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Series

RADIOACTIVE CONTAMINATION IN LIQUID WASTES
DISCHARGED TO GROUND AT SEPARATIONS FACILITIES
THROUGH DECEMBER 1961

by

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INTRODUCTION

This document summarizes the amounts of radioactive contamination discharged to ground from separations facilities through December 1961. Detailed data for individual disposal sites are presented on a month-to-month basis for the period of July through December 1961. Previous publications of this series are listed in the bibliography and may be referred to for specific information on measurements and radioactivity totals prior to December 1961.

Tables I and II list the major disposal sites in the separation facilities, total volume of waste discharged to each location, and the gross amounts of plutonium and beta particle emitters discharged to ground since startup. Tables III through XXIII present this same data on a monthly basis for cribs still in use, and also include information on the source of the waste stream and the settling facility if used.

Isotopic data are included for disposal sites from which the waste was analyzed for specific contaminants. Estimates of contamination and volumes discharged to swamps are also included in Tables XXIV and XXV.

ABSTRACTSwamps

Open disposal sites at the separation areas have received approximately 1.05×10^{11} * liters since startup. Approximately 5700 curies of fission products and 730 grams of plutonium were contained in this waste.

Other Disposal Sites

Exclusive of large volume open waste disposal sites, the estimated volume of waste discharged to ground since startup was 2.010×10^{10} liters. Included in this is over 2.5×10^6 curies of fission products and 60 kilograms of plutonium.

* Total volume and total curies corrected from original records.

TABLE I

SUMMARY OF RADIOACTIVE WASTES DISCHARGED
TO MAJOR DISPOSAL SITES IN THE 200 EAST AREA THROUGH DECEMBER 1961

Disposal Facility	Volume in Liters (n x 10 ⁶ L)	Plutonium in Grams	Beta Particle Emitters in Curies
<u>"A" Facility</u>			
216-A-2-Crib(Abnd)	0.23	127	587
216-A-3-Crib	1.8	--	479
216-A-4-Crib	6.2	140	267
216-A-5-Crib	1800	63	3,400
216-A-6-Crib	2800	21	3,986
216-A-7-Crib	--	--	17
216-A-8-Crib(a)	1030	49	10,300
216-A-9-Crib	1300	--	54
216-A-10-Crib	250	--	114
216-A-21-Crib	32	22	949
216-A-24-Crib	720	1	4,299
216-A-28-Crib	--	--	31
216-A-30-Crib	318	2	2,123
<u>"B" Facility</u>			
5 and 6 Cribs(b)	40	170	7,800
216-BC Cribs	40	50	319,000
216-BC Trenches	80	63	601,000
216-BX Trenches	15	6	15,800
216-BY Cribs	34	61	409,000
216-ER Cribs	370	367	2,570
241-B-1 and 2 Cribs	45	4260	5,350
241-B-3 Crib	27	29	710
241-B-361 Rev. Well	30	4280	3,810
242-B-1 and 2 Cribs	30	4	39
<u>"C" Facility</u>			
216-C-1 Crib	32	8	11,400
216-C-4 Crib	0.05	1	122
216-C-5 Crib	0.08	--	94
216-C-6 Crib	0.20	--	32
200 East Area (Excluding Swamps)	9000.0	9724	1,403,066

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TABLE II

SUMMARY OF RADIOACTIVE WASTES DISCHARGED
TO MAJOR DISPOSAL SITES IN THE 200 WEST AREA THROUGH DECEMBER 1961

Disposal Facility	Volume in Liters (n x 10 ⁶ L)	Plutonium in Grams	Beta Particle Emitters in Curies
<u>"S" Facility</u>			
216-S-1 and 2 Cribs	152	1,180	753,000
216-S-3 Crib	4.2	0.4	267
216-S-5 Crib	4,060	582	960
216-S-6 Crib	2,975	448	1,282
216-S-7 Crib	243	406	268,256
216-SL-1 and 2 Cribs	104	162	3,820
216-SX-1 Crib	38	2	156
276-S Crib	3.5	6	22
<u>"T" Facility</u>			
216-TY-3 Crib	3.1	9	247
216-TC-1 Crib	11	59	28,800
216-TX-3 Crib	1	4	44
241-T-1 and 2 Cribs	29	3,720	1,500
241-T-3 Crib	107	131	3,090
241-T Trenches	7	178	3,430
241-T-17 Cribs(a)	1	1	840
T-361-A Reverse Well	11	3,350	2,800
241-TX Trenches	8	7	33,500
241-TX-153 Crib	46	14	2,040
361-T-1 and 2 Cribs	45	392	17,800
<u>"U" Facility</u>			
216-U-1 and 2 Cribs	2	4	235
216-U-3 Crib	1	0.04	0.42
216-U-8 Crib	375	367	2,686
216-U-12 Crib	23	--	61
222-U Drywells	2,435	0.6	0.8
361-WR Cribs	9	38	947
<u>"Z" Facility</u>			
216-Z-3 Crib	206	5,698	--
216-Z-8 Crib	0.01	48	--

(Cont'd)

TABLE II (Continued)

Disposal Facility	Volume in Liters (n x 10 ⁶ L)	Plutonium in Grams	Beta Particle Emitters in Curies
216-Z-9 Crib	3.8	25,067	--
216-Z-12 Crib	125	7,396	--
231-W Trench	42	479	--
231-1 and 2 Cribs	31	340	--
231-W-150 Reverse Well	1	50	--
200 West Area	11,103	50,138	1,125,800

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TABLE III

Disposal Site: 216-A-3 Crib

Waste Stream: Silica gel waste for 203-A from March 1952 to date

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	0.0288	52.8	--	2.7
August	0.0096	111.6	--	2.2
September	0.0096	39.6	--	--
October	0.0096	149.6	--	0.02
November	0.0074	24.2	--	--
December	0.0032	59.4	--	--
6-Month Total	0.068	442.0	--	4.92
Previous Total	1.709	1091	--	474.17
Total to Date	1.777	1533	--	479.09

TABLE IV

Disposal Site: 216-A-5 Crib

Waste Stream: Process condensate from 202-A from November 1955 to date

Period	Volume ($n \times 10^6$ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	31.4	6.6	--	5.9
August	10.3	7.3	--	20.6
September	8.13	4.4	1.0	92.4
October	6.4	8.8	3.0	219.0
November	--	--	--	--
December	--	--	--	--
6-Month Total	56.23	27.1	4.0	337.9
Previous Total	1737.34	234.0	59.01	3066.6
Total to Date	1793.6	261	63.01	3404.5

TABLE V

Disposal Site: 216-A-10 Crib

Waste Stream: Condensate from F Cell Fractionator

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July 1961	--	--	--	--
August	--	--	--	--
September	--	--	--	--
October	--	--	--	--
November	4.7	--	--	40.8
December	11.41	2.2	--	73.6
6-Month Total	16.11	2.2	--	114.4
Previous Total	234.0	--	--	--
Total to Date	250.11	2.2	--	114.4

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TABLE VI

Disposal Site: 216-A-21 Crib

Waste Stream: I^{131} caustic scrubbing waste from October 1957 to date

Period	Volume ($n \times 10^6$ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	1.25	4.4	1.0	3.4
August	0.36	4.2	0.8	48.9
September	0.285	6.6	--	3.1
October	0.224	4.4	--	1.2
November	0.661	4.4	--	14.5
December	0.333	--	--	1.7
6-Month Total	3.113	24.0	1.8	72.8
Previous Total	28.828	28.4	20.3	875.86
Total to Date	31.941	52.4	22.1	948.66

TABLE VII

Disposal Site: 216-A-24 Crib

Waste Stream: Tank farm condensate and cooling water from May 19, 1958, to date

Period	Volume ($n \times 10^6$ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	1.93	--	--	37.0
August	0.15	--	--	22.6
September	0.678	--	--	12.0
October	0.451	--	--	4.9
November	0.289	--	--	--
December	0.475	--	--	2.1
6-Month Total	3.97	--	--	78.6
Previous Total	719.59	49.4	< 1.32	4220.1
Total to Date	723.56	49.4	< 1.32	4298.7

TABLE VIII

Disposal Site: 216-A-30 Crib

Waste Stream: Coil and jacket steam condensate from 202-A from January 1961
to date

Period	Volume ($n \times 10^6$ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	40.1	--	--	24.0
August	10.5	--	--	12.3
September	10.1	--	--	3.0
October	8.17	--	--	5.4
November	8.15	--	--	15.7
December	14.03	--	--	95.6
6-Month Total	91.05	--	--	156.0
Previous Total	227.21	2.3	2.0	1967.3
Total to Date	318.26	2.3	2.0	2123.3

TABLE IX

Disposal Site: 216-S-6 Crib

Waste Stream: 202-S process vessel cooling water since October 1954

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units of Curies Beta Particle Emitters
July, 1961	4.580	0.088	0.022	27.104
August	43.906	0.311	0.027	5.290
September	12.869	11.282	0.006	1.163
October	13.626	1.636	0.004	0.245
November	17.032	0.798	0.025	1.094
December	14.383	0.225	< 0.008	1.474
6-Month Total	106.4	14.34	0.090	36.37
Previous Total	2868.3	62.42	448.27	1245.19
Total to Date	2974.7	76.76	448.36	1281.56

TABLE X

Disposal Site: 216-S-7 Crib

Waste Stream: D-1 and D-2 wastes from January 12, 1956, to date

Period	Volume (n x 10 ³ L)	Uranium (kilograms)	Plutonium (grams)	Units of Curies Beta Particle Emitters
July, 1961	3.164	0.950	1.421	208.972
August	2.892	1.354	0.007	265.880
September	1.920	0.006	0.375	280.514
October	3.144	1.435	0.307	204.311
November	2.683	1.418	0.659	260.182
December	1.950	2.577	0.567	128.827
6-Month Total	15.75	7.74	3.34	1,348.686
Previous Total	226.9	2585.13	402.16	266,907.591
Total to Date	242.6	2592.87	405.50	268,256.277

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TABLE XI

Disposal Site: 216-SL-1 and 2 Crib

Waste Stream: 300 Area works laboratory since July 1953 (340 waste tanks)

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	1.154	2.98	0.008	0.024
August	1.287	20.84	0.084	0.039
September	0.719	74.42	0.258	0.107
October	0.927	113.60	0.380	0.146
November	1.514	363.58	1.204	0.324
December	0.984	266.0	--	0.762
6-Month Total	6.585	841.24	1.934	1.402
Previous Total	36.148	--	88.743	3332.9
Total to Date	42.733	841.24	90.68	3334.3

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Disposal Site: 216-SL-1 and 2 Crib:

Waste Stream: 300 Area works laboratory since July 1953 (340 waste tanks)

Period	Volume ($n \times 10^6$ L)	Uranium (Kilograms)	Plutonium (grams)	Beta Particle Emitters Units in Curies
July, 1961	1.154		0.008	24
August	1.287		0.084	39
September	0.719		0.258	107
October	0.927		0.380	146
November	1.514		1.204	324
December	0.984		0.889	762
6-Month Total	6.585		2.823	1402
Previous Total	36.148		88.743	3564.7
Total to Date	42.733		91.59	4966.7

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TABLE XIII

Disposal Site: 216-SL-1 and 2 Cribs

Waste Stream: Summary of 300 Area Works Lab., 222-S, and 207-SL Basin

Period	Volume (n x 10 ⁶ L)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	1.168	0.008	0.065
August	1.304	0.195	0.135
September	0.719	0.258	0.107
October	0.956	0.876	0.177
November	1.514	1.204	0.324
December	0.997	0.102	0.808
6-Month Total	6.658	2.645	1.616
Previous Total	97.822	159.168	3818.484
Total to Date	104.48	161.81	3820.1

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TABLE XIV

Disposal Site: 216-SL-1 and 2 Cribs

Waste Stream: Summary of 300 Area Works Laboratory, 222-S, and 207-SL Basin*

Period	Volume (n x 10 ⁶ L)	Plutonium (grams)	Beta Particle Emitters Units in Curies
July, 1961	1.168	0.008	24.041
August	1.304	0.195	39.096
September	0.719	0.258	107
October	0.956	0.368	146.031
November	1.514	1.204	324
December	0.997	0.991	762.046
6-Month Total	6.658	3.524	1402.214
Previous Total	97.822	159.168	3818.79
Total to Date	104.48	162.69	5,221

* 207-SL basin is inactive. In the past a total of 54.2×10^6 liters of waste, containing 9.15 grams of plutonium and 6.6 curies of beta particle emitters were discharged from 207-SL basin to 216-SL-1 and 2 cribs. Thus these totals are included in the grand totals to date from 216-SL-1 and 2.

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TABLE XV

Disposal Site: 276-S Crib

Waste Stream: 0-2 aqueous from 276-S building since February 1961

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	--	--	--	--
August	0.002	--	0.012	--
September	--	--	--	--
October	0.002	--	0.004	--
November	0.002	--	--	0.013
December	0.002	--	--	0.013
6-Month Total	0.008	--	0.016	0.026
Previous Total	3.452	0.025	6.167	21.493
Total to Date	3.46	0.025	6.183	21.519

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TABLE XVI

Disposal Site: 216-TY-3 Crib

Waste Stream: 221-T waste handling and decontamination operation since February 1960

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	0.155	4.040	0.174	5.594
August	0.220	2.429	2.902	13.188
September	0.204	3.925	< 0.242	2.750
October	0.170	1.045	0.103	76.944
November	0.292	2.225	0.216	13.514
December	0.306	1.736	0.237	9.169
6-Month Total	1.347	15.400	3.874	121.159
Previous Total	1.736	29.279	5.121	125.588
Total to Date	3.083	44.679	8.995	246.747

TABLE XVII

Disposal Site: 216-U-12 Crib

Waste Stream: 224-U concentrator condensate - April 1960 to date

Period	Volume ($n \times 10^6$ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	1.114	103.62	--	0.04
August	1.262	124.74	--	0.02
September	1.009	38.06	--	0.03
October	1.235	129.80	--	0.02
November	1.450	118.8	--	0.04
December	1.320	169.4	--	0.03
6-Month Total	7.390	684.42	--	0.18
Previous Total	15.928	366.634	--	60.544
Total to Date	23.318	1051.05	--	60.724

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TABLE XVIII

Disposal Site: 222-U Drywells

Waste Stream: 222-U laboratory waste

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	--	--	--	--
August	--	--	--	--
September	--	--	--	--
October	--	--	--	--
November	--	--	--	--
December	--	--	--	--
6-Month Total	--	--	--	--
Previous Total	2434.8	8860.0	0.631	0.791
Total to Date	2434.8	8860.0	0.631	0.791

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TABLE XIX

Disposal Site: 216-U-1 and 2 Cribs

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters
July, 1961	--	--	--	--
August	--	--	--	--
September	--	--	--	--
October	--	--	--	--
November	--	--	--	--
December	--	--	--	--
6-Month Total	--	--	--	--
Previous Total	1.79	200.6	4.17	235.0
Total to Date	1.79	200.6	4.17	235.0

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TABLE XX

Disposal Site: 216-Z-8 Crib

Waste Stream: Recouplex slug slurry since July 1955

Period	Volume (liters)	Plutonium (grams)
July, 1961	--	--
August	--	--
September	200	0.872
October	--	--
November	--	--
December	--	--
6-Month Total	200	0.872
Previous Total	9390	47.366
Total to Date	9590 ✓	48.238

TABLE XXI

Disposal Site: 216-Z-9 Crib

Waste Stream: Recouplex silica supernatant overflow since October 1957

Period	Volume ($n \times 10^6$ L)	Plutonium (grams)
July, 1961	0.055	495.0
August	0.069	586.0
September	0.060	462.0
October	0.063	540.0
November	0.054	748.0
December	0.065	781.0
6-Month Total	0.366	3,612.0
Previous Total	3.474	21,455.0
Total to Date	3.840	25,067.0

TABLE XXII

Disposal Site: 216-Z-12 Crib

Waste Stream: Analytical laboratory wastes, development laboratory wastes and
process wastes from March 11, 1959, to date

Period	Volume ($n \times 10^6$ L)	Plutonium (grams)
July, 1961	2.566	443.0
August	3.449	238.0
September	3.778	121.0
October	3.578	86.0
November	2.698	851.0
December	3.678	366.0
6-Month Total	19.743	2105.0
Previous Total	104.871	5270.9
Total to Date	124.614	7395.9

LARGE VOLUME WASTES TO OPEN DISPOSAL SITES

In addition to the radioactive waste discharged to the ground, large quantities of relatively uncontaminated water from the separations process were discharged to the open storage area in and near to the separations facilities. Periodic difficulties allowed trace quantities of radioactive material to enter these streams and thus cause these locations to become disposal sites for radioactive waste.

Prior to this publication, estimates of volume and radioactivity were reported in documents HW-63646, HW-64375, HW-69071, and HW-71971. Subsequent volume data were obtained from the process and operating groups.

Monthly samples were collected by the Environmental Monitoring Operation and analyzed for the activity density of gross alpha and gross beta particle emitters. Estimates of the total activity discharged to these sites were calculated by the Radiological Chemical Analysis Operation when not supplied by the operating groups. Large fluctuation in volume and low sampling frequency necessitates re-emphasizing that the curie and gram value should be regarded as estimates only.

TABLE XXIII

SWAMPS CURRENTLY IN USE
JULY-DECEMBER 1961

Disposal Site	Volume (liters)		Plutonium (grams)		Beta Particle Emitters (curies)	
	July-Dec.	Total to Date	July-Dec.	Total to Date	July-Dec.	Total to Date
"B" Swamp*	1.55×10^9	^{5.14} 1.52 $\times 10^{10}$	6.1	147.2	94	968.64
"U" Swamp	6.58×10^8	4.63×10^{10}	--	145	18	626
202-S Swamp Number 2	1.73×10^9	1.13×10^{10}	< 1.6	285	< 0.5	677
222-S Swamp	1.36×10^7	2.15×10^8	--	18	< 0.03	11
Gable Mt. Swamp	5.43×10^9	3.20×10^{10}	21	134.9	804	2257.06
Totals to Date		¹⁴¹ 1.05×10^{11}		730.1		4539.7

*Total volume and total curies corrected from all records.

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TABLE XXIV

SWAMPS NO LONGER IN USE
JULY-DECEMBER 1961

Disposal Site	Volume (liters)	Plutonium (grams)	Beta Particle Emitters (curies)
202-S-1	6,350	3	1050
"T" Swamp	31,000	0.01	111
Totals	37,350	3.01	1161

UNCLASSIFIED

HW-72956

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