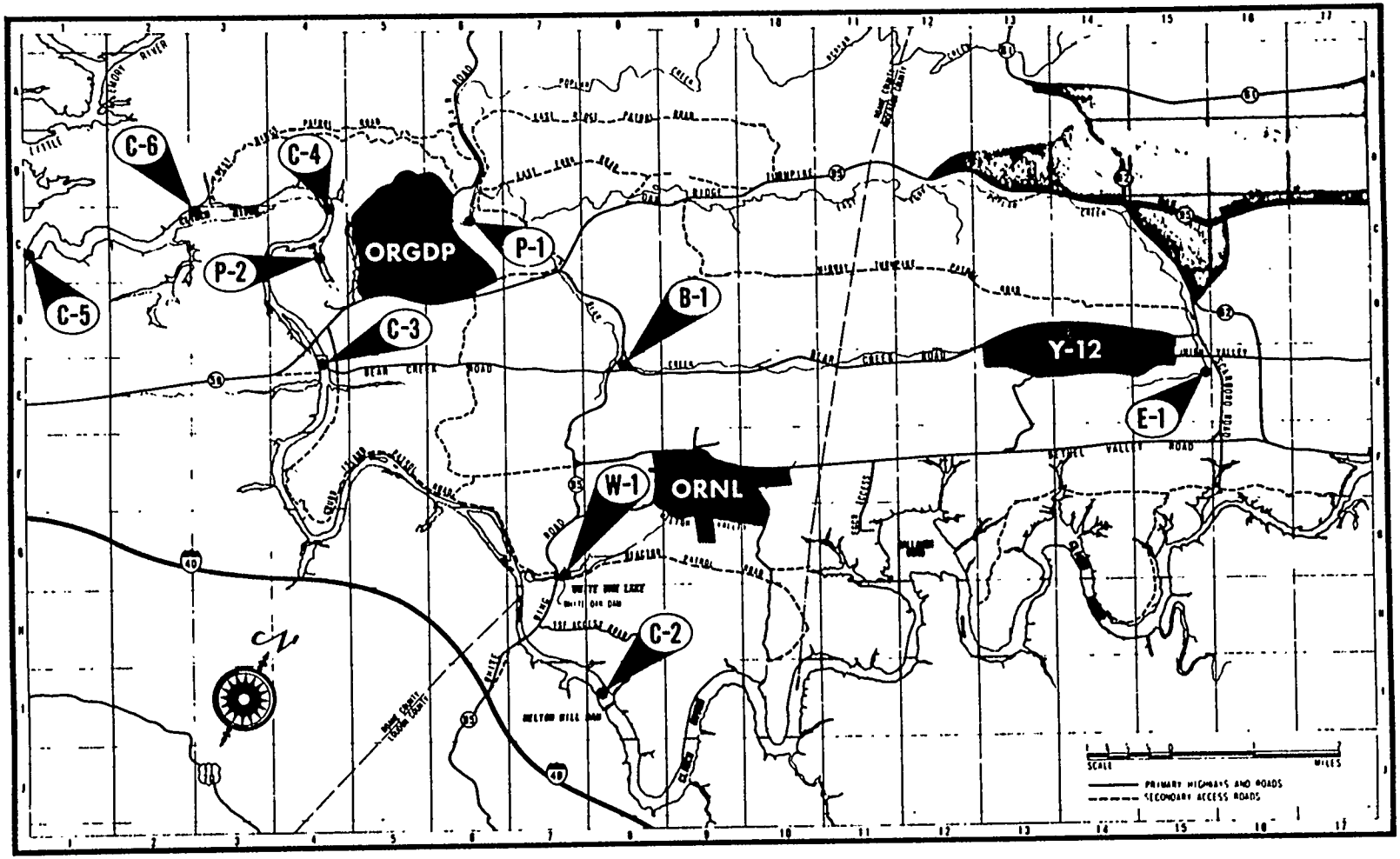

Figure 3
STREAM MONITORING LOCATIONS

Rainwater – The gross beta activity in rainwater was analyzed; the results are shown in Table 14. The fluctations among the stations for both the perimeter and remote networks are due to statistical random variation. It is noted that the average radioactivity is greater for the remote stations than the perimeter stations.

Nonradioactive – Water samples are collected for the analysis of nonradioactive substances at the same locations discussed previously under radioactive water sampling. All samples are composited for monthly analysis. Samples are analyzed for a variety of water quality parameters related to process release potential and background information needs by analytical procedures recommended by the Environmental Protection Agency.[4]

Data on chemical concentrations in surface streams are given in Tables 15 through 23. The average concentrations of all substances analyzed were in compliance with Tennessee stream guidelines[5, 6] except for fluoride at Station E-1 which was 100 percent of the guideline.

National Pollutant Discharge Elimination System (NPDES) permits were issued by the Environmental Protection Agency (EPA) for each of the Oak Ridge facilities operated by Union Carbide Corporation - Nuclear Division in 1975. The permits established a number of discharge locations at each installation and listed specific concentration limits and/or monitoring requirements for a number of parameters at each discharge location. Table 24 contains the discharge locations at each installation, the parameters at each location for which limits have been established, the permit limits for each parameter, and the percentage compliance experienced.

Biological Monitoring

Milk – Raw milk is monitored for ^{131}I and ^{90}Sr by the collection and analysis of samples from 12 sampling stations located within a radius of 80 kilometers of Oak Ridge. Samples are normally collected weekly at each of seven stations located near the Oak Ridge area. Five stations, located more remotely with respect to Oak Ridge operations, are sampled at a rate of one station each week. Milk sampling locations for all stations are shown in Figures 6 and 7. Samples are analyzed by ion exchange and gamma spectrometry; results are compared to intake guides specified by the Federal Radiation Council (FRC).[7]

The average concentrations of ^{131}I and ^{90}Sr in raw milk are given in Tables 25 and 26, respectively. If one assumes the average intake of milk per individual to be one liter per day, the average concentration of ^{131}I in the milk in both the immediate environs of the Oak Ridge area and in the environs remote from Oak Ridge were within FRC Range I. The average concentrations ^{90}Sr in milk from both the immediate and remote environs were within the FRC Range I.

Table 15

CHEMICAL WATER QUALITY DATA – WHITE OAK DAM
(Location W-1, Figure 3)
1980

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/l				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cr	10	<0.01	<0.01	<0.01	0.05	<20
Zn	10	<0.02	<0.02	<0.02	0.1	<20
$NO_3(N)$	10	9.8	0.01	4.6 ± 2.2	10	46
Hg	12	<0.001	<0.001	<0.001	0.005	<20

[a]Tennessee Stream Guidelines.

Table 16

CHEMICAL WATER QUALITY DATA – MELTON HILL DAM
(Location C-2, Figure 3)
1980

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/l				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cr	10	<0.01	<0.01	<0.01	0.05	<20
Zn	10	<0.02	<0.02	<0.02	0.1	<20
$NO_3(N)$	10	2.2	0.1	<0.55 ± 0.5	10	< 6
Hg	11	<0.001	<0.001	<0.001	0.005	<20

[a]Tennessee Stream Guidelines.

Table 17

CHEMICAL WATER QUALITY DATA – ORGDP SANITARY WATER PUMPING STATION
(Location C-3, Figure 3)
1980

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/l				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	0.003	< 0.002	< 0.002 ± 0.0002	0.01	<20
Cr	12	< 0.01	< 0.01	< 0.01	0.05	<20
CN	12	< 0.002	< 0.002	< 0.002	0.01	<20
$NO_3(N)$	12	1.3	0.2	0.5 ± 0.2	10	5
Pb	12	< 0.01	< 0.01	< 0.01	0.05	<20
$SO_4^{=}$	12	32	14	23 ± 4	250	9
T.D.S.	12	172	86	141 ± 17	500	28
Zn	12	0.2	< 0.02	< 0.06 ± 0.3	0.1	<60
F^-	12	0.1	< 0.1	< 0.1	1	<10
Hg	12	< 0.001	< 0.001	< 0.001	0.005	<20
Ni	12	0.2	< 0.01	< 0.02 ± 0.03	0.1	<20

[a]Tennessee Stream Guidelines.

Table 18

CHEMICAL WATER QUALITY DATA – ORGDP RECIRCULATING WATER PUMPING STATION
(Location C-4, Figure 3)
1980

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/l				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	0.004	< 0.002	< 0.002 ± 0.0004	0.01	<20
Cr	12	0.03	< 0.01	< 0.01 ± 0.003	0.05	<20
CN	12	< 0.002	< 0.002	< 0.002	0.01	<20
$NO_3(N)$	12	2.8	0.2	0.6 ± 0.4	10	6
Pb	12	< 0.01	< 0.01	< 0.01	0.05	<20
$SO_4^{=}$	12	35	17	23 ± 4	250	9
T.D.S.	12	283	64	183 ± 36	500	37
Zn	12	0.1	< 0.02	< 0.06 ± 0.01	0.1	<60
F^-	12	0.1	< 0.1	< 0.1	1	<10
Hg	12	< 0.001	< 0.001	< 0.001	0.005	<20
Ni	12	0.2	< 0.01	< 0.03 ± 0.04	0.1	<30

[a]Tennessee Stream Guidelines.

Table 19

CHEMICAL WATER QUALITY DATA – CLINCH RIVER DOWNSTREAM OF ORGDP
(Location C-6, Figure 3)
1980

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/l				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	0.003	< 0.002	< 0.002 ± 0.0002	0.01	<20
Cr	12	< 0.01	< 0.01	< 0.01	0.05	<20
CN	12	< 0.002	< 0.002	< 0.002	0.01	<20
$NO_3(N)$	12	2.7	0.1	0.6 ± 0.4	10	6
Pb	12	< 0.01	< 0.01	< 0.01	0.05	<20
$SO_4^{=}$	12	30	4	19 ± 4	250	8
T.D.S.	12	219	110	162 ± 19	500	32
Zn	12	0.06	0.01	0.03 ± 0.01	0.1	30
F^-	12	0.2	< 0.1	< 0.1 ± 0.01	1	<10
Hg	12	< 0.001	< 0.001	< 0.001	0.005	<20
Ni	12	0.1	< 0.01	< 0.02 ± 0.02	0.1	<20

[a]Tennessee Stream Guidelines.

Table 20

CHEMICAL WATER QUALITY DATA – EAST FORK POPLAR CREEK
(Location E-1, Figure 3)
1980

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/l				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	0.002	< 0.002	< 0.002	0.01	< 20
Cl^-	12	21	< 2	< 7 ± 6	250	< 3
Cr	12	< 0.01	< 0.01	< 0.01	0.05	< 20
F^-	12	1.3	0.7	1.0 ± 0.2	1	100
Hg	12	0.003	< 0.001	< 0.002 ± 0.001	0.005	< 40
$NO_3(N)$	12	5.2	0.7	2.7 ± 1.2	10	27
Pb	12	0.03	< 0.01	< 0.02 ± 0.01	0.05	< 40
$SO_4^=$	12	63	18	39 ± 11	250	16
T.D.S.	12	241	177	201 ± 20	500	40
Zn	12	0.05	< 0.02	< 0.03 ± 0.01	0.1	< 30

[a]Tennessee Stream Guidelines.

Table 22

CHEMICAL WATER QUALITY DATA – POPLAR CREEK ABOVE BLAIR BRIDGE
(Location P-1, Figure 3)

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/l				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	0.004	< 0.002	< 0.002 ± 0.0004	0.01	<20
Cr	12	< 0.01	< 0.01	< 0.01	0.05	<20
CN	12	< 0.002	< 0.002	< 0.002	0.01	<20
$NO_3(N)$	12	4	0.2	1 ± 0.6	10	10
Pb	12	0.01	< 0.01	< 0.01	0.05	<20
$SO_4^{=}$	12	70	31	41 ± 7	250	16
T.D.S.	12	317	126	220 ± 40	500	44
Zn	12	0.3	< 0.02	< 0.06 ± 0.04	0.1	<60
F^-	12	0.4	0.1	0.2 ± 0.06	1	20
Hg	12	< 0.001	< 0.001	< 0.001	0.005	<20
Ni	12	0.2	< 0.01	< 0.03 ± 0.03	0.1	<30

[a]Tennessee Stream Guidelines.

Table 23

CHEMICAL WATER QUALITY DATA – POPLAR CREEK NEAR CLINCH RIVER
(Location P-2, Figure 3)
1980

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/l				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	0.004	< 0.002	< 0.002 ± 0.0004	0.01	<20
Cr	12	< 0.01	< 0.01	< 0.01	0.05	<20
CN	12	< 0.002	< 0.002	< 0.002	0.01	<20
$NO_3(N)$	12	3.2	0.1	0.9 ± 0.5	10	9
Pb	12	0.01	< 0.01	< 0.01	0.05	<20
$SO_4^{=}$	12	86	23	34 ± 11	250	14
T.D.S.	12	270	127	186 ± 27	500	37
Zn	12	0.09	< 0.02	< 0.04 ± 0.02	0.1	<40
F^-	12	0.3	< 0.1	< 0.2 ± 0.04	1	<20
Hg	12	< 0.001	< 0.001	< 0.001	0.005	<20
Ni	12	0.07	< 0.01	< 0.02 ± 0.01	0.1	<20

[a]Tennessee Stream Guidelines.

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MISC: FOR TRANSMITTAL TO H. O. HICKMAN, DOE-ORO; DO NOT SEND TO DOE-TIC
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AUTHOR(S): SPEAS, IG,
MISC: DOE AND DOE CONTRACTOR'S OCCUPATIONAL SAFETY MEETING, NEW ORLEANS, LA, APR 19-22, 1983
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ENVIRONMENTAL MONITORING REPORT
UNITED STATES
DEPARTMENT OF ENERGY

OAK RIDGE FACILITIES

Calendar Year 1982

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Y/UB-18
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ENVIRONMENTAL MONITORING REPORT

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE FACILITIES

Calendar Year 1982

UNION CARBIDE CORPORATION - NUCLEAR DIVISION

Office of Health, Safety, and Environmental Affairs
Post Office Box Y
Oak Ridge, Tennessee 37830

External Gamma Radiation Monitoring

External gamma radiation background measurements are made routinely at the perimeter air monitoring stations and at the remote monitoring stations using calcium fluoride thermoluminescent dosimeters suspended one meter above the ground. Dosimeters at the perimeter stations are collected and analyzed monthly. Those at the remote stations are collected and analyzed semiannually.

Data on the average external gamma radiation background are given in Table 10. A considerable variation in background levels is normally experienced in East Tennessee depending upon elevation, topography, and geological character of the surrounding soil.[3]

External gamma radiation measurements were made along the bank of the Clinch River from the mouth of White Oak Creek several hundred yards downstream to evaluate gamma radiation levels resulting from effluent releases and "sky shine" from an experimental cesium plot located near the river bank. Measurements were made using scintillation detectors and/or thermoluminescent dosimeters suspended one meter above the ground surface. The average background level determined at the remote stations was subtracted from the measured gamma radiation levels to determine the incremental increases resulting from plant operations.

The external gamma radiation levels along the bank of the Clinch River ranged from 2 to 20 μR/h (0.5 E-09 to 5.2 E-09 C/kg/h) above background. Potential doses to individuals in the environment from these elevated gamma radiation levels were calculated and are included, where significant, in the dose assessment section of the report.

Water Monitoring

Radioactive - Water samples are collected in the Clinch River for radioactivity analyses at Melton Hill Dam (Station C-2) 3.7 kilometers above White Oak Creek outfall, at the ORGDP sanitary water intake (Station C-3) 10 kilometers downstream from the entry of White Oak Creek, at the ORGDP recirculating water intake (Station C-4) downstream from the Poplar Creek outfall, and near Brashear Island (Station C-6). A sample is also collected from the Water Plant (Station C-5) near Kingston, Tennessee, Figure 3. Samples are collected continuously at Stations C-2, and C-3. A weekly 24-hour composite sample is collected at Station C-4 and a weekly grab sample is collected at Station C-6. A daily grab sample is collected at Station C-5. Samples are composited for monthly or quarterly analysis depending upon location.

Water samples also are collected for radioactivity analyses at the mouth of White Oak Creek (Station W-1), at the outlet of New Hope Pond on East Fork Poplar Creek (Station E-1), in Bear Creek (Station B-1), and in Poplar Creek (Stations P-1 and P-2), Figure 3. The samples collected at Stations W-1, E-1, and B-1 are continuous samples. Grab samples are collected at Stations P-1 and P-2 on a weekly basis. Water samples are collected also at White Oak Dam. All samples are composited for monthly analysis.

The concentrations of fission product radionuclides present in detectably significant amounts are determined by specific radionuclide analysis and gamma spectrometry. Uranium analysis is by the fluorometric method. Transuranic alpha emitters are determined by ion exchange and alpha range analysis. The concentration of each radionuclide is compared with its respective concentration guide (CG) value as specified in the DOE Order 5480.1A and percent of concentration guide for a known mixture of radionuclides is calculated in accordance with the method given in the Order.

Data on the concentrations of radionuclides measured in the surface streams are given in Table 11. Data on the concentrations of uranium in surface streams and the quantities of radioactivity release to surface streams are given in Tables 12 and 13.

ORNL DWG 77 7445

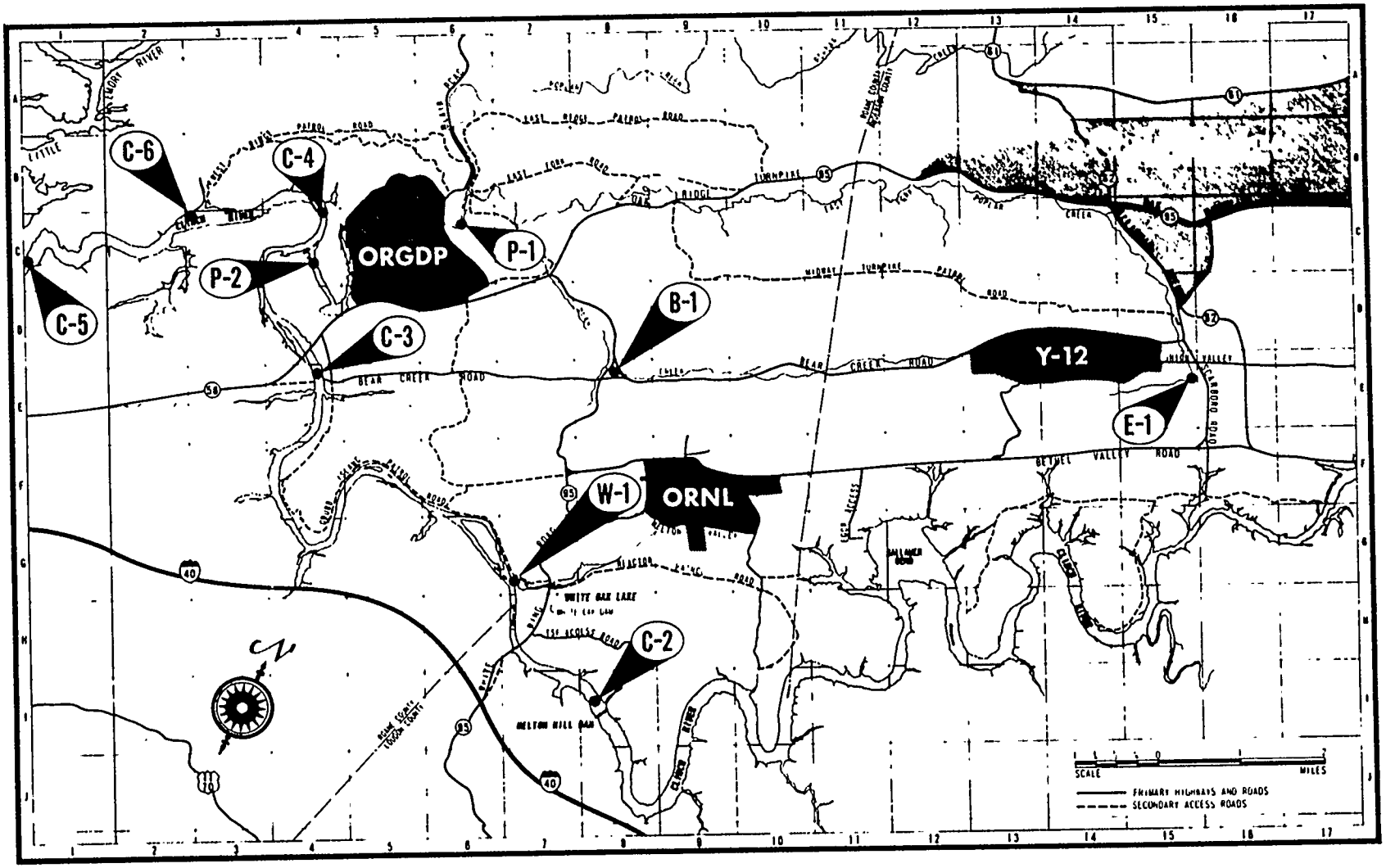

Figure 3
STREAM MONITORING LOCATIONS

Analysis of water samples collected in the mouth of White Oak Creek (Station W-1) indicated that the yearly average concentration of radionuclides was approximately 26 percent of the applicable concentration guide for uncontrolled areas. The calculated average concentration of radionuclides in the Clinch River, based on the analysis of water samples collected at White Oak Dam and the dilution afforded by the river, assuming complete mixing, was determined to be 0.3 percent of the applicable concentration guide for uncontrolled areas. The average dilution factor for 1982, based on the flow of White Oak Creek and the Clinch River, was 463. The measured average concentrations of radionuclides in the Clinch River upstream and downstream of White Oak Creek outfall were less than one percent of the applicable concentration guide.

The calculated average concentration of transuranic alpha emitters in the Clinch River resulting from effluent releases was 0.86 E-11 μCi/mL (0.33 mBq/L), which is about 0.03 percent of the concentration guide for water containing a known mixture of radionuclides.

Trends in water discharges and calculated percent concentration guide levels in the Clinch River are presented in Figures 4 and 5. Discharges of ^{90}Sr and ^{3}H are shown in Figure 4 as these nuclides contribute the majority of the radiological dose downstream.

Rainwater - The gross beta activity in rainwater was analyzed; the results are shown in Table 14. The fluctuations among the stations for both the perimeter and remote networks are due to statistical random variation. It is noted that the average radioactivity is greater for the remote stations than the perimeter stations.

Nonradioactive - Water samples are collected for the analysis of nonradioactive substances at the same locations discussed previously under radioactive water sampling. All samples are composited for monthly analysis. Samples are analyzed for a variety of water quality parameters related to process release potential and background information needs by analytical procedures recommended by the Environmental Protection Agency.[4] Samples from Station C-2 were not analyzed for nonradioactive pollutants during 1982.

Data on chemical concentrations in surface streams are given in Tables 15 through 22. The average concentrations of all substances analyzed were in compliance with Tennessee stream guidelines[5, 6] except for fluoride at Station E-1 and nitrate at Station B-1 which were 110 and 100 percent of the guidelines, respectively.

National Pollution Discharge Elimination System (NPDES) permits were issued by the Environmental Protection Agency (EPA) for each of the Oak Ridge facilities operated by Union Carbide Corporation - Nuclear Division in 1975. The permits established a number of discharge locations at each installation and listed specific concentration limits and/or monitoring requirements for a number of parameters at each discharge location. Table 23 shows the discharge locations at each installation, the parameters at each location for which limits have been established, the permit limits for each parameter, and the percentage compliance experienced.

Biological Monitoring

Milk - Raw milk is monitored for ^{131}I and ^{90}Sr by the collection and analysis of samples from 10 sampling stations located within a radius of 80 kilometers of Oak Ridge. Samples are normally collected weekly at each of six stations located near the Oak Ridge area. Four stations, located more remotely with respect to Oak Ridge operations, are sampled at a rate of one station each week. Milk sampling locations for all stations are shown in Figures 6 and 7. Samples are analyzed by ion exchange and gamma spectrometry; results are compared to intake guides specified by the Federal Radiation Council (FRC).[7]

Table 15
CHEMICAL WATER QUALITY DATA - WHITE OAK DAM
1982

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cr	11	0.02	< 0.01	< 0.01 ± 0.002	0.05	< 20
Zn	11	0.04	< 0.02	< 0.02 ± 0.004	0.1	< 20
$NO_3(N)$	10	18	0.07	7.2 ± 1.8	10	72
Hg	12	< 0.001	< 0.001	< 0.001	0.005	< 20

[a]Tennessee Stream Guidelines.

Table 16
CHEMICAL WATER QUALITY DATA - ORGDP SANITARY WATER PUMPING STATION
(Location C-3, Figure 3)
1982

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.01	< 20
Cr	12	0.03	< 0.01	< 0.01 ± 0.004	0.05	< 20
CN	12	< 0.002	< 0.002	< 0.002	0.01	< 20
$NO_3(N)$	12	0.8	0.3	0.5 ± 0.1	10	5
Pb	12	< 0.01	< 0.01	< 0.01	0.05	< 20
$SO_4^{=}$	12	25	3	21 ± 4	250	8
T.D.S.	12	154	130	142 ± 5	500	28
Zn	12	0.05	< 0.02	< 0.03 ± 0.007	0.1	< 30
F^-	12	0.2	< 0.1	< 0.1 ± 0.01	1	< 10
Hg	12	< 0.001	< 0.001	< 0.001	0.005	< 20
Ni	12	< 0.01	< 0.01	< 0.01	0.1	< 10

[a]Tennessee Stream Guidelines.

Table 17
CHEMICAL WATER QUALITY DATA - ORGDP RECIRCULATING WATER PUMPING STATION
(Location C-4, Figure 3)
1982

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.01	< 20
Cr	12	0.03	< 0.01	< 0.01 ± 0.004	0.05	< 25
CN	12	< 0.002	< 0.002	< 0.002	0.01	< 20
$NO_3(N)$	12	1	0.3	0.6 ± 0.1	10	6
Pb	12	0.02	< 0.01	< 0.01 ± 0.002	0.05	< 20
$SO_4^{=}$	12	34	21	26 ± 2	250	10
T.D.S.	12	194	90	146 ± 20	500	29
Zn	12	0.04	< 0.02	< 0.04 ± 0.02	0.1	< 40
F^-	12	0.2	< 0.1	< 0.1 ± 0.03	1	< 10
Hg	12	< 0.001	< 0.001	< 0.001	0.005	< 20
Ni	12	0.02	< 0.01	< 0.01 ± 0.002	0.1	< 10

[a]Tennessee Stream Guidelines.

Table 18
CHEMICAL WATER QUALITY DATA - CLINCH RIVER DOWNSTREAM OF ORGDP
(Location C-6, Figure 3)
1982

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.01	< 20
Cr	12	0.03	< 0.01	< 0.01 ± 0.004	0.05	< 20
CN	12	< 0.002	< 0.002	< 0.002	0.01	< 20
$NO_3(N)$	12	1	0.3	0.5 ± 0.1	10	5
Pb	12	0.02	< 0.01	< 0.01 ± 0.002	0.05	< 20
$SO_4^{=}$	12	42	4	24 ± 5	250	10
T.D.S.	12	160	79	134 ± 14	500	27
Zn	12	0.1	< 0.02	< 0.03 ± 0.02	0.1	< 30
F^-	12	0.2	< 0.1	< 0.1 ± 0.02	1	< 10
Hg	12	< 0.001	< 0.001	< 0.001	0.005	< 20
Ni	12	0.04	< 0.01	< 0.01 ± 0.006	0.1	< 10

[a]Tennessee Stream Guidelines.

Table 19
CHEMICAL WATER QUALITY DATA - EAST FORK POPLAR CREEK
(Location E-1, Figure 3)
1982

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.01	< 20
Cl^-	11	15	< 2	< 12 ± 4	250	< 5
Cr	12	0.01	< 0.01	< 0.01	0.05	< 20
F^-	12	1.3	0.8	1.1 ± 0.2	1	110
Hg	12	0.007	< 0.001	< 0.002 ± 0.002	0.005	< 40
$NO_3(N)$	12	6.4	2.6	4.3 ± 1.1	10	43
Pb	12	< 0.01	< 0.01	< 0.01	0.05	< 20
$SO_4^=$	11	74	40	54 ± 10	250	22
T.D.S.	12	370	180	239 ± 56	500	48
Zn	12	0.09	< 0.02	< 0.03 ± 0.02	0.1	< 30

[a]Tennessee Stream Guidelines.

Table 21
CHEMICAL WATER QUALITY DATA - POPLAR CREEK ABOVE BLAIR BRIDGE
(Location P-1, Figure 3)
1982

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.01	< 20
Cr	12	0.02	< 0.01	< 0.01 ± 0.002	0.05	< 20
CN	12	< 0.002	< 0.002	< 0.002	0.01	< 20
$NO_3(N)$	12	0.5	0.2	0.3 ± 0.08	10	3
Pb	12	0.03	< 0.01	< 0.01 ± 0.003	0.05	< 20
SO_4^-	12	48	29	40 ± 3	250	16
T.D.S.	12	196	68	132 ± 25	500	26
Zn	12	0.04	< 0.02	< 0.02 ± 0.004	0.1	< 20
F^-	12	0.2	< 0.1	< 0.1 ± 0.02	1	< 10
Hg	12	< 0.001	< 0.001	< 0.001	0.005	< 20
Ni	12	0.2	< 0.01	< 0.02 ± 0.02	0.1	< 20

[a]Tennessee Stream Guidelines.

Table 22
CHEMICAL WATER QUALITY DATA - POPLAR CREEK NEAR CLINCH RIVER
(Location P-2, Figure 3)
1982

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.01	< 20
Cr	12	< 0.01	< 0.01	< 0.01	0.05	< 20
CN	12	0.003	< 0.002	< 0.002 ± 0.0002	0.01	< 20
$NO_3(N)$	12	1	0.3	0.7 ± 0.2	10	7
Pb	12	< 0.01	< 0.01	< 0.01	0.05	< 20
SO_4^-	12	45	20	34 ± 4	250	14
T.D.S.	12	232	91	146 ± 24	500	29
Zn	12	0.07	< 0.02	< 0.02 ± 0.009	0.1	< 20
F^-	12	0.3	0.1	0.2 ± 0.05	1	20
Hg	12	< 0.001	< 0.001	< 0.001	0.005	< 20
Ni	12	0.04	< 0.01	< 0.01 ± 0.006	0.1	< 10

[a]Tennessee Stream Guidelines.

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AUTHOR(S): MSEA DIVISION,
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MARTIN MARIETTA

ENVIRONMENTAL MONITORING REPORT
UNITED STATES
DEPARTMENT OF ENERGY

OAK RIDGE FACILITIES

Calendar Year 1983

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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Y/UB-19

Date of Issue: June 15, 1984

ENVIRONMENTAL MONITORING REPORT

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE FACILITIES

Calendar Year 1983

MARTIN MARIETTA ENERGY SYSTEMS, INC.

*Work performed prior to April 1, 1984, by Union Carbide Corporation Nuclear Division for the U. S. Department of Energy under Contract W-7405-eng-26.

Environment, Safety, and Health
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Air monitoring data for fluorides, suspended particulates, and sulfur dioxide are presented in Tables 8 through 10. The data indicate that measured environmental concentrations of fluorides, and sulfur dioxide were in compliance with applicable standards.[2] However, suspended particulates at the Y-12 Plant have exceeded applicable standards. Baghouses are being installed on the Y-12 steam plant to correct this problem under a Federal Facilities Compliance Agreement between the Department of Energy and Environmental Protection Agency which was signed in April 1982. The compliance agreement schedule calls for completion of the project in December of 1985.

External Gamma Radiation Monitoring

External gamma radiation background measurements are made routinely at the perimeter air monitoring stations and at the remote monitoring stations using calcium fluoride thermoluminescent dosimeters suspended one meter above the ground. Two dosimeters are placed in each container at each site. Dosimeters at the perimeter stations are collected and analyzed monthly, whereas those at the remote stations are collected and analyzed semiannually.

Data on the average external gamma radiation background are given in Table 11. A considerable variation in background levels is normally experienced in East Tennessee depending upon elevation, topography, and geological character of the surrounding soil.[3]

External gamma radiation background measurements were performed along the stream course of East Fork Poplar Creek to evaluate potential external exposure from radioactivity which may be contained in the sediments as a result of effluent releases. Additionally, measurements were made along the bank of the Clinch River from the mouth of White Oak Creek several hundred yards downstream to evaluate gamma radiation levels resulting from effluent releases and "sky shine" from an experimental cesium plot located near the river bank. Measurements were made with thermoluminescent dosimeters suspended one meter above the ground surface and/or with handheld scintillation detectors. The average background level determined at the remote stations was subtracted from the measured gamma radiation levels to determine the incremental increases resulting from plant operations.

Gamma radiation levels along East Fork Poplar Creek ranged from 0.6 to 8.2 μR/h (0.2 E-09 to 2.1 E-09 C/kg/h) above background. The external gamma radiation levels along the bank of the Clinch River ranged from 5 to 30 μR/h (1.3 E-09 to 7.7 E-09 C/kg/h) above background. Potential doses to individuals in the environment from these elevated gamma radiation levels were calculated and are included, where significant, in the dose assessment section of the report.

Water Monitoring

Radioactive - Water samples are collected in the Clinch River for radioactivity analyses at Melton Hill Dam (Station C-2) 3.7 kilometers above White Oak Creek outfall, at the ORGDP sanitary water intake (Station C-3) 10 kilometers downstream from the entry of White Oak Creek, at the ORGDP recirculating water intake (Station C-4) downstream from the Poplar Creek outfall, and near Brashear Island (Station C-6). A sample is also collected from the Water Plant (Station C-5) near Kingston, Tennessee, Figure 4. Samples are collected continuously at Stations C-2, and C-3. A weekly 24-hour composite sample is collected at Station C-4 and a weekly grab sample is collected at Station C-6. A daily grab sample is collected at Station C-5. Samples are composited for monthly or quarterly analysis depending upon location.

Water samples also are collected for radioactivity analyses at the mouth of White Oak Creek (Station W-1), at the outlet of New Hope Pond on East Fork Poplar Creek (Station E-1), in Bear Creek (Station B-1), and in Poplar Creek (Stations P-1 and P-2), Figure 4. The samples collected

ORNL-DWG 77-7445R

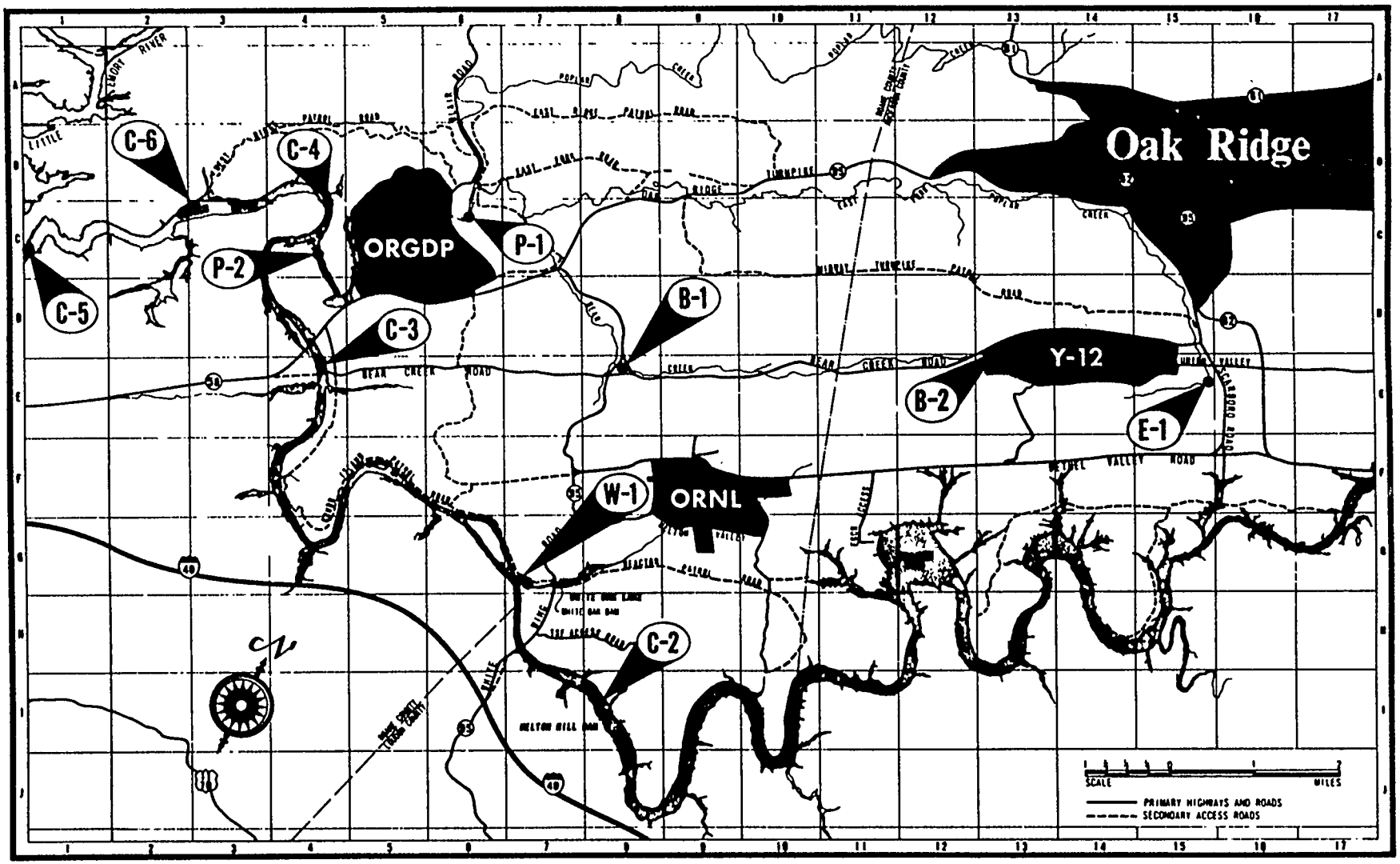

Figure 4
STREAM MONITORING LOCATIONS

at Station W-1 are continuous samples. Flow proportional samples are collected at Stations E-1 and B-1. Grab samples are collected at Stations P-1 and P-2 on a weekly basis. Water samples are collected also at White Oak Dam. All samples are composited for monthly analysis.

The concentrations of fission product radionuclides present in detectably significant amounts are determined by specific radionuclide analysis and gamma spectrometry. Uranium analysis is by the fluorometric method. Transuranic alpha emitters are determined by chemical chromatography and alpha spectrometry. The concentration of each radionuclide is compared with its respective concentration guide (CG) value as specified in the DOE Order 5480.1A and percent of concentration guide for a known mixture of radionuclides is calculated in accordance with the method given in the Order.

Data on the concentrations of radionuclides measured in the surface streams are given in Table 12. Data on the concentrations of uranium in surface streams and the quantities of radioactivity release to surface streams are given in Tables 13 and 14.

Analysis of water samples collected in the mouth of White Oak Creek (Station W-1) indicated that the yearly average concentration of radionuclides was approximately 22 percent of the applicable concentration guide for uncontrolled areas. The calculated average concentration of radionuclides in the Clinch River was determined to be 0.4 percent of the applicable concentration guide for uncontrolled areas. This value represents the yearly average of calculated monthly values based on the analysis of weekly water samples collected at White Oak Dam and the monthly dilution afforded by the river, assuming complete mixing. The measured average concentrations of radionuclides in the Clinch River upstream and downstream of White Oak Creek outfall were less than one percent of the applicable concentration guide.

The calculated average concentration of transuranic alpha emitters in the Clinch River resulting from effluent releases was 1.4 E-11 μCi/mL (0.53 mBq/L), which is about 0.05 percent of the concentration guide for water containing a known mixture of radionuclides.

Trends in water discharges and calculated percent concentration guide levels in the Clinch River are presented in Figures 5 and 6. Discharges of ^{90}Sr and ^{3}H are shown in Figure 5 as these nuclides contribute the majority of the radiological dose downstream.

The curies of ^{3}H discharged from White Oak Dam remained about the same as for 1982 and the curies of ^{90}Sr decreased slightly. Most of the discharges are due to seepage from waste disposal areas and not from current operations. The annual variation in discharges from White Oak Dam is primarily a function of the variation in annual precipitation patterns. The calculated percent of the concentration guide for the Clinch River increased slightly from 1982 and is mostly the result of the decrease in the ratio of the Clinch River flow to the White Oak Creek flow (dilution factor).

Rainwater - The gross beta activity in rainwater was analyzed; the results are shown in Table 15. The fluctuations among the stations for both the perimeter and remote networks are due to statistical random variation. It is noted that the average radioactivity is greater for the remote stations than the perimeter stations.

Nonradioactive - Water samples are collected for the analysis of nonradioactive substances at the same locations discussed previously under radioactive water sampling. All samples are composited for monthly analysis. The Y-12 Plant also collects weekly grab samples from Station E-1 for mercury analysis. In late June, the frequency of sampling for mercury was increased to daily sampling during regular working days. In June 1983, a program to collect weekly grab samples at Station B-2, Figure 4, was initiated. Station B-2 is located near the head waters of Bear Creek

where the groundwater is influenced by the S-3 Ponds discharges into the creek. Samples are analyzed for a variety of water quality parameters related to process release potential and background information needs by analytical procedures recommended by the Environmental Protection Agency.[4]

Data on chemical concentrations in surface streams are given in Tables 16 through 24. The average concentrations of all substances analyzed were in compliance with the latest Tennessee Water Quality Criteria[5] for fish and aquatic life except for cadmium, copper, fluoride, lead, mercury, and zinc.

In many cases, the current State of Tennessee Water Quality Criteria are significantly lower than the Tennessee Stream Guidelines used in earlier reports. EPA-approved analytical procedures are used to determine the concentration of the parameters specified by the State; however, the EPA analytical procedures are not sufficiently sensitive to determine compliance with the State criteria. As a result, a number of the parameters appear to be seriously out of compliance. An example of such a condition is the concentration of cadmium in the Clinch River which is reported to be less than 8,000 percent of the State standard. The actual concentration is not known, but is probably considerably closer to the State criteria than is indicated.

Figure 7 shows the concentration of mercury in East Fork Poplar Creek on a weekly basis. The data points from July on reflect the average of the daily samples. The high concentration of mercury starting in week 22 reflects a clean-up activity in the storm drain system in which some mercury contaminated sediments that were being removed from the drain system were stirred up and released. The peak at week 25 is the result of a water main break in the Alpha 4 Building which caused a significant release of mercury contaminated "dirt" from the basement of the building. Subsequently higher concentrations reflect an equilibrium upset resulting from this leak, clean-up, and other plant activities.

In September a marked beneficial change was noted in the waters collected from B-2. The pH of the water went from acidic to neutral and dissolved metallic ions were reduced sharply, Figures 8 and 9. This change may be the result of the neutralization and treatment of the S-3 Ponds, showing that when the ponds were neutralized there was a positive impact on the quality of groundwater.

National Pollution Discharge Elimination System (NPDES) permits were issued by the Environmental Protection Agency (EPA) for each of the Oak Ridge facilities operated by Union Carbide Corporation - Nuclear Division in 1975. The permits established a number of discharge locations at each installation and listed specific concentration limits and/or monitoring requirements for a number of parameters at each discharge location. Table 25 shows the discharge locations at each installation, the parameters at each location for which limits have been established, the permit limits for each parameter, and the percentage compliance experienced. A new permit for ORGDP was drafted in late 1983 and will be finalized in early 1984. Permits for the other plants will be drafted in the near future. Release limits will be more restrictive and a number of permit points will probably be added.

Biological Monitoring

Milk - Raw milk is monitored for ^{131}I and ^{90}Sr by the collection and analysis of samples from ten sampling stations located within a radius of 80 kilometers of Oak Ridge. Samples normally have been collected weekly at each of six stations located near the Oak Ridge area. Sampling at one station, number 5, was terminated in late 1982 because the owner of the dairy herd died and milk was no longer available at that location. Samples are now collected at five stations near the Oak

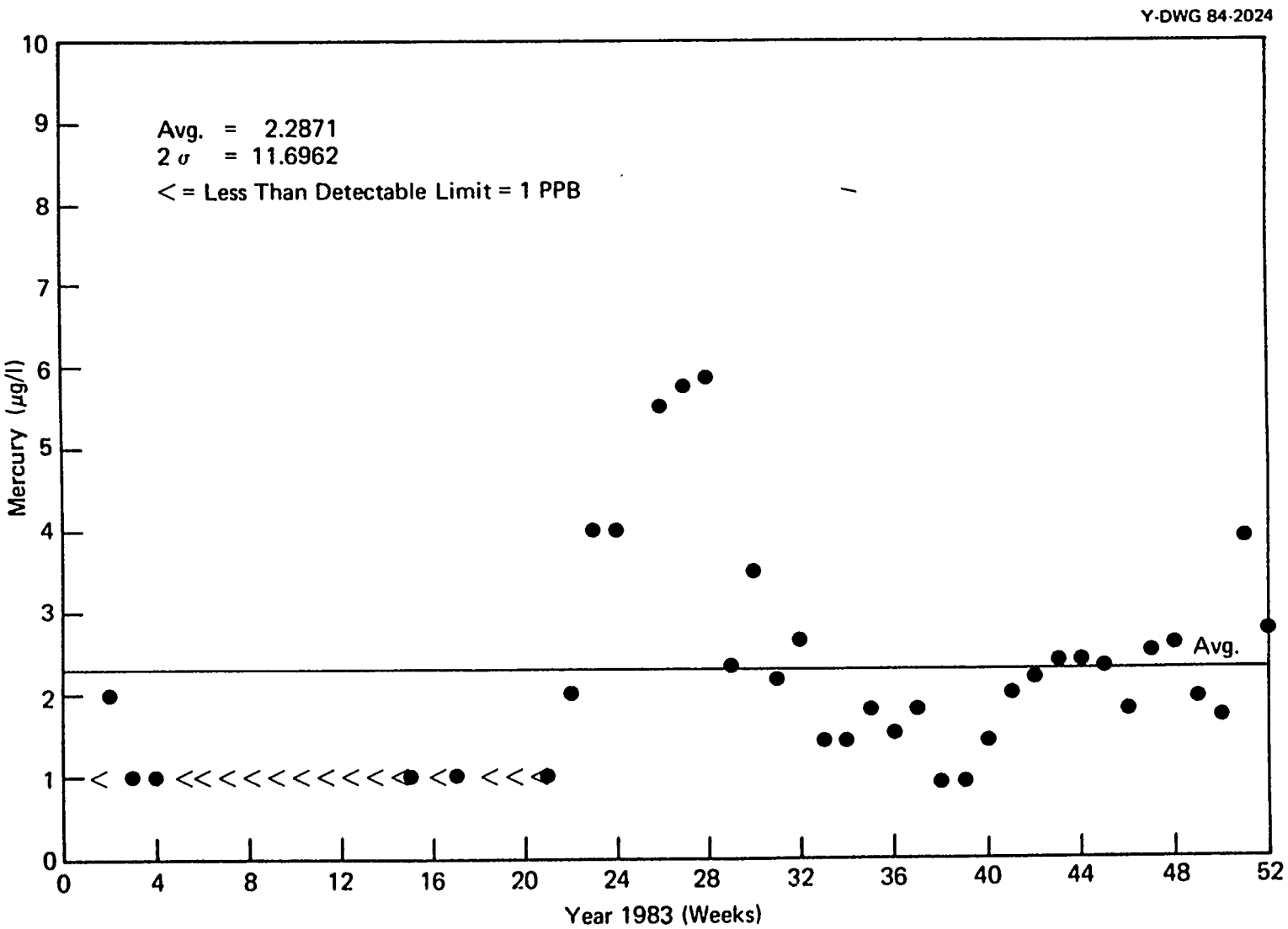

Figure 7
MERCURY CONCENTRATION IN WATER - NEW HOPE POND OUTLET

Table 16
CHEMICAL WATER QUALITY DATA - WHITE OAK DAM
(Location W-1, Figure 4)
1983

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cr	11	0.030	< 0.020	< 0.021 ± 0.002	0.05	< 42
Zn	10	0.070	< 0.020	< 0.038 ± 0.0051	0.05	< 76
$NO_3(N)$	8	13	2.7	6.6 ± 1.2	10	66
Hg	11	< 0.001	< 0.001	< 0.001	0.00005[b]	< 2000

[a]Tennessee Water Quality Criteria for Fish and Aquatic Life. Assumed Hardness = 100 mg/L as $CaCO_3$.

[b]Current EPA Water Quality Criteria for Fish and Aquatic Life (FR August 13, 1981) is 0.0002 mg/L 24 hour average and 0.0041 mg/L maximum.

Table 17
CHEMICAL WATER QUALITY DATA - MELTON HILL DAM
(Location C-2, Figure 4)
1983

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cr	8	< 0.02	< 0.020	< 0.02	0.05	< 40
Zn	8	0.04	< 0.020	< 0.022 ± 0.005	0.05	< 44
$NO_3(N)$	6	2.20	< 0.010	< 1.5 ± 0.63	10	< 15
Hg	9	< 0.001	< 0.001	< 0.001	0.00005[b]	< 2000

[a]Tennessee Water Quality Criteria for Fish and Aquatic Life. Assumed Hardness = 100 mg/L as $CaCO_3$.

[b]Current EPA Water Quality Criteria for Fish and Aquatic Life (FR August 13, 1981) is 0.0002 mg/L 24 hour average and 0.0041 mg/L maximum.

Table 18
CHEMICAL WATER QUALITY DATA - ORGDP SANITARY WATER PUMPING STATION
(Location C-3, Figure 4)
1983

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.000025[b]	< 8000
Cr	12	0.037	< 0.010	< 0.012 ± 0.005	0.05	< 24
CN	12	< 0.002	< 0.002	< 0.002	0.005	< 40
$NO_3(N)$	12	1.8	0.19	0.55 ± 0.26	10	6
Pb	12	< 0.010	< 0.010	< 0.010	0.0038[b]	< 263
$SO_4^=$	11	30	13	20 ± 3	250	8
T.D.S.	11	169	135	151 ± 8	500	30
Zn	12	0.13	< 0.020	< 0.050 ± 0.023	0.05[b]	< 100
F^-	12	0.30	< 0.10	< 0.14 ± 0.04	1	< 14
Hg	12	< 0.001	< 0.001	< 0.001	0.00005[c]	< 2000
Ni	12	0.030	< 0.010	< 0.015 ± 0.005	0.1	< 15

[a]Tennessee Water Quality Criteria for Fish and Aquatic Life. Assumed Hardness = 100 mg/L as $CaCO_3$.

[b]Monthly Average (Daily Maximum is Cd 0.003 mg/L, Pb 0.17 mg/L, Zn 0.32 mg/L).

[c]Current EPA Water Quality Criteria for Fish and Aquatic Life (FR August 13, 1981) is 0.0002 mg/L 24 hour average and 0.0041 mg/L maximum.

Table 19
CHEMICAL WATER QUALITY DATA - ORGDP RECIRCULATING WATER PUMPING STATION
(Location C-4, Figure 4)
1983

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.000025[b]	< 8000
Cr	12	0.030	< 0.010	< 0.012 ± 0.003	0.05	< 24
CN	12	0.003	< 0.002	< 0.002 ± 0.0002	0.005	< 40
$NO_3(N)$	12	1.8	0.28	0.52 ± 0.26	10	5
Pb	12	< 0.010	< 0.010	< 0.010	0.0038[b]	< 263
$SO_4^=$	12	27	12	22 ± 3	250	9
T.D.S.	11	181	91	148 ± 20	500	30
Zn	12	0.080	< 0.020	< 0.035 ± 0.010	0.05[b]	< 70
F^-	12	0.30	< 0.010	< 0.14 ± 0.04	1	< 14
Hg	12	< 0.001	< 0.001	< 0.001	0.00005[c]	< 2000
Ni	12	0.031	< 0.010	< 0.012 ± 0.003	0.1	< 12

[a]Tennessee Water Quality Criteria for Fish and Aquatic Life. Assumed Hardness = 100 mg/L as $CaCO_3$.

[b]Monthly Average (Daily Maximum is Cd 0.003 mg/L, Pb 0.17 mg/L, Zn 0.32 mg/L).

[c]Current EPA Water Quality Criteria for Fish and Aquatic Life (FR August 13, 1981) is 0.0002 mg/L 24 hour average and 0.0041 mg/L maximum.

Table 20
CHEMICAL WATER QUALITY DATA - CLINCH RIVER DOWNSTREAM OF ORGDP
(Location C-6, Figure 4)
1983

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.000025[b]	< 8000
Cr	12	< 0.01	< 0.01	< 0.01	0.05	< 20
CN	12	< 0.002	< 0.002	< 0.002	0.005	< 40
$NO_3(N)$	12	1.6	0.2	0.47 ± 0.24	10	5
Pb	12	0.03	< 0.01	< 0.012 ± 0.0039	0.0038[b]	< 316
SO_4^-	12	36	15	23 ± 3.7	250	9
T.D.S.	12	176	105	146 ± 16	500	29
Zn	12	0.03	< 0.02	< 0.02 ± 0.001	0.05[b]	< 40
F^-	12	0.30	< 0.1	< 0.15 ± 0.05	1.0	< 15
Hg	12	< 0.001	< 0.001	< 0.001	0.00005[c]	< 2000
Ni	12	0.03	< 0.01	< 0.012 ± 0.003	0.1	< 12

[a]Tennessee Water Quality Criteria for Fish and Aquatic Life. Assumed Hardness = 100 mg/L as $CaCO_3$.

[b]Monthly Average (Daily Maximum is Cd 0.003 mg/L, Pb 0.17 mg/L, Zn 0.32 mg/L).

[c]Current EPA Water Quality Criteria for Fish and Aquatic Life (FR August 13, 1981) is 0.0002 mg/L 24 hour average and 0.0041 mg/L maximum.

Table 21
CHEMICAL WATER QUALITY DATA - EAST FORK POPLAR CREEK
(Location E-1, Figure 4)
1983

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.000025[b]	< 8000
Cl^-	12	21	14	16 ± 6	250	6
Cr	12	0.01	< 0.01	< 0.01	0.05	< 20
Cu	12	0.014	< 0.005	< 0.010 ± 0.018	0.02	< 50
F^-	12	1.2	0.7	1.0 ± 2.2	1	100
$NO_3(N)$	12	6.0	1.9	3.5 ± 2.2	10	35
Pb	12	< 0.01	< 0.01	< 0.01	0.0038[b]	< 263
$SO_4^=$	12	67	34	47 ± 22	250	19
T.D.S.	12	270	160	230 ± 58	500	46
Zn	12	0.07	< 0.02	< 0.03 ± 0.04	0.05[b]	< 60
Hg	52	0.025	< 0.001	< 0.002 ± 0.012	0.00005[c]	< 4000

[a]Tennessee Water Quality Criteria for Fish and Aquatic Life. Assumed Hardness = 100 mg/L as $CaCO_3$

[b]Monthly Average (Daily maximum is Cd 0.003 mg/L, Pb 0.17 mg/L, Zn 0.32 mg/L).

[c]Current EPA Water Quality Criteria for Fish and Aquatic Life (FR August 13, 1981) is 0.0002 mg/L 24 hour average and 0.0041 mg/L maximum.

Table 22
CHEMICAL WATER QUALITY DATA - BEAR CREEK
(Location B-1, Figure 4)
1983

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	0.002	< 0.002	< 0.002	0.000025[b]	< 8000
Cl^-	12	20	2	8 ± 14	250	3
Cr	12	0.08	< 0.01	< 0.01 ± 0.04	0.05	< 20
Cu	12	1.10	0.012	0.13 ± 0.62	0.02	650
F^-	12	0.3	< 0.1	< 0.2 ± 0.2	1	< 20
Hg	12	< 0.001	< 0.001	< 0.001	0.00005[c]	< 2000
$NO_3(N)$	12	37	0.8	12 ± 22	10	120
Pb	12	0.07	< 0.01	< 0.01 ± 0.04	0.0038[b]	< 263
$SO_4^=$	12	31	< 10	< 13 ± 16	250	< 5
TDS	12	370	140	237 ± 176	500	47
Zn	12	0.06	< 0.02	< 0.03 ± 0.04	0.05[b]	< 60

[a]Tennessee Water Quality Criteria for Fish and Aquatic Life. Assumed hardness = 100 mg/L as $CaCO_3$.

[b]Monthly Average (Daily Maximum is Cd 0.003 mg/L, Pb 0.17 mg/L, Zn 0.32 mg/L).

[c]Current EPA Water Quality Criteria for Fish and Aquatic Life (FR August 13, 1981) is 0.0002 mg/L 24 hour average and 0.0041 mg/L maximum.

Table 23
CHEMICAL WATER QUALITY DATA - POPLAR CREEK ABOVE BLAIR BRIDGE
(Location P-1, Figure 4)
1983

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	0.004	< 0.002	< 0.002 ± 0.0004	0.000025[b]	< 8000
Cr	12	< 0.010	< 0.010	< 0.010	0.05	< 20
CN	12	< 0.002	< 0.002	< 0.002	0.005	< 40
$NO_3(N)$	12	4.9	0.3	1.3 ± 0.8	10	13
Pb	12	< 0.010	< 0.010	< 0.010	0.0038[b]	< 263
$SO_4^=$	12	54	27	39 ± 6	250	16
T.D.S.	12	251	87	167 ± 36	500	33
Zn	12	0.040	< 0.020	< 0.022 ± 0.004	0.05[b]	< 44
F^-	12	0.90	< 0.10	< 0.33 ± 0.18	1	< 33
Hg	12	< 0.001	< 0.001	< 0.001	0.00005[c]	< 2000
Ni	12	0.17	< 0.010	< 0.011 ± 0.001	0.1	< 11

[a]Tennessee Water Quality Criteria for Fish and Aquatic Life. Assumed hardness = 100 mg/L as $CaCO_3$.

[b]Monthly Average (Daily Maximum is Cd 0.003 mg/L, Pb 0.17 mg/L, Zn 0.32 mg/L).

[c]Current EPA Water Quality Criteria for Fish and Aquatic Life (FR August 13, 1981) is 0.0002 mg/L 24 hour average and 0.0041 mg/L maximum.

Table 24
CHEMICAL WATER QUALITY DATA - POPLAR CREEK NEAR CLINCH RIVER
(Location P-2, Figure 4)
1983

SUBSTANCE	NUMBER OF SAMPLES	CONCENTRATION, mg/L				% STD.
		MAXIMUM	MINIMUM	AVERAGE	STD.[a]	
Cd	12	< 0.002	< 0.002	< 0.002	0.000025[b]	< 8000
Cr	12	0.029	< 0.010	< 0.012 ± 0.003	0.05	< 24
CN	12	< 0.002	< 0.002	< 0.002	0.005	< 40
$NO_3(N)$	12	1.9	0.30	0.71 ± 0.28	10	7
Pb	12	0.020	< 0.010	< 0.011 ± 0.001	0.0038[b]	< 289
$SO_4^{=}$	12	60	20	32 ± 7	250	13
T.D.S.	11	238	96	163 ± 25	500	33
Zn	12	0.024	< 0.02	< 0.020 ± 0.007	0.05[b]	< 40
F^-	12	0.50	< 0.10	< 0.26 ± 0.08	1	< 26
Hg	12	0.003	< 0.001	< 0.001 ± 0.0004	0.00005[c]	< 2000
Ni	12	0.034	< 0.010	< 0.012 ± 0.004	0.1	< 12

[a]Tennessee Water Quality Criteria for Fish and Aquatic Life. Assumed hardness = 100 mg/L as $CaCO_3$.

[b]Monthly Average (Daily Maximum is Cd 0.003 mg/L, Pb 0.17 mg/L, Zn 0.32 mg/L).

[c]Current EPA Water Quality Criteria for Fish and Aquatic Life (FR August 13, 1981) is 0.0002 mg/L 24 hour average and 0.0041 mg/L maximum.

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VOLUME 1: NARRATIVE, SUMMARY, AND CONCLUSIONS

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ENVIRONMENTAL SURVEILLANCE OF THE U.S. DEPARTMENT OF ENERGY OAK RIDGE RESERVATION AND SURROUNDING ENVIRONS DURING 1987

Volume 1: NARRATIVE, SUMMARY, AND CONCLUSIONS

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dams causes scouring of the river channel (e.g., downstream from Melton Hill Dam) where bedrock is exposed on the river bed (Loar 1981). In the vicinity of the ORR, temperature increases are ameliorated by the practice of releasing cold bottom water from Norris Dam and thus maintaining cool water temperatures in Melton Hill Reservoir (Loar 1981).

Several institutions routinely monitor water quality in the Clinch River. Both the TVA and the U.S. Geological Survey (USGS) monitor water quality just below Melton Hill Dam. The Tennessee Department of Health and Environment (TDHE) maintains a monitoring station at Clinch River kilometer (CRK) 16.3, 3.2 km below the mouth of Poplar Creek and the Oak Ridge Gaseous Diffusion Plant (ORGDP).

Water quality, radioactivity, and flow measurements are made at a number of stations operated by Energy Systems for the Department of Energy (DOE). Water samples are collected and analyzed at various intervals (weekly, monthly, etc.) for radiological and nonradiological content.

Fission product radionuclide concentrations are determined by specific radionuclide analysis and gamma spectrometry. Uranium analysis is done by the fluorometric method or mass spectrometry. Transuranic alpha emitters are determined by radiochemical separation and alpha spectrometry.

Water samples are collected for analyses of nonradioactive substances at many locations both on and off the ORR. Concentrations of chemicals in streams and creeks on or around the ORR are then compared with Tennessee's in-stream allowable concentrations, which are based on the long-term protection of domestic water supply, fish and aquatic life, and recreation classifications and recommendations made by TDHE to DOE–Oak Ridge Operations (ORO). Concentrations of chemicals in the outlet for the ORGDP sanitary water plant are compared with Tennessee water quality criteria for domestic water supplies.

In some cases, the maximum concentrations recommended by TDHE and the Environmental Protection Agency (EPA) are below the detection limit of the most sensitive EPA-approved method.

2.2.1 Surface Water Monitoring

Surveillance of the water environment consists of the collection of surface water samples and samples required under the National Pollutant Discharge Elimination System (NPDES) permit. Samples are analyzed for radionuclides and nonradioactive chemicals.

2.2.1.1 Oak Ridge Y-12 Plant

At the Y-12 Plant, surface water is monitored routinely at two locations that are not required by NPDES permit No. TN0002968. At each of these locations, samples are collected for both radiological and nonradiological parameters.

The first location is at kilometer 12.4 on upper Bear Creek near the S-3 ponds area. As required by the 1983 complaint and order issued by TDHE to the Y-12 Plant, grab samples are collected weekly at this location. Analytical data are reported quarterly to the TDHE as an attachment to the Discharge Monitoring Report (DMR). (A summary of these data is presented in Table 2.2.1.) Comparison of data collected at kilometer 12.4 on upper Bear Creek during 1987 with data collected in 1986 shows a continuation of the improvements in water quality noted since the S-3 ponds were emptied of wastewater in 1986.

Monitoring is also conducted at the influent to New Hope Pond. Most of the samples collected at this location are time-proportional, 24-h composites. Both radiological and nonradiological parameters are analyzed at this location, and data collected are used for a variety of purposes. Samples at the influent to New Hope Pond are collected at the same time as samples from the effluent of the pond to help determine the effectiveness of the pond in improving the quality of water in East Fork Poplar Creek as well as monitoring the effectiveness of Y-12 Plant's area source control activities. Data from these locations indicate that New Hope Pond does act as a sink for contaminants, thus reducing the quantities of contaminants leaving the site. The data are also used to determine the most effective manner in which to close New Hope Pond under the Resource Conservation and Recovery Act (RCRA). (Summaries of the

Table 2.2.1. 1987 annual summary for Upper Bear Creek

Parameter	Concentration[a]		
	Max	Min	Av
Hg	0.0020	<0.0002	<0.0004
Alpha (pCi/L)	1000.0	6.7	496.5
^{241}Am (pCi/L)	<6.80	<0.10	<1.53
Beta (pCi/L)	2000.0	9.3	776.1
^{237}Np (pCi/L)	18.00	0.23	<2.43
^{238}Pu (pCi/L)	<2.70	<0.03	<0.70
$^{239/240}$Pu (pCi/L)	<1.80	<0.03	<0.30
^{99}Tc (pCi/mL)	<40.00	<0.03	<1.50
^{235}U (pCi/L)	40.00	<0.58	<11.17
^{235}U (%)	5.44	0.21	0.50
U	1.690	0.019	0.969
CN	0.120	<0.002	<0.013
F	1.1	0.5	0.8
Nitrate-nitrogen	600.0	6.6	198.0
Dissolved oxygen	12.0	2.8	6.8
pH (units)	7.5	6.8	7.2
Phenols	0.140	<0.001	<0.004
TDS	4100	290	2003
TSS	100	0.5	<10
Chloroform (μg/L)	80	<10	<10
Methylene chloride (μg/L)	48	<10	<10
Perchloroethylene (μg/L)	<10	<10	<10
Trichloroethane (μg/L)	<10	<10	<10
Trichloroethylene (μg/L)	<10	<10	<10
PCB	0.0006	<0.0005	<0.0005
Aluminum	20.60	<0.01	<1.01
Arsenic	<0.04	<0.04	<0.04
Barium	0.1950	0.0275	0.0764
Beryllium	0.0010	<0.0001	<0.0002
Boron	0.1700	0.0350	0.1088
Cadmium	0.017	<0.003	<0.006
Calcium	680.0	59.8	352.4
Cerium	0.03	<0.02	<0.02
Chromium	0.014	<0.006	<0.006
Cobalt	0.008	<0.002	<0.002
Copper	0.025	<0.002	<0.004
Gallium	0.02	<0.01	<0.01
Iron	11.70	<0.02	<0.57
Lanthanum	0.003	<0.003	<0.003
Lead	0.02	<0.02	<0.02
Lithium	0.060	0.011	0.021
Magnesium	130.0	8.2	60.8
Manganese	5.400	0.139	1.918
Molybdenum	<0.006	<0.006	<0.006
Nickel	0.029	<0.007	<0.008
Niobium	<0.06	<0.01	<0.01
Phosphorus	0.30	<0.06	<0.07
Potassium	21.2	3.6	9.2

Table 2.2.1. (continued)

Parameter	Concentration[a]		
	Max	Min	Av
Scandium	0.0033	<0.0004	<0.0005
Silver	0.006	<0.004	<0.004
Sodium	179.0	29.2	82.5
Strontium	1.570	0.148	0.886
Thorium	<0.01	<0.01	<0.01
Titanium	0.119	<0.002	<0.009
Vanadium	0.018	<0.004	<0.004
Zinc	0.097	<0.001	<0.009
Zirconium	0.006	<0.002	<0.002

[a]Units are in mg/L unless noted otherwise.

influent data are presented in Tables 2.2.2 and 2.2.3.)

The Y-12 Plant sanitary sewage system discharges to the City of Oak Ridge west end sewage treatment facility through two sewer lines. These discharges are monitored as required in the industrial users' permit No. 001 issued to the Y-12 Plant in final form on December 16, 1987. Before issuance of this permit, monitoring was conducted in accordance with a draft permit issued in February 1986. These data are summarized in Tables 2.2.4 and 2.2.5.

2.2.1.2 Oak Ridge National Laboratory

The ORNL site is drained by two main streams, White Oak Creek (WOC) and Melton Branch. With the exception of two small discharges from the 7600 area to Melton Hill Lake, all ORNL effluents discharge to these two main streams or their tributaries. WOC flows through Bethel Valley, where Fifth Creek, First Creek, and Northwest Tributary enter it. WOC continues through a gap in Haw Ridge into Melton Valley, and is joined there by Melton Branch, which drains Melton Valley. WOC then continues to White Oak Lake, which is controlled by White Oak Dam (WOD) and is the last monitoring/sampling point before effluents leave the ORNL site. Below WOD, WOC is affected by water levels in the Clinch River that are controlled by Melton Hill Dam (see Fig. 2.2.1).

The Clinch River flows southwest from Virginia to its mouth near Kingston, Tennessee, where it joins the Tennessee River. Major discharges to WOC include (1) treated domestic (sanitary) waste from the sewage treatment plant (STP); (2) cooling tower blowdown; (3) cooling water from various sources; (4) surface drainage from the main ORNL area, including drainage from solid waste storage areas (SWSAs) 3, 4, 6, and 7 and the pits and trenches process; (5) discharges from waste collection (190 pond area) and the process waste treatment plant (PWTP) (3544); and (6) discharges from process building areas. Major discharges to Melton Branch include those from SWSA 5, blowdown from the recirculating cooling water system at the High Flux Isotope Reactor (HFIR), and discharges from the 7900 waste pond system.

Radiological description

ORNL does not perform any nonradiological sampling of surface waters other than that specified in the NPDES permit (see Sect. 2.2.2). This section is limited to a discussion of radiological sampling performed by ORNL.

Off-site streams/discharges. Treated water samples are collected weekly at the Kingston and ORGDP (Gallaher) potable water treatment plants and are analyzed quarterly for radionuclides (see Fig. 2.2.2). For comparison, samples were collected daily from the ORNL potable water system (tap water) in Building

Table 2.2.3. 1987 annual summary for New Hope Pond influent nonradiological data

Parameter	Concentration (mg/L)		
	Max	Min	Av
Mercury	0.22	0.0005	0.0082
Selenium	<0.002	<0.002	0.002
Ammonia	2.1	<0.4	<0.5
BOD	9	<5	<5
COD	35	4.6	<11
Chloride	300	<2	<23
Cyanide	0.113	<0.002	<0.025
Fluoride	11	0.7	1.0
Nitrate	8	1.8	3.1
TOC	250	<2	<6
TDS	670	120	250
TSS	170	<5	<9
Sulfate	110	21	55
Aluminum	4.64	0.09	0.59
Arsenic	<0.04	<0.04	<0.04
Barium	0.468	0.039	0.053
Beryllium	0.0002	<0.0001	<0.0001
Boron	0.067	<0.015	<0.022
Cadmium	<0.003	<0.003	<0.003
Calcium	64.1	38.9	48.0
Cerium	<0.02	<0.02	<0.02
Chromium	0.026	<0.006	<0.007
Cobalt	0.004	<0.002	<0.002
Copper	0.029	0.005	0.012
Gallium	<0.01	<0.01	<0.01
Iron	8.18	0.07	0.77
Lanthanum	<0.003	<0.003	<0.003
Lead	0.02	<0.02	<0.02
Lithium	0.392	0.007	0.025
Magnesium	15.1	9.02	11.6
Manganese	0.229	0.032	0.080
Molybdenum	0.338	0.055	0.162
Nickel	0.36	<0.007	<0.009
Niobium	<0.01	<0.01	<0.01
Phosphorus	0.74	0.2	0.41
Potassium	3.4	1.4	2.1
Scandium	0.0011	<0.0004	<0.0004
Silver	<0.004	<0.004	<0.004
Sodium	148	7	17
Strontium	0.259	0.107	0.131
Thorium	<0.01	<0.01	<0.01
Titanium	0.058	<0.002	<0.006
Vanadium	0.011	<0.004	<0.005
Zinc	0.246	0.043	0.094
Zirconium	0.004	<0.002	<0.002

from the waste paper. The recycle of the paper would also conserve valuable land in the landfill, reduce security concerns because the landfill is located outside the plant's secured area, and reduce the amounts of biodegradable material put into the landfill. The 10 tons of paper has a heating value of 7 tons of coal, which means that the purchased amount of coal would decrease.

Commercially available pilot plant equipment was leased and pilot plant tests were completed. Pellets were produced having compressive strengths similar to coal and heat values about the same as coal. A report on the development of the process is being prepared.

The equipment and binder costs are higher than desired for the process. A second phase of the program is planned in which the paper would be chopped, shredded, and pulped to eliminate security concerns. The pulped paper would be analyzed to detect any radioactive material present. A test program involving several buildings in the plant is expected to begin in the near future. During the test, paper will be collected from offices and the test will determine the effectiveness of sorting using administrative control measures. Evaluation of different types of chopping and shredding equipment will be a part of this test. If the test is successful, substantial cost reduction would occur because of the elimination of the binder costs and labor required to form the pellets. Commercial sale of the pulped and baled waste paper would produce the same benefits as those obtained by incineration in an existing steam plant.

Reduction of Mercury in Plant Effluents X

The goal of this project was to reduce the quantity of mercury leaving the Y-12 Plant and entering EFPC. The sources of mercury are area-wide; however, it is primarily concentrated in the areas surrounding the former lithium isotope separation process equipment (mercury-use areas). This process was in operation between 1955 and 1963 and used mercury as an isotope-concentration media. Even though the process equipment has been drained and some of the equipment removed, a considerable amount of mercury remained trapped inside the building structure and drain lines, the storm sewer system, and in soils where spills and trackout from dismantling operations occurred.

The project involved removing accessible sources of mercury and isolating inaccessible sources, starting in the areas where mercury release was highest. The storm sewer system in the mercury-use areas contained considerable mercury both in its elemental form and in contaminated sediments. These storm sewers were cleaned. Certain storm sewers were relined using the Insituform process. Selection of storm sewers to be relined was based on water flow and the degree of contamination in the line as well as in the surrounding soil. The purpose of the lining was to keep clean water flowing through the sewers from becoming contaminated by contact with mercury in sediments and surrounding soils.

Within former lithium isotope separation buildings, drain lines that were highly contaminated with mercury were replaced. Followup sampling to determine the impact of the project will be done after construction activities in and adjacent to the mercury-use areas are completed. Construction activities disturb the steady-state flow characteristics, thus stifling meaningful comparison of new data with baseline data. CWK

Y-12 Plant Surface Characterization Project CWK ?

The Y-12 Plant Surface Characterization Project was initiated in late 1985, sampling was completed in 1986, and the report with a data base was issued in 1987. The initial concern of this project was the potential for exposure of employees to radioactivity when they are working outdoors. Because the methodology of this assessment involved collecting surface soil samples for radionuclide analysis, the samples were also analyzed for mercury.

Mercury was selected because of its use in years past, its persistence in the Y-12 Plant environment, and the widespread area that is the source of the mercury entering the EFPC. The objectives of the project were to

- characterize the surface environment for radionuclides and mercury,

- locate areas of concern that may require additional investigation or remediation,
- provide reports summarizing results and recommendations of the survey, and
- establish a data base that environmental managers can access to obtain existing environmental data or add new information as it becomes available.

The sampling methodology involved measuring ambient gamma radiation levels and collecting soil samples across the entire installation and surrounding valley from Scarboro Road to the intersection of Bear Creek and Old Bear Creek roads. About 2000 soil samples were collected and analyzed for radionuclides using neutron activation, gamma spectrography, and mass spectrography on a limited number of samples. Mercury analyses were performed using cold-vapor atomic absorption.

The limited nature and extent of the radionuclide contamination in the Y-12 Plant should not, under present conditions, pose any health hazard to personnel or others who may come into contact with residuals. The radionuclide contaminants are not present in large amounts, nor are they in a form that may lead to significant redistribution or migration in the environment.

Mercury contamination in soils followed use patterns. It was found in the areas surrounding former lithium isotope separation facilities and staging areas where decommissioned equipment was located. Some elevated mercury concentrations were found in the floodplains along the creek and at New Hope Pond. No large amounts of mercury were found, nor is it likely that mercury will be redistributed by natural means.

Y-12 Plant Airborne Mercury Monitoring Program — IVD

During 1987, the Y-12 Plant continued and expanded the on-site airborne (ambient) mercury monitoring program begun in July 1986. This program has been established to provide a historical data base on mercury concentrations in ambient air and to demonstrate protection of the environment and human health from releases of mercury to the atmosphere. Airborne mercury primarily results from vaporization of mercury in soils, burning of coal in the steam plant, and fugitive exhaust from Building 9201-4, a former lithium isotope separation facility that is contaminated with mercury.

The Y-12 Plant established four ambient mercury sampling stations in 1986 and added an additional site in August 1987. Sampling locations include ambient air stations Nos. 2 and 8 on the east and west ends of the plant, two portable stations near Building 9201-4 and the steam plant, and a station at New Hope Pond. Airborne mercury is collected by pulling ambient air through a Teflon filter followed by a flow-limiting orifice and an iodated charcoal sampling tube. Particulate mercury is collected on the Teflon filter for 28 d, and mercury vapor is collected in the charcoal absorber for 7 d. The flow-limiting orifice is used to restrict air flow to approximately 1 L/min.

Mercury collected on the filters and charcoal is analyzed by cold vapor atomic absorption spectrophotometry after digestion in nitric perchloric acid. Average air concentration during the sample collection period is calculated by dividing the total quantity of mercury collected on the charcoal and filter by the total volume (uncorrected to STP) of air sampled.

Table 6.10 shows the maximum, minimum, and average concentrations of airborne mercury at the five sampling locations since installation. The results indicated that on-site airborne (ambient) mercury concentrations are well below the Environmental Protection Agency (EPA) National Emissions Standards for Hazardous Air Pollutants (NESHAP) guideline for mercury in ambient air of 1 $\mu g/m^3$ (30-d av) and the industrial hygiene standard of 50 $\mu g/m^3$. The monitoring site located southwest of Building 9201-4 has usually shown the highest concentrations among the five sites. Concentrations of particulate mercury have consistently been less than 0.001 $\mu g/m^3$ at all stations.

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Volume 2: DATA PRESENTATION

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ENVIRONMENTAL SURVEILLANCE OF THE U.S. DEPARTMENT OF ENERGY OAK RIDGE RESERVATION AND SURROUNDING ENVIRONS DURING 1987

Volume 2: DATA PRESENTATION

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Table 2.2.10. 1987 concentrations at K-901 at 892

Parameter	Concentration (mg/L)		
	Max	Min	Av
Arsenic	<0.005	<0.005	<0.005
Mercury	0.0006	<0.0002	<0.0002
COD	18	<5	<6
Suspended solids	7	2	4
Dissolved solids	208	156	161
pH (units)	8.3	7.6	
Cyanide	0.005	<0.002	<0.003
Ammonia nitrogen	<0.2	<0.2	<0.2
Fluoride	0.19	<0.10	<0.10
Nitrate nitrogen	16.7	0.42	1.80
Sulfate	28	20	20
Chromium	<0.010	<0.010	<0.010
Copper	0.0300	<0.0040	<0.0063
Manganese	0.056	<0.010	<0.032
Nickel	<0.050	<0.050	<0.050
Sodium	6.6	3.9	4.8
Zinc	0.059	<0.020	<0.033
Cadmium	0.003	<0.002	<0.002
Lead	0.004	<0.004	<0.004

Table 2.2.11. 1987 concentrations at Clinch River

Parameter	Concentration (mg/L)		
	Max	Min	Av
Arsenic	<0.005	<0.005	<0.005
Mercury	<0.0002	<0.0002	<0.0002
COD	28	<5	<9
Suspended solids	13	<4	<8
Dissolved solids	216	138	165
pH (units)	8.4	7.6	
Cyanide	0.003	<0.002	<0.002
Ammonia nitrogen	<0.2	<0.2	<0.2
Fluoride	0.5	<0.1	<0.1
Nitrate nitrogen	0.61	0.17	0.40
Sulfate	25	14	21
Chromium	<0.01	<0.01	<0.01
Copper	<0.004	<0.004	<0.004
Manganese	0.074	<0.01	0.02
Nickel	<0.050	<0.050	<0.050
Sodium	5.6	2.6	4.7
Zinc	0.24	<0.02	<0.02
Cadmium	0.003	<0.002	<0.002
Lead	0.025	<0.004	<0.007

Table 2.2.12. 1987 COD concentrations at Mitchell Branch

Location	Concentration (mg/L)		
	Max	Min	Av
Source	44	<5	<16.2
Upstream	17	<5	<7.4
Downstream	25	<5	<7.1

Table 2.2.13. 1987 concentrations at West Fork Poplar Creek

Parameter	Concentration (mg/L)		
	Max	Min	Av
Arsenic	<0.005	<0.005	<0.005
Mercury	<0.0002	<0.0002	<0.0002
COD	11	<5	<7
Suspended solids	29	1	12
Dissolved solids	252	116	186
pH (units)	8.0	7.3	
Cyanide	0.01	<0.002	<0.003
Ammonia nitrogen	<0.2	<0.2	<0.2
Fluoride	0.3	<0.1	<0.2
Nitrate nitrogen	1.3	<0.11	<0.35
Sulfate	80	27	44
Chromium	<0.01	<0.01	<0.01
Copper	<0.004	<0.004	<0.004
Manganese	0.38	<0.010	<0.102
Nickel	<0.050	<0.050	<0.050
Sodium	7.3	2.4	5.2
Zinc	0.054	<0.020	<0.023
Cadmium	<0.002	<0.002	<0.002
Lead	0.014	<0.004	<0.005

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Oak Ridge Reservation Environmental Report for 1988

VOLUME 1: NARRATIVE, SUMMARY, AND CONCLUSIONS

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VOLUME 1: NARRATIVE, SUMMARY, AND CONCLUSIONS

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flow-weighted concentrations for each radionuclide are calculated by dividing the total radionuclide discharge by the total annual flow. The ratio of the flow-weighted concentrations to the DCG for each radionuclide is also given in Table 2.2.10. None of the ratios exceeded 100% of the DCG. The major problem area appears to be tritium activity in Melton Branch, which is being addressed by the RI/FS.

Oak Ridge Gaseous Diffusion Plant

Surface water samples are collected as part of the Clean Water Act (CWA) requirements and DOE orders. Both NPDES and perimeter ambient water sampling locations under ORGDP responsibility are shown in Fig. 2.2.5. Table 2.2.11 lists sampling locations, sample type, the agency requiring the sample, and the NPDES identification number where applicable.

Perimeter monitoring includes both water quality parameters and radionuclides. The purpose is to document ORGDP's impact on the surrounding streams and to differentiate the impact from that of other sites. During 1988, CH2M Hill, Inc., conducted an assessment of the Oak Ridge Reservation's ambient monitoring program. In the 1989–1990 time frame, the sampling program will be revised to address the content of the assessment conducted by CH2M Hill, Inc. The assessment is discussed in Sect. 6.

During 1988, grab samples were collected once a month at the following locations: the Clinch River, K-901 at 892, West Fork Poplar Creek, and Mitchell Branch source. At K-1513, K-716, K-1710, and K-1770, 24-h composite samples were collected once each month. All samples were analyzed for radiological and nonradiological parameters.

Table 2.2.2 in Vol. 2 gives radiological data from the ambient surface water surrounding ORGDP. Figure 2.2.4 gives the sampling locations.

With the exception of plutonium at K-1513, only uranium was above the detection limit in Poplar Creek and the Clinch River. The plutonium percentage is high (25% of DCG) because of one unexplainable high value. The quarterly ORNL data immediately downstream at Gallaher do not reflect this anomaly. The uranium determination was conducted by wet chemistry methods and reduced for presentation as pCi/L. Results indicate that uranium values were elevated in Poplar Creek both above and below ORGDP. Uranium values at West Fork Poplar Creek were not elevated. There was no relative increase in uranium values below ORGDP in Poplar Creek. There was indication of elevated uranium values in the Clinch River samples above ORGDP after the confluence of Poplar Creek. ORGDP does not appear to contribute to any elevated uranium concentrations in Clinch River and Poplar Creek.

Data indicate that both gross alpha and gross beta are sometimes elevated in Mitchell Branch; this is attributed to past practices at the plant site. Remedial investigations are planned to characterize the site conditions and determine appropriate cleanup actions.

2.2.1.2 Nonradiological summary

Y-12 Plant

Nonradiological parameters were also monitored at the non-NPDES Y-12 sites listed in Sect. 2.2.1.1 and illustrated in Fig. 2.2.1. These sites are also described more fully in that section.

A nonradiological parameter summary for kilometer 12.4 on upper Bear Creek can be found in Table 2.2.12. This monitoring was also halted temporarily in early 1988, but the special monitoring that was performed downstream, and discussed in Sect. 6, encompassed the nonradiological parameters as well.

The New Hope Pond influent was monitored for nonradiological parameters daily (Table 2.2.13). There were also real-time monitors for pH and mercury located at this site. The intake for these monitors was moved to the new diversion ditch after closure of the New Hope Pond inlet.

After closure activities began at New Hope Pond, station 17 became the plant's end monitoring point for nonradiological parameters also. Grab samples were obtained here twice per day for mercury, and composite samples were obtained one

Table 2.2.11. ORGDP water monitoring locations

Location	Agency	Type	NPDES ID if applicable
Clinch River (Brashaer Island)	DOE	Perimeter	
West Fork Poplar Creek	DOE	Perimeter	
K-710A (inactive)	TDHE	NPDES	008
K-716	DOE	Perimeter	
K-901 @ 892[a]	DOE	Perimeter	
K-901-A	TDHE	NPDES	007
K-1007-B	TDHE	NPDES	006
K-1203	TDHE	NPDES	005
K-1407-B	TDHE	NPDES	003
K-1407-E and K-1407-F	TDHE	NPDES	010
K-1407-J	TDHE	NPDES	011
K-1513	DOE	Perimeter	
K-1515-C	TDHE	NPDES	009
K-1700	TDHE	NPDES	001
K-1710	DOE	Perimeter	
K-1770	DOE	Perimeter	

[a]The water sample is removed from the transfer pipe at K-892 pumphouse; however, the sample represents water in the Clinch River downstream of ORGDP at K-901.

day per week on a rotating day of the week basis. These results are summarized in Table 2.2.14.

Nonradiological samples are obtained from the two sanitary sewer lines as required by the Industrial User's permit. These results are summarized in Tables 2.2.15 and 2.2.16.

Oak Ridge National Laboratory

At the Y-12 Plant, surface water is monitored routinely at locations that are not required by the plant NPDES permit (TN0002968) (Fig. 2.2.1). At each of these locations, samples are collected for both radiological and nonradiological parameters.

The first location is at kilometer 12.4 (mile 7.7) on upper Bear Creek where the creek first approaches Bear Creek Road. As required by the 1983 complaint and order issued by TDHE to the Y-12 Plant, grab samples are collected weekly at this location. Analytical data are reported quarterly to the TDHE as an attachment to the Discharge Monitoring Report (DMR). (A summary of 1988 data is presented in Table 2.2.1.) Comparison of these data with data collected in 1987 shows a continuation of the improvements in water quality noted since the S-3 ponds were emptied of wastewater in 1986. Some parameters, however, remain substantially elevated above background levels (e.g., NO_3-N, TDS). The S-3 Ponds were backfilled in during 1988, and a multilayered cap is being constructed to continue water quality improvements in this area. Because of construction activities in the S-3 area, sampling on upper Bear Creek was temporarily halted in late 1988; however, sampling has resumed.

Monitoring was conducted at the influent to New Hope Pond through October 1988. Most of the samples collected at this location are time-proportional, 24-h composites. Both radiological and nonradiological parameters are analyzed at this location. See Tables 2.2.2 and 2.2.3 for a summary of 1988 data.

Monitoring is also conducted at station 17 near the junction of Scarboro Road and Bear Creek Road. The samples at this point indicate the quality of the water in EFPC just before it leaves the Y-12 Plant boundary. Most of the samples collected at this location are time-proportional, 24-h composites. Both radiological and nonradiological parameters are analyzed at this location, and data collected are used for a variety

Table 2.2.14. 1988 annual summary for Station 17 influent nonradiological data[a,b]

Parameter	Concentration (mg/L)			Count	Std. error
	Max	Min	Av		
Mercury	0.0037	<0.0002	<0.0019	71	0.0001
Nitrate-N	10.0	3.4	4.3	11	0.6
Total Phosphorus	0.40	0.23	0.34	11	0.016
Copper	0.047	0.005	0.012	11	0.004
Zinc	0.139	0.048	0.080	11	0.007
Chromium	0.013	<0.006	<0.007	11	0.0007
Molybdenum	0.173	0.053	0.128	11	0.011
Lithium	0.451	0.014	0.067	11	0.04
Selenium	0.002	<0.002	<0.002	8	0
Cadmium	0.006	<0.00005	<0.004	11	0.0008
Lead	0.02	<0.001	<0.01	11	0.003
Nickel	0.020	<0.007	<0.011	11	0.001
Calcium	66.9	36.0	56.9	11	3
Magnesium	15.0	7.3	11.3	11	0.6
Sodium	55.3	0.0	23.6	11	5.6
Potassium	3.9	1.8	2.9	11	0.2
Sulfate	1900	74	334	8	223
Chloride	28	20	25	8	0.9
Fluoride	2.00	0.73	1.23	10	0.16
Total suspended solids	90	5	21	11	7.7
Total dissolved solids	440	160	317	11	24.3
Alkanlinity	130	100	116	8	3.2
Total organic carbons	110	7	26	8	12.3
Residual chlorine, total	0.2	<0.1	<0.13	11	0.011
Temperature (°F)	69	15.9	61.7	24	2.07
Ph (units)	8.3	7.3	NA	25	0.05
Dissolved oxygen	9.4	6.2	8.1	7	0.45

[a]Sampling period is Nov–Dec 1988.
[b]Flow during operations and/or discharging.
[c]NA = not applicable.

water to Rogers Quarry. The dewatered bottom ash will also be disposed of in the Sanitary Landfill.

6.1.7 Y-12 Plant Airborne Mercury Monitoring Program

During 1988, the Y-12 Plant continued and again expanded the on-site airborne (ambient) mercury monitoring program begun in July 1986. This program was established to provide a historical data base of mercury concentrations in ambient air and to demonstrate protection of the environment and human health from releases of mercury to the atmosphere. Airborne mercury at the Y-12 Plant primarily results from vaporization of mercury in soils, releases from the burning of coal at the Y-12 steam plant, and fugitive exhaust from Building 9201-4, a former lithium isotope separation facility that is contaminated with mercury.

The Y-12 Plant established four ambient mercury sampling stations in 1986 (a station each on the east and west end of the plant and two stations near Building 9201-4) and added an additional site at New Hope Pond in late August of 1987. During February 1988, a control site was established at rain gage 2 on Chestnut Ridge in the Walker Branch watershed, bringing to six the number of mercury air-monitoring stations in operation during 1988. At each of these stations, airborne mercury is collected by pulling ambient air through a Teflon filter, a flow-limiting orifice, and an iodated-charcoal sampling tube. The flow-limiting orifice restricts air flow through the collection system to approximately 1 L/min (0.035 ft^3/min). The charcoal tubes, which absorb mercury vapor, are changed every 7 d, while Teflon filters for particulate mercury are changed every 28 d. Filters and charcoal tubes are analyzed by cold-vapor atomic absorption after digestion in nitric-perchloric acid.

Average airborne mercury concentration during the sample collection period is calculated by dividing the total quantity of mercury collected on the charcoal and filters by the total volume [uncorrected to standard temperature and pressure (STP)] of air sampled during the sampling period. In 1988, hourmeters were installed in line with the air sampling pumps to record the number of hours of actual pump-operating time, thus allowing for a more accurate determination of air volume sampled in case of pump downtime because of power outages.

Table 6.1.3 shows the maximum, minimum, and average concentrations of airborne mercury recorded during 1988 for the six sampling stations. The results indicate that on-site airborne (ambient) mercury concentrations continue to be well below the U.S. Environmental Protection Agency (EPA) National Emissions Standards for Hazardous Air Pollutants guideline for mercury in ambient air of 1 $\mu g/m^3$ (30-d average) and the industrial hygiene standard of 50 $\mu g/m^3$. As would be expected, the control site (rain gage 2) had the lowest average concentration (0.006 $\mu g/m^3$) of mercury in ambient air for the six sites. The monitoring site located southwest of Building 9201-4 continued to show the highest average airborne mercury concentration among the five Y-12 Plant sites.

In general, with the exception of the New Hope Pond station, average concentrations in 1988 for the Y-12 sampling sites agreed well with the results from the 1986 and 1987 period, being approximately equal or slightly lower. The New Hope Pond station, however, showed a threefold increase in average airborne mercury concentration for 1988 over 1987 (9/19/87–12/29/87). This increase in average concentration for the New Hope Pond site appears to be an artifact of the different sampling periods for 1987 and 1988. Over the last two years of monitoring, seasonal trends in ambient air concentrations of mercury have been recorded at all six stations, with maximum concentrations recorded during the warm-weather months. Because the New Hope Pond monitoring station did not go into operation until late August of 1987, thus missing much of the warmest period of the year, the average air concentration calculated for this site for 1987 may be artificially low. Indeed, if 1988 data covering the same period (late August through December) is used to calculate the 1988 average concentration for the New Hope Pond station, the result is approximately the same as the 1987 average (0.013 $\mu g/m^3$ for 1988 vs 0.016 $\mu g/m^3$ for 1987).

Table 6.1.3. 1988 results of the Y-12 Plant airborne mercury monitoring program

Site	Sampling period	Mercury concentration ($\mu g/m^3$)		
		Max	Min	Av[a]
Ambient No. 2 (east end of Plant)	12/29/87–12/27/88	0.035	0.003	0.010
Ambient No. 8 (west end of Plant)	12/29/87–12/27/88	0.407	0.007	0.039
Building 9404-13 (SW of Building 9201-4)	12/29/87–12/27/88	0.340	0.028	0.138
Building 9805-1 (SE of Building 9201-4)	12/29/87–12/27/88	0.384	0.017	0.098
New Hope Pond (near discharge point)	12/29/87–12/27/88	0.412	0.004	0.046
Rain gage 2 (Walker Branch watershed)	02/09/88–12/27/88	0.016	0.002	0.006

[a]The average is calculated using the number of weekly samples during the sampling period.

Particulate mercury concentrations continue to be very low at all sites (<0.001 $\mu g/m^3$).

6.1.8 S-3 Pond Area Air Sampling

As the S-3 Pond waters at the Y-12 Plant were treated and discharged in 1985 and the area began to dry, concern was expressed over potential air contamination from sludge dusts. The Environmental Management Department at the Y-12 Plant placed two high-volume particulate samplers at the west and east sides of the four-pond site. With advice from Industrial Hygiene and Health Physics personnel, the Environmental Management Department selected the following parameters as probable S-3 Pond site indicators: ^{99}Tc, ^{90}Sr, ^{230}Th, ^{234}Th, and Zr. Total suspended particulates (TSP) were also measured. Data collection began January 23, 1986; the sampling schedule was set for 24 h every 3 d.

No health or environmental exceedances of the parameters were measured. As a result, the sampling schedule was adjusted to 24 h every 6 d, beginning in January 1987. Sample data for 1987 continued to show low values for all parameters.

As work began in 1988 to close the S-3 Ponds, the sampling frequency was again increased to 24 h every 3 d to adequately monitor the area. Particulate levels fluctuated as before with the dry weather conditions and other construction activities. No increase in the other indicator parameters was measured. The closure was essentially complete with the placement of the clay cap. The two TSP samplers were removed, decontaminated, and relocated to the Lake Realty/New Hope Pond construction site (see Sect. 6.1.13).

6.1.9 Y-12 Stack Sampling: Analysis and Data-Handling Improvements

In 1987, a study was made of the methods of laboratory analyses available for determining estimated uranium stack emission rates. The final report, *Uranium Stack Losses: Analytical Methods Review,* issued in October 1987, recommended changing the method of analysis for stack samples from alpha counting to fluorometric analysis. This change occurred in 1988.

Table 6.4.4. Radioactivity in contaminated geese sacrificed on 7/12/88

Goose number	Weight (kg)	Screen (counts/min)	^{137}Cs[a] in muscle
26[b]	2.6	80	40
27	2.7	100	60
28[c]	2.1	100	60
29	2.5	115	110
30[d]	3.9	50	20
31	2.6	170	110
32	2.8	95	65
33	1.9	95	60
34	2.7	55	20
35[e]	3.8	55	20
36[f]	4.5	175	70

[a]Results in pCi/g (wet wt) for muscle.
[b]Contained 3 pCi/g ^{125}I in thyroid.
[c]Contained 6 pCi/g ^{125}I in thyroid.
[d]Contained 10 pCi/g ^{60}Co in muscle.
[e]Contained 24 pCi/g ^{125}I in thyroid.
[f]Contained 30 pCi/g ^{125}I in thyroid.

residues that are later discharged. Some kinds of noncontaminated wastewaters that are not treated can also increase the amount of salts within a receiving stream. Cooling tower blowdown, for example, is high in salts because salts that occur naturally in the water are concentrated by evaporation.

Salts added to receiving waters by wastewater treatment systems can often be detected as changes in water conductivity, hardness, and/or alkalinity. These three water quality factors are conservative, because their concentrations are controlled more by weathering processes and dilution events than by biota. In natural waters, conductivity, hardness, and alkalinity are usually highly correlated but measure different properties: conductivity reflects concentrations of all dissolved salts; hardness measures largely concentrations of Ca and Mg; and alkalinity is an estimate of the water's acid-neutralizing capacity, which is controlled by the concentrations and types of soluble carbonates.

To see how relationships between conductivity, hardness, and alkalinity can be influenced by wastewater discharges at ORNL, measurements were made of conductivity, hardness, and alkalinity at 11 sites in three streams that receive wastewaters of various types. A site upstream from ORNL operations on each stream was used as a reference site. Each site was sampled 80 to 84 times during a 12-month period. An index of the degree of chemical perturbation (the sum of the values of the Pearson correlation coefficients between conductivity, hardness, and alkalinity) was used as an index of the relatedness of the three factors at each site. This index can range from -3 to $+3$ and should be highest in sites that are not perturbed chemically. Changes in the index with distance downstream were used to rank the streams with respect to their degree of chemical perturbation.

As expected, the reference sites on First Creek, Fifth Creek, and White Oak Creek all had high values (2.65 to 2.86); thus, these sites were chemically similar, and conductivity, hardness, and alkalinity were highly related. The index declined with distance downstream in all three streams, but at different rates: the decline rates per kilometer for First Creek, Fifth Creek, and for a midreach segment of White Oak Creek were 14.6%, 39.4%, and 59.9%, respectively. The index for White Oak Creek was lowest (0.70) just downstream from ORNL's coal yard runoff treatment facility. The overall degree of chemical perturbation in the streams could be ranked in the following sequence: First Creek < Fifth Creek < White Oak Creek.

This study shows that ORNL operations detectably alter relationships between fundamental, easily measured water quality factors. In-stream monitoring of conservative properties (e.g., conductivity, hardness, and/or alkalinity) would provide information that is operationally more useful than more dynamic parameters, such as dissolved oxygen, pH, and water temperature, which are now monitored.

6.5 OFF-SITE

6.5.1 Accumulation and Retention of ^{137}Cs from ORNL in the Clinch River and Watts Bar Reservoir System

From the late 1940s through the 1960s, a large quantity of fission products was produced and processed at ORNL. Many of these fission

products, which included ^{137}Cs (half-life 30 years), were retained in impoundment basins and became associated with suspended particulate material and the sediments. During periods of large-storm events, along with the drainage of WOL (one of the impoundment basins) in 1956, a portion of these contaminated sediments was resuspended and transported to the Clinch River and impounded in Watts Bar Reservoir.

In an attempt to quantify the amount of ^{137}Cs that has been retained in the reservoir sediments, approximately 60 cores and 180 surface grab samples were collected (Fig. 6.5.1) and analyzed for their radioactive components by ORNL ESD staff. The vertical distribution of ^{137}Cs in the sediment cores collected from Watts Bar Reservoir is strongly correlated with the historical release record of ^{137}Cs originating from WOL. Such cores exhibit a large subsurface peak concentration of ^{137}Cs. The depth of this subsurface peak as well as the thickness of ^{137}Cs-contaminated sediment varies with the rate of sediment accumulation. In areas of rapid sediment accumulation, such as in the upper portion of the reservoir and along the old river channel, the highest ^{137}Cs concentrations occur at sediment depths as great as 1.5 m (5 ft). In areas of less sediment accumulation, such as along the reservoir margins, the highest ^{137}Cs concentrations often occur closer to the sediment surface. This distribution may have important

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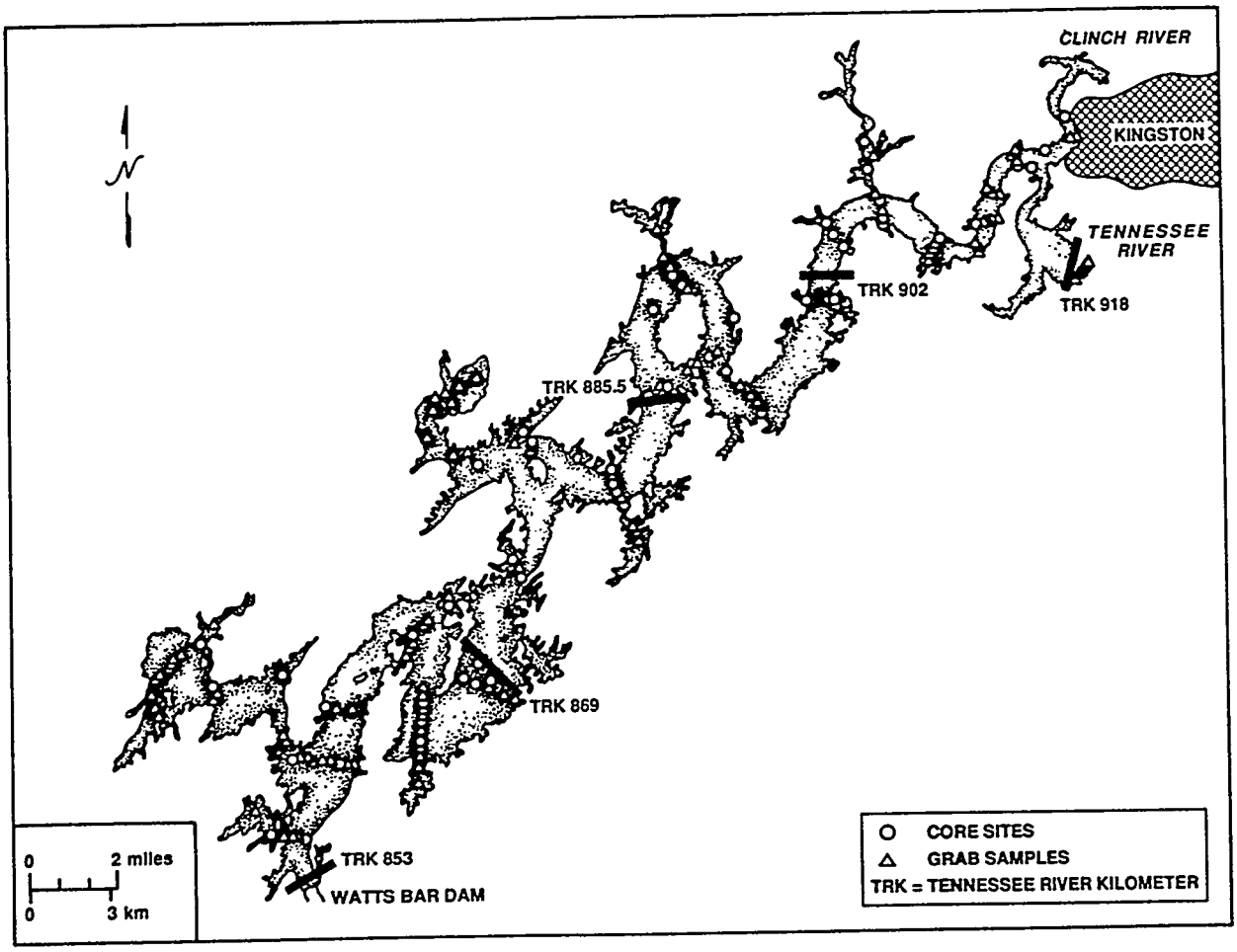

Fig. 6.5.1. Locations of ^{137}Cs sediment cores and grab sampling sites in the Clinch River and Watts Bar Reservoir.

uptake and exposure implications to aquatic organisms, which live in or feed on surface sedimentary material, as well as for humans, when lake levels are lowered.

The total accumulation of ^{137}Cs in Watts Bar Reservoir sediments was estimated by measuring the inventory of ^{137}Cs in each sediment core and in the surface grab samples and integrating these data over the entire reservoir [~115 km^2 (~45 $miles^2$)]. Initial results of this integration reveal that about 290 Ci of ^{137}Cs resides in the sediments of Watts Bar Reservoir, of which <5% is attributed to fallout from atmospheric nuclear weapons testing. Releases of ^{137}Cs from WOL (decay corrected to 1986) into the Clinch River have introduced an estimated ~335 Ci. This indicates that about 85% of ^{137}Cs from WOL has been deposited within the sediments of Watts Bar Reservoir. These results demonstrate that the reservoir serves as an effective trap for the accumulation of particle-reactive substances originating from ORNL and that they are accumulating in the benthic environment.

This work represents the initial scoping phase for a Clinch River RCRA Facility Investigation (RFI) that will be conducted in compliance with Section 3004(v) of the Hazardous and Solid Waste Amendments of 1984 to the RCRA of 1976, which addresses requirements for corrective actions for releases of hazardous wastes or constituents beyond the boundaries of RCRA-permitted facilities. The three primary objectives of this RFI are to (1) define the nature and extent of off-site contamination; (2) quantify any risk to human health and to the environment resulting from the existing off-site contamination; and (3) evaluate potential remedial actions and to implement, if necessary, the most appropriate remediation alternatives.

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Oak Ridge Reservation Environmental Report for 1989

Volume 1: Narrative, Summary, and Conclusions

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OAK RIDGE RESERVATION ENVIRONMENTAL REPORT FOR 1989

VOLUME 1: NARRATIVE, SUMMARY, AND CONCLUSIONS

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Table 2.2.10. 1989 ORNL liquid releases and radionuclide concentrations

Radionuclide	Emission (Ci)	Concentration guide (DCG)[a] (pCi/L)	Concentration (pCi/L)	Percentage of DCG[b]
		Melton Branch 1		
^{60}Co	0.11	5,000	28	0.56
^{137}Cs	0.011	3,000	2.7	0.090
Total Sr[c]	1.3	1,000	340	34
^{3}H	4,800	2,000,000	1,200,000	61
		White Oak Creek		
^{60}Co	0.083	5,000	6.4	0.13
^{137}Cs	0.96	3,000	74	2.5
Total Sr[c]	2.0	1,000	150	15
^{3}H	970	2,000,000	75,000	3.8
		White Oak Dam		
^{241}Am	0.0062	30	0.38	1.3
^{244}Cm	0.0065	60	0.40	0.67
^{60}Co	0.13	5,000	8.2	0.16
^{137}Cs	1.2	3,000	74	2.5
Gross alpha	0.16	*d*	9.8	*d*
Gross beta	7.3	*d*	450	*d*
^{238}Pu	0.0019	40	0.12	0.29
^{239}Pu	0.0021	30	0.13	0.45
Total Sr[c]	2.9	1,000	180	18
^{3}H	4,100	2,000,000	260,000	13

[a]Derived concentration guide.
[b]Percent of DCG = average flow-weighted concentration × 100/DCG.
[c]Total radioactive Sr (^{89}Sr + ^{90}Sr).
[d]Not applicable.

During 1989, grab samples were collected once a quarter at the following locations: the Clinch River, West Fork Poplar Creek, and Mitchell Branch source. At K-1513, K-716, K-1710, and K-1770, 24-h composite samples were collected once each month. After the first quarter grab sample at K-901 at 892, sampling was discontinued. Sampling at K-1770 replaces this sample location. All samples were analyzed for radiological and nonradiological parameters.

Table 2.2.2 in Vol. 2 gives radiological data from the ambient surface water surrounding ORGDP. Figure 2.2.5 gives the sampling locations.

Although two radionuclides exhibited values above 0.01% of the DOE-DCG, most were below this level. Plutonium had 1.5% and 2.9% DCG within Clinch River and West Fork Poplar Creek at monitoring stations upstream for ORGDP. Values decrease downstream of ORGDP. Uranium is slightly above detection within Poplar Creek and decreases going downstream. Gross alpha, beta, and gamma are not significant within Mitchell Branch.

2.2.1.2 Nonradiological summary

Y-12 Plant

Nonradiological parameters were also monitored at the non-NPDES Y-12 sites listed in

Table 2.2.11. ORGDP water monitoring locations

Location	Agency	Type	NPDES ID if applicable
Clinch River (Brashaer Island)	DOE	Perimeter	
West Fork Poplar Creek	DOE	Perimeter	
K-710A (inactive)	TDHE	NPDES	008
K-716	DOE	Perimeter	
K-901 @ 892[a]	DOE	Perimeter	
K-901-A	TDHE	NPDES	007
K-1007-B	TDHE	NPDES	006
K-1203	TDHE	NPDES	005
K-1407-E and K-1407-F	TDHE	NPDES	010
K-1407-J	TDHE	NPDES	011
K-1513	DOE	Perimeter	
K-1515-C	TDHE	NPDES	009
K-1700	TDHE	NPDES	001
K-1710	DOE	Perimeter	
K-1770	DOE	Perimeter	

[a]The water sample is removed from the transfer pipe at K-892 pumphouse; however, the sample represents water in the Clinch River downstream of ORGDP at K-901.

Sect. 2.2.1.1 and illustrated in Fig. 2.2.1. These sites are also described more fully in that section.

A nonradiological parameter summary for kilometer 12.4 on upper Bear Creek can be found in Table 2.2.12.

The New Hope Pond influent was monitored for nonradiological parameters daily (Table 2.2.13). There were also real-time monitors for pH and mercury located at this site. The intake for these monitors was moved to the new diversion ditch after closure of the New Hope Pond inlet.

After closure activities began at New Hope Pond, station 17 became the plant's end monitoring point for nonradiological parameters also. Grab samples were obtained here twice per day for mercury, and composite samples were obtained one day per week on a rotating day of the week basis. These results are summarized in Table 2.2.14.

Nonradiological samples are obtained from the two sanitary sewer lines as required by the Industrial User's permit. These results are summarized in Tables 2.2.15 and 2.2.16.

Nonradiological analyses

At the Y-12 Plant, surface water is monitored routinely at locations that are not required by the plant NPDES permit (TN0002968) (Fig. 2.2.1). At each of these locations, samples are collected for both radiological and nonradiological parameters.

The first location is at kilometer 12.4 (mile 7.7) on upper Bear Creek where the creek first approaches Bear Creek Road. As required by the 1983 complaint and order issued by TDHE to the Y-12 Plant, grab samples are collected weekly at this location. Due to decreased flow conditions, a more representative monitoring point is also sampled (kilometer 11.97). Analytical data are reported quarterly to the TDHE as an attachment to the Discharge Monitoring Report (DMR). (A summary of 1989 data is presented in Table 2.2.12.)

Monitoring is also conducted at station 17 near the junction of Scarboro Road and Bear Creek Road. The samples at this point indicate the quality of the water in EFPC just before it leaves the Y-12 Plant boundary. Most of the samples collected at this location are flow-proportional, 24-h composites. Both radiological and nonradiological parameters are analyzed at this location, and data collected are used for a variety of purposes. See Table 2.2.4 for a summary of 1989 data.

Table 2.2.14. 1989 Annual summary for Station 17 nonradiological data[a,b]

Parameter	No. samples	Concentration (mg/L)			Std. error
		Max	Min	Av	
Mercury	441	0.013	0.0006	0.0017	0.00004
Nitrate-N	59	6.2	2.4	3.9	0.10
Total phosphorus	45	0.84	0.024	0.263	0.02
Copper	60	0.013	<0.002	<0.008	0.0003
Zinc	60	0.109	0.029	0.063	0.002
Chromium	60	0.008	<0.006	<0.006	0.00
Molybdenum	60	0.481	0.047	0.195	0.012
Lithium	60	0.567	0.007	0.037	0.009
Selenium	42	<0.002	<0.0	<0.002	0.0001
Cadmium	60	<0.006	<0.003	<0.0035	0.0001
Lead	60	<0.02	0.002	<0.02	0.0004
Nickel	60	0.109	<0.007	<0.008	0.002
Calcium	60	77.4	41.7	59.3	1.1
Magnesium	60	13.1	6.93	11.02	0.21
Sodium	60	56.7	7.25	20.1	1.64
Potassium	60	16.6	1.2	2.6	0.2
Sulfate	44	1400	<10	<96	30.6
Chloride	44	86	11	23	1.78
Fluoride	59	1.8	0.001	0.92	0.04
Total suspended solids	60	170	<5	<19	3.5
Total dissolved solids	59	470	2.9	294.3	8.8
Alkalinity	43	170	90	113	2.1
Total organic carbons	44	29	<2	<11	1.25
Residual chlorine, total	55	0.48	<0.1	<0.11	0.007
Temperature, °F	329	72	52	69.2	0.26
pH, units	329	8.3	6.4	*b*	0.01
Dissolved oxygen	302	11	0.2	6.7	0.12

[a]Flow during operations and/or discharging.
[b]See Fig. 2.2.1
[c]Not applicable.

In November 1988, EFPC was directed through the newly constructed Lake Reality, and RCRA closure activities began for New Hope Pond (NHP). Water monitoring at NHP continued during the first quarter of 1989 on the small amount of drainage that flowed from NHP during the initial closure activities. Closure for NHP, under the approved RCRA closure plan, is now complete.

The Y-12 Plant sanitary sewage system discharges to the City of Oak Ridge sanitary sewer through two sewer lines. The wastes are treated at the City of Oak Ridge West End Treatment Facility. These discharges are monitored as required in the industrial users' permit No. 001 issued to the Y-12 Plant. These data are summarized in Tables 2.2.5 and 2.2.6.

Oak Ridge National Laboratory

Monthly surface water samples were collected at two sampling locations for the purpose of determining background concentration levels before the influence of ORNL. The two locations are Melton Hill Dam (MHD) above ORNL's discharge point into the Clinch River (with the exception of the cooling tower, roof, and parking lot runoff at the 7600 area) and White Oak Creek headwaters (WOCH) above the point where ORNL discharges to WOC (see Fig. 2.2.4). The

concentrations of these constituents decreased significantly in the quarry effluent between 1988 (see Table 2.2.18 in Vol. 2 of 1988 ORRER) and 1989 (see Table 2.2.19 in Vol. 2 of this report). Figure 6.1.1 displays the temporal pattern in the concentrations of these constituents in 1989. The rapid decrease in sulfate, arsenic, and selenium between January and April represents the flushing of these constituents from the quarry after the switch to natural gas in late 1988. The peaks in sulfate, arsenic, and selenium near the end of April correspond with initiation of aerator operation in the quarry, which would have increased mixing of deeper quarry water into surface water and discharge via the monitored overflow. Unseasonably cold air temperatures in December 1989 required increased use of coal for fuel at the Y-12 Steam Plant; therefore, the concentrations of ash-derived constituents in the effluent also increased. However, the significant, rapid overall improvement in effluent quality observed in 1989 reflects the type of recovery to expect when fly ash disposal in the quarry is completely eliminated in 1990 and bottom ash disposal (less than 20% of total ash production) is eliminated in 1993.

Monitoring of the effluent of Rogers Quarry will continue as progress on the complete elimination of the ash slurry is made. In addition, water balance monitoring (see Sect. 6.2.14 of the 1988 ORRER) will be continued. Biological monitoring of McCoy Branch, both upstream and downstream of Rogers Quarry, was begun in 1989 to document recovery.

6.1.5 Y-12 Plant Airborne Mercury Monitoring Program

The on-site airborne (ambient) mercury monitoring program at the Oak Ridge Y-12 Plant was established in July 1986 to provide a historical data base of mercury concentrations in ambient air and to demonstrate protection of the environment and human health from releases of mercury to the atmosphere. Airborne mercury at the Y-12 Plant primarily results from vaporization of mercury in soils, releases from the burning of coal at the Y-12 Steam Plant, and fugitive exhaust from Building 9201-4, a former lithium isotope separation facility that is contaminated with mercury.

During 1989, as in 1988, six ambient mercury sampling stations were operational (i.e., stations on the east and west ends of the plant, two stations near Building 9201-4, a station at New Hope Pond, and a control site on Chestnut Ridge). At each of these stations, airborne mercury is collected by pulling ambient air through a Teflon filter followed by a flow-limiting orifice and an iodated charcoal sampling tube. The charcoal tubes, which absorb mercury vapor, are changed every 7 days, and Teflon filters for particulate mercury are changed every 28 days. Average air concentration during the sample collection period is calculated by dividing the total quantity of mercury collected on the charcoal and filters by the total volume (uncorrected to STP) of air sampled during the sampling period.

Table 6.1.1 shows the maximum, minimum, and average concentrations of airborne mercury vapor recorded during 1989 for the six sampling stations. In general, with the exception of the Ambient No. 8 station at the west end of the plant and the New Hope Pond site at the east end of the plant, average air mercury concentrations for 1989 agreed well with the results from the 1986 through 1988 period, being approximately equal or slightly lower. As expected, the control site (Rain Gage 2) continued to have very low average concentrations (0.005 $\mu g/m^3$) of mercury vapor. After operating 20 months and establishing a data base of background concentrations for mercury vapor, the Rain Gage 2 station was shut down in 1989. The monitoring sites located southwest and southeast of Building 9201-4 continued to show relatively high average concentrations in comparison to background levels; however, concentrations in 1989 for both these sites did show a reduction of approximately 25% over 1988 levels. A possible explanation for the decrease in mercury vapor levels at these two sites is the switch from burning coal to burning natural gas at the Y-12 Steam Plant, which is adjacent to these monitoring sites. As in the past, seasonal trends in ambient air concentrations of mercury were apparent, especially at the two stations located near Building 9201-4, with average weekly concentrations of mercury vapor gradually increasing throughout the summer and early fall and decreasing in the

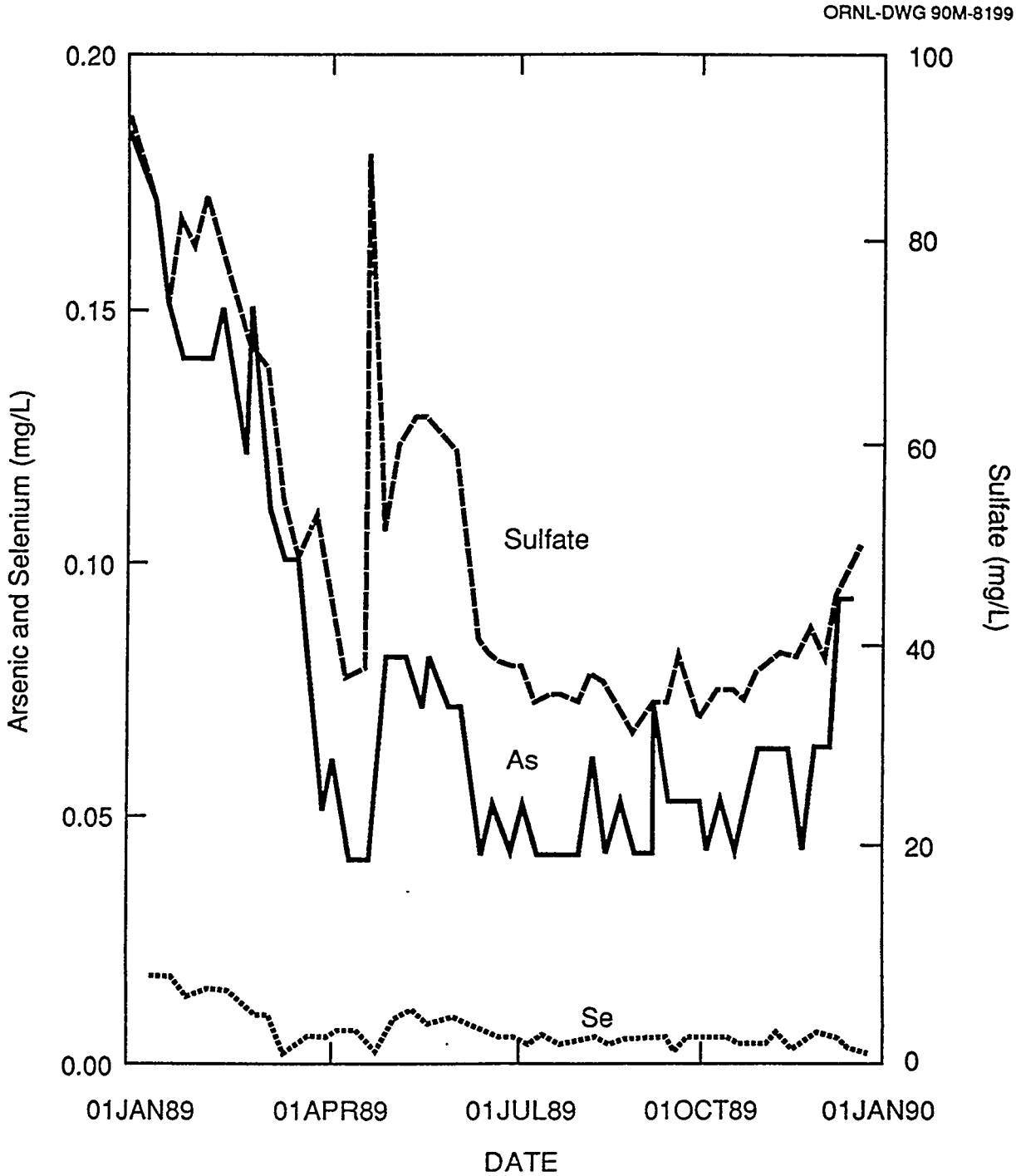

Fig. 6.1.1. Effluent quality of Rogers Quarry.

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Volume I

Oak Ridge RESERVATION

ENVIRONMENTAL REPORT FOR 1990

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OAK RIDGE RESERVATION ENVIRONMENTAL REPORT FOR 1990

VOLUME 1: NARRATIVE, SUMMARY, AND CONCLUSIONS

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3. SURFACE WATER

The surface waters on the ORR reflect the abundance of limestone and dolomite bedrock as indicated by the presence of dissolved calcium bicarbonate. Hardness is generally moderate; total dissolved solids concentrations usually range between 100 and 250 mg/L.

Water quality in ORR streams is affected primarily by wastewater discharges and by groundwater transport of contaminants from land disposal of waste. Though bedrock characteristics differ somewhat among the watersheds of these streams, the observed differences in water chemistry are most likely attributed to manmade sources rather than to geologic variation. For example, East Fork Poplar Creek (EFPC) shows higher levels of several substances than does any other ORR stream, probably reflecting the influence of effluents from the Y-12 Plant and from the City of Oak Ridge municipal wastewater treatment facility.

Field measurements and sample collections are carried out at various effluent sources and receiving streams on the ORR. Additional sampling is done at the nearest off-site municipal water intake location. Water samples are collected and analyzed at various intervals (weekly, monthly, etc.) for radiological and nonradiological parameters. Surface water data are summarized in this report for water sampling locations both on the ORR and in receiving streams near the ORR. Information not specifically required by an NPDES Permit is presented in the Surface Water section (Sect. 3.1), and all NPDES Permit-related information is summarized in the NPDES Program section (Sect. 3.2).

Concentrations of contaminants in streams and creeks on or around the ORR are compared with Tennessee's in-stream water criteria, which are based on stream classifications and recommendations made by TDC to DOE-ORO. In many cases, allowable effluent concentrations are dictated by discharge permits, which are issued by the TDC. Water quality at the intake for the K-25 Site water treatment plant is compared with Tennessee water quality criteria for domestic water supplies.

In some cases, the maximum concentrations recommended by TDC and EPA are below the detection limit of the most sensitive EPA-approved analytical method.

3.1 SURFACE WATER MONITORING

3.1.1 Radiological summary

Y-12 Plant

Routine surface water monitoring not required by the NPDES permit is performed at Y-12 sites for a variety of reasons. Various radiological parameters are monitored at these sites. These sites are shown in Fig. 3.1.

Kilometer 12.4 on Upper Bear Creek is monitored in response to Section IV, Part 4, of the Memorandum of Understanding agreed to by DOE, EPA, and TDC. This site was agreed upon as a point in the stream that is characteristic of the effects of the seepage of the S-3 Ponds. Because of decreased flow at this site since the closure of the S-3 Ponds, a new site at kilometer 11.97 is also being monitored and will be proposed as a replacement site (Table 3.1). Analytical data are reported to the TDC as an attachment to the Discharge Monitoring Report (DMR) required by NPDES. These sites were monitored once per week for the radiological parameters shown in Table 3.2. Figure 3.2 shows data from 1987 through 1990.

The sampling point for the Lake Reality area is located in the diversion ditch around the New Hope Pond Closure Area. Samples were taken here on a weekly basis for the radiological parameters shown in Table 3.3. In addition, a new sampling point was constructed to monitor East Fork Poplar Creek

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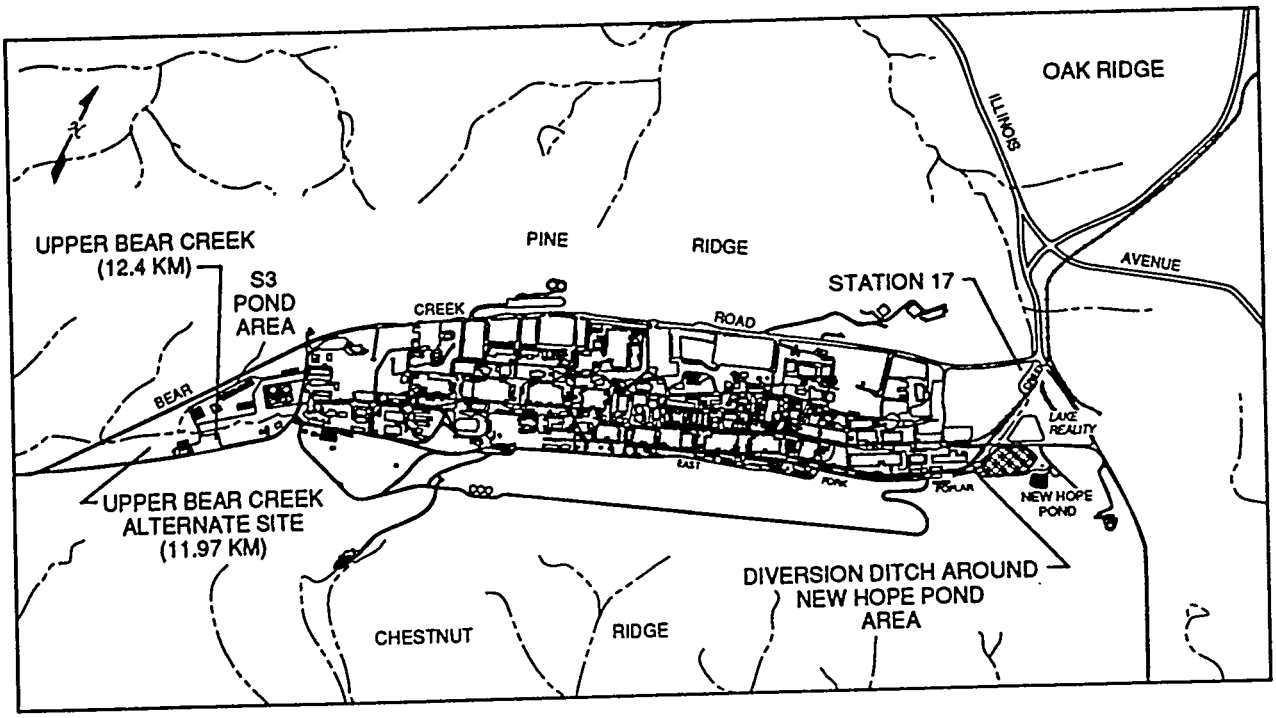

Fig. 3.1. Y-12 Plant non-NPDES routine surface water monitoring sites.

Table 3.1. 1990 annual summary for Upper Bear Creek radiological data (km 11.97)[a]

Parameter	Number of samples	Concentration (pCi/L)				% DCG
		Max	Min	Av	Standard error	
^{241}Am	38	1.10	-0.80	0.21	0.06	0.69
^{237}Np	51	3.70	0.08	0.97	0.11	3.22
^{238}Pu	51	0.75	-0.46	0.02	0.03	0.06
$^{239/240}Pu$	50	0.53	-1.30	0.03	0.03	0.11
^{99}Tc	51	1.52	0.07	0.57	0.05	0.00
Uranium, total (mg/L)	51	0.540	0.015	0.211	0.016	*c*
^{235}U (%)	51	<2.00	0.22	<0.4	0.03	*c*

[a]See Fig. 3.1.

[b]All units pCi/L unless otherwise noted. A negative number is indicative of less than laboratory background value.

[c]Not applicable.

Table 3.3. 1990 Annual radiological summary Y-12 Plant diversion ditch and Station 17[a]

Parameter	Number of samples	Concentration[b]				% DCG
		Max	Min	Av	Standard error	
		Diversion ditch				
Uranium, total	41	0.066	0.012	0.030	0.002	c
^{235}U (%)	41	1.01	0.28	0.52	0.02	c
Thorium, total	41	0.009	<0.003	<0.003	0.000	c
		Station 17				
Uranium, total	52	0.074	0.012	0.029	0.002	c
^{235}U (%)	52	0.99	0.17	0.47	0.15	c
Thorium, total	52	0.012	<0.003	<0.004	0.002	c

[a]See Fig. 3.1.
[b]Units are in mg/L unless otherwise noted.
[c]Not applicable.

following the final influent, but prior to its leaving the Y-12 Plant boundary. Station 17, located near the junction of Bear Creek and Scarboro roads, was chosen as the ideal site for this monitoring. Weekly samples were obtained here for the radiological parameters listed in Table 3.3.

The Y-12 Plant holds Industrial User's Permit Number 001 with the City of Oak Ridge. This permit allows the Y-12 Plant to discharge wastewater from two main sewerage lines into the Oak Ridge sanitary sewer system in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit. The radiological parameters monitored and results obtained in these sewer lines are listed in Tables 3.4 and 3.5. Table 3.6 shows the total uranium and associated curies released from the Y-12 Plant as a liquid effluent during 1988, 1989, and 1990.

Oak Ridge National Laboratory

ORNL collects samples for radiological analyses at off-site locations, at background or reference locations, in streams at the ORNL site, from process discharge point sources, and from various other outfalls. Table 3.7 contains a summary of the current locations, parameters analyzed, and frequencies of sample collection and analysis for all radiological samples (except Category I and II outfall samples). Results from the first three types of locations are summarized in this section. Results from the process points analyses and the categories I and II analyses are deferred to Sect. 3.2, NPDES Monitoring Program, which also contains results for three stream locations covered by the permit. Differences between the current sampling and analysis schedule presented in Table 3.7 and the schedule followed earlier in the year are described as the results are presented.

Treated water samples are collected weekly at the Kingston and the K-25 Site (Gallaher) potable water treatment plants (Fig. 3.3) and are analyzed quarterly. In addition, flow-proportional samples are collected weekly at Melton Hill Dam (MHD) (Fig. 3.3) and analyzed monthly. This sampling location, which is on the Clinch River, is above ORNL's discharge point to the Clinch River (with the exception of the cooling tower, roof, and parking lot runoff at the 7600 area) and serves as a local background or reference station.

DOE Order 5400.5, Chapter II, 3.a. requires comparison of annual average discharge concentrations to DCG values. These concentrations, which result in a dose of 100 mrem/year based upon 2 L/d water consumption, apply at the point of discharge to a receiving stream prior to dilution in the

Table 3.9. 1990 monthly flows for White Oak Creek at the dam and for Clinch River[a]

Month	Flow ($L \times 10^9$)		Average ratio[c]
	White Oak Dam[b]	Clinch River	
January	2.2	550	340
February	2.2	980	570
March	1.6	360	310
April	0.76	130	170
May	1.9	300	260
June	0.62	340	570
July	0.94	340	460
August	1.1	330	380
September	0.54	280	530
October	0.66	210	320
November	0.54	270	540
December	2.4	420	190

[a]See Fig. 3.4.
[b]White Oak Creek at White Oak Dam.
[c]Flow ratios Clinch River: White Oak Creek at White Oak Dam are calculated daily and averaged for the month.

radionuclide. The discharge is calculated by multiplying this flow-weighted concentration by the total annual flow. The ratio of the flow-weighted concentration to the DCG is also given in Table 3.10. None of the ratios exceeded 42% of the DCG. The highest average concentrations were for ^3H and total Sr at MB1, which were lower than the averages observed during 1989.

K-25 Site

Surface water samples are collected as part of the CWA requirements and DOE orders. Both NPDES and perimeter ambient water sampling locations under K-25 Site responsibility are shown in Fig. 3.5. Table 3.11 lists sampling locations, sample type, the agency requiring the sample, and the NPDES identification number where applicable.

Perimeter monitoring includes both water quality parameters and radionuclides. The purpose is to document the K-25 Site's impact on the surrounding streams and to differentiate the impact from that of other sites.

During 1990, grab samples were collected once a quarter at the following locations: the Clinch River, West Fork Poplar Creek, and Mitchell Branch source. At K-1513, K-716, K-1710, and K-1770, 24-h composite samples were collected once each month. All samples were analyzed for radiological and nonradiological parameters.

Table 3.2 in Vol. 2 gives radiological data from the ambient surface water surrounding the K-25 Site. Figure 3.5 gives the sampling locations.

Differences seen in the 1990 data as compared to the 1989 were slight increases in plutonium in Poplar Creek. Neptunium also increased upstream of the plant in the Clinch River. Gross alpha, beta, and gamma are not significant within Mitchell Branch.

3.1.2 Nonradiological summary

Y-12 Plant

Nonradiological parameters were also monitored at the non-NPDES Y-12 sites listed in Sect. 3.1.1 and illustrated in Fig. 3.1. These sites are also described more fully in that section.

A nonradiological parameter summary for kilometer 12.4 and kilometer 11.97 on Upper Bear Creek can be found in Tables 3.12 and 3.13.

Station 17, located below Lake Reality, is now the plant's end monitoring point for nonradiological parameters. Grab samples are obtained here twice per day for mercury, and composite samples are obtained

Table 3.11. K-25 Site water monitoring locations

Location	Agency	Type	NPDES ID if applicable
Clinch River (Brashaer Island)	DOE	Perimeter	
West Fork Poplar Creek	DOE	Perimeter	
K-710A (inactive)	TDC	NPDES	008
K-716	DOE	Perimeter	
K-901-A	TDC	NPDES	007
K-1007-B	TDC	NPDES	006
K-1203	TDC	NPDES	005
K-1407-E and K-1407-F	TDC	NPDES	010
K-1407-J	TDC	NPDES	011
K-1513	DOE	Perimeter	
K-1515-C	TDC	NPDES	009
K-1700	TDC	NPDES	001
K-1710	DOE	Perimeter	
K-1770	DOE	Perimeter	

one day per week on a rotating day of the week basis. These results are summarized in Table 3.14.

Nonradiological samples are obtained from the two sanitary sewer lines as required by the Industrial User's permit. These results are summarized in Tables 3.15 and 3.16.

Nonradiological analyses

At the Y-12 Plant, surface water is monitored routinely at locations that are not required by the plant NPDES permit (TN0002968) (Fig. 3.1). At each of these locations, samples are collected for both radiological and nonradiological parameters.

The first location is at kilometer 12.4 (mile 7.7) on upper Bear Creek where the creek first approaches Bear Creek Road. As required by the 1983 complaint and order issued by TDC to the Y-12 Plant, grab samples are collected weekly at this location. Due to decreased flow conditions, a more representative monitoring point is also sampled (kilometer 11.97). Analytical data are reported quarterly to TDC as an attachment to the DMR. (A summary of 1990 data is presented in Table 3.1.)

Monitoring is also conducted at Station 17 near the junction of Scarboro Road and Bear Creek Road. The samples at this point indicate the quality of the water in EFPC just before it leaves the Y-12 Plant boundary. Most of the samples collected at this location are flow-proportional, 24-h composites. Both radiological and nonradiological parameters are analyzed at this location, and data collected are used for a variety of purposes. See Table 3.4 for a summary of 1990 data.

The Y-12 Plant sanitary sewage system discharges to the City of Oak Ridge sanitary sewer through two sewer lines. The wastes are treated at the City of Oak Ridge West End Treatment Facility. These discharges are monitored as required in the industrial users' permit No. 001 issued to the Y-12 Plant. These data are summarized in Tables 3.5 and 3.6.

Oak Ridge National Laboratory

Monthly surface water samples were collected at two sampling locations for the purpose of determining background concentration levels before the influence of ORNL. The two locations are MHD above ORNL's discharge point into the Clinch River (with the exception of the cooling tower, roof, and parking lot runoff at the 7600 area) and White Oak Creek Headwaters (WOCH) above the point where ORNL discharges to WOC (see Fig. 3.4). The samples were analyzed and inorganic elements and compounds. The results of these analyses help to assess surface water quality independent of impacts from ORNL.

Table 3.17 contains a summary of the analytical results. The percent DWL column shows the average annual concentration as a percentage of the National Primary or Secondary Drinking Water Regulation

Table 3.14. 1990 Y-12 annual summary for Station 17 nonradiological data[a]

Parameter	Number of samples	Concentration (mg/L)			
		Max	Min	Av	Standard error
Mercury	508	0.0057	0.0002	0.0017	0.00004
Nitrate (as N)	109	6.9	2.2	4.8	0.08
Total phosphorus	109	0.82	0.13	0.33	0.009
Copper	106	0.014	<0.005	<0.008	0.0002
Zinc	109	0.1	0.026	0.055	0.0016
Chromium	109	<0.006	<0.006	<0.006	0.0
Molybdenum	109	0.179	<0.006	<0.042	0.003
Lithium	109	0.184	<0.001	<0.033	0.002
Selenium	90	<0.002	<0.0004	<0.002	0.00002
Cadmium	109	<0.004	<0.003	<0.004	0.00005
Lead	108	0.02	<0.001	<0.020	0.0002
Nickel	109	0.2	<0.007	<0.010	0.002
Calcium	109	79.6	40.2	62.2	0.81
Magnesium	109	14.5	6.59	11.7	0.153
Sodium	109	81.4	7.22	27.6	1.7
Potassium	109	3.8	0.45	2.51	0.05
Sulfate	109	220.0	39.0	92.0	3.5
Chloride	109	210.0	8.2	22.3	1.8
Fluoride	109	7.7	0.24	0.99	0.07
Total suspended solids	109	41.0	<5.0	<12.4	0.9
Total dissolved solids	109	600.0	94.0	320.0	7.5
Alkalinity	109	150.0	72.0	110.5	1.16
Total organic carbons	109	305.0	<2.0	<16.4	2.8
Residual chlorine, tot.	103	0.1	<0.1	<0.1	0.0
Cadmium (AA)	94	0.0021	<0.0001	<0.0007	0.00003
Temperature, °C	294	22.2	9.4	21.2	0.135
pH, standard units	290	8.6	3.7	*b*	0.024
Dissolved oxygen	289	9.2	0.4	5.4	0.095
Conductivity, mhos/cm	293	97.0	5.4	55.6	0.89

[a]Flow during operations and/or discharging.
[b]Not applicable.

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Volume 1

Oak Ridge

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ENVIRONMENTAL REPORT FOR 1991

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OAK RIDGE RESERVATION ENVIRONMENTAL REPORT FOR 1991

VOLUME 1: NARRATIVE, SUMMARY, AND CONCLUSIONS

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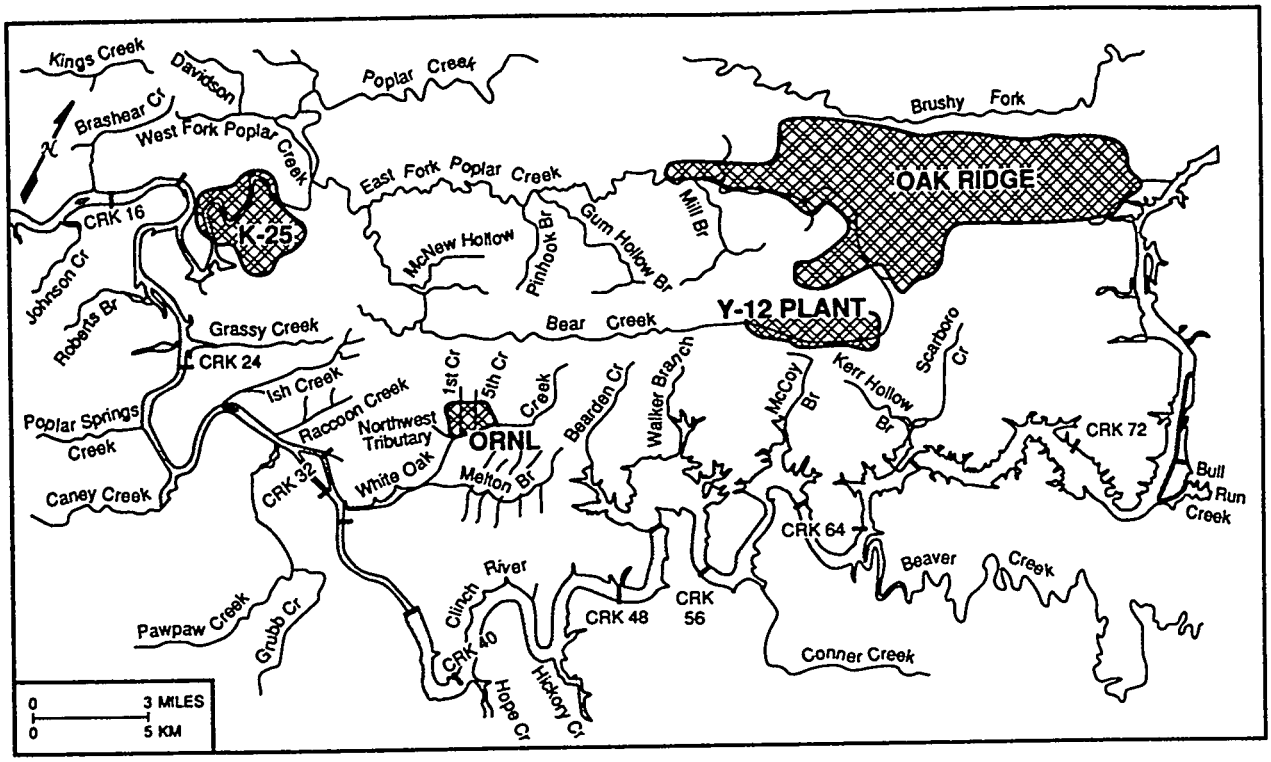

Fig. 1.14. Location map of Oak Ridge Reservation tributaries.

Chicamauga Reservoir, about 8 km (5 miles) from the reservoir proper.

1.7 ENVIRONMENTAL MONITORING

Published environmental summary reports for the DOE ORR have been issued for each year since 1971. The current environmental program is designed primarily to meet various regulatory requirements and DOE directives and to provide a continuity of data on environmental media at unregulated locations. The federal legislative framework that establishes standards and regulates environmental releases consists mainly of the following: Clean Air Act (CAA); The Clean Water Act (CWA); Safe Drinking Water Act (SDWA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as "Superfund"; RCRA; TSCA; SARA; the Atomic Energy Act (AEA); and Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Administrative bodies principally concerned with implementation and enforcement on the federal level are the U.S. Environmental Protection Agency (EPA) and DOE and, on the state level, TDEC.

Environmental monitoring consists of two major activities: effluent monitoring and environmental surveillance. Effluent monitoring is the collection and analysis of samples, or measurements, of liquid and gaseous effluents. Environmental surveillance is the collection and analysis of samples, or direct measurements, of air, water, soil, foodstuff, biota, and other media from DOE sites and their environs. Environmental monitoring is performed by each site for the purpose of characterizing and quantifying contaminants, assessing radiation exposures of members of the public, demonstrating compliance with applicable standards and permit requirements, and assessing the effects, if any, on the local environment.

The samples are analyzed for various radioactive, physical, and chemical parameters. In some cases, such as liquid effluent outfalls, the discharge permit may require the analysis of more than 60 different parameters.

Annual summaries are presented in the following sections for each of the media sampled.

The summary tables generally give the number of samples collected and the maximum, minimum, average, and standard error of the mean (SE) values of parameters for which determinations were made. This value is based on multiple samples collected throughout the year. It includes the random uncertainty over time and space associated with sampling, analysis, and the intrinsic variability of media. The random uncertainty is a statement of precision (or imprecision), a measure of the reproducibility or scatter in a set of successive measurements, and an indication of the stability of the average value for a parameter. When differences in the magnitudes of the observations are small, the SE is small, and the precision is said to be high; when the differences are large, the SE is large, and the precision is low. Random uncertainties are assessed and propagated by statistical methods (see Appendix C for calculations). Average values have been compared where possible with applicable guidelines, criteria, or standards as a means of evaluating the impact of effluent releases or environmental concentrations.

In some of the tables, radionuclide concentrations are compared with derived concentration guides (DCGs) as published in DOE Order 5400.5. These concentration guides were established for the drinking water pathway and the inhalation pathway and are guidelines for the protection of the public. DOE Order 5400.5 defines a DCG as the concentration of a radionuclide in air or water from which, under conditions of continuous exposure by one exposure pathway (i.e., drinking water, inhaling air, or submersion) for 1 year, a "reference person" would receive an effective dose equivalent of 100 mrem. A reference person is a hypothetical human who is assumed to inhale 8400 m^3 (296,700 ft^3) of air in a year and to drink 730 L (190 gal) of water in a year. When there are multiple DCGs for a given isotope, the most restrictive value is used. When the percent of the DCG is less than 0.010, the percent is reported as less than 0.01. When total radioactive Sr is measured, it is compared to the DCG for ^{90}Sr, which is the most restrictive value.

The current convention for radioactivity data at the instrument detection limit is to treat it in the same manner as instrument responses above the detection limit. The instrument background is subtracted from the actual instrument signal, and the result is reported. Because of the intrinsic uncertainties associated with making radiation measurements, it is possible to subtract a background value from a sample result and get a negative number. The advantage to this approach is that no bias is introduced in calculating statistical summaries of the data.

Measurements of nonradioactive analytes at or below the instrument detection limit are expressed as less than (<) the detection limit value. In computing summary statistics, the "less than" results are assigned the detection limit value. When a statistic includes one or more "less than" results, the computed value is also expressed as a "less than" quantity.

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4. SURFACE WATER

The surface water regime of the ORR consists of the Clinch River, which forms the reservation boundary to the south and west; a series of subbasins of the Clinch River from Brashear Creek just below the K-25 Site to Scarboro Creek east of the Y-12 Plant; and the East Fork Poplar Creek basin, which forms the hydrologic boundary of the reservation to the north and east (Fig. 1.14). Four of the subbasins of the Clinch River are affected by operations of the facilities of the ORR. The Y-12 Plant is located in the Bear Creek and East Fork Poplar Creek subbasins. ORNL is located in the White Oak Creek subbasin, which includes Melton Branch. The K-25 Site is located in the Poplar Creek subbasin, which includes Mitchell Branch. Figure 4.1 shows the Clinch River, the ORR boundary, and the affected major subbasins of the Clinch River. Raccoon Creek, which is west of ORNL, also has been affected by the reservation, but not by current operations.

The inherent quality of surface water in the vicinity of the ORR is influenced by the geochemistry and soil-water interactions of the subbasins. As discussed in Sect. 1.4 (Geology) and shown in Fig. 1.11, the surface features and surface geology of the ORR are formed by the repetition of stratigraphic units of the Rome Formation, Conasauga Group, Knox Group, and the Chickamauga Group. These units contain various amounts of sandstones, siltstones, shales, dolomites, and limestones. Interactions of groundwater with the unique collection and composition of geologic units in each subbasin result in concomitantly unique surface water chemistry for each subbasin.

The surface water and geochemical relationships are summarized by McMaster (1967). The report provides data for 29 area streams, including Bear Creek, East Fork Poplar Creek, White Oak Creek, Melton Branch, and Poplar Creek upstream of the ORR. The emphasis of the sampling program was low, medium, and high base-flow conditions (i.e., stream flow that originates as groundwater versus overland runoff). Samples of this type will show the maximum impact of geochemistry on surface water. The information from this report is useful today because the geochemical impacts upon surface water change very slowly with time.

Data in the McMaster report show that the surface waters originating in the ORR subbasins affected by the facilities are of a carbonate-bicarbonate type with little or no influence from natural sulfates, nitrates, or chloride. The major cation in Melton Branch and Bear Creek is calcium at 65 to 80%; magnesium contributes 15 to 25%. This is characteristic of base flow derived from limestone formations. In contrast, White Oak Creek cations consist of 45% calcium and 55% magnesium, which is typical for base flow derived from dolomite. Contributions of sodium and potassium to the total cations for these three streams are less than 10%. East Fork Poplar Creek has an ion composition that is unique among the streams on the ORR. Total cations consist of 50% calcium, 30% sodium and potassium, and 20% magnesium. The anions consist of 65% carbonate-bicarbonate, 20% chloride, and 15% sulfate. East Fork Poplar Creek also originates in a limestone formation; the presence of sodium, potassium, and sulfate is probably a consequence of operations at the Y-12 Plant.

The data for Poplar Creek show the influence of the Cumberland Plateau geology. The anions for this stream are 55% carbonate-bicarbonate, 40% sulfate, and 5% nitrate and chloride. The major cations consist of 60% calcium and 30% magnesium. This type of surface water is generally derived from a shale, siltstone, sandstone geology. The contribution of sulfate to the ion balance is probably influenced by surface coal mining activity on the Cumberland Plateau (McMaster 1967).

Memorandum of Understanding agreed to by DOE, EPA, and TDEC. This site, where the creek first approaches Bear Creek Road, was agreed upon as a point in the stream that is characteristic of the effects of the seepage of the S-3 ponds. Because of decreased flow at this site since the closure of the S-3 ponds, a new site at kilometer 11.97 is also being monitored and has been proposed as a replacement site. Analytical data are reported monthly to TDEC as an attachment to the discharge monitoring report (DMR) required by NPDES. These sites were monitored once per week for the radiological and nonradiological parameters shown in Tables 4.1 and 4.2 in Vol. 2. Figure 4.3 shows data from 1987–1991.

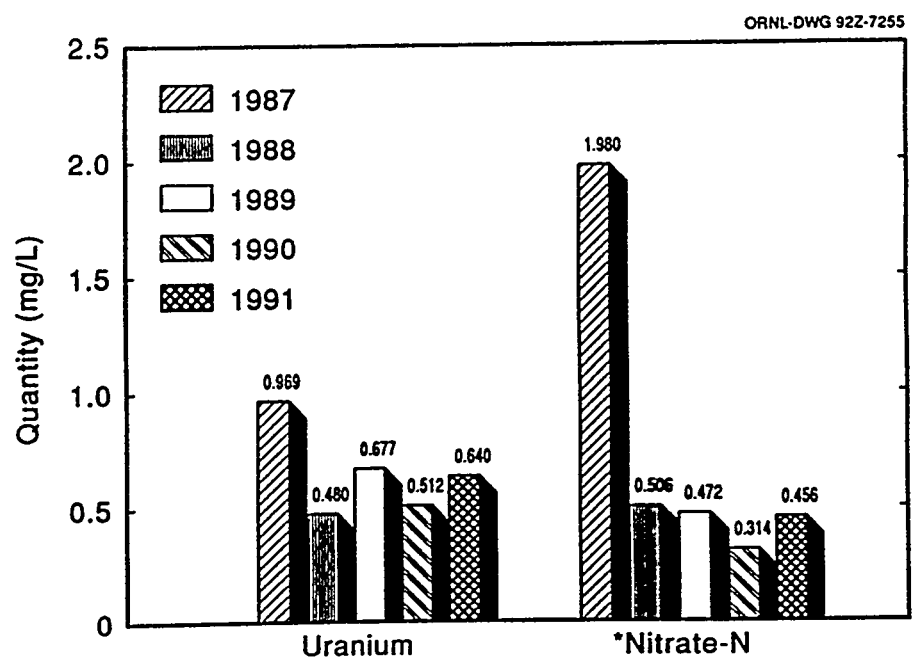
A sampling point is located in the diversion ditch around the New Hope Pond Closure Area. Samples are taken here on a weekly basis for the radiological parameters shown in Table 4.3 in Vol. 2. In addition, Station 17, located near the junction of Bear Creek and Scarboro roads, is used to monitor EFPC downstream of Lake Reality but prior to its leaving the Y-12 Plant boundary. Weekly samples were obtained here for the radiological and nonradiological parameters listed in Table 4.4 of Vol. 2. Grab samples were obtained twice per day for mercury, 24-h composite samples were obtained every day of the week, and 72-h composites were collected over the weekends.

ORR Off-Reservation Surface Waters

Data sampling and analyses of off-reservation surface waters were completed by ORNL staff and are discussed in Sect. 4.4.2.

Effluents

The Y-12 Plant holds Industrial User's Permit Number 001 with the city of Oak Ridge. Table 4.4 details the permit requirements and compliance record for each outfall in 1991. This permit allows the Y-12 Plant to discharge wastewater to be treated at the Oak Ridge Wastewater Treatment Facility through two main sewerage lines into the Oak Ridge sanitary sewer system in accordance with effluent limitations, monitoring requirements, and other conditions set forth in the permit. The radiological and nonradiological parameters monitored and the results obtained for these sewer lines and for the biology sewer line are listed in Tables 4.5, 4.6, and 4.7 of Vol. 2. Table 4.8 in Vol. 2 shows the total



*Actual Value = Chart Value x 100

Fig. 4.3. Upper Bear Creek trend chart, 1987–1991.

The study determined that the permit limit of 1.4 Mgd will not be exceeded unless unusually large amounts of precipitation occur. Flow and rainfall data will continue to be collected for future studies, and attempts will be made to establish trends between large rainfalls and elevated flows. The Y-12 Plant flow-monitoring equipment at the city station has been adjusted to total the flows daily instead of weekly to provide additional data. Many of these data will also be important indicators of reductions in flow once some of the once-through cooling waters, steam condensate, and other uncontaminated waters are rerouted from the sanitary sewer to the storm sewer.

8.1.12 Mercury Study in East Fork Poplar Creek for Methylation and Bioaccumulation in Fish

An experiment was designed to assess the role of sediment-associated mercury in fish contamination. Four cylindrical concrete enclosures, each 2 m (6.5 ft) in diameter, were placed in the channel of EFPC where it enters Lake Reality to measure directly the accumulation of methylmercury by fish exposed to mercury-contaminated sediments. Methylmercury is the form of mercury accumulated by biota that is produced by the action of microbes on inorganic mercury. Mercury was present in the EFPC water and absent in the groundwater made to flow through the enclosures. Fish were also exposed to the two water sources in tanks containing no sediments. Measurements of aqueous-phase mercury concentrations and speciation were made throughout the experiment.

Preliminary results suggest that the bioaccumulation of mercury in EFPC is a highly seasonal process. Fish exposed to contaminated sediments in both experimental treatments accumulated little mercury over the October–November period, even though they fed and grew over that time. Aqueous-phase concentrations of the methylmercury were very low in all treatments and indicated little production of this substance over the period. Further investigations of methylmercury production and bioaccumulation under summertime conditions are planned. Additionally, source studies conducted by the Environmental Restoration Division (ER) of mercury releases at the Y-12 Plant are planned to start in FY 1992. It is vital to understand the role of mercury-contaminated EFPC sediment in maintaining unacceptable concentrations of mercury in fish before deciding on the need for remedial measures such as dredging or stream relocation.

8.1.13 Fish Kill Investigations

On July 18, 1990, three (minnow-sized) dead fish were found in EFPC just downstream of Lake Reality during a routine survey conducted as part of the BMAP. During the follow-up surveys performed along the creek within the Y-12 Plant site boundaries for several days afterward, additional dead fish were found. Daily fish surveys have been performed since the initial sighting and have resulted in the recovery of approximately 2750 dead fish from EFPC through CY 1991. Daily surveys have also indicated that fish populations in EFPC have dramatically increased. This provides evidence that the upper reaches of the stream have begun recovery, but water quality may not yet be consistently adequate to fully protect aquatic life and fish propagation.

Several actions are under way in an effort to determine the causes of the ongoing fish kill and some individual fish kills that are not believed to be associated with the chronic problem. ORNL scientists who have been performing autopsies on various species of fish taken from these kills have speculated that elevated levels of chlorine in EFPC may have been a factor in the fish deaths. Streamside experiments to evaluate fish responses to chlorine stress have indicated that certain fish are susceptible to increased mortality given the current levels of chlorine in EFPC. Other factors are known to be involved and are being studied with the help of the U.S. Fish and Wildlife Service.

A committee consisting of personnel from various Y-12 Plant divisions and ORNL's Environmental Sciences Division has been examining the sources of discharges from the Y-12 Plant. The Y-12 Plant's Quality Division is in the process of analyzing data for the purpose of deriving statistical trend information that would allow identification of possible problem areas. Appropriate corrective actions will be taken, based on the findings of this committee. Daily surveys of EFPC will continue as will extensive sampling of the creek at various locations.

The reduction of chlorine from EFPC is being pursued directly in three different projects that will allow the Y-12 Plant to meet compliance levels as provided by the state of Tennessee. These projects

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Oak Ridge

RESERVATION

ENVIRONMENTAL REPORT FOR 1991

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OAK RIDGE RESERVATION ENVIRONMENTAL REPORT FOR 1991

VOLUME 2: DATA PRESENTATION

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Table 4.4. 1991 Y-12 Plant annual radiological and nonradiological data summary for Station 17[a]

Parameter	Number of samples	Concentration (mg/L)[b]			Standard error	Percentage of DCG
		Max	Min	Av		
Mercury	729	0.0076	0.0004	0.0014	0.0000	c
Nitrate	249	130.00	0.55	5.61	0.54	c
Total phosphorus	249	0.47	0.12	0.27	0.00	c
Copper	250	0.030	<0.006	<0.007	0.000	c
Zinc	249	0.170	0.017	0.044	0.001	c
Chromium	250	0.030	<0.006	<0.006	0.000	c
Molybdenum	249	0.110	<0.006	<0.007	0.000	c
Lithium	248	0.41	<0.02	<0.03	0.00	c
Selenium	225	<0.007	<0.002	<0.002	0.000	c
Cadmium	244	<0.004	<0.004	<0.004	0	c
Lead	246	0.020	<0.001	<0.002	0.000	c
Nickel	246	<0.050	<0.001	<0.037	0.001	c
Calcium	249	73.60	26.80	54.37	0.46	c
Magnesium	249	14.40	4.99	10.86	0.10	c
Sodium	249	43.0	2.8	17.6	0.5	c
Potassium	249	3.3	1.5	2.3	0.0	c
Sulfate	249	220	20	68	2	c
Chloride	249	150	1	19	1	c
Fluoride	249	5.8	0.1	1.0	0.0	c
Total suspended solids	243	62	<5	<11	1	c
Total dissolved solids	249	520	94	278	4	c
Alkalinity	249	140	68	108	1	c
Total organic carbons	249	27.0	1.7	14.9	0.4	c
Residual chlorine, total	232	<0.1	<0.1	<0.1	0	c
Cadmium (AA)	243	0.0041	<0.0001	<0.0006	0.0000	c
Temperature, °F	330	82	52	68	0	c
pH, standard units	323	8.8	5.5	b	0.0	c
Dissolved oxygen	318	10.2	2.7	7.6	0.1	c
Conductivity, mhos/cm	330	334	3	80	5	c
Alpha activity (pCi/L)	42	40.0	6.4	17.6	1.2	c
Beta activity (pCi/L)	43	27	8	17	1	c
^{237}Np (pCi/L)	43	0.75	–0.63	0.04	0.04	0.13
^{226}Ra (pCi/L)	27	4.30	0.27	2.02	0.23	2.02
^{228}Ra (pCi/L)	28	570	–240	108	34	108
^{90}Sr, (pCi/L)	43	7.1	–2.3	0.6	0.3	0.6
Th, total	43	0.015	–0.003	0.003	0.000	c
U, total	43	0.068	0.010	0.031	0.002	c
^{235}U (%)	43	0.95	0.22	0.46	0.03	c
^{238}Pu (pCi/L)	33	0.36	–0.53	0.00	0.03	0.01
$^{239/240}$Pu (pCi/L)	33	0.23	–0.14	0.03	0.01	0.10
^{99}Tc (pCi/mL)	44	0.140	–0.022	0.013	0.005	0.013
^{234}Th (pCi/L)	42	23.0	–2.7	2.0	0.8	0.02
^{228}Th (pCi/L)	43	3.8	0.01	0.83	0.11	0.21
^{230}Th (pCi/L)	43	2.1	0	0.37	0.05	0.12
^{232}Th (pCi/L)	43	0.46	–0.95	0.06	0.03	0.12
^{234}U (pCi/L)	43	150	3.4	9.7	3.3	c
^{235}U (pCi/L)	43	8.8	0.02	0.56	0.20	0.092
^{238}U (pCi/L)	43	35	3	11	1	2

[a]Flow during operations and/or discharging.
[b]Units are in mg/L unless otherwise noted.
[c]Not applicable.

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July 25, 1996

Ms. S. M. Flack
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Dear Ms. Flack:

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Enclosed are selected pages from seven documents which you have requested. These documents had previously been submitted for review and approval for public release by the Y-12 Plant Classification and Technical Information Offices.

ORNL-6209 Author not shown, "Selected pages from Environmental Monitoring Report, United States Department of Energy, Oak Ridge Facilities, Calendar Year 1984," Martin Marietta Energy Systems, Inc., (August 1985).

ORNL-6271 Author not shown, "Selected pages from Environmental Surveillance of the Oak Ridge Reservation and Surrounding Environs During 1985," Martin Marietta Energy Systems, Inc., (April 1986).

ES/ESH-1/V1 Oaks, T. W., Kimbrough, C. W., Pritz, P. M., et. al., "Selected pages from Environmental Surveillance of the U. S. Department of Energy Oak Ridge Reservation and Surrounding Environs During 1986, Volume 1: Summary and Conclusions," Martin Marietta Energy Systems, Inc., (April 1987).

ES/ESH-1/V2 Oaks, T. W., Kimbrough, C. W., Pritz, P. M., et. al., "Selected pages from Environmental Surveillance of the U. S. Department of Energy Oak Ridge Reservation and Surrounding Environs During 1986, Volume 2: Data Presentation," Martin Marietta Energy Systems, Inc., (April 1987).

ES/ESH-31/V1 Kornegay, F. C., West, D. C., McMahon, L. W., et. al., "Selected pages from Oak Ridge Reservation Environmental Report for 1992, Volume 1: Narrative," Martin Marietta Energy Systems, Inc., (September 1993).

ES/ESH-31/V2 Kornegay, F. C., West, D. C., McMahon, L. W., et. al., "Selected pages from Oak Ridge Reservation Annual Site Environmental Report for 1992, Volume 2: Data Presentation," Martin Marietta Energy Systems, Inc., (September 1993).

ES/ESH-47 Kornegay, F. C., West, D. C., McMahon, L. W., et. al., "Selected pages from Oak Ridge Reservation Annual Site Environmental Report for 1993," Martin Marietta Energy Systems, Inc., (November 1994).

If you have any questions, please contact L. L. McCauley at (423) 574-7593 or S. W. Wiley at (423) 576-0263.

Very truly yours,

L L McCauley

FOR R. M. Keyser, Director
Health, Safety, Environment,
and Accountability Organization

RMK:djl

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OAK RIDGE
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MARTIN MARIETTA

Environmental Monitoring Report
United States Department of Energy
Oak Ridge Facilities
Calendar Year 1984

OPERATED BY
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Oak Ridge Facilities

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Table 8. 1984 external gamma radiation measurements at ORGDP

Location[a]	No. of samples	μR/h			95% CC[b]
		Max	Min	Av	
76	12	16	9.4	12	1.2
77	12	13	8.2	11	1.1
78	12	20	14	17	0.86
79	9	21	14	18	1.3
80	9	15	8.2	11	1.4
81	12	19	10	14	1.8
82	12	15	8.6	11	1.5
83	12	17	9.0	13	1.6
84	12	19	12	15	1.3
85	9	16	8.2	12	1.9
Overall	111	21	8.2	13	0.62

[a]See Fig. 13.
[b]95% confidence coefficient about the average.

Gamma radiation levels along East Fork Poplar Creek ranged from 0 to 4.8 μR/h above background. The external gamma radiation levels along the bank of the Clinch River ranged from 2 to 25 μR/h above background. The impacts on the public from external radiation sources are minimal and are described in the section "Calculation of Potential Radiation Dose to the Public."

Surface Water

Radioactive

Surface streams. Flow proportional samples were composited weekly at the White Oak Dam Monitoring Station (W-2, Fig. 14). Water samples also were collected at the mouth of White Oak Creek (Station W-1), in the Clinch River at Melton Hill Dam (Station C-2) 3.7 km above the White Oak Creek outfall, at the ORGDP sanitary water outlet (Station C-3) 10 km downstream from the entry of White Oak Creek, at the ORGDP recirculating water outlet (Station C-4) downstream from the Poplar Creek outfall, and near Brashear Island (Station C-6). Processed water samples were collected from the water plant (Station C-5) near Kingston, Tennessee. Samples were collected continuously at Stations C-2, C-3, and W-1. A weekly 24-h composite sample was collected at Station C-4, and a weekly grab sample was collected at Station C-6. A daily grab sample was collected at Station C-5. Samples were composited for weekly, monthly, or quarterly analysis, depending on location.

Additional water samples were collected for uranium analyses (Fig. 14) at the outlet of New Hope Pond on East Fork Poplar Creek (Station E-1), in Bear Creek (Station B-1), and in Poplar Creek (Stations P-1 and P-2). Flow proportional samples were collected at Stations E-1 and B-1. Grab samples are collected weekly at Stations P-1 and P-2. All samples are composited for monthly analysis.

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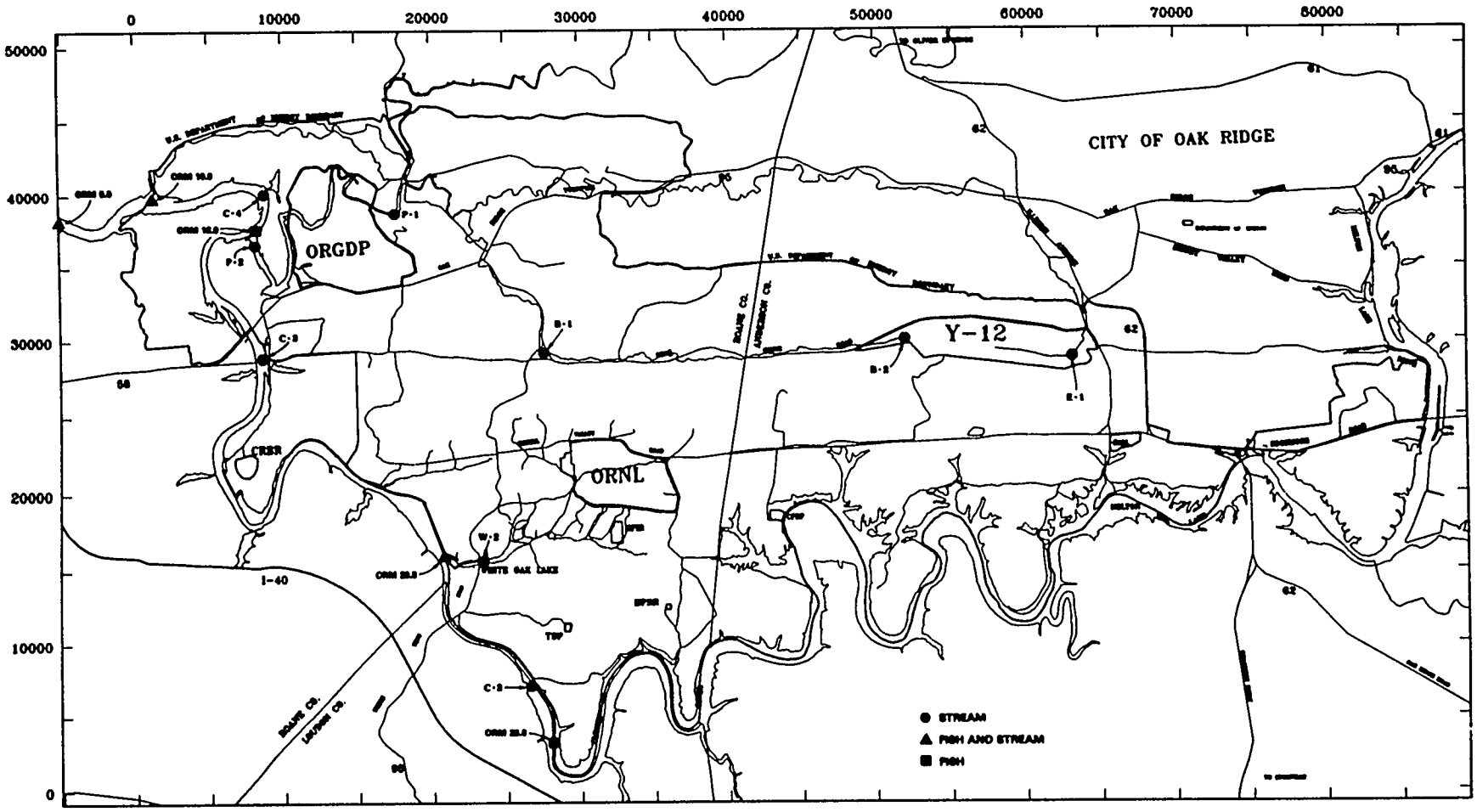

Fig. 14. Stream monitoring stations on the Oak Ridge Reservation.

which were below analytical detection limits. As points of reference, data are provided for samples collected at Melton Hill Dam above ORNL (C-2) and for samples of tap water collected at ORNL (Table 9).

Average uranium concentrations in East Fork Poplar Creek (E-1, Table 10 and Fig. 14), Bear Creek (B-1, Table 10 and Fig. 14), the Clinch River (C-3, C-4, and C-6, Table 10 and Fig. 14), and Poplar Creek (P-1 and P-2, Table 10 and Fig. 14) were about two times higher in 1984 than in 1983.

Table 10. 1984 concentrations of uranium in surface streams

Station[a]	No. of samples	Concentration (E-08 μCi/mL)			95% CC[b]	Dose[c] (millirem)
		Max	Min	Av		
P-1	12	1.2	< 0.12	< 0.70	0.08	0.83
P-2	12	1.1	< 0.12	< 0.72	0.08	0.86
C-3	12	< 0.62	< 0.12	< 0.55	0.06	0.65
C-4	12	0.74	< 0.12	< 0.57	0.06	0.67
C-6	12	0.62	< 0.12	< 0.58	0.06	0.69
E-1	12	17	0.14	5.0	3.1	3.7
B-1	12	31	0.26	6.7	5.2	8.0

[a]See Fig. 14.
[b]95% confidence coefficient about the average.
[c]Seventy-year committed effective dose equivalent based on consumption of 2.2 L of water per day. Calculations were based on the average concentrations.

The committed effective dose equivalents for consumption of 2.2 L of water per day for one year from each of the surface water stations and ORNL tap are given in Tables 9 and 10. The section "Calculation of Potential Radiation Dose to the Public" contains a discussion of the significance of the doses.

Total curies discharged from White Oak Dam to the Clinch River were calculated based on weekly concentration and daily flow data. Trends in discharges of ^{90}Sr and ^{3}H to the Clinch River are presented in Fig. 15. These are the principal contributors of radioactivity in terms of total curies to the discharge. Total curie amounts for the two radionuclides appeared to increase in 1984 compared with 1983—about 14% for ^{3}H and 20% for ^{90}Sr. Most of the discharges are primarily the result of seepage from the SWSAs at ORNL and do not reflect current operational status. The annual variations in the discharges from White Oak Lake are generally a function of the variability in annual precipitation patterns. The 1984 discharge continues to reflect an increase in total curies discharged over White Oak Dam that began in 1980 after a significant decrease from 1979 levels. Some of the apparent increase in 1984 may result from improved accuracy in high-flow readings. New weirs and associated flow instrumentation were made operational in early 1984.

Quantities of radionuclides discharged to surface streams for the past five years are given in Table 11. The transuranic elements have shown a relatively constant level over the past five-year period, as have uranium, ^{232}Th, and ^{131}I (except for 1983). Cesium-137 and ^{60}Co have decreased since 1982, whereas ^{3}H, ^{90}Sr, and ^{106}Ru appear to be increasing. Technetium-99 discharges have varied widely over the past five years, 1983 having the highest discharge and 1984 the lowest. The

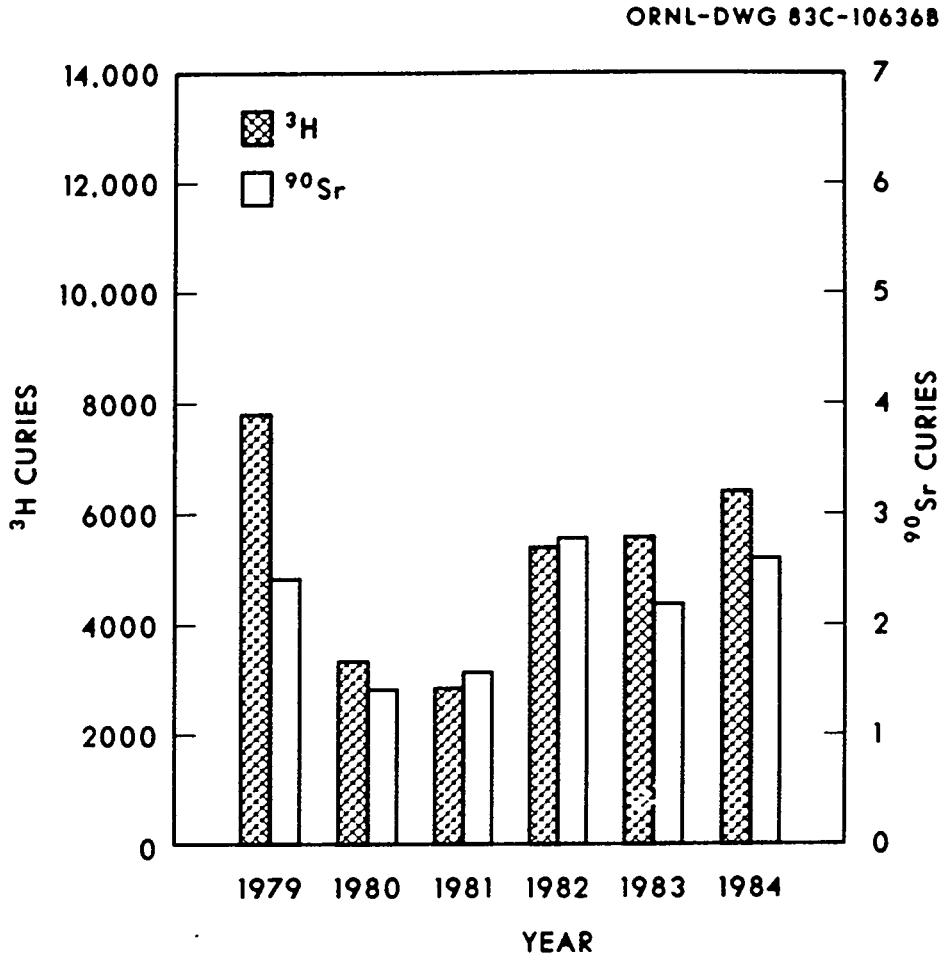

Fig. 15. Radioactive discharges over White Oak Dam.

^{3}H, ^{90}Sr, and ^{106}Ru quantities are all based on flow measurements at White Oak Dam. As mentioned previously, the capability to obtain more accurate measurements at high flows may have contributed to these results.

Rainwater. Trends in the gross beta activity in rainwater collected at perimeter and remote air monitoring stations over the past six years are shown in Fig. 16. Many of the measured activities for the remote and perimeter stations were at or near the limits of detection. Activities at the remote stations have been consistently higher than at the perimeter stations. Mean values in 1984 were higher than in 1983, but lower than in some previous years (1980 to 1981).

Nonradioactive

Water samples are collected for analysis of nonradioactive substances at the same locations discussed previously under radioactive water sampling. All samples are composited for monthly analyses; NO_3(N) values are determined from a monthly grab sample. EPA-approved methods are used for the determination of chemicals in water. Concentrations of chemicals in streams and creeks on or around the ORR are listed in Tables 12–22. Concentrations have been compared with Tennessee's instream allowable concentrations that are based on the long-term protection of domestic water supply, fish and aquatic life, and recreation classifications and recommendations made by

Table 11. Discharges of radioactivity to surface streams for 1980–1984

Radionuclide	Quantity discharged (Ci/year)				
	1980	1981	1982	1983	1984
^{137}Cs	0.60	0.23	1.5	1.2	0.56
^{60}Co	1.4	0.66	0.96	0.29	0.17
^{3}H	3400	2900	5400	5600	6400
^{131}I	0.09	0.04	0.06	0.004	0.057
^{106}Ru	< 0.01			0.18	0.28
^{90}Sr	1.4	1.5	2.7	2.1	2.6
^{99}Tc	5.1	3.5	1.7	17	0.29
Uranium[a]	0.60	0.87	0.67	0.42	0.32
^{232}Th	0.0080	0.0080	0.0090	0.007	0.010
Transuranics[b]	0.040	0.043	0.034	0.048	0.028

[a]Uranium of varying enrichments—curie quantities calculated using the appropriate specific activity for material released.

[b]Value based on gross transuranic alpha emitter analysis.

the TDHE to DOE Oak Ridge Operations.[4] Concentrations of chemicals in the outlet for the ORGDP sanitary water plant (Table 16) are compared with Tennessee Water Quality Criteria for domestic water supply.

Maximum concentrations recommended by the state for some chemicals are so low that it is impossible to measure to criteria levels using even the most sensitive EPA-approved methods. Those chemicals whose detection limits exceeded Tennessee's criteria include mercury, cadmium, and lead; however, all laboratories are working toward reducing the detection limits for these metals. The average concentrations of the other chemicals may easily be compared with Tennessee criteria. Chromium, copper, cyanide, sulfates, nickel, and total dissolved solids (TDS) were all within the Tennessee criteria (Tables 12–22). Other average concentrations that exceeded the criteria include $NO_3(N)$ at the confluence of White Oak Creek and the Clinch River (Table 13) and zinc and lead in East Fork Poplar Creek (Table 21). Average concentrations of fluoride were 100% of the Tennessee criteria at one location (Table 21).

In mid-1983, a program to collect weekly grab samples at station B-2 (Fig. 14) was initiated and continued during 1984. This station is located near the headwaters of Bear Creek and is influenced by discharges from the S-3 Ponds at Y-12. The disposal of plating shop and other liquid wastes at the S-3 Ponds was discontinued in March 1984 and neutralization activities in preparation for closure were initiated. Since that time, heavy metal concentrations at Station B-2 have

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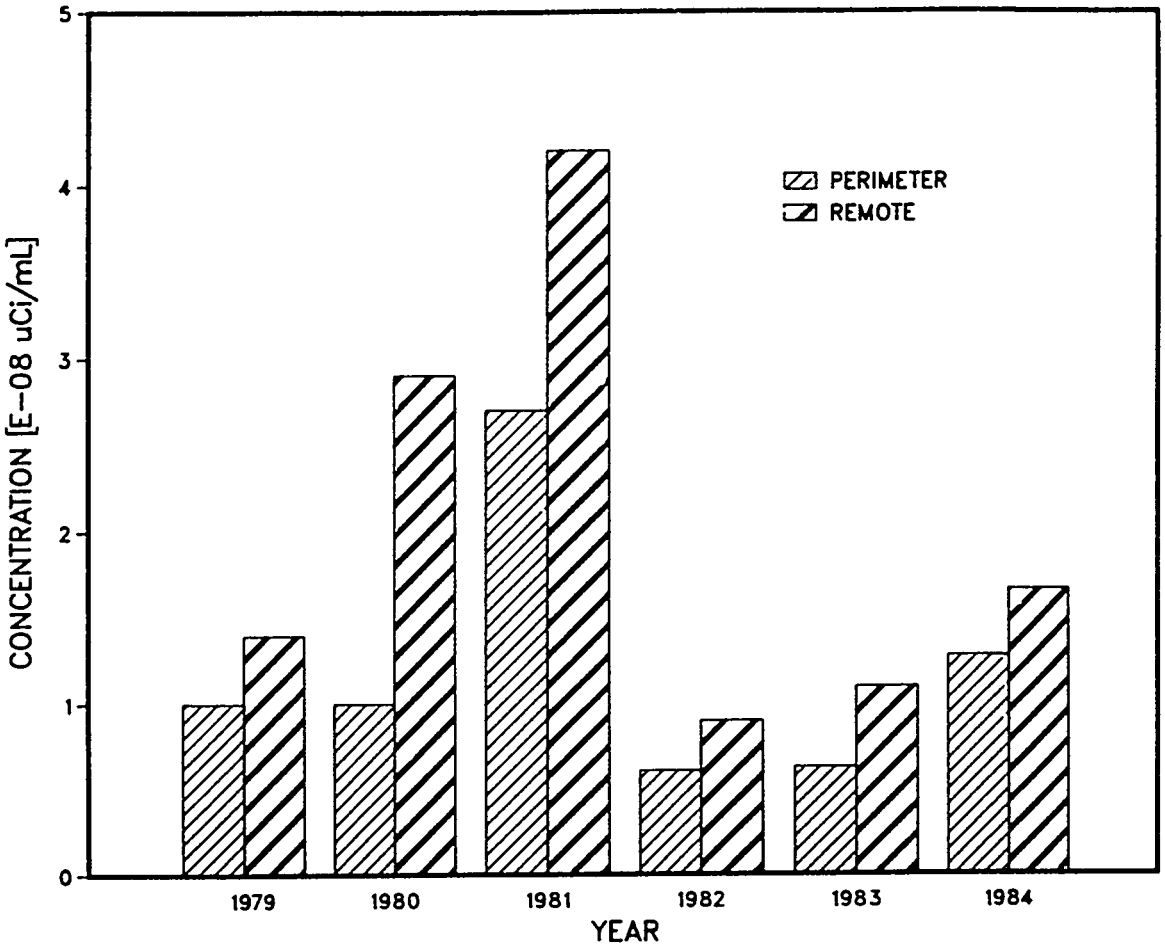

Fig. 16. Long-lived gross beta activity in rainwater.

Table 12. 1984 concentrations of chemicals in water collected at White Oak Dam (Location W-2, Fig. 14)

Chemical	No. of samples	Concentration (mg/L) Max	Min	Av	95% CC[a]	Criteria[b]	Percentage of Criteria
Cr	12	0.025	< 0.01	< 0.011	0.0025	0.05	< 23
Zn	12	0.036	< 0.02	< 0.024	0.0034	0.05	< 48
$NO_3(N)$	12	7.2	0.4	4.1	1.2	10	41
Hg	12	0.0002	< 0.00005	< 0.0001	0.00004	0.00005	< 200

[a]95% confidence coefficient about the average.

[b]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

Table 13. 1984 concentrations of chemicals in water collected at confluence of White Oak Creek and Clinch River (Location W-1, Fig. 14)

Chemical	No. of samples	Concentration (mg/L) Max	Min	Av	95% CC[a]	Criteria[b]	Percentage of Criteria
Cr	12	< 0.01	< 0.01	< 0.01	0	0.05	< 20
Zn	12	0.08	< 0.02	< 0.049	0.011	0.05	< 98
$NO_3(N)$	12	73	< 0.1	< 11	12	10	< 110
Hg	12	0.001	< 0.00005	< 0.0002	0.0001	0.00005	< 400

[a]95% confidence coefficient about the average.

[b]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

Table 14. 1984 concentrations of chemicals in water collected at Melton Hill Dam (Location C-2, Fig. 14)

Chemical	No. of samples	Concentration (mg/L) Max	Min	Av	95% CC[a]	Criteria[b]	Percentage of criteria
Cr	12	< 0.01	< 0.01	< 0.01	0.00	0.05	< 20
Zn	12	0.06	< 0.02	< 0.023	0.0067	0.05	< 47
$NO_3(N)$	12	4.0	0.27	1.8	0.50	10	18
Hg	12	< 0.0002[c]	< 0.00005	< 0.0001	0.00005	0.00005	< 200

[a]95% confidence coefficient about the average.

[b]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[c]Detection limit changed during 1984.

Table 15 (continued)

Parameter	Concentration (mg/L)	
	Third quarter	Fourth quarter
^{99}Tc[b]		< 2.7
Total dissolved solids	229	170
Kjeldahl nitrogen	0.18	0.10
Total organic carbon	1.5	2.3
Total phosphorous	< 0.10	< 0.10
Total suspended solids	14	3.0
Total uranium[f]	0.00016	0.00031
V	< 0.022	< 0.030
Zn	< 0.02	< 0.02

[a]See Appendix B for abbreviations.
[b]Units are pCi/L.
[c]Units are millions of fibers per L.
[d]Units are colonies per 100 mL.
[e]Units are mL/L.
[f]For the third quarter, the percentages of uranium isotopes by weight were ^{234}U, 0.008; ^{235}U, 0.73; and ^{238}U, 99.26. For the fourth quarter, the percentages of uranium isotopes by weight were ^{234}U, 0.008; ^{235}U, 0.71; and ^{238}U, 99.28.

Table 16. 1984 chemical water quality data for the ORGDP sanitary water pumping station (Location C-3, Fig. 14)

Substance	No. of samples	Concentration (mg/L)					Percentage of criteria
		Max	Min	Av	95% CC[a]	Criteria[b]	
Cd	12	< 0.002	< 0.002	< 0.002	0.0	0.01	< 20
Cr	12	< 0.01	< 0.01	< 0.01	0.0	0.05	< 20
CN	12	< 0.002	< 0.002	< 0.002	0.0	0.2	< 1
$NO_3(N)$	12	0.58	0.24	0.40	0.08	10	4
Pb	12	0.038	< 0.004	< 0.009	0.01	0.05	< 18
SO_4^{2-}	12	22	16	19	1.3	250	8
TDS[c]	12	160	130	140	5	500	28
Zn	12	0.09	< 0.02	< 0.03	0.01	5	< 1
F^-	12	0.29	< 0.10	< 0.17	0.04	1.4–2.4[d]	< 12
Hg	12	< 0.001	< 0.001	< 0.001	0.0	0.0002	< 500
Ni	12	0.04	< 0.01	< 0.01	0.01	0.1	< 10

[a]95% confidence coefficient about the average.
[b]Tennessee Water Quality Criteria standards for domestic water supplies.
[c]Total dissolved solids.
[d]Temperature dependent. Below 12°C maximum fluoride concentration is 2.4 mg/L; above this, the maximum concentration is 1.4 mg/L.

Table 17. 1984 chemical water quality data for the ORGDP recirculating water pumping station (Location C-4, Fig. 14)

Substance	No. of samples	Concentration (mg/L)					Percentage of criteria
		Max	Min	Av	95% CC[a]	Criteria[b]	
Cd	12	< 0.002	< 0.002	< 0.002	0.0	0.000025	< 8000
Cr	12	< 0.01	< 0.01	< 0.01	0.0	0.05	< 20
CN	12	0.005	< 0.002	< 0.002	0.001	0.0035	< 57
$NO_3(N)$	12	0.58	0.27	0.43	0.07	10	4
Pb	12	0.006	< 0.004	< 0.006	0.003	0.0038	< 160
SO_4^{2-}	12	28	16	21	2	250	8
TDS[c]	12	170	110	150	10	500	30
Zn	12	0.14	< 0.02	< 0.04	0.02	0.05	< 80
F^-	12	0.32	< 0.10	< 0.18	0.04	1	< 18
Hg	12	< 0.001	< 0.001	< 0.001	0.0	0.00005	< 2000
Ni	12	0.15	< 0.01	< 0.02	0.03	0.1	< 20

[a]95% confidence coefficient about the average.

[b]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[c]Total dissolved solids.

Table 18. 1984 chemical water quality data for the Clinch River downstream of ORGDP (Location C-6, Fig. 14)

Substance	No. of samples	Concentration (mg/L)					Percentage of criteria
		Max	Min	Av	95% CC[a]	Criteria[b]	
Cd	12	< 0.002	< 0.002	< 0.002	0.0	0.000025	< 8000
Cr	12	< 0.01	< 0.01	< 0.01	0.0	0.05	< 20
CN	12	< 0.002	< 0.002	< 0.002	0.0	0.0035	< 57
$NO_3(N)$	12	0.58	0.24	0.41	0.08	10	4
Pb	12	< 0.01	< 0.004	< 0.01	0.001	0.0038	< 270
SO_4^{2-}	12	22	16	19	1.4	250	8
TDS[c]	12	160	110	140	9.0	500	28
Zn	12	0.04	< 0.02	< 0.02	0.004	0.05	< 40
F^-	12	0.26	< 0.10	< 0.16	0.03	1.0	< 16
Hg	12	< 0.001	< 0.001	< 0.001	0.0	0.00005	< 2000
Ni	12	0.05	< 0.01	< 0.01	0.01	0.1	< 10

[a]95% confidence coefficient about the average.

[b]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[c]Total dissolved solids.

Table 19. 1984 chemical water quality data for Poplar Creek above Blair Bridge (Location P-1, Fig. 14)

Substance	No. of samples	Concentration (mg/L)					Percentage of criteria
		Max	Min	Av	95% CC[a]	Criteria[b]	
Cd	12	< 0.002	< 0.002	< 0.002	0.0	0.000025	< 8000
Cr	12	< 0.01	< 0.01	< 0.01	0.0	0.05	< 20
CN	12	< 0.002	< 0.002	< 0.002	0.0	0.0035	< 57
$NO_3(N)$	12	2.6	0.26	1.2	0.45	10	12
Pb	12	0.012	< 0.004	< 0.006	0.002	0.0038	< 270
SO_4^{2-}	12	45	17	33	6.4	250	13
TDS[c]	12	240	110	170	24	500	34
Zn	12	0.05	< 0.02	< 0.03	0.01	0.05	< 60
F^-	12	0.72	< 0.10	< 0.30	0.13	1	< 30
Hg	12	< 0.001	< 0.001	< 0.001	0.0	0.00005	< 500
Ni	12	0.04	< 0.01	< 0.02	0.01	0.1	< 20

[a]95% confidence coefficient about the average.

[b]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[c]Total dissolved solids.

Table 20. 1984 chemical water quality data for Poplar Creek near the Clinch River (Location P-2, Fig. 14)

Substance	No. of samples	Concentration (mg/L)					Percentage of criteria
		Max	Min	Av	95% CC[a]	Criteria[b]	
Cd	12	< 0.002	< 0.002	< 0.002	0.0	0.000025	< 8000
Cr	12	< 0.01	< 0.01	< 0.01	0.0	0.05	< 20
CN	12	0.003	< 0.002	< 0.002	0.0002	0.0035	< 57
$NO_3(N)$	12	0.90	0.19	0.49	0.15	10	5
Pb	12	0.016	< 0.004	< 0.006	0.002	0.0038	< 270
SO_4^{2-}	12	37	17	26	3.4	250	10
TDS[c]	12	170	98	130	18	500	26
Zn	12	0.04	< 0.02	< 0.02	0.004	0.05	< 40
F^-	12	0.31	0.10	0.18	0.05	1	18
Hg	12	< 0.001	< 0.001	< 0.001	0.0	0.00005	< 2000
Ni	12	0.03	< 0.01	< 0.01	0.004	0.1	< 10

[a]95% confidence coefficient about the average.

[b]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[c]Total dissolved solids.

Table 21. 1984 chemical water quality data for East Fork Poplar Creek (Location E-1, Fig. 14)

Substance	No. of samples	Concentration (mg/L)					Percentage of criteria
		Max	Min	Av	95% CC[a]	Criteria[b]	
Cd	12	0.003	< 0.002	< 0.002	0.0	0.000025	< 8000
Cl^-	12	42	6	15	8	250	6.0
Cr	12	0.02	< 0.01	< 0.01	0.03	0.05	< 20
Cu	12	0.048	0.008	0.016	0.01	0.02	80
F^-	12	1.1	0.6	1.0	0.1	1.0	100
Hg	12	0.0038	< 0.0005	< 0.0016	0.0009	0.00005	< 3200
$NO_3(N)$	12	6.0	2.4	3.8	1.0	10	38
Pb	12	0.03	< 0.01	< 0.01	0.005	0.0038	< 270
SO_4^{2-}	12	70	36	52	11	250	21
TDS[c]	12	260	180	220	24	500	44
Zn	12	0.20	0.03	0.07	0.04	0.05	140

[a]95% confidence coefficient about the average.

[b]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[c]Total dissolved solids.

Table 22. 1984 chemical water quality data for Bear Creek (Location B-1, Fig. 14)

Substance	No. of samples	Concentration (mg/L)					Percentage of criteria
		Max	Min	Av	95% CC[a]	Criteria[b]	
Cd	12	0.003	< 0.002	< 0.002	0.0002	0.000025	< 8000
Cl^-	12	21	5.0	8.0	4.0	250	3.2
Cr	12	< 0.01	< 0.01	< 0.01	0.0	0.05	< 20
Cu	12	0.013	< 0.004	< 0.007	0.003	0.02	< 35
F^-	12	0.6	0.1	0.2	0.1	1.0	20
Hg	12	0.0058	< 0.0005	< 0.0012	0.0014	0.00005	< 2400
$NO_3(N)$	12	15	3.2	7.3	3.1	10	73
Pb	12	< 0.01	< 0.01	< 0.01	0.0	0.00038	< 270
SO_4^{2-}	12	31	< 10	< 16	6	250	< 6
TDS[c]	12	350	180	220	53	500	44
Zn	12	0.18	< 0.02	< 0.04	0.04	0.05	< 80

[a]95% confidence coefficient about the average.

[b]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[c]Total dissolved solids.

local private business. This discovery led to a concern that the contamination was on-going and contaminating the sewer system. To monitor this potential problem, an in-line radiation detector was installed as an in-stream sewage monitor. In addition, an automatic water sampler was put in place. These were installed at the pump house, which was routinely visited for equipment maintenance. Water samples were brought to the laboratory and counted. This study yielded 44 water samples in which one or more of the previously mentioned radionuclides exceeded background. However, none of the measured parameters exceeded the most restrictive case identified in the Code of Federal Regulations as 10 CFR 20.

As a result of the contamination on Emory Valley Road, sampling of the Oak Ridge Wastewater Treatment Facility began in April 1984. Sewage sludge was routinely monitored for ^{137}Cs and ^{60}Co before being transported to a disposal site. The sludge was also periodically tested for mercury and the other parameters identified in the multiparameter analysis section.

Since the radiation monitoring began in April, the concentration of ^{137}Cs and ^{60}Co in the sludge has declined from 7.1 and 23 pCi/mL to 2.36 and 7.35 pCi/mL, respectively. During this time, there were three cases where a sudden spike of ^{137}Cs and ^{60}Co appeared. The reason for this has not been determined.

Characterization of the Nature of the Mercury Contamination in the Soil

The characterization of the mercury present in floodplain soils has been of interest to the ORTF. In August 1984, small black particles were discoved to be associated with mercury-contaminated soils but not with uncontaminated soils. A strong positive correlation was observed between the black particles and the concentration of mercury. Thus, it was suspected that the mercury is directly attached in some fashion to these particles. It was also noted that when contaminated soils were heated both the black particles and the mercury were lost. This loss of black particles at these temperatures implies they may be organic in nature. The organic composition has yet to be determined. At that time, it was hypothesized that the mercury could be attached to these organic particles via some sort of sulfur bond. However, subsequent leaching and heating experiments and comparing the results to similarly treated HgS have not supported the sulfur-bond hypothesis.

Further experimentation on these particles indicate that the mercury is probably not organically bound, nor is it elemental. This finding indicates that a the substance is probably an inorganic mercury compound (probably excluding HgS) or that the mercury is somehow occluded in the black matrix.

Multiparameter Analysis

Because of concerns that other contaminants besides mercury were released from the Y-12 plant, multiparameter analyses have been run on a subset of soil samples that indicate mercury contamination. These additional analyses included several radiochemical parameters (uranium and thorium) as well as those for barium, lead, arsenic, chromium, silver, selenium, beryllium, other metals, methyl-mercury, and PCBs (Tables C.3–C.9). The total soil mercury concentrations in this multiparameter study ranged from 130–480 ppm; no sample showed methyl-mercury above the detection limit of 0.1 ppm.

For comparison, several soil samples that showed mercury levels at background were submitted for multiparameter analysis. The results of these analyses are summarized in Table C.10.

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ENVIRONMENTAL SURVEILLANCE OF THE OAK RIDGE RESERVATION AND SURROUNDING ENVIRONS DURING 1985

OPERATED BY
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DEPARTMENT OF ENERGY

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ENVIRONMENTAL SURVEILLANCE OF THE OAK RIDGE RESERVATION AND SURROUNDNG ENVIRONS DURING 1985

Date Published: April 1986

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Table 4.3.1. Listing of identifications and new numbers of surface water sampling stations[a]

Location	New station number
Melton Hill Dam	W1
Confluence of White Oak Creek	W2
White Oak Dam (WOD)	W3
Melton Branch (MB)	W4
White Oak Creek (WOC)	W5
East weir WOC	W6
West weir WOC	W7
HFIR/TRU	W8
NSPP	W9
7500 bridge	W10
Northwest Tributary	W11
First Creek	W12
STP	W13
PWTP	W14
3500 (190 ponds) Ponds	W15
Flume Station 2	W16
Fifth Creek	W17
Raccoon Creek	W18
Ish Creek	W19
ORGDP sanitary water	W20
Poplar Creek above Blair Bridge	W21
Poplar Creek near Clinch River	W22
West Fork Poplar Creek	W23
East Fork Poplar Creek	W24
Bear Creek[b]	W25
K-1515	W26
K-710-A	W27
K-901-A	W28
K-1007-B	W29
K-1203	W30
K-1700	W31
Upper Bear Creek	W32
Kerr Hollow 301	W33
Rogers Quarry 302	W34
New Hope Pond 303	W35
Bear Creek 304	W36
Oil Pond 1-305	W37
Oil Pond 2-306	W38
Steam Plant Flyash Sluice Water 623	W39
S-3 Ponds Liquid Treatment Facility 507	W40
Mobile Waste Water Treatment Facility 508	W41
Waste Coolant Processing Facility 510	W42
Central Pollution Control Facility (CPCF) 501	W43
Poplar Creek[b]	W44
Kingston Water Plant	W45

[a]This new numbering system is being put in place for CY 1985. Most of these stations did not have old numbers.

[b]Future location.

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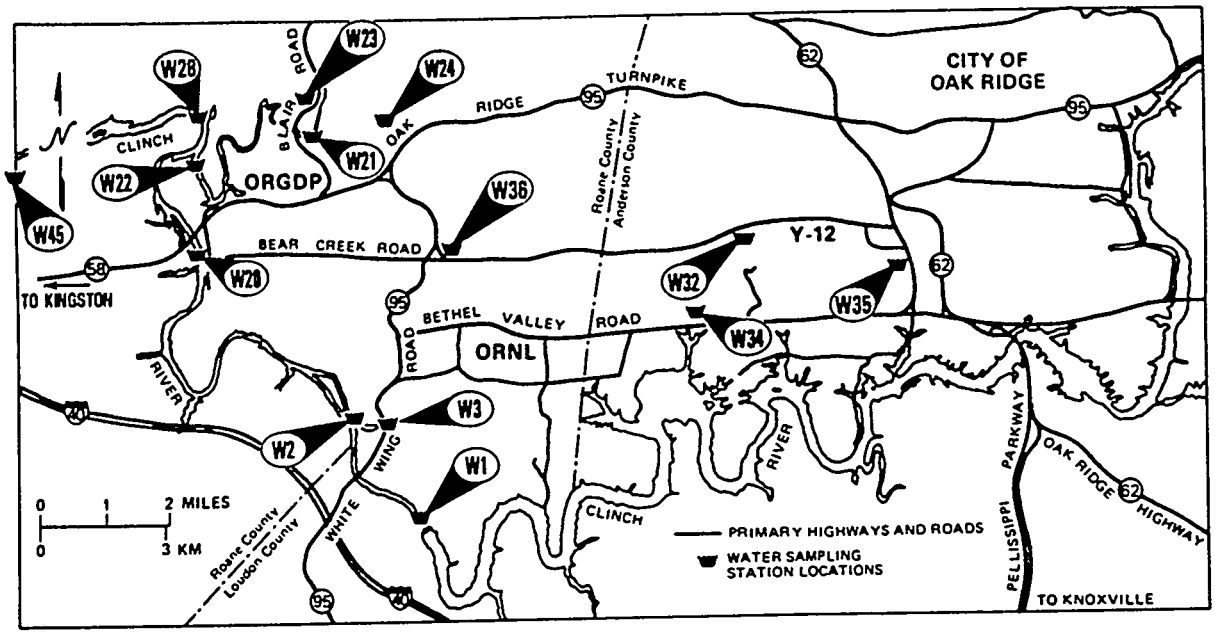

Fig. 4.3.1. Location map of water sampling locations W1 through W3 and W21 through W25 and W33, W36 and W44.

(2) Confluence of White Oak Creek and the Clinch River (station W2, Fig. 4.3.1)—represents the closest point of access by the public. Time proportional samples were collected daily and composited for weekly analysis.

(3) White Oak Dam (station W3, Fig. 4.3.1)—ORNL discharge point from White Oak Creek to Clinch River. Flow proportional samples were collected daily and composited for weekly analysis.

(4) ORNL tap water—a reference sample. Samples were collected daily and composited for quarterly analysis.

(5) ORGDP sanitary water (station W20, Fig. 4.3.1)—10 km downstream from the confluence of White Oak Creek and the Clinch River. A grab sample was collected and analyzed quarterly.

(6) Water plant near Kingston (station W45, Fig. 4.3.1)—downstream from the entry of White Oak Creek. A sample was collected daily and composited for quarterly analysis.

(7) A number of additional water sampling stations in WOC and Melton Branch, Bear Creek, and Poplar Creek.

Fission product radionuclide concentrations were determined by specific radionuclide analysis and gamma spectrometry. Uranium analysis was by the fluorometric method or mass spectrometry. Transuranic alpha emitters were determined by chemical chromatography and alpha spectrometry.

Concentrations of radionuclides of primary concern are shown in Tables 4.3.2 and 4.3.3. Concentrations determined at

Table 4.3.5. 1985 flow in the Clinch River and White Oak Creek

Month	Flow (10^9 Liters) Clinch River (W1)[a]	White Oak Creek (W3)[a]	Average ratio[b]
January	460	1.1	540
February	230	1.1	230
March	180	0.70	250
April	82	0.78	108
May	110	0.72	150
June	140	0.61	220
July	300	0.98	305
August	390	1.7	330
September	310	0.58	540
October	230	0.90	260
November	140	0.96	160
December	200	0.56	350

[a]See Fig. 4.3.3.
[b]Ratio of Clinch River to White Oak Creek flow is calculated weekly and averaged for the month.

being investigated. Doses from these concentrations are given in Sect. 3. Quantities of radionuclides discharged to surface streams for the past five years are given in Sect. 2.1. The discharge values reported in Sect. 2.1 are approximately equivalent to 0.39 Ci of uranium discharged to EFPC and 0.13 Ci to Bear Creek.

Rainwater samples are collected for radioactivity analyses on ORR and at remote locations shown in Figs. 4.3.5 and 4.3.6, respectively. Trends in the gross beta activity in rainwater (Table 4.3.4) collected at ORR stations over the past seven years are shown in Fig. 4.3.7. Many of the measured activities for the remote and perimeter stations were at or near the limits of detection. Activities at the remote stations have been consistently higher than at the perimeter stations. Mean values in 1985 were higher than in 1984, but lower than in some previous years (1980 and 1981).

4.3.3 Nonradioactive Water Quality

Water samples are collected for analysis of nonradioactive substances at many locations on and off the ORR. Samples are composited for monthly analyses; $NO_3(N)$ values are determined from a monthly grab sample. EPA-approved methods are used for the determination of chemicals in water. Concentrations of chemicals in streams and creeks on or around the ORR are determined as reviewed in this Section. These concentrations have been compared with Tennessee's in-stream allowable concentrations that are based on the long-term protection of domestic water supply, fish and aquatic life, and recreation classifications and recommendations made by the TDHE to DOE Oak Ridge Operations.[5] Concen-

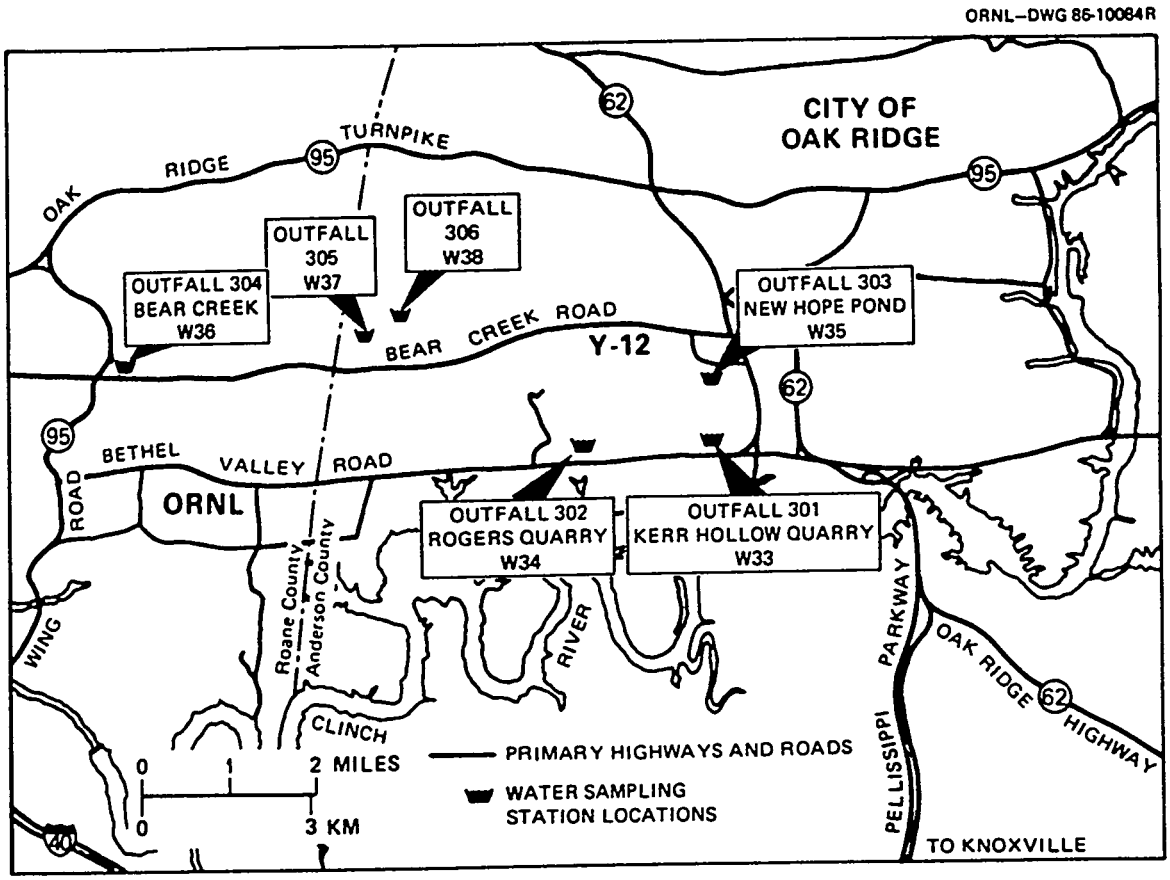

Fig. 4.3.4. Location map of Y-12 NPDES points W33 through W38.

the ORGDP recirculating pumping station. Chemical water quality data for the Clinch River downstream from ORGDP are given in Table 4.3.19. The 1985 chemical water quality data for Poplar Creek above Blair Bridge are given in Table 4.3.20. Table 4.3.21 lists the 1985 chemical water quality data for Poplar Creek near the Clinch River. The 1985 chemical water quality data for West Fork Poplar Creek on Blair Road are given in Table 4.3.22. Chemical water quality data for East Fork Poplar Creek are given in Table 4.3.23. Chemical water quality data for Bear Creek are given in Table 4.3.24.

Average chemical concentrations on or around the ORNL area are within TDHE criteria, except for mercury and zinc. The average zinc concentration slightly exceeded the criteria at White Oak Creek (Table 4.3.12). Average mercury concentrations exceeded TDHE criteria at all stations except Melton Hill Dam (Table 4.3.14).

NPDES permits under the Clean Water Act were issued by the EPA for each of the Oak Ridge facilities in 1975. The permits established a number of discharge locations at each installation and listed specific concentration limits and/or monitoring requirements for a number of parameters at each discharge location. A new NPDES permit was issued to ORGDP in February 1984. The sampling locations are shown in Fig. 4.3.8. Tables 4.3.23 through 4.3.28 list the

Table 4.3.14. 1985 concentration of mercury in surface water

Location	No. of samples	Concentration (mg/L)				Percentage of criterion[b]
		Max	Min	Av	95% CC[a]	
Flume (W15)	12	0.0003	<0.00005	<0.00012	0.000043	<250
3539 and 3540 pond discharges (W15)	12	0.059	0.013	0.011	0.0094	<22000
Melton Branch[c] (W4)	12	0.0001	<0.00005	<0.000054	0.000008	<110
White Oak Creek[c] (W5)	12	0.0006	<0.00005	<0.00023	0.000097	<470
White Oak Dam[c] (W3)	12	0.0003	<0.00005	<0.00011	0.000042	<220
Melton Hill Dam[d] (W1)	12	<0.00005	<0.00005	<0.00005	0.0	<100
Clinch River[d] (W20)	12	0.0001	<0.00005	<0.000058	0.00001	<120

[a]95% confidence coefficient about the average.
[b]Criterion is 0.00005 mg/L.
[c]See Fig. 4.3.3.
[d]See Fig. 4.3.1.

Table 4.3.15. 1985 concentration of chromium in surface water

Location	No. of samples	Concentration (mg/L)				Percentage of criterion[b]
		Max	Min	Av	95% CC[a]	
Flume (W15)	12	<0.01	<0.002	<0.0053	0.0014	<11
3539 and 3540 pond discharges (W15)	12	0.12	<0.005	<0.032	0.023	<64
Melton Branch[c] (W4)	12	<0.01	<0.002	<0.0053	0.0014	<11
White Oak Creek[c] (W5)	12	<0.01	<0.004	<0.0055	0.0012	<11
White Oak Dam[c] (W3)	12	<0.015	<0.004	<0.0079	0.0022	<16
Melton Hill Dam[d] (W1)	12	<0.01	<0.002	<0.0053	0.0014	<11
Clinch River[d] (W20)	12	<0.01	<0.002	<0.0053	0.0014	<11

[a]95% confidence coefficient about the average.
[b]Criterion is 0.05 mg/L.
[c]See Fig. 4.3.3.
[d]See Fig. 4.3.1.

Table 4.3.17. 1985 chemical water quality data for the ORGDP sanitary water pumping station[a]

Substance	No. of samples	Concentration (mg/L)				Criteria[c]	Percentage of criteria
		Max	Min	Av	95% CC[b]		
Cd	12	<0.0020	<0.0020	<0.0020	0.00	0.000025	*d*
Cr	12	0.030	<0.010	<0.010	0.0030	0.05	<23
CN	12	0.0040	<0.0020	<0.0020	0.00	0.0035	<11
No_3(N)	12	0.58	0.29	0.41	0.060	10	4
Pb	12	0.38	<0.0040	<0.0070	0.0060	0.0038	<15
SO_4^{2-}	12	25	21	23	0.90	250	9
TDS[e]	12	1500	40	240	220	500	49
Zn	12	0.35	0.020	0.084	1.5	0.05	17
F^-	12	0.28	<0.010	0.15	0.020	1.4-2.4[f]	<11
Hg	12	<0.0010	<0.00020	<0.0010	0.00	0.00005	*d*
Ni	12	0.060	<0.010	<0.020	0.010	0.1	<18

[a]Location W27, Fig. 4.3.3.

[b]95% confidence coefficient about the average.

[c]Tennessee Water Quality Criteria for domestic water supplies.

[d]When max, min, and av values were all less than (<) values, no percentages of criteria were determined because this is an indication that criteria are below the analytical lower limit of detection.

[e]Total dissolved solids.

[f]Temperature dependent. Below 12°C maximum fluoride concentration is 2.4 mg/L; above this, the maximum concentration is 1.4 mg/L.

The aluminum noncompliances at K-1700 (outfall 001) are intermittent conditions that occur occasionally during periods of heavy rainfall and subsequent heavy runoff. Samples have been collected from the streams that feed the K-1700 holding pond in an attempt to locate the source of the aluminum. A potential source is the clay, which has a high content of natural aluminum that would be carried to the streams as suspended solids during periods of heavy rain. Sampling will continue during 1986.

The noncompliances at K-1007-B (outfall 006) are due to increased COD loading. This occurs during periods of heavy rainfall, which deposits naturally occuring organic decomposition products into the K-1007-B holding pond. These conditions will continue to cause noncompliances in the future.

The total chromium violations at K-901-A (outfall 007) were due to the resuspension of colloidal hexavalent chromium compounds. This condition was believed to be associated with the low operating levels resulting from the shutdown of the gaseous diffusion cascade. Because of the reduced power levels, the concentration of polymers required to maintain the chromium ions in the trivalent state was changed, thus causing a colloidal suspension of the hexavalent chromium ions in the pond. The

Table 4.3.18. 1985 chemical water quality data for the ORGDP recirculating pumping station[a]

Substance	No. of samples	Concentration (mg/L)				Criteria[c]	Percentage of criteria
		Max	Min	Av	95% CC[b]		
Cd	11	0.0030	<0.0020	<0.0020	0.00	0.000025	<8000
Cr	11	0.020	<0.010	<0.0120	0.0020	0.05	<24
CN	12	0.0040	<0.0020	<0.0030	0.00050	0.0035	<86
$NO_3(N)$	12	0.71	0.25	0.45	0.084	10	5
Pb	11	0.010	<0.0040	<0.0050	0.0010	0.0038	<132
SO_4^{2-}	12	32	21	25	1.7	250	10
TDS[d]	12	1400	120	300	210	500	60
Zn	11	0.42	<0.020	<0.080	0.067	0.05	<160
F^-	12	0.34	<0.020	<0.16	0.05	1.4–2.4[e]	16
Hg	12	0.0020	<0.00020	<0.0010	0.00	0.00005	<2000
Ni	11	0.060	<0.010	<0.020	0.010	0.1	<20

[a]Location W28, Fig. 4.3.8.

[b]95% confidence coefficient about the average.

[c]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[d]Total dissolved solids.

[e]Temperature dependent. Below 12°C maximum fluoride concentration is 2.4 mg/L; above this, the maximum concentration is 1.4 mg/L.

immediate corrective action was to seed the pond with the polymer to induce precipitation. A plan was then developed to adjust the polymer feed rates to prevent future conversion of the hexavalent chromium. Since these actions were taken in August 1985, there has been no resuspension of the hexavalent chromium.

The Y-12 Plant surface water monitoring programs for nonradioactive substances consist primarily of sampling the sanitary sewer wastewaters and discharges covered under the NPDES permit. The NPDES program alone covers over 236 outfalls varying in source from wastewater treatment facilities to precipitation runoff (Figs. 4.3.4 and 4.3.9). This is a result of the new NPDES permit issued to the Y-12 Plant on May 24, 1985. In comparison, the former permit contained four discharge monitoring locations. The parameters and limits for the new permit are based on best management practices and in-stream water protection criteria. In most cases the limits are much more stringent than before and compliance is based on mass loading as well as on concentration values.

Tables 4.3.23 and 4.3.24 show the concentration of chemicals in EFPC and Bear Creek, respectively, as compared with Tennessee's in-stream allowable concentrations, which are based on the long-term protection of domestic water supply, fish and aquatic life, and recreation classifications. Many of the substances are monitored under the NPDES permit,

Table 4.3.19. 1985 chemical water quality data for the Clinch River downstream from ORGDP[a]

Substance	No. of samples	Concentration (mg/L)				Criteria[c]	Percentage of criteria
		Max	Min	Av	95% CC[b]		
Cd	12	<0.0020	<0.0020	<0.0020	0.00	0.000025	*d*
Cr	12	0.030	<0.010	<0.012	0.0030	0.05	<23
CN	12	0.0050	<0.0020	<0.0030	0.0010	0.0035	<79
$NO_3(N)$	12	0.61	0.18	0.37	0.071	10	3.7
Pb	12	0.021	<0.0040	<0.0060	0.25	0.0038	<156
SO_4^{2-}	12	26	16	22	1.5	250	9
TDS[e]	12	1100	130	230	150	500	45
Zn	12	0.050	<0.020	<0.030	0.010	0.05	<57
F^-	12	0.27	<0.010	<0.15	0.040	1.4-2.4[f]	<15
Hg	12	0.0010	<0.00020	<0.0010	0.00	0.00005	<2000
Ni	12	0.18	<0.010	<0.040	0.030	0.1	35

[a]Location W45.

[b]95% confidence coefficient about the average.

[c]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[d]When max, min, and av values were all less than (<) values, no percentages of criteria were determined because this is an indication that criteria are below the analytical lower limit of detection.

[e]Total dissolved solids.

[f]Temperature dependent. Below 12°C maximum fluoride concentration is 2.4 mg/L; above this, the maximum concentration is 1.4 mg/L.

which has less stringent limits than those listed in the tables. Consideration must also be given to the fact that some of the criteria limits are well below the reportable detection limits and analytical capabilities of the laboratories.

The locations of the ten major Y-12 NPDES discharge points are shown in Figs. 4.3.4 and 4.3.9. The remaining outfalls lie within the various categories listed in Table 4.3.26. This table lists the effluent limits as they appear in the May 1985 revision of the Y-12 Plant NPDES permit. However, the Percent of Compliance Column reflects the whole year and not just the last eight months (May to December). Many of the noncompliances reported in Table 4.3.26 were experienced prior to the effective date of the revised permit.

In mid-1983, a program to collect weekly grab samples at station W32 (Fig. 4.3.1) was initiated and was continued during 1985 (Table 4.3.24). Station W32 is located near the headwaters of Bear Creek and is influenced by discharges from the S-3 Ponds at Y-12. The disposal of plating shop and other liquid wastes at the S-3 Ponds was discontinued in March 1984 and neutralization activities in preparation for closure were initiated. Since that time, heavy metal concentrations at W32 have decreased significantly.

The locations of the ORNL NPDES points are shown in Fig. 4.3.3. NPDES permits were issued by the EPA to DOE-

Table 4.3.20. 1985 chemical water quality data for Poplar Creek above Blair Bridge[a]

Substance	No. of samples	Concentration (mg/L)				Criteria[c]	Percentage of criteria
		Max	Min	Av	95% CC[b]		
Cd	12	<0.0020	<0.0020	<0.0020	0.00	0.000025	*d*
Cr	12	0.030	<0.010	<0.013	0.0035	0.05	<26
CN	12	0.015	<0.0020	<0.0030	0.0020	0.0035	<86
$NO_3(N)$	12	1.5	0.21	1.0	0.22	10	10
Pb	12	0.012	<0.0040	<0.014	0.019	0.0038	<368
SO_4^{2-}	12	46	34	40	0.56	250	16
TDS[d]	12	550	100	190	68	500	38
Zn	12	0.23	0.020	0.090	0.50	0.05	180
F^-	12	0.30	0.060	0.22	0.47	1.4-2.4[e]	16
Hg	12	<0.0010	<0.00020	<0.0010	0.00	0.00005	*d*
Ni	12	0.060	<0.010	<0.020	0.010	0.1	<20

[a]Location W21, Fig. 4.3.1.

[b]95% confidence coefficient about the average.

[c]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[d]When max, min, and av values were all less than (<) values, no percentages of criteria were determined because this is an indication that criteria are below the analytical lower limit of detection.

[e]Temperature dependent. Below 12°C maximum fluoride concentration is 2.4 mg/L; above this, the maximum concentration is 1.4 mg/L.

ORO to discharge to and monitor nonradiological substances in streams near ORNL in 1975. The permits established three discharge locations at ORNL (White Oak Creek, Melton Branch, and the Sewage Treatment Plant) and listed specific concentration limits and/or monitoring requirements for a number of parameters at each discharge location. ORNL achieved compliance of 99 to 100% for all effluent parameters at both White Oak Creek and Melton Branch (Table 4.3.28). At the sewage treatment plant (STP), less than 100% compliances were documented for ammonia (58%), BOD (90%), residual chlorine (96%), and suspended solids (87%). When compared with the compliances achieved in 1984, a trend of improvement was observed. This improvement is the result of the new Sewage Treatment Plant, which was completed in August 1985 and has been in use at ORNL since September 4, 1985. This new plant has the capacity for an average flow of 1,134,000 L/d and has the design capability for surges as high as 2,835,000 L/d. The treatment system consists of an aeration tank, a final clarifier, sludge holding and recirculation equipment, mixed media filter equipment, and sludge wastage piping. Effluent from the new treatment plant has been directed from the filter to the chlorination system. The noncompliances before and after the startup of the new sewage treatment plant are shown in Fig. 4.3.10. Discharge

Table 4.3.21. 1985 chemical water quality data for Poplar Creek near the Clinch River[a]

Substance	No. of samples	Concentration (mg/L)				Criteria[c]	Percentage of criteria
		Max	Min	Av	95% CC[b]		
Cd	12	<0.0020	<0.0020	<0.0020	0.00	0.000025	
Cr	12	0.030	<0.010	0.013	0.0040	0.05	<26
CN	12	0.0030	<0.0020	<0.0020	0.00	0.0035	<57
$NO_3(N)$	12	0.93	0.35	0.69	0.11	10	7
Pb	12	0.016	<0.0040	<0.0050	0.0040	0.0038	<132
SO_4^{2-}	12	36	26	33	2.1	250	13
TDS[d]	12	1300	14	230	190	500	46
Zn	12	1.0	0.020	0.040	0.020	0.05	80
F^-	12	0.32	<0.10	<0.23	0.040	1.4-2.4[e]	<17
Hg	12	<0.0010	<0.00020	<0.0010	0.00	0.00005	
Ni	12	0.080	<0.010	0.030	0.010	0.1	<30

[a]Location W45, Fig. 4.3.1.

[b]95% confidence coefficient about the average.

[c]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[d]Total dissolved solids.

Table 4.3.22. 1985 chemical water quality data for West Fork Poplar Creek on Blair Road[a]

Substance	No. of samples	Concentration (mg/L)				Criteria[c]	Percentage of criteria
		Max	Min	Av	95% CC[b]		
Cd	12	<0.0020	<0.0020	<0.0020	0.00	0.000025	*d*
Cr	12	0.020	<0.010	<0.010	0.00	0.05	<20
CN	12	0.0050	<0.0020	<0.0030	0.0010	0.0035	<86
$NO_3(N)$	12	0.50	0.17	0.32	0.060	10	3.2
Pb	12	0.027	<0.0040	0.0090	0.0050	0.0038	<237
SO_4^{2-}	12	63	34	39	7.0	250	16
TDS[e]	12	780	100	200	100	500	40
Zn	12	0.070	0.020	0.040	0.010	0.05	80
F^-	12	0.27	<0.10	<0.17	0.040	1.4-2.4[e]	<12
Hg	12	<0.0010	<0.00020	<0.0010	0.00	0.00005	*d*
Ni	12	0.080	<0.010	<0.020	0.010	0.1	<20

[a]Location W23, Fig. 4.3.1.

[b]95% confidence coefficient about the average.

[c]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[d]When max, min, and av values were all less than (<) values, no percentages of criteria were determined because this is an indication that criteria are below the analytical lower limit of detection.

[e]Total dissolved solids.

Table 4.3.23. 1985 chemical water quality data for East Fork Poplar Creek[a]

Paremeter	No. of samples	Concentration (mg/L)				Criteria[c]	Percentage of criteria
		Max	Min	Av	95% CC[b]		
Hg	12	0.0039	0.0006	0.0018		0.00005	3600
TSS	12	66	<5.0	<20		NC[d]	
TDS[e]	12	340	150	240		500	48
Cl	12	190	13	34		250	14
CN	12	0.006	<0.002	<0.003		0.0035	<85
F^-	12	1.0	0.8	0.9		1.0	90
MBAS	12	<0.05	<0.05	<0.05		NC	
TKN	12	10	0.3	1.4		NC	
NO_3(N)	12	34	1.4	6.9		10	69
SO_4^{2-}	12	80	44	58		250	23
Turbidity	12	17	0.7	7.9		NC	
Ag	12	0.03	<0.01	<0.01		NC	
Al	12	1.2	0.07	0.3		NC	
As	12	<0.06	<0.06	<0.06		NC	
B	12	0.07	0.02	0.04		NC	
Ba	12	<0.2	<0.2	<0.2		NC	
Be	12	<0.0005	<0.0005	<0.0005		NC	
Ca	12	47	33	39		NC	
Cd	12	<0.002	<0.002	<0.002		0.000025	*f*
Ce	12	<0.03	<0.03	<0.03		NC	
Co	12	<0.002	<0.002	<0.002		NC	
Cr	12	<0.01	<0.01	<0.01		0.05	*f*
Cu	12	0.09	0.006	0.019		0.02	95
Fe	12	1.3	0.06	0.6		NC	
Ga	12	<0.04	<0.04	<0.04		NC	
K	12	2.6	1.3	1.9		NC	
La	12	<0.01	<0.01	<0.01		NC	
Li	12	0.03	0.01	0.02		NC	
Mg	12	11	8.2	9.5		NC	
Mn	12	0.22	0.01	0.08		NC	
Mo	12	<0.1	<0.1	<0.1		NC	
Na	12	36	8.9	16		NC	
Nb	12	<0.02	<0.02	<0.02		NC	
Ni	12	0.15	<0.01	<0.02	0.1		
P	12	0.3	0.11	0.2	NC		
Pb	12	<0.01	<0.01	<0.01		0.0038	*f*
Sc	12	<0.001	<0.001	<0.001		NC	
Sr	12	0.12	0.09	0.17		NC	
Th	12	<0.02	<0.02	<0.02		NC	
Ti	12	0.017	<0.001	<0.008		NC	
V	12	<0.003	<0.003	<0.003			
Y	12	0.002	<0.001	<0.001			
Zn	12	0.09	<0.02	<0.05		0.05	<100
Zr	12	0.002	<0.001	<0.001			

[a]Location W24, Fig. 4.3.1.

[b]95% confidence coefficient about the average.

[c]Tennessee stream standards based on protection of domestic water supply, fish and aquatic life, and recreation classifications.

[d]NC = No criteria available.

[e]Total dissolved solids.

[f]When max, min, and av values were all less than (<) values, no percentages of criteria were determined because this is an indication that criteria are below the analytical lower limit of detection.

Table 4.3.26. 1985 National Pollutant Discharge Elimination System (NPDES) compliance at the Y-12 Plant

Discharge point	Effluent parameter	Effluent limits: Daily av (kg/d)	Daily max (kg/d)	Daily av (mg/L)	Daily max (mg/L)	Percent of compliance
301	Lithium				5.0	100
(Kerr Hollow	pH units			>6.5	<8.5	100
Quarry)	Total suspended solids			30.0	50.0	100
	Temperature, °C				30.5	100
	Zirconium				3.0	100
302	Oil and grease			10.0	15.0	96
(Rogers Quarry)	pH units			>6.5	<8.5	91
	Settleable solids, mL/L				0.5	96
	Total suspended solids			30.0	50.0[a]	98
	Temperature, °C				30.5	100
303	Ammonia (as N)				1.6	97
(New Hope Pond)	Cadmium, total			0.0025	0.0035	94
	Chromium, total			0.05	0.08	100
	Copper, total			0.015	0.022	94
	Dissolved oxygen			5.0[b]		97
	Dissolved solids				2000	100
	Fluoride			1.5	2.0	100
	Lead, total			0.012	0.17	100
	Lithium, total				5.0	100
	Mercury, total			0.0035	0.0080	91
	Nitrogen, total (as N)				20.0	94
	Oil and grease			10.0	15.0	94
	pH units			>6.5	<10.0	96
	Settleable solids (mL/L)				0.50	96
	Surfactants (as MBAS)			5.0	8.0	98
	Total suspended solids				20.0[c]	100
	Temperature, °C				30.5	100
	Zinc, total			0.20	0.30	100
304	Oil and grease			10.0	15.0	100
(Bear Creek)	pH units			>6.5	<8.5	100
305 (leaking burial	Oil and grease			10.0	15.0	100
grounds and wet weather	pH units			>6.5	<8.5	87
springs—Oil Pond #1)	Total suspended solids			30.0	50.0	100
306 (seepage from burial	Oil and grease			10.0	15.0	87
pit and surface water	pH units			>6.5	<8.5	100
runoff—Oil Pond #2)	Total suspended solids			30.0	50.0	87
Category I outfalls (precipitation runoff and small amounts of groundwater)	pH units			>6.5	<8.5	100
Category II Outfalls	pH units			>6.5	<8.5	98
(cooling waters, condensate,	Temperature[d]					100

modeling purposes would be the averages and the standard deviations. On a larger (30-m) depth scale extending into comparatively unweathered bedrock, there appeared to be some general decline in most radionuclide Kd's.

Cation exchange capacities averaged 210 meq/kg and were quite uniform in this characteristic. There appeared to be only a minor influence of vegetational nutrient cycling, as evidenced by the modest decline in exchangeable calcium with depth in each profile tested. A number of significant correlations were observed among the soil chemical properties. Of particular note are the correlations between exchangeable acidity and percent base saturation and pH ($r = 0.80$ and -0.72, respectively). This relationship is to be expected because the lower the soil pH, the more exchange sites that are occupied by acid cations (Al^{+3} and H^{+}) and, hence, the lower the percentage of these sites that are occupied by basic cations. Calcium dominated these exchangeable bases when the base saturation increased, which accounts for its high correlation ($r = 0.90$) with percent base saturation and its negative correlation with exchangeable acidity ($r = -0.73$). A summary of radionuclide, chemical, physical, and mineralogical properties for soils collected at the ETF site is contained in Table 5.1.1.

5.1.4 Y-12 Plant Air Monitoring Programs

To accurately assess the effect of Y-12 Plant operations on the region's ambient air quality, the Y-12 Plant currently has in place a comprehensive plan to upgrade stacks and its air monitoring program.[5] This program is expected to grow significantly in the next five years as the Y-12 Plant obtains hundreds of air pollution operating permits and new emission sources are added or modified. In addition, recently enacted, proposed, or considered changes in air pollution regulations,[6] such as the expansion of hazardous air pollution regulations and the regulation of airborne radionuclides, may significantly increase the air pollution monitoring requirements of the Y-12 Plant in the near future.

Air pollution monitoring at the Y-12 Plant involves three distinct but interrelated monitoring methods. The first, mandated by the Clean Air Act,[7] is source emission or stack testing. This procedure is required to ensure that air pollution control devices are operating efficiently and that permitted emission rates are not exceeded. This method of air pollution testing is very important because it specifically determines the degree of compliance with emission limitations for individual air pollution point sources. The remaining two methods of air pollution monitoring, ambient air and atmospheric dispersion modeling, attempt to determine the impact of Y-12 Plant operations on the region's air quality.

In 1985 the Y-12 Plant continued to make significant strides in defining the physical and chemical characteristics of airborne releases emitted from production stacks. The "Stack Catalog Project," initiated in 1984, was completed to provide an overall inventory and evaluation of the Y-12 Plant's ventilation stacks. Efforts are continuing to maintain an up-to-date inventory of the Y-12 Plant's ventilation systems to account for emissions stemming from inside the plant boundaries. During 1985, emphasis continued to be placed on upgrading controls on existing air pollution sources to further reduce emissions of contaminants into the atmosphere; a number of capital projects

are under way at the Y-12 Plant that will reduce emissions of air contaminants. One of these projects, the Y-12 Steam Plant Improvement—Emissions Control Project, which had been ongoing for several years, was completed in 1985. The installation of new, high-efficiency, fabric-filter baghouses on all four pulverized coal boilers of the Y-12 Plant's Steam Plant was completed and has significantly reduced the amount of particulates (fly ash) released into the atmosphere. Opacity of the steam plant stack emissions is continuously monitored using light photometry. During 1984, readings that were taken before the baghouse installation indicated that visible emissions exceeded state-imposed limits. Opacity measurements taken following baghouse installation were well within compliance limits.

A comprehensive program to significantly improve monitoring and quantification of radiological air emissions from the Y-12 Plant's many process stacks was developed in 1985 and initiated under an ambitious schedule in order to meet the requirements issued by the EPA under the NESHAP program. The Y-12 Plant Airborne Radionuclide Monitoring Program involves a strategy consisting of a number of independent but interrelated program elements. The strategy combines periodic EPA stack sampling techniques with continuous stack sample collection and real-time emissions monitoring. All program elements were designed to interact to fulfill the goal of quantifying radiological air emissions and demonstrating compliance with NESHAP in the most expeditious time period possible. Approximately 120 process stacks, which serve equipment that processes enriched or depleted uranium, are involved in the program.

Progress continues to be made to quantify radiological air discharges from uranium processing exhaust stacks and significantly upgrade the emissions monitoring capabilities of the Y-12 Plant.

Stack sampling activities were initiated and are currently being conducted by the ORGDP Systems and Equipment Technology Department under contract with Y-12 to obtain an EPA-approved characterization of stack effluents from a large number of uranium processing exhausts. Many of these stacks are being lengthened or otherwise modified, and permanent stack sampling access platforms are being installed in order to meet the EPA criteria for the collection of particulate stack samples. Construction was completed in late 1985 on the first four stacks to be modified, and detailed engineering design is continuing for the modification of all remaining stacks that do not meet sampling requirements. Where possible, independent stacks are being combined and complete emissions sampling and monitoring capabilities provided in order to continuously measure potential radiological emissions in the most cost-effective manner possible.

In addition to obtaining an EPA-approved stack gas characterization of all significant Y-12 Plant uranium processing exhaust stacks, continuous emission stack samplers are being installed. The purpose is to monitor daily radiological emissions and alert operating personnel of possible emission excursions.

The major improvements in Y-12's radiological air emissions monitoring will continue through 1986. The completion of the Y-12 Plant Radionuclide Monitoring Program by February 1987 continues to be one of the highest priorities of the Y-12 Plant, with significant capital and

manpower resources dedicated to its success.

The Y-12 Plant currently operates two stations within the Plant boundaries to monitor the ambient air concentrations of total suspended particulate matter and sulfur dioxide. Eleven monitoring stations located around the perimeter of the Plant are also maintained. These stations gather data on the concentrations of various uranium isotopes. In addition, efforts continued during 1985 to expand the existing perimeter system by including an ambient air monitor for the Scarboro Community of the City of Oak Ridge. This project is scheduled for completion in early 1986 and will involve installation of ambient air monitoring stations capable of sampling (1) particulates, with a high-volume sampler; (2) radionuclides, with a charcoal filter; and (3) both dry (deposition) and wet (precipitation) atmospheric fallout. Data will be collected in a digital format and the host computer will be able to calculate daily and weekly averages for all monitoring variables.

Atmospheric dispersion modeling will play an important role in the Y-12 Plant's Air Pollution Control Program. Computer-aided atmospheric dispersion modeling provides a valuable tool for determining long-range transport of air contaminants and predicting downwind ground-level concentration of materials near a source. Air pollution modeling will enable the Y-12 Plant to model emergencies and estimated effects on employees and population centers downwind of the plant. Dispersion modeling is also required in the calculations of dose equivalent rates for compliance with EPA radionuclide emissions regulations.[6]

To provide meteorological data, two meteorological towers were installed at the Y-12 Plant that have automated data collection and solid-state telemetry data transfer to a computer. A 100-m tower located near the east boundary of the plant has instrumentation at the 10-, 30-, and 100-m levels. A 60-m tower just west of the plant has monitors at the 10- and 60-m levels. Wind and other meteorological parameters will be monitored to provide data on the stability class of the atmosphere as well as wind speed and direction data essential for reliable dispersion modeling. As data from the meteorological towers and various process stacks are obtained, the Y-12 Plant, in conjunction with ORNL, will examine the development of an atmospheric dispersion modeling program for Bear Creek Valley.

5.1.5 Y-12 Plant Water Pollution Control Monitoring

The new NPDES permit issued on May 24, 1985, imposes a variety of environmental monitoring requirements for compliance. More than 236 specified outfalls require routine effluent monitoring for specific parameters. However, a large percentage of monitoring for compliance with the NPDES permit is for biological and toxicological monitoring programs.

A biological monitoring and abatement program[5] was initiated in 1985 and will be continued for at least the next five years. The Environmental Sciences Division at ORNL prepared a proposal that was submitted to the TDHE and EPA for approval. The results of the biological monitoring will determine whether the classified uses of East Fork Poplar Creek are being maintained or protected. In addition, the effluent limitations at the treatment facilities may also be modified on the basis of the results of the study.

The NPDES permit also requires a Toxicity Control and Monitoring Program (TCMP) for most of the treatment facilities, cooling tower blowdown, and all Category IV discharges (untreated process wastewaters). This evaluation consists of performing bioassay studies that provide information on the toxic potential of the identified discharges. Before the studies could be conducted, toxicity evaluation plans had to be submitted to the EPA and the TDHE for approval. At a minimum, each plan of study had to include a study implementation schedule, a consideration of waste variability, evaluation of wastewater dispersion and persistence in the receiving water, and an assessment of toxic components in the receiving water body and biota.

During 1985, the Y-12 Plant submitted and received approval on several plans and began the toxicity evaluations for several of the identified discharges. The evaluations are being performed by the Ecological Effects Group and Reservation Studies Group of the Environmental Sciences Division of ORNL. They consist of performing bioassay studies that provide information on the toxic potential of the identified discharges by exposing sensitive aquatic organisms (fathead minnows and *Ceriodaphnia*) to various concentrations of the wastewaters. From the fatality rate, growth rate, and reproductivity rate of the test organisms, the acute and chronic toxicity of the wastewater can be determined.

Toxicity evaluation studies will continue through 1986. The results of the studies will be used to determine whether the effluent limitations of the NPDES permit are adequate to protect the receiving water body and biota. If the results indicate that the wastewaters are discharged in toxic amounts, Y-12 must submit a toxicity control and implementation schedule that would include appropriate measures to reduce the discharges to acceptable levels.

The Y-12 Plant has traditionally monitored for uranium in plant effluents; PCB monitoring has recently been implemented for specific locations and processes. The reissued NPDES permit requires both a radiological and a PCB monitoring program. During 1985 a sampling program was initiated to identify and verify specific types of radioactivity at various discharges. After the initial sampling was complete, a detailed proposal was developed and submitted to TDHE, EPA, and DOE. The PCB monitoring program proposal developed and submitted in 1985 outlined a program to evaluate the entire plant and identify other possible sources of PCB contamination.

The mercury problem at the Y-12 Plant has necessitated the development and installation of an on-line monitor to measure the mercury concentrations in East Fork Poplar Creek that emanate from within the Plant boundary. The monitor is capable of (1) unattended round-the-clock operations, (2) transmitting data to a remote central monitoring facility, (3) operating routinely in the 1- to 10-ppb range, and (4) ultimately detecting less than 0.1 ppb mercury.

The monitor has been configured around (1) a commercially available mercury vapor generator, (2) an inexpensive, dedicated cold vapor atomic absorption spectrophotometer with background correction, (3) a small computer with a real-time clock, and (4) an alarm indicating abnormal mercury concentrations. As configured, the system is capa-

ble of monitoring two locations on the stream (i.e., the entrance and the exit of New Hope Pond) every hour but could be modified to monitor both locations every 15 minutes.

The Y-12 Plant sanitary sewers discharge domestic wastewater to the City of Oak Ridge sewer system. Treatment is provided by the City of Oak Ridge Wastewater Treatment Plant, located in the western part of the city near East Fork Poplar Creek. Preliminary monitoring of treatment plant sludge indicated uranium concentrations at or above background levels. Current disposition of the City of Oak Ridge sludge in land applications has led to an increased interest in evaluating the sanitary sewer waste flows leaving the Y-12 Plant for uranium.

Portable automatic samplers are being used by the Y-12 Plant Environmental Monitoring Group to collect 24-h composite samples. The four monitoring locations include the sewer lines serving the Plant's west area, the Plant's east area, the Valley Industrial Park, and the Scarboro Road sewer main.

Connections and discharges to the municipal sewer system are regulated by a sewer use ordinance[8] adopted by the Oak Ridge City Council and administered by the Oak Ridge Department of Public Works. This ordinance limits the discharge of specific pollutants to the Oak Ridge system and sets forth stringent protection criteria for industrial wastewater flows. The protection criteria establish limitations on specific metals and organic pollutants.

Based on data collected in 1984 and 1985, the Y-12 Plant sewer discharges are in compliance with both the municipal ordinance for conventional domestic pollutants and anticipated EPA pretreatment standards.[8] Several metal pollutants (copper, zinc, iron, magnesium, and cadmium) are slightly in excess of the current protection criteria limits. Composite sampling will continue to enable full compliance verification. Requests for new connections to the Y-12 Plant's sanitary sewer system are reviewed for compliance with City of Oak Ridge protection criteria and EPA pretreatment standards.

5.1.6 Biological Monitoring and Abatement Program for East Fork Poplar Creek

On May 24, 1985, an NPDES permit was issued for the Y-12 Plant. As specified in Part III(C): Special Condition No. 7 of the permit, a plan for the biological monitoring of the East Fork Poplar Creek had to be submitted to the EPA and the TDHE within 90 days of the effective date of the permit. The Biological Monitoring and Abatement Program, as outlined in Ref. 9, was developed to meet this requirement.

The proposed program will be conducted for the duration of the NPDES permit. The proposed plan is based on preliminary discussions held on October 25, 1984, and April 4, 1985, between staff of Energy Systems, DOE, EPA, and TDHE. The current plan also reflects the results obtained from a reconnaissance of the proposed sampling sites on East Fork Poplar Creek conducted on May 9, 1985, by the staff from Energy Systems and TDHE. Because the composition of existing effluent streams entering New Hope Pond will be altered shortly, baseline (pre-operational) conditions in East Fork Poplar Creek will exist only for the next few months. Consequently, preliminary studies of the fish population were initiated on May 14, 1985.

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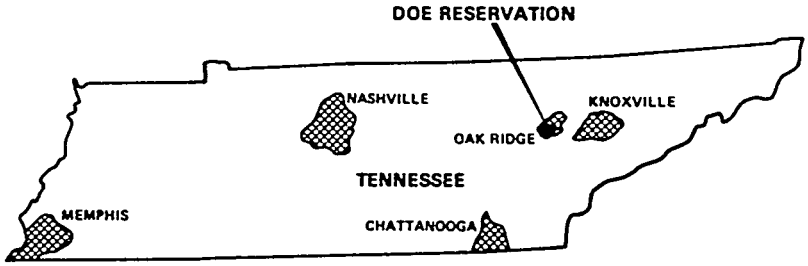
Volume 1: SUMMARY AND CONCLUSIONS



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U.S. DEPARTMENT OF ENERGY
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USGS monitor water quality just below Melton Hill Dam. TDHE maintains a monitoring station at CRK 16.3 (3.2 km below the mouth of Poplar Creek and ORGDP).

Water quality, radioactivity, and flow measurements are made at a number of stations operated by Energy Systems for DOE. As a result of technical reviews of environmental monitoring programs during 1985, the numbering system was redone, as shown in Table 5.2.1.

Water samples were collected and analyzed at various intervals (weekly, monthly, etc.) for radiological and nonradiological content from the following stations:

- Melton Hill Dam (station W1, Fig. 5.2.1)—in the Clinch River 3.7 km above the White Oak Creek outfall. This is a background or reference point. Flow proportional samples were collected daily and composited for quarterly analysis.
- White Oak Dam (station W3, Fig. 5.2.1)—ORNL discharge point from White Oak Creek to the Clinch River. Flow proportional samples were collected daily and composited for weekly analysis.
- ORNL tap water—a reference sample. Samples were collected daily and composited for quarterly analysis.
- ORGDP sanitary water (station W30, Fig. 5.2.1)—10 km downstream from the confluence of White Oak Creek and the Clinch River. A grab sample was collected and analyzed quarterly.
- Water plant near Kingston (station W55, Fig. 5.2.1)—downstream from the entry of White Oak Creek. A sample was collected daily and composited for quarterly analysis.
- A number of additional water sampling stations in WOC and Melton Branch, Bear Creek, and Poplar Creek.

Fission product radionuclide concentrations were determined by specific radionuclide analysis and gamma spectrometry. Uranium analysis was by the fluorometric method or mass spectrometry. Transuranic alpha emitters were determined by radiochemical separation and alpha spectrometry.

Figure 5.2.2 is a flow diagram of the water sampling stations on White Oak Creek and Melton Branch.

Water samples are collected for analysis of nonradioactive substances at many locations on and off the ORR. Concentrations of chemicals in streams and creeks on or around the ORR have been compared with Tennessee's in-stream allowable concentrations, which are based on the long-term protection of domestic water supply, fish and aquatic life, and recreation classifications and recommendations made by TDHE to DOE Oak Ridge Operations. Concentrations of chemicals in the outlet for the ORGDP sanitary water plant are compared with Tennessee water quality criteria for domestic water supply.

In some cases, the maximum concentrations recommended by TDHE and EPA are below the detection limit using the most sensitive EPA-approved method.

The total discharges to surface waters from 1982 through 1986 for tritium, strontium-90, technetium-99, cobalt-60, cesium-137, uranium, ruthenium-106, transuranics, iodine-131, and thorium-232 are given in Figs. 5.2.3 through 5.2.12.

5.3 NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMITS

5.3.1 Oak Ridge Y-12 Plant NPDES Permit

In compliance with the CWA and a 1983 Memorandum of Understanding between DOE, EPA, and TDHE, the Oak Ridge Y-12 Plant submitted NPDES permit applications in the spring of 1984. After extensive negotiations between DOE, TDHE, EPA, and Energy Systems for approximately a year, EPA issued the Oak Ridge Y-12 Plant a new NPDES permit on May 24, 1985. The new permit combines water-quality and industry-based effluent limitations with biological and toxicological monitoring. Discharges authorized in the permit are as follows:

- Kerr Hollow Quarry, discharge point 301 (W43)

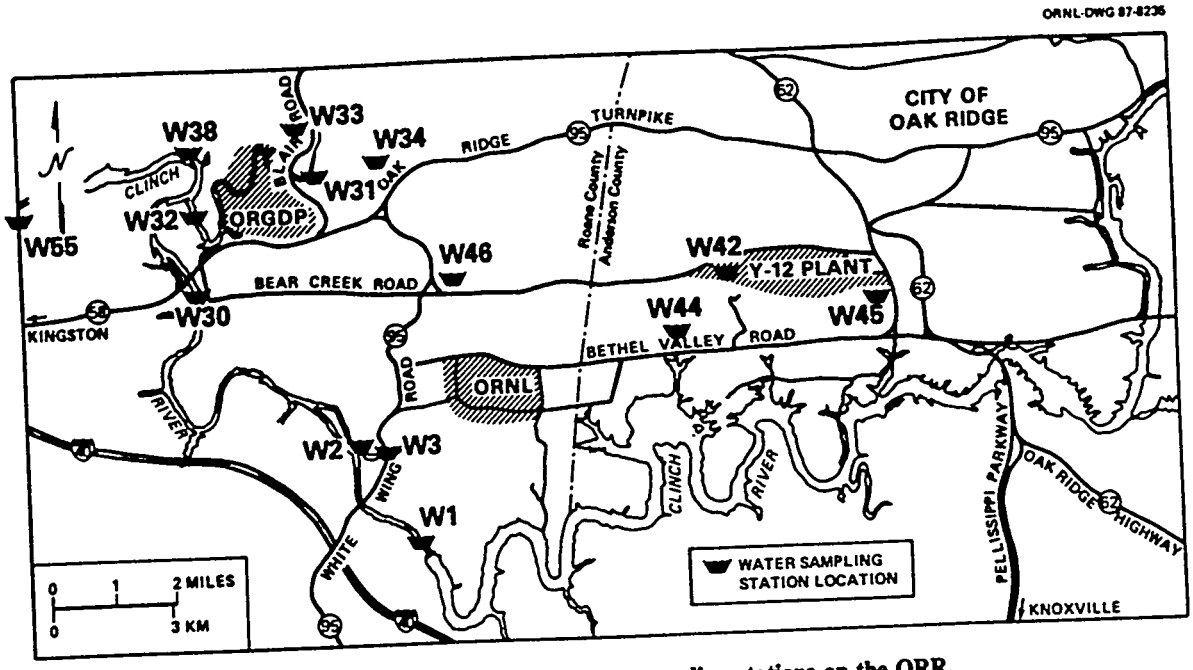

Fig. 5.2.1. Location map of water sampling stations on the ORR.

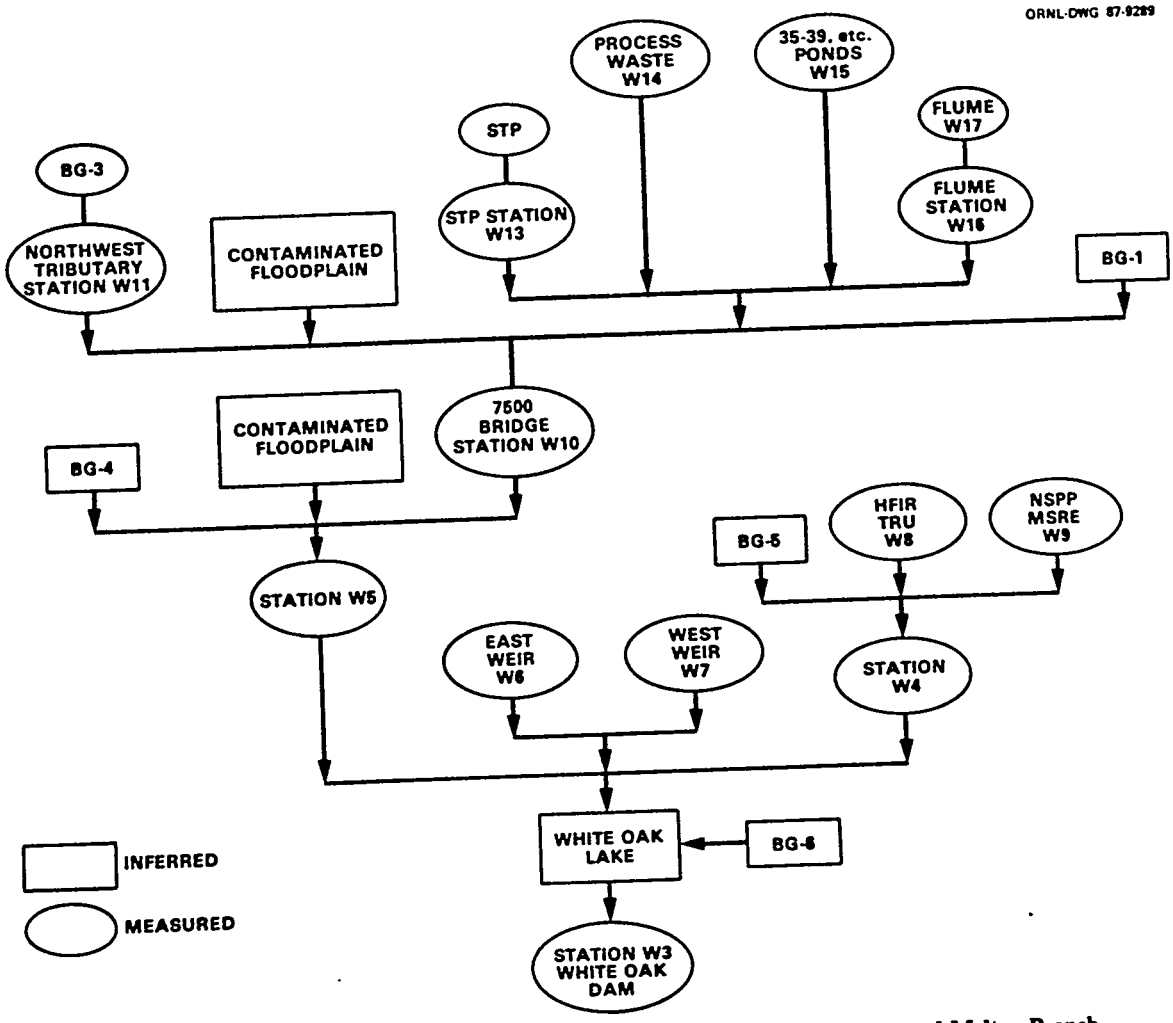

Fig. 5.2.2. Flow diagram of water sampling stations on White Oak Creek and Melton Branch.

NESHAP regulations. The new NESHAP regulations not only established maximum allowable dose limits for airborne radioactivity released from DOE federal installations, but also set forth provisions requiring each facility to demonstrate its compliance status to EPA. Each DOE installation is now required to quantify and defend estimates of airborne radioactivity to regulatory agencies under Section 112 of the Clean Air Act.

The Oak Ridge Y-12 Plant, like many other DOE facilities, has several hundred point sources of exhaust air from production equipment and process areas. Approximately 85 of these exhausts are potential sources of airborne radioactivity and are potentially regulated under provisions of the new EPA NESHAP regulations.

Continuous real-time monitoring of radiological exhaust stacks is an important part of efforts under way at the Oak Ridge Y-12 Plant to reassure the public and the regulators that emissions are being controlled. Real-time radiation stack monitors can be used to detect emission excursions that may result from process upsets or other unusual conditions (e.g., failure of emission control equipment). Immediate corrective actions can be initiated, and a potential significant release of radioactive material may be prevented.

In practice, the real-time radiological monitoring of production area exhaust stacks proves difficult. The presence of highly variable concentrations of naturally occurring radon and radon daughter products can result in an excessive number of false alarms or an unacceptably high monitor detection sensitivity. The presence of dirt, oils, and corrosive acid fumes common to many production exhaust streams also presents significant technical challenges that must be considered in design.

12.1.8 Stack Monitor Evaluations at the Oak Ridge Y-12 Plant

Uranium particulate detection is to be monitored using a thin (0.1-cm-thick) sodium iodide scintillator. The sensitivity of the detector allows detection of X rays from 6 to 60 keV. Enriched uranium is of primary concern because of the 1% ^{234}U present. This isotope emits L-shell X rays in the 10- to 20-keV energy band. Radon daughters show activity in the 40- to 60-keV band. Filter papers of collected enriched uranium have been counted, as have radon-contaminated papers. A factor correcting for radon contamination of the uranium window has been generated for preventing radon activity from mistakenly causing false alarms.

12.1.9 Oak Ridge Y-12 Plant Airborne Mercury Monitoring Program

During 1986 the Oak Ridge Y-12 Plant initiated an on-site airborne (ambient) mercury monitoring program. This program has been established to provide a historical database on mercury concentrations in ambient air and to demonstrate protection of the environment and human health from releases of mercury to the atmosphere. Airborne mercury primarily results from vaporization of mercury in soils, burning coal at the steam plant, and fugitive exhaust from Building 9201-4, a former lithium isotope separation facility that is contaminated with mercury.

With the assistance of the ORNL, the Oak Ridge Y-12 Plant has established four ambient mercury sampling stations. Sampling locations include ambient air stations A62 and A68 on the east and west ends of the site and two mobile stations near Building 9201-4 and the steam plant. Four additional mercury sampling stations are planned in 1987. Airborne mercury is collected by pulling ambient air through a Teflon filter followed by a flow-limiting orifice and a charcoal sampling tube. Particulate mercury is collected for 28 days on the Teflon filter, and mercury vapor is collected for 7 days in the charcoal absorber. The flow-limiting orifice is used to restrict air flow to less than 1000 mL/min.

Mercury collected on the filters and charcoal absorbers is analyzed by cold vapor atomic absorption spectrophotometry after digestion in nitric-perchloric acid. Average air concentration during the period of sample collection is

calculated by dividing the total quantity of mercury collected on the charcoal and filter by the total volume (uncorrected for STP) of air sampled.

Table 12.1.2 shows the maximum, minimum, and average concentrations of airborne mercury at the four sampling locations in 1986. The results indicated that on-site airborne (ambient) mercury concentrations are well below the EPA NESHAP guideline for mercury in ambient air of 1 $\mu g/m^3$ (30-day average) and the industrial hygiene standard of 50 $\mu g/m^3$. The monitoring site located southwest of Building 9201-4 has usually shown the highest concentrations among the four sites. Concentrations of particulate mercury measured since September 1986 have been less than 0.001 $\mu g/m^3$.

Table 12.1.2. 1986 results of the Y-12 Plant airborne mercury monitoring program

Site	Sampling period	Mercury concentration ($\mu g/m^3$)		
		Max	Min	Av
Ambient No. A62 (east end of plant)	7/18–12/30	0.058	0.003	0.011
Ambient No. A68 (west end of plant)	8/12–12/30	0.034	0.002	0.017
Building 9404-13 (SW of Building 9201-4	7/15–12/30	0.200	0.033	0.110
Building 9805-1 (SE of Building 9201-4)	9/23–12/30	0.140	0.026	0.071

12.1.10 Oak Ridge Y-12 Plant Surface Characterization Project

The Oak Ridge Y-12 Plant Surface Characterization Project was initiated in late 1985 and completed in 1986. The initial concern of this project was the potential for exposure of employees to radioactivity when they are working outdoors. Because the methodology of this assessment involved collecting surface soil samples for radionuclide analysis, it was decided also to analyze the soil samples for mercury. Mercury was selected because of its use in years past, its persistence in the Oak Ridge Y-12 Plant environment, and the area source nature of the mercury entering East Fork Poplar Creek. The objectives of the project were to:

- Characterize the surface environment for radionuclides and mercury,
- Locate areas of concern that may require additional investigation or remediation,
- Provide reports summarizing results and recommendations of the survey, and
- Establish a database that environmental managers can access to obtain existing environmental data or add new information as it becomes available.

The sampling methodology involved measuring ambient gamma radiation levels and collecting soil samples across the entire installation and surrounding valley from Scarboro Road to the intersection of Bear Creek and Old Bear Creek roads. About 2000 soil samples were collected and analyzed for radionuclides using neutron activation, gamma spectrography, and mass spectrography on a limited number of samples. Mercury analyses were performed using cold vapor atomic absorption. These analyses are expected to be complete and the database management system operational by late spring 1987.

The survey discovered some ^{137}Cs contamination on the railroad tracks outside the fence near Scarboro Road. Further investigation found additional ^{137}Cs contamination on the railroad spurs to the east of Scarboro Road. Because ^{137}Cs is not used in the Oak Ridge Y-12 Plant, DOE contracted with ORAU to assess the level of contamination and its impact.

12.1.11 Investigation of Heavy Metal Wastes at the Oak Ridge Y-12 Plant

In June 1986, an investigation was initiated to determine whether solid waste disposal facilities at the Oak Ridge Y-12 Plant improperly received

12.1.14 Investigation of Subsurface Mercury at the Oak Ridge Y-12 Plant

An investigation of the fate of spills and leaks of elemental mercury that occurred in the past at the Oak Ridge Y-12 Plant has been carried out through a multiphased well installation and soil boring program. The overall program resulted in the installation of a 43-well monitoring network and the analysis of 430 soil/mud and 113 groundwater samples for mercury content. Results of mercury analyses of soils and fill indicate that high concentrations (up to 1% by weight) of mercury occur in the shallow soil and fill at several sites within the installation, but the estimated total quantity located (~3150 kg) represents only about 2% of the amount estimated to have been lost to the ground. Additional quantities of mercury may exist in the extensive cavity system underlying much of the installation. Estimates are based on analysis and known solubility of mercury in water compared with knowledge of spills, leaks, and soil contaminant levels. Results of mercury analyses of groundwater indicated that mercury does not appear to be moving in significant quantities in an aqueous phase; the highest soluble concentrations found (~1 μg/L) were limited to three wells. The analyses of the groundwater samples from the total well network for other chemical constituents revealed the presence of several contaminant plumes within the installation, including sulfates from a large coal pile, nitrates from liquid waste disposal operations, and chlorides from several sources, as well as general increases of electrical conductance (an inorganic pollutant indicator) and alkalinity.

12.1.15 Oak Ridge Y-12 Plant Waste Minimization Strategy

The 1984 amendments to the Resource Conservation and Recovery Act mandate that waste minimization be a major element of hazardous waste management. In addition, the costs for waste treatment, storage, and disposal are high and will increase as environmental regulations become more stringent. Thus, waste reduction and elimination must be an integral part of industries' waste management programs. Unlike traditional approaches, waste minimization focuses on controlling waste at the beginning of production instead of at the end. This approach includes (1) substituting nonhazardous process materials for hazardous ones, (2) recycling or reusing waste effluents, (3) segregating nonhazardous from hazardous or radioactive waste, and (4) modifying processes to generate less, or less-toxic, waste.

An effective waste minimization program must provide the appropriate incentives for generators to reduce their waste and provide the necessary support mechanisms to identify opportunities for waste minimization. This approach consists of four major program elements: (1) promotional campaign, (2) process evaluation for waste minimization opportunities, (3) waste generation tracking system, and (4) information exchange network.

12.1.16 ORNL's Environmental ALARA Program

The ORNL environmental ALARA program is an installation-wide effort applicable to each person, project, activity, and operation at ORNL. It is implemented at all stages of an ORNL project from initial planning to final decommissioning. A wide range of methods are used for implementing the program.

At the planning stage of a proposed project or activity, an environmental review is conducted and the review is documented at one of three levels: as an Action Description Memorandum, Activities Description Memorandum, or Environmental ALARA Memorandum. Details of the review process, decision criteria for determining the level of documentation, and mechanisms for effectively handling hundreds of projects are given in this presentation. The means for disseminating environmental ALARA information, for tracking projects, for maintaining auditable computer files, and for ensuring compliance are discussed. Sources of conflict are examined, methods that have been used for settling disputes are elaborated on, and some foreseeable problems are addressed.

12.1.17 Uranium Detection in and Source Separation of Oak Ridge Y-12 Plant Solid Wastes

Calibration of the new Oak Ridge Y-12 Plant Trash Monitoring Station has been concluded and the facility placed in operation. Statistical analysis of the data obtained from the calibration studies indicates that the lower level of detection is 120 g with a ±70-g variability for depleted uranium at the 95% confidence level.

The facility is being used to monitor uranium contamination in solid waste collected in steel dumpsters. In addition, it has been used to "spot check" dumpsters from ORNL for the presence of cesium contamination.

In the absence of regulatory guidelines to define a below regulatory concern quantity of radioactivity, the Oak Ridge Y-12 Plant is following guidelines for the on-site burial of solid waste based on current operating limitations at the Trash Monitoring Station. Out of approximately 200 dumpster stations within the installation, approximately 20 have been found to be consistently contaminated. These dumpster stations and the generators contributing to them are the current target of the Oak Ridge Y-12 Plant's waste segregation efforts.

A pilot test program has been initiated at the Oak Ridge Y-12 Plant to determine the effectiveness of administrative control in the source separation of uranium-contaminated trash from sanitary trash. Dumpsters and trash collection containers have been designated in test areas, and waste dumpsters are being monitored to determine the effectiveness of this method of source separation. This program is currently being refined and expanded to other production buildings.

12.1.18 Oak Ridge Y-12 Plant Steam Plant Waste Minimization

Methods to minimize chemical consumption, operating costs, and waste generation of the Oak Ridge Y-12 Plant steam plant were evaluated. Pilot-scale studies and modeling of process options are emphasized. Implementation of recommendations will allow estimated reductions of 85% in chemical consumption, 90% in boiler blowdown, 6% in water consumption, 3% in coal consumption, and 50 to 90% in waste generation. The estimated return on investment is 35%. No dollar value was placed on improved environmental compliance.

The proposed process uses electrodialysis to remove 70 to 90% of the dissolved solids. Residual cations are removed by ion exchange. Next, a strong base ion exchange resin removes silica. This allows substantial reductions in boiler blowdown and in the consequent loss of heat and water. Electrodialysis reduces the chemical loading to the resin enough to make silica removal cost effective.

Finally, the plant's demineralized water system is to be supplied entirely from electrodialysis product. Currently, the system is fed half with untreated water and half with steam condensate. The recommended change will improve the quality of demineralizer feed water while allowing more recovered steam condensate to be recycled to the boiler.

12.1.19 Water Conservation Plan for the Oak Ridge Reservation

The Water Conservation Plan for the ORR is part of the site development study required by DOE Order 4300.1A to ensure that maximum benefit is derived from water resources and that they are protected. The plan includes the ORR water balance, options for maximizing the efficiency of water usage, plans for the improvement and protection of water quality, and measures to curtail water usage in the event of prolonged drought.

The ORR water balance includes the water supply and wastewater discharge. There are several potential options for minimizing water use at the ORR installations: controlling water line leakages, recycling effluents, reducing once-through cooling, and installing flow meters for accurate accountability of water use. In the event of prolonged drought, water usage and wastewater discharge could be restricted. Curtailment measures range from elimination of water usage at nonessential facilities to the

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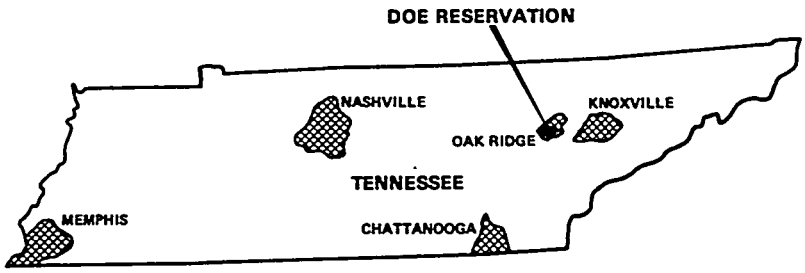

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Environmental and Safety Activities
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and
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Oak Ridge Y-12 Plant, Oak Ridge National Laboratory,
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for the
U.S. DEPARTMENT OF ENERGY
Under Contract No. DE-AC05-84OR21400

Table 5.1.5. Design conditions for new sewage treatment plant: effluent discharge limitations

Parameter	Concentration
Ammonia nitrogen	1.8 mg/L
BOD5	5.0 mg/L
Chlorine, residual	0.5–2.0 mg/L
Fecal coliform	200/100 mL monthly mean 400/100 mL weekly mean
pH	6.0–9.0 units
Settleable solids	0.5 ml/L
Suspended solids	10.0 mg/L

Table 5.1.6. Coal pile specifications

Total moisture, maximum	8%
Ash (dry basis), maximum	8%
Sulfur (dry basis)	2 to 3%
Delivered heat content, minimum	13,000 Btu/lb
Ash softening temperature, minimum	2300°F
Size	3/8 to 1¼ in.
Fines, maximum	5%
Other	*a*

[a]Washed and substantially free of surface impurities such as earth, wood, rock, slate, or pyrite.

Table 5.1.7. Chemical pollutant limits for cooling tower discharges

Parameter	Average	Maximum	Sample frequency
Chromium		1.0 mg/L	Quarterly
Zinc	0.5 mg/L	1.0 mg/L	Quarterly
Copper	0.5 mg/L	1.0 mg/L	Quarterly
Chlorine, residual		0.2 mg/L	Quarterly
Temperature, °C	35	38	Quarterly
pH	6.0–9.0		Quarterly

include waste collection and treatment, BMPs, source identification, and compliance monitoring. The Oak Ridge Y-12 Plant will continue to improve and expand programs to ensure compliance with the ALARA philosophy.

5.2 SURFACE WATER MONITORING

Water samples are collected and analyzed regularly for radiological content from the following stations (Fig. 5.2.1).

- Melton Hill Dam (station W1)—in the Clinch River 3.7 km above the White Oak Creek outfall as reference point. Flow proportional samples are collected daily and composited for quarterly analysis.
- White Oak Dam (station W3)—ORNL discharge point from White Oak Creek to the Clinch River. Flow proportional samples are collected daily and composited for weekly analysis.
- ORNL tap water—reference samples are collected daily and composited for quarterly analysis.
- ORGDP sanitary water (station W30)—10 km downstream from the confluence of White Oak Creek and the Clinch River. A grab sample is collected and analyzed quarterly.
- Water plant near Kingston (station W55)—downstream from the entry of White Oak Creek. A sample is collected daily and composited for quarterly analysis.
- A number of additional water sampling stations in WOC and Melton Branch, Bear Creek, and Poplar Creek.

Fission product radionuclide concentrations are determined by specific radionuclide analysis and gamma spectrometry. Uranium analysis is by the fluorometric method or mass spectrometry. Transuranic alpha emitters are determined by radiochemical separation and alpha spectrometry.

Water samples are collected for analysis of nonradioactive substances at locations on and off the ORR. Samples are composited for monthly analyses; $NO_3(N)$ values are determined from a monthly grab sample. EPA-approved methods are used to the determine chemicals in water. Concentrations of chemicals in streams and creeks on or around the ORR have been compared with Tennessee's in-stream allowable concentrations, which are based on the long-term protection of domestic water supply, fish and aquatic life, and recreation classifications and recommendations made by TDHE to DOE Oak Ridge Operations (ESR, 1985). Concentrations of chemicals in the inlet for the ORGDP sanitary water plant are compared with Tennessee water quality criteria for domestic water supply.

ORNL-DWG 87-9289

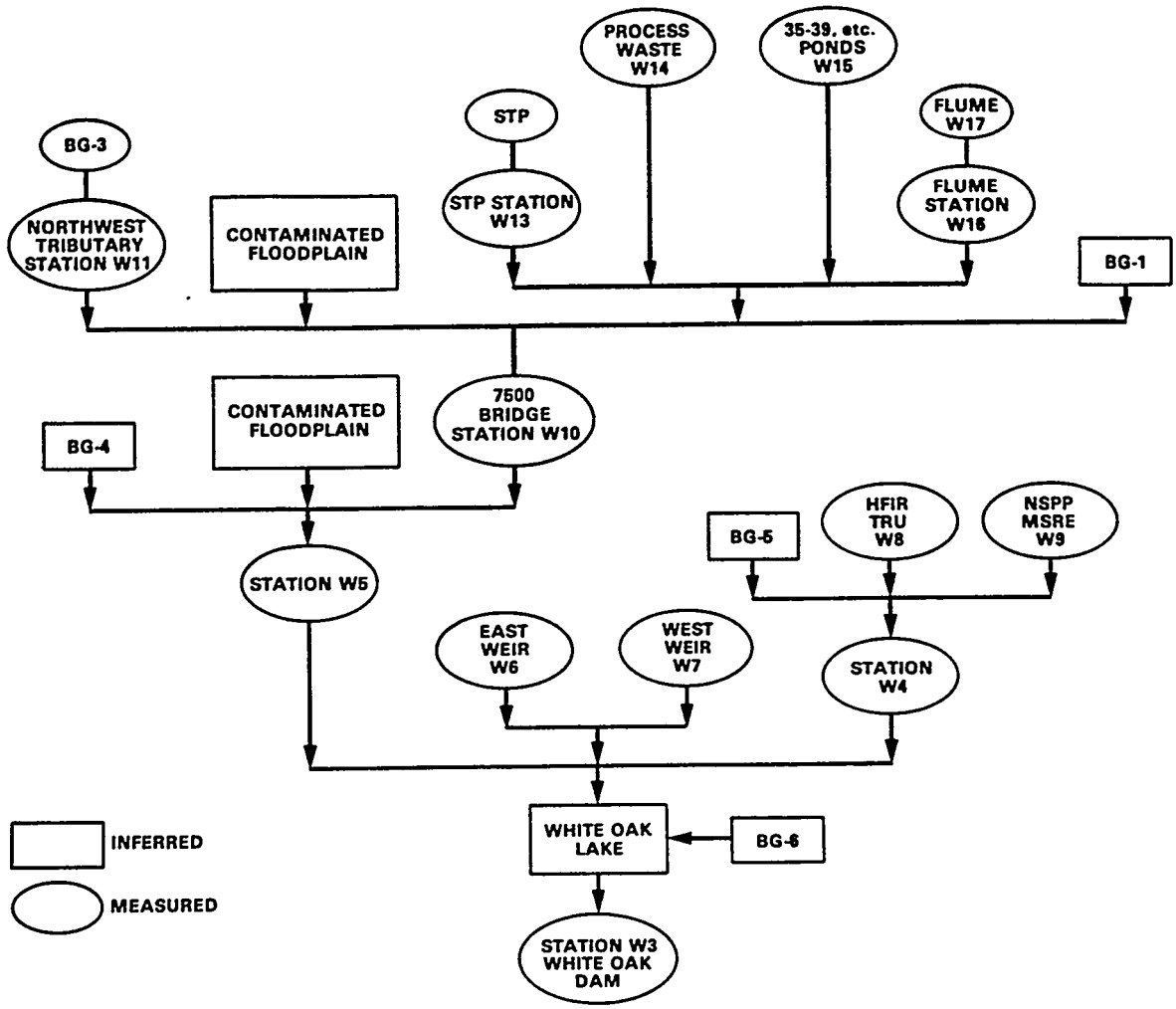

Fig. 5.2.1. Flow diagram of water sampling stations on White Oak Creek and Melton Branch.

In some cases, maximum concentrations recommended by the TDHE and EPA are below the detection limit using the most sensitive EPA-approved method. The practical limit of detection may vary with the matrix and other factors. In 1986 Energy Systems analytical laboratories changed their reportable detection limits on some metals (such as Be and Hg) and some organics (such as herbicides and pesticides), resulting in inconsistencies in the analytical data.

Data for composite samples at Bear Creek outfall 304 are given in Tables 5.2.1 through 5.2.8. Surface water data for upper Bear Creek near the S-3 Pond site by month are given in Tables 5.2.9 through 5.2.14. Radiochemical water quality data for Bear Creek, East Fork Poplar Creek, and New Hope Pond are given in Tables 5.2.15 to 5.2.20.

The Oak Ridge Y-12 Plant discharges sanitary and process water into the City of Oak Ridge sewage system. The 1986 concentrations of parameters in this discharge are given in Tables 5.2.21 through 5.2.23.

Water samples were collected regularly from First Creek, Fifth Creek, 7500 Bridge, Melton Branch 1 (MB1), Melton Branch 2 (MB2),

Radioactive strontium discharges from ORNL, unlike ^{3}H, which comes primarily from SWSA 5, are much more diffuse primarily resulting from discharges from the main ORNL area burial grounds and floodplains, with lesser amounts also being contributed by process discharges. Most of the strontium measured can be attributed to discharges into WOC above the monitoring station. Strontium concentrations below the range of 160 to 190 pCi/L measured in 1985 can be attributed to low levels of precipitation during 1986. It is believed that a significant portion (>50%) of the strontium discharges at ORNL during normal rainfall are the result of runoff. Concentrations of radionuclides in surface streams and tap water are given in Table 5.2.30.

At WOD, WOC, MB1, and the STP ^{90}Sr discharges are calculated by multiplying the concentration (in Ci/L) by the flow (in liters per second). Those data are given in Table 5.2.31. At WOC, MB1, and the STP, a single flow proportional sample was analyzed monthly to estimate radionuclide concentrations. At WOD, weekly flow proportional samples were analyzed. Radionuclide discharges at WOC, MB1, and the STP were calculated by dividing the concentration in the monthly composite sample by the total flow for the month at each station. However, at WOD, weekly radionuclide discharges are calculated by dividing the weekly composited sample concentration by the total weekly flow. A flow weighted concentration at WOD for the year was calculated by dividing the total radionuclide discharge by the total flow.

Surface water concentrations in West Fork Poplar Creek, ORGDP sanitary water, Poplar Creek near the Clinch River, Clinch River near ORGDP, K-901, and Poplar Creek above Blair Bridge are given in Tables 5.2.32 through 5.2.37. Concentrations of uranium in surface water are given in Table 5.2.38. Concentrations in the K-1515 sanitary water plant are given in Table 5.2.39.

5.3 WATER DISCHARGES AND NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

5.3.1 Oak Ridge Y-12 Plant Water Discharges

Discharges from the Oak Ridge Y-12 Plant area affect water quality and flow in Kerr Hollow Quarry, Rogers Quarry, East Fork Poplar Creek, or Bear Creek before entering the Clinch River. Regulators have directed the Oak Ridge Y-12 Plant to provide treatment for a variety of liquid wastes discharged to East Fork Poplar Creek. Until all of the new wastewater treatment facilities are constructed and ready for operation, steam plant and plating shop rinse waters are being discharged to East Fork Poplar Creek. Discharges allowed under permits include storm drainage, cooling water, water from firefighter training, cooling tower blowdown, and process wastewaters including effluents from pollution control treatment facilities. Sumps that collect groundwater in building basements also discharge to the stream. Major point discharges and treatment facility discharges are categorized according to their NPDES outfalls in Table 5.3.1 (NPDES, 1984).

The sanitary sewage effluent from the Oak Ridge Y-12 Plant site flows to the City of Oak Ridge West End Treatment Plant. The average daily flow is approximately 2 to 2.7 million liters per day and is independent of storm drainage and industrial waste systems (Daugherty, 1984).

A network of storm drains covers the entire area of the Oak Ridge Y-12 Plant that discharges into East Fork Poplar Creek. The system gathers rainfall from the adjacent hillsides, the parking areas north of the developed portion of the plant, the roof drains, and fire water flow from the testing of the fire protection system. In the past, interconnecting with the storm drainage system were numerous process discharges and laboratory

Table 5.2.32. 1986 concentration at West Fork Poplar Creek (W33)

Parameter	Concentration (mg/L)		
	Max	Min	Ave
Arsenic	<0.005	<0.005	<0.005
Mercury	0.0002	<0.0002	<0.0002
COD	41	<5	<11
Suspended solids	82	5	<21
Dissolved solids	320	118	179
pH	7.9	7.3	7.6
Cyanide	0.004	<0.002	<0.002
Ammonia nitrogen	0.5	<0.2	<0.23
Fluoride	0.18	<0.1	<0.11
Nitrate nitrogen	0.56	<0.11	<0.33
Sulfate	60	30	45
Chromium	0.03	<0.01	<0.01
Copper	0.094	<0.004	<0.012
Manganese	0.44	0.01	<0.15
Nickel	<0.05	<0.05	<0.05
Sodium	8.1	3.4	5.3
Zinc	0.04	<0.02	<0.02
Cadmium	0.002	<0.002	<0.002
Lead	0.013	<0.004	<0.005

Table 5.2.33. 1986 concentration in ORGDP Sanitary Water (W30)

Parameter	Concentration (mg/L)		
	Max	Min	Ave
Arsenic	<0.005	<0.005	<0.005
Mercury	0.0002	<0.0002	<0.0002
COD	44	<5	<9.2
Suspended solids	47	<1	<8.0
Dissolved solids	202	94	161
pH	8.3	7.5	7.9
Cyanide	0.006	<0.002	<0.002
Ammonia nitrogen	4.2	<0.2	<0.6
Fluoride	0.11	<0.1	<0.1
Nitrate nitrogen	0.54	<0.17	<0.39
Sulfate	29	23	24
Chromium	0.014	<0.01	<0.01
Copper	0.036	<0.004	<0.014
Manganese	1.0	<0.01	<0.102
Nickel	<0.05	<0.05	<0.05
Sodium	<6.3	4.9	5.6
Zinc	0.068	<0.02	<0.028
Cadmium	<0.002	<0.002	<0.002
Lead	0.009	<0.004	<0.005

Table 5.2.34. 1986 concentration at Poplar Creek near Clinch River (W32)

Parameter	Concentration (mg/L)		
	Max	Min	Ave
Arsenic	<0.005	<0.005	<0.005
Mercury	0.0004	<0.0002	<0.0002
COD	44	<5	<13.0
Suspended solids	41	8	19.8
Dissolved solids	260	155	191
pH	8.3	7.1	7.9
Cyanide	0.008	<0.002	<0.003
Ammonia nitrogen	0.5	<0.2	<0.22
Fluoride	0.33	<0.1	<0.19
Nitrate nitrogen	1.98	0.16	0.81
Sulfate	44	29	37
Chromium	0.02	<0.01	<0.011
Copper	0.034	<0.004	<0.008
Manganese	0.17	<0.01	<0.09
Nickel	<0.05	<0.05	<0.05
Sodium	10.0	4.9	7.6
Zinc	<0.02	<0.02	<0.02
Cadmium	0.005	<0.002	<0.002
Lead	<0.012	<0.004	<0.007

Table 5.2.35. 1986 concentration in Clinch River near ORGDP (W55)

Parameter	Concentration (mg/L)		
	Max	Min	Ave
Arsenic	<0.005	<0.005	<0.005
Mercury	<0.0002	<0.0002	<0.0002
COD	41	<5	<8.8
Suspended solids	27	3	11.9
Dissolved solids	186	17	147
pH	8.5	7.6	8.0
Cyanide	0.003	<0.002	<0.002
Ammonia nitrogen	0.4	<0.2	<0.2
Fluoride	0.19	<0.1	<0.11
Nitrate nitrogen	0.48	<0.11	<0.35
Sulfate	28	21	24
Chromium	0.02	<0.01	<0.011
Copper	0.061	<0.004	<0.009
Manganese	0.13	0.011	0.043
Nickel	<0.05	<0.05	<0.05
Sodium	6.2	4.9	5.6
Zinc	0.06	<0.02	<0.023
Cadmium	<0.002	<0.002	<0.002
Lead	0.006	<0.004	<0.004

Table 5.2.36. 1986 concentration at intake to K-901 @ 892 (W29)

Parameter	Concentration (mg/L)		
	Max	Min	Ave
Arsenic	<0.005	<0.005	<0.005
Mercury	<0.0002	<0.0002	<0.0002
COD	41	<5	<9.1
Suspended solids	19	<1	<5.2
Dissolved solids	216	114	162
pH	8.2	7.3	7.7
Cyanide	0.003	<0.002	<0.002
Ammonia nitrogen	0.8	<0.2	<0.28
Fluoride	0.18	<0.1	<0.11
Nitrate nitrogen	0.59	0.18	0.41
Sulfate	31	1.1	22.4
Chromium	0.014	<0.01	<0.01
Copper	0.042	<0.004	<0.010
Manganese	0.58	<0.01<	0.033
Nickel	<0.05	<0.05	<0.05
Sodium	11.0	5.1	6.4
Zinc	0.071	<0.02	<0.041
Cadmium	0.004	<0.002	<0.002
Lead	0.028	<0.004	<0.008

Table 5.2.37. 1986 concentration at Poplar Creek above Blair Bridge (W31)

Parameter	Concentration (mg/L)		
	Max	Min	Ave
Arsenic	<0.005	<0.005	<0.005
Mercury	0.0003	<0.0002	<0.0002
COD	31	<5	<9.5
Suspended solids	50	5	18
Dissolved solids	440	114	205
pH	8.4	7.4	7.7
Cyanide	0.001	<0.002	<0.004
Ammonia nitrogen	0.7	<0.2	<0.27
Fluoride	0.7	<0.1	<0.30
Nitrate nitrogen	2.1	0.44	1.30
Sulfate	60	34	42
Chromium	0.016	<0.01	<0.01
Copper	0.038	<0.004	<0.009
Manganese	0.19	0.01<	0.094
Nickel	<0.05	<0.05	<0.05
Sodium	16.0	4.2	9.9
Zinc	0.02	<0.02	<0.02
Cadmium	0.002	<0.002	<0.002
Lead	0.013	<0.004	<0.006

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1.6.3 Watershed Characteristics

The Clinch River has its headwaters near Tazewell, Virginia, and empties into the Tennessee River near Kingston, at Tennessee River kilometer (TRK) 914 (river mile 568). The Clinch watershed comprises about 11% of the Tennessee River watershed. Four dams operated by TVA control the flow and levels of the Clinch River. Norris Dam, constructed in 1936, is about 50 km (31 miles) upstream from the ORR. Melton Hill Dam, completed in 1963, controls the flow of the river near the ORR. Its primary function is power generation (Boyle et al. 1982). Fort Loudon Dam, on the Tennessee River upstream of the confluence with the Clinch River, controls water flow into Watts Bar Lake, which is formed by Watts Bar Dam. Watts Bar Dam is located on the Tennessee River downstream of the Clinch.

1.6.4 Water Use

Five public water supplies are located downstream within 80 km (50 miles) of the ORR. The K-25 Site water treatment plant is located 4 km (2.5 miles) above the mouth of Poplar Creek and supplies drinking water to about 4000 employees. The Kingston water treatment plant serves about 6841 persons, and its intake is located at TRK 914.7 (river mile 568.4), about 0.6 km (0.37 miles) above the confluence of the Clinch and Tennessee rivers and 34.1 km (21.1 miles) below the mouth of Poplar Creek. The Rockwood treatment plant serves about 7387 persons and is located downstream of Kingston on the King Creek embayment near Thief Neck Island. The remaining water plants are on Chickamauga Reservoir. The Dayton plant serves 9605 persons and is located at TRK 810.6 (river mile 503.7). The Soddy-Daisy/Falling Water Utility District plant draws water from the Soddy Creek embayment of Chickamauga Reservoir, about 8 km (5 miles) from the reservoir proper.

1.7 Environmental Monitoring

Published environmental summary reports for the ORR have been issued for each year since 1971. The current environmental program is designed primarily to meet various regulatory requirements and DOE directives and to provide a continuity of data on environmental media at unregulated locations. The federal legislative framework that establishes standards and regulates environmental releases consists mainly of the following: Clean Air Act (CAA); The Clean Water Act (CWA); Safe Drinking Water Act (SDWA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), also known as "Superfund"; RCRA; TSCA; SARA; the Atomic Energy Act; and Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Administrative bodies principally concerned with implementation and enforcement on the federal level are the U.S. Environmental Protection Agency (EPA) and DOE and, on the state level, the Tennessee Department of Environment and Conservation (TDEC).

Environmental monitoring consists of two major activities: effluent monitoring and environmental surveillance. Effluent monitoring is the collection and analysis of samples, or measurements, of liquid and gaseous effluents. Environmental surveillance is the collection and analysis of samples or direct measurements, of air, water, soil, foodstuff, biota, and other media from DOE sites and their environs. Environmental monitoring is performed by each site to characterize and quantify contaminants, assess radiation exposures of members of the public, demonstrate compliance with applicable standards and permit requirements, and assess the effects (if any) on the local environment.

The samples are analyzed for various radioactive, physical, and chemical parameters. In some cases, such as liquid effluent outfalls, the discharge permit may require the analysis of more than 60 different parameters.

Annual summaries are presented in the following sections for each of the media sampled. The summary tables generally give the number of samples collected and the maximum, minimum, average, and standard error of the mean values of parameters for which determinations were made. This value is based on multiple samples collected throughout the year. It includes the random uncertainty over time and space associated with sampling, analysis, and the intrinsic variability of media. The random uncertainty is a statement of precision (or imprecision), a measure of the reproducibility or scatter in a set of successive measurements, and an indication of the stability of the average value for a parameter. When differences in the magnitudes of the observations are small, the

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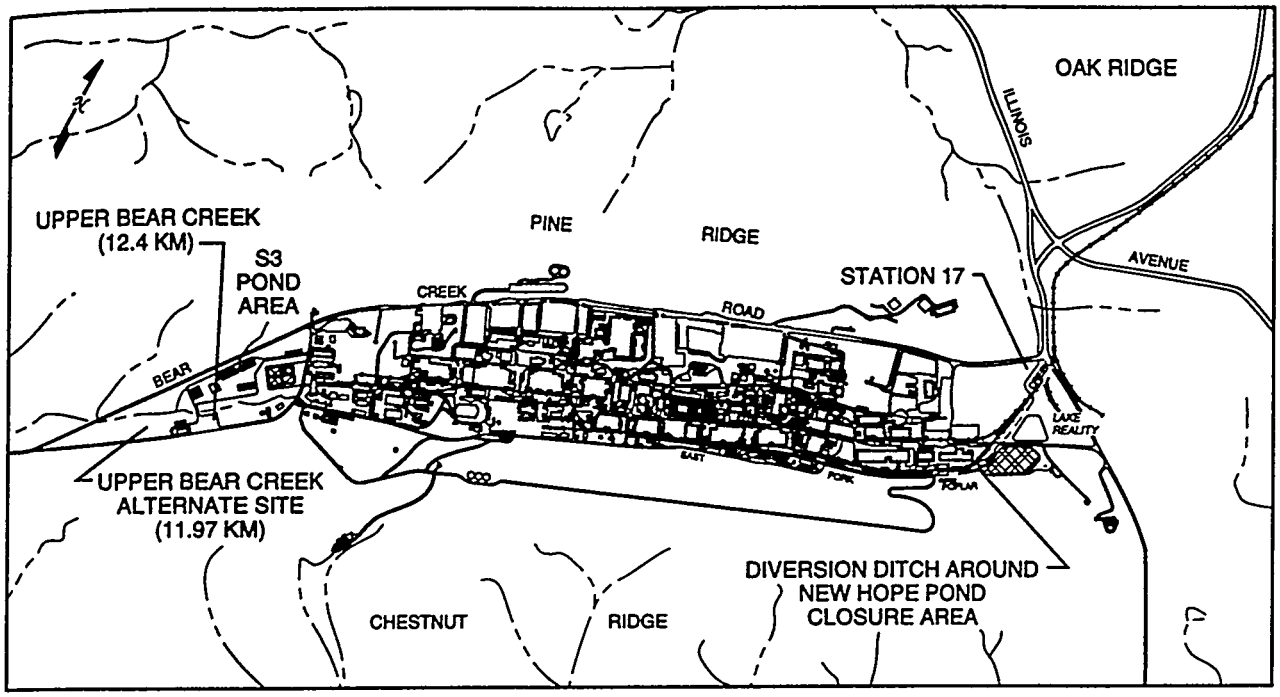

Fig. 4.3. Y-12 Plant non-NPDES routine surface water monitoring sites.

the radionuclide signature would be required as specified in DOE Order 5400.1.

Kilometer 12.4 (mile 7.7) on upper Bear Creek is monitored in response to Section IV, Part 4, of a memorandum of understanding agreed to by DOE, EPA, and TDEC. This site, where the creek first approaches Bear Creek Road, was agreed upon as a point in the stream that is characteristic of the effects of the seepage of the S-3 ponds. Because of decreased flow at this site since the closure of the S-3 ponds, a new site at kilometer 11.97 is also being monitored and has been proposed as a replacement site. The analytical data from both these sites have been compared, and changes in the monitoring routine were proposed. These changes should be implemented in 1993. Analytical data are reported monthly to TDEC as an attachment to the discharge monitoring report (DMR) required by NPDES. These sites were monitored once per week for the radiological and nonradiological parameters shown in Tables 4.1–4.4 in Vol. 2. For both locations, all radiological results were well below DCGs listed in DOE Order 5400.5, with ^{237}Np being the only radionuclide exceeding 2% of a DCG (3.77% at km 11.97 and 2.35% at km 12.4). Figure 4.4 shows total uranium and nitrate data from 1987 to 1992 for Upper Bear Creek site at kilometer 12.4.

A sampling point is located in the diversion ditch around the New Hope Pond Closure Area. Samples are taken here on a weekly basis for the radiological parameters shown in Table 4.5 in Vol. 2. In addition, Station 17, located near the junction of Bear Creek and Scarboro roads, is used to monitor EFPC downstream of Lake Reality but prior to its leaving the easternmost Y-12 Plant boundary. Weekly samples were obtained at Station 17 for the radiological and nonradiological parameters listed in Tables 4.6 and 4.7 of Vol. 2.

In like manner these data are compared with the State of Tennessee Water Quality Criteria, where a criterion exists for each parameter, and to DCGs. All radiological results are well below DCGs, with no single radionuclide exceeding 2% of the DCG.

Bear Creek kilometer 4.55 (Fig. 4.1), also designated as NPDES outfall 304, is also monitored weekly for radiological parameters. This location is the westernmost monitoring location on Bear Creek as the creek leaves the Y-12 boundary. Rogers

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Volume 2

Oak Ridge

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ENVIRONMENTAL REPORT FOR 1992

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OAK RIDGE RESERVATION ENVIRONMENTAL REPORT FOR 1992

VOLUME 2: DATA PRESENTATION

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Date Published: September 1993

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for the
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Table 4.6. 1992 Y-12 Plant annual nonradiological data summary for Station 17[a]

(EFPC 23.4 km, near junction of Bear Creek and Scarboro Road)

Parameter	Number of samples	Concentration[b]			Reference value[c]	Number of values exceeding reference
		Max	Min	Av		
Mercury	248	0.0089	0.0005	0.0017	0.00015	248[d]
Nitrate	248	16	<0.1	<5.2	*e*	*e*
Total phosphorus	248	0.74	<0.14	<0.33	*e*	*e*
Copper	248	0.032	<0.006	<0.008	0.018	9
Zinc	248	0.31	0.02	0.06	0.117	16
Chromium	248	0.03	<0.006	<0.006	0.016	2
Molybdenum	248	0.03	<0.006	<0.007	*e*	*e*
Lithium	248	0.2	<0.02	<0.03	*e*	*e*
Selenium	248	0.002	<0.002	<0.002	0.020	0
Cadmium	248	<0.02	<0.004	<0.004	0.004	1
Lead	247	0.061	<0.001	<0.004	0.082	0
Nickel	248	0.04	<0.0008	<0.008	1.400	0
Calcium	247	100	39.6	57	*e*	*e*
Magnesium	247	21.7	6.7	11	*e*	*e*
Sodium	248	43.9	7.1	16.9	*e*	*e*
Potassium	248	4.7	1.5	2.2	*e*	*e*
Sulfate	248	150	<5	<63	*e*	*e*
Chloride	248	33	8	18.4	*e*	*e*
Fluoride	248	72	0.38	1.3	*e*	*e*
Total suspended solids	248	310	<5	<13	*e*	*e*
Total dissolved solids	247	32000	0.32	421	*e*	*e*
Alkalinity	248	200	69	108	*e*	*e*
Total orgainic carbons	246	29	<2	<17.2	*e*	*e*
Residual chlorine, total	251	7.9	0	0.09	*e*	*e*
Cadmium (AA)	247	0.011	–0.0005	<0.0009	*e*	*e*
Temperature, °C	310	36	11	20	*e*	*e*
pH, standard units	317	8.8	7.4	*e*	6.5/8.5[f]	0/16
Dissolved oxygen	299	10.3	2.8	7.4	3	1
Conductivity, mhos/cm	206	471.2	0	6.3	*e*	*e*
Tetrachloroethene	247	<0.010	<0.010	<0.010	0.088	0

[a]Flow during operations and/or discharging.
[b]Units are in mg/L unless otherwise noted.
[c]Tennessee Water Quality criteria.
[d]The analytical detection limit for this parameter is higher than the reference value.
[e]Not applicable.
[f]Minimum value/maximum value.

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Annual Site Environmental Report for 1993

Units of radiation measure

Current System	Système International	Conversion
curie (Ci)	becquerel (Bq)	1 Ci = 3.7×10^{10} Bq
rad (radiation absorbed dose)	gray (Gy)	1 rad = 0.01 Gy
rem (roentgen equivalent man)	sievert (Sv)	1 rem = 0.01 Sv

Fractions and multiples of units

Multiple	Decimal equivalent	Prefix	Symbol	Report format
10^{6}	1,000,000	mega-	M	E+06
10^{3}	1,000	kilo-	k	E+03
10^{2}	100	hecto-	h	E+02
10	10	deka-	da	E+01
10^{-1}	0.1	deci-	d	E–01
10^{-2}	0.01	centi-	c	E–02
10^{-3}	0.001	milli-	m	E–03
10^{-6}	0.000001	micro-	μ	E–06
10^{-9}	0.000000001	nano-	n	E–09
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under Contract No. DE-AC05-84OR21400

Uranium releases to surface waters over a 5-year period (1989–93) were investigated to observe their trend (Fig. 4.23). Only those release locations that had data available for the 5-year period were included. Data for the investigation were extracted from the 1989, 1990, 1991, and 1992 annual site environmental report and from the 1993 quarterly performance indicator reports.

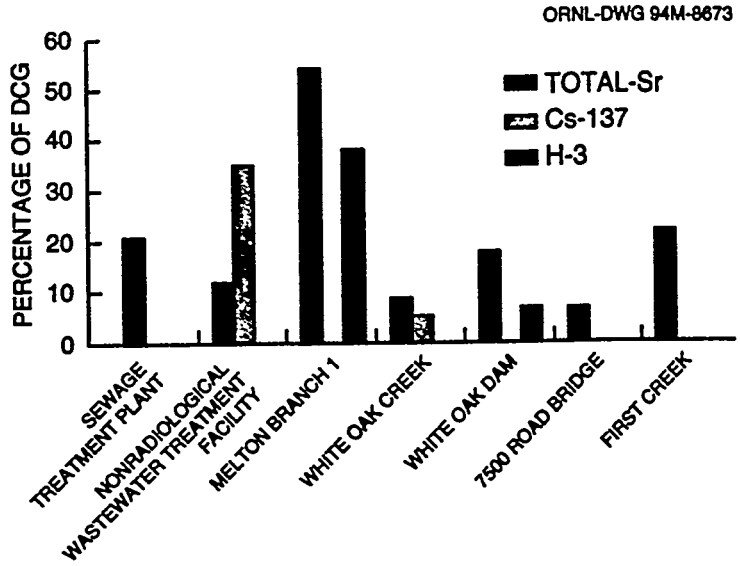

Fig. 4.15. Radionuclides with average concentration greater than 5% of derived concentration guide in 1993.

Nonradiological Liquid Discharges

The Federal Water Pollution Control Act and its amendments, more commonly known as the Clean Water Act (CWA), were the culmination of almost a century of litigation and political debates about water pollution. The two main goals of the CWA are (1) to attain a level of water quality that provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water and (2) to eliminate the discharge of pollutants into waters of the United States.

The CWA requires that EPA establish limits on the amounts of specific pollutants that may be discharged to surface waters. The standards, called "effluent limitations," are written into NPDES permits issued to all municipal and industrial dischargers. The Y-12 Plant, ORNL, and the K-25 Site are each required to monitor discharges at frequencies specified in their permits to ensure compliance with the NPDES effluent limitations. The TDEC Division of Water Pollution Control has the authority to issue NPDES permits and to monitor compliance with the permits in the state of Tennessee under the Tennessee Water Control Act and according to the rules and regulations of the Tennessee Water Quality Control Board.

The CWA also created the Federal Pretreatment Program to regulate industrial discharges to sanitary sewer systems, which are also referred to as a "publicly owned treatment works" (POTW). Under the Federal Pretreatment Program, industries are required to monitor and regulate their discharges to the POTW. The state of Tennessee has created the Tennessee Pretreatment Program, which requires municipalities to develop their own pretreatment programs for their local industries. Pretreatment programs issue permits to industries, spelling out the responsibilities of the industries for pretreatment and compliance with the sewer-use ordinance. These responsibilities include the monitoring of their waste streams to determine pollutant concentration limits.

Sanitary wastewater from the Y-12 Plant is discharged to the city of Oak Ridge POTW. Both ORNL and the K-25 Site have on-site sewage treatment plants. DOE waste treatment facilities have formal wastewater acceptability control and surveillance programs that ensure the protection of the facilities and the proper treatment of wastes. Among other things, these programs define pretreatment requirements and waste acceptance criteria. Discharges are regulated under NPDES permits.

Y-12 Plant

Surface Water and Liquid Effluents

The current NPDES permit issued May 25, 1985, is a reflection of the 1977 amendments to the Federal Water Pollution Control Act and the Y-12 FFCA signed by EPA and DOE on April 17, 1985. This current NPDES permit combines water quality and industrial best available technology effluent limitations for the metal finishing and steam electric power generation industries with emphasis on biological and toxicological monitoring. Under the conditions of the permit, the Y-12 Plant was required to accomplish the following:

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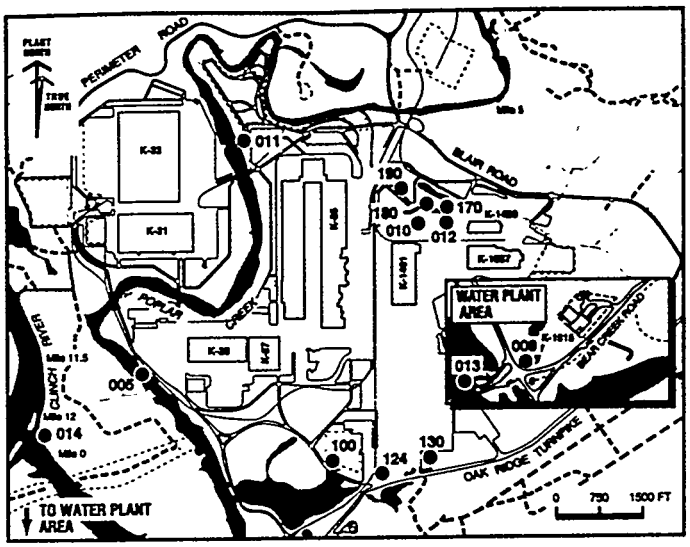

Fig. 4.22. K-25 Site NPDES major outfalls and Category IV storm drain outfalls.

- develop and implement a best management practices plan that prevents or minimizes the potential of wastewater from Category I and II outfalls,
- determine the biological toxicity of wastewater streams from several locations and develop a toxicity characteristic monitoring plan as necessary,
- develop a radiological monitoring plan,
- develop a PCB monitoring plan,
- develop a biological monitoring and abatement program (BMAP) for East Fork Poplar Creek, and
- comply with discharge limitations on identified miscellaneous discharge points.

The Y-12 Plant is committed to achieving effluent characteristics that are better than those specified by the best available technology. The effluent limitations for each treatment facility may be adjusted if the treated effluent results in instream toxicity as determined by the toxicity control and monitoring program (TCMP) plan or if East Fork Poplar Creek does not display a healthy ecological system as determined by BMAP.

The Y-12 Plant NPDES permit requires sampling and analysis at 14 serially numbered outfalls, about 195 categorized outfalls, and about 30 miscellaneous discharges. This listing is subject to change as outfalls are eliminated or consolidated. A total of 32 outfalls to East Fork Poplar Creek were eliminated (source flows stopped and outfalls physically removed) in 1993. A total of 14 outfalls had previously been eliminated in 1992. Plans are to remove 15 outfalls in 1994, which will bring the total number of active outfalls to 135. Since the mid-1980s, more than 200 untreated wastewater point sources that previously discharged to the surface water have either been treated or eliminated from direct discharge to the creek.

The water quality of surface streams in the vicinity of the Y-12 Plant is affected by current and past operations. Discharges from Y-12 Plant processes affect water quality and flow in East Fork Poplar Creek before entering the Clinch River. In past years, discharge of coal bottom ash slurry to the McCoy Branch Watershed from the Y-12 Steam Plant occurred only when coal was in use. Bear Creek water quality is affected by area source runoff and groundwater discharges. Discharges to surface water allowed under the permit include storm drainage, cooling water, cooling tower blowdown, and treated process wastewaters, including effluents from wastewater treatment facilities. Sumps that collect groundwater inflow in building basements are also permitted for discharge to the creek. The monitoring data collected by the sampling and analysis of permitted discharges are compared with the appropriate NPDES limits when a limit exists for each parameter. Some parameters are "monitor only," with no limits specified.

Outfalls 302 (Rogers Quarry) and 304, which are considered instream sampling points for McCoy Branch and Bear Creek, respectively, are also compared with state of Tennessee water quality criteria, as a component of surveillance monitoring conducted by the Y-12 Plant. The most restrictive of either the freshwater fish and aquatic life criterion maximum concentration (CMC) or the recreation concentration for organisms only standards (10^{-5} risk factor for carcinogens) was used. See Sect. 5 for these and other results of surveillance monitoring.

The existing Y-12 Plant NPDES permit expired in May 1990. An application for permit renewal was submitted to TDEC/EPA in November 1989, and an addendum to this application was submitted to TDEC in February 1993. The addendum contains an extensive collection of proposed monitoring points and subsequent categories, consisting of 33 Category II outfalls (storm water and cooling water condensate), 12 Category III

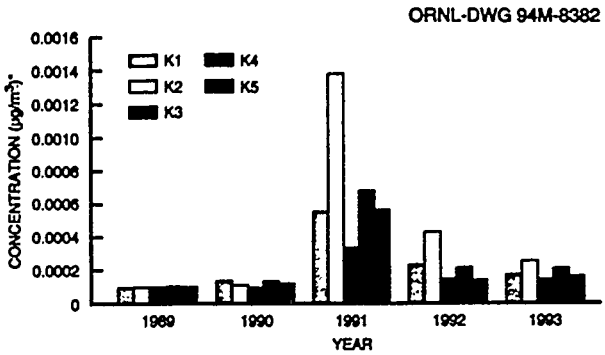

Fig. 5.13. Ambient air monitoring 5-year trend results for uranium at the K-25 Site.

SURFACE WATER MONITORING

ORR Surface Water Monitoring

Under the environmental monitoring plan for the ORR, to assess the impact of past and current DOE operations on the quality of local surface water, samples are collected and analyzed from 22 locations around the ORR (Fig. 5.14). Sample locations are on streams downstream of ORR waste sources, at reference points on streams and reservoirs upstream of waste sources, on reference streams off site, and at public water intakes. Sampling locations are

- Bear Creek downstream from all DOE inputs (BCK 0.6)
- Bear Creek downstream from Y-12 Plant burial grounds (BCK 9.4)
- Clinch River downstream from all DOE inputs (CRK 16)
- Water supply intake for the K-25 Site (CRK 23)
- Clinch River downstream from ORNL (CRK 32)

ORNL-DWG 93M-9752

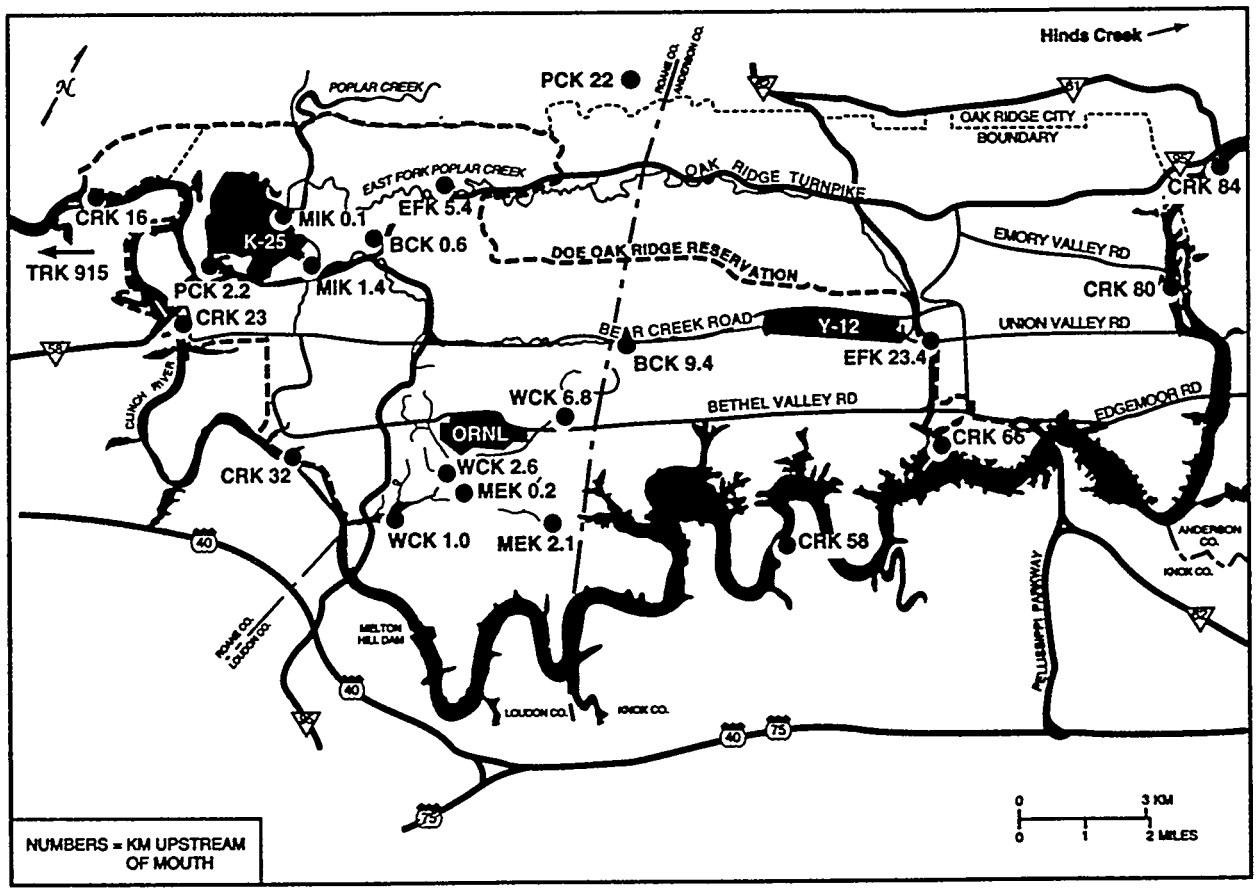

Fig. 5.14. Locations of ORR surface water sampling stations.

- Water supply intake for Knox County (CRK 58)
- Melton Hill Reservoir above city of Oak Ridge water intake (CRK 66)
- Melton Hill Reservoir, Oak Ridge Marina (CRK 80)
- Melton Hill Reservoir above all DOE inputs, Anderson County Filtration Plant (CRK 84)
- East Fork Poplar Creek downstream from floodplain (EFK 5.4)
- East Fork Poplar Creek downstream from Y-12 Plant (EFK 23.4)
- Hinds Creek (reference site for East Fork Poplar Creek) (HC)
- Melton Branch downstream from ORNL (MEK 0.2)
- Melton Branch upstream from ORNL (MEK 2.1)
- Mitchell Branch downstream from K-25 Site (MIK 0.1)
- Mitchell Branch upstream from K-25 Site (MIK 1.4)
- Poplar Creek downstream from K-25 Site (PCK 2.2)
- Poplar Creek upstream from K-25 Site and East Fork Poplar Creek (PCK 22)
- Water supply intake for city of Kingston (TRK 915)
- White Oak Lake at White Oak Dam (WCK 1.0)
- White Oak Creek downstream from ORNL (WCK 2.6)
- White Oak Creek upstream from ORNL (WCK 6.8)

Water quality measurements serve as a guide to the general health of the environment. The sampling and analysis in this program are conducted in addition to requirements mandated in National Pollutant Discharge Elimination System (NPDES) permits for individual ORR DOE facilities. Although there is some overlap of sampling sites in the NPDES and environmental monitoring plan programs, frequency and analytical parameters vary.

Sampling frequency under the environmental monitoring plan is bimonthly, with half of the sites being sampled one month and the other half in the following month. Grab samples are collected and analyzed for general water quality parameters, total metals, and volatile organics. They are also screened for radioactivity and analyzed for specific radionuclides when appropriate.

Tennessee water quality criteria for domestic water supplies and for freshwater fish and aquatic life are used as references for locations where they are applicable. Out of the 79 parameters sought at each of the 22 locations, zinc at Melton Branch downstream from ORNL (MEK 0.2) on the ORR is the only parameter that exceeded 100% of the reference value.

Y-12 Plant Surface Water Monitoring

Routine surface water monitoring that is not required by the NPDES permit is performed at the Y-12 Plant site for a variety of reasons, and various radiological and nonradiological parameters are monitored. Monitoring results are compared with state water quality criteria and with DOE order requirements. Nonradiological data are compared with Tennessee water quality criteria, where a criterion exists for that parameter. The most restrictive of either the freshwater fish and aquatic life criterion maximum concentration or the recreation concentration for organisms only standard (10^{-5} risk factor for carcinogens) was used. Radiological data are compared with DCGs published in DOE Order 5400.5. The DCG for water is the concentration of a given radionuclide that, if ingested at the rate of 730 L/year, would result in an effective dose equivalent of 100 mrem/year to "reference man," as defined by International Commission on Radiation Protection Publication 23. Radiological data are reported as percentage of the DCG for a given radionuclide. In the event that a sum of the DCG percentages for a location ever exceeds 100%, an analysis of the best available technology to reduce the sum of the percentages of the radionuclide concentrations to their respective DCGs to less than 100% would be required as specified in DOE Order 5400.5.

Station 17, located near the junction of Bear Creek and Scarboro roads, is used to monitor East Fork Poplar Creek downstream of Lake Reality but prior to its leaving the easternmost Y-12 Plant boundary (Fig. 5.15). Discharges from Y-12 Plant processes affect water quality and flow in East Fork Poplar Creek before it enters the Clinch River. Daily samples were obtained at Station 17 for radiological and nonradiological parameters; grab samples for mercury and volatile organics were obtained daily at Station 17. With the exception of about

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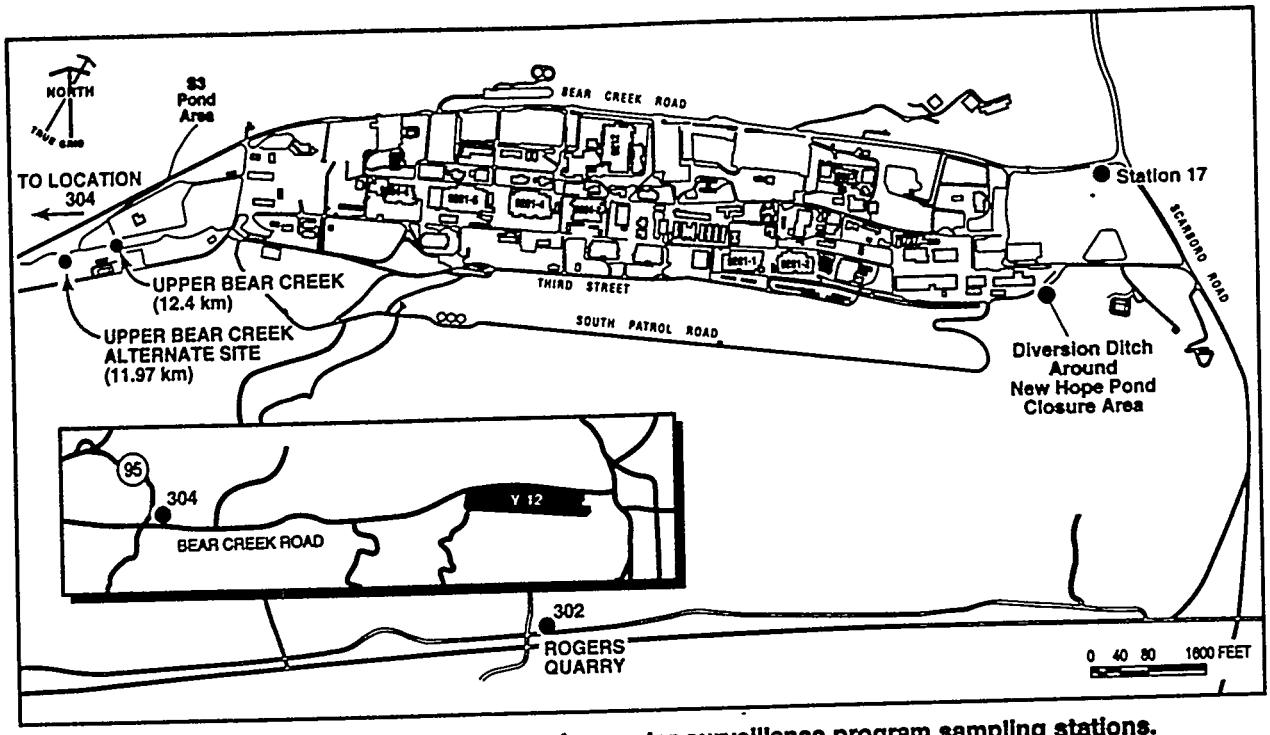


Fig. 5.15. Locations of Y-12 Plant surface water surveillance program sampling stations.

three weeks in February and March when power lines had to be reconstructed (because of damage from a tornado on Feb. 22), 24-hour composite samples were obtained every day of the week, with a 72-hour composite collected on weekends for a variety of chemical parameters.

More than 200 samples were collected in 1993 at Station 17 for analysis of nonradiological parameters, resulting in nearly 15,000 measurements. Comparison with Tennessee water quality criteria, for parameters where there was an exceedence, is shown in Table 5.13. All 203 measurements for silver and mercury were above those criteria, because the analytical-method detection limits for silver (0.006 mg/L) and mercury (0.0002 mg/L) are above the water quality criteria (0.004 and 0.00015 mg/L, respectively). Of the remaining measurements, only a single measurement each for cadmium and chromium exceeded the criteria.

Table 5.13. Surface water sampling measurements exceeding Tennessee water quality criteria at the Y-12 Plant, 1993

Parameter	Location	No. of samples	Concentration (mg/L)			Water quality criteria (mg/L)	No. of measurements exceeding criteria
			Detection limit	Max	Av		
Silver	Station 17	203	0.006	<0.006	<0.006	0.004	203
Mercury	Station 17	203	0.0002	0.0093	<0.0016	0.00015[a]	203
Mercury	Rogers Quarry (Outfall 302)	52	0.0002	0.0006	<0.0002	0.00015	52
Chromium	Station 17	203	0.006	0.028	<0.006	0.016	1
Cadmium	Station 17	94	0.0005	0.0082	<0.0019	0.004	1

[a]The Tennessee water quality standard for recreation is 0.00015 mg/L. The freshwater fish and aquatic life standards are 0.0024 and 0.000012 mg/L for the maximum and continuous concentrations, respectively.

Mercury data are used for long- and short-term trending of mercury concentrations in plant effluents. The legacy of contamination resulting from the use and storage of mercury at the Y-12 Plant has been previously

acknowledged and has prompted a series of remedial measures. In the late 1950s, the average annual concentration of mercury in East Fork Poplar Creek peaked at about 2.3 mg/L (2300 µg/L) (Fig. 5.16). Recent annual average concentrations ranged from 0.0014 to 0.0016 mg/L (1.4 to 1.6 µg/L) (Fig. 5.17). Because of mercury abatement activities and decreases in water flow, mercury loading to East Fork Poplar Creek from the Y-12 Plant has decreased significantly. Average daily values were about 60 g/day in the early 1980s, whereas recent values are near 15 g/day. This represents a 75% decrease in mercury releases over the past decade.

All radiological measurements at Station 17 were well below the DCGs. The summed percentage of DCGs for measured radionuclides at Station 17 was 3.29%. The largest single contributor to this total was ^{238}U. The median value for ^{238}U at this location for 1993 was 6.2 pCi/L, which represents 1% of the DCG. In 1993, the total uranium and associated curies released from the Y-12 Plant, as measured at Station 17 on Upper East Fork Poplar Creek, was 134 kg, or 0.081 Ci (3.0×10^9 Bq).

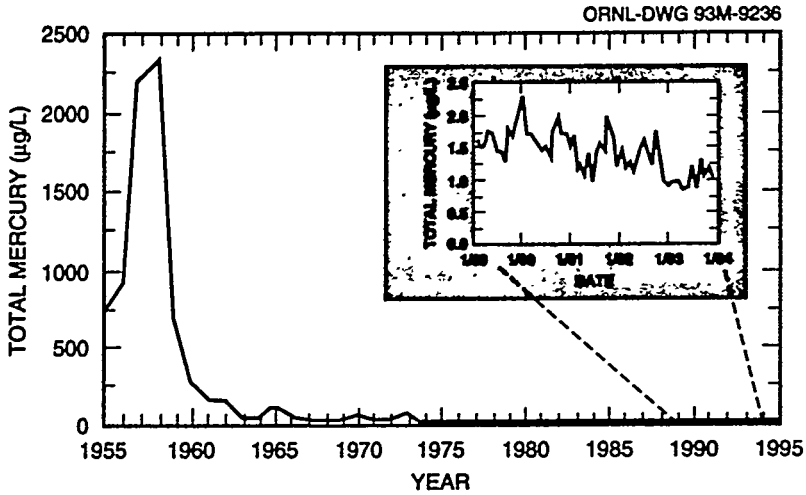


Fig. 5.16. Mercury concentrations in surface water leaving the Y-12 Plant, 1955–93. Values plotted in large graph are annual averages. Values in inset are monthly averages.

NPDES sampling locations 302 (Rogers Quarry) and 304 on Bear Creek (km 4.55) are considered instream sampling points for McCoy Branch and Bear Creek. In past years, coal bottom ash slurry was discharged to the McCoy Branch Watershed from the Y-12 Steam Plant. Bear Creek water quality is affected by area source runoff and groundwater discharges from waste disposal sites. Of measurements collected and comparisons made to state water quality criteria for surface water surveillance, only mercury exceeded the criteria at Outfall 302. Again, this was because the analytical-method detection limit for mercury (0.0002 mg/L) exceeds the water quality criterion (0.00015 mg/L). At Outfall 304, no measurements made as part of the surface water program exceeded water quality criteria.

Additional surface water sampling is conducted at Outfall 304 by the Y-12 Plant groundwater protection program to monitor trends throughout the Bear Creek Hydrogeologic Regime (see Section 7).

In addition to surveillance monitoring via conventional surface water sampling, the Y-12 Plant has established a series of monitoring stations on the storm sewer collection system and East Fork Poplar Creek (Fig. 5.18). These stations are officially known as the Surface Water Hydrological Information Support System (SWHISS). The SWHISS network is designed to monitor and record various surface water parameters to aid in spill tracking and water quality determination.

Telemetry delivers real-time monitoring data to the Utilities

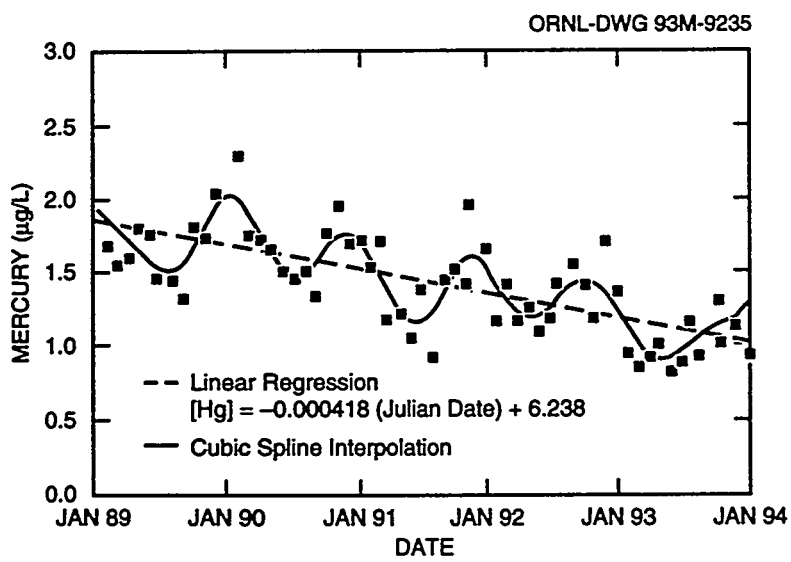


Fig. 5.17. Monthly average (N = 40) mercury concentrations in East Fork Poplar Creek at Station 17 near the eastern end of the Y-12 Plant, January 1989–December 1993. Straight and sinusoidal lines fitted to data represent long-term and seasonal trends.

ORNL-DWG 94M-8135

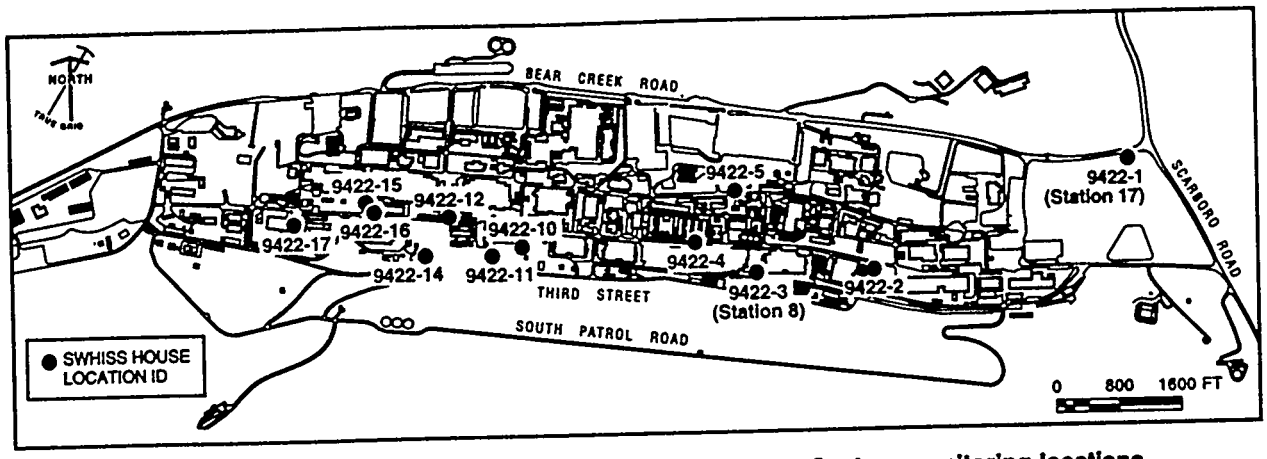


Fig. 5.18. Surface Water Hydrological Information Support System monitoring locations.

Monitoring Station 9 and the SWHISS house central computer in Building 9704-1. Real-time monitoring parameters vary for each site but typically include pH, temperature, conductivity, dissolved oxygen, and flow. Two locations on East Fork Poplar Creek also measure chlorine.

During 1993, the SWHISS network was instrumental in identifying a need for change in operational procedures at the Steam Plant Wastewater Treatment Facility (SPWTF). SWHISS data revealed a need for the installation of an additional pH meter in a process tank because a wide range of pH readings had been observed during discharge from the facility. This addition has improved the quality of treated wastewater discharged.

ORNL Reference Surface Water Monitoring

The net impact of ORNL on surface waters is evaluated by comparing data from samples collected at reference locations with information from samples collected downstream of the facility. Monthly surface water samples are collected at two sampling locations to determine contamination levels before the influence of ORNL activities. One sampling location is Melton Hill Dam above ORNL's main discharge point into the Clinch River. The other sampling location is White Oak Creek headwaters above any ORNL discharge points to White Oak Creek (Fig. 4.15).

Analyses are performed to detect radioactivity and conventional, inorganic, and organic pollutants in the water. Conventional pollutants are indicated by conductivity, temperature, turbidity, pH, total dissolved solids, total suspended solids, and oil and grease. Inorganic parameters are indicated by metal and anion analyses. The presence of organic pollutants is indicated by results from total organic carbon analysis. If the total organic carbon result is greater than 2.5 mg/L, analyses for volatile and semivolatile organic compounds are conducted.

In March 1993, a total organic carbon value of 2.6 mg/L was received for Melton Hill Dam. A recheck of the total organic carbon analysis was performed and resulted in a value of 2.4 mg/L. Values from analyses in the next 4 months ranged from 1.8 to 2.2 mg/L. There were no other high levels of organic compounds detected by the total organic carbon analysis at either location, as indicated by the maximum value of 2.6 mg/L at Melton Hill Dam and by the maximum value of 0.96 mg/L at White Oak Creek headwaters.

In an effort to provide a basis for evaluation of analytical results and for assessment of surface water quality, DWSs (from 40 CFR Parts 141 and 143, as amended, and the Tennessee General Water Quality Criteria for Domestic Water Supply, as amended) have been used. Although DWSs are used, it is unrealistic to assume that members of the public are going to drink water from Melton Hill Dam or White Oak Creek headwaters.

There is reasonably good agreement between parameters measured at White Oak Creek headwaters and those at Melton Hill Dam. At White Oak Creek headwaters, the only average concentrations that exceeded the DWSs are aluminum, iron, and lead. At Melton Hill Dam, the only average concentrations that exceeded the DWSs are aluminum, iron, lead, and manganese. Concentrations of these magnitudes are commonly associated with the hydrogeology of the Clinch River.

Radiological data are compared with DOE DCGs. The average concentration for a radionuclide is expressed as a percentage of its DCG when a DCG exists and when the average concentration is significantly greater than

9. Special Studies

T. P. Brennan, P. Leminski, J. B. Murphy, M. J. Norris, R. M. Rush, G. R. Southworth, M. F. Tardiff, L. O. Vaughan, C. H. Wilkinson, and G. G. Worley

Abstract

Many environmentally related special studies are conducted on the Oak Ridge Reservation each year. The studies included in this section are not associated directly with annual environmental monitoring activities but may be of special interest to some readers. The site most involved with each study submitted its description.

SPECIAL STUDIES AT THE Y-12 PLANT

Integrated Mercury Strategy for the Oak Ridge Reservation

Past waste-disposal and operations activities at the ORR have led to the propagation of mercury in the environment. Much of the environmental media contaminated with mercury was transported off site by East Fork Poplar Creek. Since this problem was identified, a substantial amount of work has been preformed on the ORR and at the Y-12 Plant to measure, remediate, limit, and control mercury contamination. The initial remediation work was performed at the Y-12 Plant between 1985 and 1991 under the Reduction of Mercury in Plant Effluent (RMPE) project.

In 1993, a strategy was developed to integrate further CERCLA actions for mercury remediation on the ORR with anticipated NPDES compliance requirements to limit mercury discharges from the Y-12 Plant and waste management and disposal operations for wastes generated during remedial actions. Another reason for the integrated approach is to minimize duplication of activities and to ensure the dissemination of technical knowledge among the various organizations involved in mercury-related functions. A major component of the integrated mercury strategy is implementation of the Reduction of Mercury in Plant Effluent Phase II Program (RMPE II).

The RMPE II program is structured to serve as a bridge between downstream remediation of Lower East Fork Poplar Creek and upstream remedial actions at the Y-12 Plant. A key goal of this program is to reduce the annual mercury release from Y-12 Plant by about 70% by the end of the 5-year NPDES permit period. Six projects (four building source elimination efforts and two treatment units) have thus far been identified under the RMPE II Program to reduce mercury contamination to upper East Fork Poplar Creek. To eliminate sources of mercury, rerouting of pipes has been proposed for buildings 9201-2, 9201-4, 9201-5, and 9204-4. Installation of an interim mercury treatment unit is proposed for Building 9201-2. This unit will use carbon-column treatment and will serve to prove treatment technology previously demonstrated in laboratory-scale tests. Additionally, a modification to the Central Pollution Control Facility is proposed to provide permanent mercury-treatment capability.

In 1993, an engineering report and preliminary plans were prepared for an interim mercury-treatment unit in Building 9201-2. The unit, which is planned to be operational by July 1994, will treat mercury-contaminated groundwater collected in the basement sumps of Building 9201-2.

Site-Specific Water Quality Criterion for Total Mercury in East Fork Poplar Creek Downstream from the Y-12 Plant

The EPA water quality standard for mercury, which has been adopted by TDEC as a water quality standard, is based on assumptions that are not applicable for East Fork Poplar Creek. The biological availability of mercury in East Fork Poplar Creek is relatively low and is not typical of most systems to which the criterion is meant to be applied. In addition, the EPA standard of 0.012 μg/L (freshwater fish and aquatic life criterion continuous concentration) is based on the assumption that all aqueous-phase mercury is present as methylmercury and that the predominant pathway for bioaccumulation by fish is direct uptake from water. Site-specific data in

East Fork Poplar Creek indicate that these assumptions are incorrect by a wide margin. EPA recognizes the uncertainty associated with the published criterion and encourages using site-specific data that support an alternate limit. In 1993, a study was conducted to establish an alternate water quality limit for mercury in East Fork Poplar Creek.

Site-specific toxicity tests of East Fork Poplar Creek water, and toxicological data supporting the derivation of the EPA water quality criterion for mercury, indicate that adverse effects to aquatic life are unlikely to occur at concentrations of total mercury less than or equal to 0.2 µg/L. Comparison of aqueous-phase mercury concentrations and mercury in fish at the same sites in East Fork Poplar Creek indicate that reduction of aqueous-phase mercury to 0.2 µg/L in the upper reaches of East Fork Poplar Creek would cause mercury levels in fish at those sites to drop to levels safe for human consumption. A site-specific criterion of 0.2 µg/L total mercury in East Fork Poplar Creek at the Y-12 Plant Station 17 monitoring site would be a limit that would continue to force remedial actions, and when met, would ensure that the uses of East Fork Poplar Creek as classified by TDEC are protected with respect to the effects of mercury. DOE has submitted a detailed report of this special study to TDEC.

Environmental Assessment for Interim Storage of Enriched Uranium at the Y-12 Plant

Compliance with NEPA ensures that consideration is given to environmental values and factors in federal planning and decision making. In accordance with NEPA, an environmental assessment for storage of interim enriched uranium at the Y-12 Plant was prepared in 1993. Enriched uranium from dismantled nuclear weapons and other sources has historically been returned to the Y-12 Plant. DOE proposes to continue interim storage of enriched uranium at the Y-12 Plant until decisions on ultimate disposition of enriched uranium and other special nuclear materials are made and implemented. This would require storage of enriched uranium in amounts that would exceed the maximum historical level at the Y-12 Plant. Public meetings were held in early 1994 to determine applicability of a "finding of no significant impact" under NEPA.

Treatment Plant Discharge Project

The Y-12 wastewater treatment facilities have done an excellent job during the past few years in complying with the current National Pollutant Discharge Elimination System (NPDES) Permit (issued in 1985), with very few excursions. Even though these excursions have been minor and infrequent, the goal is to eliminate noncompliances to the greatest extent possible. The Treatment Plant Discharge Project was scoped with the requirement of improving treatment-facility capability to ensure that more stringent effluent standards of the new NPDES permit can be met using the best available technology. An engineering feasibility study was completed in 1993, and a conceptual design report was initiated.

The project addresses the following areas:

- consolidation of outfalls;
- addition of facilities for effluent retention until a laboratory evaluation can be performed;
- improvement of treatment technology at the Central Pollution Control Facility/Plating Rinsewater Treatment Facility, the West End Treatment Facility, and the Groundwater Treatment Facility, the effluents from which would be fed to a new polishing facility followed by effluent holdups before being discharged into East Fork Poplar Creek; and
- improvement of the Steam Plant Wastewater Treatment Plant, which will continue as a stand-alone facility with additional treatment steps, including aeration to aid in iron removal, an enhanced pH-adjustment system to improve reliability and filtration, and effluent holdup tanks.

SPECIAL STUDIES AT ORNL

ORNL Well Data Base

A data base of information has been developed for wells on the ORNL Site. It contains details of location, physical properties, use, custodianship, and miscellaneous other information. The data were collected from a variety of sources. The initial sources were the well-construction data sets that were collected as part of the

~~779-8890~~
~~CWoody~~

~~incl. Task 4 in param. compares~~ fish

~~ask Nancy about N3 comments on T-2~~

~~call ISEE @ 2 to program~~ other missing letters when printed (@ rt margin)

'85, '86, '87: missing data — email Ralph, (Wiley?)

consider interpolation – any chk. reviewer comments on this?

any studies IN and OUT of NHP?

PD form

10 d notification of acceptance — send G+Obj. to ? Tom, Don

≥ 2 wks — review resumé (presents/abstrs)

ISEE prelim. program

≥ 60 sessions

ANNUAL SUMMARY OF STREAM DISCHARGE, MERCURY CONCENTRATION AND LOADING FOR UPPER EAST FORK POPLAR CREEK.

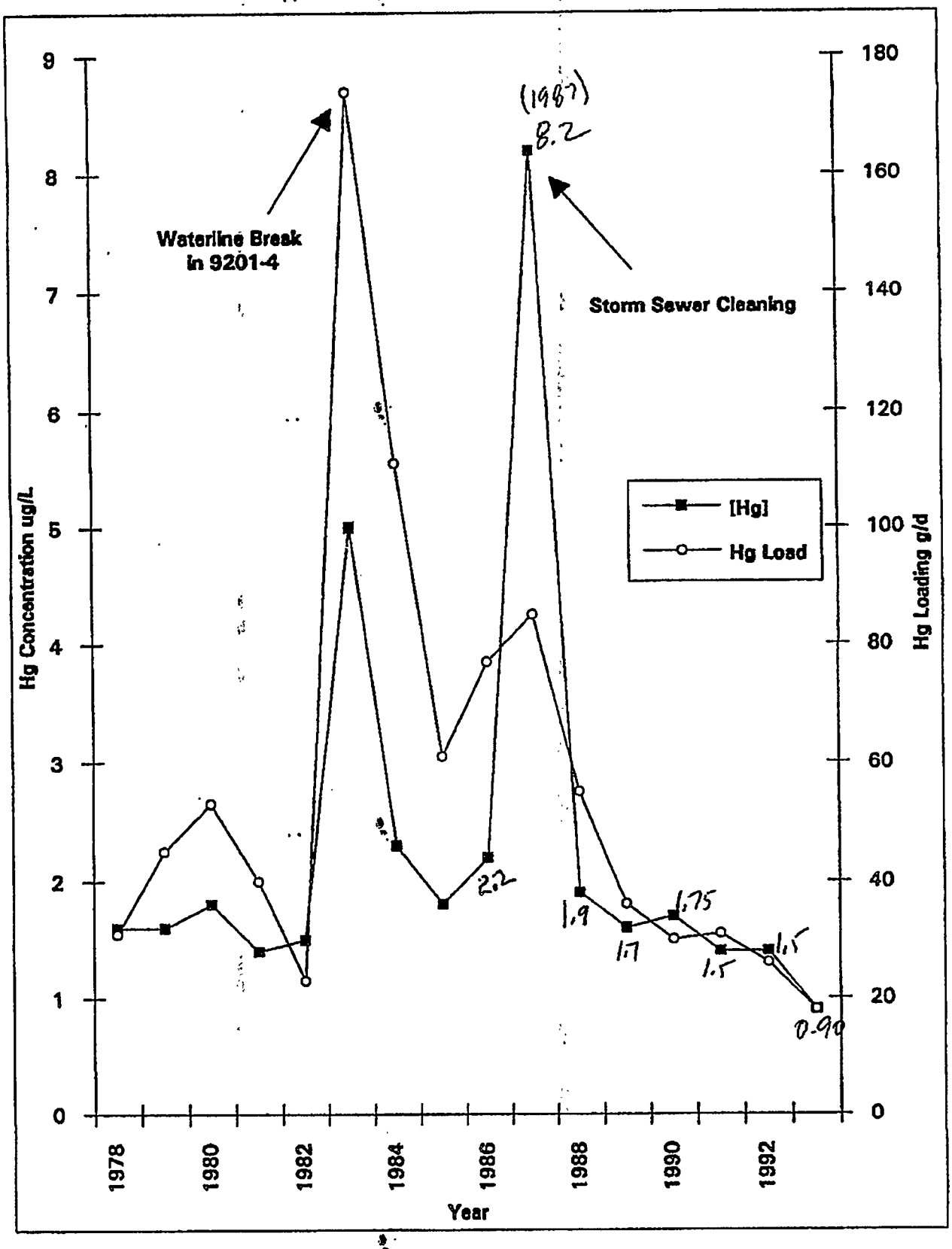
Year	Average Discharge (mgd)	Average Mercury (μg/L)	Average Hg Load (grams/day)	Average Hg Load (lbs/year)
1983	9.0	5.0	171	137
1984	13	2.3	111	89
1985	9.0	1.8	61	49
1986	9.2	2.2	77	62
1987	8.0	2.8	85	68
1988	7.6	1.9	55	44
1989	5.9	1.6	36	29
1990	4.7	1.7	30	24
1991	5.8	1.4	31	25
1992	4.9	1.4	26	21
1993	4.5	1.0	17	14
1994	6.9	0.92	24	19
1995*	4.2	0.87	14	11

* Data through July only

TO: Sue Flock
FAX #: 510/521-1547
FROM: Ralph Turner
FAX #:
PHONE #:
DATE: / /
PAGES INCLUDING THIS PAGE: 2
TOPS 14650

Sue: The 1995 and 1996 Hg Abatement Reports are Y/ER-251 and Y/ER-277

Hg Concentration and Loading in UEFPC



Spills

from Y/HG-0509 (3/56)

UNCLASSIFIED

Date	Location	Remarks	Injury or Loss
1-12-56	Beta-2	Explosion in dry box. First, second, and third degree burns; eye injury.	1 injury
1-10-56	Beta-2	Failure of 30-inch pressure vessel	$500,000 112,500 lbs.?
→ 1-1-56	Alpha-5	Ruptured expansion joint allowed X112.5lb/gal 1,000 gals. of amalgam to leak thru celotex insulated roof onto motor generator.	11,000 lbs. Hg 14 kgs. 25% Li6 vs. 70,000 lbs. (Y/EX-24)
12-11-55	Alpha-5	Several holes burned in amalgam tray due to short circuit. Several electrical switches burned up.	$8,000
9-21-55	Alpha-4	Short in amalgam tray burned ten anodes as well as hole in tray.	$8,070
8-24-55	? Y-12	Spill of B-38 molten metal from cracked crucible.	$2,600 ✓
7-4-55	Alpha-4	Plugged nitrogen purge line allowed explosive hydrogen concentration to develop. Minor explosion in absorber tray followed.	$ 500
M-92 6-17-55	Alpha-5	Hydrogen explosion in evaporator feed tank. (Compensation on one injury reported as adding $75,000).	66 injured $132,275
6-22-55	? Y-12	Transformer failure from unknown cause required shutdown of Alpha-5, Beta-2 and 4, and 9212.	?
5-16-55	Alpha-5	Mechanical fault damaged armature, brushes, and brush holders of 2500-KW motor generator set.	$28,000
5-9-55	9201-5	Series of hydrogen explosions in absorber trays followed stopping of mercury circulating pump which allowed lithium plating on trays which in turn reacted with water giving hydrogen.	$4,000

UNCLASSIFIED

UNCLASSIFIED

Date	Location	Remarks	Injury or Loss
4-19-55	Beta-2	Filter fire in ventilating system. Fire involved combustible filters and celotex lining of ducts.	$17,555
3-2-55	9204-3	Runaway freight car struck building causing damage to transformer and rectifier.	$4,555
3-3-55	9206	Reduction reactor explosion.	$2,600

UNCLASSIFIED

M-468 Accidents [3-3-55 to 1-12-56] prior to July 1955, accds. reported to security*

(Y/HG-509) 3/56

4-19-55 β-2 filter fire

5-9-55 α-5 H_2 explosions

6-17-55 α-5 H_2 explosion 66 injured

7-4-55 α-4 "

→ 1-1-56 α-5 1000 gal Hg spill

1-12-56 β-2 explosion 1 injured

(Y/HG-253) 6/56 *

5-14-56 Zr explosion 2 killed

(Y/HG-269) 7/31/56

ref. to their 7-20-56 letter

ref. to 1-10-56 β2 pressure vessel failure

pt. is H_2 Hazard Control

new cascade vent system, dump pit ventilation

for process accountability

for solvent contam. control

✓ L. Porter: 2 people for 1 month to declass. Y/EX-21 entire report

acid wash

Hg inventory no's

graphite

APPROVED FOR PUBLIC RELEASE

M. L. Bond 2/8/95

Technical Information Office Date

To Ray Williams

UNITED STATES
ATOMIC ENERGY COMMISSION

Oak Ridge, Tennessee 37830

May 13, 1966

IN REPLY REFER TO:

OPA:WBK

RECEIVED
MAY 23 1966
METAL PREPARATION DIVISION

Case w/encl. 1 & 2
Jasny w-2/encl. 1 & 2
File w/encl. 1 & 2

Y/HG-0072 Pt1 DEL.RE

Union Carbide Corporation
Nuclear Division
Post Office Box P
Oak Ridge, Tennessee 37830

Attention: Dr. C. E. Larson, President

Subject: REPORT OF INVESTIGATING COMMITTEE - LOSS OF MERCURY AT THE Y-12 PLANT on March 26-28, 1966

Gentlemen:

Transmitted herewith are Parts 1, unclassified, and 2, Official Use Only, of the subject report.

Immediate steps should be taken to implement the recommendations of the Committee.

Periodic reports should be submitted giving the progress made on implementation of the recommendations until all required actions are completed.

Please convey to Messrs. R. E. Hulme, J. J. Kurtz, and H. T. Kite of the Y-12 Plant, my appreciation for their participation on the Committee. It would be appreciated if they could still be made available as needed to complete the collection and evaluation of the remaining data necessary to define the distribution and concentration of the mercury and issue a final report on the loss.

~~Very truly~~ yours,

for S. R. Sapirie
Manager
Oak Ridge Operations

RECEIVED
MAY 18 1966
J. M. CASE

Enclosures:
1. Report #1
2. Report #2(OUO)

CC: Mr. R. C. Armstrong
w/o Encls.

APPROVED FOR PUBLIC RELEASE
Technical Information Office 8/12/94 Date

Y/HG-0072 PT. 1 DEL. REV.

Part 1 14

UNITED STATES ATOMIC ENERGY COMMISSION

REPORT OF INVESTIGATING COMMITTEE

LOSS OF MERCURY AT THE Y-12 PLANT

Prepared by

UNION CARBIDE CORPORATION
NUCLEAR DIVISION
Y-12 PLANT

RECEIVED
MAY 24 1966
V. B. GRITZNER

U. S. ATOMIC ENERGY COMMISSION
OAK RIDGE OPERATIONS OFFICE
OAK RIDGE, TENNESSEE

RECEIVED
MAY 18 1966
J. M. CASE

APPROVED FOR PUBLIC RELEASE
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Part 1

UNITED STATES ATOMIC ENERGY COMMISSION

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U. S. ATOMIC ENERGY COMMISSION
OAK RIDGE OPERATIONS OFFICE
OAK RIDGE, TENNESSEE

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EFFECTS OF SPILL LOSS	12

EXHIBITS

Figure No.	
1	Memorandum, dated March 30, 1966, from S. R. Sapirie, Establishing the Investigating Committee
2	Equipment Section and Sight-Gage Location
3	View of Plastic Sight-Tube Arrangement
4	Estimated Distribution of Mercury in Fan Room E
5	Estimated Distribution of Mercury in Fan Room F
6	Structural Details of Dump Pit
7	Plot Plan of Fan Room E and Core-Drill Data
8	Plot Plan of Fan Room F and Core-Drill Data

COMMITTEE

In accordance with the Atomic Energy Commission and Oak Ridge Manual Chapters 0502 and 0703, Mr. S. R. Sapirie, Manager, Oak Ridge Operations Office, Atomic Energy Commission, in a memorandum dated March 30, 1966 (Exhibit 1), appointed the following committee to investigate a mercury spill loss at the Y-12 Plant between March 26 and 28, 1966:

Chairman: W. B. Kenna, Assistant Chief, Nuclear Materials Control Branch, Production Division, ORO, AEC

R. E. Hulme, Engineering Division, UCC, Nuclear Division, Y-12

H. T. Kite, Development Division, UCC, Nuclear Division, Y-12

J. J. Kurtz, Engineering Division, UCC, Nuclear Division, Y-12

The committee, chaired by Mr. W. B. Kenna, was directed by Mr. S. R. Sapirie to convene immediately and endeavor to establish the facts relating to the inciden to collect data and to present its findings, conclusions, and recommendations in a report.

The committee met initially on March 30, 1966, with all members in attendance Mr. J. J. Kurtz was appointed secretary. The committee members inspected the area in which the spill loss occurred and then had preliminary discussions concerning the scope of the investigation.

A preliminary report of the incident was prepared and issued to notify proper Atomic Energy Commission headquarters personnel. Subsequent meetings were held by the committee to review findings and progress.

SUMMARY

Between 4:00 p.m., on March 25, 1966 and 8:15 a.m., on March 28, 1966, approximately 105,000 pounds of elemental mercury spilled from a two-tank collection system in Building 9201-5 in the Y-12 Plant of the Union Carbide Corporation, Nuclear Division. The mercury was from residual accumulations in process equipment currently being dismantled in the area. Approximately 55,000 pounds of mercury were recovered by salvage operations initiated as soon as the spill was discovered. The remaining 50,000 pounds, with a March 28, 1966 market value of $277,000, was assumed to have seeped through structural expansion joints into the earth-fill under the concrete slab. The spill occurred because of a failure in the temporary support system of a level measuring adaptation consisting of a piece of transparent plastic tubing connected to the tank. The cause of the loss was a failure to close a valve isolating the plastic tube system from the mercury supply.

On March 30, 1966, exploratory excavation and core-drilling operations were initiated to determine the amount and distribution of elemental mercury under the concrete floor slabs in the area. These explorations are not complete, but available evidence indicates that the mercury is most heavily concentrated just beneath the concrete slab and reduces to low concentrations in consolidated shale and rock. Insufficient data is available at this time to establish the quantity of recoverable mercury in the sub-soil under the slab. Additional exploratory excavations are required to determine the validity of core-drilling data and to obtain mercury concentration profiles in the suspected areas. Recovery costs can then be estimated.

HISTORY AND DESCRIPTION OF COLLECTION SYSTEM

The area in which the mercury spill incident occurred in Building 9201-5 is called the "Solvent Dump Pit No. 1". The original function of the main tanks, F-1 and F-2, each with a nominal capacity of 1500 gallons, was to collect the mercury inventory from process equipment requiring maintenance. The tanks were used for this purpose from January, 1955 through March, 1959. Between the period from March, 1959 and June, 1959, the tank volumes were calibrated and utilized to establish the total mercury inventory in Building 9201-5. Since the latter date, the tanks have been used to store miscellaneous collections of mercury acquired from equipment drainage and minor spill collections. Most of the transfers into the tanks were through the upper manholes. The mercury in the tanks was generally contaminated with process residues, corrosion products and miscellaneous materials which eventually coated the sight-gages so that they were extremely difficult to read. In addition, since the tanks were initially intended to supply only mercury holding capacity, the sight-gage installation had substantial blind areas in which tank levels were obscured.

The illustration on Figure 2 shows the location of these blind areas. In order to overcome these blind areas, a transparent plastic tube was attached to the drain nozzle of the sight-gages. The tubing was temporarily secured with plastic adhesive tape to the top of the sight-gages. Normally, the sight-gage drain valve would be closed to isolate the tube from the mercury supply except at such times when inventory readings were made.

OPERATIONS LEADING TO LOSS

The bulk of the mercury once contained in the process equipment in Building 9201-5 had been bottled and removed in conventional mercury flasks by June, 1965. Miscellaneous quantities of mercury which did not drain normally to the bottling station because of elevation differences or flow impediments were collected in a pair of calibrated 1500 gallon vertical tanks, F-1 and F-2, in the "Solvent Dump Pit No. 1". By June 4, 1965, 60,852 pounds of mercury was collected in these tanks.

During the following ten months up to March 25, 1966, more than 89,000 pounds of additional mercury was collected in the calibration tanks. This additional accumulation resulted from the process equipment dismantling and stripping operatic which were initiated in June, 1965. The sources of the mercury were pipe-line and equipment pockets which could be drained only by piercing or up-ending the pockets during the dismantling operations. The mercury which drained from the dismantled equipment was diverted into the building mercury collection system. This consists of a network of floor drains, sumps and piping that terminate in a decanting tank system on the Building 9201-5 first floor. The decanting tanks drain by gravity into the two calibrated tanks, F-1 and F-2, in a pit extending to the basement floor. The active procedure is to determine the inventory in tanks F-1 and F-2 at the end of each month. Initially this inventory was determined by measuring the distance from the tank-bottom tangent line to the level of mercury in the sight-gages. As the mercury level increased, the sight-glass became ineffective due to the existence of a blind area extending at least 12 inche in height. This is illustrated on Figure 2. In order to circumvent this difficul a transparent plastic tube was attached to the sight-glass drain nozzle and extended vertically parallel with the sight-glass. The top of the tube was

secured with plastic adhesive tape near the upper end of the sight-glass. This arrangement shown on Figure 3, provided for the determination of mercury level at any point in the tank. The normal procedure instituted for inventory determinations with the plastic tube sight-gage was to:

1. Open the sight-glass drain valve.
2. Let mercury equalize in plasti sight-gage tube.
3. Make mercury level measurement.
4. Close sight-glass drain valve.

On March 1, 1966, inventory determinations were made, except Step 4 of the procedure was inadvertently omitted because of an interruption in the sequence. While measuring the mercury level in the tanks, _____ the foreman taking the inventory, was informed by a process operator that another "pig", or 10-gallon container of mercury, would be added to the tank contents. Since a forklift truck is used to transport these mercury "pigs" to the collection tanks and an indeterminate amount of time would be consumed to make the transfer, _____ decided to return temporarily to his other responsibilities which have no association with mercury. Since he anticipated at the time that he would be returning shortly, _____ neglected to close the sight-gage drain valve isolating the plastic tube sight-gage from the mercury supply. In the interim, however, since Mr. _____ was engaged in executing his other responsibilities, it escaped his memory to return for a new inventory determination and to complete the inventory procedure.

Another routine operating procedure was to investigate daily the mercury level in a sump tank in the Dump Pit No. 1 floor, which collects miscellaneous drainings

from the 1st floor in Building 9201-5. While making this routine investigation on or about March 16, 1966, a process operator, discovered the sight-glass drain valve in an open position. Since this valve is not provided with a handwheel, started to look for an available wrench to permit him to close the valve. While searching for a wrench, supervisor, Mr. , a maintenance foreman, directed him to proceed to another area to clean up a mercury spill. neglected to tell of the open drain valve and then forgot to return to close the valve.

The last routine check of the sump in the Dump Pit area, before the spill incident was discovered, was made by . between 3:00 p.m. and 4:00 p.m. on March 25, 1966. At this time there was no evidence of any mercury leakage.

Between 8:15 a.m. and 8:30 a.m. on March 28, 1966, noticed that the Dump Pit floor was completely covered with mercury. The depth was determined to be between three to five inches. Mr. and Mr. entered the pit area immediately to determine the leak source. It was evident that the plastic adhesive tape securing the plastic sight-gage tube to the sight-glass had become detached. The hose had fallen free, allowing the mercury to drain from the tanks, F-1 and F-2, through the open sight-glass drain valve. Mr. then retaped the plastic tube, and with Mr. proceeded to pump the mercury from the floor into the collection tanks.

When the mercury in the pit was secured in the tanks, Mr. established that a substantial amount of mercury was still unaccounted for. He proceeded, therefore, with Mr. to investigate into the adjoining fan rooms E and F. A large pool of mercury was found in each of the fan rooms. The incident was then immediately reported to their supervisor, Mr. Figures 4 and 5 show views of the fan rooms with the estimated extent of the mercury distribution.

A team of process operators was assigned immediately to recover the mercury in the fan rooms.

The last estimated mercury inventory before the spill and after the immediate recovery operations are presented below.

March 1, 1966		
Inventory	145,608 pounds	
March Collections (Estimated)	5,000	
Total Before Spill		150,608 pounds
March 28, 1966		
Inventory in Tanks F-1 & F-2 after recovery	85,188 pounds	
Collected from Fan Rms. E & F	15,567	
Total After Spill		100,755 pounds
Net Loss		49,853 pounds

877.2 lbs/ft^3

EXPLORATORY ACTIVITIES

The structural concrete details shown on Figure 6 furnish a clue that the allegedly lost mercury may have escaped to the underside of the concrete floor slab in the basement area of Building 9201-5. This theory was postulated because no direct routes, other than concrete joints between the dump pit wall and column G-22 footing could be determined to account for the mercury present in the fan rooms E and F. Similarly, the joints between the pit wall and the floor slab should be permeable to mercury. On the strength of this theory, an electronic metal detector was introduced to scan the fan room floors for unusual metal accumulations under the floor slabs in the fan rooms. The strongest signals were indicated along the path of an existing vitrified clay drain-tile system under the floor slab in Fan Rooms E and F. It was postulated, therefore, that the mercury may have accumulated in the backfill in the drain system trench. An exploratory excavation was made, therefore, in Fan Room F near the dump pit wall. The drain tile trench and location of this exploratory excavation is shown on Figure 7. Mercury was visibly evident in the shale mixture which was removed from the exploratory hole. Core-drilling was then initiated to determine the extent of the mercury distribution under the concrete slab. In addition, other core-drillings were made to establish the depth of mercury penetration into the shale under the concrete slab. The location and mercury content of all the exploratory holes bored to this date in Fan Rooms E and F are shown on Figures 7 and 8, respectively. From this data it can be concluded tentatively that the mercury did not diffuse uniformly through disturbed and undisturbed shale. The highest mercury concentrations appear to be confined to backfill material or disturbed shale.

Additional data is required before an estimate of the quantity of recoverable mercury under the concrete slab can be computed.

EFFECTS OF SPILL LOSS

The mercury which is contained under the concrete slab, does not present any foreseeable additional hazard to personnel or future activities in Building 9201-5. However, it may present problems when and if future building alterations are made which require disturbance of the sub-floor in the area.

The lost mercury will be affectively maintained in the confines of the building footings since the footings are located on hard shale. The only loss from within these confines would be through fissures which may be present in the area sub-soil.

Respectfully submitted,

W. B. Kenna, Chairman
U. S. Atomic Energy Commission

R. E. Hulme
Engineering Division
Union Carbide Corporation
Nuclear Division, Y-12 Plant

H. T. Kite
Development Division
Union Carbide Corporation
Nuclear Division, Y-12 Plant

J. J. Kurtz
Engineering Division
Union Carbide Corporation
Nuclear Division, Y-12 Plant

Committee Members March 30, 1966

S. R. Sapirie, Manager
Oak Ridge Operations

COMMITTEE TO INVESTIGATE APPARENT LOSS OF MERCURY AT THE Y-12 PLANT - MARCH 28, 1966

OPA:WBK

In accordance with AEC Manual Chapter 0703, the following personnel are appointed to a Committee to investigate and report upon the circumstances surrounding the subject incident. The Company official who nominated the employee is parenthetically named with each member:

W. B. Kenna	Chairman - AEC
J. J. Kurtz	Member - UCC (J. M. Case)
H. T. Kite	Member - UCC (J. M. Case)
R. E. Hulme	Member - UCC (J. M. Case)

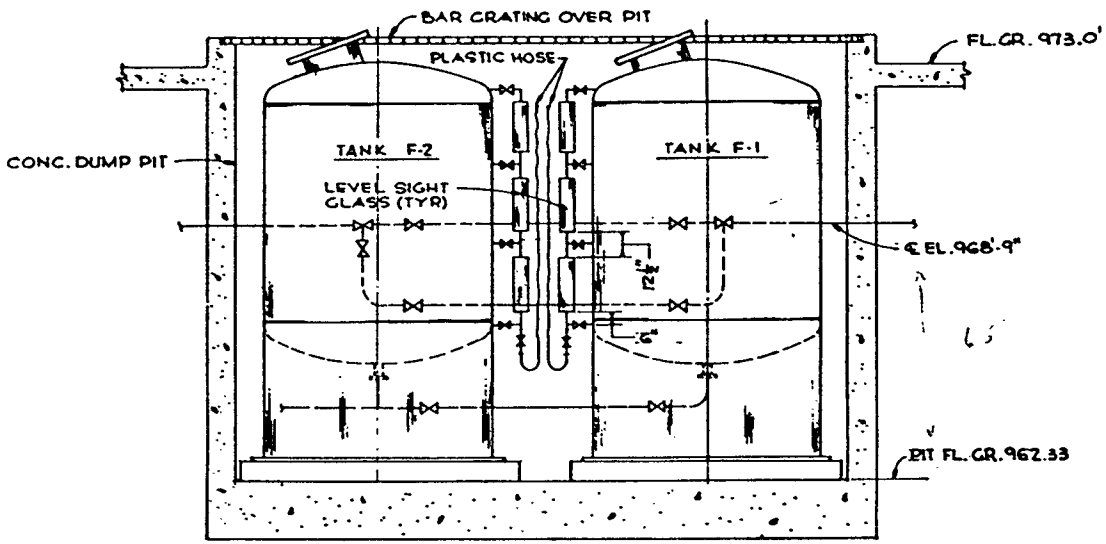
The Committee will convene immediately and endeavor to establish the facts and collect data. They will set forth their findings, conclusions and recommendations in a clear, concise and factual report. The Committee should endeavor to present practical recommendations to reduce the probability of accidents in this or other process equipment of similar types.

The final report shall be submitted to the Manager, ORO, within twenty-five (25) days. If circumstances prevent the Committee from meeting the above deadline, it is the responsibility of the Chairman to notify the Manager as to the reason for the delay, and the anticipated date for the submission.

Mr. Harold Newton of the Office of Chief Counsel is assigned as legal advisor.

ORIGINAL SIGNED BY
E. A. WENDE
for S. R. Sapirie

CC: R. C. Armstrong
Harold Newton
H. B. Mills
R. F. Hibbs, UCC-ND(4)

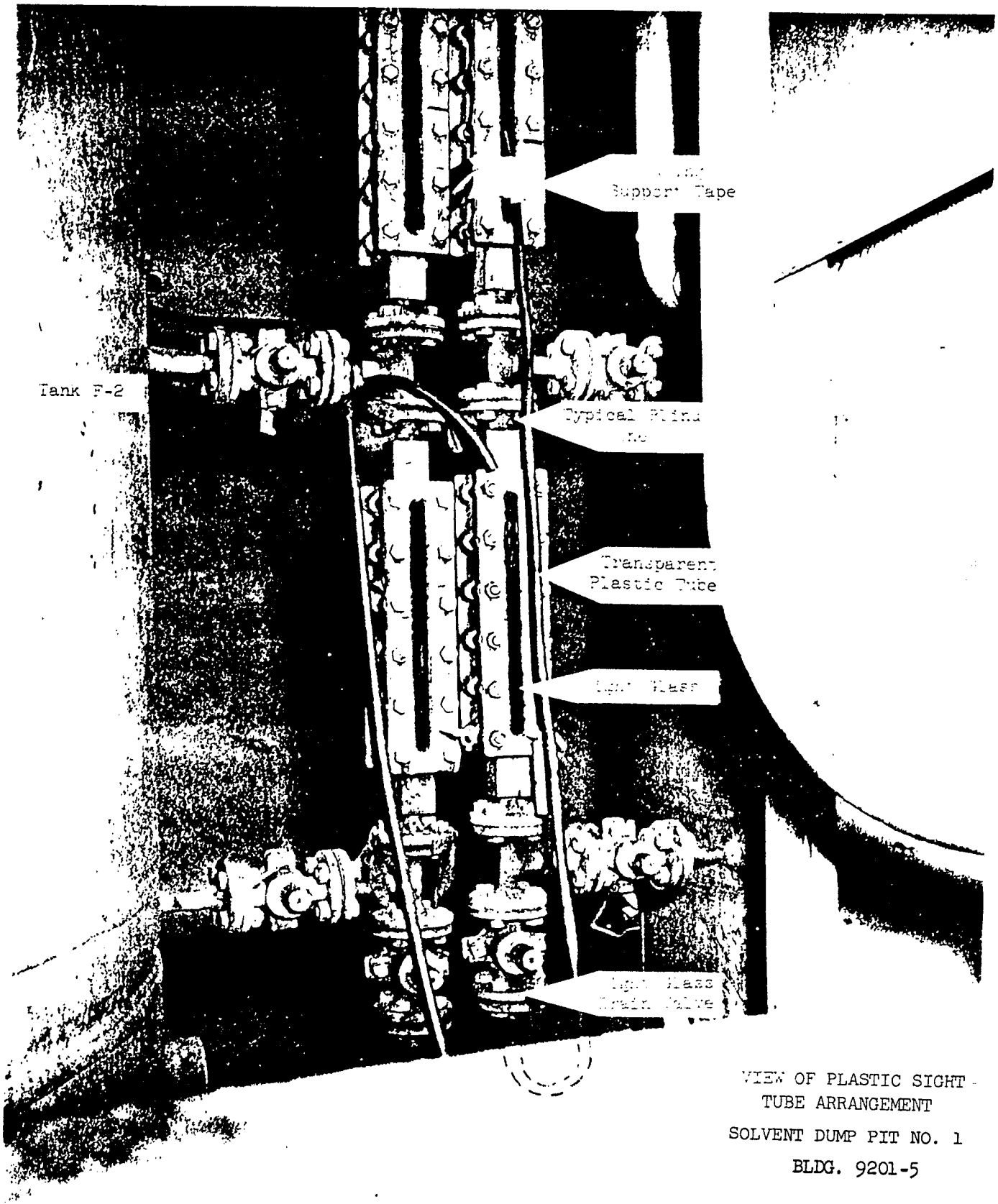


EQUIPMENT SECTION &
SIGHT-GAGE LOCATIONS

SOLVENT DUMP PIT NO. 1

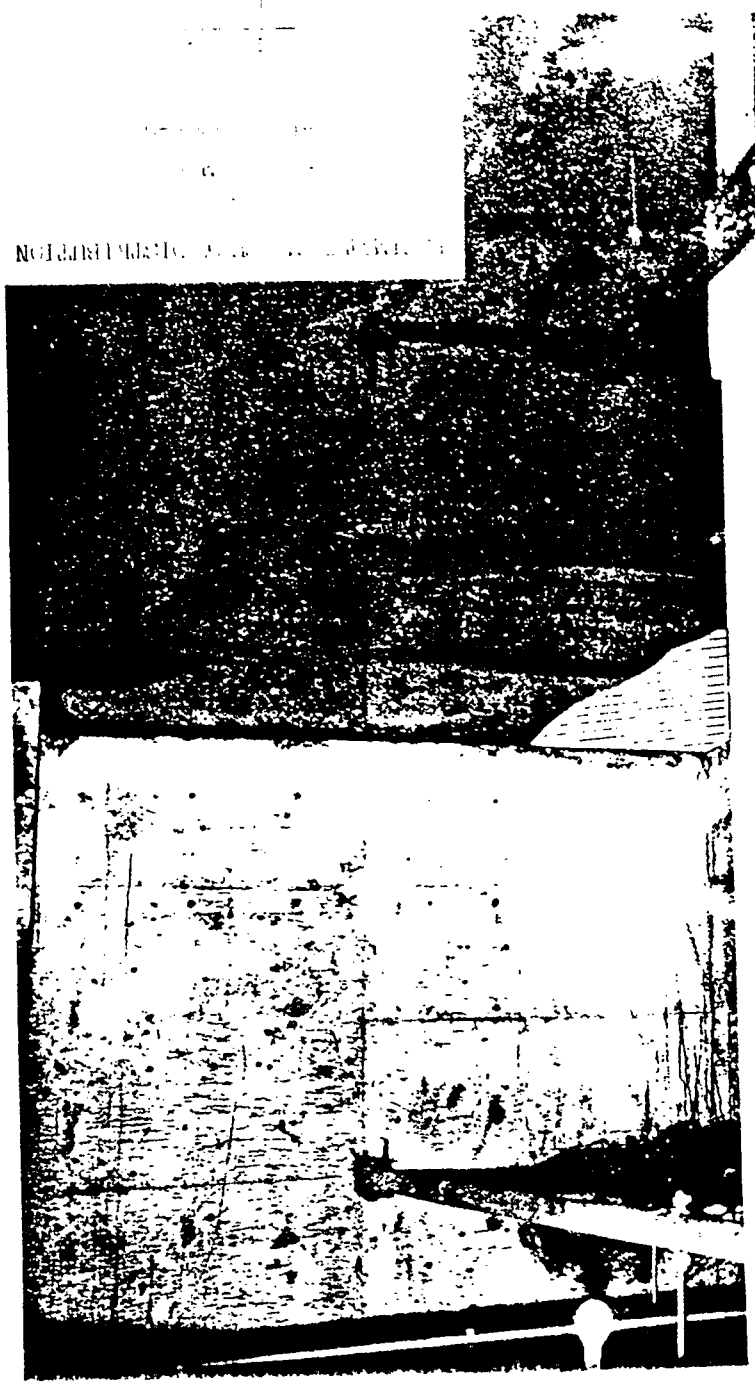
BUILDING 9201-5

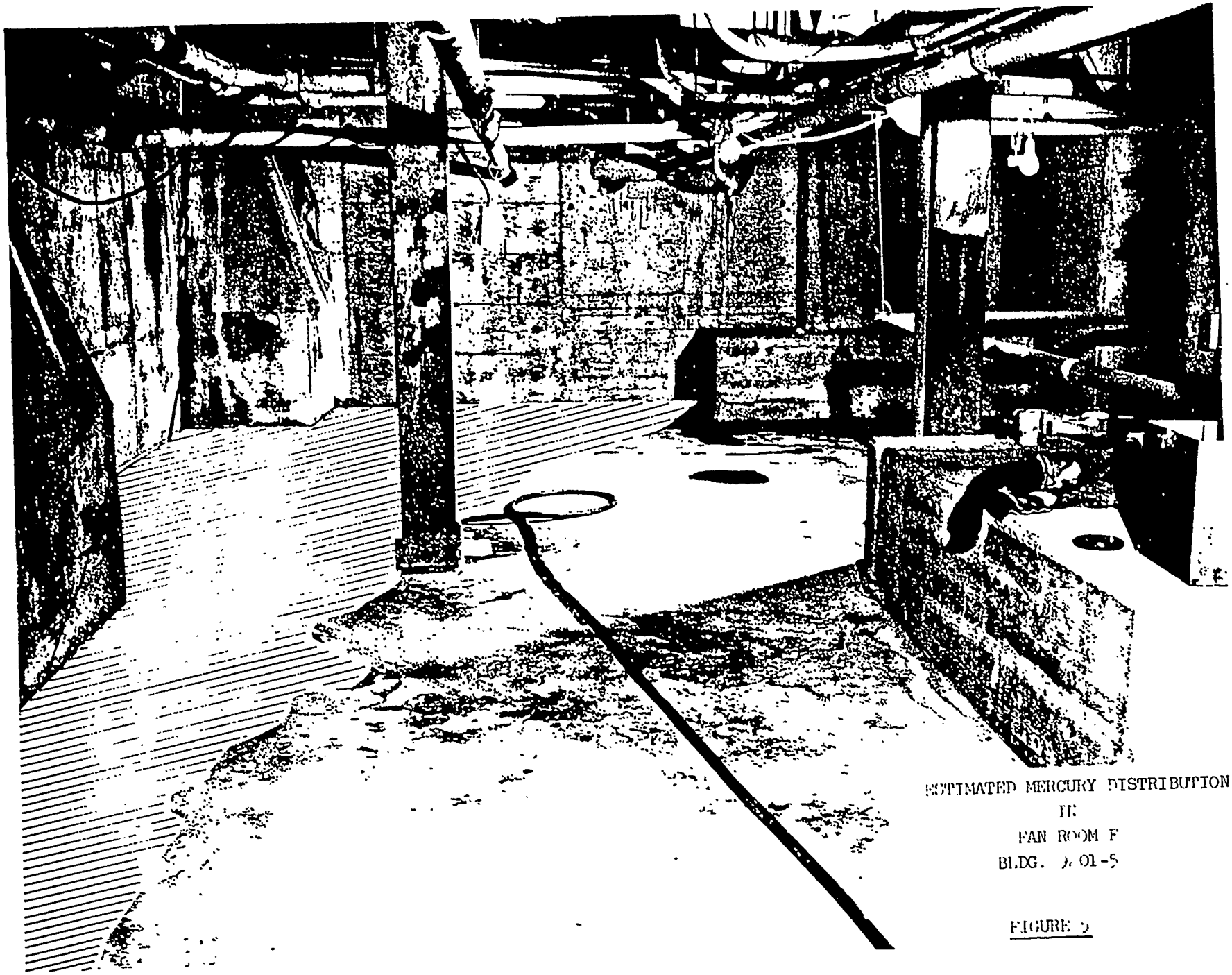
FIGURE 2



VIEW OF PLASTIC SIGHT
TUBE ARRANGEMENT
SOLVENT DUMP PIT NO. 1
BLDG. 9201-5

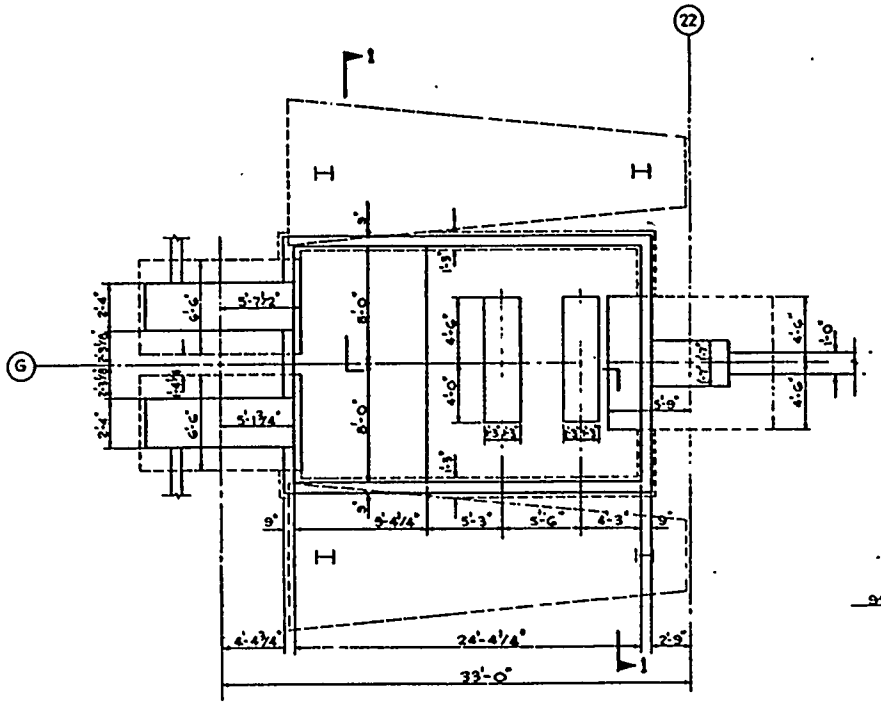
FIGURE 3



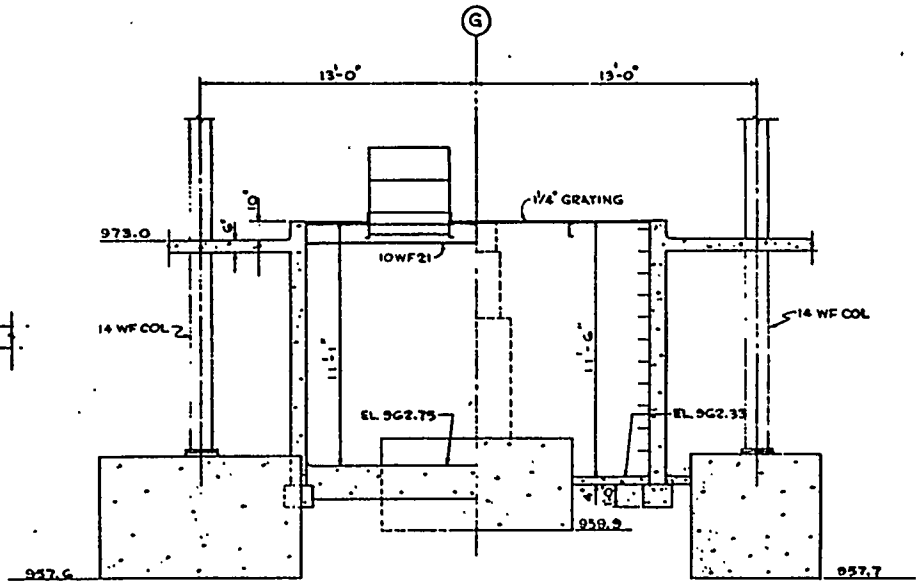


ESTIMATED MERCURY DISTRIBUTION
IN
FAN ROOM F
BLDG. 401-5

FIGURE 2



PLAN
SCALE : 1/4" = 1'-0"



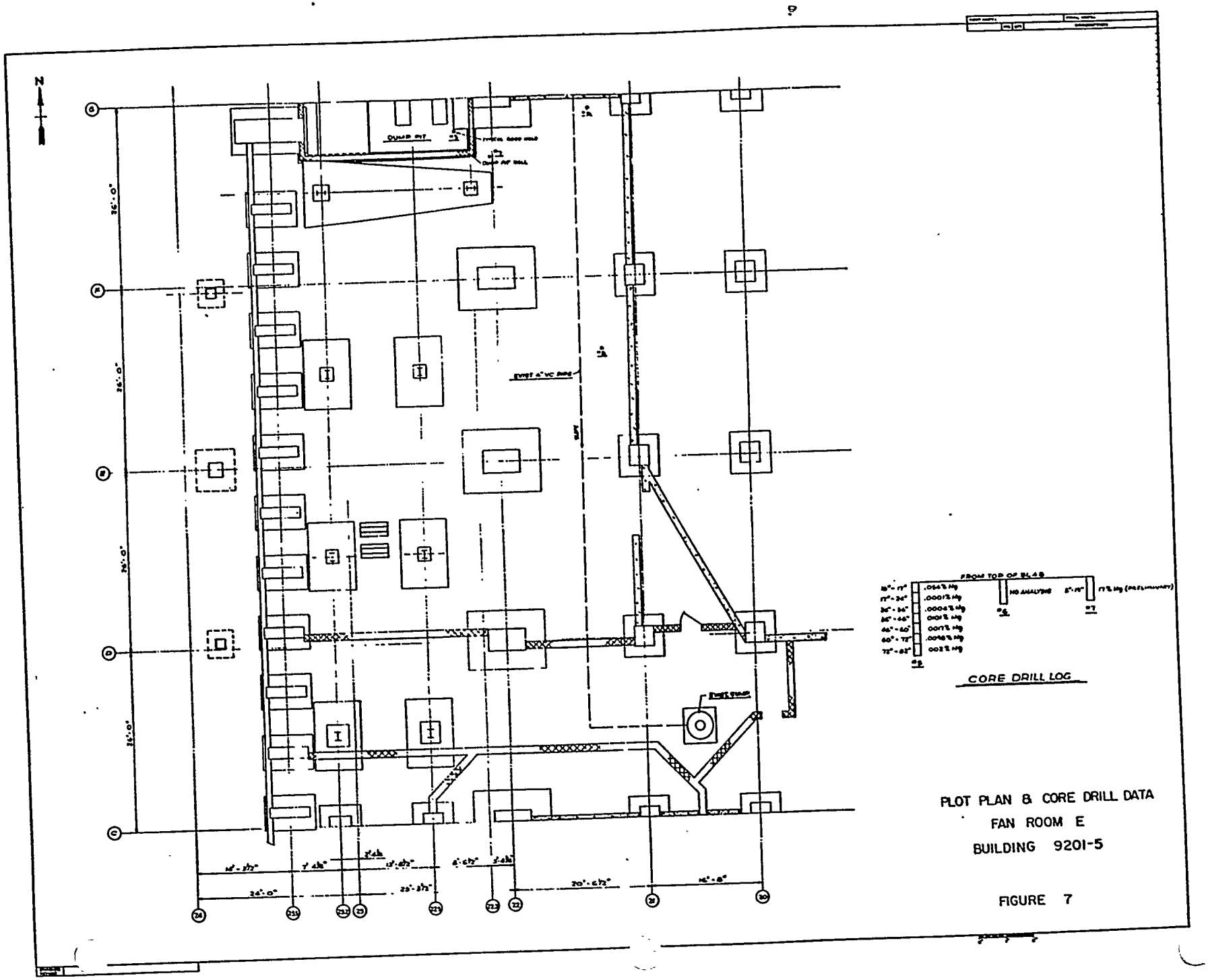
1 - 1
SCALE : 3/8" = 1'-0"

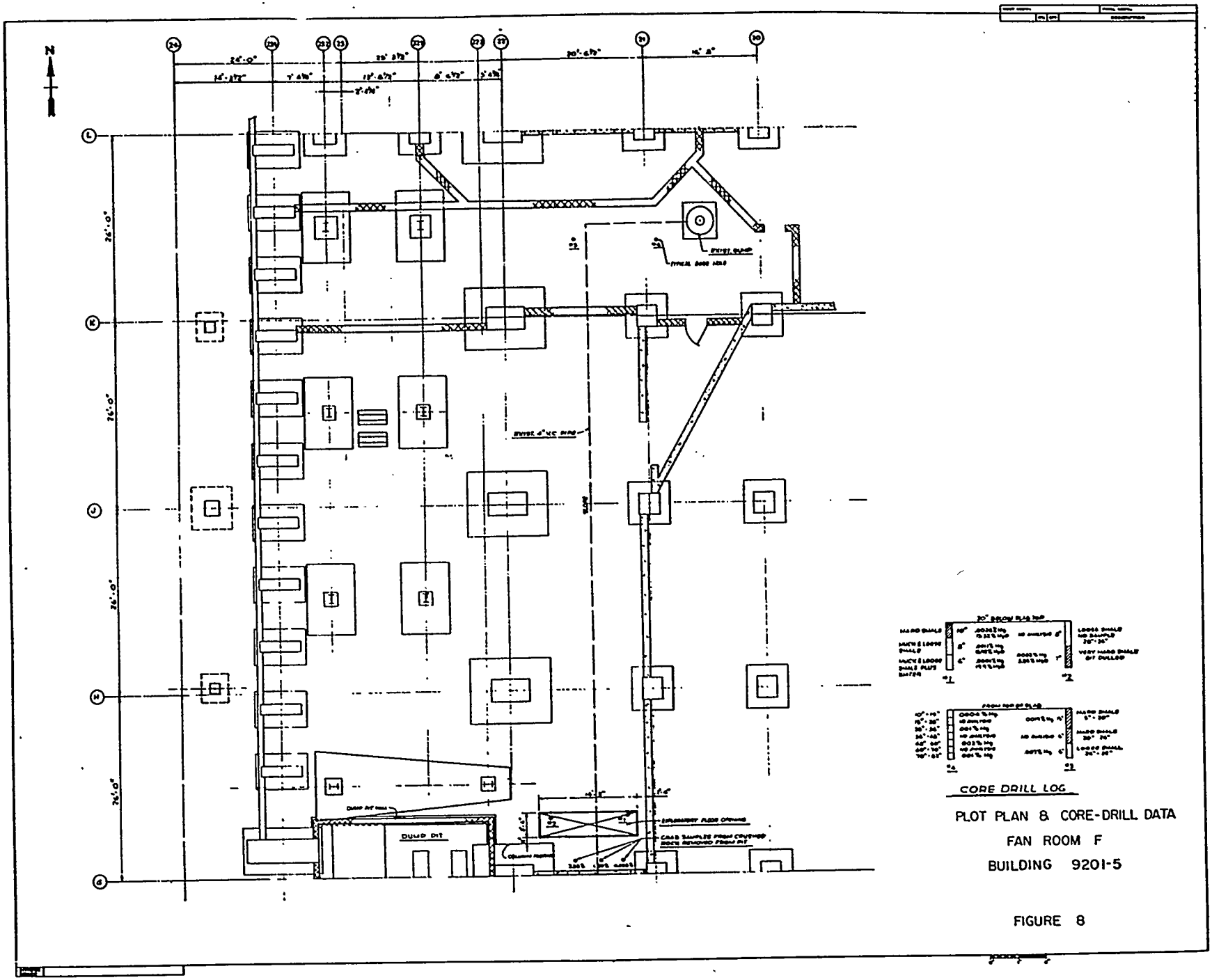
STRUCTURAL DETAILS OF TANK PIT

SOLVENT DUMP PIT NO. 1

BUILDING 9201-5

FIGURE 6


N
CORE DRILL LOG
FROM TOP OF SLAB
NO ANALYSIS
PLOT PLAN & CORE DRILL DATA
FAN ROOM E
BUILDING 9201-5
FIGURE 7



PLOT PLAN & CORE-DRILL DATA

FAN ROOM F

BUILDING 9201-5

FIGURE 8

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Y/HG-0072 Pt.2 DEL. REV 14

PART 2

UNITED STATES ATOMIC ENERGY COMMISSION

REPORT OF INVESTIGATING COMMITTEE

LOSS OF MERCURY AT THE Y-12 PLANT

APPROVED FOR PUBLIC RELEASE

[signature] 8/12/94

Technical Information Office Date

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Loss of HG/Y-12 Plant
[illegible] 8-6-70

Prepared by

UNION CARBIDE CORPORATION
NUCLEAR DIVISION
Y-12 PLANT

U. S. ATOMIC ENERGY COMMISSION
OAK RIDGE OPERATIONS OFFICE
OAK RIDGE, TENNESSEE

RECEIVED
MAY 18 1966
J. M. CASE

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PART 2

UNITED STATES ATOMIC ENERGY COMMISSION

REPORT OF INVESTIGATING COMMITTEE

LOSS OF MERCURY AT THE Y-12 PLANT

Prepared by

UNION CARBIDE CORPORATION
NUCLEAR DIVISION
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U. S. ATOMIC ENERGY COMMISSION
OAK RIDGE OPERATIONS OFFICE
OAK RIDGE, TENNESSEE

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EXHIBIT LIST

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2	STATEMENT OF J. H. HAMMOND	9
3	STATEMENT OF J. W. COTTRELL	10

INVESTIGATING COMMITTEE'S CONCLUSIONS AND RECOMMENDATIONS

LOSS OF MERCURY AT THE Y-12 PLANT

Part 1 of the Investigating Committee report described the incident and presented certain findings of fact. This report is to present the conclusions and recommendations of the Committee.

CONCLUSIONS

The immediate cause of the mercury spill was an open valve which is operated procedurally only once each month during mercury inventory determinations. Several factors contributed to the open valve condition:

a. The individual responsible for determining the mercury level in tanks F-1 and F-2 was diverted from non-related operations to perform this function once a month.

b. An interruption of indeterminate duration during the inventory procedure caused the individual making the level measurements to resume his other responsibilities, with the intention of returning shortly to complete the inventory operation.

c. An operator who discovered the open valve during routine daily investigation of leaks in the dump pit area was assigned to other necessary operations before he had the opportunity to close the open drain valve.

d. Inadequate communications of process conditions between responsible individuals appears to have contributed to the open valve conditions.

RECOMMENDATIONS

Since the spill incident is primarily the result of inadequate communications between operating personnel and a failure to follow established operational procedures, the Committee recommends that:

a. Liaison between operating groups and individuals be improved.

b. Any discrepancy in process conditions or procedures be reported immediately to the immediate supervisor even if the condition was corrected. The supervisor should personally view the condition to determine if proper corrective action is implemented and if it is adequate.

c. Personnel engaged in processing valuable and toxic materials be thoroughly oriented in regard to their function and responsibilities and informing their supervisors of system anomalies.

d. Where temporary equipment is utilized to facilitate a process operation involving valuable material, the area should be continuously attended until the security of the valuable contents are assured by adequate and acceptable means not of a temporary nature.

e. The mercury concentration in the areas affected by the spill should be monitored on a routine basis, even if the building is deactivated. Areas showing hazardous concentrations of mercury in the air should be posted as "Mask Areas".

f. Record drawings of the building structural details should be marked with appropriate identification to indicate mercury contamination of the sub-soil.

Respectfully submitted,

W. B. Kenna, Chairman
U. S. Atomic Energy Commission

R. E. Hulme
Engineering Division
Union Carbide Corporation
Nuclear Division, Y-12 Plant

H. T. Kite
Development Division
Union Carbide Corporation
Nuclear Division, Y-12 Plant

J. J. Kurtz
Engineering Division
Union Carbide Corporation
Nuclear Division, Y-12 Plant

STATEMENT OF _____

A spillage of mercury occurred in Building 9201-5 on March 26th or 27th. The loss occurred from two storage tanks in which mercury was being collected from the cascade dismantling operation.

The spill was reported to me at about 10:00 a.m., on March 28th. Mr. _____, and Mr. _____ reported the spill after pumping the mercury out of the pit into the tanks from which it had spilled. They also reported less mercury in the tanks than before and that mercury was on the floor in Fan Rooms E and F which adjoin the pit into which the mercury had spilled.

I assigned three operators in addition to Messrs. _____ and _____ to collect the mercury from the fan rooms into drums so that it could be pumped back into the tanks. This operation continued on the 3 to 11 shift.

I inventoried the mercury on March 1st. At this time the tanks showed 25-1/4 inches in each tank as they are valved together so they will equalize. I was told by a process operator at this time that another pig of mercury would be added shortly to the tanks. Thus, I left the sight-gage drain valve open to re-inventory the mercury after the pig of mercury had been added to the tanks. Since there was going to be a time interval before the mercury could be transported to the tanks, I left the pit area to attend to my other responsibilities with the intention of returning after the mercury addition. Since my other responsibilities have no association with mercury, it escaped my memory to return to the pit area.

To inventory the mercury in the tanks, a tygon hose had been attached approximately nine months ago to a valve on the bottom of a sight-glass on each tank. This was done to permit inventory measurements below the level of the sight-glass and between the blind sections of the sight-glass, and partially because areas of the sight-glass were opaque because of scum accumulations on the interior surface.

Mercury inventory in the tanks was taken by opening the sight-gage drain valve and allowing the mercury in the tygon tube to equalize with the tank level. The height of the mercury was then measured. The tanks are calibrated so that the weight of mercury per inch of height in the tanks is known.

I inventoried the mercury again on March 29th after the drums of mercury which had been recovered were pumped back into the storage tanks. This indicated a loss of approximately 50,000 pounds.

Signature

April 27, 1966

STATEMENT OF

Between 8:15 a.m. and 8:30 a.m., on Monday, March 28, 1966, Mr. _____ and I crossed over the area enclosing the F-1 and F-2 tanks and noticed the entire floor covered with mercury. We estimated that the depth of mercury on the floor was between three to five inches. Mr. _____ and I immediately went into the Dump Pit to determine the source of the spill. We noticed that the tape holding the tygon hose to the sight-glass had become detached from the sight-glass and the hose had fallen free. There was tape still attached to the tygon hose. At the time, we noticed the source of the spill, mercury was still draining from the hose, and then raised the hose and taped it back to the sight-glass and then closed the drain valve. Then Mr. _____ and I set up an air-driven pump and proceeded to pump the mercury from the floor of the tank area back into the two tanks.

After completing the pumping operation, I checked the level in the tanks through the open top manholes. I noticed at this time that the level was not as high as it had been previously. I then went with Mr. _____ into the fan rooms looking for mercury.

In the fan rooms, or wind tunnels, E- and F- , we found large amount of mercury on the floor. We then reported this condition to Mr. _____ who was our supervisor when we were assigned to the Arc-melt Department.

_____

April 27, 1966

STATEMENT OF

On the morning of March 28, 1966, at about 8:15 a.m., Mr. ____ and I discovered mercury covering the entire floor of the "Solvent Dump Pit No. 1". Mr. ____, and I went into the pit area to determine the source of the spill. We noticed the tape used to hold the upper end of the tygon tube sight-gage had become detached and allowed the tubing end to fall. Mercury was still flowing from the plastic tubing when we discovered the spill source. Mr. ____ secured the free end of the tubing. Then Mr. ____ and I prepared an air-driven pump to pump the mercury from the floor back into the two tanks. After recovering the visible spill, Mr. ____ noticed that the tank levels were not where he previously remembered them to be. So he and I went into the fan rooms looking for more mercury. We found large amounts of mercury in fan rooms E and F. Mr. ____ and I then reported this condition to our supervisor, Mr. ____

April 27, 1966

326-73-898 ~~#192~~ #202 MH&S 16-5 Loss of Mercury at Y-12

Part 1

10

Forward this to Susan Flack

There are three parts to this accident. I am sure you probably have this document but just in case you don't, I have made a copy of first few pages.

UNITED STATES ATOMIC ENERGY COMMISSION

REPORT OF INVESTIGATING COMMITTEE

LOSS OF MERCURY AT THE Y-12 PLANT

Prepared by

UNION CARBIDE CORPORATION
NUCLEAR DIVISION
Y-12 PLANT

U. S. ATOMIC ENERGY COMMISSION
OAK RIDGE OPERATIONS OFFICE
OAK RIDGE, TENNESSEE

This document is UNCLASSIFIED
M.R. Theisen, EASI 3/1/96 Date

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SUMMARY

Between 4:00 p.m., on March 25, 1966 and 8:15 a.m., on March 28, 1966, approximately 105,000 pounds of elemental mercury spilled from a two-tank collection system in Building 9201-5 in the Y-12 Plant of the Union Carbide Corporation, Nuclear Division. The mercury was from residual accumulations in process equipment currently being dismantled in the area. Approximately 55,000 pounds of mercury were recovered by salvage operations initiated as soon as the spill was discovered. The remaining 50,000 pounds, with a March 28, 1966 market value of $277,000, was assumed to have seeped through structural expansion joints into the earth-fill under the concrete slab. The spill occurred because of a failure in the temporary support system of a level measuring adaptation consisting of a piece of transparent plastic tubing connected to the tank. The cause of the loss was a failure to close a valve isolating the plastic tube system from the mercury supply.

On March 30, 1966, exploratory excavation and core-drilling operations were initiated to determine the amount and distribution of elemental mercury under the concrete floor slabs in the area. These explorations are not complete, but available evidence indicates that the mercury is most heavily concentrated just beneath the concrete slab and reduces to low concentrations in consolidated shale and rock. Insufficient data is available at this time to establish the quantity of recoverable mercury in the sub-soil under the slab. Additional exploratory excavations are required to determine the validity of core-drilling data and to obtain mercury concentration profiles in the suspected areas. Recovery costs can then be estimated.

HISTORY AND DESCRIPTION OF COLLECTION SYSTEM

The area in which the mercury spill incident occurred in Building 9201-5 is called the "Solvent Dump Pit No. 1". The original function of the main tanks, F-1 and F-2, each with a nominal capacity of 1500 gallons, was to collect the mercury inventory from process equipment requiring maintenance. The tanks were used for this purpose from January, 1955 through March, 1959. Between the period from March, 1959 and June, 1959, the tank volumes were calibrated and utilized to establish the total mercury inventory in Building 9201-5. Since the latter date, the tanks have been used to store miscellaneous collections of mercury acquired from equipment drainage and minor spill collections. Most of the transfers into the tanks were through the upper manholes. The mercury in the tanks was generally contaminated with process residues, corrosion products and miscellaneous materials which eventually coated the sight-gages so that they were extremely difficult to read. In addition, since the tanks were initially intended to supply only mercury holding capacity, the sight-gage installation had substantial blind areas in which tank levels were obscured.

The illustration on Figure 2 shows the location of these blind areas. In order to overcome these blind areas, a transparent plastic tube was attached to the drain nozzle of the sight-gages. The tubing was temporarily secured with plastic adhesive tape to the top of the sight-gages. Normally, the sight-gage drain valve would be closed to isolate the tube from the mercury supply except at such times when inventory readings were made.

OPERATIONS LEADING TO LOSS

The bulk of the mercury once contained in the process equipment in Building 9201-5 had been bottled and removed in conventional mercury flasks by June, 1965. Miscellaneous quantities of mercury which did not drain normally to the bottling station because of elevation differences or flow impediments were collected in a pair of calibrated 1500 gallon vertical tanks, F-1 and F-2, in the "Solvent Dump Pit No. 1". By June 4, 1965, 60,852 pounds of mercury was collected in these tanks.

During the following ten months up to March 25, 1966, more than 89,000 pounds of additional mercury was collected in the calibration tanks. This additional accumulation resulted from the process equipment dismantling and stripping operations which were initiated in June, 1965. The sources of the mercury were pipe-line and equipment pockets which could be drained only by piercing or up-ending the pockets during the dismantling operations. The mercury which drained from the dismantled equipment was diverted into the building mercury collection system. This consists of a network of floor drains, sumps and piping that terminate in a decanting tank system on the Building 9201-5 first floor. The decanting tanks drain by gravity into the two calibrated tanks, F-1 and F-2, in a pit extending to the basement floor. The active procedure is to determine the inventory in tanks F-1 and F-2 at the end of each month. Initially this inventory was determined by measuring the distance from the tank-bottom tangent line to the level of mercury in the sight-gages. As the mercury level increased, the sight-glass became ineffective due to the existence of a blind area extending at least 12 inches in height. This is illustrated on Figure 2. In order to circumvent this difficulty, a transparent plastic tube was attached to the sight-glass drain nozzle and extended vertically parallel with the sight-glass. The top of the tube was

secured with plastic adhesive tape near the upper end of the sight-glass. This arrangement shown on Figure 3, provided for the determination of mercury level at any point in the tank. The normal procedure instituted for inventory determinations with the plastic tube sight-gage was to:

1. Open the sight-glass drain valve.
2. Let mercury equalize in plasti sight-gage tube.
3. Make mercury level measurement.
4. Close sight-glass drain valve.

On March 1, 1966, inventory determinations were made, except Step 4 of the procedure was inadvertently omitted because of an interruption in the sequence. While measuring the mercury level in the tanks, Mr. Cecil Stanifer, the foreman taking the inventory, was informed by a process operator that another "pig", or 10-gallon container of mercury, would be added to the tank contents. Since a forklift truck is used to transport these mercury "pigs" to the collection tanks and an indeterminate amount of time would be consumed to make the transfer, Mr. Stanifer decided to return temporarily to his other responsibilities which have no association with mercury. Since he anticipated at the time that he would be returning shortly, Mr. Stanifer neglected to close the sight-gage drain valve isolating the plastic tube sight-gage from the mercury supply. In the interim, however, since Mr. Stanifer was engaged in executing his other responsibilities, it escaped his memory to return for a new inventory determination and to complete the inventory procedure.

Another routine operating procedure was to investigate daily the mercury level in a sump tank in the Dump Pit No. 1 floor, which collects miscellaneous drainings

from the 1st floor in Building 9201-5. While making this routine investigation on or about March 16, 1966, Mr. J. H. Hammond, a process operator, discovered the sight-glass drain valve in an open position. Since this valve is not provided with a handwheel, Mr. Hammond started to look for an available wrench to permit him to close the valve. While searching for a wrench, Mr. Hammond's supervisor, Mr. R. C. Pruden, a maintenance foreman, directed him to proceed to another area to clean up a mercury spill. Mr. Hammond neglected to tell Mr. Pruden of the open drain valve and then forgot to return to close the valve.

The last routine check of the sump in the Dump Pit area, before the spill incident was discovered, was made by Mr. Hammond between 3:00 p.m. and 4:00 p.m. on March 25, 1966. At this time there was no evidence of any mercury leakage.

Between 8:15 a.m. and 8:30 a.m. on March 28, 1966, Mr. Hammond noticed that the Dump Pit floor was completely covered with mercury. The depth was determined to be between three to five inches. Mr. Hammond and Mr. Cottrell entered the pit area immediately to determine the leak source. It was evident that the plastic adhesive tape securing the plastic sight-gage tube to the sight-glass had become detached. The hose had fallen free, allowing the mercury to drain from the tanks, F-1 and F-2, through the open sight-glass drain valve. Mr. Hammond then retaped the plastic tube, and with Mr. Cottrell proceeded to pump the mercury from the floor into the collection tanks.

When the mercury in the pit was secured in the tanks, Mr. Hammond established that a substantial amount of mercury was still unaccounted for. He proceeded, therefore, with Mr. Cottrell to investigate into the adjoining fan rooms E and F. A large pool of mercury was found in each of the fan rooms. The incident was then immediately reported to their supervisor, Mr. Stanifer. Figures 4 and 5 show views of the fan rooms with the estimated extent of the mercury distribution.

A team of process operators was assigned immediately to recover the mercury in the fan rooms.

The last estimated mercury inventory before the spill and after the immediate recovery operations are presented below.

March 1, 1966		
Inventory	145,608 pounds	
March Collections (Estimated)	5,000	
Total Before Spill		150,608 pounds
March 28, 1966		
Inventory in Tanks F-1 & F-2 after recovery	85,188 pounds	
Collected from Fan Rms. E & F	15,567	
Total After Spill		100,755 pounds
Net Loss		49,853 pounds

OPTIONAL FORM NO. 10
5010-104

UNITED STATES GOVERNMENT

Memorandum

TO : Those Listed Below DATE: May 10, 1966

FROM : S. R. Sapirie, Manager
Oak Ridge Operations Office

SUBJECT: REPORT OF INVESTIGATING COMMITTEE - "LOSS OF MERCURY AT THE Y-12 PLANT"

OPA:WBK

Reference: Teletype, dated March 30, 1966, addressed to F. P. Baranowski, Director, Division of Production, Washington, (Symbol OPA:WBK), regarding above subject.

As stated in referenced teletype, a Committee was appointed to investigate the circumstances surrounding the loss of mercury at the Y-12 Plant.

Forwarded herewith are Parts 1, unclassified, and 2, OUO, covering findings, conclusions and recommendations of the Committee.

We are transmitting copies of this report to Union Carbide Corporation, Nuclear Division, instructing them to accomplish the recommendations and to provide us with periodic status reports on the recommendations.

S. R. Sapirie

Enclosures:
Reports #1 & #2

Addressees:
F. P. Baranowski, Dir. Prod., Hq.
P. A. Morris, Dir., DOS, Hq.
G. F. Quinn, Asst.GM Plans & Prod.,Hq.
C. A. Nelson, Dir., Div. of Inspection, Hq.
J. A. Harris, Dir. Div. Public Info., Hq.

CC: R. C. Armstrong w/Encls.
H. B. Mills w/Encls.
Harold Newton w/Encls.
E. Stokely w/Encls.

U.S. DEPARTMENT OF COMMERCE
National Technical Information Service.

PB-286 179

Factors Influencing the Volatilization of Mercury from Soil

MERCURIC NITRATE

(U.S.) Environmental Monitoring and Support. Lab, Las Vegas, NV

May 78

United States
Environmental Protection
Agency

Environmental Monitoring
and Support Laboratory
P.O. Box 15027
Las Vegas NV 89114

EPA 600/3-78-054
May 1978

Research and Development

PB 286 179

EPA

Ecological Research Series

Factors Influencing the Volatilization of Mercury from Soil

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16. ABSTRACT

Mercury volatilization from soils amended to 1 ppm mercury with mercuric nitrate ceased within 1 week after application. During the first week, 20% of the applied mercury was lost from a silty clay-loam soil and 43% was lost from a loamy sand soil. Volatilization of Hg from the loamy sand soil resulted in a concurrent decrease in ammonium nitrate-extractable mercury. Other work with sterile soil indicates that the volatilization was mediated by microorganisms.

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FACTORS INFLUENCING THE VOLATILIZATION OF MERCURY FROM SOIL

By
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U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
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FOREWORD

Protection of the environment requires effective regulatory actions which are based on sound technical and scientific information. This information must include the quantitative description and linking of pollutant sources, transport mechanisms, interactions, and resulting effects on man and his environment. Because of the complexities involved, assessment of specific pollutants in the environment requires a total systems approach which transcends the media of air, water, and land. The Environmental Monitoring and Support Laboratory-Las Vegas contributes to the formation and enhancement of a sound monitoring data base for exposure assessment through programs designed to:

- develop and optimize systems and strategies for monitoring pollutants and their impact on the environment
- demonstrate new monitoring systems and technologies by applying them to fulfill special monitoring needs of the Agency's operating programs

A study was conducted to determine some of the factors responsible for the volatilization of mercury from soils amended with mercury. It was discovered that the amount of mercury lost from the soil could be correlated with the amount of mercury in the soil that is solubilized by ammonium nitrate. In addition it was found that the volatilization was mediated by microorganisms. The conclusions can be beneficial in designing experiments dealing with mercury compounds and soils and also in the interpretation of data gathered by other investigators. Users who should find the report of value include the Office of Air Programs, Office of Toxic Substances, laboratories within the Office of Research and Development, other Federal agencies, University and industrial research staffs.

George B. Morgan
Director
Environmental Monitoring and Support Laboratory
Las Vegas, Nevada

ABSTRACT

Mercury volatilization from soils amended to 1 ppm mercury with mercuric nitrate ceased within 1 week after application. During the first week, 20% of the applied mercury was lost from a silty clay-loam soil and 43% was lost from a loamy sand soil. Volatilization of Hg from the loamy sand soil resulted in a concurrent decrease in ammonium nitrate-extractable mercury. Other work with sterile soil indicates that the volatilization was mediated by microorganisms.

CONCLUSIONS

Mercury (Hg) when applied to soil in a soluble form was initially very rapidly volatilized from the soil. The rate of volatilization decreased with time until it approached zero even though the soil still contained 50 to 80% of the applied Hg. Increasing the concentration of soil Hg increased the period of maximum volatility.

Volatilization is the result of microbial action. The rate is determined by the availability of Hg to the microbes. This in turn is determined by many factors including soil texture and organic matter content.

RECOMMENDATIONS FOR FUTURE RESEARCH

Clarification of how Hg is bound in soil is needed. Also, information on the volatility of various species of Hg is needed to understand the complexities of Hg contamination of soil. It is likewise important to determine the microorganisms involved in these reactions in order to understand and predict mercury movement and its potential threat to food contamination.

INTRODUCTION

Interest in the environmental cycling of Hg has turned to the transformation of Hg into forms other than organics. It is known that Hg applied to the soil in many chemical forms can be lost as volatiles (Alberts et al., 1974; Kimura and Miller, 1964; Hitchcock and Zimmerman, 1957). However, no definitive study on the volatility rate, chemical species formed, and binding of mercury in soil has been reported. What mediates the volatilization of Hg from soil systems is not well understood. Kimura and Miller (1964) noted that autoclaved soils showed a decreased loss of Hg vapor, thus indicating a biological interaction. Specific microorganisms have been isolated from lake and river sediments (Izaki, 1977; Holm and Cox, 1975; Avotins and Jenne, 1975; Summers and Silver, 1972; Tonomura, Maeda, and Futai, 1968) which reduce ionic Hg to elemental Hg. These same microbes can be found in aerobic soil; therefore, it is reasonable to assume that there can be biological reduction and volatilization of Hg from natural and agricultural soils. The duration and rates of Hg volatilization after application are not available. In addition, the solubility of Hg in the soil solution as related to the volatility has not been determined.

A study was conducted to investigate the volatilization of Hg from amended soils, the rate of loss, the chemical and biological availability of Hg in soil, and whether such volatility is of a biological origin.

MATERIALS AND METHODS

Two soils, a loamy sand and a silty clay-loam, were used for this study. They were collected from the upper 10 centimeters (cm) of the Ap horizon (plow layer) in an agricultural area of southern Nevada. The moist soil was processed through a 2-millimeter (mm) sieve and stored at room temperature in plastic bags. Some physical and chemical properties of the soils are listed in Table 1. Sterilized soil was prepared by steam autoclaving 200-gram (g) quantities at 121° C for 4 hours. After 3 days the samples were reautoclaved. To insure that the soils were indeed sterile, 0.1 g of each soil was spread over the surface of nutrient agar in a petri dish. These samples were then incubated for 1 week. No growth was seen on the inoculated dishes.

TABLE 1. PHYSICAL AND CHEMICAL PROPERTIES OF SOIL

Soil (Texture Classification)	Series	Sand	Clay %	Organic Carbon	Cation Exchange Capacity meq/100g	pH
Sand (Loamy Sand)	Bluepoint - a member of the mixed thermic family of Typic Torripsamment	79.8	3.5	0.53	4.3	9.0
Clay (Silty Clay Loam)	Overton - a member of the fine montmorillonitic calcareous thermic family of Mollic Haplaquepts	14.7	34.4	3.44	20.0	7.8

Mercuric nitrate [$Hg(NO_3)_2$] was used to amend the soil. To each portion of soil (20 g), 20 micrograms (µg) of Hg was added and stirred. This resulted in a concentration of 1 part per million (ppm) Hg. Radioactive mercury [$^{203}Hg(NO_3)_2$] was mixed with the stable $Hg(NO_3)_2$ before the soil addition. Those soils from which volatile Hg was to be determined received 40 nanocuries (nCi) of ^{203}Hg and the soils used for extraction purposes received 4 nCi of ^{203}Hg. The mixed solution was such that 2 milliliters (ml) of solution contained the desired amount of both stable and radioactive Hg. The Hg solution was added to 20 g of soil contained in 250-ml polyethylene bottles. After addition, distilled water was added to bring the soil moisture to 50% of the soil moisture-holding capacity. The bottles with their contents were weighed daily and the amount of water lost through

evaporation was replaced as necessary. The bottles were closed with rubber stoppers containing connections for inlet and outlet air lines. All bottles were flushed during the study at a rate of 20 cubic centimeters per minute (cc/min) with water-saturated, compressed air.

Air flushed from the bottles being used for the volatility experiments was passed through a charcoal collector located inside a side-hole scintillation crystal. Flexible tubing used to connect the bottle to the collector had a polyethylene liner. The charcoal collector was made from a 10-ml volumetric pipette cut to length, with the bulb being filled with charcoal pulverized to a 16 mesh.

Air from bottles whose contents were to be used in the extraction portion of this study was passed through charcoal traps connected to the outlet tubes of the rubber stopper. These traps were used as a safety measure and not to determine volatile Hg. It was not necessary to change them during the course of the study.

Each of the two side-hole scintillation crystals was connected to a single-channel analyzer and the output was recorded on a strip chart recorder. In this way a continuous record was obtained of the amount of volatilization in terms of ^{203}Hg disintegrations as cpm. The charcoal collectors were changed 2 to 4 times a day during the first 72 hours of each experiment to insure that the cpm rate did not go off scale. The bottles were maintained at 25° C in water baths. Figure 1 is a representation of the experimental set up.

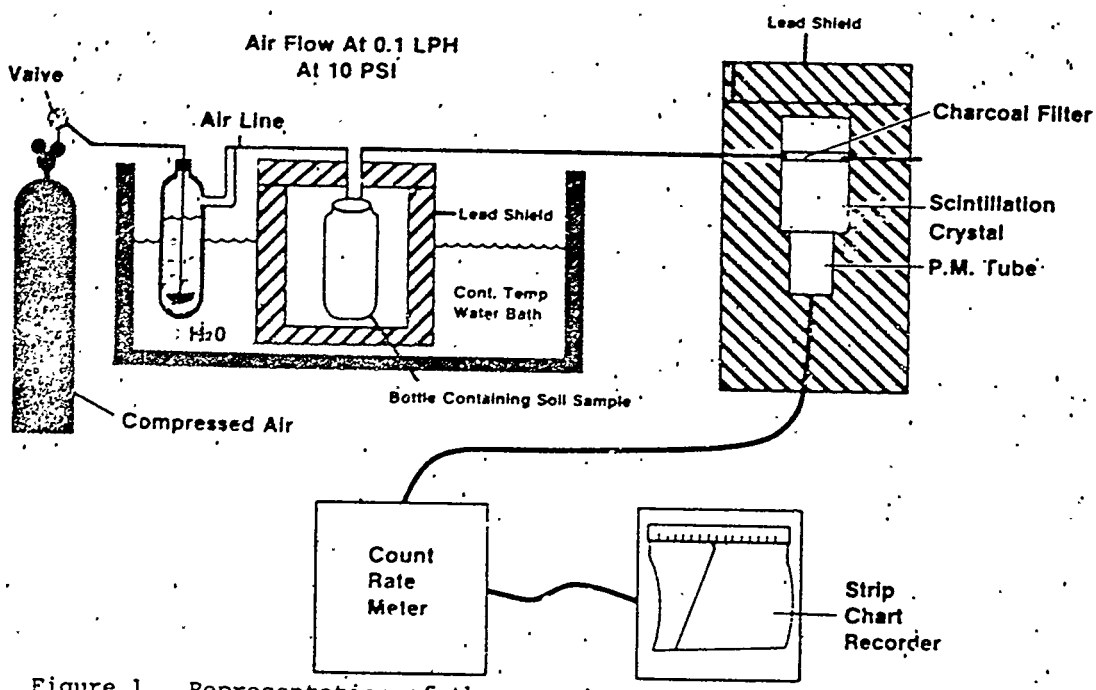

Figure 1. Representation of the experimental setup for determining the rate of Hg volatilization.

After an experiment, the counts per minute (cpm) which had been continously recorded on graph paper were converted to a more meaningful form by applying appropriate corrections for decay, specific activity, efficiency and unit conversion. The slope of the line was then determined at 1-hour intervals and the results presented as the Hg volatility rate (nanograms per hours, ng/h).

Soils amended with Hg were subjected to different extracting agents after 24 hours of incubation in order to determine one suitable for use. These solutions included H_2O, 1N NH_4NO_3, and DTPA (Follett and Lindsay, 1971). Each extraction was for 18 hours and included vigorous agitation on a rotary shaker. The soil mixture was then centrifuged and the supernatant was passed through a Whatman number 1 filter paper. The resulting clear extract was used for the ^{203}Hg determination. Table 2 gives the amount of the applied Hg which was extracted from each of the soils. In all subsequent experiments 1N NH_4NO_3 was used for the extractions.

Experiments were designed so that volatile mercury was determined from one set of replicates and the extractable and soil-bound mercury from another set. By combining these results a budget could be reconstructed. Agreement was generally good between the amount of mercury lost via volatilization as determined by integrating the loss-rate curve and the amount determined by subtracting the amount remaining as soil-bound and extractable from the original amount of the amendment. However, there was one exception where there was a discrepancy of 18% between these two methods of determining loss. Because of greater precision the results of the direct analysis of the volatile mercury are presented as the most reliable measure of the amount lost via this route. The amount of mercury in the 1N NH_4NO_3-wash solution and the amount remaining in the soil after extraction were determined by counting the gamma activity on a sodium iodide scintillation crystal using a multi-channel analyzer. For convenience in interpretation, the data are presented so that the volatility rate is superimposed over the data depicting the soluble and nonsoluble Hg. This was done to allow visualization of how changes in loss rate were correlated with amounts of mercury residual in the soil as soluble and nonsoluble compounds.

TABLE 2. PERCENT MERCURY EXTRACTED FROM SOIL WITH VARIOUS EXTRACTANTS AFTER 24-HOUR INCUBATION

Extractant	% Recovered from Sand	% Recovered from Clay
H_2O	8.5	0.6
1N NH_4NO_3	20.5	0.6
DTPA	8.2	0.6

RESULTS

Various combinations of soil type, Hg concentration, and sterile and natural soils were investigated. Replicates of experimental trials yielded similar results but varied slightly in summation of the mercury budgets. Yet all replicates gave similar rates, thus representative curves will be presented instead of the entire data collected. When sandy soils were amended with 20 µg Hg/20 g soil (1 ppm Hg), 43% of the applied mercury was lost within the first 6 days. The data presented in Figure 2 show that volatilization increased reaching a peak rate at about 40 hours after the Hg was added. The rate of decreasing 1N NH_4NO_3-soluble and nonsoluble mercury content was greatest when the volatility rate was at its maximum. Soluble Hg decreased from 30% of the amount initially applied to about 2% at the termination of these tests. The volatility rate decreased to a minimum by about 100 hours after which there appeared to be a steady state established. Some volatility continued at a rate which appeared to be in equilibrium with the amount of soluble Hg.

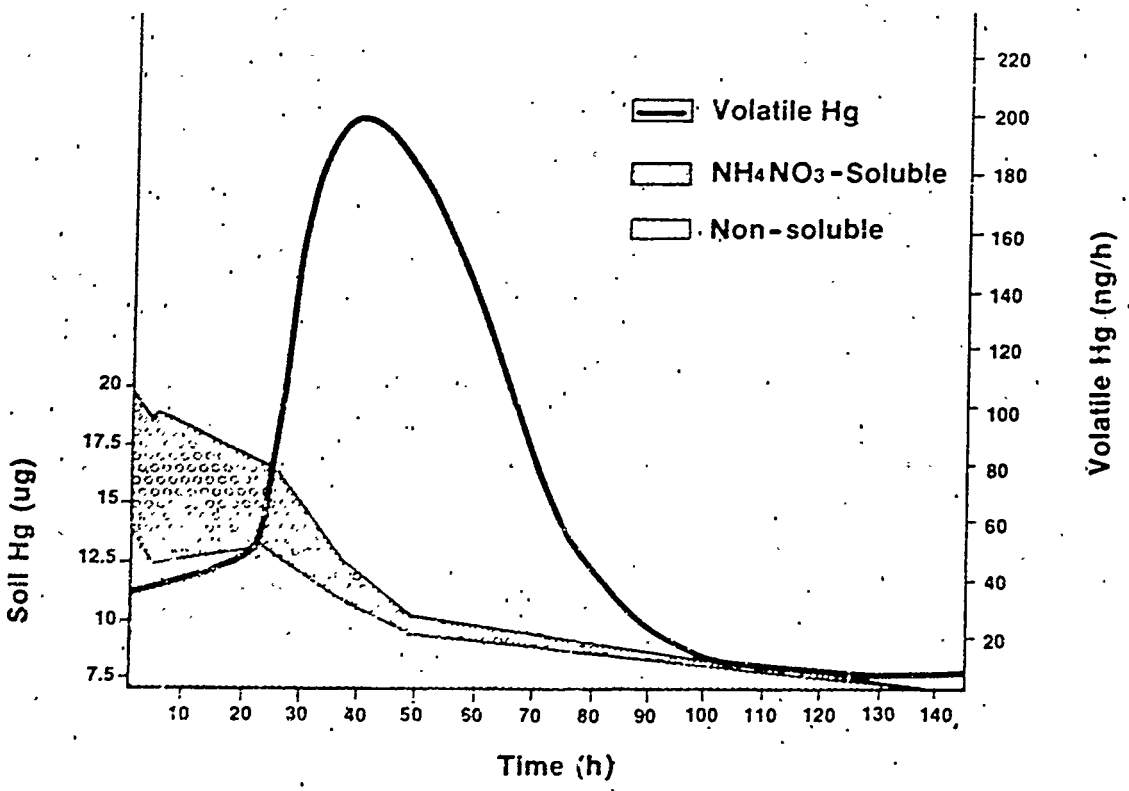

Figure 2. Rate of Hg volatilization and Hg remaining in sandy soil amended to 1 ppm Hg. The soil Hg (µg) axis is nonzero.

Sandy soil was also amended with $Hg(NO_3)_2$ at a concentration of 10 µg Hg/g soil (10 ppm Hg). During the 6-day incubation period, approximately 50% of the applied Hg was lost in the vapor form (Figure 3). There was a lag time of some 20 hours before the onset of rapid volatilization, but in this case no distinct volatilization peak was noted, rather the maximum rate of between 700 and 900 ng Hg/h persisted for some 50 hours before

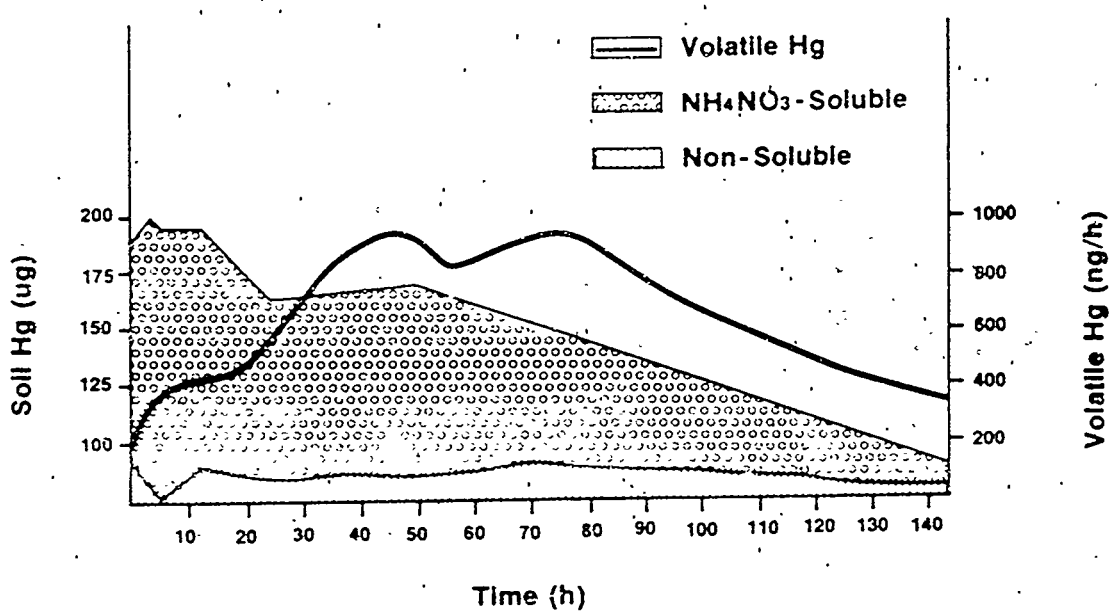

Figure 3. Rate of Hg volatilization and Hg remaining in sandy soil amended to 10 ppm Hg. The soil Hg (µg) axis is nonzero.

gradually decreasing. Even at the end of the test there was a substantial rate of volatile Hg loss. A decrease in the 1N NH_4NO_3-soluble Hg was noted after 12 hours and continued throughout the study (e.g., at 144 hours only 16% of the applied Hg was still soluble versus 50% at the start).

Steam-autoclaved sandy soil amended with $Hg(NO_3)_2$ at a concentration of 20 µg Hg/20 g soil (1 ppm) had a total volatile loss of only 10% of the applied Hg after 144 hours (Figure 4). There was no initial lag in volatilization as with the non-sterile sand trials. The rate of Hg loss decreased rapidly during the first 16 hours and then remained about constant throughout the duration of the test. The decrease in 1N NH_4NO_3-soluble Hg during the test period was negligible.

The pattern of Hg loss from the clayey soil was quite different from that of the sandy soil. Clayey soil amended to a concentration of 1 ppm Hg as $Hg(NO_3)_2$ lost a total of 20% of the applied Hg during the 144-hour examination period (Figure 5). Of this amount, 80% of the volatile loss occurred within the first 36 hours. Since there was no 1N NH_4NO_3-extractable Hg from this soil, the loss of Hg was from the non-extractable fraction. In addition there was no lag period between Hg applications and peak Hg volatilization rate with any of the treatments of this soil.

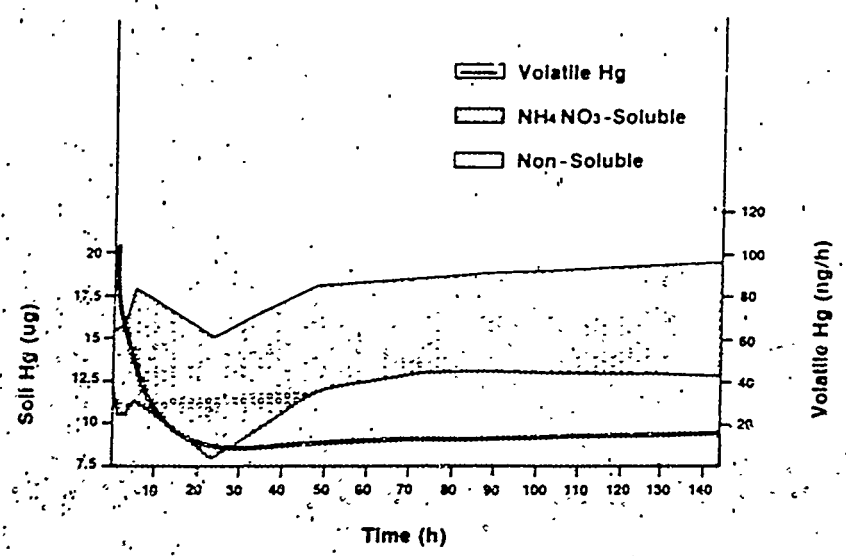

Figure 4. Rate of Hg volatilization and Hg remaining in sterilized sandy soil amended to 1 ppm Hg. The soil hg (µg) axis is nonzero.

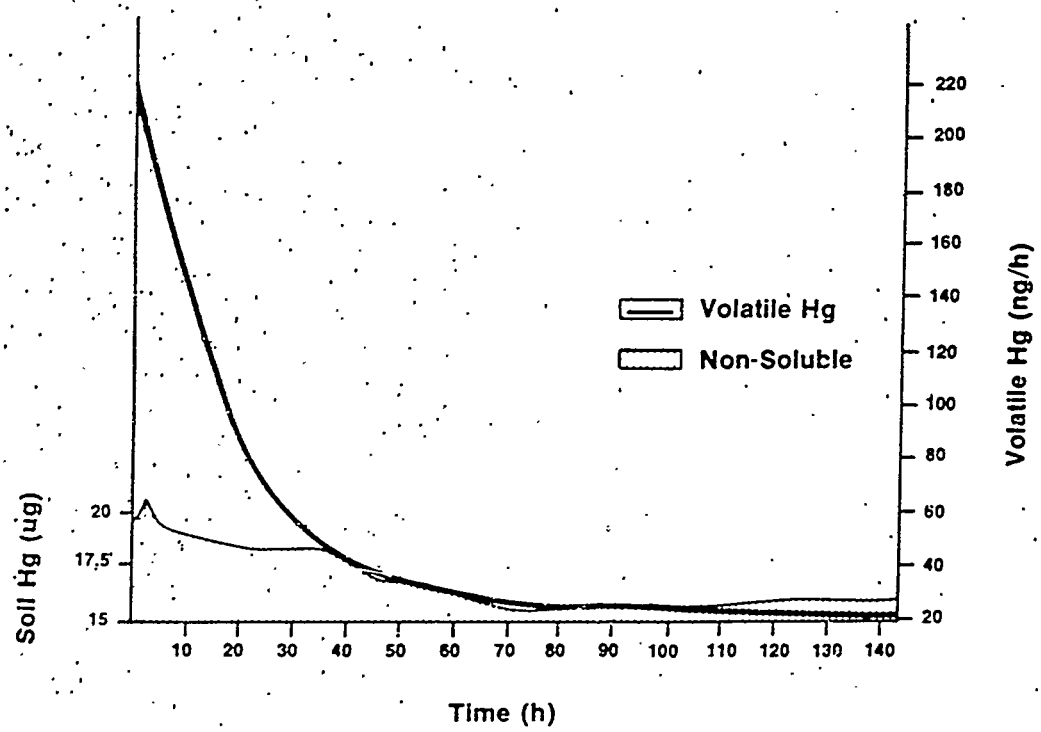

Figure 5. Rate of Hg volatilization and Hg remaining in clayey soil amended to 1 ppm Hg. The soil Hg (µg) axis and the volatile Hg (ng/h) axis are nonzero.

Clayey soil amended to 10 ppm Hg as $Hg(NO_3)_2$ volatilized 31% of this Hg during the test period (Figure 6). The bulk of this loss was during the first 3 days with an initial loss rate of 1,500 ng/h. During the first 24 hours of incubation, a small amount (4.5% of the total) of the Hg was found to be 1N NH_4NO_3-extractable.

Steam-sterilized clay lost only 2% of the applied 20 µg Hg (Figure 7). No 1N NH_4NO_3- extractable Hg was found.

DISCUSSION

The data from this study show that Hg was lost from soils amended with $Hg(NO_3)_2$. In every case, except one (Figure 3), almost 100% of the volatilization of applied Hg occurred within the first week. There was a considerable difference between the sand and clay. In general, the volatilization from clay was faster to start but less of the Hg was lost overall. Increasing the Hg concentration from 1 ppm to 10 ppm increased the loss of Hg from the sand by a factor of 11 and the clay by 15 times (Figures 3 and 6).

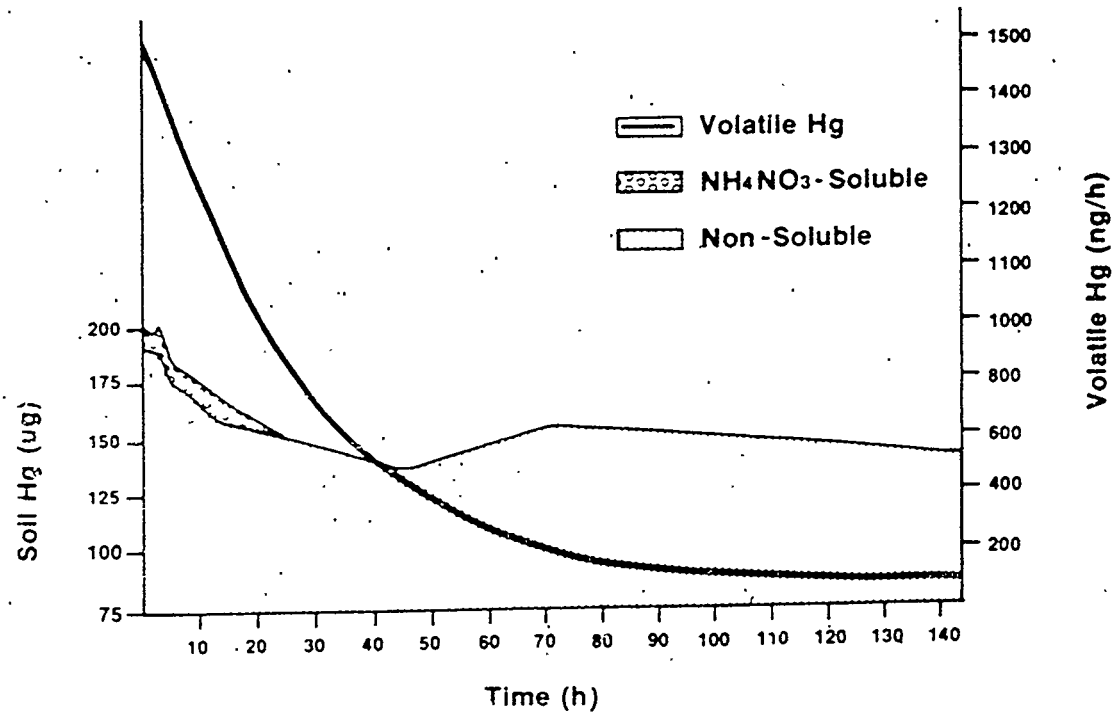

Figure 6. Rate of Hg volatilization and Hg remaining in clayey soil amended to 10 ppm Hg. The soil Hg (µg) axis is nonzero.

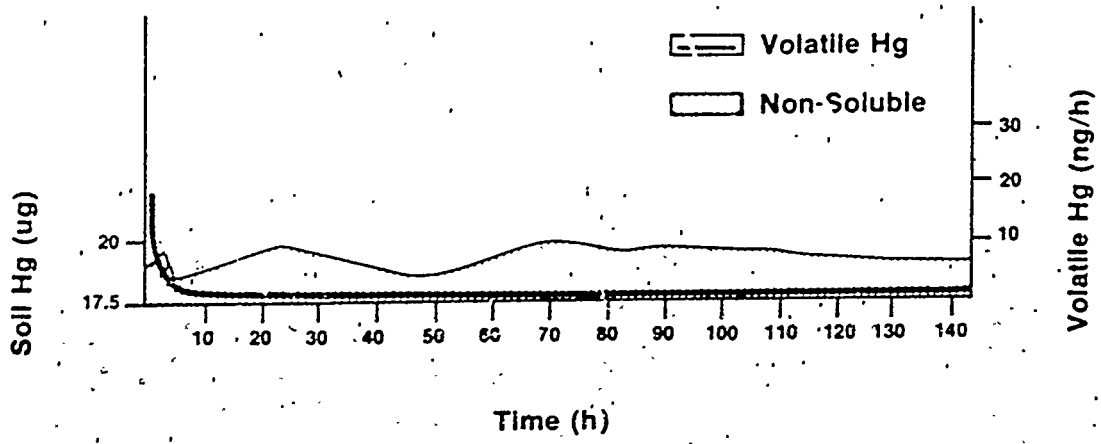

Figure 7. Rate of Hg volatilization and Hg remaining in sterile clayey soil. The soil Hg (µg) axis is nonzero.

Autoclaving the soils had a pronounced effect on the amount of Hg lost over the duration of these tests (144 hours, Figures 4 and 7). In the case of the sandy soil, this reduction was from 8.6 µg Hg to .2 µg Hg and a change of 4 µg Hg to 0.4 µg Hg for the clay. To insure that the Hg loss was initiated biologically, both soils were inoculated with 1 g of each of their respective nonsterile soils after 160 hours of incubation. No effect was noted with the clayey soil but within 8 hours the inoculated sandy soil started volatilizing Hg at a high rate (Figure 3). The volatilica-

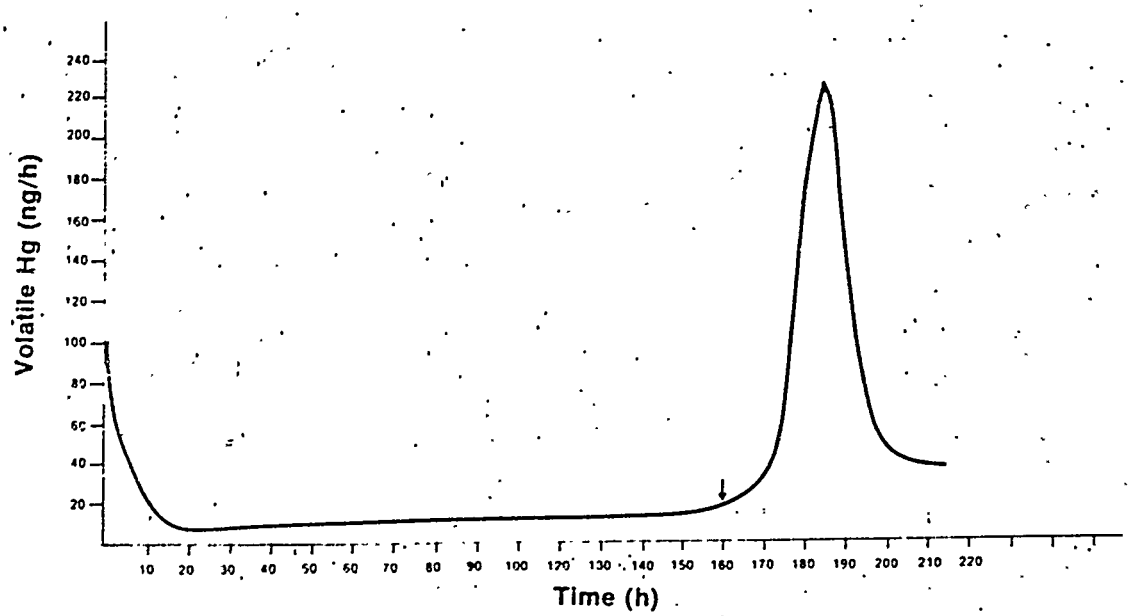

Figure 8. Rate of Hg volatilization from sterile sandy soil. Arrow indicates when soil was inoculated with 1 g of nonsterile soil.

tion from the sandy soil reached a peak 22 hours after inoculation. Total Hg loss after 214 total elapsed hours was 31%. Since the pool of 1N NH_4NO_3-extractable Hg had not been reduced in the sandy soil during the period of sterile incubation (Figure 4), it is speculated that this fraction was being volatilized. There was apparently no Hg available for volatilization in the clayey soil.

These data clearly indicate that Hg loss from these soils was mediated by a biological system, although this may not be the case for all soils since it has been shown that humic acid solutions can mediate the loss of ionic mercury (Hg^{++}) as elemental Hg (Alberts et al., 1974). Workers in the area of aquatic Hg cycling have shown in recent years that there are several microorganisms which can cause the volatilization of Hg. These microbes include *Escherichia coli*, *staphyloccus aureus*, and several species of *Pseudomonas* (Summers and Sugarman, 1974). Mercury loss from cultures of *Pseudomonas* amended with Hg^{++} was found to be elemental Hg (Tonomura, Furukawa, and Yamada, 1972). Some algae are also capable of causing the volatilization of Hg from solutions amended with $HgCl_2$ (Ben-Bassat and Mayer, 1975). The consensus is that these organisms cause Hg loss by the reduction of Hg^{++} to elemental Hg which is then lost because of its elevated vapor pressure (Tonomura, Maeda, and Futai, 1968; Izaki, 1977). It should be noted that while the pathways for volatile Hg in these soils are biological, the transformation of Hg^{++} into methyl Hg is abiological (Rogers, 1977, 1976). Methylmercury also has an elevated vapor pressure and, when formed one molecule at a time, it too is suspected of being volatile.

In the clayey soil the volatility rate continuously decreased while in the sandy soil the rate remained relatively stable for a few hours, followed by a significant increase. Since the enzyme system responsible for volatilization has been shown to be inducible (Furukawa and Tonomura, 1971) it may be that such an induction was responsible for the increases observed in the sandy soils (Figures 2 and 3). The lack of a similar pattern in the clayey soils may indicate the lack of a similar inducible enzyme system or more probably, the removal of mercury from microbe availability. The presence of only a small 1N NH_4NO_3-extractable fraction in the 10-ppm treatment (Figure 5) and no detectable 1N NH_4NO_3-soluble fraction in the 1-ppm treatment (Figure 4) of the clayey soils may also represent the lack of availability.

The number of soil microbes at the time of dosing were 30 x 10^6/g soil and 2 x 10^6/g soil for the clayey and sandy soils respectively. These numbers did not change significantly after 30 hours of incubation. Species of organisms were not ascertained. The initial volatility rates observed in the clayey and sandy soils were in approximate relationship to the ratio of the numbers of microbes. However, insufficient data were collected to ascertain if this was a cause-effect relationship.

In all cases (except sand with 10 ppm Hg) the rate of Hg volatilization decreased to near zero long before all the applied Hg was used (80 to 71% remaining in clay and 50 to 57% remaining in sand). In the sandy soil the decrease in volatility correlated with a decrease in the amount 1N NH_4NO_3-extractable Hg and to a lesser extent with a decrease in the nonsoluble

fraction (Figures 2 to 4). However, since the volatilization of Hg decreased to near zero when the extractable Hg was exhausted, it is speculated that, in the case of the sand, Hg was lost only from the soluble fraction and the easily exchangeable fraction of the nonsoluble Hg. Data from studies on the volatile loss of Hg from water also link volatility with Hg availability. It has been shown that, as the concentration of complexing agents such as chlorine and bromine increase, the amount of Hg volatilized decreases because of a decrease in microbially available Hg (Jenne and Avotins, 1975). In other work with nonsterile solutions, it was shown that the amount of Hg volatilized from the solution depends on the amount of Hg which has become unavailable for microbial action due to combination with organic matter (Avotins and Jenne, 1975). The same authors reported that volatilization had almost ceased after 96 hours. These data are comparable with the findings from the sandy soil as far as the effect of Hg-complexing material, biological interactions on Hg volatilization, and the time required for the volatilization of the biologically available Hg. Note that during the time course of the sterile sand study, the extractable Hg content remained unchanged (Figure 4). Results from this study also support the hypothesis that the decrease in Hg volatility with time is caused by a loss of available Hg and not because the Hg is becoming more tightly bound with time.

While the volatilization of Hg from the clayey soil is also obviously a biological phenomenon (Figure 5 and 7), the Hg being volatilized was not correlated with a 1N NH_4NO_3-extractable source. Even though the Hg was not 1N NH_4NO_3-extractable, some 20 to 31% of it was biologically available (Figures 5 and 6). This would indicate that the Hg was initially in a form available to microbes but not in solution or easily removed from the soil exchange sites. How the Hg is being bound is not known but it has been shown that Hg is tightly complexed on organic matter and cannot be replaced with another ion except Hg (Strohal and Huljev, 1971). Since the clayey soil was higher in organic matter than the sandy soil, the soil organic matter could also be a viable factor in Hg retention by the clayey soil. The same could also be true for the inorganic exchange sites. Because the experiments were not designed to isolate clay or organic matter as factors affecting volatilizations, it is not possible from these data to emphasize which has the greater effect. It is possible that the amount of observed Hg volatility is not a true indication of the total Hg vapor occurring in the soil. This is because both clay and organic matter can sorb vapor-phase Hg (Krenkel, 1974; Trost and Bisque, 1971).

The data from both the sandy and clayey soils show that the amount of Hg volatilized from a soil is not an indication of the total amount of Hg contained by the soil. Conversely, knowing the total amount of Hg contained by a soil will not give an indication of potential losses due to volatilization. But, with more information from different soils some idea on how Hg is being bound by soils could be obtained from determining what portion of the total soil Hg is being volatilized.

The increase in volatility in response to the increase in Hg concentration (Figures 3 and 6) indicates that the organisms responsible for volatilization are capable of processing large quantities of Hg. It was apparent

that the Hg-binding sites in the clayey soil had not been saturated since over 150 µg of the initial 200 µg of Hg remained after volatilization had almost ceased. With the sandy soil, even after 170 hours (not shown in Figure 3), Hg was being evolved at a rate of 260 ng Hg/h. If evolution were to continue at this rate for 2 more weeks, 95% of the applied Hg would be volatilized. This would bring the remaining Hg to about the same concentration as that found in the sand amended with 10 µg of Hg after it ceased volatilization (11 µg).

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SPECIAL PROJECTS

1. New Methods and Tools

a. Scheduling Thorium Processing Personnel for Body Counts - In order to improve the facility of scheduling employees working with thorium for periodic body counts, scheduling has been set up on IBM. Each month a list is prepared which shows the persons to be counted during the month.

b. Special Gamma Counting - A comparison of the data obtained from gamma counting on the single channel analyzer in the Emergency Radiation Dosimetry Laboratory and the 512 channel analyzer in the Bio-Assay Laboratory shows good agreement. However, because of the added capabilities of the 512 channel analyzer, special gamma counting of samples such as SRO material, thorium samples, and SNAP reactor samples were done using the laboratory facility.

2. New Programs

a. Move of the In Vivo Radiation Monitoring Facility - The completion of the move of the IVRM facility took place during this quarter. The iron room was painted on the inside and a vinyl tile floor was installed. The radiation background in the room is approximately 16% above the values before the move. Since the move to the new location, it has been possible to tighten the counting schedule which has resulted in an increase from 10 to 14 in the number persons scheduled per eight-hour day.

b. Disassembly of Weapons - This program was continued during this period and Health Physics monitoring was maintained on the operations to assure safe handling from a radiation safety standpoint.

c. Poplar Creek Empoundment - This facility has been officially named New Hope Lake. The facility is equipped with continuous sampling system and pH recorder on the upstream and downstream sides of the lake. The results from these systems reveal that the result of analysis for various anions, cations and radionuclides is well within recommended limits. While the pH on the upstream side reveals short term variations from 3 to 10.5 there is little effect on the downstream side. The average pH on the downstream side is in the order of 8.3. Since the lake has been placed into operation algae has formed on the spillways and on rocks downstream indicating that the effluent water will support plant life.

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Report Number ~~Y-KB-40~~

Health Physics

UNION CARBIDE CORPORATION
NUCLEAR DIVISION

Y-12 PLANT

Contract W-7405-eng-26
With the U. S. Atomic Energy Commission

Y-12 PLANT QUARTERLY HEALTH PHYSICS REPORT
THIRD QUARTER CY 1963

Y-12 Radiation Safety Department

Oak Ridge, Tennessee
December 23, 1963

APPROVED FOR PUBLIC RELEASE
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OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM

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Other:

The attached sheets outline background information, purpose and general description of the subject system as well as operating responsibilities.

MSG 10-17

ORIGINATOR: J. F. Terrell

DEPARTMENT: L. F. Hemphill

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NEWHOPE POND SYSTEM, Y-12 AREA

HISTORY

Since its inception the Y-12 Plant was primarily concerned with keeping radioactive and pollutant materials within the plant environs. The establishment of the west end ponds (S-3) provided satisfactory means for disposal of heavy metal containing solutions as well as plating shop toxic effluents.

All other waste streams (excluding the sanitary sewer flow) discharge into the east fork of Poplar Creek which in turn flows into Poplar Creek and the Clinch via the city of Oak Ridge.

In the interest of cooperating with the Department of Interior's appeal to clean up the nation's streams a study was initiated in 1960 to examine our contribution to stream pollution.

Guides as to what constituted objectionable compounds or conditions were provided by the Director of the Tennessee State Stream Pollution Control Board, S. Leary Jones. Summary of his recommendations follow:

(1) The pH of the Y-12 area liquid effluent should be maintained within 6.8 and 8.6 limits. Further, after a target figure is established the maximum fluctuation from this number should be in the order of ± 0.5 pH.

(2) Known objectionable items from Y-12 which require controls are nitrates (40 ppm)*, chlorides (100 ppm), sulfates (250 ppm), cyanides (0 ppm), copper (1 ppm), free chlorine (1 ppm), aluminum, oil and toxic chemicals in general. Also sudden temperature fluctuations of more than 9°F should be avoided. No figures were given for suspended solids; it was suggested these were to be kept to a practical minimum.

Using the above as criteria the Newhope Pond System was designed to perform the following functions.

(1) pH Levelling - Wide variations whereby water goes from acid to alkaline or vice versa is responsible for destroying marine and biological life. These desirable organisms are unable to exist if subjected to wide pH changes. To assist in keeping the pH within the recommended range a diversion ditch was provided to take the plant waste stream (east fork of Poplar Creek) and distribute it evenly into an 8,000,000 gallon settling pond. This volume provides almost a day's holding time if no severe short circuiting occurs. The holding time is believed sufficient to even out pH peaks caused by dumping of large volumes of acidic or alkaline solutions in short time intervals. A continuous pH record of the pond inlet and outlet streams is located in the PSS office.

(2) A day's holding time in the pond appears to be more than adequate to reduce concentrations of objectionable anions and cations to render them harmless to marine and biological life.

In order to detect the presence of contaminants quantitatively, a system is provided for collecting liquid samples for weekly spectographic analysis including NO_3^-, Cl^-, SO_4^{--}, F^-, alpha and beta + gamma. A quarterly composite is taken and analyzed for radionuclides Pu, Th, U, and fission products.

* Numbers in parentheses denote maximum allowable concentration.

RESPONSIBILITIES

Health Physics

(1) Take periodic composite samples from 9720-6 sample collection system and arrange for analyses.

(2) Collect and examine pH recorder charts.

(3) Initiate proceedings to alleviate undesirable conditions revealed by instruments, analyses, or visual observations. This consists of tracking the source of contaminant, making the particular operating group aware of the problem and providing suggestions for solution.

(4) Advise operations and engineering regarding disposal of toxic materials.

General Plant Maintenance (Mechanical & Service Section)

(1) Inspect and keep facility in working order.

(a) Inspect and maintain pond exit gates to assure proper liquid level.

(b) Inspect and maintain inlet distribution system (inlet dam, ditch and piping) to preclude short circuiting of waste liquid directly toward the exit dam.

(c) Operate oil skimmer system (future). During heavy rainfall this will not be possible as effluent will flow over inlet dam.

(d) Inspect, maintain and operate liquid sampling system. This includes once per shift checks to assure that a sufficient continuous flow (about 1 gpm) of liquid is passing through the two pH cells. It is recommended that a sail switch be installed to perform this function.

(e) Repair bank erosion.

(2) Inspect and report to Health Physics any unusual conditions such as:

(a) Solids (fly ash, coal dust, sludge, etc.) buildup in diversion ditch, pond, or banks.

(b) Abnormal oil slick or deposit.

Instrument Maintenance

(1) Check pH cells weekly with standard buffer solution. PSS office should be notified prior to testing.

Plant Shift Superintendents

(1) Notify Health Physics in the event pH readings indicate sustained abnormal levels. For example, a pond inlet pH of less than 5 or greater than 9.5 which lasts longer than 6 hours should be reported.

Engineering

(1) In designing process systems the engineer should be aware of what constitutes objectionable contaminants and preclude these from entering sewer systems.

(2) Engineering shall assist the Health Physics and Maintenance groups as required to fulfill their respective responsibilities.

(3) Engineering shall work jointly with Health Physics to evaluate the feasibility of installing tonnage capacity bulk acid and alkaline emergency dump facilities to preclude violation of pH limits.

Operating Divisions

(1) Operations should be aware of what constitutes objectionable contaminants and preclude these from entering sewer systems.

(2) Consult with Health Physics prior to sewering any new toxic waste as well as large amounts of current wastes.

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File (NoY-12RC)

Subject Characterization of New Hope Pond Sludge

DOCUMENT NUMBER: Y-DA-4875

APPROVED FOR PUBLIC RELEASE
P. L. McKenney 6/21/95
Technical Information Office Date

SUMMARY

Prior to a planned dredging operation of New Hope Pond, samples of the sludge in the pond were obtained for analytical characterization studies. Spark source mass spectrographic analyses showed the sludge solids on a dry basis to contain 5.5 - 7.0 ppm arsenic, 10-30 ppm thorium, 110-200 ppm uranium (depleted assay), 0.9 - 1.0 ppm selenium, and 550 - 1200 ppm chromium. Atomic absorption spectrophotometry showed the presence of 118 ppm mercury. The matrix consisted of the silicates of many metals mixed with aquatic growths, oils, chlorinated paraffins, hydraulic fluids, and sulfonated hydrocarbons.

INTRODUCTION

The New Hope Pond located at the East end of the Y-12 Plant was constructed in 1963 to serve as a mixing and settling basin for various wastewater streams emanating from the plant. The pond is four-foot deep, covers an area of about five acres, and holds about nine million gallons of water.

Currently, the New Hope Pond contains a large amount of settled solids, aquatic growths, etc., and needs to be dredged so as to restore its normal water flow capacity and increase the retention time required for settling of solids particulates so that they are not discharged into the Oak Ridge

[redacted]

environment. Prior to this planned dredging operation, it was requested that samples of the sludge solids in the pond be obtained for analytical characterization so as to assess the presence of any potential environmental pollutants.

EXPERIMENTAL

Samples of the black sludge were obtained from the bottom of New Hope Pond at the West perimeter and characterized analytically. A summary of miscellaneous analytical data obtained on the sludge solids is given in Table 1. The organic content of the sludge was determined by Soxhlet extraction using Freon-113 and was found to be 2.5 percent. A chromatographic separation of the Freon-113 extract showed it to contain aliphatic and aromatic hydrocarbon oils (30%), chlorinated paraffins (20%), triarylphosphate hydraulic fluid (30%), and a sulfonated hydrocarbon (20%).

Spark source mass spectrographic analyses were made of the dry sludge solids for over 70 different elements and are presented in Table 2.

Particle size distribution analyses of the sludge solids were obtained using the Coulter Counter method after first screening out large artifacts that were present in the sludge with a 325-mesh screen. Results are shown in Figure 1. These large artifacts represented approximately ten weight percent of the total solids sample.

Samples of the black sludge were heated to dryness in a crucible, ignited in air, and examined by electron microprobe to determine the distribution of the elemental components in the ashed material. Figure 2(A) shows a secondary electron videograph of an area of the ashed sample. X-ray videographs were made of the same area of sample and showed that silicon, iron, aluminum, and potassium were distributed in the larger pieces of the sample, as shown in Figures 2B, 2C, and 2D. Magnesium and phosphorous were found to be distributed in these larger-sized pieces.

X-ray videographs of potassium, calcium, titanium, and sulfur, as presented in Figures 3A, 3B, 3C, and 3D, were made and indicated that these elements were distributed in the ash as very small, concentrated particulates.

The black sludge was examined microscopically and showed a relatively large amount of macro and micro-biological plant life and organisms.

DISCUSSION

Samples of the sludge sediment from New Hope Pond were obtained at the West perimeter of the pond by throwing a weighted sample jar attached to a Nylon cord for a distance of 20 feet and dredging it slowly along the bottom to the shore. As shown in Figure 1, the general particle size of the sludge solids is extremely fine, having an average particle diameter of 11.2 microns. Ninety percent of the particles were less than 31.8 microns and ten percent were less than 3.2 microns.

[redacted]

As indicated in Table I, the alpha and beta activity of the sludge solids is normal, but the presence of mercury (118 ppm Hg) and chromium (1,390 ppm Cr), and chlorinated paraffin hydrocarbons in the sludge solids is significant. The chromatographic resolution of the 2.5 percent organic content found by Freon-113 extraction also indicates that a considerable amount of organic liquid wastes is being discharged into New Hope Pond. The 2.5 percent content found in this study only represents that fraction of organics retained by the solids by adsorption.

The data in Table 2 indicate the existence of silicates of many common metals and only trace impurities of such elements as arsenic, selenium, thorium, uranium, and chromium. The 0.1 ppm values for mercury, as shown in Table 2, are probably biased low inasmuch as spark source mass spectrometry requires an ashing technique in preparing the sample for analyses and some mercury may have been lost by volatilization. The 118 ppm mercury value obtained by atomic absorption spectrophotometry (Table I) is believed to be more realistic inasmuch as the sludge sample was prepared for analyses by refluxing in nitric acid and any loss of mercury was thus minimized.

According to Malin,[1] the disposal of sludge represents one of the most difficult waste treatment problems for final disposal of the solid residues. Currently it is planned to store the New Hope Pond sludge in a lagoon, but mechanical sludge dewatering, incineration, or sanitary landfill of the incinerated ash may be considered at a future date.

Some of the macro-sized organisms identified microscopidally included insect larvae and worms up to approximately 0.5-inch long. Some of the organisms identified included Tubifex worms, amoeba, protozoa, and various forms of algae. Photomicrographs showing some typical filamentous algae associated with the sludge solid particulates are presented in Figure 4.

REFERENCES

(1) Malin, Jr., H. H., "Sludge Handling: The Hardest Phase of Waste Treatment," Environmental Science & Technology 5: 670-671, August, 1971.

C R Schmitt

C. R. Schmitt

CRS:erd

Attachments: Tables and Figures

[redacted]

TABLE I

ANALYTICAL DATA ON SLUDGE SOLIDS FROM BOTTOM OF NEW HOPE POND

Loss on Drying at 100° C	52.9%
Solids Content	47.1%
Alpha Activity,(1) dis/min/g	1,140
Beta Activity,(1) dis/min/g	1,120
Organic Content by Soxhlet Extraction(1)	2.5%
Loss on Ignition After 100° C Drying	19.27%
Carbon(1)	10.29%
Nitrogen,(1) ppm	27.2
Mercury,(1,2) ppm	118
Zinc,(1,2) ppm	720
Manganese,(1,2) ppm	407
Lead,(1,2) ppm	229
Chromium,(1,2) ppm	1,390
Sulfate,(1) ppm as SO_4	2,510
Chloride,(1) ppm Cl^-	<200
Nitrate,(1) ppm NO_3^-	< 30
Cyanide,(1) ppm CN^-	< 2.0

(1) Dry sample basis

(2) By atomic absorption analysis

TABLE 2

SPARK SOURCE MASS SPECTROGRAPHIC ANALYSES OF SLUDGE SOLIDS REMOVED FROM BOTTOM OF NEW HOPE POND

Element	Sample No. 1 (ppm)	Sample No. 2 (ppm)	Element	Sample No. 1 (ppm)	Sample No. 2 (ppm)
Be	0.25	0.3	Ag	Support(1)	Support(1)
B	15	20	Cd	0.08	0.08
F	15	20	In	0.02	0.02
Na	20	10	Sn	6	5
Mg	1,750	1,500	Sb	1.0	0.6
Al	Matrix	4,500	Te	0.7	0.7
Si	Matrix	Matrix	I	0.3	0.07
P	350	225	Cs	0.1	0.3
S	500	250	Ba	350	250
Cl	75	120	La	3	6
K	2,750	2,500	Ce	25	10
Ca	Matrix	Matrix	Pr	1.0	2
Sc	2.5	0.8	Nd	15	15
Ti	5,250	4,000	Sm	5	3
V	125	65	Eu	3	2
Cr	1,200	550	Gd	4	4
Mn	725	300	Tb	0.3	0.5
Fe	25,000	8,000	Dy	1.0	1.0
Co(2)	10	5	Ho	1.0	0.3
Ni	250	200	Er	0.3	0.3
Cu	80	225	Tm	0.05	0.05
Zn	65	60	Yb	0.5	0.3
Ga(2)	15	0.7	Lu	0.03	0.05
Ge	0.6	0.6	Hf	1.0	1.0
As	7.0	5.5	Ta	3.0	1.0
Se	1.0	0.9	W(2)	10	3
Br	0.1	0.3	Re	0.06	0.06
Rb	0.7	1.0	Os	0.09	0.09
Sr	200	75	Ir	0.06	0.06
Y	6	7	Pt	0.1	0.1
Zr	90	100	Au	0.1	0.1
Nb	20	30	Hg	0.1	0.1
Mo	0.8	0.8	Tl	0.06	0.06
Ru	0.3	0.09	Pb(2)	60	20
Rh	0.2	0.06	Bi	0.1	0.04
Pd	0.9	0.1	Th(2)	30	10
			U	200	110

(1) Added Conductor

(2) Not homogeneously distributed; value represents average of two determinations

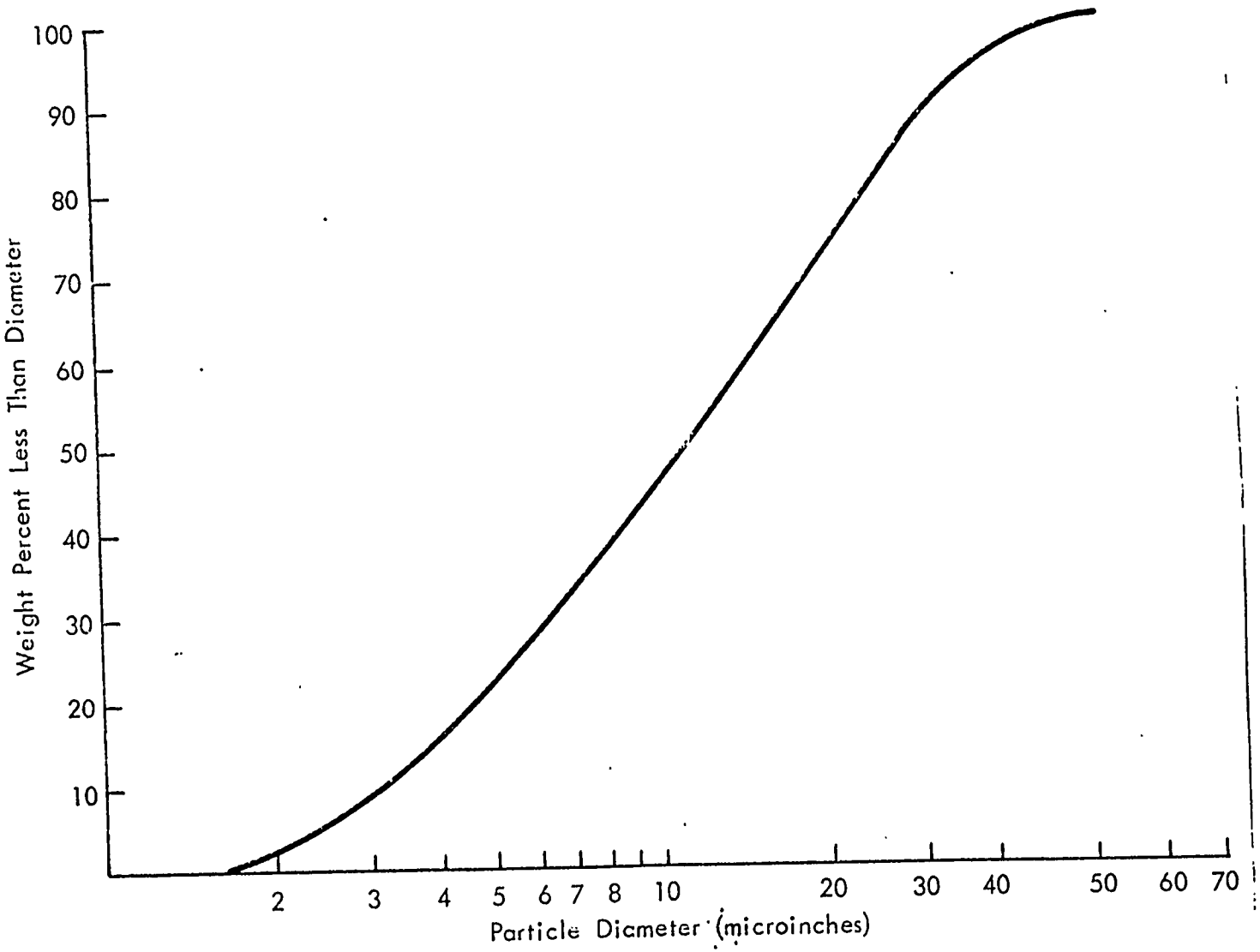
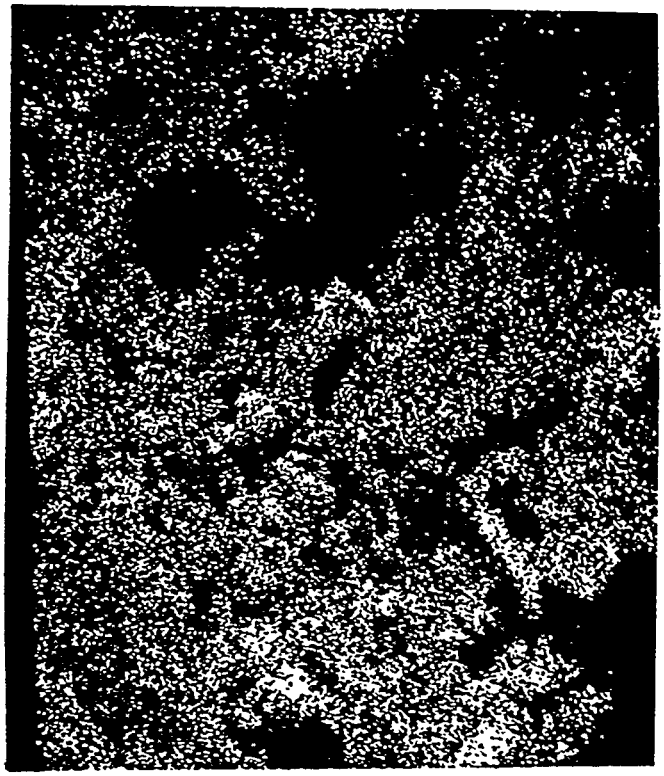
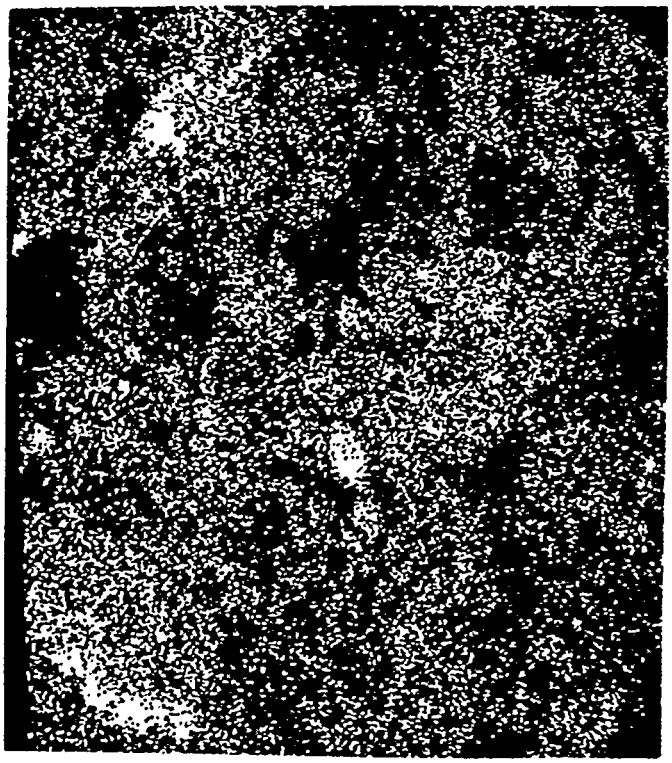


FIGURE 1. PARTICLE SIZE DISTRIBUTION OF SLUDGE SOLIDS FROM BOTTOM OF NEW HOPE POND

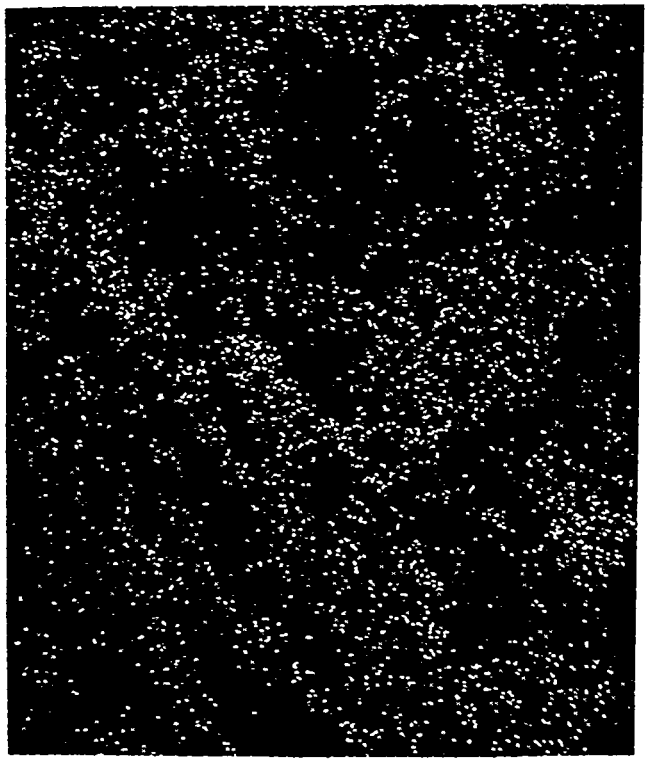
(A) 300X. Secondary Electron Videograph.



(B) 300X. Silicon X-Ray Videograph.

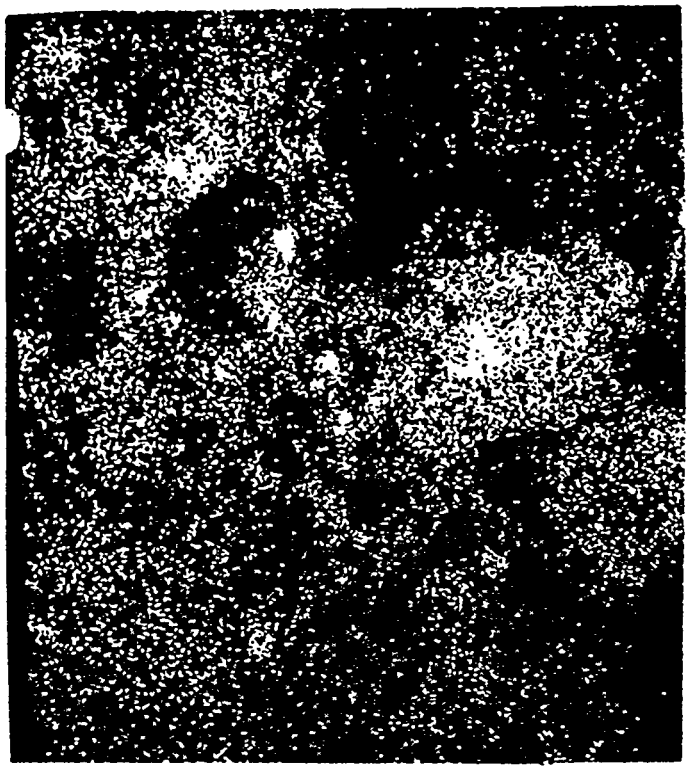


(C) 300X. Iron X-Ray Videograph.

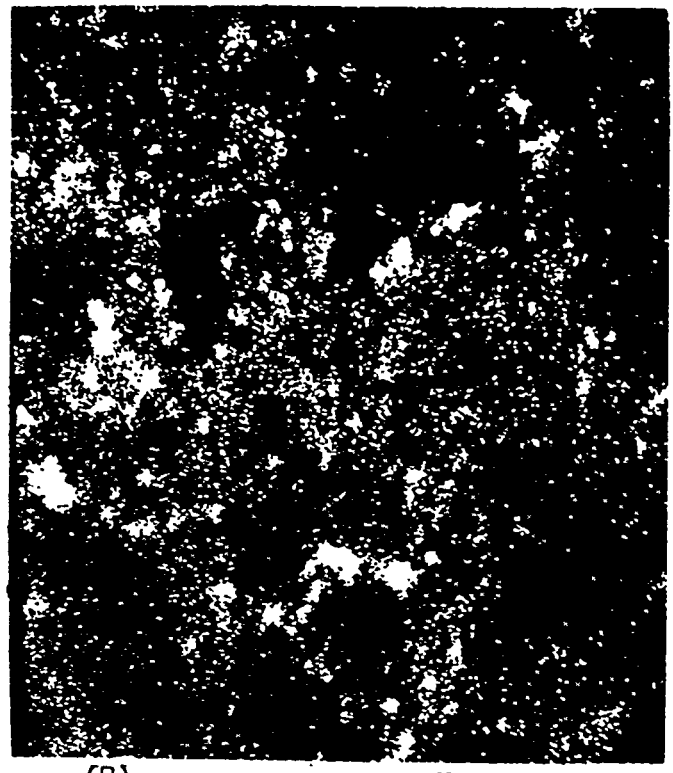


(D) 300X. Aluminum X-Ray Videograph.

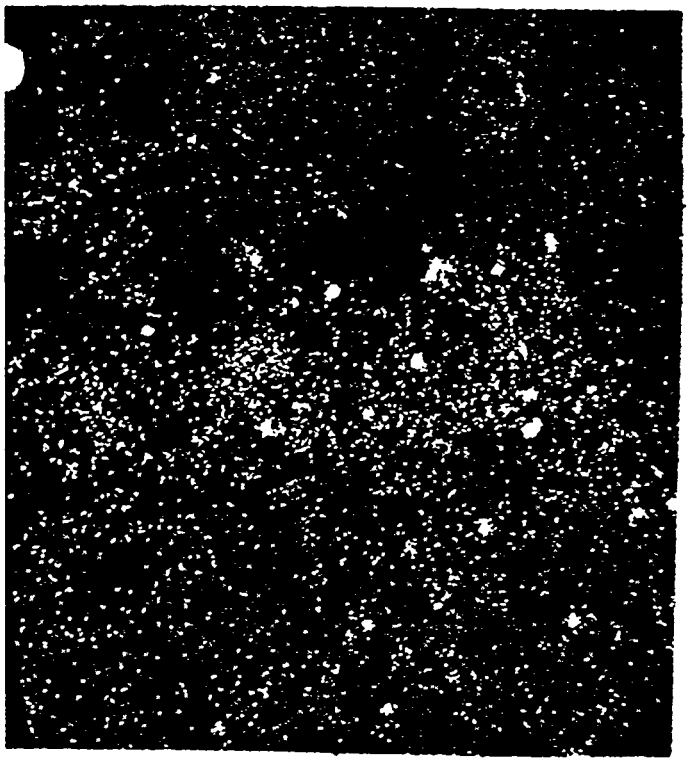
FIGURE 2. ELECTRON MICROPROBE VIDEOGRAPHS OF NEW HOPE POND SLUDGE SOLIDS (300X)



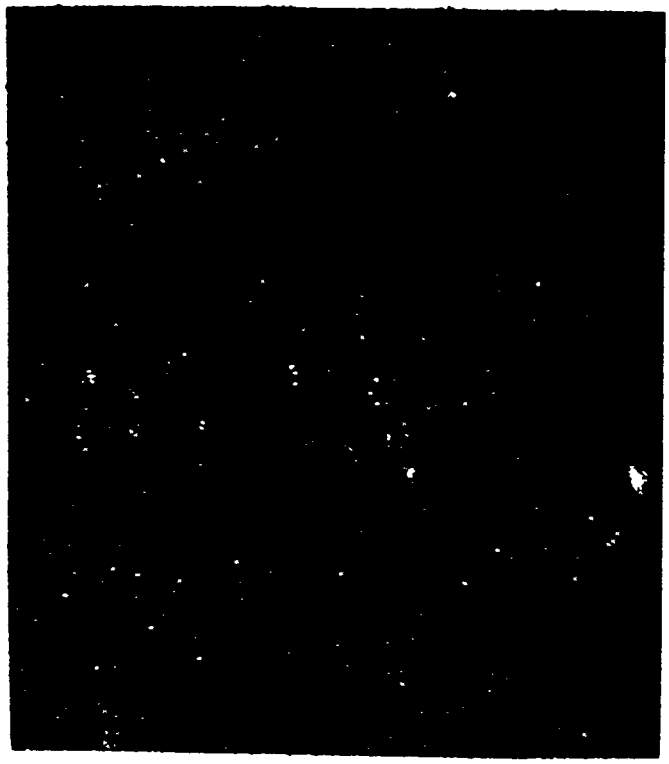
(A) 300X. Potassium X-Ray Videograph.



(B) 300X. Calcium X-Ray Videograph.



(C) 300X. Titanium X-Ray Videograph.



(D) 300X. Sulfur X-Ray Videograph.

FIGURE 3. ELECTRON MICROPROBE VIDEOGRAPHS OF NEW HOPE POND SLUDGE SOLIDS (300X)

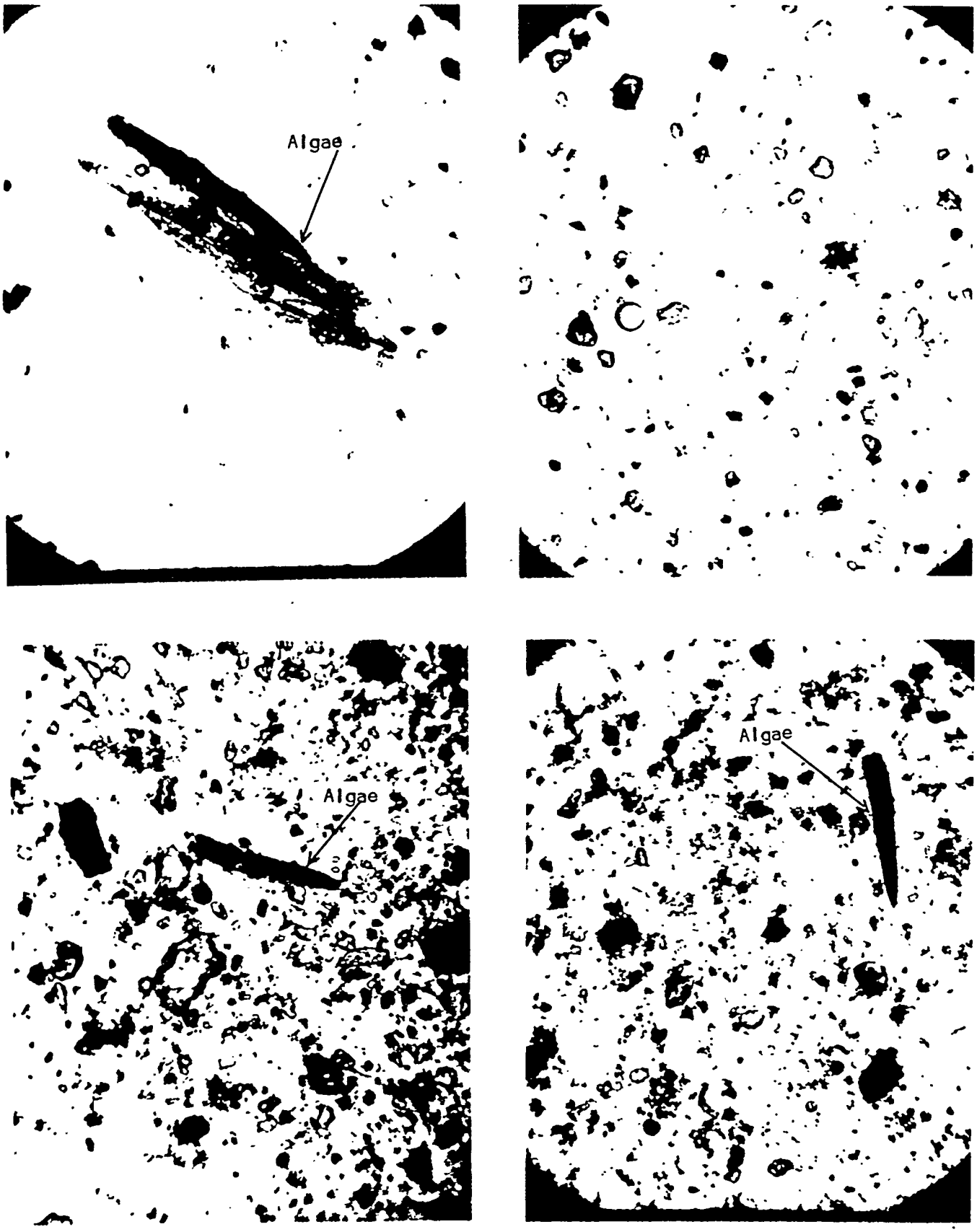


FIGURE 4. PHOTOMICROGRAPHS OF NEW HOPE POND SLUDGE SOLIDS (100X)

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NEW HOPE POND DREDGING OPERATION

OAK RIDGE Y-12 PLANT

M. Sanders

Union Carbide Corporation - Nuclear Division
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

For presentation at AEC Pollution Control Conference

APPROVED FOR PUBLIC RELEASE

Technical Information Office 5/3/94 Date

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NEW HOPE POND DREDGING OPERATION - OAK RIDGE Y-12 PLANT

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ABSTRACT

The background and experience with an industrial waste treatment pond designed for pH equalization are discussed. The original design provided for a 24-hour liquid retention; however, due to silting and sludge deposits within the pond, the effectiveness of the pond has been reduced by 60 percent. The plans, problems, and solutions for the restoration of this facility by dredging are discussed.

In early 1960, the Y-12 Plant recognized the need for a technique to equalize the pH effluent from the Y-12 industrial complex. The conceptual design which was conceived was a water distribution system which would permit a 24-hour mixing time of the plant 24-hour water discharge of approximately eight million gallons. The liquid effluent from the plant discharges into the head waters of the east fork of Poplar Creek which in turn flows through the center of the city of Oak Ridge.

In 1963 a 5.2 acre pond was constructed at the east end of the plant at a cost of $150,000. The pond provides for a proportional sampling system on the inlet and outlet. A continuous pH recording monitoring system is telemetered into the Plant Emergency Control Center where abnormal pH changes can be observed. (See Figure 1.) 1972

(continuous [Hg] monitor 1985)

Figure 1

AUTOMATIC CONTINUOUS PROPORTIONAL SAMPLER FOR NEW HOPE POND

Additional facilities to improve the control of pollution have been added to the pond for continuous automatic analysis. These analytical apparatus test for chemical oxygen demand, hexavalent chromium, conductivity, and nitrates.

The flow of the stream is also recorded continuously by a depth recorder which has been calibrated against a specially designed weir.

The pond design includes a water distribution system with fifteen separate outlets for the equal dispersion of liquid into the main body of the pond. (See Figure 2.)

Figure 2

NEW HOPE POND

Approximately eighteen months ago, the pond was equipped with an improved oil removal system. The old system had some shortcomings, since it did not work effectively in the presence of floating debris and when the oil is deflected by wind. The new system operates independently of trash or wind and will cope with a heavy accidental spill from plant operations.

The new oil removal system consists of a small basin of approximately 25 x 40 feet at the inlet of the large pond. The upstream end of the basin is fitted with a weir which floats about one inch below the surface of the creek. Oil and small debris will float over the weir into the basin, where oil and trash will be retained by a skimmer weir at the basin outlet. The excess water flows under the outlet weir through a culvert into the large pond. Accumulated oil and debris can be periodically pumped to a trailer for disposal by oil biodegrading technique.

Before the pond was constructed in 1963, the pH in the stream leaving the plant fluctuated between a range of 3 to 12 for the period 1962, while the lower curve (as shown in Figure 3,) revealed the effect of good pH control from the plant liquid effluent since the pond was constructed.

However, the current pH control has been less effective as a result of decreased retention time caused from silt generation from recent construction jobs at the plant site.

Figure 3

pH OF EFFLUENT FROM OAK RIDGE Y-12 PLANT NEW HOPW POND INTO POPLAR CREEK

The technique for the removal of 20,000 cubic yards of silt from the pond, at a cost of $50,000, will consist of an approved hydraulic dredge method such as National Car Rental System, Inc., Hydro Soil Division "Mud Cat." This system consists of a floatation barge, pump, auger, and necessary pipe for the transfer of the silt to a disposal area south of the existing pond. (See Figure 4.)

Figure 4

DISPOSAL AREA FOR NEW HOPE POND SEDIMENT

The prepared disposal area for the silt is approximately 143 feet above the surface of the existing pond. The disposal site consists of a retention pond with a capacity of 38,000 cubic yards of silt. The silt will be permitted to settle, while the water effluent from the disposal area will be returned to the upstream side of the existing pond. It is generally felt that this silt disposal technique minimizes water turbidity during the dredging operation with no deleterious effect to the east fork of Poplar Creek.

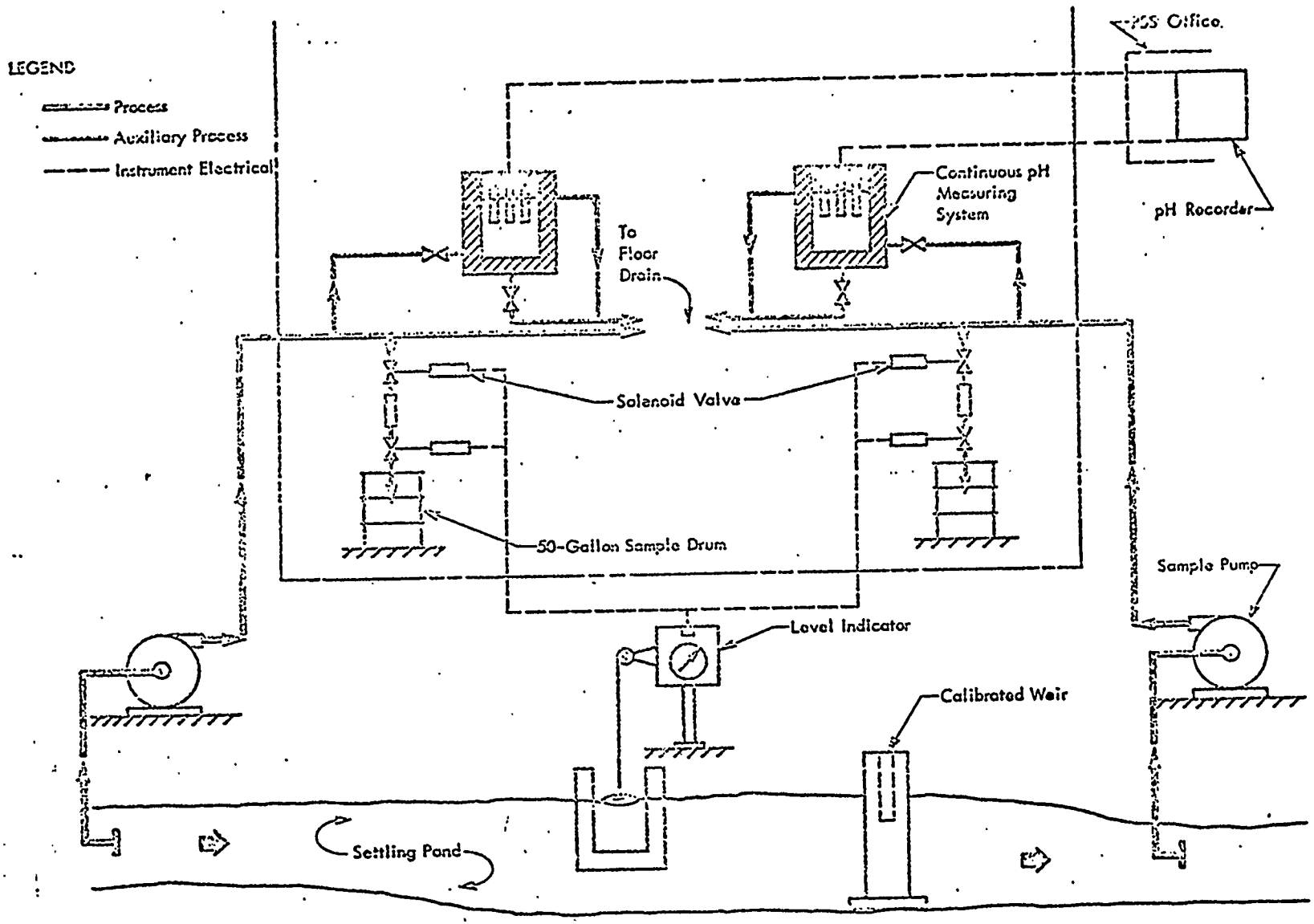


Figure 1

AUTOMATIC CONTINUOUS PROPORTIONAL SAMPLER FOR NEW HOPE POND

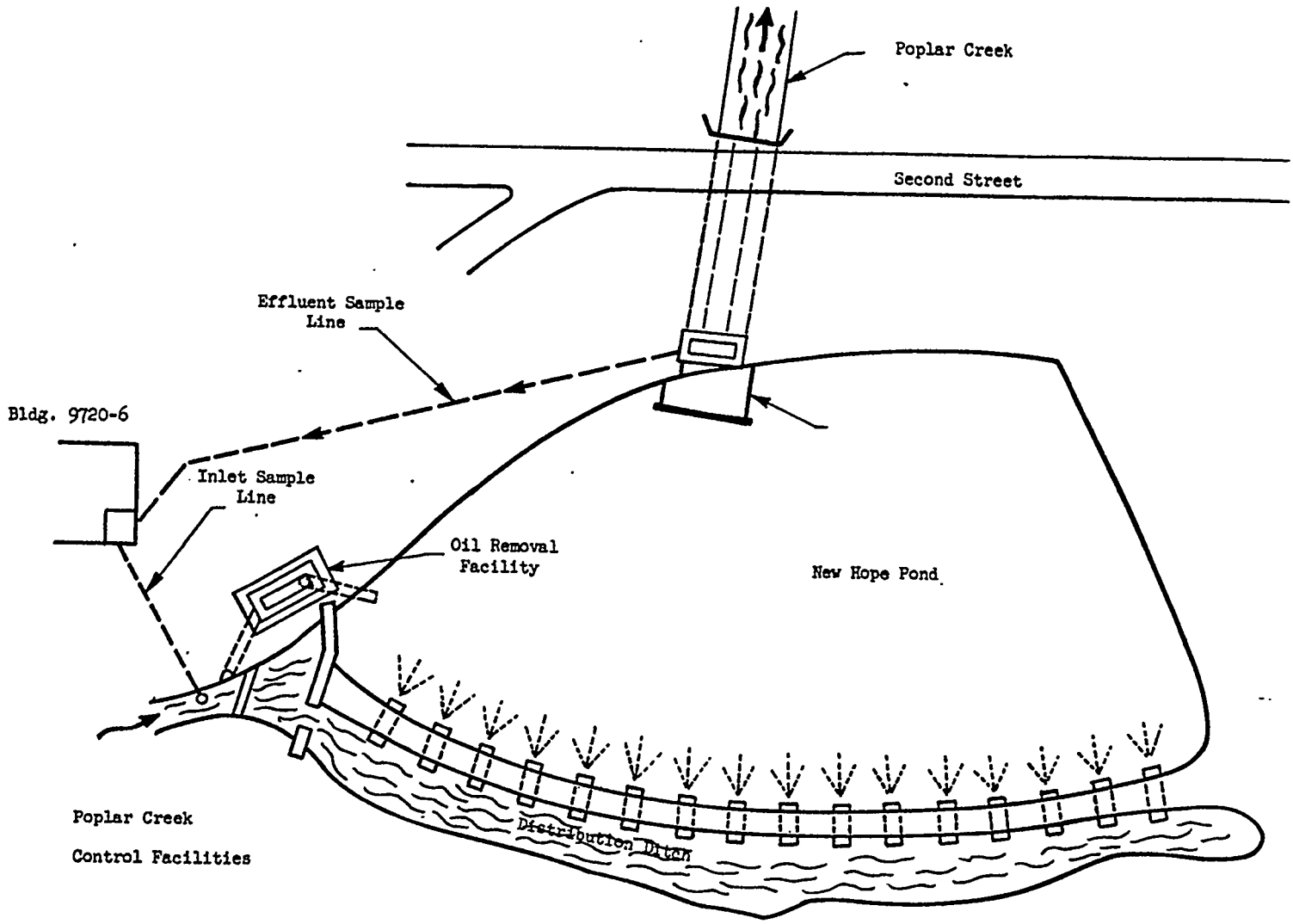
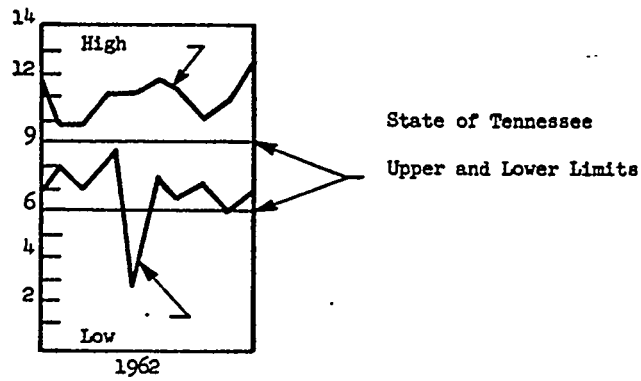


Figure 2

NEW HOPE POND



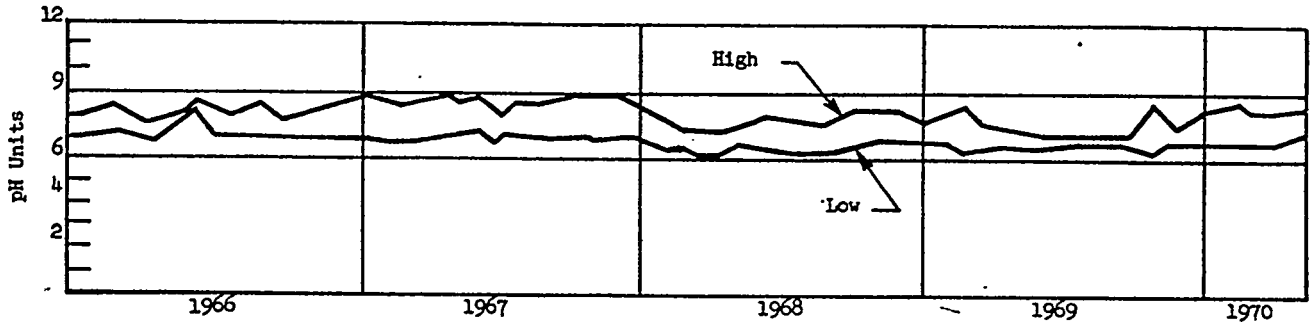


Figure 3

pH OF EFFLUENT FROM OAK RIDGE Y-12 PLANT NEW HOPE POND INTO POPLAR CREEK

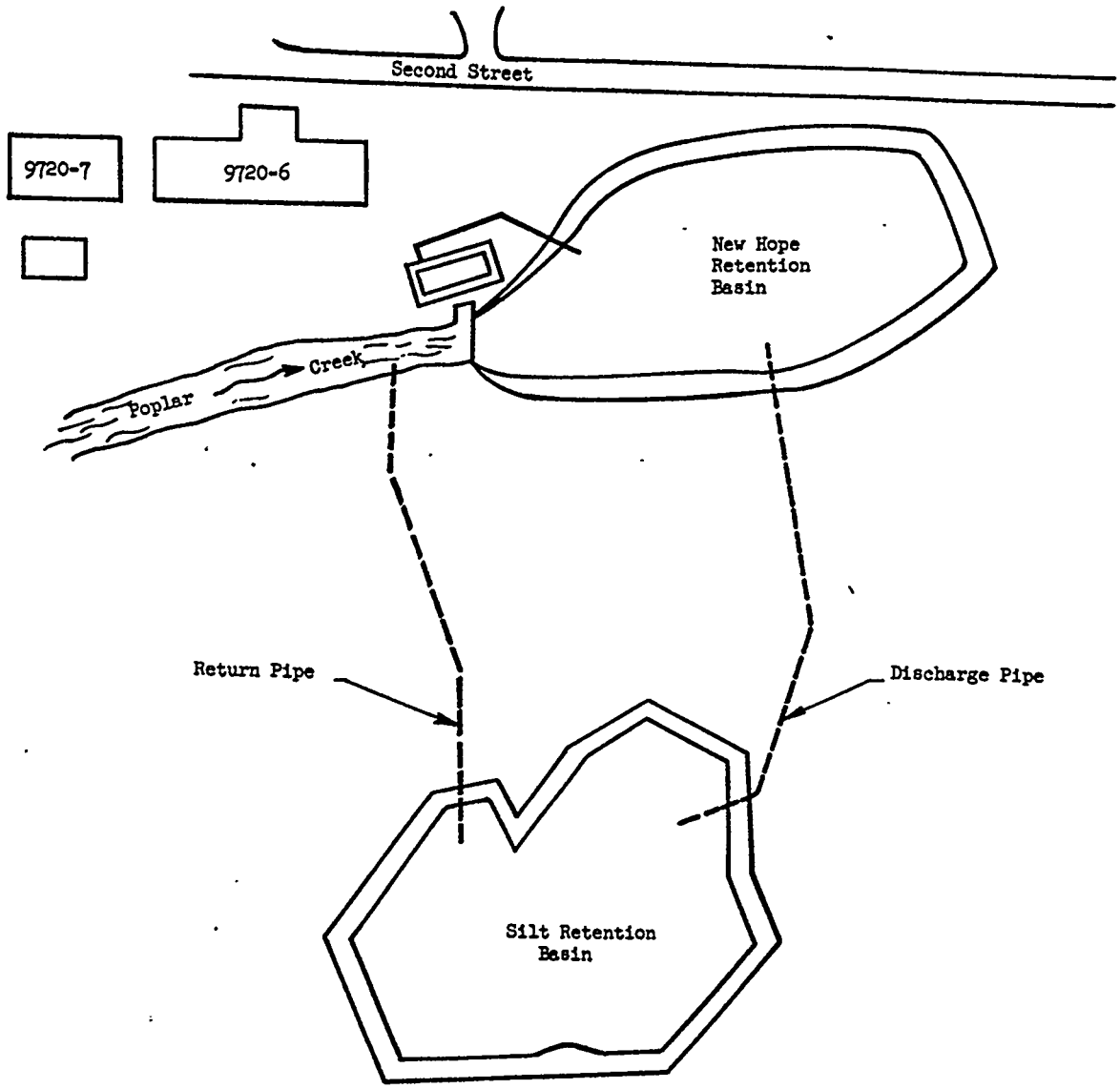


Figure 4

DISPOSAL AREA FOR NEW HOPE POND SEDIMENT

M-744

Y/HG-0115

UNION CARBIDE

NUCLEAR DIVISION

INTERNAL CORRESPONDENCE

August 9, 1982

APPROVED FOR PUBLIC RELEASE
Technical Information Office 4/13/84 Date

J. G. Dorsey, 9995, MS-2, Y-12

Determination of Organic Mercury in Sediments

Three sediment samples from New Hope Pond were analyzed for organic mercury. (Frozen samples were obtained from Ralph Turner.)

Organic mercury was extracted as a bromide species into toluene. A 1% solution of cysteine stripped the organic mercury from the toluene. Total mercury was determined in the cysteine solution using HNO_3-$HClO_4$ oxidation, cold vapor AA.

The following results were obtained:

Sample No.	Organic mercury, μg/g	Total Hg
NHP – 3	0.04	116
NHP – 6	0.06	174
NHP – 13	0.11	220

Quality assurance included the following items:

1. Extraction of standards prior to sample analysis. Greater than 80% was recovered in every case.
2. Extraction of two or more aliquots of each sample.
3. Spiking samples prior to extraction.

N. M. Ferguson, 1505, Rm 210, ORNL (4-4904)

NMF:dmw

82R-0811-211

NUCLEAR DIVISION

INTERNAL CORRESPONDENCE

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Technical Information Office 4/5/84 Date

August 18, 1982

m516

Y/HG-0041

W. Van Winkle, 1505, Rm A-246, ORNL

Additional Data on Core Samples from New Hope Pond

Per our discussions, representative samples of your core sample have also been analyzed for chromium, uranium and polychlorinated biphenyl (PCB). These data, along with your mercury analysis, are tabulated in Table 1 and graphically shown in Figure 1.

The data indicates that a time estimate when the sediment was deposited can be made. The pond was installed in 1962; therefore, the earliest sediment had to be deposited after 1962.

Chromium was added as a corrosion inhibitor to cooling towers in the late 1950's (about 1956). In 1974, the use of chromium was stopped, and chromium in effluent waters immediately decreased. The decreased chromium point in the sediment occurred in the 30-35 cm sample and may be related to 1974.

In the 1960's, polychlorimated biphenyl (PCB) was used for coolants in machining metal shapes. In 1971, this practice was terminated, and a drop in the PCB in sediments occurred in the 45-50 cm layer, which indicates that this layer may have a date of 1971.

The amount of soluble uranium in effluent waters has decreased due to process changes designed to reduce these losses. About 1970, concentrated efforts extending up to the present time were made to decrease uranium losses. The drop in the sediment layer (50-55 cm) may be related to these actions, and, if true, a date of 1970 could be applied to the 50-55 cm layer.

Prior processes containing mercury were shut down in 1963. The drop in the mercury data in the 85-90 cm layer to the 50-55 cm layer could be related to this shutdown. In 1967, the equipment in one of the old process buildings was stripped, and the building was thoroughly cleaned. The increase in the mercury sediment data may be related to the 1967 stripping operations. However, the stripping operation date (1967) would not be consistent with predicted dates for the other elements.

While these projected dates cannot be confirmed, a trend shown in Figure 2 indicates that the sediment may have been deposited in a near linear manner. If true, data in your report also indicates that mercury from an unknown source is still entering the effluent waters since the sediment has essentially been constant for 25 cm (0-25 cm layers). The

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PCB, uranium, and chromium data leveled off after known sources were eliminated. It can be reasonably assumed that the mercury was deposited similar to these impurities.

I will be happy to aid you in your new sample program if needed.

J. M. Napier

J. M. Napier, 9202, MS 1 (4-1884)

JMN:jml

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R. R. Turner, 1505, ORNL
File - JMN - RC

Table 1

SEDIMENT ANALYSIS

Sample Code	Sample Depth (cm)	Cr (ppm)	PCB (ppm)	U (ppm)	Hg (ppm)
NHP-1	0-5	150	1.7	420	107
2	5-10	160	2.2	250	108
3	10-15	180	2.4	295	116
4	15-20	210	3.5	460	110
5	20-25	200	3.2	495	122
6	25-30	290	4.4	430	174
7	30-35	---	5.8	650	240
8	35-40	780	7.0	585	220
9	40-45	780	9.3	475	278
10	45-50	1600	43.0	640/525	170/166
11	50-55	1000	71.0	1190	159
--	55-60	----	----	----	---
13	60-65	810	41.0	1280	220
14	70-75	410	96.0	800	302
15	80-85	140	130.0	1080	299

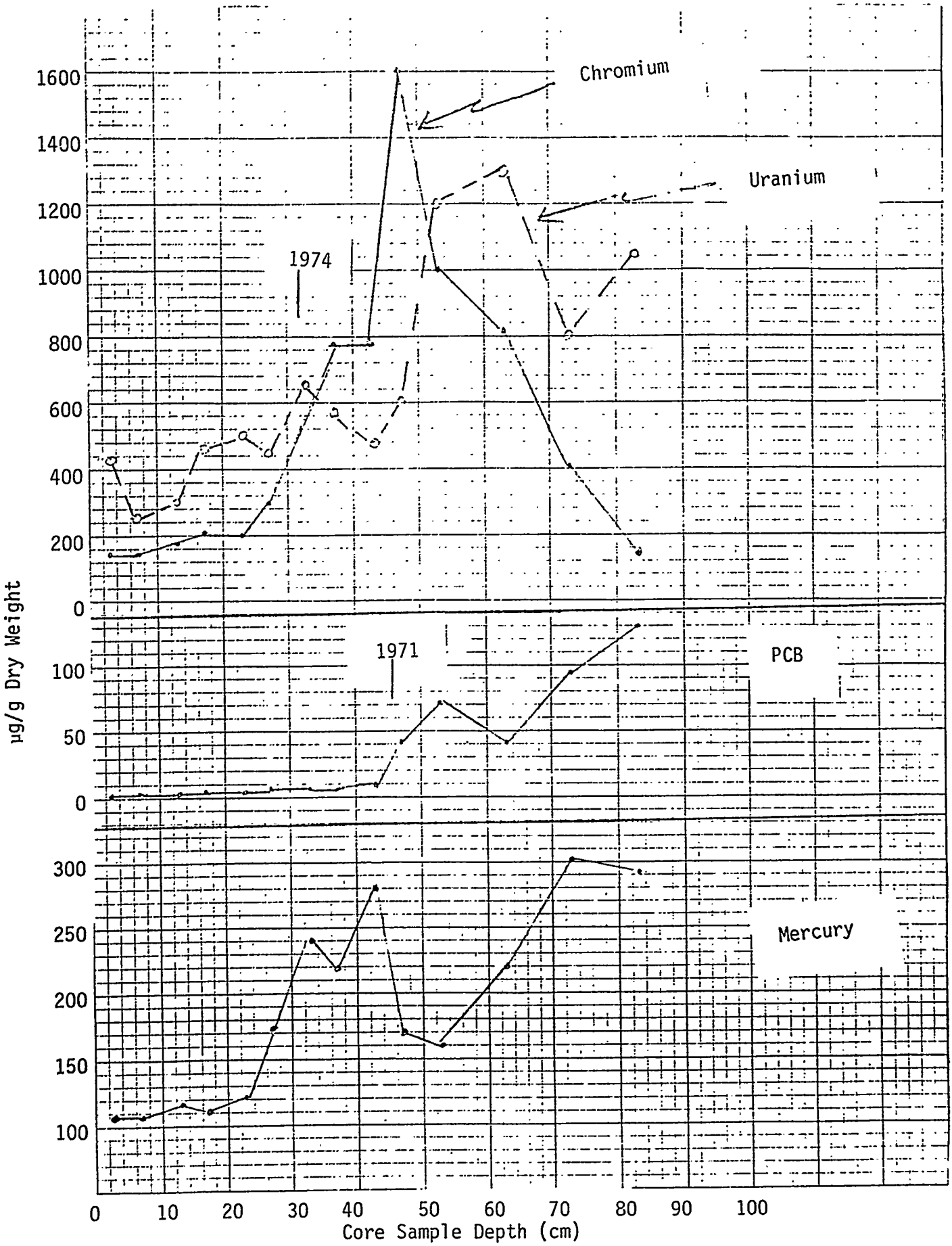

Figure 1. ESTIMATED DATES OF SEDIMENTS.

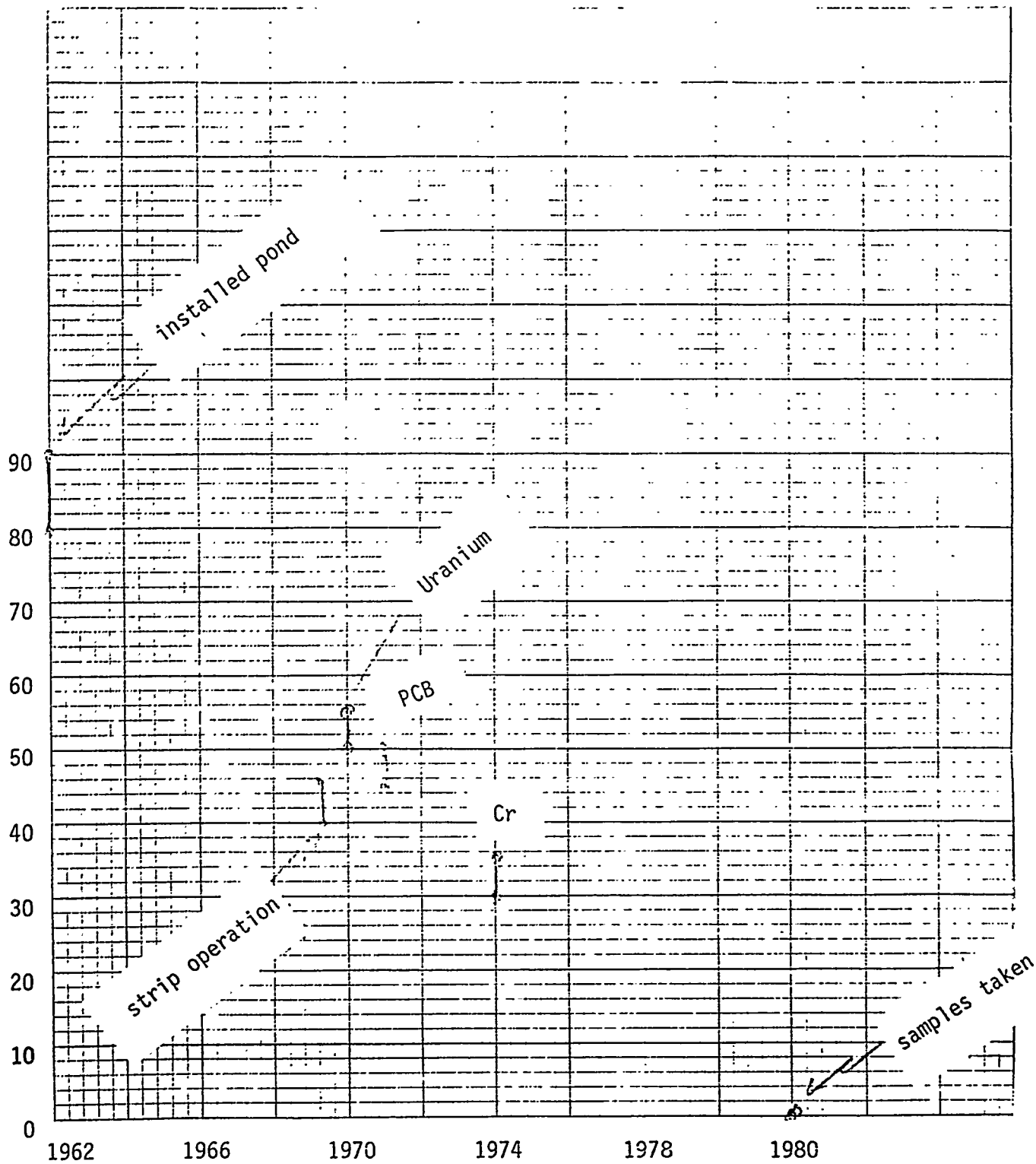

Figure 2. ESTIMATED DATES OF SEDIMENTS

M-744

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

May 27, ~~1982~~ 1983

Y/HG-0118

To: R. W. Counts

From: R. R. Turner (4-7856) RRT

Subject: Estimate of Amount of Hg in the New Hope Pond Sediments

As requested I have calculated the total quantity of mercury currently in the sediment deposited in New Hope Pond. My assumptions are as follows:

(1) Surface Area of the Pond = 5 Acre. 5.2

(2) Hg concentrations, percent moistures and sediment thickness as reported in Table 3 of ORNL/CF-82/ is representative of the entire pond.

(3) Density of sediment particles averages 2.5 g/cc. (I calculated bulk densities of each sediment layer using the measured moisture contents.)

The attached table gives the data for each layer. For layers where no mercury value was given I used the average of the adjacent layers. The grand total represents a reasonable estimate. I doubt the true value could be more than 50% lower but would not be surprised by a true value twice as high (i.e. ~ 25,000 lbs). The most serious limitations of the estimate is the uncertainty in sediment thickness. From later coring work for John Napier, I know that sediment thickness in several areas of the pond is much less than 85 cm. Napier has the mercury analyses for these later cores but declined to give me the data in a timely manner. Thus my estimate is based entirely on data from one core.

RRT:ms

Attachment

cc: S. I. Auerbach

APPROVED FOR PUBLIC RELEASE

Technical Information Office 4/16/94 Date

Table 1. Mercury Concentrations in New Hope Pond Sediment Layers and Estimates of Total Pond Contents of Mercury

Sediment Interval (cm)	Percent Water	Bulk Density (g/cc)	Mercury Concentration (μg/g)	Total Quantity of Mercury (kg)	(lbs)
0-5	80	1.3	107	140	309
5-10	68	1.5	108	160	354
10-15	64	1.5	116	176	389
15-20	70	1.4	110	156	345
20-25	60	1.5	122	185	409
25-30	61	1.6	174	282	623
30-35	54	1.7	240	413	913
35-40	59	1.6	220	356	788
40-45	47	1.8	278	506	1118
45-50	52	1.7	168	289	639
50-55	46	1.8	159	289	639
55-60	45	1.8	190[1]	346	765
60-65	43	1.9	220	423	935
65-70	43	1.9	261[1]	502	1109
70-75	54	1.7	302	519	1147
75-80	48	1.8	297[1]	541	1196
80-85	47	1.8	292	532	1176
85-90[2]	30	---	---	---	---
90-95[2]	27	---	---	---	---
			Pond Total		12,854 lbs

[1]Estimate based on average of adjacent layers.

[2]Hard clay substrate - mercury concentration not measured.