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FOR THE
ATOMIC ENERGY COMMISSION
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NOTEBOOK NO. 12

Assigned to: Robert A. Lauderdale
Department: Health Physics
Location: 104B
Date: 1-5-49

This notebook is assigned to personnel performing research and development work and must be used for all original calculations, notes and abstracts from reports.

Assignee is responsible for the safe-guarding of this notebook in accordance with security regulations.

Do not use scrap paper.

Be sure to record all personal conferences.

This notebook must be returned to Central Files-Bldg. 703-A when completed or upon termination of assignee.

Subject	Page

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LABORATORY RECORDS
1954

INVENTORY 1953

CLASSIFICATION CANCELLED
DATE 12-27-63
For The Atomic Energy Commission
H. P. Carroll
Chief, Declassification Branch

This document has been approved for release to the public by:

David C Hamm 9/13/95
Technical Information Officer Date
ORNL Site

1-5-49

Date Jan. 27, 1948

'48 WOL
'57 Clinch River
'68 WOL

7
2015
1988
792

Rep. No.

Object = to determine the relative amounts of radioactive substances associated with particulate and soluble matter in water from White Oak Lake. Further, to determine the effectiveness of alum treatment ~~of water~~ in removing radioactivity from water.

Materials used = (1) Samples of water collected from White Oak Dam during the storm of Jan. 5, 6, 7, 1948; composited into four large samples according to the counts obtained from the centrifuged supernate of the individual samples. Samples with approximately the same count were combined, regardless of the time at which the sample was taken from the lake.

(2) Alum solution, containing 50 mg $Al_2(SO_4)_3 \cdot 18H_2O$ per ml.

(3) 0.02 N and 0.002 N H_2SO_4, standardized against Na_2CO_3.

Procedure - The composite samples, containing about 2800 ml. of water, were tested to determine pH (colorimetrically) and initial alkalinity (by titration to methyl orange end point with 0.02 N H_2SO_4). Each composite sample was then divided into four equal portions of ~~about~~ 700 ml. each, which were placed in beakers of about 2 liter capacity. The individual samples were dosed with different quantities of alum, with the sample being stirred vigorously for one minute during and following the addition. An additional 20 minutes of very slow stirring was allowed for floc formation, followed by a settling time of one hour. About 250 ml. of supernate were decanted from each beaker for further treatment. The remainder of the contents of the beakers was filtered to separate the floc and entrained particles.

As a measure of the degree of settling, the supernate was tested for per cent transmittance in a Lumetron Colorimeter. Residual alkalinity was determined by titration against 0.002 N H_2SO_4, and pH was determined as before.

Counting samples were obtained by evaporating to dryness in aluminum dishes 100 ml. of supernate from each sample (filtered), and by igniting in crucibles the floc obtained by filtering the treated water. The residues from the ignition crucibles were ~~was~~ transferred ~~the~~ to aluminum dishes.

Results are shown in the table on page 6 ~~which follows~~. Original counting data were recorded on counting sheets # 1A, 8A, 9A

Signed Robert G. Lounsdale

Sample No.	Original Samples in Composite	Average Counts per Minute/Gram in Composite (1.0% Gen)	Alkalinity of Composite as $CaCO_3$ in P.P.M.	pH of Composite		Sample Number	Wt. Plum Used (Grams)	% Recovery (Cost H_2O = 98.2%)	Plum Used as Percent of Composite			Counts/min/Gram	Corrected for Background & 1.0% Gen. (Due to Counts/min/Gm of Solubles 1.0% Gen)		Wt. Plum Used Containing Sample Being Emp. Gms.	Counts/min. from Plum Used for 1.0% Gen.	Counts/min per 100 Wt. Comp. Used
	2					1	0.5	[illegible]	39.4	[illegible]	0.0074	280			[illegible]	3855	55
E	1	583	61.0	7.3		2	1.0	95.5	29.5	5.4	0.0102	269			0.0898	3896	55
	5					3	1.5	97.5	10.4	[illegible]	0.0122	270			0.0933	3627	518
	7					4	2.0	97.0	3.4	5.2	0.0138	328			0.0893	3556	508
	3					1	0.125	24.5	39.6	6.0	0.0077	241			No	Sample	
I	6	496	45.0	7.3		2	0.25	93.2	32.3	[illegible]	0.0064	223			0.0666	2013	288
	21					3	0.50	95.4	27.8	5.6	0.0067	243			0.0890	2693	38
	8					4	1.00	95.5	13.4	5.8	0.0078	233			0.0943	2566	36
	19					1	0.125	92.5	34.9	6.9	0.0064	198			0.0848	1900	27
II	4	397	42.8	7.2		2	0.25	91.9	32.7	5.8	0.0064	161			0.0942	1968	281
	20					3	0.50	95.8	21.9	6.5	0.0067	172			0.0894	1781	25
	10					4	1.00	94.7	10.8	5.6	0.0092	223			0.0908	1696	24
	9					1	0.125	28.2	26.5	6.7	0.0080	155			0.1022	1134	162
V	13	330	34.2	7.2		2	0.25	[illegible]	[illegible]	6.6	0.0087	161			0.1485	1539	220
	11					3	0.50	[illegible]	[illegible]	6.5	0.0053	146			0.1668	1685	241
	14					4	1.00	[illegible]	[illegible]	5.6	0.0067	190			0.1778	1519	21

Signed [illegible]

Object - to determine the efficiency of removal of radioactivity by adsorption on clay.

Materials - Cat. Floodwater collected Feb. 9, 1949. Kaolinite clay from vicinity of Knoxville, Tenn. which had been finely ground.

Procedure - To each of four jars was added 1 liter of water. Clay in the amounts of 1,000; 3,000; 5,000; 10,000 was then added and the mixture mixed rapidly. Samples were drawn from the jars after 5, 10, 30, 55, and 83 minutes and allowed to settle overnight. A portion of each 5 minute sample was centrifuged for 10 minutes immediately after removal from the jars. One milliliter portions of the supernates from each sample were evaporated to dryness for counting.

Data - Complete data may be found on Liq. Waste Treatment Study sheets #1 & 2, and on counting sheets # 12, 13, & 14. Counts were made on the raw water and four samples only. Mean counts at 10% geo. are shown below. No correction was made for coincidence losses.

ppm clay	Mixing time min.	Settling time	c/m/cc at 10% geo.	% Removal (% of original count)
0	0	0	30,640	
1000	5	overnight	26,583	13.24
1000	83	"	26,060	14.95
10,000	5	"	16,186	47.17
10,000	83	"	15,132	50.61

Signed R. G. Lauderdale
March 2, 1949

Date Feb. 15, 1949

Object - to determine the efficiency of removal of radioactivity from water by adsorption on clay.

Materials: East Pond water, collected Feb 9, 1949, diluted with distilled water in ratio 15 parts E. P. water to 985 parts distilled water. Kaolinite ~~Kaolinite~~ clay from vicinity of Knoxville, finely ground.

Procedure - To 1 liter portions of diluted E. P. water was added clay in the amounts of 1000, 5000, 10000, and 20000 ppm. The mixture was stirred rapidly and portions drawn from each beaker after mixing times of 2, 5, 15, and 30 min. Part of the 2 min sample from each mixture was centrifuged for 20 min. All other samples were allowed to settle overnight. Settling was poor so each sample was centrifuged 20 min before being evaporated for counting.

Data: Complete data may be found on Liq. Waste Treatment Study Sheets #3 & 4, and on counting sheets 17, 18, 20, 21, 22, 25, 26. Summary of data is given below.

ppm clay	mixing time	c/m/cc of supernate 10% geo.	% removal (% of orig. count)		ppm clay	mixing time min.	c/m/cc of supernate 10% geo	% of orig. count removed.
0	0	53 ~~152~~						
1000	2	17.6	67.0		10000	2	85	84.0
1000	2	251	52.9	← centrifuged 20 min →	18000	2	121	77.3
1000	5	143	73.2		10000	5	78	85.3
1000 ~~5000~~	15	145	72.8		10000	15	80	85.0
1000	30	152	71.5		10000	30	70	86.8
5000 ~~1000~~	2	105	80.3		20000	2	73	86.3
5000	2	152	71.5	← centrifuged 20 min →	20000	2	90	83.1 ~~89.5~~
5000	5	106	80.1		20000	5	57	89.3
5000	15	96	82.0		20000	15	50	90.6
5000	30	108	79.7		~~20000~~	30	71	86.7

Signed

Object - to determine the effect of pH on the removal of radioactivity from water by kaolinite type clay. to determine the effect of alum coagulation on the removal.

Materials - kaolinite clay, finely ground, East Pond water diluted 15:1 with distilled water, HNO_3, and lime.

Procedure - The pH of the diluted waste water was adjusted with HNO_3 to values of 9.08, 8.00, 7.02, and 5.98. To 1 liter portions of each of these waters was added 1000 ppm clay, and the mixture rapidly stirred for 10 minutes. Samples were drawn from each beaker for settling and counting. The pH values of the remaining mixtures was adjusted to 7.3-7.4 with HNO_3 or lime solution and 5 ppm alum was added to each with rapid stirring. One thirty minutes slow mixing was allowed for flocculation and coagulation. Samples of the alum treated water were withdrawn for settling. All samples were allowed to settle overnight. Triplicate 5 ml. portions of the supernates were evaporated for counting. The uncoagulated samples were then centrifuged and recounted.

Data - Original data may be found on Liq. Waste Treatment Study Sheet #5 and on counting sheets 37, 38, 39. Counting data are given below.

c/m/ml at 10% geometry

Initial pH of waste	clay treatment only	clay treatment + centrifugation	clay treatment + alum coagulation
9.08	179	152	160
8.00	174	148	148
7.02	168	142	151
5.98	163	154	166

Signed

Date Nov. 14, 1949

Literature Survey of Decontamination Methods

Evaporation – Overall decontamination factors of 10^3 expected (ORNL-323, part I, Sr, Cs, and Ru found in condensate. Ru not found at pressures under 75 psig.

ORNL-323, part 2 = Ion Exchange = Redox waste used. 10^3 β, γ decontamination obtained. Ru decontamination of 2. Ru d.f. upped to 8000 by use of an additional "break through" ion exchange col., prior to the Al adsorption col. In this process filtrate from scavenging step is acidified with HNO_3 and reduced with hydroxylamine and passed through break-through col. the Ru^{+3} is strongly held while Al, after saturating the column, breaks through. The effluent is then passed to the next column for β, γ decontamination. Calculated that 20 times the amount of Al held on column will be passed through before Ru breaks through, corresponding to Al yield of 95.4% to obtain quantitative reduction of Ru, reduction must be carried out under acid conditions. Flow sheet for process given page 69.

ORNL-323, part 2 Crystallization Process = Designed for recovery and decontamination of $(Al)_2(NO_3)_3$ from Redox or "25" wastes by recrystallization from 85% nitric acid. Results showed that aluminum recovered from a 2.4 M aluminum nitrate solution (3×10^6 c/m/ml of "X" activity) may be decontaminated by factors of 10^4, 700, and 10^4 for β, γ, and Ru respectively, in a two cycle process with equally good decontamination for all major fission products with exception of Cb (Cb d.f. lower by factor of 6 to 10). Residual activity was found to be 40% Cb and 47% Ru.

ORNL-65 page 73. Ru^{106} precipitated with $Fe(OH)_3$. apparently good removals

(Unclass) MON-C-417 - Ra separated from Ba using Dowex-50 in 1 cm² x 15 cm column. Elution with ammonium citrate (0.5 M) at rate of 0.3 ml/min. Separation better than from fractional crystallization.

AECD-2435 Ion Exchange separation of Zr and Hf. Oxides of Zr and Hf dissolved in H_2SO_4 and HF and fumed to dryness. Residue dissolved in HCl and hydroxides precipitated with NH_4OH. Hydroxides dissolved in HCl and oxychlorides crystallized by evaporation. One cc 250-500 mesh Dowex-50 (NH_3 form) were suspended in 30 cc 2 molal perchloric acid and oxychlorides added over 15 min period. About 80% of Zr & Hf goes on resin. Resin slurry placed on top of column 1 cm² x 30 cm (H form). Elution by 6 M HCl.

ORNL-329 Adsorption of Protactinium from HCl solns by Anion Exchange Resins - Due to the formation of two negatively charged complexes in HCl, Pa can be purified by exchange separation. Pa at trace levels can be adsorbed from 8 M HCl and eluted with 4 M HCl.

MDDC-1688 - Rare earth separations improved by using 0.5 M citric acid at pH 3.8 and 4.3.

MDDC-1447 Separation, Purification, and Concentration of Small Amounts of Ions, with particular reference to the fission products.

Amberlite IR-1 used (40-60 mesh) (H form).

Solution used was ~ 0.1 N HCl solution containing fission products plus varying amounts of Fe, NH_4, WO_3 as impurities. Fe was removed by isopropyl ether extraction, and NH_4 and WO_3 by HCl evaporation. Fission products included Zr, Cb, Y, Cl, Nd, Pr, Ce, Ba, Sr. Starting solutions also contained as impurities Cu, Ni, Cr, Mn, Ca, Mg, Zr, Na, K, Pb, Ti, V.

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Ru and Te appeared nearly ~~quantitively~~ quantitatively in the effluent from the adsorption step. Elution was made with 5% citric acid at varying pH. Fractions of the eluate were readsorbed on columns and re-eluted with dilute HCl to purify the active isotope.

K-447 Separation of Copper, Iron, Nickel, and Uranyl Ions by Ion Exchange columns.

Use theoretical plate approach to separate ions. Factors affecting the number of plates are:

(1) temperature
(2) exchanger type
(3) particle size
(4) Nature and conc. of solute
(5) Type of eluent and flowrate
(6) rates of diffusion
(7) column length.

Equilibrium distribution of an ion between the solution and resin can be obtained only when concentration of ion is below some critical value. For rare earths this has been found to be 3×10^{-4} M for Dowex-50 and 10^{-6} M for Amberlite IR-1.

Iron was found to interfere with elution of other ions and must be separated prior to adsorption.

K-443 Separation of Cesium from Sodium By Means of Fullers Earth.

In an investigation of the adsorption of cesium by fullers earth from solutions containing large concentrations of sodium nitrate, sulfate, carbonate, and phosphate the following information was obtained.

1. For the adsorption of cesium from the solutions a pH of about 11 was found to be optimum.

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2. The concentration of sodium (and the anions listed) does not materially affect the adsorption of cesium.
3. A high degree of decontamination of the solutions by removal of cesium ^{137} can be achieved in several passes of the solution over the fullers earth.
4. Fullers earth has the ability to remove cesium in many successive equilibrations, especially from dilute solutions and solutions containing trace amounts if washed and dried between passes.
5. The capacity of fullers earth is relatively independent of its mesh size.
6. The capacity of fullers earth under the conditions used was found to be greater than 0.04 gms of cesium chloride per gm. of earth.
7. Temperature had but little effect on rate of adsorption.
8. The initial rate of adsorption is very high.
9. It is possible to achieve a high degree of removal with a percolation method involving several stages of passage through the adsorbent.

Water and simulated Hanford initial waste solution.
Fullers earth used was of order of gms/100ml (1, 2, 3, 4, 5) of 30/60 mesh size.

ORNL-41 - Effect of column variables on Elution

Signed

KAPL-117 - Liquid Waste Disposal - Report of waste disposal work at Knolls atomic Power Lab. Methods considered included ion exchange, carrier precipitation, dilution, and evaporation.

Ion exchange probably as efficient as any other means. Cation exchange alone will not remove all activity. Dowex 50 found most acceptable.

MLM-380 (Secret) Treatment Hanford crib wastes. Ferro ferrocyanide (for Ru) and silicotungstic acid (for Cs). Also iron filings and clay.

TID-274 (Secret) Gives some tolerance figures, etc.

Signed

Date Jan. 20, 1958

Analysis of Sr^{90} - Y^{90} for coagulation studies

Quantity recd. 0.196 mc (0.1 ml) Sr^{90} from SrCl-31-1

Analysis - Sr^{90} & Y^{90} in equilibrium
Sr^{89} - none detected
Ba^{140} - none detected
La^{140} - " "
Gross alpha 23 c/m/ml
T.S. 8.0 mg/ml
N.V.M. 3.6 mg/ml
$SrCl_2$ in 3.04 N. acid

Spec. analysis - Al - faint trace
Ba - very strong
Ca - strong
Cr - very weak
Fe - very faint trace
Mg - trace
Na - faint trace
Ni - very weak
Pb - trace
Sr - moderate

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Mr. German - Health Physics aspects - no discharge to streams, ~~sewage~~ sewers, etc.
Reduce all waste to solid for storage. Incinerator gave vol. red. of 35:1 in container.

Problems in incineration - segregation and handling.

Slide shown of evaporator - 10 gal/min, reflux ½ gal/min, operates under 26" Hg., Semi-continuous, solids in feed <1%. Concentrated to 40% solids, fed to drier. Steam economy 85-98%, pH of raw waste ~3, ~~on~~ recirculating stream pH ~9.

Dec. factors - worst: (0-8)(α), 0-35 for β
average - α 2 d/min/l, β - 20 d/m/l.
df of 10^6 for α
10^8 β

allowable discharge 350 d/m/l for α
4400 d/m/l for β, γ

Drier set-up - Dried because want min. vol., minimizes corrosion of storage containers. Have 2 twin drum driers.
Large drier - 32 ft² surface heated internally, has variable speed. (1-5 rpm). Made of S.S., chrome plated, shielded with 6' concrete. Hoppers have vibrators to settle solids.
Catch in 70 gal. drums, operated remotely

Variables - drum r.p.m. } vary with type of feed. Start at
steam pressure } moderate speed. Rate 60#/hr on
splasher speed } dry basis.

Cost - 3.5 ¢/gal, without plant amortization
~7.5¢/gal. with

Signed

— Incinerator - Burn filters, etc. - Jacketed and cooled by compressed air. (Combustion rate ~20 #/hr.) Small particles in flue gas scrubbed by steam jet and scrubbing column. Gases also filtered before discharge. Operation under 3-5 inches H_2O.

Zebroski Separations Chemistry - Crystallization

Crystallization limited in use. (1) Need diff. in solubility (separation factor) (see June Analyt. Chem).

(2) High yield

(3) Mechanical requirements

(a) Easily handled and filtered

Possible applications -

1.

Ferguson - Crystallization of Sodium Nitrate - waste non-U bearing. pH = 11 with caustic. 0.2 M nitrates. 10^4 β c/m/ml. Waste evaporated, neutralized with 70% nitric acid. Insolubles filtered. Evap. cont. to slurry. 0.5 M. Sodium nitrate added. Salt dissolved and recrystallized. d.f. = 5000 in laboratory, yield ~ 98% per cycle. Activity left were Ru + Cb.

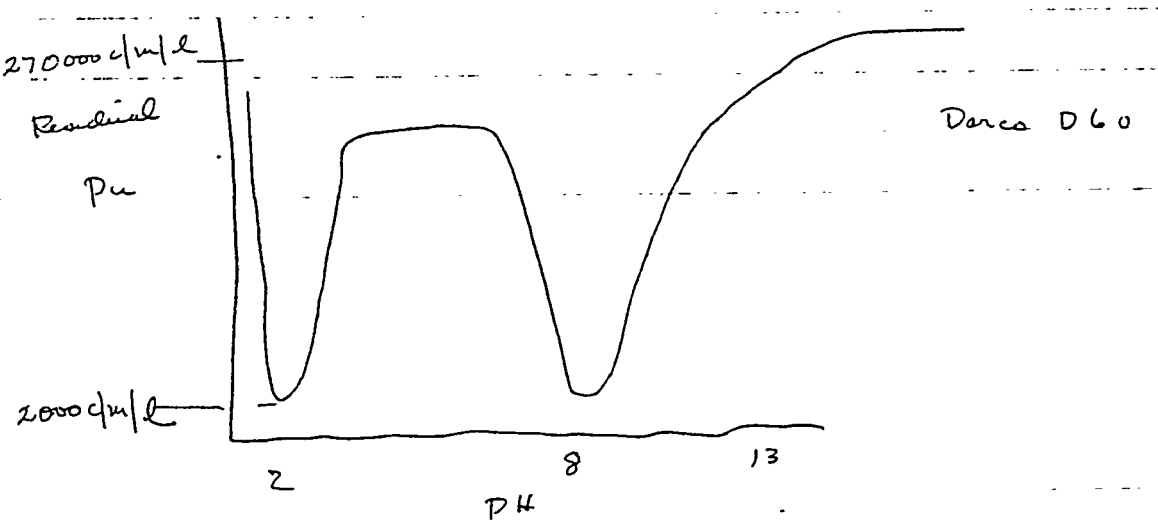
Signed

Introductory Remarks - E. C. Pitzer (KAPL)

Vol. 3000 g/day + 300 gal. from laundry. Activity ~ 3 mc/day with 0.2% solids. 5×10^{-5} d/m/liter (7×10^{-10} gms/liter). $FeCl_3$ used as coagulant. D.F. for Sr decreased with increasing pH. For Cs reverse was true.

Removal of Pu from Liquid Wastes (L.A).

Christenson - waste - pH = 3, solids 200-8000 ppm. 3000 c/m/l. of Pu. Iron worked well if 20 ppm used. Alum, iron, ammonia, and NaOH tried. 70 c/m/liter of Pu left. Fluorides left. Precipitated as calcium fluoride. Citric acid interfered. No floc could be obtained. Attempts to oxidize acid failed. Activated sludge (24 hours aeration) worked. Method cumbersome. Finally used excess lime and pH ~12 with iron. Phosphates interfered. Not always get ferric hydroxide floc but any floc seemed to work. Hot sludge (1.9% of vol. of waste) with all Pu and solids. 400000 c/m Pu. Buried so far. Hope to dissolve and reprecipitate Pu. Activated carbon also used. Best pH seems to be about 2.

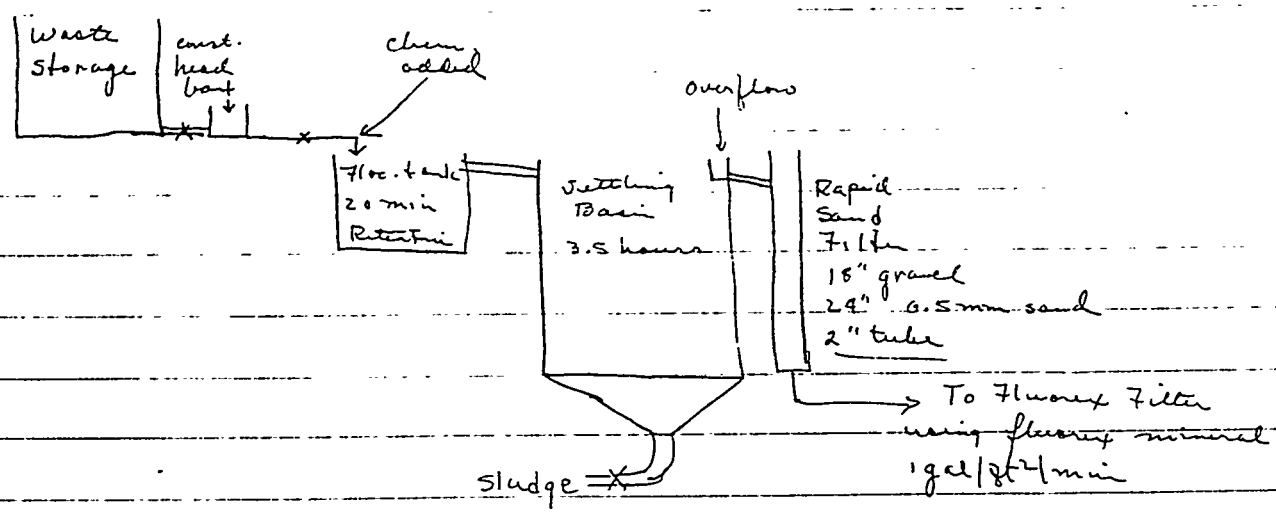


Remarks - nuchar 000 found good. Reducing agent helps.

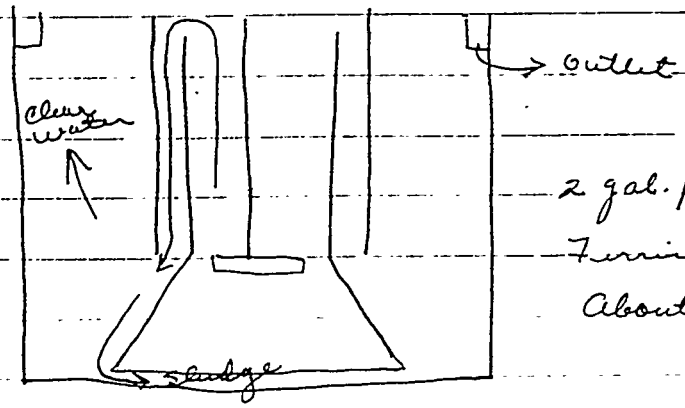
Signed

 Date June 27, 1950.

Pilot Plant Studies - Calcium chloride used for calcium, Also NaOH + FeCl
Tech area waste used. 4000 c/m/l. Solids and pH change
rapidly. 14900 gal. average flow. Pilot plant 1 liter/min.
Usual eq. used. + defluorinator.



2nd Plant for Production Area Waste - 5000 gal/day or less.
Batch treatment. Higher Pu content. Continuous flow desirable.
~~Infl~~ Accelator unit used.



2 gal./min capacity
Ferric chloride + lime used.
About 2 hours detention.

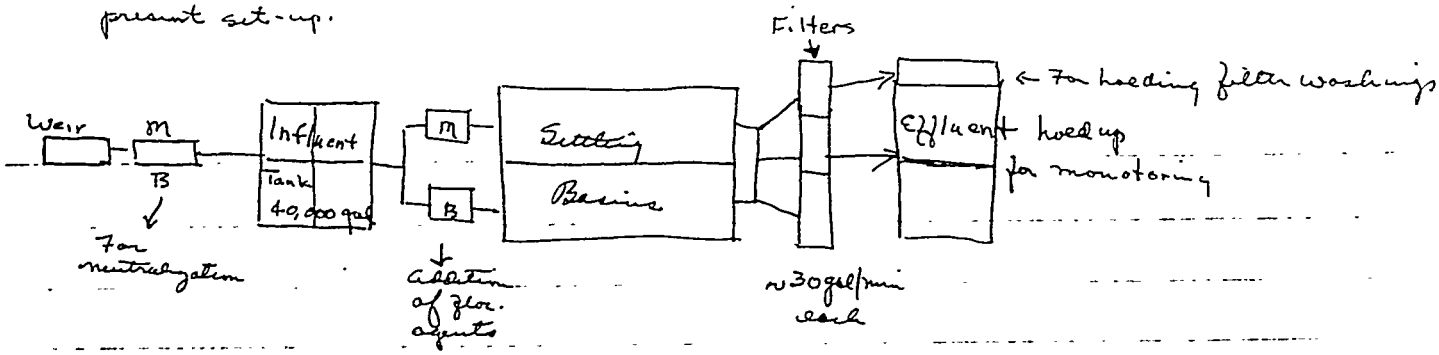
Signed

Results - Chem. app.

		$FeCl_3$ as Fe	$CaCl_2$ as Ca	NaOH	Pu (c/m/liter) Raw	Settled	Final	%
Area	Tech	33.7	50.8	440	4126	31	11	99.1
	D.P.	36	$[Ca(OH)_2]$ 229		9701	355	262	97.-

Description of L.A. Treatment Plant - For Pu Removal.

Plant capacity ~ (12 hr detention) 16000 gal/8 hours maximum under present set-up.



Sludge to filter room. Cake to Pu recovery.

Cost of plant ~$175,000

NOTES FROM MLM-466 COPY 77A

MOUNDS WASTE DISPOSAL SECTION

Work on four methods - adsorption, metal scrub, precipitation, filtration.

Metal scrub - 99.5 % Ru, pH dependent. Solution at pH ~4.5 passed over iron filings. 400 ppm iron dissolved.

Adsorption	Ru^{106}	Zr^{95}
c/m/ml	1.9×10^6	1.3×10^6
pH	8.9	6.1
shaking time	20 hrs.	20 hrs
	% Remaining	
Silica Gel	6.2	1.9
Activated carbon	0.2	0.2
Activated alumina	1.7	0.1
MnO_2	0.04	0.04
Superfiltrol FO	1.4	0.07
Attapulgus Clay	1.9	0.05
Titanium dioxide	0.3	0.4
Zirconium dioxide	-	0.8

Precipitation with ferrous sulfide - For Ru ~ ~~97% removed~~

c/m/ml	10^6	10^5	10^4	10^3	10^2
% left	1.6	1.7	2.2	2.7	7.3

~~For [illegible] % removed~~

Precipitation with ferrous ferrocyanide For Ru ~ 10% removed

Distilled water tests → For Sb ~ 0 % removed

With fluorides present removal increased to max. of 99%

Application of process to crib waste

Initial count 39000 c/m/ml β, 150 c/m/ml α

Material used	ppm	Final pH	Activity Remaining
Nuchar 000	4000	4	4500
Nuchar 000 + H_2S	4000	4	1000
Ferrous ferrocyanide	450	3 - 8	600 - 700
Ferrous Sulfide	1600	4.5	4 - 600

Signed

Argonne Lab. Coagulation Experiments -
Test on dissolver solution (1000 c/m/ml) df ≅ 10-12
Tests on coagulation with Sr. gave about 20.
Lime, soda ash (Na_2CO_3), $FeCl_3$ ≅ 26%
Fullers earth, large sludge vol. In column, df = 14-60

See Page 25

Co-precipitation at Hanford - Pu worst ~~process~~ isotope to worry about.

Waste ~~Precipitant~~	Initial Pu (gm/yr)	% of total Pu
221 - 2nd Cycle	14.2	7.1
221-5-6	109	54.8
224	17.7	8.9
231	48.6	24.4

Waste	Scavenger	Res. Pu μg/cc	pH = 10
221 (2nd Cycle)	—	2.6×10^{-5}	~~Initial 5.2×10^{-3}~~
221-5-6	0		Final
224	10^{-2} M $S_2O_8^{=}$	1×10^{-4}	
231 Process	~~Pro~~ 10^{-3} M Fe	5×10^{-6}	
Lab	10^{-4} M Tannic acid	$< 5 \times 10^{-6}$	
234 Process	10^{-3} M Fe^{+++}	4×10^{-6}	
Lab	10^{-3} M Fe^{+++} or Cu^{++}	4×10^{-6}	

Process decreased 221-5-6 from 109 gms/yr to 0.8 gm/y

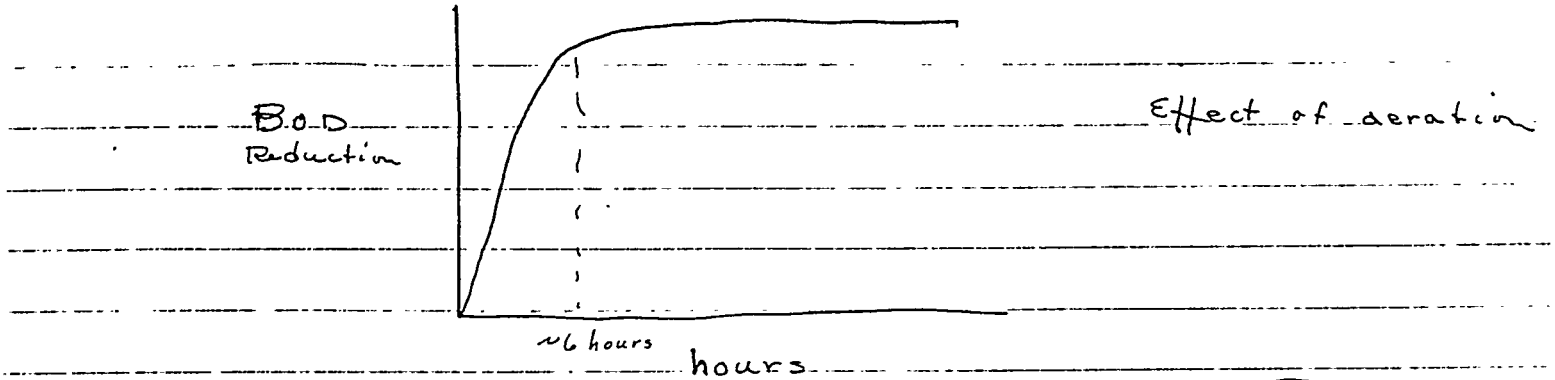
Signed

Rudcoff - Activated Sludge -

a biochemical oxydative ~~assyt~~ assymillation

$$\left.\begin{matrix} CHO \\ CHON \end{matrix}\right\} \longrightarrow \begin{matrix} NH_3 \rightarrow NO_2 \text{ or } NO_3 \\ H_2O \\ CO_2 \\ O \end{matrix}$$

Zooglea responsible. 1-2 μ in size but grow in colonies



COAGULATION AT ARGONNE ANL-4463

PROGRAM OF Waste Sampling - series of 6 samples, representing composites collected from drains. Flow, pH, T.S., and activity measured. Volume - 1000-1800 gal/day, pH = 2.6-6.. T.S. 268-420 ppm. 1 - 45x10^{-4} μc/l α, and 6-140x10^{-4} μc/l of β.

COAGULATION - Used Lab-drain waste spiked with month old dissolver solutio

Chemicals used were alum, activated silica, $FeCl_3$, NaOH, hydrated lime.

Doses of alum 0.5 - 5.5 gpg gave d.f. varying from 2-10

$FeCl_3$ 2.0 - 4.7 gpg df 4-12

Hydrated lime 3.0 - 9.5 gpg df 5-9

Initial count in waste 59-107 c/m/ml.

Attempt was made to adsorb remaining activity on fullers earth, added in doses from 600-1200 gpg. Addition made with other chemicals. D.F. improved from about 5 to 9 or 10 for the waste used. Highest factor obtained was 15, made on 12 liters of drain waste with 4 g/gal $FeCl_3$ and 10 gpg lime. Sludge vol was 200 ml.

Work thus far has demonstrated that about 90% of mixed f.p. can be removed by single stage treatment. Now planning to test columnwise use of adsorbents, and ion exchange resins.

Signed

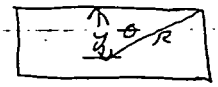
Standardization of Radiation Measurement - Present Status
Bureau of Standards - R. C. Peabody - Not present.

Analytical Techniques for α and β Radiation A. Stehney

Allowable conc. 10^{-7} μc/cc of either α or β.
Corresponds to ~ 200 d/m/liter
For α PC-2A 1-2 c/hr B.G. 50% geo
β End Window 20 c/m B.G. 20% geo
also PC-1 50 c/m B.G. 50% geo.

Determination of α - evaporation simplest. Problem of evaluation of counting rate arises. Must consider
(1) geometry (See T. B. Novey - Rev. Sci. Inst. April '50)

(2) Self absorption - Range for α (a) in air 4-6 cm
(b) in material of A.W. 40 - 6-7 mg/cm²
Fraction of α counted = $\frac{1}{2}(1 - \cos\theta_{max})$ where $\cos\theta_{max} = y/R$



If range of α is exceeded, counting rate in layer corresponding to range is ~ 1/4 disintegration rate.

Signed

Range is function of material and energy.

β analysis - (1) Geometry - Su Novey

With Ra DEF standard Ra D = ~ 25 KV β

E = 1.1 meV β

F = α

Count α at 50% and get dis. rate for sample.

Using equations $\frac{T_b}{T_s} = \sqrt{\frac{N_{bg}}{N_s + N_{bg}}}$

and error $y = K\left(\frac{N_{s+bg}}{T_{s+bg}} + \frac{N_{bg}}{T_{bg}}\right)^{1/2}$

For 100 d/m should count sample 7.5 min, bg 5 min on 50% geo. counter.

Hankford Water Monitor - Hesley - (0.5-2 μc/l)

Used to monitor pile effluent (Na^{24}, Mn^{55}, P). Final design used tank with circle of 3/16" tubes which allowed water to flow in circle around tube (glass GM tube.)

Sensitivity 300-400 c/m/μc/l.

Signed

K-25 instrument - Bill Fort -
Original reg. 10^{-5} μc/cc β (Sr^{90})

Argonne Program - no program to speak of. Evap. of 1 L to 100 ml., take 4 ml. aliquot.

Brookhaven - Cowen -
BNL Limits for Release of Dilute Liq Waste

3 month average 3×10^{-12} c/cc
max 3×10^{-11} c/cc
max/yr 1.5 curies

KAPL - Use commercially available counters -
Monitor & mostly.
Use emulsions for low level. Detect .02 c/m/hour
Emulsion AgBr, 50 μ thickness, (NRC-2). Give 1-2 wk. exposure.

L.A. ~~[illegible]~~

Signed

Standardization Of Radiation Measurement - Bob Buchanoff

B. of St. wants standard solution to be used by all installations. Standardization of instruments considered not too important, since many are comparable. Standard method of reporting data

① Permissible limits -

Chalk River Conference - (Get official limits)

0.3 r/wk, and 0.5 μgm Pu/life. Opinion of committee is that it should consider permissible discharge limits from site only, with no concern of dilution factor. Same difference of opinion expressed. Suggestion (Eister) was made that committee concern itself with monitoring streams with range between 40000 and 0.2 d/m/ml, and that effort of committee work to get necessary instrument to cover the range decided upon.

② Units of activity - μc/cc generally agreed on. If counts not convertible state reasons and qualifications.

Methods of counting - Nucleonics, Jan. 1950.

Run short adsorption coefficient, use eg. $\frac{N}{N_0} = e^{-mx}$ where m = slope

x = thickness

Correct for back scatter, abs. in window, size of sample

See MDOC ___. Counter calibrations in the H. I. methods Group.

③ Counter Equipment

a. Sensitivity - 10^{-8} μc/cc.

b. Limits of error - Recommend that confidence level be included

(4) Analysis - Precision Scientific Co. has evaporator, capacity 3 l., rate 12 L./hr.

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AERE – HP/M.3.

Proposed max. per. conc.

Isotope	water curies/cc	air curies/cc
Sr^{89}	10^{-11}	2×10^{-15}
Sr^{90}	3×10^{-14}	6×10^{-18}
Y^{91}	2×10^{-10}	1.4×10^{-15}
Zr^{95}	2×10^{-10}	1.1×10^{-15}
Ru^{103}	6×10^{-9}	2.5×10^{-14}
Ru^{106}	8×10^{-10}	10^{-15}
Te^{127}	1.3×10^{-9}	4×10^{-13}
Te^{129}	6×10^{-10}	1.8×10^{-13}
I^{131}	1.4×10^{-11}	4×10^{-15}
Cs^{137}	1.6×10^{-10}	5×10^{-14}
Ba^{140}	6×10^{-12}	2×10^{-15}
Ce^{144}	3×10^{-11}	1.1×10^{-16}
Pm^{147}	1×10^{-10}	4×10^{-16}

Signed

Date Jan 4, 1950

Summary of Activity Discharged to White Oak Creek - Taken from Operations Division Monthly Reports

Month	Curies Discharged	Flow (gal)	Remarks
Jan 1949	154.8 (Settling Basin)	10,482,000	
	0.6 (East Pond)	170,600	
	0.15 (Retention Pond)	477,400	
Feb 1949	154.59 (Settling Basin)	9,761,000	
	0.19 (Retention Pond)	480,200	
March 1949	107.86 (S.B)	9,080,000	During changes made in S.B.
	0.18 (R.P.)	464,000	waste was discharged through
	12.73 (W.P.)	2,980,000	W.P. for period of 9 days.
April 1949	146.96 (S.B)	12,403,000	
	0.17 (R.P.)	381,700	
May 1949	137.11 (S.B.)	16,409,000	
	0.48 (R.P.)	347,550	
June 1949	63.45 (S.B)	22,577,000	Evaporator put into service
	0.2 (R.P.)	274,000	First bottom June 2.
July 1949	50.43 (S.B.)	26,932,000	Gal. to evap 231,059 (151.5 curies)
	0.2 (R.P.)	380,900	Gal. concentrate to W-6 24,359
	0.175 from evaporator		
Aug. 1949	98.41 (S.B.)	28,773,000	Gal. to evap. 213,242 (730.34 curies)
	0.09 (R.P.)	287,680	Gal. concentrate to W-6 = 18,312
	38.53 from evap. to S.B.)		Increase in evap. condensate activity due to Radium Iodine discharged
Sept 1949	61.7 (S.B.)	23,412,000	
	0.06 (R.P.)	265,300	
	12.0 (evap to S.B.)		

Gal to evap. 258,170 (935.6 curies), Gal. concentrate to W-6 - 34,985

Water used to decontaminate cell A, Bldg 706-D was sent directly to S.B.

Oct. 1949	32.04 (S.B.)	29,049,000	
	2.78 (R.P.)	351,000	
	20.95 evap. to S.B.		

Gal. to evap - 245,140 (717.97 curies). Gal conc. to W-6, - 8,276.

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Date

Operations Data - Activity Discharged - Taken from [illegible] weekly reports

Jan '49 through May '50

Date	Settling Basin			Retention Pond		Evaporator				
49 Jan	Flow gal/1000	Approx c/m/ml	approx curies	discharge gal/1000	Approx curies	Feed	Concentrate	volumn reduction	curies In	curies out
1	276	1084	4.05	113.2	0.06					
2	268	741	2.68							
3	338	1186	5.41							
4	324	1112	4.86							
5	411	3084	17.11							
6	328	1185	5.25							
7	363	679	3.33							
8	268	490	1.77	161.5	0.6					
9	262	1176	4.16							
10	374	1194	6.02							
11	421	855	4.86							
12	417	1089	6.13							
13	328	2169	9.6							
14	311	2394	10.05							
15	302	1726	7.04	73.0	0.03					
16	276	919	3.42							
17	320	710	3.07							
18	302	823	3.36	East Pond						
19	302	1122	4.57	120.6	0.6					
20	346	858	4.01							
21	354	743	3.55							
22	346	598	2.79	113.6	0.03					
23	346	483	2.26							
24	415	538	3.27							
25	406	773	3.59							
26	432	784	4.57					Ave flow	338000 gal/day	
27	406	822	4.51					Ave curies/day = 4.98		
28	346	1520	7.1							
29	276	1305	4.86	112.0	0.03					
30	290	954	3.73							

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DATE FEB. 1949	SETTLING BASIN Flow gal/1000	c/m/ml	curies	RETENTION POND Flow gal/1000	curies
1	346	828	3.87		
2	363	1080	5.29		
3	328	1219	5.4		
4	354	918	4.39		
5	354	1040	4.97	131.1	0.02
6	294	951	3.77		
7	307	1173	4.86		
8	389	1688	8.86		
9	294	2909	11.55		
10	242	1867	6.1		
11	233	1563	4.92		
12	285	1326	5.1	110.2	0.025
13	320	1187	5.13		
14	346	982	4.25		
15	380	1369	7.02		
16	415	1012	5.67		
17	397	939	5.03		
18	380	799	4.1		
19	389	659	3.46	130.7	0.07
20	389	791	4.15		
21	449	770	4.67		
22	415	1104	6.19		
23	415	1473	8.25		
24	389	1052	5.52		
25	346	878	4.1		
26	285	976	3.76	127.2	0.07
27	294	902	3.58		
28	346	2169	10.13		
			154.59	ave c/day ≈ 5.52	

DATE MARCH 1949	SETTLING BASIN Flow gal/1000	c/m/ml	curies	Retention Pond Flow gal/1000	curies
1	455	~~70~~ 1546	8.66		
2	441	1098	6.54		
3	415	959	5.37		
4	397	678	3.63		
5	354	513	2.45	105.2	0.06
6	354	551	2.63		
7	380	759	3.89		
8	398	759	3.05		
9	215	768	2.23		
no discharge S.B. 3/10, 3/11, 3/12, 3/13, 3/14, 3/15					
~~10~~ West Pond Discharge					
8	185	1160	2.9		
~~11~~ 9	380	355	1.82		
10	380	154	.79		
~~12~~ 11	380	82	.42		
12	380	80	.41	84.65	0.03
13	380	43	.22		
14	380	782	4.0		
15	380	398	2.04		
16	380	78	.13		
16	111	1303	1.95		
17	380	1012	5.19		
18	380	918	4.71		
19	380	573	2.94	87.9	0.03
20	380	735	3.77		
21	380	651	3.34		
22	380	809	4.15	Total c for march ave. c/day	≈107.5 ≈3.4
23	380	679	3.48		
24	380	954	4.89		
25	380	950	4.89		
26	380	751	3.85	108.9	0.05
27	380	1052	5.4		
28	380	650	3.33		
29	380	1060	5.44		
30	380	813	4.13		

West Pond

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DATE APRIL 1949	SETTLING BASIN Flow gal/1000	c/m/ml	curies	RETENTION POND Flow gal/1000	curies
1	380	1827	9.37		
2	380	1065	5.46	133.4	0.04
3	380	733	3.76		
4	380	949	4.87		
5	380	921	4.72		
6	380	999	5.12		
7	380	1073	5.5		
8	380	750	3.85		
9	380	675	3.46	89.4	0.02
10	380	730	3.74		
11	380	661	3.39		
12	380	960	4.92		
13	380	1111	5.7		
14	380	1043	5.35		
15	380	1316	6.75		
16	380	1256	6.44	91.4	0.02
17	380	851	4.37		
18	380	1160	5.95		
19	380	975	5.0		
20	380	657	3.37		
21	475	540	3.46		
22	423	656	3.75		
23	406	883	4.84	94.7	0.09
24	406	1119	6.13		
25	458	954	5.9	Total c for April	= 146.96
26	475	609	3.9	Ave c/day for April	= 4.89
27	553	421	3.41		
28	562	437	3.32		
29	553	648	4.84		
30	492	801	5.32	79.0	0.03

DATE MAY 1949	SETTLING BASIN Flow gal/1000	c/m/ml	curies	RETENTION PO Flow gal/1000	curie:
1	406	687	3.77		
2	415	664	3.72		
3	518	701	4.9		
4	510	773	5.32		
5	467	770	4.85		
6	484	791	5.17		
7	544	704	5.17	96.3	0.02
8	527	469	3.34		
9	562	725	5.5		
10	562	807	6.12		
11	510	537	3.7		
12	527	524	3.73		
13	518	737	5.5		
14	475	676	4.33	92.4	0.02
15	510	449	3.09		
16	536	351	2.54		
17	501	2143	14.49		
18	536	1770	12.45		
19	544	841	6.18		
20	501	923	6.24		
21	605	619	5.06		
22	605	289	2.36		
23	570	328	2.52	Total c for May ave c/day	= 137. = 4.4
24	579	270	2.11		
25	631	178	1.52		
26	570	139	1.07		
27	622	374	3.14		
28	562	541	4.1	63.0	0.3
29	475	292	1.86		
Signed 30	484	171	1.12		

DATE	SETTLING BASIN			RETENTION POND		EVAPORATOR				
JUNE 1949	Flow gal/1000	c/m/ml	CURIES	Flow gal/1000	CURIES	Feed gal/100	concentrate to w.c. gal/1000	vol. reduction	Decontam. factor	
1	570	371	2.85							
2	596	416	3.35				First hot run made on			
3	622	450	3.71				evaporator.			
4	562	473	3.59	73.0	0.11					
5	613	388	3.21							
6	631	420	3.58							
7	648	397	3.47							
8	700	470	4.44							
9	804	445	4.83							
10	769	307	3.19							
11	864	269	3.14	53.9	0.05					
12	950	199	2.55							
13	959	144	1.86							
14	743	164	1.65							
15	700	187	1.77							
16	750	129	1.31							
17	812	84	0.92							
18	1045	78	0.82	64.7	0.06					
19	985	141	1.87							
20	947	137	1.57							
21	743	132	1.32							
22	717	100	0.97							
23	778	106	1.11							
24	804	89	0.97							
25	717	59	0.57	56.42	0.03	42.811	2.131	20:1	10^5	
26	717	77	0.75							
27	717	67	0.65							
28	804	80	0.87							
29	700	146	1.38							
30	708	114	1.1							

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DATE	SETTLING BASIN			RETENTION POND		EVAPORATOR					
JULY 1949	Flow gal/1000	c/m/ml	curies	Flow gal/1000	curies	FEED gal/1000	concentrate gal/1000	vol. reduction	Decontamination Factor		
1	717	87	0.84								
2	700	74	0.7	73.0	0.04	44.29	1.447	30.611	10^3		
3	726	75	0.74								
4	683	210	1.94								
5	743	673	6.75							foam were caused	
6	734	522	5.17							actively discharge	
7	726	299	2.93							to go up,	
8	752	215	2.18								
9	847	115	1.31	67.3	0.04	48.5	4.28	11.3	10^3		
10	829	98	1.1								
11	839	101	1.14								
12	855	107	1.24								
13	829	67	0.75								
14	942	195	2.48								
15	760	185	1.9								
16	648	180	1.57	119.7	0.11	51.84	4.04	11.8	$\beta = 750$ $\alpha, \gamma = \infty$	curies discharged 2.7	
17	657	102	0.90								
18	881	46	0.55								
19	821	115	1.27								
20	968	95	1.24								
21	985	80	1.06								
22	933	114	1.44								
23	959	103	1.33	101.5	0.04	62.04	8.47	6.3	680		
24	959	74	0.96								
25	938	65	0.74			Total curies for July			= 50.43		
26	916	70	0.87			Ave curies/day for July			= 1.626		
27	968	49	0.64								
28	976	93	1.23						curies In	Curies Out	Decontam Factor
29	994	117	1.57								
30	1028	72	1.0	79.8	0.02	68.7	7.56	8.45	151.5	0.179	846

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Date

DATE	SETTLING BASIN			RETENTION POND		EVAPORATOR					
AUGUST 1949	Flow gal/1000	c/m/ml	curies	Flow gal/1000	curies	Feed gal/1000	concentrate gal/1000	Volume Reduction	curies In	Curies Out	Decontamination Factor
1	1026	75 ~~200~~	1.04								
2	964	60 ~~75~~	0.78								
3	975	80 ~~60~~	1.06								
4	948	74 ~~80~~	0.95								
5	955	71 ~~74~~	0.91								
6	968	84	1.10	56.29	0.03	60.0	7.46	12.46	73.34	0.61	120.2 ~~[illegible]~~
7	959	68	0.88								
8	1002	65	0.88								
9	1158	96	1.5								
10	1175	63	1.0								
11	1149	46	0.71								
12	1037	105	1.47								
13	976	74	0.98	54.4	0.02	67.26	3.944	16	114.25	0.75	152
14	942	83	1.05								
15	847	58	0.66								
16	829	54	0.6								
17	955	43	0.5								
18	760	32	0.33								
19	855	39	0.45								
* 20	864	2473	28.84	60.7	0.03	45.22	2.375	18	246.52	23.63	I^{131} from R waste and feed. 10.43
21	864	1355	15.8								
22	890	622	7.47								
23	968	1040	13.59								
24	929	404	4.52								
25	821	280	3.1								
26	734	144	1.43								
27	812	115	1.26	74.9	0.02	40.75	4.53	10	296.23	13.544	21.87
28	855	68	0.78								
29	933	82	1.03								
30	968	141	1.84								

Total curies for August = 98.41

Ave curies/day for Aug = 3.174

Signed

Date

DATE	SETTLING BASIN			RETENTION POND		EVAPORATOR					
SEPT. 1949	Flow gal/1000	c/m/ml	curies	Flow gal/1000	curies	Feed gal/1000	concentrate gal/1000	Volume Reduction	curies In	Curies Out	Decontamination Factor
1	890	160	1.92								
2	786	90	0.95								
3	829	49	0.55	74.9	0.01	64.76	8.93	6.25	140.02	5.546	25.2
4	838	80	0.91								
5	795	60	0.64								
6	873	45	0.57								
7	1002	45	0.61								
8	976	46	~~2.12~~ 0.61								
9	864	182	2.12								
10	812	833	9.13	59.7	0.01	73.47	3.53	19.8	50.60	1.10	46.0
11	778	705	7.40								
12	881	699	8.31			High discharge due to washing Cell A					
13	933	540	6.80			of Bldg. 706-D. Washings sent directly to					
14	864	404	4.71			settling basin due to insufficient storage in					
15	855	278	3.21			tank farm. Vol. reduction in evaporator low					
16	760	180	1.85			due to high sp. feed.					
17	938	123	1.39	79.5	0.03	52.44	9.63	4.4	633.7	1.95	324.9
18	881	109	1.3								
19	786	64	0.7								
20	717	63	0.61								
21	622	52	0.44								
22	648	46	0.4								
23	742	48	0.49								
24	821	48	0.53	58.70	0.01	67.496	12.79	4.3	111.3	3.4	32.7
25	829	43	0.48								
26	864	48	0.56								
27	873	38	0.45								
28	976	57	0.75								
29	847	71	0.81								
30	907	42	0.51								

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Date Oct. 1949	Settling Basin Flow gal/1000	c/m/ml	curies	Retention Pond Flow gal/1000	curies	Evaporator Feed gal/1000	concentrate gal/1000	volume reduction	curies in	Curies out	Decontamination Factor
1	812	35	0.38	71.5	0.01	47.8	4.14	10.5	25.26	3.48	7.25
2	812	27	0.30								
3	855	46	0.53								
4	855	43	0.50								
5	873	38	0.45								
6	697	36	0.34								
7	739	31	0.31								
8	718	20	0.19	47.0	0.006	45.0	1.075	45.95	22.04	2.11	10.44
9	838	24	0.27								
10	924	40	0.50								
11	881	102	1.21								
12	855	227	2.62			Increase in activity discharged due					
13	821	245	2.72			primarily to I^{131} from Bata run					
14	743	182	1.83								
15	795	301	3.23	53.279	0.01	93.48	1.844	49.7	526.15	9.58	54.9
16	778	176	1.85								
17	855	217	2.50								
18	804	153	1.66								
19	950	104	1.33								
20	786	64	0.68								
21	795	42	0.45								
22	847	38	0.43	96.5	2.67	12.06	.350	33.5	95.44	4.46	21.39
23	734	37	0.37								
24	734	75	0.74			Total curies for Oct.			= 32.04		
25	855	59	0.68			Ave curies/day " "			= 1.03		
26	769	60	0.62								
27	804	32	0.35								
28	916	60	0.74								
29	907	57	0.70	82.8	0.09	46.8	.868	52.9	49.08	1.22	40.22
30	994	39	0.52								

Signed

Date

DATE Nov. '49	SETTLING BASIN Flow gal/1000	c/m/ml	curies	RETENTION POND Flow gal/1000	curies	EVAPORATOR Feed gal/1000	concentrate gal/1000	volume reduction	curies In	Curies Out	Decontamination Factor
1	959	50	0.65								
2	994	69	0.93								
3	981	58	0.69								
4	760	42	0.43								
5	881	62	0.74	141.8	0.05	84.0	1.7	48.4	53.14	3.68	14.44
6	921	48	0.53								
7	864	171	1.99								
8	899	80	0.97								
9	829	53	0.59								
10	804	30	0.32								
11	769	17	0.18								
12	804	23	0.25	77.1	0.01	54.4	1.2	44.2	20.8	1.63	12.76
13	786	39	0.41								
14	855	38	0.44								
15	752	30	0.30								
16	838	35	0.40								
17	795	25	0.27								
18	812	41	0.45								
19	726	30	0.29	49.0	0.01	80.24	2.79	27.7	80.87	0.106	762.9
20	778	53	0.56								
21	708	70	0.67								
22	778	30	0.32								
23	651	55	0.48								
24	596	157	1.26								
25	631	81	0.69								
26	562	82	0.62	61.9	0.07	37.44	2.457	14.2	1232	0.192 (Low)	6410
27	579	173	1.35								
28	605	246	2.00								
29	613	124	1.03								
30	613	98	0.81								

Waste from Rala run evaporated during this period. Decreased evaporation (200 gph) rates and concentration factor (10:1) resulted in low curie discharge

Rala waste

Signed

Date

Date Dec. 1949	Settling Basin Flow gal/1000	c/m/ml	curies	Retention Pond Flow gal/1000	curies	Evaporator Feed gal/1000	concentrate gal/1000	Vol. Reduction	Curie's In	Curie's Out	Decontamination Factor
1	648	50	0.44								
2	639	40	0.35								
3	544	33	0.24	87.8	0.22	51.0	8.3	5.1	570.88	2.59	220.4
4	510	26	0.18								
5	769	50	0.52								
6	804	56	0.61								
7	778	47	0.49								
8	734	41	0.41								
9	613	30	0.25								
10	570	32	0.22	59.6	0.03	50.19	7.51	5.7	168.78	0.94	179.5
11	536	13	0.09								
12	570	14	0.11								
13	726	23	0.23								
14	562	25	0.19								
15	605	28	0.23								
16	562	24	0.18								
17	570	26	0.20	142.2	0.19	55.27	6.96	8.9	103.19	0.34	303.5
18	596	24	0.19								
19	588	28	0.22								
20	648	20	0.17								
21	700	28	0.26								
22	795	23	0.25								
23	596	18	0.14								
24	648	19	0.17	147.5	0.09	51.68	8.075	6.4	106.87	0.32	333.9
25	570	30	0.23								
26	648	16	0.14		Total curies for Dec			= ~~31~~	7.97		
27	786	20	0.21		Ave	"/day	"	= ~~0.10~~	0.257		
28	778	35	0.38								
29	769	17	0.18								
30	760	25	0.26			Signed					

Date JAN 1950	Settling Basin Flow gal/1000	c/m/ml	curies	Retention Pond Flow gal/1000	curies	Evaporator Feed gal/1000	Concentrate gal/1000	Volume Reduction	curies In	Curies Out	Decontam Factor
1	717	15	0.15								
2	752	16	0.16								
3	812	17	0.19								
4	769	37	0.38								
5	743	28	0.28								
6	812	24	0.27								
7	726	26	0.26	141.1	0.89	41.91	1.67	24:1	233.45	0.323	723
		Total	1.69								
8	743	28	0.28								
9	769	41	0.43								
10	812	29	0.32								
11	821	22	0.24								
12	683	17	0.16								
13	700	21	0.20								
14	717	21	0.20	155.6	0.87	30.24	1.189	24.4:1	262.24	0.139	1.886
		Total	1.83								
15	726	25	0.25								
16	717	22	0.21								
17	683	33	0.30								
18	717	30	0.29								
19	726	66	0.65								
20	674	72	0.66								
21	605	48	0.39	129.4	0.04	46.25	1.636	27.2:1	490.59	0.255	1923
		Total =	2.75								
22	622	200	1.68								
23	665	210	1.89								
24	631	81	0.69								
25	579	49	0.38								
26	622	38	0.32								
27	684	41	0.38								
28	641	30	0.26	109.5	0.03	25.79	1.181	18.72:1	179.99	0.10	
		Total =	5.60								
29	637	20	0.17								
30	793	15	0.16								
31	743	53	0.53								

Evaporation rate was dropped to 200 gal/hr. due to presence of iodine from Ra La run in the waste.

Low rate of evaporation due to iodine

Rate reduced due to I^{131}

High c/m/ml on 22nd and 23rd believed to be due to hot waste being poured into process line after hot drain from 706A was taken from service due to plugging.

Signed

Date

~~Date~~	DATE FEB. 1950	SETTLING BASIN Flow gal/1000	c/m/ml	curies	RETENTION POND Flow gal/1000	curies	EVAPORATOR Feed gal/1000	conc. gal/1000	Volume Reduction	curies In	curies Out	Decontam Factor
	1	700	16	0.15								
	2	687	47	0.42								
	3	622	67	0.57								
	4	657	56	0.50	180.6	0.05	49.34	2.188	21.5:1	728.2	0.335	2173
			Total	3.5								
	5	700	126	1.19								
	6	726	95	0.93								
	7	683	113	1.04								
	8	501	118	0.80								
	9	622	65	0.55								
	10	596	37	0.30								
	11	544	43	0.32	160.0	0.04	58.85	2.116	26.8:1	408.44	0.219	1865
			Total	5.13								
	12	536	33	0.24								
	13	631	27	0.23								
	14	752	38	0.39								
	15	674	30	0.27								
	16	683	16	0.15								
	17	691	21	0.20								
	18	639	18	0.16	113.0	0.03	78.66	4.32	17.2:1	1104.5	262	4222
			Total	1.64								
	19	700	16	0.15								
	20	778	18	0.19								
	21	691	23	0.21								
	22	769	31	0.32								
	23	700	33	0.31								
	24	674	33	0.30								
	25	726	42	0.41	113.3	0.06	59.9	9.09	5.59:1	464.28	0.231	2099
			Total	1.89								
	26	726	31	0.30								
	27	795	22	0.24								
	28	795	17	0.18								

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Date March 1950	Settling Basin Flow gal/1000	c/m/ml	curies	Retention Pond Flow gal/1000	curies	Evaporator Feed gal/1000	concentr. gal/1000	Volume Reduction	curies In	Curies Out	Deconta Factor
1	804	21	0.23								
2	769	25	0.26								
3	743	17	0.17								
4	691	13	0.12	88.2	0.01	60.60	6.48	8.3:1	97.35	0.133	
5	752	16	0.16								
6	691	22	0.21								
7	743	14	0.14								
8	734	9	0.09								
9	700	16	0.15								
10	752	24	0.24								
11	712	18	0.18	89.2	0.02	58.01	6.52	8.9:1	77.44	0.025	3,061
12	795	12	0.13								
13	752	12	0.12								
14	708	13	0.12								
15	734	20	0.20								
16	734	28	0.28								
17	700	37	0.35								
18	691	16	0.15	124.1	0.2	37.007	5.708	5.5:1	236.38	0.124	1901
19	674	11	0.10								
20	691	14	0.13								
21	726	13	0.13								
22	700	13	0.12								
23	657	28	0.25								
24	691	54	0.50								
25	683	54	0.50	96.0	0.09	43.07	5.43	6.9:1	508.39	0.166	3,063
26	731	48	0.47								
27	839	46	0.52								
28	867	33	0.39								
29	890	27	0.32								
30	864	38	0.44								
31	907	57	0.70								

Signed

Date

DATE APRIL 1950	SETTLING BASIN Flow gal/1000	c/m/ml	curies	Retention Pond Flow gal/1000	curies	EVAPORATOR Feed gal/1000	concent. gal/1000	volume Reduction	curies In	Curies Out	Deconta Factor
1	847	35	0.40			61.5	5.4	10.4:1	194.74	0.551	353
2	916	24	.30								
3	786	17	.18								
4	726	15	.15								
5	631	57	.49								
6	536	80	.58								
7	510	50	.34								
8	484	30	.20	94.7	0.05	40.3	7.7	4.2:1	119.87	0.035	3430
9	510	22	.15								
10	562	19	.40								
11	579	23	.18								
12	579	31	.24								
13	553	33	.25								
14	570	71	.55								
15	604	54	.44	67.6	0.07	37.96	3.26	10.6:1	615.9	0.912	615
16	588	50	0.40								
17	544	39	0.29								
18	579	96	.75								
19	631	81	.69								
20	596	107	.86								
21	544	88	.65								
22	510	54	.37	85.1	0.03	34.4	5.95	4.8:1	1077.8	1.20	898
23	570	41	0.32								
24	562	33	0.25								
25	562	25	0.19								
26	648	38	0.33								
27	570	53	0.41								
28	581	54	037								
29	510	39	0.27			32.5	8.5	2.8:1	169.5	0.19	897
30						Signed					

DATE MAY 1950	SETTLING BASIN Flow gal/1000	c/m/ml	curies	RETENTION POND Flow gal/1000	curies	EVAPORATOR Feed gal/1000	concent. gal/1000	Volume Reduction	curies In	Curies Out	Decontamination Factor.
1											
2											
3											
4											
5											
6											
7	578	30	.21								
8	518	30	.21								
9	605	25	.20								
10	615	18	.15								
11	613	18	.15								
12	855	23	.22								
13	619	11	.10			45.6	2.3	18.7:1	98.5	0.06	1654
14	829	10	0.11								
15	864	8	0.09								
16	812	16	.18								
17	657	12	.11								
18	726	14	.14								
19	760	29	.30								
20	700	43	.41			43.7	3.49	11.5:1	6457.9	0.73	8814
21	752	85	0.86	~~38.6~~							
22	855	486	5.61								
23	726	433	4.21								
24	812	310	3.40								
25	829	260	2.91								
26	890	157	1.89								
27	916	175	2.16	38.6	0.009	32.5	6.65	3.9:1	111.57	0.08	1349
28											
29											
30											

Pile canal suspected of being source of activity

Signed