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**RADIOACTIVE
WASTE DISPOSAL DATA
FOR THE *MASTER*
NATIONAL REACTOR TESTING
STATION**

Joe H. Osloond

April 7, 1965

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Health and Safety Division
U. S. Atomic Energy Commission
Idaho Falls, Idaho

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RADIOACTIVE WASTE DISPOSAL DATA FOR NRTS FACILITIES

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ABSTRACT

This report summarizes the data pertaining to the disposal of radioactive waste at the National Reactor Testing Station. The volumes of liquid, gaseous and solid wastes are reported with the concentration and total amounts of contained nuclides given. Detailed information is listed for the years 1962 through 1964. Yearly summary totals are listed for the years since 1955.

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RADIOACTIVE WASTE DISPOSAL DATA FOR NRTS FACILITIES

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I. INTRODUCTION

Inquiries for information on radioactive waste disposals from NRTS reactor operations and associated facilities have necessitated assembling this report. This information will be of greatest value to those involved with waste management and associated programs such as treatment, environmental research and future operational planning. Presentation of data is the only purpose of this report and no attempt is made to discuss effects due to disposal.

Radioactive liquid wastes disposed to the subsurface vary in concentration levels from 10^{-2} microcuries per milliliter to 10^{-9} uc/ml. Treatment of liquid prior to discharge by means of evaporation and ion exchange is used by some facilities as justified. Radioactive waste measured prior to being discharged to the atmosphere is in concentrations of less than 10^{-4} microcuries per cubic centimeter. More than 90 percent of this waste is in the gaseous form. Radioactive gases having significant levels of activity or particulates are filtered prior to being dispersed into the atmosphere. Filtering systems at the NRTS are used mostly for processing and laboratory facilities associated with the reactors. Disposal of solid radioactive waste is accomplished by simple burial without recourse to volume reduction.

II. ABBREVIATIONS

Following is an explanation of NRTS facility abbreviations as used in this report:

ANL	Argonne National Laboratory, NRTS Facilities
ALW	Large Ship Reactor
ARA	Army Reactor Area
BORAX	Boiling Water Reactor No. 5
CFA	Central Facilities Area
CF-Laundry	Central Facilities Laundry
EBR-I & II	Experimental Breeder Reactor No. 1 and No. 2
ECF	Expended Core Facilities
ETR	Engineering Test Reactor
GCRF	Gas Cooled Reactor Facility
ICPP	Idaho Chemical Processing Plant
ML-1	Mobile Low Power Reactor No. 1
MTR	Materials Testing Reactor
NRF	Naval Reactor Facilities
OMRE	Organic Moderated Reactor Experiment
SLW	Submarine Thermal Reactor
SL-1	Stationary Low Power Reactor
SPERT	Special Power Excursion Reactor Test
TREAT	Transient Reactor Test Facility
TAN	Test Area North
TRA	Test Reactor Area
WCF	Waste Calcination Facility

III. RADIOACTIVE LIQUID WASTE

Proportional composite samples of liquid waste are obtained from all continuous flowing systems. Gross activity is determined daily and isotopic concentrations monthly. Anomalous concentrations are detected by alarm systems. Samples of batch disposals are analyzed quantitatively and qualitatively prior to disposal. Isotopic identification is required on the basis of the following gross beta-gamma concentrations:

<u>Concentration</u>	<u>Isotopes to be Identified</u>
10^{-7} uc/ml	H ³
10^{-6} "	Sr-90, H ³
10^{-5} "	Sr-90, I-129-131, Ru-Rh-106, H ³
10^{-4} "	Same as 10^{-5} plus Sr-89, Ce-144, Cs-137
10^{-3} "	Same as 10^{-4} plus Cd-115, Zr-Nb-95

Analysis for Cr-51 and Co-60 are required on the TRA and NRF disposals.

Two methods of waste disposal to the ground are used. Disposal wells are used at the ICPP and TAN facilities and seepage ponds are used at all others.

Tables I through III list in detail disposals by month for 1964 from the TRA, ICPP and NRF facilities. Table IV is a summary of NRTS wastes for 1964 and the past nine years. Waste discharged during 1962 and 1963 is tabulated in Tables V through X for the areas contributing the major amount of activity.

The activity amounts shown as unidentified in the Tables are composed principally of isotopes with a half-life of less than 30 days. The amount of this activity is determined by the difference between daily and monthly samples.

Liquid waste disposed to the ground during the years 1961 through 1964 contained five identified isotopes with a sufficiently long half-life to still be radioactive in December 1964. The isotopes and activity remaining as of December 1964, are as follows:

Sr-90 (28y) - 37.9 curies, Cs-137 (33y) - 62.0 curies, RuRh-106 (1y) - 113.3 curies, Co-60 (5y) - 25.7 curies and tritium (12y) 4,934.2 curies. This totals 5,173 curies compared to an original discharge of 23,254 curies (see Table IV).

All high level liquid waste at the NRTS is stored in cooled or uncooled stainless steel tanks. The largest amount of this waste is

created at the ICPP from processing irradiated reactor fuel elements (containing highly enriched uranium). ICPP waste amounting to approximately 1,413,000 gallons was stored in six (6) cooled tanks and eight (8) uncooled tanks at the end of 1964. During 1964 a total of approximately 510,000 gallons of ICPP waste was calcined into a solid form. Two isotopes, cesium-137 and strontium-90, are a major concern in the ICPP waste. TAN area high-level liquid waste is generated through evaporation of liquid from labs, hot cells, decontamination, and radioactive drains. TAN evaporator sludge at the end of 1964 amounted to 59,200 gallons. Predominate isotopes in this waste are cobalt-60, cesium-134 and 137. Four tanks, two glasslined (9,000 gallons each) and two stainless steel (10,000 gallons each) are used to store waste for the TRA (MTR-ETR) facilities until transfer to the ICPP. These tanks contained a total of 8,800 gallons at the end of 1964 and 17,900 gallons in 1963. The only other NRTS installations having stored waste at the end of 1964 are the ECF and SIW at NRF. One 2,500-gallon tank at the SIW contains 2,200 gallons consisting of sludge with water added to provide shielding. A 10,500-gallon tank at the ECF contains 1,700 gallons of sludge waste. The sludge at the NRF results from evaporation of intermediate level liquids. Principal isotopes in this waste are manganese-54, cesium-137, cobalt-58 and -60. Disposal of NRF sludge waste has been through land burial in concrete tank-type containers.

TABLE I

LIQUID WASTE DISCHARGED TO THE SEEPAGE PONDS MTR-ETR (1964)

Month	Activity Curies	Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)									Unident.
				Sr-89	Sr-90	I-131	Cs-137	Ce ^{1/}	Cr-51	^{2/} RuRh	BaLa-140	H ³	
Jan.	158	11.0	3.8 x 10 ⁻³	1.9	0.1	3.2	0.6	0.9	9.7	2.1	2.9	39.3	97.3
Feb.	183	12.2	4.0 x 10 ⁻³	1.6	0.1	6.0	0.1	17.9	13.8	2.2	4.4	27.6	109.3
Mar.	149	10.8	3.6 x 10 ⁻³	1.4	0.1	2.5	0.3	4.9	4.5	0.7	3.2	37.9	93.5
Apr.	149	13.5	2.9 x 10 ⁻³	1.5	0.2	1.5	0.3	1.5	3.4	2.0	2.6	36.9	99.1
May	183	11.2	4.3 x 10 ⁻³	1.1	0.4	0.9	0.1	0.4	1.2	1.1	3.5	25.9	148.4
June	188	14.4	3.4 x 10 ⁻³	0.8	<0.1	3.2	0.3	0.7	4.7	1.3	5.4	38.7	132.8
July	185	14.7	3.3 x 10 ⁻³	1.8	0.5	5.2	0.3	1.3	6.6	2.4	5.2	8.5	153.2
Aug.	253	22.3	3.0 x 10 ⁻³	2.5	0.1	11.0	1.9	9.3	-	3.4	6.9	44.0	173.9
Sept.	228	19.9	3.0 x 10 ⁻³	2.0	-	2.0	0.3	0.6	3.3	3.9	6.2	42.8	166.9
Oct.	172	16.0	2.8 x 10 ⁻³	0.8	-	0.9	0.1	0.3	1.2	0.4	2.7	18.7	146.9
Nov.	208	14.9	3.7 x 10 ⁻³	0.7	-	2.6	-	2.0	3.7	1.8	3.8	58.3	135.1
Dec.	149	10.9	3.6 x 10 ⁻³	1.2	-	0.7	0.4	0.9	3.0	1.0	3.3	20.4	118.1
Total	2,205	171.8	3.4 x 10 ⁻³	17.3	1.5	39.7	4.7	40.7	55.1	22.3	50.1	399.0	1,574.
1963	5,918	202.1	7.7 x 10 ⁻³	47.3	1.2	132.5	6.7	107.8	130.6	116.2	195.6	386.4	4,794.
1962	7,065	283.3	6.6 x 10 ⁻³	40.9	0.7	74.0	8.1	172.5	203.2	108.6	142.9	279.7	6,035.
1961	3,863	234.6	4.0 x 10 ⁻³	58.4	1.3	74.7	5.9	89.2	115.6	23.4	-	303.0	3,192.

^{1/} Ce-141 and 144^{2/} Ru-103, 106 and Rh-106

TABLE II

LIQUID WASTE DISCHARGED TO THE LITHOSPHERE - ICPP (1964)

Disposal Well (To Water Table)

Month	Activity Curies	Gallons X 10 ⁶	Gross	Isotopic Activity (Curies)								Zr-Nb-95	Unident.
			Concentration uc/ml	Sr-89	Sr-90	I-131	Cs-137	Ce-144	Ru-106	H ³			
Jan.	1.5	16.6	2.3 x 10 ⁻⁵						0.1	1.3		0.1	
Feb.	17.8	27.8	1.7 x 10 ⁻⁴	0.2						17.6		0.	
Mar.	110.9	18.2	1.6 x 10 ⁻³	0.2	0.1		0.2			110.4		0.	
Apr.	232.4	23.6	2.6 x 10 ⁻³	1.1	0.1		0.3	1.3		229.6		0.	
May	212.2	28.4	2.0 x 10 ⁻³		0.2		0.4	1.8	0.1	209.7		0.	
June	211.4	38.9	1.4 x 10 ⁻³	0.4			0.1	3.1	<0.2	207.5		0.1	
July	169.3	40.6	1.1 x 10 ⁻³	0.9	0.2		0.4	0.1	0.2	167.4		0.1	
Aug.	56.0	28.2	5.2 x 10 ⁻⁴		0.2		0.4		0.1	55.3		0.	
Sept.	20.6	26.0	2.1 x 10 ⁻⁴		0.2		0.2		0.1	20.1		0.	
Oct.	34.3	29.3	3.1 x 10 ⁻⁴	0.1	0.1		0.4		0.4	33.3		0.	
Nov.	578.2	36.5	4.2 x 10 ⁻³	0.1					<0.2	569.3	8.5	0.1	
Dec.	75.3	30.0	6.6 x 10 ⁻⁴	0.1						74.8		0.4	
Total	1,719.9	344.1	1.3 x 10 ⁻³	3.1	1.1	-	2.4	6.3	<1.4	1,696.	8.5	0.8	
1963	1,025.5	257.0	1.0 x 10 ⁻³	1.3	-	0.4	-	-	0.2	1,021.	0.7	1.8	
1962	175.8	261.7	1.8 x 10 ⁻⁴	0.8	<0.2	24.4	-	0.1	0.7	146.	1.0	2.0	
1961 <u>1/</u>	624.5	188.0	8.8 x 10 ⁻⁴	2.2	0.2	18.0	0.4	4.6	3.4	590.	1.2	4.5	

Seepage Pit in Regolith

			Isotopic Activity (Curies)										
Month	Activity	Gallons	Gross									Zr-Nb-95	Unident.
	Curies	X 10 ⁶	Concentration	Sr-89	Sr-90	I-131	Cs-137	Ce-144	Ru-106	H ³			
			uc/ml										
Jan.	2.1	0.14	4.0 x 10 ⁻³				0.1				2.0	0.	
Feb.	1.7	0.12	3.8 x 10 ⁻³								1.7	0.	
Mar.	7.2	0.11	1.7 x 10 ⁻²		0.1						7.1	0.	
Apr.	3.6	0.10	9.5 x 10 ⁻³								3.6	0.	
May	3.2	0.08	9.5 x 10 ⁻³								3.2	0.	
June	6.0	0.12	1.3 x 10 ⁻²								6.0	0.	
July	7.8	0.12	1.7 x 10 ⁻²								7.8	0.	
Aug.	10.0	0.15	1.8 x 10 ⁻²								10.0	0.1	
Sept.	7.4	0.10	1.9 x 10 ⁻²								7.3	0.1	
Oct.	7.8	0.09	2.3 x 10 ⁻²								7.7	0.1	
Nov.	9.2	0.11	2.2 x 10 ⁻²								9.2	0.	
Dec.	6.9	0.09	2.0 x 10 ⁻²								6.9	0.	
Total	72.9	1.33	1.4 x 10 ⁻²	-	0.1	-	0.1	-	-		72.5	-	0.3
1963	85.7	2.5	9.1 x 10 ⁻³	2.0	10.4	-	13.4	0.3	-		58.2	-	0.4
1962	243.6	4.8	1.3 x 10 ⁻²	1.5	22.6	-	20.6	0.7	0.6		194.4	0.4	2.8

^{1/} Above amounts for 1961 include all wastes from ICPP combined.

TABLE III

LIQUID WASTE DISCHARGED TO SEEPAGE PONDS - NRF-S1W (1964)

Month	Activity Curies	Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)						Sr- 1/ Total	I-131	103 RuRh-106	H ³	Unident.
				Co-58	Co-60	Sb-124	Ce-144	Cs-137	141					
Jan.	0.02	0.42	1.3 x 10 ⁻⁵		0.01								0.01	-
Feb.	0.64	0.75	2.3 x 10 ⁻⁴	0.36	0.05		0.09	0.08		0.02			0.02	0.02
Mar.	0.17	0.65	6.9 x 10 ⁻⁴		0.13		0.01	0.01					0.05	-
Apr.	0.40	0.75	1.4 x 10 ⁻⁴		0.13		0.08	0.02		0.01	0.14		0.02	-
May	0.43	0.64	1.8 x 10 ⁻⁴	0.01	0.33		0.03			0.01		0.01	0.03	0.01
June	2.00	1.84	2.9 x 10 ⁻⁴		1.30		0.25			0.03	0.16	0.05	0.02	0.19
July	0.83	2.67	8.2 x 10 ⁻⁵	0.03	0.51			0.03		0.02	0.04	0.05	-	0.15
Aug.	1.73	4.93	9.3 x 10 ⁻⁵	0.02	1.06			0.04		0.04	0.06	0.07	-	0.44
Sept.	0.33	2.50	3.5 x 10 ⁻⁵		0.18		0.05			0.01		0.05	-	0.04
Oct.	1.10	2.15	1.4 x 10 ⁻⁴	0.10	0.30					0.01	0.60	0.02	-	0.07
Nov.	0.73	2.0	9.6 x 10 ⁻⁵		0.37		-	0.04		-	0.16	0.10	-	0.06
Dec.	0.62	1.92	8.6 x 10 ⁻⁵	-	0.20		-	0.10		0.02	0.03	0.07	0.10	0.10
Total	9.0	21.2	1.1 x 10 ⁻⁴	0.52	4.57		0.51	0.32		0.17	1.19	0.42	0.25	1.08
1963	15.7	12.3	3.4 x 10 ⁻⁴	0.63	5.88		-	0.02		0.02	-	-	7.40	1.44
1962	6.2	12.8	4.7 x 10 ⁻⁵	0.28	1.34		-	0.10		0.01	-	-	3.93	0.69
1961	1.8	13.1	3.7 x 10 ⁻⁵	0.09	0.61		-	0.48		0.01	-	-	0.02	0.59

AlW-ECF

Month	Activity Curies	Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)						Sr- 1/ Total	I-131	103 RuRh-106	H ³	Unident.
				Co-58	Co-60	Sb-124	Ce-144	Cs-137	141					
Jan.	5.73	0.91	1.7 x 10 ⁻³	1.01	0.15		0.02	0.27		0.07	0.02		4.12	0.07
Feb.	5.13	0.82	1.6 x 10 ⁻³	0.59	0.09		0.15	0.12		0.03			4.10	0.05
March	3.18	0.86	9.8 x 10 ⁻⁴	0.02	0.08	0.01	0.07	0.05		0.02			2.90	0.03
Apr.	2.26	0.69	8.6 x 10 ⁻⁴		0.05		0.09	0.02		0.01	0.15		1.92	0.02
May	3.30	0.78	1.1 x 10 ⁻³	0.03	0.34		0.12	0.02		0.01	0.02	0.02	2.72	0.02
June	2.11	0.33	1.7 x 10 ⁻³		0.09	0.53							1.49	-
July	0.23	0.28	2.2 x 10 ⁻⁴		0.01	0.03							0.15	0.09
Aug.	0.28	0.26	2.9 x 10 ⁻⁴		0.02	0.02							0.24	-
Sept.	0.21	0.35	1.6 x 10 ⁻⁴		0.01	0.01						0.01	0.14	0.04
Oct.	0.32	0.28	3.0 x 10 ⁻⁴			0.01							0.28	0.03
Nov.	0.23	0.38	1.6 x 10 ⁻⁴										0.23	-
Dec.	0.06	0.16	1.0 x 10 ⁻⁴										0.05	0.01
Total	23.04	6.1	1.0 x 10 ⁻³	1.65	0.84	0.61	0.45	0.48		0.14	0.19	0.03	18.3	0.36
1963	41.52	15.0	7.3 x 10 ⁻⁴	-	8.35	-	3.23	0.76		0.26	2.94	-	17.2	5.62
1962	34.99	15.3	1.4 x 10 ⁻⁴	-	2.54	-	-	0.57		0.08	0.05	-	27.0	4.03
1961	29.37	11.5	3.9 x 10 ⁻⁴	1.45	6.73	-	-	0.52		0.07	-	-	12.55	8.05

1/ Activity is ~50 per cent Sr-90

TABLE IV
RADIOACTIVE LIQUID WASTE SUMMARY

1964 Installation	Activity Curies	Volume Gal. X 10 ⁶	Gross Concentration uc/ml	Identified Isotopes
MTR-ETR	2,205	172	3.4×10^{-3}	H ³ , Sr-89-90, I-131, Cs-137, Ce-141-144, BaLa-140 RuRh-103-106
ICPP (Disp. Well)	1,720	344	1.3×10^{-3}	H ³ , Sr-89-90, I-131, Cs-137, Ce-144, Ru-106, Zr-Nb-95
ICPP (Manhole)	73	1.3	1.5×10^{-2}	H ³ , Sr-89-90, I-131, Cs-137, Ce-144, Ru-106, Zr-Nb-95
NRF (AlW-ECF)	23	6.1	9.9×10^{-4}	H ³ , Co-58-60, Cs-137, I-131, Ce-141-144, Sb-124
NRF (SlW)	9	21.2	1.1×10^{-4}	H ³ , Co-58-60, Cs-137, I-131, Ce-141-144, Sb-124
TAN (PPCo.)	2.5	31.4	2.1×10^{-5}	H ³ , Sr-90, Cs-137, Co-60, Ce-144, Zr-Nb-95
CFA	1.1	48.5	6.0×10^{-6}	Sr-89-90, Beta less Sr
GCRF	0.3	0.4	2.0×10^{-4}	Aq-110
SPERT	0.2	1.4	3.8×10^{-5}	Sr-90, I-131, RuRh-106, Ce-144
ANL	0.1	0.1	2.6×10^{-4}	Sr-89-90, Zr-Nb-95, BaLa-140, Ce-141
Total	4,034.	626.		

Year	Volume Liters	Activity (Curies)
1955	1.93×10^9	1,260
1956	1.75	860
1957	1.33	1,260
1958	2.46	3,600
1959	2.32	5,070
1960	1.83	3,420
1961	1.87	4,590
1962	2.50	7,540
1963	2.22	7,090
1964	2.37	4,034

TABLE V

LIQUID WASTE DISCHARGED TO SEEPAGE PONDS - MTR-ETR (1963)

Month	Activity Curies	Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)									
				Sr-89	Sr-90	I-131	¹ / _{RuRh}	Cs-137	Ce ² /	Cr-51	H ³	BaLa-140	Unident.
Jan.	253	19.9	3.4 x 10 ⁻³	1.8	Insig.	2.3	0.8	0.1	5.0	0.1	23.4	4.8	215.
Feb.	255	19.4	3.5 x 10 ⁻³	1.3	"	8.8	0.6	0.7	2.9	0.4	64.9	5.0	170.
Mar.	3,181	21.2	4.0 x 10 ⁻²	18.8	0.4	48.9	66.8	2.0	21.2	16.8	19.2	136.1	2,851.
Apr.	204	17.4	3.1 x 10 ⁻³	4.5	0.1	12.1	22.4	0.6	16.8	0.8	49.5	6.0	91.
May	241	18.0	3.5 x 10 ⁻³	1.7	Insig.	16.6	5.0	1.3	8.6	7.9	25.6	5.0	169.
June	233	17.6	3.5 x 10 ⁻³	1.7	0.1	4.4	3.8	0.2	2.0	4.7	24.0	5.5	187.
July	243	15.8	4.1 x 10 ⁻³	2.4	Insig.	5.7	2.9	0.4	6.6	7.8	33.9	4.3	179.
Aug.	277	15.1	4.8 x 10 ⁻³	4.3	0.1	6.4	5.2	0.4	8.6	13.2	26.9	9.1	203.
Sept.	344	18.1	5.1 x 10 ⁻³	4.3	0.2	10.4	3.3	0.3	21.4	4.5	32.4	4.8	262.
Oct.	217	14.1	4.1 x 10 ⁻³	1.6	0.1	9.5	1.9	0.4	4.3	18.9	25.5	10.7	144.
Nov.	247	13.8	4.7 x 10 ⁻³	4.0	0.1	5.2	1.3	0.1	10.0	52.5	28.3	3.0	143.
Dec.	223	11.7	5.0 x 10 ⁻³	0.9	0.1	2.2	2.2	0.2	0.4	3.0	32.8	1.3	180.
Total	5,918	202.1	7.7 x 10 ⁻³	47.3	1.2	132.5	116.2	6.7	107.8	130.6	386.4	195.6	4,794.
1962	7,065	283.3	6.6 x 10 ⁻³	40.9	0.7	74.0	108.6	8.1	172.5	203.2	279.7	142.9	6,035.

¹/ Ru-103-106 and Rh-106²/ Ce-141-144

TABLE VI

LIQUID WASTE DISCHARGED TO THE LITHOSPHERE - ICPP (1963)

Disposal Well (To Water Table)

Month	Activity Curies	Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)								141 Ce-144	H ³	Unident.
				Sr-89	Sr-90	I-131	Ru-106	Zr- Nb-95	Cs-134	Cs-137				
Jan.	0.5	12.0	1.1 x 10 ⁻⁵			0.2						0.3	Insig.	
Feb.	0.4	9.7	1.1 x 10 ⁻⁵			0.1							0.3	
Mar.	0.4	12.0	8.9 x 10 ⁻⁶			0.1						0.3	0.	
Apr.	0.1	9.6	2.8 x 10 ⁻⁶										0.1	
May	0.2	8.0	6.7 x 10 ⁻⁶	Insig.	Insig.	Insig.	Insig.					0.1	0.1	
June	482.3	24.1	5.3 x 10 ⁻³	"	"	"	0.2					481.9	0.2	
July	336.2	32.4	2.7 x 10 ⁻³									336.1	0.1	
Aug.	130.6	40.1	8.6 x 10 ⁻⁴	0.2	"							130.0	0.4	
Sept.	63.4	31.0	5.4 x 10 ⁻⁴	0.3				0.3				62.8	0.	
Oct.	7.6	29.7	6.8 x 10 ⁻⁵	0.8	"			0.4				6.4	0.	
Nov.	0.2	30.0	1.7 x 10 ⁻⁶										0.2	
Dec.	3.6	18.4	5.2 x 10 ⁻⁵									3.2	0.4	
Total	1,025.5	257.0	1.0 x 10 ⁻³	1.3		0.4	0.2	0.7				1,021.	1.8	
1962	175.8	261.7	1.8 x 10 ⁻⁴	0.8	0.2	24.4	0.7	1.0			< 0.1	146.	2.0	

Seepage Pit in Regolith

Month	Activity Curies	Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)								141 Ce-144	H ³	Unident.
				Sr-89	Sr-90	I-131	Ru-106	Zr- Nb-95	Cs-134	Cs-137				
Jan.	16.3	0.59	7.3 x 10 ⁻³	0.1	2.2		Insig.		0.2	2.3	0.2	11.2	0.1	
Feb.	7.1	0.20	1.0 x 10 ⁻²	Insig.	0.7		"		Insig.	2.2	Insig.	4.2	Insig.	
Mar.	6.3	0.19	8.7 x 10 ⁻³	"	0.8		"		0.1	1.2	0.1	4.1	0.	
Apr.	9.4	0.20	1.3 x 10 ⁻²	"	0.7		"		0.1	1.4		7.1	0.1	
May	8.6	0.20	1.2 x 10 ⁻²	0.6	0.9		"		Insig.	0.2	Insig.	6.8	0.1	
June	8.6	0.19	1.2 x 10 ⁻²	0.4	1.0		"		0.1	1.4		5.6	0.1	
July	8.3	0.18	1.2 x 10 ⁻²	0.3	1.1		"		0.1	1.3		5.5	0.	
Aug.	7.1	0.18	1.0 x 10 ⁻²	0.3	1.4		"		0.1	1.1		4.2	0.	
Sept.	4.3	0.14	8.1 x 10 ⁻³	0.1	0.4				0.1	0.8		2.9	0.	
Oct.	4.0	0.13	8.2 x 10 ⁻³	0.1	0.6				0.1	0.7		2.5	0.	
Nov.	4.1	0.16	6.8 x 10 ⁻³	0.1	0.6		"		0.1	0.8		2.5	0.	
Dec.	1.6	0.11	3.8 x 10 ⁻³		Insig.							1.6	Insig.	
Total	85.7	2.5	9.1 x 10 ⁻³	2.0	10.4				1.0	13.4	0.3	58.2	0.4	
1962	243.6	4.8	1.3 x 10 ⁻²	1.5	22.6		0.6	0.4		20.6	0.7	194.4	2.8	

TABLE VII

LIQUID WASTE DISCHARGED TO SEEPAGE PONDS - NRF-A1W-ECF (1963)

Month	<u>1/</u>		Gross Concentration uc/ml	Isotopic Activity (Curies)								Unident.
	Activity Curies	Gallons X 10 ⁶		Sr-Total	Co-60	Cs-134	Cs-137	Ce-144 ^{2/}	I-131	Cr-51	H ³	
Jan.	2.27	1.01	5.9 x 10 ⁻⁴		0.26	0.03	0.01	0.05	0.05		1.84	0.03
Feb.	4.44	0.86	1.4 x 10 ⁻³	0.04	0.76		0.09	0.32	0.42	0.03	2.18	0.60
Mar.	2.77	0.97	7.5 x 10 ⁻⁴		0.55			0.03	0.12	0.08	1.78	0.21
Apr.	8.16	1.46	5.6 x 10 ⁻³	0.04	0.98		0.10	0.14	0.44	2.80	3.48	0.18
May	2.93	1.41	5.5 x 10 ⁻⁴		0.25		0.03	0.42	0.45		1.53	0.25
June	3.75	1.82	5.4 x 10 ⁻⁴	<0.01	1.77		0.05	0.18	0.09	0.13	0.90	0.62
July	3.07	1.82	4.5 x 10 ⁻⁴		0.39		Insig.	0.74	0.33		1.15	0.46
Aug.	1.51	1.54	2.6 x 10 ⁻⁴	0.01	0.18			0.30	0.03		0.59	0.40
Sept.	6.91	1.34	1.4 x 10 ⁻³	0.07	2.84	0.05	0.18	0.84	0.82		0.33	1.78
Oct.	2.13	1.05	5.4 x 10 ⁻⁴	0.02	0.15	0.03	0.13	0.17	0.06		0.79	0.78
Nov.	1.91	0.92	5.5 x 10 ⁻⁴	0.04	0.13	0.02	0.07	0.04	0.02		1.39	0.20
Dec.	1.67	0.77	5.7 x 10 ⁻⁴	<0.03	0.09	0.03	0.10	Insig.	0.11		1.20	0.11
Total	41.52	14.97	7.3 x 10 ⁻⁴	<0.26	8.35	0.16	0.76	3.23	2.94	3.04	17.16	5.62
1962	34.99	15.31	1.4 x 10 ⁻⁴	0.08	2.54	0.33	0.57		0.05		27.0	4.03

LIQUID WASTE DISCHARGED TO THE GROUND - NRF-S1W (1963)

Month	<u>1/</u>		Gross Concentration uc/ml	Isotopic Activity (Curies)								Unident.
	Activity Curies	Gallons X 10 ⁶		Sr-Total	Sr-90	Co-60	Co-58	Cs-137	Mn-54	H ³	Cr-51	
Jan.	2.53	0.86	7.8 x 10 ⁻⁴			0.04	0.01			2.47		0.01
Feb.	3.76	1.15	8.6 x 10 ⁻⁴		Insig.	0.34	0.05			3.36		0.01
Mar.	0.70	0.86	2.1 x 10 ⁻⁴		Insig.	0.19	0.06	0.02		0.41		0.02
Apr.	0.51	0.87	1.6 x 10 ⁻⁴			0.16	0.03			0.25		0.06
May	0.74	1.42	1.4 x 10 ⁻⁴			0.15				0.32	0.26	0.01
June	5.06	0.98	1.4 x 10 ⁻³	0.01		4.45	0.48			0.12		0.01
July	0.25	1.00	6.6 x 10 ⁻⁵			0.16				0.10		0.00
Aug.	0.26	1.23	5.5 x 10 ⁻⁵			0.05				0.12		0.09
Sept.	1.60	1.18	3.6 x 10 ⁻⁴	0.01		0.29				0.08		1.23
Oct.	0.05	0.96	1.4 x 10 ⁻⁵			0.01				0.03		0.00
Nov.	0.11	1.07	2.7 x 10 ⁻⁵							0.10		0.00
Dec.	0.11	0.73	3.9 x 10 ⁻⁵			0.04				0.04	0.03	0.00
Total	15.68	12.3	3.4 x 10 ⁻⁴	0.02		5.88	0.63	0.02		7.40	0.29	1.44
1962	6.25	12.8	4.7 x 10 ⁻⁵	0.01		1.34	0.28	0.10	0.1	<3.93		0.69

1/ Beta Gamma activity including tritium. 2/ Includes Ce-144 and 141. Sr total composed of Sr-89 & 90 principally.

TABLE VIII

LIQUID WASTE DISCHARGED TO SEEPAGE PONDS - MTR-ETR (1962)

Month	Curies	<u>1/</u> Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)							^{2/} H ³	BaLa- 140	Unident.
				Sr-89	Sr-90	I-131	RuRh-106	Cs-137	Ce-144	Cr-51			
Jan.	1,848	26.0	1.87 x 10 ⁻²	6.9	0.2	0.3	12.5	0.3	20.9	22.1	23.5	33.6	1,729
Feb.	1,518	27.2	1.47 x 10 ⁻²	9.9	0.2	12.0	36.4	1.3	48.4	75.7	22.1	28.3	1,284
Mar.	514	22.9	5.93 x 10 ⁻³	4.2	0.1	1.8	11.5	0.2	14.7	23.4	36.6	7.2	414
Apr.	441	24.6	4.74 x 10 ⁻³	2.3		8.8	11.7	1.0	25.2	54.1	17.2	9.0	312
May	711	30.0	6.27 x 10 ⁻³	3.4		25.0	11.8	1.7	14.8	5.6	38.3	8.2	602
June	380	17.3	5.81 x 10 ⁻³	1.8		3.1	1.9	0.5	12.4	3.5	22.9	4.8	329
July	196	19.6	2.64 x 10 ⁻³	0.5		1.4	1.7	0.3	6.2	3.3	11.5	2.7	168
Aug.	306	24.9	3.25 x 10 ⁻³	0.7	0.1	1.6	3.3	0.1	4.6	5.7	21.4	4.6	264
Sept.	254	25.0	2.69 x 10 ⁻³	1.7		3.1	3.2	0.5	9.4	2.6	21.7	9.0	203
Oct.	307	25.5	3.19 x 10 ⁻³	1.5		1.3	7.7	0.6	8.1	3.0	23.4	4.3	257
Nov.	398	22.7	4.64 x 10 ⁻³	5.3	0.1	11.2	3.8	0.7	7.1	0.3	23.3	18.0	328
Dec.	192	17.6	2.88 x 10 ⁻³	2.7		4.4	3.1	0.9	0.7	3.9	17.8	13.2	145
Total	7,065	283.3	6.59 x 10 ⁻³	40.9	0.7	74.0	108.6	8.1	172.5	203.2	279.7	142.9	6,035
1961	3,530 ^{3/}	234.6	3.97 x 10 ⁻³										

1/ Does not include alpha activity.

2/ Includes Ce-144 and Ce-141.

3/ Excludes tritium (303 Curies).

TABLE IX

LIQUID WASTE DISCHARGED TO THE LITHOSPHERE - ICPP (1962)

Disposal Well (To Water Table)

Month	Activity Curies	Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)							H ³	Unident.
				Sr-89	Sr-90	I-131	Cs-137	RuRh-106	Zr-Nb-95	Ce-141 Ce-144		
Jan.	125.8	28.4	1.18 x 10 ⁻³	0.06		0.30		0.02	0.03	0.02	125.3	0.1
Feb.	11.2	22.5	1.31 x 10 ⁻⁴	0.07		0.14			0.04	0.01	10.2	0.7
Mar.	5.5	30.0	4.85 x 10 ⁻⁵	0.05	0.01	0.11		0.04			5.3	0.0
Apr.	4.0	22.6	4.60 x 10 ⁻⁵	0.04		0.13		0.04	0.94		2.0	0.8
May	2.1	26.2	2.15 x 10 ⁻⁵	0.34	0.02	0.15	0.5				1.0	0.1
June	2.5	22.0	3.01 x 10 ⁻⁵	0.17	0.14	1.54		0.04			0.4	0.2
July	0.8	23.7	8.90 x 10 ⁻⁵			0.05		0.31			0.4	0.1
Aug.	0.6	23.3	6.20 x 10 ⁻⁶	0.04		0.03		0.13			0.4	0.0
Sept.	0.5	19.8	6.10 x 10 ⁻⁶		0.03	0.02		0.03			0.4	0.0
Oct.	21.8	19.3	2.98 x 10 ⁻⁴			21.58					<0.2	0.0
Nov.	0.5	13.4	1.00 x 10 ⁻⁵			0.17		0.05			0.3	0.0
Dec.	0.5	10.5	1.30 x 10 ⁻⁵	0.05	<0.01	0.23					0.2	0.0
Total	175.8	261.7	1.77 x 10 ⁻⁴	0.82	<0.21	24.45	0.5	0.66	1.01	0.03	<146.1	2.0

Seepage Pit in Regolith

Month	Activity Curies	Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)							H ³	Unident.
				Sr-89	Sr-90	Cs-137	RuRh-106	Zr-Nb-95	Ce-141-144			
Jan.	14.4	0.22	1.76 x 10 ⁻²	0.07	0.6	0.56	0.17	0.13			12.8	0.09
Feb.	7.7	0.13	1.62 x 10 ⁻²	<0.01	0.03	0.89	<0.05		0.17		6.5	0.05
Mar.	12.9	0.17	2.01 x 10 ⁻²	0.04	0.61	0.40		0.06	0.01		11.7	0.07
Apr.	14.7	0.19	1.99 x 10 ⁻³	0.03	0.66	0.65			0.08		13.1	0.18
May	4.2	0.20	5.54 x 10 ⁻³	0.16	1.19	1.15		0.05	0.15		1.2	0.20
June	32.1	0.45	1.87 x 10 ⁻²	0.15	3.20	2.97	<0.01	0.13	0.25		25.1	0.30
July	27.4	0.34	2.14 x 10 ⁻²	0.20	2.06	2.03					22.9	0.20
Aug.	23.6	0.36	1.72 x 10 ⁻²	0.16	3.02	1.93	0.01				18.2	0.25
Sept.	32.7	0.62	1.39 x 10 ⁻²	0.16	3.79	2.68	0.03				25.6	0.40
Oct.	36.2	1.00	9.6 x 10 ⁻³	0.26	3.53	3.56	0.23				28.1	0.57
Nov.	18.5	0.57	8.6 x 10 ⁻³	0.08	1.48	1.94	0.02				14.7	0.28
Dec.	19.2	0.56	9.08 x 10 ⁻³	0.22	2.40	1.79	0.03				14.5	0.26
Total	243.6	4.81	1.34 x 10 ⁻²	1.54	22.57	20.55	0.55	0.37	0.66		194.4	2.85

TABLE X

LIQUID WASTE DISCHARGED TO SEEPAGE PONDS (1962)

SLW										
Month	Activity	Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)						
	Curies			Sr-Total	Co-60	Co-58	Cs-137	Mn-54	H ³	Unident.
Jan.	0.418	1.00	1.11 x 10 ⁻⁴	0.001	0.104	0.117	0.075	0.042	0.05	0.079
Feb.	0.032	0.85	9.94 x 10 ⁻⁶		0.012	0.007	0.005		0.04	0.008
Mar.	0.101	0.63	4.23 x 10 ⁻⁵	0.002	0.029	0.052			0.01	0.018
Apr.	0.101	0.88	3.03 x 10 ⁻⁵	0.001	0.033			0.059	0.03	0.008
May	0.090	0.60	4.01 x 10 ⁻⁵		0.048	0.016			0.02	0.026
June	0.410	1.34	8.10 x 10 ⁻⁵	0.004	0.307				Undet.	0.099
July	0.117	1.20	2.60 x 10 ⁻⁵	0.001					≤ 0.02	0.116
Aug.	0.216	1.50	3.81 x 10 ⁻⁵		0.102	0.028			≤ 0.02	0.086
Sept.	0.220	1.46	3.55 x 10 ⁻⁵						0.06	0.220
Oct.	0.210	1.16	4.79 x 10 ⁻⁵	0.001	0.187	0.015	0.006		0.42	0.001
Nov.	0.158	1.16	3.61 x 10 ⁻⁵	Insig.	0.101	0.031	0.003		1.28	0.023
Dec.	0.247	1.04	6.28 x 10 ⁻⁶	0.002	0.214	0.015	0.008		1.98	0.008
Total	2.32	12.82	4.7 x 10 ⁻⁵	0.012	1.137	0.281	0.097	0.101	≤ 3.93	0.692
1961	1.808	13.06	3.66 x 10 ⁻⁵							

ALW-ECF

Month	Activity	Gallons X 10 ⁶	Gross Concentration uc/ml	Isotopic Activity (Curies)						
	Curies			Sr-Total	Co-60	Co-58	Cs-134	Cs-137	I-129-131	H ³
Jan.	1.19	1.23	2.55 x 10 ⁻⁴	0.02	0.08	0.18				8.5
Feb.	0.28	1.24	5.97 x 10 ⁻⁵		0.14					1.3
Mar.	0.70	1.09	1.70 x 10 ⁻⁴	0.01	0.38					1.3
Apr.	1.40	1.22	3.02 x 10 ⁻⁴	0.01	0.24			0.06	0.05	1.2
May	0.81	1.30	1.65 x 10 ⁻⁴	0.01	0.22		0.15	0.32		1.6
June	0.29	1.35	5.76 x 10 ⁻⁵							2.8
July	0.36	1.52	6.28 x 10 ⁻⁵							1.8
Aug.	1.18	1.73	1.79 x 10 ⁻⁴	0.02	0.38		0.16	0.07		0.7
Sept.	0.67	1.56	1.17 x 10 ⁻⁴	0.01	0.39	0.09		0.07		0.2
Oct.	0.34	0.94	9.67 x 10 ⁻⁵		0.25	0.04	0.02	0.02		0.6
Nov.	0.58	1.13	1.35 x 10 ⁻⁴		0.38	0.06		0.02	Insig.	3.6
Dec.	0.19	1.00	4.96 x 10 ⁻⁵		0.08	0.01		0.01	Insig.	3.4
Total	7.99	15.31	1.37 x 10 ⁻⁴	0.08	2.54	0.38	0.33	0.57	0.05	27.0
1961	16.82	11.48	3.9 x 10 ⁻⁴							4.03

1/ Excludes tritium activity.

IV. RADIOACTIVE WASTE DISCHARGED TO THE ATMOSPHERE

The airborne radioactive waste discharged from NRTS installations such as the MTR, ETR, and ICPP contains both particulate and gaseous effluents. The activity from particulate waste is less than 5% of that for gaseous waste. All significant activity disposed is exhausted to the atmosphere via stacks from 50 to 250 feet in height.

Table XI contains the activity and volume of waste discharged during 1964 to the atmosphere from MTR-ETR, ICPP and ANL areas. These three facilities accounted for 99% of the total activity. The WCF at the ICPP during 1964 contributed greater than 90% of the waste from this area. A waste summary is given in Table XII for the past ten years. Table XIII and XIV lists in more detail the airborne waste for the past two years (1962-1963).

Total alpha activity during 1964 as in previous years amounted to less than 0.1 curie for all NRTS operations.

TABLE XI

RADIOACTIVITY DISCHARGED TO THE ATMOSPHERE - 1964

ICPP			Isotopic Activity (Curies)						ANL		
Month	<u>1/</u> Activity Curies	Volume Ft ³ (10 ⁹)							<u>2/</u> Activity Curies	Volume Ft ³ (10 ⁴)	
			H ³	Ru-106	¹⁴⁴ Ce-141	Zr-Nb-95	Cs-137	Sr-90			
Jan.	318.	5.4	310	8.				0.03	17.	9.6	
Feb.	331.	5.0	320	11.				0.03	8.	3.6	
Mar.	328.	5.4	320	8.				0.01	11.	4.8	
Apr.	212.	5.2	180	32.				-	6.5	4.8	
May	209.	5.4	180	29.				-	25.	14.0	
June	218.	5.2	180	38.				-	15.5	11.4	
July	309.	5.6	230	79.				0.02	63.	1200.	
Aug.	231.	5.4	210	21.				0.04	2.	1.6	
Sept.	156.	5.2	150	6.				0.01	6.	664.8	
Oct.	197.	4.5	90	107.				0.02	6.	4.2	
Nov.	44.	4.4	-	4.	22.	9.	3.	3.22	13.	9.0	
Dec.	3.	4.9	-	1.	1.	1.		0.03	5.	6.0	
Total	2556.	62.	2170	344.	23.	10.	3.	3.4	178.	1934.	
1963	294432.	60.	330	2.	-	-	0.1	0.1	206.	80.	
1962	609419.	60.	-	-	-	-	-	-	186.	92.	

MTR-ETR		Isotopic Activity (Gaseous) Curies							Particulate	
Month	Activity ^{1/}	Volume								
	Curies	Ft ³ (10 ⁹)	Ar-41	Xe-137	Xe-138	Kr-88	Kr-89	Unident.	Activity (Curies)	
Jan.	48142.	2.3	15375.	17415.	1046.	97.4	13403.	805.6	15.7	
Feb.	45802.	2.3	16316.	15568.	1076.	145.0	11984.	713.0	20.8	
Mar.	42249.	2.2	14517.	14788.	865.	73.9	11339.	666.1	10.8	
Apr.	46475.	2.2	13599.	17596	933.	53.0	13468.	826.0	7.8	
May	47368.	2.2	19043.	14932	1014.	182.9	11502.	694.1	23.8	
June	52828.	2.5	15338.	20019.	1061.	114.8	15371.	924.2	14.1	
July	51802.	2.4	10736.	21959.	1179.	79.0	16848.	1001.0	11.0	
Aug.	42765.	2.4	9288.	17818.	1043.	107.1	13686.	822.9	15.3	
Sept.	42125.	2.5	12515.	15664.	1013.	126.6	12080.	726.4	19.2	
Oct.	52296.	2.4	10570.	22201.	1318.	123.4	17045.	1038.6	19.2	
Nov.	57435.	2.5	12120.	24214.	1304.	101.4	18577.	1118.6	15.2	
Dec.	43833.	2.4	10746.	17378.	1278.	178.9	13461.	791.1	28.2	
Total	573120.	28.3	160163.	219552.	13130.	1383.	168764.	10128.	201.	
1963	596624.	26.9	149866.	234296	16749	3024.	181095	11594.		
1962	349423.	26.5	170488.							

^{1/} Particulate & Gaseous Activity (B & Y)^{2/} Predominate Isotope Ar-41

TABLE XII
RADIOACTIVITY DISCHARGED TO THE ATMOSPHERE
1964 SUMMARY

Facility	Activity Curies	Volume	Identified Isotopes
MTR	553,380.	$16.2 \times 10^9 \text{ ft}^3$	Ar-41, Xe-137-138, Kr-88-89, Cr-51, Na-24
ETR	19,738.	$12.1 \times 10^9 \text{ ft}^3$	Ar-41, Xe-138, Kr-88-89, Rb-88-89, Cs-138
ICPP (WCF)	2,556.	$61.4 \times 10^9 \text{ ft}^3$	H ³ , Sr-90, Ru-106, Cs-137, Ce-144, Zr-Nb-95
ANL (TREAT)	123.	$73.2 \times 10^4 \text{ ft}^3$	Ar-41
ANL (BORAX V)	66.	$2.4 \times 10^7 \text{ ft}^3$	Xe-133-135, Kr-85
Other	3.	$23.8 \times 10^9 \text{ ft}^3$	Mixed F.P.
Total	575,866.	$11.35 \times 10^{10} \text{ ft}^3$	

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Year	Volume (Cu. meters)	Activity (Curies)
1955	$< 2.5 \times 10^9$	404,000
1956	"	213,000
1957	"	364,000
1958	"	883,000
1959	"	735,000
1960	"	900,000
1961	"	659,000
1962	2.45×10^9	959,000
1963	2.81×10^9	891,000
1964	3.21×10^9	576,000

TABLE XIII

RADIOACTIVITY DISCHARGED TO THE ATMOSPHERE - 1963

Month	<u>ANL</u>		<u>ICPP</u>		Isotopic Activity (Curies)						
	<u>1/</u> Activity Curies	Volume Ft ³ (10 ⁴)	<u>2/</u> Activity Curies	Volume Ft ³ (10 ⁹)	H ³	Xe-133 ^{4/}	Xe-135 ^{4/}	Ru-106	Cs-137	Sr-90	Unident.
Jan.	20	9.6	77026	5.0		58000	19000				26
Feb.	39	12.0	86033	4.6		65000	21000				33
Mar.	10	8.4	56003	5.0		44000	12000				3
Apr.	4	4.2	75004	4.9		57000	18000				4
May	20	8.4	1	5.1							1
June	19	10.0	21	4.9							21
July	29	8.4	3	5.1							3
Aug.	12	5.4	5	5.1							5
Sept.	18	4.2	2	4.9							2
Oct.	4	6.0	1	5.0							1
Nov.	4	1.2	1	5.2							1
Dec.	27	2.4	332	5.4	330			2.1	0.1	0.1	0
Total	206	80.	294432	60.	330	224000	70000	2.1	0.1	0.1	100
1962	186	92.	609419	60.	-	468000	141160	-	-	-	85

Month	<u>MTR-ETR</u>		Isotopic Activity (Gaseous) Curies						
	<u>3/</u> Activity Curies	Volume Ft ³ (10 ⁹)	Ar-41	Xe-137	Xe-138	Kr-88	Kr-89	Unident.	
Jan.	40880	2.6	11146	15361	1319.5	294.6	11980	779.3	
Feb.	45602	2.2	12912	17013	1336.6	296.6	13212	831.2	
Mar.	104552	2.2	5437	52809	3170.6	346.4	40422	2367.0	
Apr.	45558	2.3	11658	17910	1137.6	185.0	13799	868.5	
May	55610	2.2	11707	23279	1442.3	179.4	17875	1127.4	
June	47217	2.1	12828	17926	1410.7	293.8	13886	872.1	
July	49119	2.1	13566	17855	2128.6	560.8	14101	907.2	
Aug.	42288	2.2	11786	16012	1149.7	205.9	12363	771.6	
Sept.	48101	2.2	13320	18382	1204.7	151.6	14155	887.9	
Oct.	39379	2.4	14567	12846	1081.8	224.0	10034	626.7	
Nov.	30429	2.2	14704	8161	317.0	167.8	6332	757.3	
Dec.	47889	2.2	16235	16742	1050.0	118.1	12946	798.1	
Total	596624	26.9	149866	234296	16749.	3024.	181095	11594.	
1962	349423	26.5	170488						

1/ B-~~8~~ activity 100% A-412/ B-~~8~~ activity3/ Particulate & Gaseous B-~~8~~ activity4/ Activity calculated for Rala releases

TABLE XIV

RADIOACTIVITY DISCHARGED TO THE ATMOSPHERE (1962)

Month	<u>TREAT</u>		<u>ICPP</u>				<u>MTR-ETR</u>			
	Curies ^{1/}	Isotope	Curies ^{2/}	Isotopic Activity (Curies)			Curies ^{3/}	Isotopic Activity (Curies) ^{4/}		
				I-131	I-132	Unident.		A-41	Kr-88-89-90	Xe-137-138
Jan.	19	A-41	73.8	2.1	27.1	44.6	35,796	25,017	4,578	2,862
Feb.	4	A-41	51.0	2.4	39.9	8.7	35,550	22,499	5,596	7,294
Mar.	21	A-41	24.1	2.2	16.6	5.3	26,398	15,672	4,333	6,150
Apr.	20	A-41	35.3	3.5	21.2	10.6	26,924	9,170	7,650	9,623
May	15	A-41	9.1	1.1	5.2	2.7	30,962	7,894	9,666	11,889
June	17	A-41	4.3	0.4	---	3.8	27,874	12,489	6,617	8,457
July	8	A-41	0.4	---	---	0.4	24,703	12,340	5,346	6,714
Aug.	37	A-41	11.2	1.5	7.9	1.7	23,599	12,494	5,189	5,701
Sept.	7	A-41	2.6	0.4	1.6	0.6	26,906	12,510	6,165	7,529
Oct.	--	----	4.1	2.0	0.9	1.2	29,181	15,318	5,892	7,731
Nov.	19	A-41	2.3	0.4	0.7	1.1	26,946	12,334	6,176	8,191
Dec.	19	A-41	40.6	17.4	19.1	4.1	34,496	12,751	9,185	12,202
Total	186		258.8	33.4	140.2	84.8	349,335	170,488	76,393	94,343
1961	106		326.6				335,423			

^{1/} Does not include ≤ 7.5 uc of alpha activity.

^{2/} Does not include ≤ 0.01 curies of alpha activity or rare earth gases.

^{3/} Includes gaseous and particulate activity.

^{4/} Determined on gaseous activity only (isotopes).

SUMMARY

Installation	Curies	Identified Isotopes	Volume (Estimated)
TREAT	186	A-41	$2.6 \times 10^4 \text{ m}^3$
ICPP	259	I-131, I-132	$1.7 \times 10^9 \text{ m}^3$
MTR-ETR	349,334	A-41, Kr-88-89-90, Xe-137-138	$7.5 \times 10^8 \text{ m}^3$
Other (Area ML-1, NRF, OMRE, SPERT)	601	Ce-141-144, Nb-Zr-95, Kr-91-92, Xe-139	
Total 1962	350,380		
1961	343,080		

V. SOLID RADIOACTIVE WASTE

Solid waste originating at NRTS of off-site areas during 1963 and 1964 was buried at the burial ground located in the southwest portion of the NRTS. This burial ground occupies a total of 88 acres. An estimated 44 acres remain available for use at the end of 1964. Approximately 5 acres were used in 1963 and 4 acres in 1964. Since August of 1963 disposal of off-site generated waste was discontinued with the exception of one company under AEC contract. Private commercial firms are now operating burial sites for low level unclassified waste from licensees and other agencies.

Table XV summarized on- and off-site solid waste for 1964 and tabulated totals covering 1955 through 1964. Volumes and activities of solid waste are listed for NRTS facilities in Table XVI and XVII. On- and off-site solid waste is listed in Tables XVIII - XX by category for the past four years.

Figure 1 is a map of the NRTS burial ground area showing layout of trenches, pits and roadways as of 1964. A map of the SL-1 burial ground is shown on Figure 2. The SL-1 burial ground has not been used since 1962 after the disposal of material from the reactor incident. During 1964 a burial ground area near EBR-II was developed but not placed in operation. Figure 3 is a map of the EBR-II burial ground which will be used for high level waste from fuel processing. Disposal of waste containers will be made from a transfer cask into steel lined holes.

TABLE XV

ON- AND OFF-SITE SOLID RADIOACTIVE WASTE (1964)

Identification	January through June			July through December		
	Containers	Cubic Ft.	Curies	Containers	Cubic Ft.	Curies
Category I ^{1/}						
A. <u>On-Site</u>						
High Level	0	0	0	0	0	0
Intermediate	197	603	12,809	24	414	118,800
Low Level	3,966	49,826	1,329	4,661	59,879	10,256
B. <u>Off-Site</u>						
High Level	0	0	0	0	0	0
Intermediate	0	0	0	0	0	0
Low Level	7,508	66,310	1,146	5,331	66,266	1,145
A&B Total	11,671	113,739	15,284	10,016	126,559	130,201

SUMMARY

Year	<u>On-Site</u>		<u>Off-Site</u>		<u>On- and Off-Site</u>	
	Volume Cu. Meters	Activity Curies	Volume Cu. Meters	Activity Curies	Volume Cu. Meters	Activity Curies
1955					1,910	1,500
1956	2,754	"	1,066	"	3,820	10,000
1957	3,269	"	1,701	"	4,970	15,000
1958	5,909	"	971	"	6,909	10,500
1959	2,813	"	1,667	"	4,480	23,600
1960	3,462	"	1,948	"	5,410	9,200
1961	3,022	134,038	4,662	21,737	7,684	155,775
1962	4,468	112,369	3,703	5,808	8,171	118,177
1963	3,278	239,518	5,477	14,047	8,755	253,565
1964	3,133	143,194	3,752	2,291	6,885	145,485

^{1/} AEC and AEC contractors.

TABLE XVI

ON-SITE SOLID RADIOACTIVE WASTE

Facility	Jan. - June 1963		July - Dec. 1963		1963 - Total		
	Cubic Ft.	Curies	Cubic Ft.	Curies	Cubic Ft.	Cubic Meters	Curies
ANL	518	<0.1	1,658	2.8	2,176	62	2.8
ARA	1,200	151.4	1,152	3,030.3	2,352	67	3,181.7
CFA	438	0.8	661	<0.1	1,099	31	0.8
GCRF-ML-1	963	0.1	1,489	0.1	2,452	69	0.2
ICPP	4,918	<177.0	6,752	145.0	11,670	330	<322.0
MIR-ETR	14,769	129,193.5	19,062	48,542.7	33,831	957	177,736.2
NRF-S1W	1,878	0.4	4,595	2.2	6,473	183	2.6
NRF-A1W-ECF	16,979	15,983.5	18,400	5,268.6	34,983	990	21,252.1
OMRE	4,280	302.9	3,536	3.0	7,816	221	305.9
SPERT	258	0.5	427	0.1	685	19	0.6
TAN (PPCo)	8,522	29,468.2	2,704	7,246.0	11,226	318	36,714.2
TAN (G.E.)	648	<0.1	324	<0.1	972	28	<0.1
Total	55,371	175,278	60,760	64,241	115,735	3,275	239,519
1962	107,261	86,381	50,602	25,988	157,863	4,468	<112,369

Facility	Jan. - June 1964		July - Dec. 1964		1964 - Total		
	Cubic Ft.	Curies	Cubic Ft.	Curies	Cubic Ft.	Cubic Meters	Curies
ANL	1,265	248	1,432	167	2,697	76	415.
AEC	96	<0.1	112	0.1	208	6	---
ARA	927	159.	116	<0.1	1,043	30	159.
CFA	336	<0.1	940	0.1	1,276	36	---
GCRF-ML-1	1,362	19	1,164	1.	2,526	71	20.
ICPP	9,703	160	9,319	94.	19,022	538	254.
MIR-ETR	13,186	3,692	17,447	114,131.	30,633	867	117,823.
NRF	16,076	6,643	20,362	17,407.	36,438	1,031	24,050.
SPERT	343	1	229	0.1	572	16	1.
TAN (PPCo)	7,135	3,216	8,848	426	15,983	452	3,642.
TAN (G.E.)	0	0	324	<0.1	324	9	---
Total	50,429	14,137	60,293	132,226.	110,722	3,132	146,364

TABLE XVII

ON-SITE SOLID RADIOACTIVE WASTE

Facility	Jan-June 1961		July-December 1961		Jan-June 1962		July-December 1962	
	Cubic Ft.	Curies	Cubic Ft.	Curies	Cubic Ft.	Curies	Cubic Ft.	Curies
ANL	1,668	76.6	459	2.0	605	6.5	766	448.0
ARA	None	None	72	<0.1	446	48.5	1,083	24.0
CFA	708	0.7	624	0.1	498	0.1	492	0.1
GCRF	803	1.2	144	1.4	441	70.4	None	None
ICPP	9,483	279.1	4,043	92.5	4,027	49.1	3,291	53.1
MTR-ETR	18,123	104,057.1	14,652	18,352.0	16,569	71,430.4	14,416	10,710.4
NRF-SIW	15,538	300.7	6,707	9,916.6	1,884	0.1	1,619	0.3
NRF-AIW-ECF	None	None	4,531	767.1	11,370	7,236.6	14,644	5,090.3
ML-1	None	None	None	None	None	None	686	23.0
OMRE	4,657	0.1	3,888	0.1	2,835	0.1	4,617	0.5
SPERT	60	<0.1	100	<0.1	12	<0.1	783	1.2
SL-1	600	<0.1	13,950	63.4	67,344	536.2	None	None
TAN (G.E.)	2,337	49.3	3,597	76.8	972	7,004.0	5,493	9,044.7
TAN (PPCo)	None	None	None	None	258	<0.1	2,712	592.0

Facility	1961 Totals		1962 Totals	
	Cubic Ft.	Curies	Cubic Ft.	Curies
ANL	2,127	78.6	1,371	454
ARA	72	<0.1	1,529	72.5
CFA	1,332	0.8	990	<0.2
GCRF	947	2.6	441	70.4
ICPP	13,526	371.6	7,318	102
MTR-ETR	32,775	122,000	30,985	82,100
NRF-SIW	22,245	10,200	3,503	0.4
NRF-AIW-ECF	4,531	767.1	26,014	12,300
ML-1	None	None	686	23.0
OMRE	8,545	0.2	7,452	0.6
SPERT	160	<0.2	795	1.2
SL-1	14,550	63.5	67,344	536
TAN (G.E.)	5,934	126.1	6,465	16,000
TAN (PPCo)	None	None	2,970	<592
Total	106,744	133,611	157,863	<112,252

TABLE XVIII

ON- AND OFF-SITE SOLID RADIOACTIVE WASTE

Identification	January through June 1963			July through December 1963		
	Containers	Cubic Ft.	Curies	Containers	Cubic Ft.	Curies
Category I (AEC & Contractors)						
A. <u>On-Site</u>						
High Level	2	5	110,000	1	2	3,000
Intermediate	164	2,047	54,444	30	691	48,092
Low Level	4,472	53,406	10,832	4,707	59,670	13,150
B. <u>Off-Site</u>						
High Level	0	0	0	0	0	0
Intermediate	0	0	0	0	0	0
Low Level	7,588	112,321	10,133	7,140	67,553	1,001
A&B Total	12,226	167,779	185,409	11,878	127,916	65,243
Category II (Armed Services or Federal Agencies)						
High Level	0	0	0	1	1	1,080
Intermediate	0	0	0	0	0	0
Low Level	12	716	78	9	188	<0.1
Total	12	716	78	10	189	1,080
Category III (Licensees)						
High Level	0	0	0	0	0	0
Intermediate	11	27	<1,133	0	0	0
Low Level	929	9,071	604	413	3,657	<18
Total	940	9,098	<1,737	413	3,657	<18

Low Level waste - <10 curies/cubic feet
Intermediate waste - 10 to 1,000 c/ft³
High Level waste - >1,000 c/ft³

TABLE XIX

ON- AND OFF-SITE SOLID RADIOACTIVE WASTE

Identification	Jan. 1 through June 30, 1962			July 1 through Dec. 31, 1962		
	Containers	Cubic Ft.	Curies	Containers	Cubic Ft.	Curies
Category I						
A. <u>On-Site</u>						
High Level	1	4	18,000	0	0	0
Intermediate	13	141	59,744	51	498	17,054
Low Level	3,077	107,115	8,637	3,720	50,105	8,934
Total	3,091	107,260	86,381	3,771	50,603	25,988
B. <u>Off-Site</u>						
High Level	0	0	0	0	0	0
Intermediate	0	0	0	0	0	0
Low Level	6,631	57,028	502	7,117	59,655	2,704
Total	6,631	57,028	502	7,117	59,655	2,704
Category II						
High Level	0	0	0	0	0	0
Intermediate	0	0	0	0	0	0
Low Level	73	720	224	20	254	<1
Total	73	720	224	20	254	<1
Category III						
High Level	0	0	0	0	0	0
Intermediate	2	22	375	6	31	400
Low Level	931	5,917	<79	930	7,215	1,524
Total	933	5,939	454	936	7,246	1,924

TABLE XX

ON- AND OFF-SITE SOLID RADIOACTIVE WASTE

Identification	Jan. 1 through June 30, 1961			July 1 through Dec. 31, 1961		
	Containers	Cubic Ft.	Curies	Containers	Cubic Ft.	Curies
Category I						
A. <u>On-Site</u>						
High Level	0	0	0	1	1	15,000
Intermediate	25	1,191	100,221	11	44	5,819
Low Level	4,100	52,786	4,544	3,135	52,775	8,454
Total	4,125	53,977	104,765	3,147	52,820	29,273
B. <u>Off-Site</u>						
High Level	0	0	0	0	0	0
Intermediate	0	0	0	0	0	0
Low Level	9,326	77,018	11,934	6,636	64,915	8,898
Total	9,326	77,018	11,934	6,636	64,915	8,898
Category II						
High Level	0	0	0	0	0	0
Intermediate	0	0	0	0	0	0
Low Level	511	5,620	11	231	1,556	1
Total	511	5,620	11	231	1,556	1
Category III						
High Level	0	0	0	0	0	0
Intermediate	0	0	0	2	1	100
Low Level	957	9,218	134	1,135	6,416	659
Total	957	9,218	134	1,137	6,417	759

PIT NO.	DATE OPENED	DATE CLOSED	TRENCH NO	DATE OPENED	DATE CLOSED
1	11-1-57	10-1-59	1	7-8-52	10-1-54
2	10-1-59	7-1-63	2	10-1-54	12-21-54
3	12-15-61	1-3-63	3	12-22-54	4-22-55
4	1-3-63		4	4-22-55	11-21-55
5	6-18-63		5	11-4-55	3-29-56
			6	3-22-56	9-4-56
			7	8-14-56	12-20-56
			8	12-13-56	5-7-57
			9	1-17-57	9-6-57
			10	7-19-57	2-7-58
ACID PIT	1-1-54	11-1-61	11	2-11-58	7-25-58
			12	1-3-58	1-16-59
			13	1-9-59	4-24-59
			14	4-16-59	7-30-59
			15	7-31-59	10-16-59
			16	10-17-59	4-12-60
			17	11-1-59	7-1-60
			18	5-10-60	7-20-60
			19	7-5-60	11-29-60
			20	12-1-60	6-30-61
			21	12-13-60	1-10-61
			22	2-1-61	4-25-61
			23	6-20-61	9-15-61
			24	10-1-61	7-31-62
			25	8-1-61	7-27-62
			26	4-13-62	8-17-62
			27	8-20-62	1-4-63
			28	12-26-62	3-12-63
			29	11-19-62	3-20-63
			30	3-2-63	9-12-63
			31	3-25-63	11-22-63
			32	4-1-63	11-18-63
			33	10-11-63	8-11-64
			34	3-18-64	8-27-64
			35	8-28-64	
			36	12-1-64	
			37	12-24-64	

FIGURE 1

7 1-18-65 REVISED & BROUGHT UP TO DATE AS OF 1-1-65			
6 7-20-64 REVISED & BROUGHT UP TO DATE AS OF 7-1-64			
5 1-13-64 REVISED & BROUGHT UP TO DATE AS OF 1-1-64			
4 7-16-63 REVISED & BROUGHT UP TO DATE AS OF 7-1-63			
3 1-14-63 REVISED & BROUGHT UP TO DATE AS OF 1-14-63			
2 9-22-61 ADDED PIT NO. 4, TRENCH NO. 23, 24, 25 AND ROAD			
1 1-12-61 ADDED TRENCHES 20, 21, 22 & PIT NO. 3			
REVISIONS			APPROVED
APPROVED BY	BY	DATE	
CIVIL			
ELECTRICAL			
MECHANICAL			
SANITARY			
STRUCTURAL			
PROJ. ENGR.			
CONST. BRANCH			
SAFETY BRANCH			
OPERATIONS DIV.			
H. & S. DIV.			
SECURITY DIV.			
DRAWN BY B. M. JOHNSON			SCALE AS SHOWN
CHECKED BY G. Masterson			DATE OF ISSUE 2/19/60
DWG. NO. B25-101-100-3			SHEET 1 OF 1

NATIONAL REACTOR TESTING STATION
PLAN OF
BURIAL GROUND AREA
U. S. ATOMIC ENERGY COMMISSION
IDAHO OPERATIONS OFFICE
IDAHO FALLS, IDAHO

APPROVED BY _____ DATE _____
APPROVED BY _____ DATE _____

PUBLICATION OR GENERAL DISSEMINATION OF INFORMATION SHOWN ON THIS DRAWING IS PROHIBITED

PIT NO.	DATE OPEN	DATE CLOSED	TRENCH NO.	DATE OPEN	DATE CLOSED
1	OCT. 1961	MAR. 1962	1	OCT. 1961	JULY 1962
2	MAR. 1962	MAY 1962			

FIGURE 2

No.		DATE		REVISIONS		APPROVED	
APPROVED	BY	DATE		<p>SL-1 BURIAL GROUND</p> <p>U. S. ATOMIC ENERGY COMMISSION IDAHO OPERATIONS OFFICE IDAHO FALLS, IDAHO</p> <p>APPROVED BY _____ DATE _____ DIRECTOR-DIVISION OF ENG R & CONST</p> <p>APPROVED BY _____ DATE _____ CHIEF-ENGINEERING BRANCH</p>			
CIVIL							
ELECTRICAL							
MECHANICAL							
SANITARY							
STRUCTURAL							
PROJ. ENGR.							
CONST. BRANCH							
SAFETY BRANCH							
OPERATIONS DIV							
H & S DIV.							
SECURITY DIV.							
DRAWN BY: DLN 7/25/62		SCALE: 1" = 100'		DATE OF ISSUE:		REV.	
CHECKED BY:		DWG. No.		SHEET		OF	

PUBLICATION OR GENERAL DISSEMINATION OF INFORMATION SHOWN ON THIS DRAWING IS PROHIBITED

- INDICATES 20" Ø HOLE
- ⊙ 6" Ø CASED HOLES WITH 188 WALL THICKNESS

TYPICAL SECTION THRU HOLE

FIGURE 3