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MAY 23 1995 (21)

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Page 1 of 1
1. EDT 118528

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The document is based on a search of Pre-1970 Hanford Solid Waste Records. The available data indicates seven out of the thirty-one solid waste burial sites used appear to be Transuranic, using the >100 nCi/gm definition.

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Solid Waste Burial Sites

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7. Abstract The document is based on a search of pre-1970 Hanford Solid Waste Records. The available data indicates seven out of thirty-one solid waste burial sites used for pre-1970 waste appear to be Transuranic (TRU). A burial site defined to be TRU contains >100 nCi/gm Transuranic nuclides.		

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LIST OF TERMS

AEC	U.S. Atomic Energy Commission
ALARA	as low as reasonably achievable
HEPA	high-efficiency particulate air (filter)
SNM	special nuclear material
SWITS	Solid Waste Information and Tracking System
TRU	transuranic
WHC	Westinghouse Hanford Company

PRE-1970 TRANSURANIC SOLID WASTE AT THE HANFORD SITE

1.0 INTRODUCTION

In 1970, the U.S. Atomic Energy Commission (AEC) defined transuranic (TRU) waste as a separate waste category (Immediate Action Directive [IAD]). The AEC declared that the long-lived TRU radionuclide contaminated waste would have to be segregated from other radioactive waste and stored in a manner such that it could be retrieved within a 20-year span. This would allow time for decisions and facilities to be established to provide a permanent geologic storage/disposal system for TRU waste to ensure the public would not be inadvertently exposed to long-lived radioactive waste.

Prior to 1970, low-level radioactive solid waste at the Hanford Site was categorized primarily as contact-handled (nonshielded) and remote-handled (caisson) waste. A total of 339,817 m³ (>12,000,000 ft³) of waste was recorded as buried during the 1944 through 1969 time period (see Appendix A). Waste termed TRU after 1970 was mixed in with both the contact and remote-handled waste categories prior to that time. TRU waste was originally defined as containing greater than 10 nCi/g TRU radionuclides; later (in 1982), it was redefined as containing greater than 100 nCi/g TRU radionuclides. The purpose of this report is to review pre-1970 burial and other applicable records to determine how much of the buried solid waste is TRU and the locations of the various TRU waste burial sites.

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2.0 WASTE DESCRIPTIONS

2.1 CONTACT-HANDLED WASTE

Prior to 1970, most of the bulk volume of waste was packaged and handled in cardboard cartons measuring 0.46 x 0.46 x 0.61 m (1.5 x 1.5 x 2 ft) and equivalent to 0.13 m³ (4.5 ft³). After packaging, the typical waste carton was checked by a radiation monitoring technician and released for disposal if the exposed surface was found to be clean. Early on, the waste cartons were loaded into a load lugger generally placed near the back of the facility. The load lugger was normally checked once or twice a week. When full, the lugger of cartons was typically shipped to the nearest burial ground. The waste was emptied into a 5-8 meter deep, near-surface burial trench and covered with 3-6 meters of dirt (Harvey, 1969) (Figure 2-1). Later, waste cartons were stored in covered (dry) areas near the waste generating facility and picked up by a covered van on a routine basis, as shown in Figure 2-2. It was general practice that nearly all reasonably small-sized waste went into cartons, including uranium and plutonium waste. Metal drums were typically used for containing heavy waste, such as contaminated metals. Lead bricks, pumps, or other spent equipment, and glass or other sharp objects that might puncture the cardboard. Drums were also to be used for large amounts of radioactive material including uranium and plutonium. Accountable quantities of special nuclear material (SNM) plutonium could be placed in either cartons or drums, but drums were preferable. However, no plutonium assays were made of either the cardboard cartons or drums so accountability could not be confirmed.

Cartons were generally considered to have 1 g or less of plutonium unless specified (marked or labeled) on the package. In reality, accurate marking and accounting of plutonium and other quantities of SNM material on waste containers were comparatively lax compared to current procedures and practices. On the other hand, waste containers were used as a means of balancing the SNM inventories. The amount listed for the waste drum or carton was often the inventory difference between what was known to be left in the material zone and the known material that had been removed. The amount listed for the average waste drum or carton was often less than the actual amount except near the end of the month. The SNM material had to be accounted for at the end of the month so waste containers generated at that time often listed higher-than-actual SNM values to balance the books for losses sustained earlier in the month. Plutonium holdup in equipment, hoods, and gloveboxes also caused inventory variations that led to SNM waste package discrepancies. Because of plutonium holdup, listed SNM package contents were probably higher than estimated from inventory differences because holdup and the holdup amounts were often not recognized by SNM holders. Accountability factors more than anything else provided the basis for plutonium waste estimates. Therefore, a facility's annual estimate totals were probably reasonably good even though the individual SNM package contents were probably not very good (factor of 2 or 3).

Figure 2-1. Handling of Cardboard Cartons of Packaged Solid Waste.

Figure 2-2. Burial of Cardboard Cartons of Packaged Solid Waste.

91706-9CM

Figure 2-3 shows a copy of a typical solid waste burial record that was obtained from the Westinghouse Hanford Company (WHC) records storage facility (712 Building). The record shows the 1968 burial of 21 cardboard cartons containing 94.5 ft³ (2.7 m³) of plutonium-uranium waste. The approximate total weight of the cartons is 588 lb (267 kg), but there is no listed SNM value for either the plutonium or the uranium. The waste has a 308 Building shipment number and is assumed to be 308-generated waste. Plutonium and enriched uranium are accountable to the nearest gram and normal uranium to the nearest pound. It is likely there is accountable plutonium present, less likely there is accountable uranium. However, as stated previously, because the SNM was accounted for overall for each facility, other containers with listed plutonium contents are likely short of their listed inventory.

Wastes placed in disposal trenches in the 1950's and 1960's included contaminated tools and equipment, laboratory supplies, swabs, desk coverings, floor sweepings, contaminated clothing, and liquids in sealed containers (plastic bottles), sorbed on absorbent, or embedded in concrete (Parker 1954). Other general items included chemicals, glassware, paper, wood, and cloth. Contaminants included uranium, thorium, transuranics, fission products, and other radioisotopes used in research.

The types and quantity of waste containers submitted for disposal are listed in Table 2-1 and are the same, or similar, to many containers used in the 1980s and 1990s. In addition to the standard cartons and drums, waste containers included concrete burial vaults, including some designed specifically for high activity contaminated high-efficiency particulate air (HEPA) filters (Figure 2-4), wooden and steel boxes (Figures 2-5 and 2-6, respectively), plastic wrap, and self-contained materials such as tanks, hoods, gloveboxes, and cardboard boxes other than the standard carton (Figure 2-7). Probably the other most common cardboard package containing waste is the low-activity HEPA filters that were placed back into the cardboard cartons in which they were procured. Other specialty containers were made for certain unique types of waste such as reactor tools or hardware, irradiated fuel assembly pieces or parts, and ion exchange equipment. Drummed materials greater than 200 mrem/h and similar high-radiation materials were considered remote handled and were placed into the caisson waste where possible. If pieces were too large and could not be cut down, they were buried as best as they could be in the regular burial trench (see pipe sections in Figure 2-7). Some high-activity materials were placed near the center of the trench to allowing other waste to be placed around it and provide natural shielding and additional distance. Parts of railroad cars, contaminated vehicles or parts, concrete and/or other building debris, and similar materials also can be found in the burial grounds. The latter materials, because of their high relative weight, would generally be considered non-TRU in character. However, discarded gloveboxes generally were grossly contaminated with plutonium and would be considered to be part of the TRU fraction. Additional information on containers can be obtained from WHC-EP-0225 (Anderson et al. 1990), which addresses primarily post-1970 TRU waste.

Figure 2-3. Example of Typical Solid Waste Burial Record from 1968.

BATTELLE-NORTHWEST RICHLAND WASHINGTON		SOLID WASTE BURIAL		DATE 3-1-68	SHIPMENT NUMBER 308-6
NUMBER OF PACKAGES 21		TYPE Waste cartons			
TOTAL VOLUME (ft ³) 94.5		Pu (Grams) —			
TRITIUM (Grams) —		ENRICHMENT —			
ACTIVITY OTHER THAN U OR Pu (Curies) — 192 41.0 Ci					
PRINCIPAL ACTIVITY DESCRIPTION (if known Pu, U, Sr, Cs, etc.)					
REMARKS ON PACKED ITEMS OR SPECIAL CONDITIONS CA-21-94.5-588 Pu-U Contaminated Waste					
BY SHIPPER J. Jensen		BY WASTE DISPOSAL W. Thurber		DATE 3/1/68	
DISTRIBUTION					
BY SHIPPER		BY WASTE DISPOSAL - RETAIN ALL COPIES AND FORWARD TO:			
Copy 1		Copy 1 - ERM Waste Disposal & Decontamination, 325 Alder			
Copy 2 - ARHCO		Copy 2 - Retain			
Copy 3		Copy 3 - Retain			
Copy 4 - ERM Snipper					
Copy 5 - ERM WD&D					

WH-1007-372 (12-67)

Table 2-1. Waste Container Types Submitted for Burial in 1968. (2 sheets)

Container type ^a	Containers	Totals				
		Containers	Volume (m ³)	Weight (kg)	Plutonium (g)	Beta/gamma (Ci ^b)
1 gal	Metal drums, barrels, kegs	1,188	5.35	3,600	400	16,000
10 gal	Metal drums, barrels, kegs	25	0.86	540	60	130
1,470 ft ³	Concrete boxes	1	40	18,000	--	410
15 gal	Metal drums, barrels, kegs	14	0.81	500	--	0.01
1,672 ft ³	Concrete boxes	2	95	42,000	--	16,000
1,728 ft ³	Concrete boxes	5	250	110,000	--	3,800
1 x 3 x 3	Wooden boxes, cartons, cases	1	0.26	110	--	0.02
1.5 x 1.5 x 10	Wooden boxes, cartons, cases	1	0.45	200	--	0.02
1.5 x 1.5 x 3	Fiberboard boxes	43,741	5,800	650,000	7,200	36,000
2 ft ³	Fiberboard/plastic boxes, cartons, cases	2,901	150	16,000	180	1,200
2 gal	Metal drums, barrels, kegs	8	0.07	47	--	1,200
2 x 2 x 2	Wooden boxes, cartons, cases	1	0.21	100	--	0.5
2 x 2 x 2.5	Wooden boxes, cartons, cases	1	0.29	180	--	190
2 x 2 x 3	Metal drums, barrels, kegs	23	8.79	3,900	23	100
2 x 2 x 3	Wooden boxes, cartons, cases	6	2.27	1,000	--	220
2 x 2 x 4	Wooden boxes, cartons, cases	2	0.88	390	--	0.03
2 x 2 x 6	Wooden boxes, cartons, cases	1	0.61	340	--	410
2 x 3 x 4	Wooden boxes, cartons, cases	3	1.95	870	--	--
2 x 3 x 5	Wooden boxes, cartons, cases	9	7.65	3,400	--	--
2 x 3 x 7	Wooden boxes, cartons, cases	1	1.2	320	--	810
2 x 4 x 10	Wooden boxes, cartons, cases	1	2.27	1,000	--	0.04
2 x 4 x 4	Wooden boxes, cartons, cases	2	1.88	960	--	660
2 x 4 x 5	Wooden boxes, cartons, cases	1	1.05	700	--	710
2 x 4 x 8	Wooden boxes, cartons, cases	6	17	4,400	--	0.04
3 gal	Metal drums, barrels, kegs	2	0.02	16	--	82
30 gal	Metal drums, barrels, kegs	277	35	13,000	3.41	1,900
3 x 3 x 3	Wooden boxes, cartons, cases	16	9.7	5,100	0.01	4,300
3 x 3 x 4	Wooden boxes, cartons, cases	3	3.06	1,400	0.01	0.95
3 x 3 x 5	Wooden boxes, cartons, cases	1	1.33	100	--	900
3 x 3 x 7	Wooden boxes, cartons, cases	5	8.3	2,500	--	2,900
3 x 4 x 4	Wooden boxes, cartons, cases	2	2.5	1,300	--	780
3 x 4 x 5	Wooden boxes, cartons, cases	3	6.61	3,100	--	1,000
3 x 4 x 6	Wooden boxes, cartons, cases	7	0.3	28	--	0
3 x 4 x 8	Wooden boxes, cartons, cases	3	8.15	3,700	0	0.94
3 x 5 x 25	Wooden boxes, cartons, cases	1	11	4,800	--	0.38
3 x 5 x 5	Wooden boxes, cartons, cases	1	1.91	880	--	--
3 x 5 x 8	Concrete boxes	1	2.83	1,200	--	200
3 x 8 x 8	Wooden boxes, cartons, cases	2	9.06	4,100	--	0

Table 2-1. Waste Container Types Submitted for Burial in 1968. (2 sheets)

Container type ^a	Containers	Totals				
		Containers	Volume (m ³)	Weight (kg)	Plutonium (g)	Beta/gamma (Ci ^b)
4 x 4 x 12	Wooden boxes, cartons, cases	12	67	30,000	0.01	1.82
4 x 4 x 14	Wooden boxes, cartons, cases	1	6.34	2,800	--	0.5
4 x 4 x 4	Wooden boxes, cartons, cases	1	1.81	810	--	--
4 x 4 x 5	Wooden boxes, cartons, cases	1	2.27	1,000	--	--
4 x 4 x 6	Wooden boxes, cartons, cases	1	2.72	1,200	--	--
4 x 4 x 8	Fiberboard/plastic boxes, cartons, cases	31	4.5	63	--	0.8
4 x 4 x 8	Wooden boxes, cartons, cases	19	66	29,000	0.75	47
4 x 5 x 6	Wooden boxes, cartons, cases	1	3.4	1,500	--	0.04
4 x 5 x 7	Wooden boxes, cartons, cases	5	21	2,900	--	15,000
4 x 5 x 8	Wooden boxes, cartons, cases	1	4.49	1,100	--	3,100
4 x 6 x 8	Wooden boxes, cartons, cases	1	5.44	2,400	--	--
5 gal	Metal drums, barrels, kegs	1,167	34	23,000	390	8,000
55 gal	Metal drums, barrels, kegs	1,024	220	110,000	120	3,300
5 x 7 x 7	Wooden boxes, cartons, cases	1	7.65	3,400	50	0.01
5 x 7 x 8	Wooden boxes, cartons, cases	1	7.93	3,600	--	--
5 x 8 x 10	Metal drums, barrels, kegs	1	11	5,100	--	14
8 x 10 x 12	Concrete boxes	1	27	12,000	--	24,000
8 x 10 x 19	Concrete boxes	4	170	77,000	--	79,000
Unknown	Burlap, cloth, paper or plastic bags, wrap	233	29	10,000	20	7.35
Unknown	Concrete boxes	84	670	380,000	830	10,000
Unknown	Dump truck	121	420	620,000	--	150
Unknown	Fiberboard/plastic drums, barrels, kegs	81	14	3,300	--	22
Unknown	Gloveboxes	5	24	11,000	9.32	0.21
Unknown	HEPA filters	414	65	19,000	80	970
Unknown	Metal boxes, cartons, cases	3	0.2	110	0.36	--
Unknown	Metal cylinder, casks	2	1.71	770	6.9	0.47
Unknown	Metal drums, barrels, kegs	70	1.29	920	190	510
Unknown	Miscellaneous scrap	328	130	50,000	41	250
Unknown	Self contained, equipment	197	170	120,000	30	2,900
Unknown	Tanks, portable	28	26	10,000	--	89,000
Unknown	Trucks, flatbeds, compactor, load lugger	267	1,500	720,000	26	580
Unknown	Unknown container type	31	330,000	230,000,000	350,000	480,000
Unknown	Wooden boxes, cartons, cases	114	470	190,000	460	120

^aThese measurements not converted to metric because they are the original 1968 container types.^bThese measurements not converted to metric because they are the original 1968 measurements. To convert from Ci to Bq, multiply by 3.7×10^{10} .

HEPA = high-efficiency particulate air (filter).

Figure 2-4. Typical Concrete Burial Vault.

Hanford Engineering Development Laboratory	WASTE CONTAINERS	
HANDBOOK OF SHIPPING CONTAINERS MG 104	Revision 4	Page 9
	Date DECEMBER 30, 1983	
	Approval <i>R. Martin</i>

1. COMMON NAME: Non-TRU Concrete Filter Burial Box
2. OFFICIAL NAME: Non-TRU Concrete Filter Burial Box
3. CONTAINER EXTERIOR DIMENSIONS: 34" x 34" x 34"
 INTERIOR DIMENSIONS: 30" x 30" x 26"
 EMPTY WEIGHT: 2400 pounds MAXIMUM GROSS WEIGHT: 2420 pounds
 SHIELDING MATERIAL: Concrete THICKNESS: 4"
 DESCRIPTION: DRAWING No. H-3-35290
 Constructed of 3000 lbs/sq in. concrete. Lid is sealed with neoprene gasket;
 bonded with Silicon rubber (Dow Corning RTV-732).
 FOR INFORMATION CONTACT: Waste Systems Operations, 6-3012
 No. OF AVAILABLE CONTAINERS: 20

Figure 2-5. Wooden Shipping and Burial Container.

DOT 7A Type A **49 CFR 178.350**

Wooden Box - LLNL Flush Panel

DOT = Department of Transportation
LLNL = Lawrence Livermore National Laboratory

Note: Measurements not converted to metric
because diagram depicts the standards
used for pre-1970 waste packaging.

4 Steel Bands
3/4 in. Wide

3 Steel Bands
1 1/4 in. Wide

39411112.7

Figure 2-6. Steel Transport and Burial Container.

Hanford Engineering Development Laboratory			
HANDBOOK OF SHIPPING CONTAINERS			
MG 104			
Approval <i>[Signature]</i>			
Date		DECEMBER 30, 1983	
Revision	4	Page	13
WASTE CONTAINERS

1. COMMON NAME: CI 667 Transport and Burial Container

2. OFFICIAL NAME: CI 667

3. CONTAINER EXTERIOR DIMENSIONS: 7' L x 6' W x 6' H

INTERIOR DIMENSIONS:

78-3/8" L x 66-3/8" W x 70" H

EMPTY WEIGHT: 2700 pounds

MAXIMUM GROSS WEIGHT: 12,000 pounds

SHIELDING MATERIAL: Steel

THICKNESS: 3/16"

DESCRIPTION

DRAWING No. H-2-91888

A steel box built of 3/16" low carbon steel. Closure is by self-drilling and self-tapping screws. A neoprene gasket is used to seal the lid. It is authorized to contain TRU waste, and has a volume of 210 cu. ft. FOR INFORMATION CONTACT: Waste System Engineering

No. OF AVAILABLE CONTAINERS: Must be ordered from manufacturer.

Figure 2-7. Near-Surface Burial Trench for Various Waste Burial Containers.

13101.1

2.2 REMOTE-HANDLED WASTE

The remote-handled waste was placed in various caisson or similar facilities. Caissons were of various designs including long, straight pipes that went deep into the ground; steel drum units (five or six each) welded together and having just a top and a bottom; and corrugated pipe units most commonly 1.8 to 2.4 m (6 to 8 ft) in diameter with a small straight or crooked neck pipe feed section. Figure 2-8 shows the basic design of one of the more typical caisson units. Other designs are shown in WHC-EP-0225 (Anderson, 1990). The caisson shown in Figure 2-8 is open bottom, post-1970 caissons were closed-bottom with concrete sides to make them retrievable.

The waste that went into the caissons was typically from hot cell or similar operations. The size of the containers was comparatively small, typically 18.9 L (5 gal) or smaller. Much of the caisson waste was packaged in either 3.8- or 4.7-L (1-gal or 5-qt) metal paint cans with a standard friction seal lid that was tapped on with a hammer, a portion of lead brick, or some other heavy weight. The waste contents varied depending primarily on the generating facility. The caisson waste from the 327/300 facility contained a lot of small irradiated fuel pieces, pellets, and samples that were mounted, examined, and discarded. The 327 waste also included a lot of metallographic wastes such as plastic mounts, sanding and polishing discs, and similar materials. The waste containers generated ranged from 0.9-L (1-qt) juice cans to 3.8-L (1-gal) paint cans, opened 18.9- or 22.7-L (5- or 6-gal) aluminum milk cans sealed with gel, and other miscellaneous containers. Hot cells in 325 generated fuel reprocessing type waste such as spent ion exchange resin, used extraction columns and test extractors, spent glassware and glass columns, stainless steel tubing and fittings, heaters, boildown pots, and hotplates. A lot of the waste generated here was placed in 18.9-L cans or similar type containers. The analytical hotcells in the 325 Building generated lots of small glass vials, stirrers, damaged or dirty glassware, broken electrodes, cut up instrumentation, and absorbed liquids. Most of the waste generated in this type of hot cell was placed in 3.8- or 4.7-L paint cans. Some of the waste was placed in concrete shielded drums and disposed of in the burial trenches; however, the higher activity material was sent to the caissons.

Prior to 1970, both radioactive and TRU remote-handled solid waste went into the same caisson receptor. After 1970, separate caissons were constructed so that radioactive and TRU caisson waste could be segregated. An example of the TRU/non-TRU split is provided by RHO-CD-78 (Brown et al. 1977), as shown in Table 2-2.

Figure 2-8. Typical Caisson Waste Burial Unit for Receiving Remote-Handled Waste.

Note: Measurements not converted to metric because diagram depicts the standards used for pre-1970 waste disposal.

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Table 2-2. Trench, Caisson, and Transuranic Pad Storage and Burial Quantities for 1976.

Location	Volume (m ³)	Plutonium (kg)	Beta/gamma activity (Ci)
Transuranic waste			
Pad	250	2,040	1.1
Caisson	1.6	430	3,400
Trench	590	2,800	0
Nontransuranic waste			
Caisson	1.7	0	310
Trench	4,600	0	19,000
Total waste	5,340	5,270	22,000

Source: Brown et al. 1977.

3.0 DISPOSAL OF SOLID WASTE

Burial records showing the disposal of solid waste since the Hanford Site was activated in 1943 are provided in Appendix A from the Solid Waste Information and Tracking System (SWITS) database records. The original records were neither very complete nor detailed, but the information and data available were assembled and placed in the database as completely as possible. The records do provide an estimate of the amounts and types of waste disposed prior to 1970 in which the TRU waste and other radioactive waste were typically mixed together. The burial records also show a large volume increase in 1969. This is due to 100 Area Solid Waste being added to the database, and is not due to any other operational changes.

Once TRU waste was defined, it became a requirement to segregate it from the other radioactive waste. It was soon recognized that segregation could and should minimize the amount or volume of TRU waste generated by not contaminating other radioactive waste with the TRU radionuclides. Therefore, the ratio of TRU to total solid waste declined sharply in the 1970's while the nCi/g unit value increased. Figure 3-1 shows the volume of radioactive waste generated in the pre-1970 time period. Figure 3-2 shows the TRU waste volume generated, and Figure 3-3 shows waste volume ratios for TRU versus total waste for the pre-1970 time period, based upon listed SNM package contents. Figures 3-4 and 3-5 show similar graphs for the post-1970 time period, and Figure 3-6 shows the TRU/non-TRU waste ratio for 1970 through 1980. There is a higher comparative volume of TRU waste during the pre-1970's than has occurred since. In addition, most pre-1970 TRU waste has a lower TRU activity. The TRU to non-TRU ratio for pre-1970, determined from data in Section 5.0, is 0.158. The 1970 through 1980 ratio, determined from data in Table 3-1, is 0.097.

The low-level solid waste and TRU waste generation values from SWITS for 1970 through 1980 are given in Table 3-1. The records show 141,400 m³ (4,993,467 ft³) of low-level, non-TRU solid waste was generated during those 11 years for an average generation of 12,854 m³ (453,932 ft³) per year versus the pre-1970 average generation of 10,983 m³ (387,859 ft³) per year, which included the TRU waste. The generation of TRU waste averaged 2,067 m³ (72,995 ft³) for post-1970 versus 1,250 m³ (44,143 ft³) for what was designated as the average pre-1970 TRU waste generation rate.

The definition of TRU waste has changed since it was first defined in 1970. The definition from 1970 to 1973 was based on generator practice. From 1974 to 1982 the definition was specified as >10 nCi/g. Since 1982 the definition has been specified as >100 nCi/g. This report considers the pre-1970 waste based on the present >100 nCi/g definition. Therefore, some of the 1970's TRU waste cited for comparative purposes might actually be non-TRU by the current definition. This reclassification may become more apparent in later years as stored TRU waste is retrieved and reassayed for certification at the present >100 nCi/g TRU definition. However, this is expected to have little effect on the conclusions of this report.

Figure 3-1. Pre-1970 Radioactive Solid Waste Volumes Buried at the Hanford Site.

Figure 3-2. Pre-1970 Transuranic Solid Waste Volumes Buried at the Hanford Site.

Figure 3-3. Pre-1970 Radioactive and Transuranic Solid Waste Volumes Buried at the Hanford Site.

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Figure 3-4. Post-1970 Radioactive Solid Waste Generated at the Hanford Site.

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Figure 3-5. Post-1970 Transuranic Solid Waste Generated at the Hanford Site.

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Figure 3-6. Post-1970 Radioactive and Transuranic Solid Waste Generated at the Hanford Site.

39411112.6

Table 3-1. Low-Level Solid Waste Generated from 1970 to 1980.

Year	Waste classification			
	Radioactive		Transuranic	
	Volume (m ³)	Weight (kg)	Volume (m ³)	Weight (kg)
1970	9,600	5,300,000	2,300	940,000
1971	6,200	6,300,000	58	20,000
1972	44,000	38,000,000	280	91,000
1973	11,000	8,600,000	1,900	660,000
1974	7,700	3,800,000	420	420,000
1975	6,300	3,200,000	3,000	1,100,000
1976	5,800	2,800,000	100	59,000
1977	14,000	7,500,000	3.62	1,600
1978	14,000	10,000,000	2,900	980,000
1979	8,800	4,800,000	31	64,000
1980	14,000	7,600,000	2,400	600,000

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4.0 BURIAL SITE LOCATIONS

The burial sites used for disposal of pre-1970 waste are given in Table 4-1 based on the Hanford SWITS records. The volumes and weights of waste placed in the sites, the plutonium and uranium contents, and the beta/gamma curie levels are listed. Using the 0.08 Ci/g plutonium factor used by Anderson et al. (1990), the plutonium densities of the sites were estimated. Twenty-five of the 31 listed burial site locations contain radioactive, non-TRU waste with estimated plutonium contents at or below 100 nCi/g. The other six disposal sites have plutonium densities above 100 nCi/g and are considered to be TRU waste disposal sites. This has not been confirmed by physical measurements of burial site plutonium or other TRU radionuclides.

Table 4-1. The Radioactive and Transuranic Classification of Pre-1970 Solid Waste Burial Sites.

Location	Gross volume (m ³)	Gross weight (kg)	Plutonium content (g)	Uranium nat. content (g)	Total beta/gamma (Ci)	Plutonium density (nCi/g)	Waste type
118B	2,700	2,300,000	--	--	1,300	--	Rad
118C	5,100	4,400,000	--	--	1,800	--	Rad
118D	11,000	10,000,000	--	--	2,100	--	Rad
118DR	240	2,000,000	--	--	4,500	--	Rad
118F	11,000	9,700,000	--	--	1,900	--	Rad
118H	8,400	7,000,000	--	--	3,500	--	Rad
118K	10	9,100	--	--	20	--	Rad
218E1	3,000	1,400,000	900	880	100	53	Rad
218E10	13,000	15,000,000	4,000	1,800	160,000	22	Rad
218E12A	15,000	6,800,000	8,900	2,200	890	104	TRU
218E12B	3,200	1,300,000	1,300	16	6,000	78	Rad
218E14	570	660,000	--	--	88,000	--	Rad
218E15	140	160,000	--	--	1,200	--	Rad
218E2	9,000	1,000,000	800	660	25,000	6.06	Rad
218E4	1,600	710,000	10	2.2	10	1.12	Rad
218E5	3,200	3,700,000	620	260	7,500	13	Rad
218E5A	6,200	7,200,000	1,400	260	17,000	15	Rad
218E8	2,300	1,000,000	20	4.41	10	1.57	Rad
218W1	7,200	3,200,000	94,000	1,500	200	2,300	TRU
218W11	1,200	520,000	--	--	0.1	--	Rad
218W1A	14,000	16,000,000	2,000	2,000	48,000	10	Rad
218W2	8,200	3,700,000	130,000	3,100	500	2,700	TRU
218W2A	18,000	21,000,000	6,000	4,400	240,000	22	Rad
218W3	11,000	4,900,000	68,000	150,000	900	1,100	TRU
218W4A	18,000	7,800,000	35,000	870,000	3,800	360	TRU
218W4B	6,200	1,500,000	8,000	44	180,000	420	TRU
218W9	490	220,000	--	--	0.1	--	Rad
222BV	170	76,000	1	2.2	600	1.05	Rad
222SV	160	71,000	0.7	1.54	4,000	0.79	Rad
222TV	68	30,000	0.3	0.66	770	0.79	Rad
618	160,000	90,000,000	1,200	240,000	10,000	1.07	Rad

Rad = radioactive.

TRU = transuranic.

Five of these TRU waste burial sites are located in the 200 West Area (Figure 4-1) (ERDA 1975), and one is in the 200 East Area (Figure 4-2) (Brown et al. 1977). The 200 West Area burial grounds are located west and north of the Plutonium Finishing Plant. Burial site 218-E-12A is located north of the Plutonium-Uranium Extraction Plant and east of B Plant facilities in the 200 East Area.

Figure 4-1. 200 West Area Radioactive Solid Waste Disposal Sites.

Figure 4-2. 200 East Area Radioactive Solid Waste Disposal Sites.

In addition to the six TRU sites identified by the SWITS data, the 618-11 burial site also appears to be a TRU site based on a detailed review of the waste that was buried or potentially buried there (Demiter and Greenhalgh 1994). The 618-11 burial site operated from 1962 to 1967 and is located just west of the Washington Nuclear Plant 2 reactor building (Phillips et al. 1977). The site was open during the operation of the Plutonium Recovery Test Reactor, and a significant fraction of the Plutonium Recovery Test Reactor's plutonium, as well as some research and development reprocessing plutonium from the Plutonium-Uranium Extraction Facility (PUREX) and the Reduction Oxidation Plant (REDOX), is thought to be there (Demiter and Greenhalgh 1994). During its period of operation, essentially all 300 Area waste, except some 308 Building and 325 Building waste, was deposited there. Some of the 308 and 325 Buildings' higher content plutonium waste was sent out to the 200 West burial grounds after 1963. The SWITS records show some burial of plutonium material in "618," but there are several 618 sites, and the 618 burial records may be incomplete or contain errors. The 618-11 site is considered to have a plutonium density of approximately 300 nCi/g and therefore is also considered to be a TRU burial site (Demiter and Greenhalgh 1994). The 618-11 burial ground, shown in Figure 4-3¹, is located just north of the Washington Nuclear Plant 2 between the 300 and 200 Areas of the Hanford Site (Brown et al. 1977).

These seven burial sites are all that can be identified based on the SWITS database and WHC-EP-0649 (Demiter and Greenhalgh 1994), but Albaugh et al. (1985) and Kupfer et al. (1986) each list 11 pre-1970 burial sites which they consider to be TRU. The 11 sites from Kupfer et al. (1986) are shown in Table 4-2.

Table 4-2. Pre-1970 Transuranic Waste Burial Sites
(RHO 1986).

Burial site	Total plutonium (g)	Transuranic density (nCi/g)
218-W-1	94,000	560
218-W-2	130,000	290
218-W-3	68,000	140
218-W-4B	9,900	78
218-W-4A	35,000	76
218-E-1	900	16
218-E-5A	1,400	34
218-E-12B	1,200	14
618-1	1,000	110
618-2	1,000	75
618-11	10,000	68

¹The various 618 burial grounds have been renamed to 318 to reflect their location in what is now known as the 300 Area of the Hanford Site. Although this report uses 618 in the text, Figures 4-3 and 4-4 use the 318 designator.

Figure 4-3. Designated 600 and/or 300 Area Numbered Radioactive Solid Waste Disposal Sites.

Figure 4-4. 300 Area Radioactive Solid Waste Disposal Sites.

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Four of the burial sites listed in the table have transuranic densities of >100 nCi/g. Of these, three already have been identified in this report as TRU waste burial sites. The fourth, 618-1, was initially considered to be a TRU waste burial site with a listed Pu content of 1000 grams. Figure 4-4 shows the location of 618-1 just north of the 306 Building in the 300 Area (Brown et al. 1977). However, Ruck (Ruck, 1987) issued a letter resolving at that time the plutonium contents of 300 Area Waste Sites between the draft Hanford Defense Waste - Environmental Impact Statement (HDW - EIS) and the Hanford Inactive Site Survey (HISS) database. They listed the plutonium contents as given below:

<u>Waste Site</u>	<u>Pu Content (g)</u>
618-1	1
618-2	0
618-10	200
618-11	10,000

The plutonium content of 1 gram appears to these authors to be low since 618-1 received waste from 3706 building, some of which was TRU. However, the original estimate of 1000 grams cannot be justified either based on the limited plutonium work at 3706 building and the other contributors were uranium only waste generators (Gerber, 1990) (ERDA-1975). Therefore, this report estimates the 618-1 burial ground Pu content at <100 grams and lists the burial site as non-TRU (approximately 10 to 15 nCi/g).

Albaugh et al. (1985) and Kupfer et al. (1986) selected the 11 potential TRU burial sites based on the criteria of >10 nCi/g and the believed potential for areas of concentrated TRU. For this report, the present standard of >100 nCi/g is the preferred criteria. This appears to be consistent with as low as reasonably achievable (ALARA) practices. Under the >10 nCi/g criteria, operators could be required to exhume, repackage, and assay questionable buried waste only to find most of it is non-TRU that can be reburied. There may be areas where the waste is concentrated to >100 nCi/g, but because the burial grounds involved have all been covered and stabilized, the average trench risk based on the average plutonium content is the major consideration. In essence, each burial site is being treated as an individual burial container. Therefore, burial sites 218-W-1, 218-W-2, 218-W-3, 218-W-4A, 218-W-4B, 218-E-12A, and 618-11 should be listed as TRU based on the SWITS database, Demiter and Greenhalgh (1994), and Kupfer et al. (1986). The remaining pre-1970 waste burial sites are consider to be non-TRU.

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5.0 SOLID WASTE VOLUMES

The volume of solid waste generated from 1944 through 1970 is listed in SWITS files. These files have been reproduced in a condensed form (for 1968 and 1969) and are given in Appendix A. The waste units as provided in SWITS were evaluated for the listed plutonium content and plutonium density (nCi/gm), and are identified in the table in Appendix A as either RAD (radioactive) or TRU (transuranic). The volume of TRU waste identified is also listed. Table 5-1 gives a summary of the waste volumes, plutonium content, and the accumulative values for the pre-1970 years. Specific generator information was not available until 1968, so it is not included. Further work linking TRU waste volumes with generator identification might be worthwhile.

Figures 3-1, 3-2, and 3-3 show the respective volumes of radioactive, TRU, and total solid waste. The accumulative total of pre-1970 buried solid waste is $339,817 \text{ m}^3$ ($\approx 12,000,000 \text{ ft}^3$). That fraction which appears to be TRU in nature comprises $53,744 \text{ m}^3$ ($\approx 1,900,000 \text{ ft}^3$) or approximately 16% by volume. Segregation and waste minimization since 1970 have reduced the Radioactive-to-TRU waste ratio. Figures 3-4, 3-5, and 3-6 show the comparative post-1970 waste volumes. The Radioactive-to-TRU waste ratio since 1970 has dropped below 10% and continues to decrease.

A search of various other records (Appendix B) added little to the SWITS data and the information provided above. A lot of information was published about disposal of liquid wastes, but comparatively little was mentioned about solid waste. Liquid waste was considered mobile or potentially mobile, which caused it to be of concern in the pre-1970 period. Solid waste trenches, however, were made in dry desert sand above the water table. The yearly average rain total is less than 20 cm (8 in.) so there is little water penetration through the first meter of sand and certainly no significant penetration through more than 5 meters into the trenches (Geiger, 1977). Therefore, once solid waste was placed in a burial trench and covered it was assumed to be adequately disposed.

Gydesen (1946), Baker (1967), and Hall (1968 and 1969) provide some information on solid waste. The volumes of waste provided by these references versus the SWITS data are given in Table 5-2 for comparison. There does not appear to be any readily comparable relationship between the SWITS data and other available sources for the volume data. The plutonium contents, however, are more comparable and tend to support the SWITS database. For this reason, and because of its apparent completeness, this report assumes the SWITS data is the best source of solid waste burial data. Unfortunately, documentation during the pre-1970 time period was generally limited in completeness and accuracy. The example in Figure 2-3 is very typical of the available burial records.

Table 5-1. A Summary of Pre-1970 Solid Waste Volumes.

Year	Volume (m ³)	Plutonium (kg)	TRU (m ³)	Accumulative values		
				Volume (m ³)	TRU (m ³)	plutonium (kg)
1944	14	0	0	14	0	0
1945	2,104	1.34	453	2,118	453	1.34
1946	2,161	1.34	453	4,279	906	2.68
1947	3,576	1.435	594	7,855	1,500	4.115
1948	3,520	1.435	538	11,375	2,038	5.55
1949	3,607	6.415	623	14,982	2,660	11.965
1950	4,822	21.36	1,330	19,804	3,990	33.325
1951	4,737	31.32	1,387	24,541	5,377	64.645
1952	5,434	32.335	1,769	29,975	7,146	96.98
1953	5,747	30.190	1,989	35,722	9,135	127.17
1954	7,153	31.700	2,046	42,875	11,181	158.87
1955	9,010	33.340	2,100	51,885	13,281	192.21
1956	8,317	34.905	2,949	60,202	16,230	227.12
1957	8,807	31.965	3,854	69,009	20,085	259.08
1958	7,797	32.555	3,724	76,806	23,809	291.64
1959	7,739	6.975	3,809	84,545	25,920	298.61
1960	8,914	3.300	2,822	93,459	30,440	301.91
1961	5,125	5.890	3,547	98,584	33,986	307.8
1962	5,834	5.695	3,840	104,418	37,826	313.5
1963	4,980	6.160	3,257	109,398	41,083	319.7
1964	5,802	6.500	3,572	115,200	44,656	326.2
1965	25,059	6.450	2,059	140,259	46,714	332.6
1966	5,101	6.660	2,030	145,360	48,745	339.3
1967	19,556	7.930	3,246	164,916	51,991	347.2
1968	5,620	6.646	990	170,536	52,981	353.8
1969	69,281	4.757	763	339,817	53,744	358.6

Source: Solid Waste Information and Tracking System data.
TRU = transuranic.

*Note: This contains 100 Area Waste in addition to the Typical 200 Area database records.

Table 5-2. Solid Waste Volume Figures from Sources Other Than the Solid Waste Information and Tracking System.

Year	Volume (m ³)	SWITS volume (m ³)	Plutonium content (kg)	SWITS plutonium (kg)	Reference
1944 - 1946	1,840	4,279	Not listed	2.68	Gydesen (1946)
1967	3,710	19,556	6.270	7.930	Baker (1968)
1968	7,775	5,620	6.220	6.646	Hall (1969)
1969	8,915	169,281	3.620	4.757	Hall (1970)

SWITS = Solid Waste Information and Tracking System.

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6.0 CONCLUSIONS

The pre-1970 solid waste was disposed in primarily 31 burial sites, seven of which are designated TRU because records show the TRU content on a total trench basis to be >100 nCi/g without correction for soil overburden additions. These seven TRU-designated burial grounds include 218-W-1, 218-W-2, 218-W-3, 218-W-4A, 218-W-4B, 218-E-12A, and 618-11.

The total volume of solid waste buried in the pre-1970 time period is $339,817 \text{ m}^3$ ($\approx 12,000,000 \text{ ft}^3$). The amount of TRU generated in the pre-1970 time period amounts to approximately 16% of the total solid waste volume.

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7.0 REFERENCES

- Albaugh, J. F., J. D. Anderson, and D. R. Groth, 1985, "Management and Disposal of Hanford Solid Transuranic Waste," *Waste Management '85*, Vol. 1, pp. 199-203, Tucson, Arizona.
- Anderson, B. C., J. D. Anderson, J. A. Demiter, D. R. Duncan, and D. C. McCann, 1990, *Contact-Handled Transuranic Waste Characterization Based on Existing Records*, WHC-EP-0225, Westinghouse Hanford Company, Richland, Washington.
- Baker, E. G., 1968, *Hanford Waste Disposal Summary - 1967*, BNWL-793, Battelle-Northwest Laboratories, Richland, Washington.
- Brown, D. J., J. F. Geiger, and R. E. Isaacson, 1977, *Assessment of Hanford Burial Grounds and Interim TRU Storage*, RHO-CD-78, Rockwell Hanford Company, Richland, Washington.
- Demiter, J. A., and W. O. Greenhalgh, 1994, *Characterization of the 618-11 Solid Waste Burial Site*, WHC-EP-0649, DRAFT, Westinghouse Hanford Company, Richland, Washington.
- ERDA, 1975, *Final Environmental Statement Waste Management Operations*, ERDA-1538, Vol. 2, Energy Research and Development Administration, Richland, Washington.
- Gerber, M. S., *Past Practices Technical Characterization Study - 300 Area - Hanford Site*. WHC-MR-0388, page 192, Westinghouse Hanford Company, December, 1992.
- Geiger, J. F., *Assessment of Hanford Burial Grounds and Interim TRU storage*, RAO-CD-78, Rockwell Hanford Operations, Richland, Washington, August, 1977.
- Gydesen, S. E., 1946, *A Study of Total Amounts of Active Waste Released in All Manners by the H.E.W. Process to Date*, HW-7-5463-DEL, Hanford Engineering Works, Richland, Washington.
- Hall, R. B., 1969, *Hanford Waste Disposal Summary - 1968*, BNWL-1081, Battelle-Northwest Laboratories, Richland, Washington.
- Hall, R. B., 1970, *Hanford Waste Disposal Summary - 1969*, BNWL-1427, Battelle-Northwest Laboratories, Richland, Washington.
- Harvey, R. W., 1969, *The Safe Management of Radioactive Wastes*, ARH-SA-52, Atlantic Richfield Hanford Company, Richland, Washington.
- Kupfer, W. J., R. A. Watrous, L. A. Poling, and D. L. Merrick, 1986, *Hanford Site Transuranic Waste Inventory Work Off Plan*, RHO-WM-PL-14-P, Rockwell Hanford Operations, Richland, Washington.
- Parker, H. M., 1954, *Ground Disposal of Radioactive Wastes at the Hanford Site*, HW-32041, General Electric Company, Richland, Washington.

Phillips, S. J., A. E. Reisenauer, W. H. Rickard, and G. A. Sandness, 1977, *Initial Site Characterization and Evaluation of Radionuclide Contaminated Solid Waste Burial Grounds*, BNWL-2184, Battelle-Northwest Laboratories, Richland, Washington.

Ruck, F. A. III, 1987 letter: *Amount of Plutonium in Waste Sites 618-1, 618-2, 618-10, 618-11*. Rockwell International (March 10, 1987), Richland, Washington.

Williams, G., 1970, *Immediate Action Directive #0511-21, Policy Statement Regarding Solid Waste Burial*. U.S. Atomic Energy Commission, Washington, D.C.

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APPENDIX A

PRE-1970 SOLID WASTE BURIAL DATA

(From the Solid Waste Information and
Tracking System — Condensed)

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Solid Waste Burial Records, pre1970

Shipping Ref. No.	Accept Date	Gross Volume (M3)	PU Content	PU (nCi/g)	U Nat. Content (g)	Total Beta/Gamma (Ci)	Location	Waste Type
200W-44-0001S	9/30/44	14		0	0	0	218W1	RAD
Total		14	0	0	0	0		
200E-45-0001S	6/30/45	28	15	36	2		218E2	RAD
200E-45-0002S	6/30/45	311	110	63	110	10	218E1	RAD
200W-45-0001S	6/30/45	8	0	1	0	20	222TV	RAD
200W-45-0002S	6/30/45	1303	110	6	121	1000	218W1A	RAD
200W-45-0003S	6/30/45	453	1105	435	110	20	218W1	TRU
Total		2104	1340	541	344	1050		
200E-46-0001S	6/30/46	28	15	36	2		218E2	RAD
200E-46-0002S	6/30/46	368	110	53	110	10	218E1	RAD
200W-46-0001S	6/30/46	8	0	1	0	25	222TV	RAD
200W-46-0002S	6/30/46	1303	110	6	110	2000	218W1A	RAD
200W-46-0003S	6/30/46	453	1105	435	110	20	218W1	TRU
Total		2161	1340	531	333	2055		
200E-47-0001S	6/30/47	28	0	1	0	100	222BV	RAD
200E-47-0002S	6/30/47	1274	110	6	95	1000	218E2	RAD
200E-47-0003S	6/30/47	368	110	53	110	10	218E1	RAD
200W-47-0001S	6/30/47	8	0	1	0	50	222TV	RAD
200W-47-0002S	6/30/47	1303	110	6	121	3000	218W1A	RAD
200W-47-0003S	6/30/47	595	1105	331	110	30	218W1	TRU
Total		3576	1435	398	437	4190		
200E-48-0001S	6/30/48	28	0	1	0	100	222BV	RAD
200E-48-0002S	6/30/48	1274	110	6	93	2000	218E2	RAD
200E-48-0003S	6/30/48	368	110	53	110	10	218E1	RAD
200W-48-0001S	6/30/48	8	0	1	0	100	222TV	RAD
200W-48-0002S	6/30/48	1303	110	6	110	4000	218W1A	RAD
200W-48-0003S	6/30/48	538	1105	366	110	20	218W1	TRU
Total		3520	1435	433	424	6230		
118-F-4	12/31/49	3		0	0	1	118F	RAD
200E-49-0001S	6/30/49	28	0	1	0	100	222BV	RAD
200E-49-0002S	6/30/49	1274	110	6	95	3000	218E2	RAD
200E-49-0003S	6/30/49	368	110	53	110	15	218E1	RAD
200W-49-0001S	6/30/49	8	0	1	0	125	222TV	RAD
200W-49-0002S	6/30/49	1303	110	6	121	5000	218W1A	RAD
200W-49-0003S	6/30/49	623	6085	1742	110	20	218W1	TRU
Total		3607	6415	1809	437	8261		
200E-50-0001S	6/30/50	28	0	1	0	100	222BV	RAD
200E-50-0002S	6/30/50	1274	110	6	93	4000	218E2	RAD
200E-50-0003S	6/30/50	368	110	53	110	15	218E1	RAD
200W-50-0001S	6/30/50	8	0	1	0	150	222TV	RAD
200W-50-0002S	6/30/50	1812	110	4	110	5000	218W1A	RAD
200W-50-0003S	6/30/50	1331	21030	2818	110	20	218W1	TRU
Total		4822	21360	2884	424	9285		
200E-51-0001S	6/30/51	28	0	1	0	100	222BV	RAD
200E-51-0002S	6/30/51	1274	110	6	95	5000	218E2	RAD
200E-51-0003S	6/30/51	368	110	53	110	15	218E1	RAD
200W-51-0001S	6/30/51	8	0	1	0	150	222TV	RAD
200W-51-0002S	6/30/51	1671	110	5	121	5000	218W1A	RAD
200W-51-0003S	6/30/51	1388	30990	3984	110	20	218W1	TRU
Total		4737	31320	4049	437	10285		
118-F-3	12/31/52	224		0	0	40	118F	RAD

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MHC-SD-WH-ES-325 REV 0

Solid Waste Burial Records, pre1970

Shipping Ref. No.	Accept Date	Gross Volume (M3)	PU Content	PU (nCi/g)	U Nat. Content (g)	Total Beta/Gamma (Ci)	Location	Waste Type
200E-52-0001S	6/30/52	28	0	1	0	100	222BV	RAD
200E-52-0002S	6/30/52	1303	110	6	93	5000	218E2	RAD
200E-52-0003S	6/30/52	425	120	50	110	15	218E1	RAD
200W-52-0001S	6/30/52	6	0	2	0	30	222SV	RAD
200W-52-0002S	6/30/52	8	0	1	0	150	222TV	RAD
200W-52-0003S	6/30/52	1671	615	25	584	9000	218W1A	RAD
200W-52-0004S	6/30/52	1770	31490	3174	772	50	218W1	TRU
Total		5434	32335	3259	1559	14385		
118-B-5	12/31/53	65		0	0	35	118B	RAD
118-B-6	12/31/53	40		0	0	0	118B	RAD
118-H-5	12/31/53	16		0	0	5	118H	RAD
200E-53-0001S	1/15/53	85	10	21	0		218E1	RAD
200E-53-0002S	6/30/53	198	15	13	2	10	218E12A	RAD
200E-53-0003S	6/30/53	1303	110	6	95	5000	218E2	RAD
200W-53-0001S	6/30/53	11	0	1	0	200	222SV	RAD
200W-53-0002S	6/30/53	2039	615	21	584	14000	218W1A	RAD
200W-53-0003S	6/30/53	1991	29450	2639	772	75	218W2	TRU
Total		5747	30200	2701	1453	19325		
118-D-5	12/31/54	10		0	0	5	118D	RAD
200E-54-0001S	6/30/54	283	15	9	2	10	218E12A	RAD
200E-54-0002S	6/30/54	1472		0	0	2000	218E5	RAD
200W-54-0001S	6/30/54	23	0	0	0	400	222SV	RAD
200W-54-0002S	6/30/54	2832	585	14	518	47120	218W2A	RAD
200W-54-0003S	6/30/54	2047	31100	2710	772	105	218W2	TRU
202S-54-0001S	9/15/54	486		0	0	0	218W9	RAD
Total		7153	31700	2734	1292	49640		
200E-55-0001S	6/30/55	283	15	9	2	10	218E12A	RAD
200E-55-0002S	6/30/55	1557		0	0	2000	218E5	RAD
200E-55-0003S	7/31/55	1501	10	1	2	10	218E4	RAD
200W-55-0001S	6/30/55	28	0	1	0	600	222SV	RAD
200W-55-0002S	6/30/55	3540	585	11	518	42380	218W2A	RAD
200W-55-0003S	6/30/55	2101	32730	2778	772	135	218W2	TRU
Total		9010	33340	2801	1294	45135		
118-B-2	12/31/56	45		0	0	25	118B	RAD
200E-56-0001S	6/30/56	85		0	0		218E4	RAD
200E-56-0002S	6/30/56	708	770	194	187	40	218E12A	TRU
200E-56-0003S	6/30/56	142	620	300	265	3500	218E5	TRU
200E-56-0004S	6/30/56	1529	200	9	66	1500	218E5A	RAD
200W-56-0001S	6/30/56	25	0	1	0	650	222SV	RAD
200W-56-0002S	6/30/56	3681	585	11	518	27450	218W2A	RAD
200W-56-0003S	6/30/56	2101	32730	2778	772	185	218W2	TRU
Total		8317	34905	3292	1808	33350		
118-H-3	12/31/57	1529		0	0	650	118H	RAD
200E-57-0001S	6/30/57	827	775	167	187	40	218E12A	TRU
200E-57-0002S	6/30/57	1472	200	9	66	5000	218E5A	RAD
200W-57-0001S	6/30/57	23	0	1	0	700	222SV	RAD
200W-57-0002S	6/30/57	1926	490	17	419	20320	218W2A	RAD
200W-57-0003S	6/30/57	3030	30500	1795	11684	225	218W3	TRU
Total		8807	31965	1990	12357	26935		
200E-58-0001S	6/30/58	1133	10	2	2	5	218E8	RAD
200E-58-0002S	6/30/58	830	775	167	187	40	218E12A	TRU
200E-58-0003S	6/30/58	1671	780	32	66	5000	218E5A	RAD
200W-58-0001S	6/30/58	21	0	1	0	700	222SV	RAD
200W-58-0002S	6/30/58	1246	490	27	419	18270	218W2A	RAD

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MHC-SD-WM-ES-325 REV 0

Solid Waste Burial Records, pre1970

Shipping Ref. No.	Accept Date	Gross Volume (M3)	PU Content	PU (nCi/g)	U Nat. Content (g)	Total Beta/Gamma (Ci)	Location	Waste Type
200W-58-0003S	6/30/58	2897	30500	1878	22487	225	218W3	TRU
Total		7797	32555	2106	23162	24240		
200E-59-0001S	6/30/59	1133	10	2	2	5	218E8	RAD
200E-59-0002S	6/30/59	830	775	167	187	40	218E12A	TRU
200E-59-0003S	6/30/59	1501	200	9	66	5000	218E5A	RAD
200W-59-0001S	6/30/59	20	0	1	0	700	222SV	RAD
200W-59-0002S	6/30/59	1274	490	26	419	18220	218W2A	RAD
200W-59-0003S	6/30/59	2982	5500	329	46297	230	218W3	TRU
Total		7739	6975	534	46972	24195		
118-B-3	12/31/60	2464		0	0	1220	1188	RAD
200E-60-0001S	6/30/60	830	775	167	187	50	218E12A	TRU
200E-60-0002S	7/31/60	1586	535	23	234	3000	218E10	RAD
200W-60-0001S	6/30/60	1	0	6	0	50	222SV	RAD
200W-60-0002S	6/30/60	580	490	58	419	10200	218W2A	RAD
200W-60-0003S	6/30/60	1994	1500	134	73855	220	218W3	TRU
202A-60-0001S	6/30/60	300		0	0	45400	218E14	RAD
2WTF-60-0001S	6/30/60	1160		0	0	0	218W11	RAD
Total		8914	3300	388	74695	60140		
200E-61-0001S	6/30/61	728	770	189	187	50	218E12A	TRU
200E-61-0002S	6/30/61	1444	530	25	231	3000	218E10	RAD
200W-61-0001S	6/30/61	178	470	180	419	4010	218W2A	TRU
200W-61-0002S	6/30/61	2643	4120	278	234	320	218W4A	TRU
202A-61-0001S	6/30/61	132		0	0	1700	218E14	RAD
Total		5125	5890	672	1071	9080		
200E-62-0001S	6/30/62	677	760	200	187	50	218E12A	TRU
200E-62-0002S	6/30/62	1671	535	22	243	4000	218E10	RAD
200W-62-0001S	6/30/62	255	30	8	0	170	218W2A	RAD
200W-62-0002S	6/30/62	3166	4370	246	368833	280	218W4A	TRU
202A-62-0001S	6/30/62	66		0	0	40000	218E14	RAD
Total		5834	5695	477	369263	44500		
200E-63-0001S	6/30/63	1022	775	135	187	50	218E12A	TRU
200E-63-0002S	6/30/63	1300	530	28	231	2000	218E10	RAD
200W-63-0001S	6/30/63	422	30	5	0	235	218W2A	RAD
200W-63-0002S	6/30/63	2236	4825	385	102669	330	218W4A	TRU
Total		4980	6160	553	103088	2615		
118-DR-1	12/31/64	241		0	0	4500	118DR	RAD
200E-64-0001S	6/30/64	1257	775	110	187	50	218E12A	TRU
200E-64-0002S	6/30/64	1155	535	32	231	2000	218E10	RAD
200W-64-0001S	6/30/64	763	490	44	209	8305	218W2A	RAD
200W-64-0002S	6/30/64	2317	4700	362	64000	390	218W4A	TRU
202A-64-0001S	6/30/64	68		0	0	700	218E14	RAD
Total		5802	6500	547	64629	15945		
118-F-1	12/31/65	7646		0	0	1330	118F	RAD
118-F-2	12/31/65	3115		0	0	530	118F	RAD
118-H-1	12/31/65	6513		0	0	2720	118H	RAD
118-H-2	12/31/65	178		0	0	75	118H	RAD
118-H-4	12/31/65	116		0	0	50	118H	RAD
200E-65-0001S	6/30/65	2016	775	69	187	100	218E12A	RAD
200E-65-0002S	6/30/65	2449	535	15	243	8700	218E10	RAD
200W-65-0001S	6/30/65	966	490	35	220	20190	218W2A	RAD
200W-65-0002S	6/30/65	2060	4650	403	211159	315	218W4A	TRU
Total		25059	6450	521	211809	34010		

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Solid Waste Burial Records, pre1970

Shipping Ref. No.	Accept Date	Gross Volume (M3)	PU Content	PU (nCi/g)	U Nat. Content (g)	Total Beta/Gamma (Ci)	Location	Waste Type
200E-66-0001S	6/30/66	2076	775	67	187	150	218E12A	RAD
200E-66-0002S	6/30/66	994	535	37	231	4200	218E10	RAD
200W-66-0001S	6/30/66	352	540	105	220	5135	218W2A	TRU
200W-66-0002S	6/30/66	1679	4810	511	80469	300	218W4A	TRU
Total		5101	6660	719	81108	9785		
118-D-1	12/31/67	4248		0	0	775	118D	RAD
118-D-4	12/31/67	7079		0	0	1270	118D	RAD
118-K2	12/31/67	10		0	0	20	118K	RAD
200E-67-0001S	6/30/67	2684	385	26	115	200	218E12A	RAD
200E-67-0002S	6/30/67	1511	275	12	121	6500	218E10	RAD
200E-67-0003S	6/30/67	487	160	59	15	670	218E12B	RAD
200W-67-0001S	6/30/67	221	235	73	110	7000	218W2A	RAD
200W-67-0002S	6/30/67	3248	6875	378	41425	415	218W4A	TRU
202A-67-0001S	6/30/67	68		0	0	700	218E15	RAD
Total		19556	7930	547	41786	17550		

Solid Waste Records, pre1970

Accept date	Gross Volume (M3)	PU Content	PU (nCi/g)	U Nat. Content (g)	Total Beta/Gamma (Ci)	Location	Waste Type
1/68	0		0	0	322	218W4B	RAD
1/68	0	150	600246	0	2623	218W4B	TRU
1/68	26		0	0	95	218E12B	RAD
1/68	35	64	8247	0	57	218E12B	TRU
1/68	68	571	71133	0	3	218W4A	TRU
1/68	94	0	0	1	770	218W4A	RAD
1/68	165		0	0	1710	218E10	RAD
Totals	389	785	679626	1	5579		
2/68	0		0	2		218W4B	RAD
2/68	0	245	1050286	0	814	218W4B	TRU
2/68	28		0	0	110	218E12B	RAD
2/68	32	44	5306	0	53	218E12B	TRU
2/68	67	454	64794	0	2	218W4A	TRU
2/68	133	0	15	1	691	218W4A	RAD
Totals	260	743	1120401	2	1670		
3/68	35	54	5786	0	57	218E12B	TRU
3/68	44		0	0	200	218E12B	RAD
3/68	55		0	0	569	218E10	RAD
3/68	59	488	286542	0	923	218W4B	TRU
3/68	291	0	93	0	146	218W4B	RAD
Totals	484	542	292421	0	1895		
4/68	18		0	0	188	218E10	RAD
4/68	36		0	0	148	218E12B	RAD
4/68	38	53	6408	0	61	218E12B	TRU
4/68	40	503	108798	0	0	218W4B	TRU
4/68	207	0	108	0	227	218W4B	RAD
Totals	340	556	115314	0	625		
5/68	40		0	0	192	218E12B	RAD
5/68	40	54	5216	0	63	218E12B	TRU
5/68	55		0	0	570	218E10	RAD
5/68	106	513	231330	0	2938	218W4B	TRU
5/68	316	0	76	0	3218	218W4B	RAD
Totals	556	567	236623	0	6980		
6/68	28	47	6980	0	67	218E12B	TRU
6/68	28	348	121686	0	0	218W4B	TRU
6/68	41		0	0	203	218E12B	RAD
6/68	176	0	212	0	1164	218W4B	RAD
6/68	188		0	0	1942	218E10	RAD
Totals	461	395	128878	0	3376		
7/68	30	486	178477	0	868	218W4B	TRU
7/68	33	55	7877	0	42	218E12B	TRU
7/68	55		0	0	70	218E12B	RAD
7/68	222	0	180	0	169	218W4B	RAD
Totals	341	541	186534	0	1149		
8/68	34	64	6988	0	43	218E12B	TRU
8/68	49		0	0	61	218E12B	RAD
8/68	90	938	114546	0	39	218W4B	TRU

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Solid Waste Records, pre1970

Accept date	Gross Volume (M3)	PU Content	PU (nC1/g)	U Nat. Content (g)	Total Beta/Gamma (C1)	Location	Waste Type
8/68	110		0	0	1140	218E10	RAD
8/68	177	0	0	0	789	218W4B	RAD
Totals	460	1002	121534	0	2072		
9/68	20	44	7804	0	26	218E12B	TRU
9/68	39	303	105982	7	57	218W4B	TRU
9/68	98	3	79	0	46	218E12B	RAD
9/68	161		0	0	1670	218E10	RAD
9/68	192	0	4	0	128	218W4B	RAD
Totals	511	350	113869	7	1928		
10/68	25	61	38491	0	26	218E12B	TRU
10/68	36	348	137643	0	78	218W4B	TRU
10/68	89	1	51	0	53	218E12B	RAD
10/68	296	1	59	0	65632	218W4B	RAD
Totals	446	411	176243	0	65789		
12/68	30	138	189594	0	39	218E12B	TRU
12/68	40		0	0	20	118B	RAD
12/68	77	512	154843	0	48	218W4B	TRU
12/68	83		0	0	63413	218E10	RAD
12/68	279	4	363	0	172	218E12B	RAD
12/68	332	0	72	0	2171	218W4B	RAD
Totals	841	655	344871	0	65864		
1/69	9	26	91052	0	0	218E12B	TRU
1/69	42	392	105882	0		218W4B	TRU
1/69	43		0	0	12000	218E10	RAD
1/69	88		0	0	2048	218E12B	RAD
1/69	349	0	75	0	1064	218W4B	RAD
Totals	531	419	197009	0	15113		
2/69	3	46	186570	0	0	218E12B	TRU
2/69	36	110	30148	0		218W4B	TRU
2/69	75	1	91	0	49	218E12B	RAD
2/69	150	0	82	0	715	218W4B	RAD
Totals	264	157	216890	0	764		
3/69	7	56	64080	0	0	218E12B	TRU
3/69	43		0	0	1050	218E10	RAD
3/69	51	125	33573	0		218W4B	TRU
3/69	68		0	0	500	218E15	RAD
3/69	159		0	0	197	218E12B	RAD
3/69	246	4	208	2	36307	218W4B	RAD
Totals	573	185	97861	2	38054		
4/69	12	55	78981	0	1	218E12B	TRU
4/69	34	107	263815	0	20	218W4B	TRU
4/69	94		0	0	3150	218E10	RAD
4/69	194	0	89	0	95	218E12B	RAD
4/69	258	0	191	0	159	218W4B	RAD
Totals	591	162	343076	0	3426		
5/69	0		0	0	600	218W2A	RAD
5/69	3	33	264930	0	2	218E12B	TRU

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Solid Waste Records, pre1970

Accept date	Gross Volume (M3)	PU Content	PU (nC1/g)	U Nat. Content (g)	Total Beta/Gamma (C1)	Location	Waste Type
5/69	36	340	817711	0	20	218W4B	TRU
5/69	138	2	88	0	65	218E12B	RAD
5/69	218	0	57	0	8028	218W4B	RAD
Totals	397	375	1082786	0	8715		
6/69	1		0	0	744	218W2A	RAD
6/69	8	65	264566	0	0	218E12B	TRU
6/69	54	230	102765	0	88	218W4B	TRU
6/69	109	1	68	0	73	218E12B	RAD
6/69	481	1	5	0	666	218W4B	RAD
Totals	653	297	367405	0	1571		
7/69	3		0	0	200	218W2A	RAD
7/69	5	6	10523	0	2	218E12B	TRU
7/69	39	124	60217	0		218W4B	TRU
7/69	141	0	0	0	518	218E12B	RAD
7/69	252	0	98	0	835	218W4B	RAD
Totals	440	130	70839	0	1555		
8/69	6	26	83779	0	9	218E12B	TRU
8/69	34		0	0	4530	218W2A	RAD
8/69	48	143	45820	0	0	218W4B	TRU
8/69	50		0	0	75	218E10	RAD
8/69	105		0	0	95	218E12B	RAD
8/69	218	1	128	0	738	218W4B	RAD
Totals	461	170	129727	0	5446		
9/69	7	33	308335	0	3	218E12B	TRU
9/69	45	193	117375	33	161	218W4B	TRU
9/69	101		0	0	1500	218E10	RAD
9/69	110		0	0	23	218E12B	RAD
9/69	218	0	147	0	1337	218W4B	RAD
Totals	481	226	425857	33	3025		
10/69	7	35	99245	0	5	218E12B	TRU
10/69	37	179	237141	0	91	218W4B	TRU
10/69	75		0	0	30000	218E10	RAD
10/69	149		0	0	68	218E12B	RAD
10/69	203	0	3	0	513	218W4B	RAD
Totals	471	214	336390	0	30676		
12/69	8	43	113713	0	9	218E12B	TRU
12/69	98		0	0	11700	218E10	RAD
12/69	101	1177	367139	0	9157	218W4B	TRU
12/69	163	1000	901	117506	0	618	TRU
12/69	186	1	65	0	194	218E12B	RAD
12/69	319	0	135	0	40791	218W4B	RAD
12/69	5097		0	0	1800	118C	RAD
12/69	158977	202	2	117775	10000	618	RAD
Totals	164950	2423	481955	235282	73650		

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APPENDIX B

**DOCUMENTS REVIEWED WHILE PERFORMING
PRE-1970 SOLID WASTE BURIAL STUDY**

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The documents reviewed during this study are shown in Table B-1. This list should be of value if an additional review of pre-1970 solid waste is required.

Table B-1. Documents Reviewed While Performing Solid Waste Burial Study. (6 sheets)

Document No.	Title	Primary Author	Date	Summary
HW-7-5463-DEL	<u>A Study of Total Amounts of Active Waste Releases in ALL Matters By the N.E.W. Proceeds to Date</u>	F.P. Seymour	December 1946	Solid waste information is present.
HW-31882 copy 1	<u>Columbia River Flood 1948</u>	H. A. Kramer	November 1, 1948	Discussion of flood of 1948, Columbia River. No solid waste information present.
HW-11849	<u>Commission - Wide Program on Waste Disposal</u>	R.H. Beaton	December 13, 1948	Discussion on current and planned liquid waste disposal. No solid waste information present.
HW-14058	<u>Hazardous Waste Storage at Hanford Works, Part 1</u>	H.M. Parker, Manager Health Inst. Division	August 2, 1949	Speculation on the hazards involved in the accidental dissemination of material at Hanford. No solid waste data present.
HW-14315	<u>Geologic and Hydrologic Features of the Richland Area Washington Relevant to Disposal Operations of the ABC</u>	G.C. Parker	August 31, 1949	Letter. No data on solid waste present.
HW-15494	<u>Proposed Research Program - Treatment of 200 Area Nonuranium Waste</u>	H.M. Parker	December 22, 1949	Two-page document of a proposed liquid waste plan. No solid waste data present.
HW-18259	<u>Forecast of Waste Storage Facilities in 200 East and 200 West Area</u>	S.D. Smiley	July 3, 1950	Variable solid and liquid waste data - TBP waste, metal waste, first cycle waste, space available, current waste.
HW-18635	<u>Notes on Waste Disposal Meeting at Schenectady</u>	J.W. Heely	August 21, 1950	Notes on evaporation crystallization, low-level analytical techniques. No solid waste information present.
HW-21740	<u>200 Areas Waste Storage Analysis Revision No. 2</u>	J.E. Maider, Manager Production Division	July 25, 1951	Liquid waste storage facilities. No solid waste data present.
HW-23140 DEL	<u>Monthly Report Hanford Atomic Products Operation for December 1951</u>	Compiled by department managers	January 22, 1952	Department operations. No solid waste information present.
HW-26523	<u>Quarterly Progress Report, Research and Development Activities, December 1952</u>	H.M. Parker, Director of Radiological Science Department	January 5, 1953	Quarterly report of science and development activities of the radiological department. No solid waste data present.
HW-26720 DEL	<u>Monthly Report Hanford Atomic Products Operation for December 1952</u>	Compiled by department managers	January 23, 1953	Department operations. No solid waste data present.
HW-27337	<u>Unconfined Underground Radioactive Waste and Contamination</u>	H.G. Rupert	January 29, 1953	Presents knowledge about locations in the 100 Areas where radioactive material has been discharged to ground. No solid waste data present.
HW-27510	<u>Radioactive Contamination in the Environs of the Hanford Works for the Period July, August, September 1952</u>	H.J. Paas	April 15, 1953	Three-month study of the environs for radioactive contamination. No solid waste data present.

Table B-1. Documents Reviewed While Performing Solid Waste Burial Study. (6 sheets)

Document No.	Title	Primary Author	Date	Summary
HW-28121	<u>Release of Radioactive Waste to Ground</u>	J.W. Healy	May 20, 1953	Recent advances from studies performed in earth science indicate need for better disposal system with brief summary of waste data. Solid waste information present.
HW-28471	<u>Unconfined Underground Radioactive Waste and Contamination in the 200 Area</u>	H.G. Ruppert, Radiological Sciences Department	July 1, 1953	Planned disposal of solid and liquid waste.
HW-30423	<u>Monthly Report Hanford Atomic Products Operation for December 1953</u>	Compiled by department managers	January 22, 1954	Discussion of department statistics, safety, plant, projects, accounting. No solid waste data present.
HW-32041	<u>Ground Disposal of Radioactive Waste at the Hanford Site</u>	H.M. Parker	June 4, 1954	Discusses general climate of Hanford and its geography, discussion of liquid waste disposal, fission products. No solid waste data present.
HW-34147 DEL	<u>Monthly Report Hanford Atomic Products Operation for December 1954</u>	Compiled by department managers	January 25, 1955	Department operations. No solid waste information present.
HW-35009	<u>An Evaluation of Buried Waste Line Design Practice Interim Report No. 2</u>	R.T. Jaske	April, 1955	Discussion mostly on underground pipeline and structure corrosion study program. No solid waste data present.
HW-37680-22	<u>Study of Waste Facilities</u>	H.W. Stivers	June 30, 1955	Liquid waste, classification of waste and waste storage facilities. No solid waste data present.
HW-39076	<u>Unconfined Underground Waste and Contamination in the 300 Area and Miscellaneous Areas not Included in Other Reports</u>	H.J. Paas	September 20, 1955	Discussion on relocated burial ground, liquid waste disposal trenches for new laboratory areas, old-new waste ponds, solid burial ground, amps, and unconfined waste. Solid waste information present.
HW-46002-30	<u>Waste Disposal Monitoring Activities Summary, July, 1956</u>	Regional Monitoring Operation, Radiation Protection Operation, Hanford Laboratories Operation, Hanford Atomic Products Operation	1956	No solid waste information present.
HW-SA-36	<u>Waste Disposal to the Ground, Operating Practices and Experience at Hanford</u>	C.E. Linderoth	1956	Disposal to the ground of liquid waste. No solid waste data present.
HW-41018	<u>A Report on the Geneva Conference Sessions Dealing with Biology, Medicine, and Waste Disposal</u>	R.F. Foster	January 10, 1956	Consists mostly of the papers submitted at the conference. No solid waste data present.
HW-40692 DEL	<u>Monthly Report Hanford Atomic Products Operation for December 1955</u>	Compiled by department managers	January 30, 1956	General discussions of projects, statistical data, safety. No solid waste information present.

Table B-1. Documents Reviewed While Performing Solid Waste Burial Study. (6 sheets)

Document No.	Title	Primary Author	Date	Summary
HW-41791, part 1	<u>Purex Waste Storage, Part I, 241-A Waste Storage Facilities</u>	G.L. O'Neil	March 7, 1956	Liquid waste, waste storage facilities. No solid waste data present.
HW-42230	<u>200 Area Waste Storage Study</u>	H.E. Hanthorn	March 27, 1956	Waste storage requirements. No solid waste data present.
HW-42626	<u>Monthly Report Hanford Atomic Products Operation for April 1953</u>	Compiled by department managers	May 21, 1956	General discussions of projects, statistical data, safety. No solid waste data present.
HW-44041	<u>Quarterly Progress Report, Research and Development Activities, April-June 1956</u>	H.M. Parker, Director of Radiological Science Department	July 13, 1956	Quarterly report of science and development activities of the radiological department. No solid waste data present.
HW-47675 DEC	<u>Chemical Processing Department Monthly Report for December 1956</u>	Compiled by operational managers	January 21, 1957	No waste disposal waste information present.
HW-47858 DEC	<u>Hanford Laboratories Operation Monthly Activities Report December 1956</u>	Compiled by operational managers	January 22, 1957	No waste disposal waste information present.
HW-55450	<u>History and Cost Waste Storage At HAPO</u>	R.E. Roberts	March 24, 1958	Liquid waste underground. No solid waste information present.
HW-56914C	<u>Monthly Report, July 1958, Chemical Research and Development Operation</u>	Compiled by Chemical Research, Chemical Development, Analytical Laboratories, Chemical Effluent Technologies Submitted by L.P. Bupp	August 11, 1958	Consists mostly of many different processes. Contains reports of various methods, processes, and extraction techniques. No solid waste data present.
HW-58943	<u>Revised Hazards Study - Underground Storage of Radioactive Liquid Waste</u>	W.A. Haney	1959	Liquid waste.
Berkley Conference on Ground Disposal	<u>A Comparison of Ground Waste Disposal Status at Hanford</u>	E.R. Irish	September 1950	Liquid waste.
HW-SA-36	<u>Waste Disposal to the Ground, Operating Practices and Experiences at Hanford</u>	C.E. Linderoth	July 1959	Liquid waste disposal data. No solid waste data present.
HW-60430	<u>Losses Associated with Interim Purification Processing of Neptunium</u>	V.R. Cooper	May 19, 1959	Discussion on neptunium purification and disposal. No solid waste data present.
TID-7621	<u>Ground Disposal of Radioactive Waste</u>	W.J. Kaufman	August 25, 1959	Waste management practices and liquid waste disposal data. No solid waste data present.
HW-69803	<u>Chemical Processing Department Monthly Report, May 1961</u>	Compiled by operation managers	June 21, 1961	Plutonium processing resulted in 556 g of plutonium (May) and 758 g of plutonium (June) being discarded to waste.
HW-77274	<u>Burial of Hanford Radioactive Waste</u>	G.E. Backman	April 15, 1963	Discusses current policies and procedure and future plans for Hanford's solid waste.

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Table B-1. Documents Reviewed While Performing Solid Waste Burial Study. (6 sheets)

Document No.	Title	Primary Author	Date	Summary
HW-77820	<u>UNH Transfer Study</u>	R.B. French	June 17, 1963	Discussion of the transfer of uranyl nitrate hexahydrate. No solid waste data present.
HW-SA-3321	<u>The Plutonium Recycle Program at Hanford</u>	N.G. Wittenbrock	January 16, 1964	Plutonium recycle plan. No data on disposal.
HW-SA-3575	<u>Discussion of Radioactive Waste Management Practices</u>	G.E. Backman	June 5, 1964	Discusses all three waste types. Solid waste information present.
HW-84317	<u>Separation Capability</u>	M.K. Harmon	October 8, 1964	Neptunium recovery. No solid waste data present.
BNWL-CC637 2	<u>Environmental Status of the Hanford Reservation for January - February, 1966</u>	T.H. Essig	April 1966	Compilation of data collected from Hanford Reservation for the Environmental Surveillance Program. No solid waste data present.
BNWL-CC637 5	<u>Environmental Status of the Hanford Reservation for May, 1966</u>	T.H. Essig	June 15, 1966	Compilation of data collected from Hanford Reservation for the Environmental Surveillance Program. No solid waste information present.
BNWL-CC637 4	<u>Environmental Status of the Hanford Reservation for March - April, 1966</u>	T.H. Essig	June 15, 1966	Compilation of data collected from Hanford Reservation for the Environmental Surveillance Program. No solid waste data present.
BNWL-CC637 6	<u>Environmental Status of the Hanford Reservation for June, 1966</u>	T.H. Essig	August 15, 1966	Compilation of data collected from Hanford Reservation for the Environmental Surveillance Program. No solid waste data present.
BNWL-CC637 8	<u>Environmental Status of the Hanford Reservation for July - August, 1966</u>	T.H. Essig	October 15, 1966	Compilation of data collected from Hanford Reservation for the Environmental Surveillance Program. No solid waste data present.
BNWL-CC913	<u>Environmental Status of the Hanford Project 1965 Annual Summary</u>	T.H. Essig Environmental Studies Section, Environmental Health and Engineering Department	November 8, 1966	Compilation of data collected from Hanford Reservation for the Environmental Surveillance Program. No solid waste data present.
BNWL-CC637 10	<u>Environmental Status of the Hanford Reservation for September - October, 1966</u>	T.H. Essig	December 15, 1966	Compilation of data collected from Hanford Reservation for the Environmental Surveillance Program. No solid waste data present.
BNWL-CC637 11	<u>Environmental Status of the Hanford Reservation for November, 1966</u>	T.H. Essig	January 30, 1967	Compilation of data collected from Hanford Reservation for the Environmental Surveillance Program. No solid waste data present.

Table B-1. Documents Reviewed While Performing Solid Waste Burial Study. (6 sheets)

Document No.	Title	Primary Author	Date	Summary
BNWL-CC637 12	<u>Environmental Status of the Hanford Reservation for December 1966 (Annual Summary)</u>	T.H. Essig	March 20, 1967	Compilation of data collected from Hanford Reservation for the Environmental Surveillance Program. No solid waste data present.
ARH-62 DEL	<u>200 Areas Operation</u>	Compiled by the Chemical Processing and Business Management Decisions	December 1967	Operations of ARHCO - managed production facilities. No solid waste data present.
ARH-231	<u>Hanford Low Level Waste Management Reevaluation Study</u>	Compiled by R.J. Sloat	December 29, 1967	Study of ionizing radiation on environment. No solid waste data present.
ARH-311	<u>200 Areas Operation Monthly Report</u>	Compiled by the Chemical Processing and Business Management Decisions	December 1968	Operations of ARHCO - managed production facilities. No solid waste data present.
ARH-1596	<u>Radioactive Solid Waste Management at Richland</u>	O.F. Hill	February 20, 1970	Management policies and methods. No data on disposal.
ARH-2015, part 1	<u>Radioactivity in Gaseous Waste Discharged from the Separation Facilities During 1970</u>	M.C. Jacobs	March 10, 1971	Gaseous waste discharge. No solid waste data present.
ERDA-1538 V2 C1	<u>Final Environmental Statement Waste Management Operations</u>	U.S. Energy Research and Development Commission	December 1975	Environmental impact statement detail maps of the Hanford Reservation. No solid waste data present.
ERDA-1538 V1 C1	<u>Final Environmental Statement Waste Management Operations</u>	U.S. Energy Research and Development Commission	December 1975	Final environmental statement on the waste management operations program at Hanford. No solid waste data present.
RHO-CD-78	<u>Assessment of Hanford Burial Ground Interim TRU Storage</u>	J.F. Geiger	August 1977	Trench volume data for pre-1976. Solid waste information present.
DOE/RW-0006	<u>Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics</u>	U.S. Department of Energy	1984	Summary information.
DOE/RW-0006 (DOE/NE-0017/3)	<u>Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics</u>	Oak Ridge National Laboratory	1984	Summary waste data.
RHO-WM-PL-7 Rev 2	<u>Hanford Waste Management</u>	T.R. McKenzie	April 1984	Post-1970 waste data plus management plans and cost.
SD-WM-DP-008	<u>Hanford Defense Waste Environmental Impact Statement Engineering Data Package: Transuranic Pre-1970 Buried Solid Waste Sites</u>	F.M. Coony	1985	Burial ground data.
<u>Proceedings of Waste Management '85</u>	<u>"Management and Disposal of Hanford Solid Transuranic Waste"</u>	J.F. Albaugh	1985	Summary information.

Table B-1. Documents Reviewed While Performing Solid Waste Burial Study. (6 sheets)

Document No.	Title	Primary Author	Date	Summary
RHO-WM-PL-14-P	<u>Hanford Site Transuranic Waste Inventory Work Off Plan</u>	W. J. Kupfer, R. A. Watrous, L. A. Poling, D. L. Merrick	1986	Pre- and post-1970 data.
CONF-890854-5 (WHC-SA-0567)	<u>Hanford Site Solid Low-Level Mixed Waste Program</u>	J.D. Anderson	June 1989	Solid radioactive waste disposal early 1940's. Solid waste information present.
WHC-EP-0225	<u>Contact-Handled Transuranic Waste Characterization Based on Existing Records</u>	B.C. Anderson	1990	Post-1970 TRU waste data.
DE91 010834	<u>Mixed Waste Management at the Hanford Site</u>	R.J. Roberts	1991	No historical data.
WHC-SA-1020	<u>Mixed Waste Management at Hanford Site</u>	R.J. Roberts	January 1991	Fifty-year history of the mixed waste at the Hanford site. Solid waste information present.
DOE-RW-0006 Rev 8 C2	<u>Integrated Data Base for Radioactive Waste Inventories, Projections, Characteristics</u>	J.A. Klein	October 1992	Transuranic waste accumulative totals (1991). Solid waste information present.

ARHCO = Atlantic Richfield Hanford Company.

TBP = tributyl phosphate.

TRU = transuranic.

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