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RADIOACTIVE CONTAMINATION IN LIQUID WASTES DISCHARGED TO
GROUND AT THE SEPARATIONS FACILITIES THROUGH DECEMBER 1962

AUTHOR

G. E. Backman

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March 12, 1963

RADIOACTIVE CONTAMINATION IN LIQUID WASTES

DISCHARGED TO GROUND AT SEPARATIONS FACILITIES

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THROUGH DECEMBER 1962

DATE 9/9/71

by

FOR THE ATOMIC ENERGY COMM.

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INTRODUCTION

This document summarizes the amounts of radioactive contamination discharged to ground from separations facilities through December 1962. Detailed data for individual disposal sites are presented on a month-to-month basis for the period of January through December 1962. 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 1962.

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 XXI 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 XXII and XXIII.

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ABSTRACT

SWAMPS

Open disposal sites at the separation areas have received approximately 2.00×10^{11} liters since startup. Approximately 7500 curies of fission products and 780 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 1.98×10^{10} liters. Included in this is over 2.6×10^6 curies of fission products and 65 kilograms of plutonium.

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TABLE I

SUMMARY OF RADIOACTIVE WASTES DISCHARGED
TO MAJOR DISPOSAL SITES IN 200 EAST AREA THROUGH 1962

<u>Disposal Facility</u>	<u>Volume In Liters ($n \times 10^6$)</u>	<u>Plutonium In Grams</u>	<u>Beta Particles Emitters In Curies</u>
"A" Facility			
216-A-2-Crib (Abandoned)	< 1	127	590
216-A-3-Crib	2.0	0.2	480
216-A-4-Crib	6.2	140	270
216-A-5-Crib	1,800	63	3,400
216-A-6-Crib	2,800	21	4,000
216-A-7-Crib	-	-	17
216-A-8-Crib	1,000	49	10,000
216-A-9-Crib	1,300	-	54
216-A-10-Crib	640	71	56,000
216-A-21-Crib	52	27	1,200
216-A-24-Crib	740	-	4,400
216-A-28-Crib	-	-	31
216-A-30-Crib	810	42	3,700
216-A-31-Crib	-	-	-
"B" Facility			
5 and 6 Cribs	40	170	7,800
216-BC-Cribs	40	50	320,000
216-BC-Trenches	80	63	600,000
216-BX-Trenches	15	6	16,000
216-BY-Cribs	34	61	410,000
216-ER-Cribs	370	367	2,600
241-B-1 and 2 Cribs	45	4,260	5,400
241-B-3-Crib	27	29	710
241-361 Reverse Well	30	4,280	3,800
242-B-1 and 2 Cribs	30	4	39
"C" Facility			
216-C-1-Crib	32	8	11,000
216-C-4-Crib	< 1	1	120
216-C-5-Crib	< 1	-	94
216-C-6-Crib	< 1	0.05	140
200 East Area Excluding Swamps	9,900	9,840	1,460,000

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TABLE II

SUMMARY OF RADIOACTIVE WASTES DISCHARGED
TO MAJOR DISPOSAL SITES IN THE 200 WEST AREA THROUGH 1962

<u>Disposal Facility</u>	<u>Volume In Liters (n x 10⁶l)</u>	<u>Plutonium In Grams</u>	<u>Beta Particles Emitters In Curies</u>
"S" Facility			
216-S-1 and 2 Cribs	150	1,180	750,000
216-S-3-Crib	4.0	0.4	270
216-S-5-Crib	4,100	582	960
216-S-6-Crib	3,200	450	1,500
216-S-7-Crib	280	119	270,000
216-SL-1 and 2 Cribs	127	167	6,300
216-SX-1 Crib	42	2	170
276-S-Crib	4.0	6	24
"T" Facility			
216-TY-3-Crib	67	20	2,200
216-TC-1-Crib	11	59	29,000
216-TX-3-Crib	1	4	44
241-T-1 and 2 Cribs	29	3,720	1,500
241-T-3 Crib	110	131	3,100
241-T-Trenches	7	178	3,400
241-T-17 Crib	1	1	840
T-361-A-Reverse Well	11	3,350	2,800
241-TX-Trenches	8	7	34,000
241-TX-153 Crib	46	14	2,000
361-T-1 and 2 Cribs	45	392	18,000
"U" Facility			
216-U-1 and 2 Cribs	2	4	240
216-U-3-Crib	1	0.04	< 1
216-U-8-Crib	380	367	2,700
216-U-12-Crib	37	-	66
222-U-Dry Wells	-	0.6	1
361-WR-Crib	9	38	950
"Z" Facility			
216-Z-3-Crib	206	5,698	
216-Z-8-Crib	0.01	48	
216-Z-9-Crib	4	27,511	
216-Z-12-Crib	149	10,241	
231-W-Trench	42	479	
231-1 and 2 Cribs	31	340	
231-W-150 Reverse Well	1	50	
200 West Area Excluding Swamps	9,000	55,159	2,160,000 1,130,066

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TABLE III

Basal 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	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	0.036	19.2	0.17	< 1			
February	0.024	11.4					
March	0.024	10.2					
April	0.012	2.3					
May	0.036	11.3					
June	0.030	15.0					
July	-	-					
August	-	-					
September	-	-					
October	-	-					
November	-	-					
December	-	-					
12-Month Total	0.16	70	0.17	< 1	< 1	< 1	< 1
Previous Total	1.78	1182	-	480	< 1	< 1	< 1
Total to Date	1.94	1252	0.17	480	< 1	< 1	< 1

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TABLE IV

Disposal Site: 216-A-5 Crib

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

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962							
February							
March							
April							
May							
June							
July							
August							
September							
October							
November							
December							
12-Month Total	-	-	-	-	-	-	-
Previous Total	1800	240	63.01	3400	-	4	4
Total to Date	1800	240	63.01	3400		4	4

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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	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	20	2.4	11.2	95			
February	9	5.9		4			
March	21	1.4		11			
April	23	3.6		15			
May	40	3.2		150			
June	37	3.6		620			
July	51	6.8	2	410			
August	15		18	550			
September	35	1.4	6	210			
October	47	7.7	1	270			
November	41	9.5	3	25,000			
December	53	10	30	28,000			
12-Month Total	392	55.5	71.2	56,000	102	86	4
Previous Total	250	0.5	-	110	-	-	-
Total to Date	642	56	71.2	56,110 56,100	102	86	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 x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	0.89	1.8		-			
February	0.35	0.9		3.0			
March	0.61	0.9		2.6			
April	0.73	4.1		8.9			
May	1.2	7.7	1	70			
June	1.1	-		24			
July	1.7	2.7		26			
August	0.83	30	4	26			
September	6.6	2.3		27			
October	1.8	0.5		15			
November	1.9	0.9		38			
December	1.9	-		29			
12-Month Total	19.5	52	5	270		0.4	39
Previous Total	31.9	33	22.1	949		-	-
Total to Date	51	85	27.1	1220		0.4	39

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TABLE VII

Disposal Site: 2J6-A-24 Crib

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

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	2.7	0.01		23			
February	1.9			6			
March	1.8			4			
April	1.9			3			
May	1.5			3			
June	1.6			7			
July	1.6			9			
August	1.4			9			
September	1.1			9			
October	1.2			8			
November	1.0			8			
December	1.7			11			
12-Month Total	19	0.01	< 1	113	-	0.2	118
Previous Total	724	49	< 1	4300	-	5	300
Total to Date	743	49	< 1	4420		5.2	418

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TABLE VIII

Disposal Site: 216-A-30 Crib

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

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	34	0.6	11	59			
February	25	-		3			
March	33	5.0		223			
April	39	2.7		96			
May	56	0.9	27	47			
June	49	-		38			
July	51	-		10			
August	25	0.9	2	5			
September	33	-		32			
October	47	-		8			
November	43	-		8			
December	49	-		11			
12-Month Total	489	10.1	40	540		1.3	46
Previous Total	313	2.9	2	2120		16.2	11
Total to Date	810	13	42	2660		17.5	57

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TABLE IX

Disposal Site: 216-C-4 and 216-C-6 Cribs

Waste Stream: Hot Semiworks crib wastes

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962							
February							
March							
April							
May							
June							
July							
August							
September							
October							
November							
December							
12-Month Total	0.105	-	-	111	-	9.8	-
Previous Total	0.007	-	-	1700 (est.)	-	170	-
Total to Date	0.11	-	-	1810	-	180	-

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TABLE X

Disposal Site: 216-S-6

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

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	18.9	0.7		0.2			
February	16.7	6.1		-			
March	20.4	0.4		3.7			
April	15.9	2.1		0.1			
May	19.3	2.3		0.1			
June	8.2	0.1		0.2			
July	8.7	0.3		-			
August	16.3	0.8		73.1			
September	12.5	0.3		3.9			
October	29.5	0.3		9.8			
November	12.9	0.7		0.4			
December	12.5	0.7		127.0			
12-Month Total	192	15.3	~ 1	219		13	8
Previous Total	2970	77	449	1280	-	178	42
Total to Date	3160	92	450	1500	-	191	50

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TABLE XI

Disposal Site: 216-S-7 Crib

Waste Stream: D-1 and D-2 wastes from January 12, 1959 to date

Period	Volume (n x 10 ³ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Ce ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	3.0	23.6		186			
February	3.2	6.1		100			
March	2.6	1.2	-	176			
April	0.2	0.2	-	12			
May	1.0	0.2	-	30			
June	3.6	34.7	11.5	403			
July	1.3	4.0	0.2	49			
August	4.1	1.3	0.3	111			
September	3.7	12.3	0.3	97			
October	3.7	11.1	0.1	118			
November	2.7	1.7	0.4	51			
December	2.7	17.1	0.1	91			
12-Month Total	32.7	119	13.1	1424	0.2	56	16
Previous Total	243	2590	405.5	263,200	1.9	2770	226
Total to Date	276	2610	418.6	270,000	2.1	2826	242

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TABLE XII

Disposal Site: 216-SL-1 and 2 Cribbs

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

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	1.2	1.6	0.2	87			
February	0.8	-	0.01	32			
March	1.0	5.5	0.04	93			
April	0.9	5.7	0.01	14			
May	0.9	0.7	0.52	60			
June	1.1	1.2	1.45	248			
July	1.0	0.9	0.05	81			
August	1.0	2.8	0.59	126			
September	0.9	1.5	0.35	75			
October	1.5	0.6	0.9	151			
November	1.2	0.3	0.13	23			
December	1.2	1.0	0.50	100			
12-Month Total	12.7	21.8	4.75	1090		19	51
Previous Total	43	-	92	4970	-	4	40
Total to Date	56	22	97	5060		23	91

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TABLE VIII

Disposal Site: 216-SL-1 and 2 Cribbs

Waste Stream: 222-S and 207-SL basin wastes

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	-						
February	-						
March	0.012	0.13		0.03			
April							
May							
June	0.038	0.15		0.03			
July	-						
August	-						
September	0.015	0.06	0.03				
October							
November	0.014	0.03	0.02				
December	0.014	0.05	0.03	0.02			
12-Month Total	0.093	0.47	0.13	0.08		-	-
Previous Total	2.3	7.2	60.1	22.2		1.4	0.3
Total to Date	2.9	7.7	60.2	22.3		1.4	0.3

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TABLE XIV

Disposal Site: 216 SL-1 and 2 Cribbs 216-S-20

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

Period	Volume (n x 10 ⁵ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	1.2	1.6	0.2	87			
February	0.3	-	0.01	32			
March	1.0	5.5	0.04	93			
April	0.9	5.7	0.01	14			
May	0.9	0.7	0.52	60			
June	1.1	1.2	1.45	248			
July	1.0	0.9	0.05	81			
August	1.0	2.8	0.59	126			
September	0.9	1.5	0.35	75			
October	1.5	0.6	0.9	151			
November	1.2	0.3	0.13	23			
December	1.2	1.0	0.50	100			
12-Month Total	12.7	21.8	5	1090		19	51
Previous Total	46	7.2	152	4992		4.4	40
Total to Date	59	30	157	5082 6082		24	91

* 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: 216-SX-1 crib 216-S-21

Waste Stream: 241-SX tank farm condensate since November 1954

Period	Volume (n x 10 ⁶ L)	Uranium (kilograms)	Plutonium (grams)	Units in Curies Beta Particle Emitters	Co ⁶⁰	Sr ⁹⁰	Cs ¹³⁷
January, 1962	0.11	0.03		0.15			
February	0.34	0.01		1.47			
March	0.74	0.03		4.13			
April	0.74	0.02		2.66			
May	0.25	-		0.74			
June	0.21	-		0.63			
July	0.15			0.65			
August	0.46			0.92			
September	0.50	0.05		0.04			
October	0.46	0.02		1.26			
November	0.07			0.13			
December	0.10			0.08			
12-Month Total	4.13	0.16	-	12.86	-	0.4	12.6
Previous Total	38.3	3.3	2.15	156	0.04	17.6	79.9
Total to Date	42.4	3.5	2.15	169	0.04	18.0	92.5

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TABLE XVI

Disposal Site: 276-S Crib 24-S-13

Waste Stream: 0-2 aqueous waste from 276-S Building since February 1951

Period	Volume (m x 10 ⁶ L)	Uranium (kilograms)	Plutonium	Units in Curies Beta Particle Emitters
January 1962	0.002			0.92
February	0.002			0.07
March	0.002			0.07
April	-			
May	0.002			0.03
June	0.002			0.18
July	0.002			0.02
August	0.002			0.35
September	0.002			-
October	0.002			0.01
November	0.002			0.44
December	0.002			0.24
12-Month Total	0.022	< 1	< 0.01	2.21
Previous Total	3.45	< 1	6.17	21.5
Total to Date	3.47	< 1	6.17	23.7

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TABLE XVII

Disposal Site: 216-TY-3 Crib 214-T-28

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

Period	Volume ($n \times 10^6$ L)	Uranium (kilograms)	Plutonium	Units in Curies Beta Particle Emitters
January, 1962	0.21	1.9	0.12	26.4
February	0.30	9.6	0.31	150.2
March	0.33	3.8	4.00	36.8
April	0.29	9.4	5.64	511.6
May	0.06	0.1	0.02	38.5
June			-	
July	0.52	6.9	0.30	820.7
August				
September	0.35	1.4		394.3
October	0.19	1.9		88.1
November				
December	0.40	5.9	0.11	123.4
12-Month Total	2.65	40.9	10.58	2195
Previous Total	3.1	44.7	9.00	247
Total to Date	5.8	85.6	19.58	2440

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TABLE XVIII

Disposal Site: 216-U-1 and 2 Cribs

Waste Stream:

Period	Volume ($n \times 10^6$ L)	Uranium (kilograms)	Plutonium	Units in Curies Beta Particle Emitters
January, 1962				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
12-Month Total				
Previous Total	1.3	201	4.2	235
Total to Date	1.3	201	4.2	235

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TABLE XIX

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	Units in Curies Beta Particle Emitters
January, 1962	1.2	88.7		0.1
February	1.0	22.8		~ 0.1
March	0.9	15.6		
April	1.2	48.3		
May	1.2	21.7		
June	1.2	19.4		
July	1.0	10.4		
August	1.5	51.2		~ 1
September	1.3	25.6		~ 1
October	1.3	20.3		~ 1
November	1.3	20.8		~ 1
December	1.0	71.7		0.8
12-Month Total	14.1	417		5.0
Previous Total	23.3	508		60.7
Total to Date	37.4	925		65.7

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Period	Volume (Liters) X 10 ⁶	Plasma (Lum) (grams)
January, 1958	0.00	300
February	0.00	000
March	0.00	077
April	0.00	100
May	-	-
June	0.00	32
July		
August		
September		
October		
November		
December		
12-Month Total	0.00	2444
Previous Total	0.00	25,067
Total to Date	4.02	27,511

Knaplex ship slurry 216-2-9

Disposal Site: 2-9 only
Knaplex ship slurry 216-2-9

TABLE 101

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TABLE XXI

Disposal Site: 216-Z-12 Crib

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

Period	Volume (liters) <i>lit</i>	Plutonium (grams)
January, 1962	2.64	684.0
February	2.23	295.3
March	2.47	60.0
April		
May	0.64	43.2
June	3.47	113
July	2.52	118.9
August	2.15	103
September	2.25	157
October	2.15	272
November	1.68	563
December	2.28	436
12-Month Total	24.48	2843.6
Previous Total	124.6	7396
Total to Date	149.1	10,239

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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 areas 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 and HW-69071. 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 values should be regarded as estimates only.

TABLE XXII
SWAMPS CURRENTLY IN USE

Disposal Site	Volume (Liters)		Uranium (Kilograms) 1962	Plutonium (Grams)		Beta Particle Emitters (Curies)	
	1962	Total to Date		1962	Total to Date	1962	Total to Date
"B" Swamp & Chem Sewer	1.89×10^9	5.53×10^{10}	7.4	3.7	151	262.5	1231
"U" Swamp 215-0-10	1.12×10^9	4.79×10^{10}	194.5	-	145	8.3	633
202-S Swamp #1 215-5-13	2.99×10^9	1.43×10^{10}	109.8	0.5	285	15	692
222-S Swamp 215-5-14	3.15×10^7	2.47×10^8	4.0	0.03	18	0.4	11
Gable Mtn. Swamp 215-1-25	1.35×10^{10}	4.54×10^{10}	32.6	27	178	1489	3744
Total to Date		1.63×10^{11}			.777	1775	6311

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TABLE XXIII

SWAMPS NO LONGER IN USE

Disposal Site	Volume (liters) $n \times 10^6$	Plutonium (grams)	Beta Particle Emitters (curies)
202-S-1	6.3×10^3	3	1100
"T" Swamp	3.1×10^4	0.01	110
Totals	3.7×10^4	3.0	1200

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