RFP 3680

DEFENSE TRANSURANIC
WASTE PROGRAM

REMOTE-HANDLED/SPECIAL CASE TRU WASTE CHARACTERIZATION SUMMARY

MARCH 1984

Rockwell International
ENERGY SYSTEMS GROUP
ROCKY FLATS PLANT

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TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

REMOTE HANDLED/SPECIAL CASE WASTE CHARACTERIZATION

Introduction

TRU wastes are those (other than high level waste) contaminated with specified quantities of certain alpha-emitting radionuclides of long half-life and high specific radiotoxicity. TRU waste is defined as 226Ra isotopic sources and those other materials that, without regard to source or form, are contaminated with transuranic elements with half-lives greater than 20 years, and have TRU alpha contamination greater than 100 nCi/g.

RH TRU waste has high beta and gamma radiation levels, up to 30,000 R/hr, and thermal output may be a few hundred watts per container. The radiation levels in most of this remotely handled (RH) TRU waste, however, are below 100 R/hr.

Remote-handled wastes are stored at Los Alamos, Hanford, Oak Ridge, and the Idaho National Engineering Laboratory. The following will be a site by site discussion of RH waste handling, placement, and container data. This will be followed by a series of data tables that were compiled in the TRU Waste Systems Office. These tables are a compendium of data that is the most up to date and accurate data available today.

Hanford

Hanford has RH waste in concrete caissons, and in nonstandard casks. The concrete caissons are filled with 1 gallon paint cans which have no liners and are sealed with clip locks. Some of these clip locks are known to have broken open, spilling contents inside the caisson. The caissons are cylindrical concrete encasements that are 13.1 ft. below the surface having dimensions of 8 ft. diameter x 10 ft. high. Cans are dumped into the caisson down an angled steel chute. The contents of the paint cans include plastic, cloth, metal, paper, glass, and some irradiated fuel elements.

On railroad flat cars, Hanford stores large pieces of equipment from the Purex reprocessing facility. For example, dissolvers, condensors, piping, and metal equipment. These railroad cars are stored in two tunnels that are approximately 8 ft. below the surface. Equipment is stacked on cars usually with no additional containment. This equipment is classified as "Facility D & D" waste and is not included in the tables.

INEL

The INEL currently has RH waste stored in 30-gallon drums and in steel inserts. The 30-gallon drums are stored at the Intermediate Level TRU Storage Facility (ILTSF). The ILTSF is a carbon steel storage vault that consists of 7.9 m vertical pipes, 61 cm and 40.1 cm in diameter. The pipes are enclosed in a 1.5 m high earth shield, with a removable cement shield plug. Inside the 30-gallon drums are 100 mil rigid plastic liners. The waste is usually contained in 3- or 5-gallon paint cans (steel) but may be loose which is then bagged in plastic. The drums are sealed with rubber gaskets and bolted closure rings.

The steel inserts are also placed in the ILTSF with the waste usually being inside of plastic bags. The steel inserts are 12-3/4 in. in diameter and 72-in. long with a lifting fixture attached. Waste primarily is associated with fuels examination and testing. For example, fuel assemblies, paper, gloves, plastic, labware, and small tools, and equipment.

LANL

The LANL stores most of their RH waste in concrete cylinders. These are essentially steel pipes that are concreted inside a larger steel pipe. These casks stand vertically in individual shafts 0.76 m diameter x 4.0 to 4.6 m deep. Concrete is used to seal around the cask tops in the shafts. This is a very thin layer of concrete, leaving the cask retrievable without extensive removal methods. Inside the casks are 3.8 liter paint cans, sealed in a rigid plastic container and bagged which contain hot-cell trach, wipes, glassware, small tools, absorbed liquids, and plastics.

ORNL

The ORNL stores their RH waste in concrete casks and stainless steel capsules. The concrete casks are reinforced with dimensions of 1.27 m to 1.37 m OD x 2.13 m to 2.44 m long. These casks are placed in unlined trenches with concrete poured over the top; these are considered nonretrievable (buried). Today they are not pouring concrete on top. The specific contents are not known. There are no sludges and ORNL estimates metal content at about 10%. Some casks contain large equipment items such as pumps and furnaces.

The stainless steel capsules at the ORNL are placed in stainless steel wells with the tops of the wells being at ground level and surrounded by a concrete pad. These wells are then closed with a concrete shielding plug. The waste inside of these

capsules are either bagged, canned, or loose since packaging is done on a case by case basis. Contents are mostly fuel elements which have been cut up for examination along with the associated hardware.

SUMMARY OF RH CHARACTERISTICS AT DOE STORAGE SITES

Following the assumptions section are a set of quantitative tables that characterize the RH TRU waste that is buried, stored, and projected (newly generated) to be generated at the storage sites through FY 2015. Tables 1 and 2 address Hanford remote handled waste and projections. Each of these tables details out all characteristics of the waste. Tables 3 and 4 characterize the stored RH waste that will or will not be certifiable without processing. Tables 5 and 6 characterize the projected, newly generated, RH waste that will or will not be certifiable without processing. Tables 7-10 characterize the RH waste as either soft RH waste, hard RH waste, processed/treated RH waste, or special case RH waste. These tables are a compilation of data submitted to the TWSO in the Inventory Work-Off Plans. There are Blanks in the data tables which means that the site did not enter any information in the table. In most cases, the data is not available due to a lack of information contained in the records of RH data.

DEFINITIONS

Following are some definitions that were agreed on at a workshop held at the ORNL in Dec. of 1983 by members of the TRU community in conjunction with the Integrated Data Base effort.

1. Buried waste-- TRU waste that has been placed in shallow-land burial with no plans for retrieval. This TRU waste may or may not be associated with various amounts of low-level waste. Burial of TRU waste is no longer being done, but reported inventories may change due to corrections and/or revisions to historical data as emplacement records are reviewed and burial grounds are characterized.

2. Contaminated soil-- Some containers of buried TRU waste have developed leaks or have been breached and the contents have contaminated the surroundings. Also contamination has occurred from liquid spills and the early practice of disposing of some liquid waste in soil.

3. Projected waste volume-- This is the volume of waste as packaged for retrievable storage or for shipment to WIPP, and is the volume after any treatment given the waste before packaging.

4. Remotely handled waste-- A waste is defined as remotely

handled TRU waste when the surface beta-gamma-neutron radioactivety of the waste container is sufficiently high to require remote handling of the container (greater than 200 mrem/hr).

5. Special packaging-- Not all TRU waste may be amenable to standard packaging and shipping due to size, shape, or weight; for example, large process equipment items, contaminated vehicles, etc.

6. Volume-- The volume of retrievably stored TRU waste is the total volume occupied by the waste containers that are placed in storage including the volume of the containers themselves. Overpack volume is included when the overpack is permanent and is a part of the retrievably stored volume. Temporary shielding and/or removable overpack required for handling or shipping are not considered part of the waste volume.

ASSUMPTIONS

The following assumptions and pertinent facts were used in compiling the data tables.

1. The waste volumes to be shipped to WIPP were based on the current WIPP-Waste Acceptance Criteria (WAC) as of March 31,1983.

2. These data tables were completed by storage sites only. Beginning in FY 89, all waste generators will ship their waste directly to WIPP, so waste that is generated at non-storage sites after FY 88 is not included in most of the tables unless the site is specifically mentioned.

3. Information given on buried waste and older stored waste was generally based on studies done by the sites rather than actual records. If studies were not available, the buried waste characteristics were often assumed to be similar to more recently generated waste.

4. The RH-TRU waste in the caissons at Hanford would remain onsite.

Following are the data tables ,a few of which are accompanied by a pie-chart which exhibits relative volumes of waste at individual sites.

TABLE 1.

HANFORD REMOTE HANDLED WASTE

SITE	Volume of Waste (ft)	Radiation Level (At Contact)			Curies Pu		SS Material Designation	Avg. Heat Output (W/ft)	Avg. Density (lb/ft)	Total Weight (lb)	Hazards		
		Max. Rad. Level (mr/hr)	Avg. Rad. Level (mr/hr)	% Above 200mr/hr	Total (Ci)	Avg. (Ci/ft)					Fines Content	Gas Generation	Non-Rad. Hazardous Materials
HANFORD													
A. Sub-surface caissons	1,320	1.5E6 @ 1 ft	5E5 @ 1 ft	100%	1.2E4	9.4	Pu-54	.2	60	5.4E4	NO	NO	NO

TABLE 2.

SPECIAL CASE TRU WASTE
STORED AND NEWLY GENERATED REMOTE HANDLED TRU WASTE TO BE LEFT ON SITE
(Waste Deemed Not Certifiable Through Year 2015)

SITE	Volume of Waste (ft)	Radiation Level (At Contact) Max. Rad. Level (mr/hr)	Avg. Rad. Level (mr/hr)	Curies Pu Total (Ci)	Avg. (Ci/ft)	SS Material Design-ation	Avg. Heat Output (W/ft^3)	Avg. Density (lb/ft)	Total Weight (lb)	Hazards Fines Content	Gas Generation (lb/ft)	Non-Rad. Hazardous Materials
HANFORD	0(3)											
INEL	0 - NONE WILL BE LEFT ON SITE											
LANL	0(2)											
NTS	0 -											
ORNL	15,750	9E3	500	1	5E-5	TRU Waste	10	16	2.5E5	NO	NO	NO
SRP	0											
TOTAL:	15,750								2.5E5			

(1) If the Waste Repackaging Facility is constructed at ORNL, this volume will go to zero.
(2) There is a possibility that 790 ft^3 may be left on site if no acceptable means of processing for WIPP is established. This will effect the waste shown on Tables 3 and 4.
(3) Hanford's Purex Facility will produce approximately 4,350 cubic feet per year; however, this waste is now classified as Facility D&D.

TABLE 3

STORED WASTE EXPECTED TO BE CERTIFIABLE WITHOUT PROCESSING
(RH WASTE 1970 - 1982)

SITE	Volume of Waste (Ft^3)	Radiation Level (at Contact)		Curies Pu		SS Material Designation	Average Heat Output (w/ft^3)	Average Density (lbs/ft^3)	Total Weight (lbs)	Hazards			<100 NCi/g (%)	Container Count		Container Size	
		Maximum Rad Level (mr/hr)	Average Rad Level (mr/hr)	Total (Ci)	Avg. (Ci/ft^3)					Fines Content	Gas Generation (lbs/ft^3)	Non-Rod Hazardous Material		Drums	Boxes	Gallons	LWH
Hanford	0																
INEL	1,457	178,000 @3 ft	19,300	1,645	1.1	CS-137-21.5% CE-144-20.3% SR-90- 16.7% MFP 11.7% CS-134 10.0% Other 19.8%	UNK	27.9	40.6E4	No Data - - - - - - - - - - - - >				339 16		30 12-3/4 in. dia. by 74-1/2 in. length	
LANL	180 (1)	1E5	25E3	8.7	.050	Pu 239-U-235	<0.1	130	23,400	No	No	No	40		5NTS		0
ORNL	0																
SRP	0																
Total	1,637			1,653.7					429,400					355	5		

(1) Assumes overpacking is acceptable for WIPP disposal.

TABLE 4.

STORED WASTE NOT EXPECTED TO BE CERTIFIABLE WITHOUT PROCESSING
(RH Waste - 1970-1982)

SITE	Volume of Waste (ft^3)	Radiation Level (At Contact)		Curies Pu		SS Material Designation	Avg. Heat Output (w/ft^3)	Avg. Density (lb/ft^3)	Total Weight (lb)	100 NCi/g (%)	Container Count		Container Size	
		Max. Rad. Level) (mr/hr)	Avg. Rad. Level (mr/hr)	Total (Ci)	Avg. (Ci/ft^3)						Drums	Boxes	Gallons	LUH
HANFORD	1,320													
INEL	0													
LANL	610[1]	1E5	5E4	66.3	.11	Pu-239 U-235	.1	130	79.3E3	23%				
NTS	0													
ORNL	2.1E4	9E3	500	1	5E-5	TRU Waste	10	49	8E6	0				
SRP	0													
TOTAL:	22,930			67.3					8.1E6					

(1) Assumes LANL can process their oversized sealed canisters.

TABLE 5.

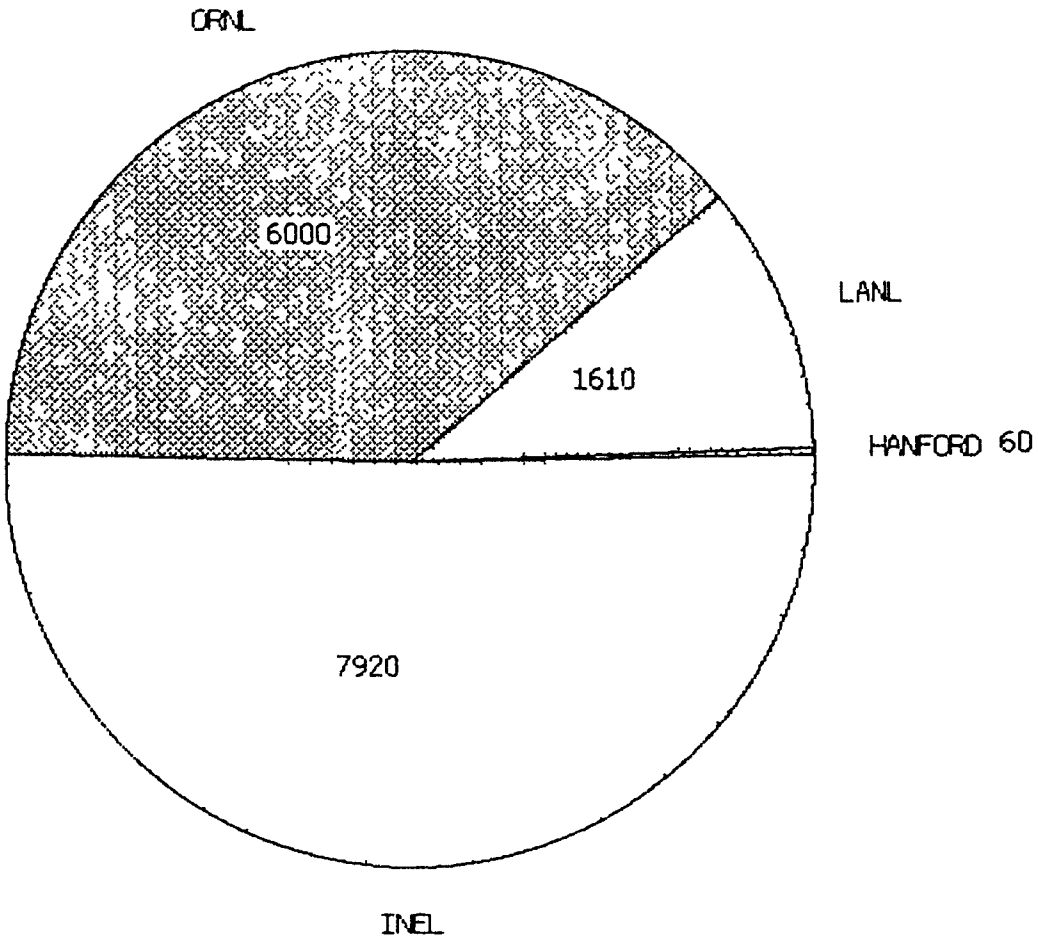
NEWLY GENERATED WASTE EXPECTED TO BE CERTIFIABLE WITHOUT PROCESSING
(RH Waste - 1984-1993)

SITE	Volume of Waste (ft)	Avg. Rad. Level (mr/hr)	Curies Pu		SS Material Design-ation	Weight			Avg. Heat Output (W/ft)	Fines Content	Hazards		Containers			
			Total (Ci)	Avg. (Ci/ft)		Avg. Density (lb/ft)	Max. Density (lb/ft)	Total Wt. (lb)			Gas Generation	Non-Rad. Hazardous Materials	Count Drms.	Count Bxs.	Size Gals.	Size LWH
HANFORD(1)	60(2)	5E5 at 1 ft.	564	9.4	Pu-54	60	80	3600	.2	NO	NO	NO	160		165	
INEL	7920	52,720	1778	.22	Pu-52-68%	23	150	183E3	.1	NO	NO	NO				Varies
LANL	1610	1E5	322	.2	Pu-239 U-235	115	130	185E3	.1	NO	NO	NO				Varies
NTS	0															
ORNL	6.E3	500	.76	6E-5	TRU Waste	16	30	2E5	10	NO	NO	NO	1,240			Varies
SkP	0															
TOTAL:	13,950		2665					571,600								

(1) This waste stream begins in 1991.
(2) This number does not include 5,000 cubic feet that will be generated at the Process Modification Facility in the early 1990s.

NEWLY GENERATED WASTE EXPECTED TO

BE CERTIFIED WITHOUT PROCESSING (RH WASTE---1984-1993)



VOLUME OF WASTE (CUBIC FEET)

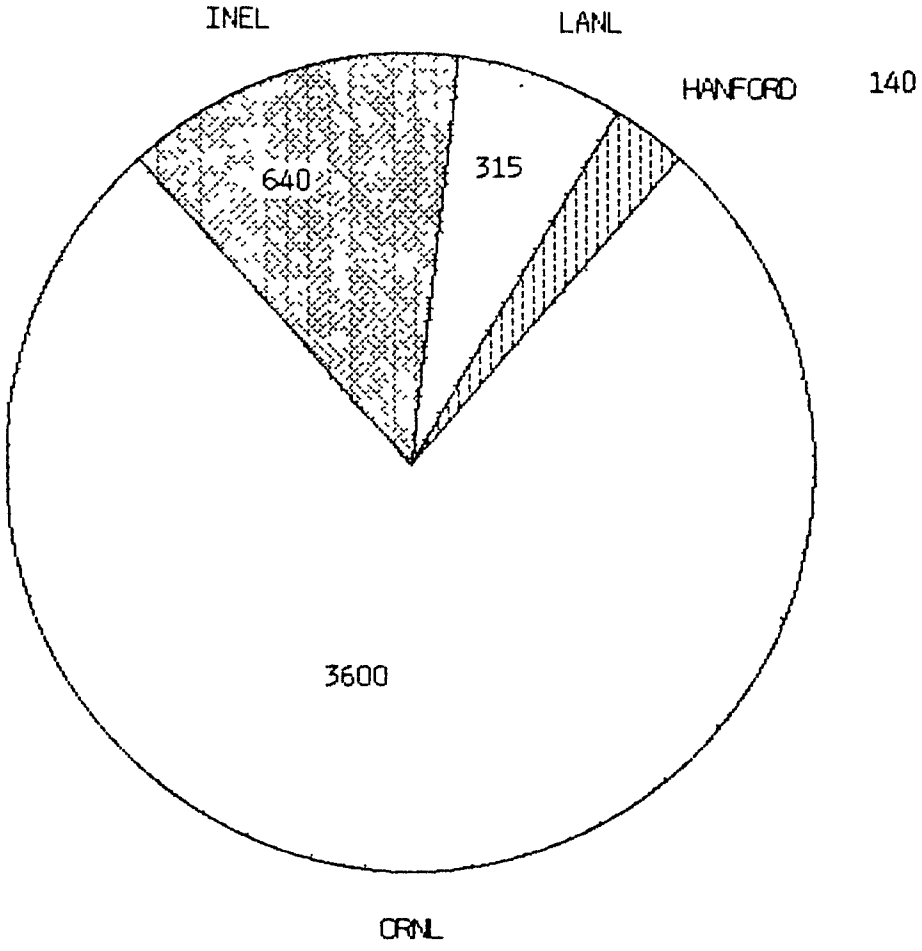
TABLE 6.

NEWLY GENERATED WASTE NOT EXPECTED TO BE CERTIFIABLE WITHOUT PROCESSING
(RH Waste - 1984-1993)

SITE	Volume of Waste (ft)	Avg. Rad. Level (mr/hr)	Curies Pu		SS Material Design-ation	Weight			Avg Heat Output (W/ft)	Fines Contest	Hazards		Containers	
			Total (Ci)	Avg. (Ci/ft)		Avg. Density (lb/ft)	Max. Density (lb/ft)	Total Wt. (lb)			Gas Generation	Non-Rad. Hazardous Materials	Count Drums	Count Bxs.	Size Gals.	Size LWH
HANFORD	140	.5E6 @ 1 ft	500 g/piece	9.4	Pu-52	68		3E5	.008	NO	NO	Hg	160		185	
INEL	640	2E5	25.6	.04	U-98.5% Pu-1.5%	90	100	57.6E3	.1	NO	Negligible	NO	128			12"diaX60"lg (insert)
LANL	315	1E5	28	0	U-235/ Pu-239	115	130	16,100	.1	NO	NO	NO	4			
NTS	0															
ORNL	3.6E3	500	.15	6E-5	TRU Waste	16	30	4E4	10	NO	NO	NO	36			60 X 72
SRP	0															
TOTAL:	4,695							413E3					328			

NEWLY GENERATED WASTE NOT EXPECTED TO

BE CERTIFIED WITHOUT PROCESSING (RH WASTE---1984-1993)



VOLUME OF WASTE (CUBIC FEET)

TABLE 7. -- Part I.

SOFT RH-TRU WASTE THAT WILL BECOME AVAILABLE FOR SHIPMENT
(1984-2015)

SITE	Package	Vol. (ft^3)	# Pkgs.	Number at Each Radiation Level (R/hr) 0.2	1	100	Number at Each Pu Curie Level 0.6	2	5	10	20	84	100	1K
HANFORD	1 & 5-Gal Paint Cans	375	2,750	----------NO DATA----------										
INEL	30-Gal Drums	1,420	355		130	225	32	226	54	15		30		
	12" Dia X 60" L Cans	1,095	219			219	219							
	5 cu. ft. Special	35	7		7		5		1	1				
LANL(1)	0													
ORNL	0													
SRP	0													
TOTAL:		2,925	3,331		137	444	256	226	55	16		30		

(1) Waste is a mixture of hard and soft, etc. Multiple cans of waste then are packaged into the WIPP-approved canister. Therefore, since no one waste category applies to a specific package, all RH waste is categorized as "Special".

TABLE 7. -- Part II. (Continued)

SITE	Number at Each Wt (lbs.)									Number Exhibiting Hazards					
	400	800	1500	3000	5000	7000	12000	17000	25000	Fines		Gas Generation		Non-Rad Hazards	
										NO	YES	NO	YES	NO	YES
HANFORD	2,750									2,750		2,750		2,750	
INEL	355									250		250		250	
		219								219		219		219	
		7													
LANL	0														
NTS	0														
ORNL	0														
SRP	0														
TOTAL:	3,105	226								3,219		3,219		3,219	

TABLE 8. -- Part I.

SOFT RH-TRU WASTE THAT WILL BECOME AVAILABLE FOR SHIPMENT
(1984-2015)

SITE	Package	Vol. (ft^3)	# Pkgs.	Number at Each Radiation Level (R/hr)				Number at Each Pu Curie Level							
				0.2	1	100	1000	0.6	2	5	10	20	84	100	1K
HANFORD[1]	1 & 5-Gal Paint Cans	125	1,000	NO DATA											
INEL	30-Gal Drums	3,492	873		40	833		33	594	66					
	55-Gal Drums	35	5			5									
	12"Dia X60" Waste Can	1,235	247			186	61	151	96						
	1' X 6' Cylindrical	150	30			30			30						
	5 ft3	25	5			5									
TOTAL:		5,062	2,160	0	40	1,059	61	184	720	66					

(1) From 1991 on, the waste will be put into WIPP-approved containers and not caissons.

TABLE 8. -- Part II. (Continued)

SITE	Number at Each Wt. (lbs.)									Number Exhibiting Hazards					
										Fines		Gas Generation		Non-Rad Hazards	
	400	800	1500	3000	5000	7000	12000	17000	25000	NO	YES	NO	YES	NO	YES
HANFORD	1,000									1,000		1,000		1,000	
INEL	873									693		693		693	
	5														
		247								247		247		247	
	30									30		30		30	
	5														
TOTAL:	1,913	247								1,970		1,970		1,970	

TABLE 9. -- Part I.

PROCESSED/TREATED RH-TRU WASTE THAT WILL BECOME AVAILABLE FOR SHIPMENT
(1984-2015)

SITE	Package	Vol. (ft^3)	# Pkgs.	Number at Each Radiation Level (R/hr)				Number at Each Pu Curie Level							
				0.2	1	100	1000	0.6	2	5	10	20	84	100	1K
HANFORD	None Identified														
INEL	12"Dia X60" Waste Cans	2,330	466			405	61	370	96						
TOTAL:		2,330	466			405	61	370	96						

TABLE 9. -- Part II. (Continued)

SITE	Number at Each Wt. (lbs.)									Number Exhibiting Hazards					
	400	800	1500	3000	5000	7000	12000	17000	25000	Fines		Gas Generation		Non-Rad Hazards	
										NO	YES	NO	YES	NO	YES
INEL		466								466		466		466	
TOTAL:		466								466		466		466	

TABLE 10. -- Part II. (Continued)

SITE	Number at Each Wt. (lbs.)									Number Exhibiting Hazards					
	400	800	1500	3000	5000	7000	12000	17000	25000	Fines		Gas Generation		Non-Rad Hazards	
										NO	YES	NO	YES	NO	YES
LANL						188				188		188		188	
TOTAL:						188				188		188		188	

TABLE 10. -- Part I.

SPECIAL CASE RH-TRU WASTE THAT WILL BECOME AVAILABLE FOR SHIPMENT
(1984-2015)

SITE	Package	Vol. (ft^3)	# Pkgs.	Number at Each Radiation Level (R/hr)				Number at Each Pu Curie Level							
				0.2	1	100	1000	0.6	2	5	10	20	84	100	TK
HANFORD	None Identified														
LANL	2'Dia X 10'L Canister	6,580	188			110	78				98	82	8		
TOTAL:		6,580	188			110	78				98	82	8		