DOE/CAO-95-1121

TRANSURANIC WASTE BASELINE INVENTORY REPORT

(REVISION 3)

June 1996

NOTICE TO READERS

This document, Revision 3 of the Transuranic Waste Baseline Inventory Report (TWBIR), has been prepared to document the transuranic (TRU) waste inventory data to be used in the Sandia National Laboratories/New Mexico (SNL/NM) calculations for the Waste Isolation Pilot Plant's (WIPP's) performance assessment (PA). The TWBIR Revision 3, is comprised of previously published information found in Revision 2 of the TWBIR and supplemented with information and data that were specifically requested by the U.S. Department of Energy (DOE) Carlsbad Area Office (CAO) for the SNL/NM PA calculations.

The data contained in this document will also be used as the inventory basis for the WIPP Compliance Certification Application (CCA) to be submitted to the U.S. Environmental Protection Agency. The site information requested in the January 1996 data call has not been included in Revision 3. Future editions of the TWBIR will be identified by the year of data origin.

M

TABLE OF CONTENTS

M

M

LIST OF FIGURES

Figure **Page**

LIST OF TABLES

M

ACRONYMS AND ABBREVIATIONS

AE	Argonne National Laboratory-East site identifier
AL	Ames Laboratory site identifier
AM	ARCO Medical Products Company site identifier
AW	ANL-W site identifier
BC	Battelle Columbus Laboratory site identifier
BT	Bettis Atomic Power Laboratory site identifier
C&C Agreement	Agreement for Consultation and Cooperation between the Department of Energy and the State of New Mexico on the Waste Isolation Pilot Plant
CAO	Carlsbad Area Office
CCA	Compliance Certification Application
CFR	Code of Federal Regulations
CH	contact-handled
CY	calendar year
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
ET	Energy Technology Engineering Center site identifier
FFCAct	Federal Facilities Compliance Act
IDB	Integrated Data Base
IN	Idaho National Engineering Laboratory site identifier
IT	Inhalation Toxicology Research Institute site identifier
KA	Knolls Atomic Power Laboratory-Schenectady site identifier
kg	kilograms
LA	Los Alamos National Laboratory site identifier
LANL	Los Alamos National Laboratory
LB	Lawrence Berkeley Laboratory site identifier
LL	Lawrence Livermore National Laboratory site identifier
LWA	Land Withdrawal Act
MC	U.S. Army Material Command
MD	Mound Plant site identifier
m^3	cubic meters
mrem	millirem
MU	University of Missouri Research Reactor site identifier
NT	Nevada Test Site site identifier
OR	Oak Ridge National Laboratory site identifier
ORIGEN2	Oak Ridge Isotope Generation and Depletion Code
ORNL	Oak Ridge National Laboratory
PA	performance assessment (in text only)
PA	Paducah Gaseous Diffusion Plant site identifier (in waste profiles only)
PCB	polychlorinated biphenyls
PX	Pantex site identifier
RCRA	Resource Conservation and Recovery Act
RF	Rocky Flats Environmental Technology Site site identifier
RFETS	Rocky Flats Environmental Technology Site

RH	remote-handled
RL	Hanford (Richland) site identifier
SA	Sandia National Laboratories/New Mexico site identifier
SNL/NM	Sandia National Laboratories/New Mexico
SR	Savannah River Site site identifier
SRS	Savannah River Site
TB	Teledyne Brown Engineering
TOC	total organic carbon
TRU	transuranic
TWBIR	Transuranic Waste Baseline Inventory Report
WAC	waste acceptance criteria
WIPP	Waste Isolation Pilot Plant
WMC	waste matrix code
WMP	waste material parameter
WV	West Valley Demonstration Project site identifier

EXECUTIVE SUMMARY

The *Transuranic Waste Baseline Inventory Report* (TWBIR) establishes a methodology for grouping wastes of similar physical and chemical properties from across the U.S. Department of Energy (DOE) transuranic (TRU) waste system into a series of "waste profiles" that can be used as the basis for waste form discussions with regulatory agencies.

The purpose of Revisions 0 and 1 of this report was to provide data to be included in the Sandia National Laboratories/New Mexico (SNL/NM) performance assessment (PA) processes for the Waste Isolation Pilot Plant (WIPP). Revision 2 of the document expanded the original purpose and was also intended to support the WIPP Land Withdrawal Act (LWA) requirement for providing the total DOE TRU waste inventory. The document included a chapter and an appendix that discussed the total DOE TRU waste inventory, including nondefense, commercial, polychlorinated biphenyls (PCB)-contaminated, and buried (predominately pre-1970) TRU wastes that are not planned to be disposed of at WIPP.

Revision 3 of the TWBIR is based on the TWBIR Revision 2 data which are supplemented by data in several memoranda issued during early calendar year (CY) 1996. These memoranda summarize additional data requested by the U. S. Department of Energy/Carlsbad Area Office (DOE/CAO) to support the SNL/NM PA modeling. The primary purpose of Revision 3 is to provide the summary data from TWBIR Revision 2 and the supplemental information used by SNL/NM in the development of the Compliance Certification Application (CCA) to be delivered to the Environmental Protection Agency (EPA), and to support the LWA (Public Law, 1992b). The supplemental information was generated from specific data requests to the TRU waste sites since the publication of Revision 2. The supplemental data discussed in detail in Chapter 3 and Appendices A and B are listed below:

- Radionuclide data in support of the Compliance Certification Application.
- Estimate of complexing agents in TRU solidified waste forms scheduled for disposal in WIPP.
- Estimate for SNL/NM PA calculations of nitrate, sulfate, and phosphate content in transuranic solidified wastes destined for disposal in WIPP.
- Estimate of cement content in TRU solidified waste forms scheduled for disposal in WIPP.

Revision 2 of the TWBIR included both the TRU waste that is allowed to be disposed of in WIPP and the DOE TRU waste that is not currently allowed to be disposed of in WIPP (Public Law, 1992b). Because the primary purpose of this Revision 3 TWBIR is to support the CCA and PA, it includes only the DOE TRU waste that is currently allowed to be disposed of in WIPP.

Revision 3 of the TWBIR is different from previous revisions in that it provides the TRU waste inventory information developed for Revision 2 along with supplemental data. It is necessary for the reader to be familiar with Revision 2 of the TWBIR to understand this TWBIR Revision 3 document. Much of the TWBIR Revision 2 information is referenced, rather than repeated, in this document, resulting in an abbreviated document. Revision 3 of the TWBIR consists of one volume having five chapters and four appendices. There is not a new electronic database for

TWBIR Revision 3 because the data in the Revision 2 database are unchanged; therefore new database diskettes are not being published with this document.

The WIPP anticipated (stored and projected) inventory of TRU waste is defined as the sum of retrievably stored waste plus currently projected TRU waste volumes. Current projections do not include waste generated as a result of future environmental restoration (ER) and decontamination and decommissioning (D&D) activities and have only been developed over a 25 year period, consequently the anticipated inventory for CH-TRU waste is not sufficient to fill the maximum CH-TRU disposal inventory for WIPP (calculated to be approximately 168,500 cubic meters or 5,950,000 cubic feet). Scaling has been developed as a means for SNL/NM to model the impacts of a full repository. Scaling has not been applied to the RH-TRU inventory since the sites have reported sufficient RH-TRU waste to fill the RH-TRU disposal inventory (approximately 7,080 cubic meters or 250,000 cubic feet).

The TWBIR also estimates the WIPP disposal inventory in terms of 12 waste material parameters and additional packaging materials that have been identified by SNL/NM as necessary for PA. The 12 waste material parameters and additional packaging materials are constituents of TRU waste and are input parameters for one or more PA models or are required to adequately describe the waste form.

The 12 waste material parameters and additional packaging materials are listed below:

Waste Material Parameters
- Iron-base metal/alloys
- Aluminum-base metal/alloys
- Other metal/alloys
- Other inorganic materials
- Vitrified
- Cellulosics
- Rubber
- Plastics
- Solidified inorganic material
- Solidified organic material
- Cement (solidified)
- Soils

Packaging Materials
- Steel
- Plastic
- Lead (for RH-TRU waste only)

The waste material parameters are expressed on a weight/volume (kilograms per cubic meter) basis. The occurrence of more than one waste material parameter at the maximum value within a waste stream is highly unlikely. If required by PA calculations, the sampling statistics must be controlled so that several waste material parameters do not get sampled all at their maximum value (weight/volume), thereby exceeding the average weight/volume.

Attached to this Executive Summary are several summary tables from the body of the TWBIR Revision 3 which are frequently requested by TWBIR users:

- Table ES-1. WIPP CH-TRU Waste Material Parameter Disposal Inventory
- Table ES-2. WIPP RH-TRU Waste Material Parameter Disposal Inventory
- Table ES-3. WIPP CH-TRU Waste Anticipated Inventory by Site
- Table ES-4. WIPP RH-TRU Waste Anticipated Inventory by Site
- Table ES-5. Summary Radionuclide Inventory

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Table ES-1. WIPP CH-TRU Waste Material Parameter Disposal Inventory*

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	2.6E+03	1.7E+02	0.0E+00
Aluminum Base Metal/Alloys	8.0E+02	1.8E+01	0.0E+00
Other Metal/Alloys	1.6E+03	6.7E+01	0.0E+00
Other Inorganic Materials	1.4E+03	3.1E+01	0.0E+00
Vitrified	2.5E+03	5.5E+01	0.0E+00
Cellulosics	9.6E+02	5.4E+01	0.0E+00
Rubber	6.3E+02	1.0E+01	0.0E+00
Plastics	8.9E+02	3.4E+01	0.0E+00
Solidified Inorganic Material	2.2E+03	5.4E+01	0.0E+00
Solidified Organic Material	1.4E+03	5.6E+00	0.0E+00
Cement (Solidified)	1.2E+03	5.0E+01	0.0E+00
Soils	1.6E+03	4.4E+01	0.0E+00
Container Materials - Kg/m3			
Steel		139	
Plastic/ Liners		26	

*This table is identical to Table ES-1 of TWBIR Revision 2, page ES-4 (DOE. 1995c).

Table ES-2. WIPP RH-TRU Waste Material Parameter Disposal Inventory*

Waste Material Parameters (Kg/m3	Maximum	Average	Minimum
Iron Base Metal/Alloys	1.7E+03	1.0E+02	0.0E+00
Aluminum Base Metal/Alloys	1.7E+02	7.1E+00	0.0E+00
Other Metal/Alloys	9.1E+02	2.5E+02	0.0E+00
Other Inorganic Materials	2.0E+03	6.4E+01	0.0E+00
Vitrified	2.5E+03	4.7E+00	0.0E+00
Cellulosics	5.7E+02	1.7E+01	0.0E+00
Rubber	4.4E+02	3.3E+00	0.0E+00
Plastics	6.2E+02	1.5E+01	0.0E+00
Solidified Inorganic Material	6.1E+02	2.2E+01	0.0E+00
Solidified Organic Material	8.1E+02	9.3E-01	0.0E+00
Cement (Solidified)	5.8E+02	1.9E+01	0.0E+00
Soils	2.4E+01	1.0E+00	0.0E+00
Container Materials - Kg/m3			
Steel		446	
Plastic/Liners		3.1	
Lead		465	
Steel Plug		2145	

*This table is identical to Table ES-2 of TWBIR Revision 2, page ES-5 (DOE, 1995c).

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Table ES-3. WIPP CH-TRU Waste Anticipated Inventory By Site*

(Cubic Meters)

Storage/Generator Site	Stored Volumes	Projected Volumes	Anticipated Volumes
Ames Laboratory - Iowa State Univ.	0.0E+00	4.2E-01	4.2E-01
Argonne National Laboratory - East	1.1E+01	1.3E+02	1.4E+02
Argonne National Laboratory - West	6.5E+00	7.4E+02	7.5E+02
Bettis Atomic Power Laboratory	0.0E+00	1.2E+02	1.2E+02
Energy Technology Engineering Center	1.7E+00	0.0E+00	1.7E+00
Hanford (Richland) Site	1.2E+04	3.3E+04	4.6E+04
Idaho National Engineering Laboratory	2.9E+04	0.0E+00	2.9E+04
Lawrence Livermore National Laboratory	2.3E+02	7.1E+02	9.4E+02
Los Alamos National Laboratory	1.1E+04	7.4E+03	1.8E+04
Mound Plant	2.7E+02	0.0E+00	2.7E+02
Nevada Test Site	6.2E+02	9.0E+00	6.3E+02
Oak Ridge National Laboratory	1.3E+03	2.6E+02	1.6E+03
Paducah Gaseous Diffusion Plant	0.0E+00	1.9E+00	1.9E+00
Pantex Plant	6.2E-01	0.0E+00	6.2E-01
Rocky Flats Environmental Technology Site	7.1E+02	4.4E+03	5.1E+03
Sandia National Laboratory - Albuquerque	6.7E+00	7.5E+00	1.4E+01
Savannah River Site	2.9E+03	6.8E+03	9.6E+03
Teledyne Brown Engineering	2.1E-01	0.0E+00	2.1E-01
U.S. Army Material Command	2.5E+00	0.0E+00	2.5E+00
University of Missouri Research Reactor	2.1E-01	8.3E-01	1.0E+00
Total CH Volumes	**5.8E+04**	**5.4E+04**	**1.1E+05**

*This table is identical to Table ES-3 of TWBIR Revision 2, page ES-6 (DOE, 1995c).

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Table ES-4. WIPP RH-TRU Waste Anticipated Inventory By Site*

	(Cubic Meters)		
Storage/Generator Site	**Stored Volumes**	**Projected Volumes**	**Anticipated Volumes**
Argonne National Laboratory - West	1.9E+01	1.3E+03	1.3E+03
Battelle Columbus Laboratories	5.8E+02	0.0E+00	5.8E+02
Bettis Atomic Power Laboratory	0.0E+00	6.7E+00	6.7E+00
Energy Technology Engineering Center	8.9E-01	0.0E+00	8.9E-01
Hanford (Richland) Site	2.0E+02	2.2E+04	2.2E+04
Idaho National Engineering Laboratory	2.2E+02	0.0E+00	2.2E+02
Los Alamos National Laboratory	9.4E+01	9.9E+01	1.9E+02
Oak Ridge National Laboratory	2.5E+03	4.5E+02	2.9E+03
Total RH Volumes	**3.6E+03**	**2.3E+04**	**2.7E+04**
Total TRU Waste Volumes	**6.2E+04**	**7.7E+04**	**1.4E+05**

*This table is identical to Table ES-4 of TWBIR Revision 2, page ES-7 (DOE, 1995c).

Table ES-5. Summary Radionuclide Inventory[1]*

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)
Am241	2.62E+00	8.42E-01
Ba137m	4.53E-02	2.89E+01
Cm244	1.87E-01	4.45E-02
Co60	3.83E-04	1.47E+00
Cs137	4.78E-02	3.05E+01
Pu238	1.55E+01	2.05E-01
Pu239	4.66E+00	1.45E+00
Pu240	1.25E+00	7.15E-01
Pu241	1.37E+01	2.00E+01
Sr90	4.07E-02	2.95E+01
Y90	4.07E-02	2.95E+01

[1]Summary shows the ten radionuclides with the highest concentration in curies per cubic meter for both CH-TRU and RH-TRU waste. The list includes eleven radionuclides because the ten radionuclides with the highest concentration are different for CH-TRU and RH-TRU waste.

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*This table is an update of Table ES-7, of TWBIR Revision 2, page ES-10 (DOE, 1995c).

1. INTRODUCTION

1.1 BACKGROUND

Transuranic (TRU) waste is defined as waste that is contaminated with alpha-emitting radionuclides with an atomic number greater than 92, with half-lives greater than 20 years, and concentrations of TRU isotopes greater than 100 nanocuries per gram of waste at the time of assay (DOE, 1988). TRU wastes are classified as either contact-handled (CH) waste or remote-handled (RH) waste, depending on the dose rate at the surface of the waste container. CH-TRU wastes are packaged TRU wastes with an external surface dose rate less than 200 millirems (mrem) per hour, while RH-TRU wastes are packaged TRU wastes with an external surface dose rate of 200 mrem or greater per hour (Public Law, 1992b). Unless otherwise indicated, for the purposes of this document, all references to TRU waste include TRU waste and mixed TRU waste (waste that contains both radioactive and hazardous components, as defined by the Atomic Energy Act [Public Law, 1954] and the Resource Conservation and Recovery Act [RCRA] as codified in Title 40 Code of Federal Regulations [CFR] Part 261.3 [EPA, 1980]).

The Waste Isolation Pilot Plant (WIPP) is a TRU waste management facility operated by the U.S. Department of Energy (DOE). The WIPP is currently identified as the permanent disposal site for TRU wastes (in retrievable storage or projected) generated at various DOE sites from defense-related activities of the United States government. The WIPP is scheduled to receive and dispose of TRU defense wastes from 8 major and additional minor DOE TRU waste sites (see Figure 1-1).

The DOE is committed to demonstrating compliance with all applicable regulations prior to permanent disposal of TRU defense wastes in the WIPP repository. These regulations are the environmental standards for management and disposal of TRU defense wastes as mandated in 40 CFR Part 191 (EPA, 1993) and Part 194 (EPA, 1996), and the RCRA regulations. Compliance demonstration through Sandia National Laboratories/New Mexico (SNL/NM) performance assessment (PA) calculations will be based on the inventory of existing and currently projected waste streams compiled in this document and the *Transuranic Waste Baseline Inventory Report* (TWBIR) Revision 2, as reported by the DOE TRU waste sites. Revision 3 of the TWBIR is different from previous revisions in that it provides the TRU waste inventory information developed for Revision 2 along with supplemental data. It is necessary for the reader to be familiar with Revision 2 of the TWBIR (DOE, 1995c) to understand TWBIR Revision 3.

1.2 PURPOSE

The purpose of the TWBIR is to document the total inventory of DOE TRU waste as defined by the DOE TRU waste sites. This document is based on the TWBIR Revision 2 data supplemented by several memoranda prepared during early calendar year (CY) 1996 that summarize additional data requested by the U. S. Department of Energy/Carlsbad Area Office (DOE/CAO) to support the SNL/NM PA modeling. The primary purpose of this document is to provide the summary data from TWBIR Revision 2 and the supplemental information used by SNL/NM for the development of the Compliance Certification Application (CCA) to be delivered to the Environmental Protection Agency (EPA), and to support the Land Withdrawal Act (LWA) (Public Law, 1992b). The supplemental information was generated from specific data requests

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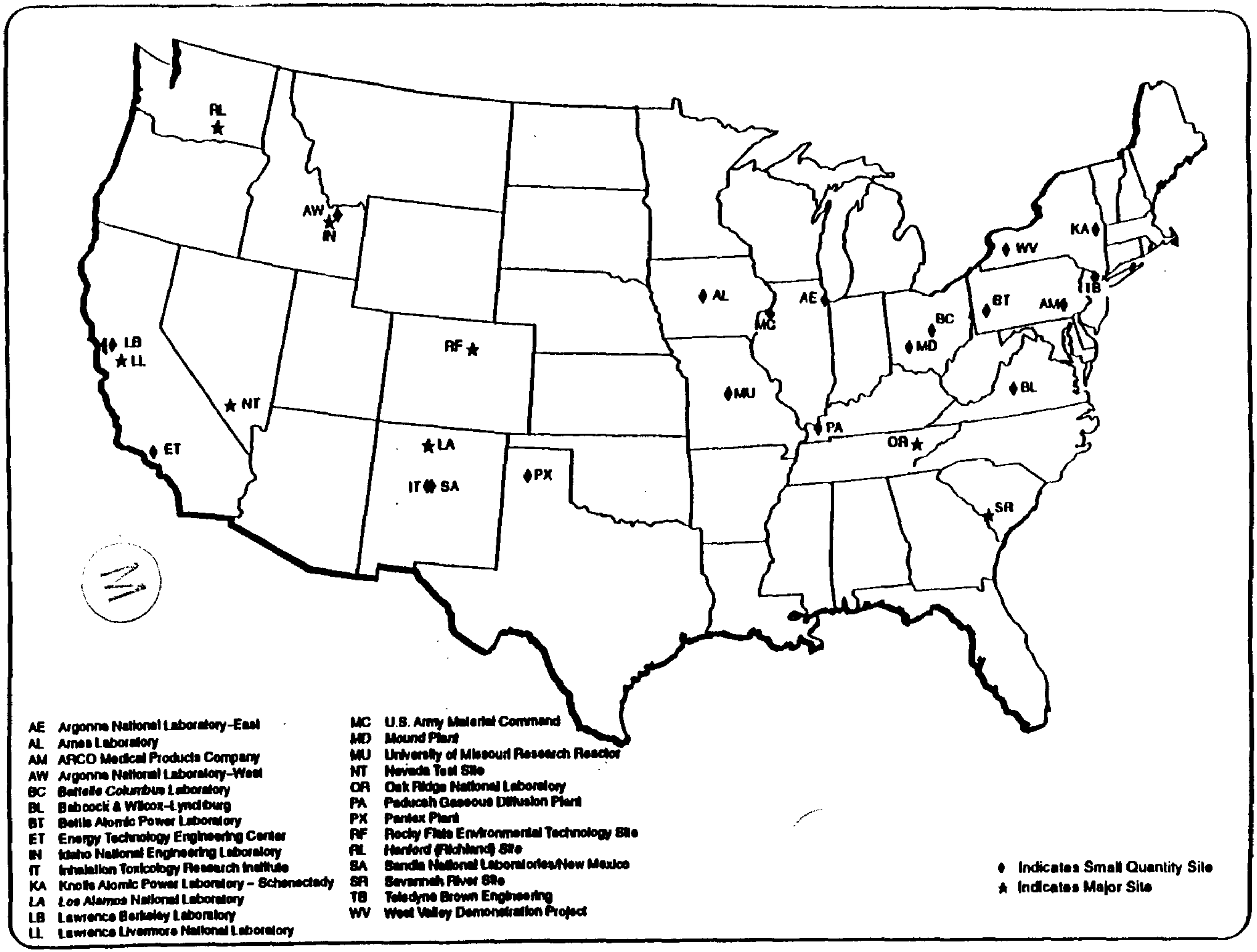

Figure 1-1. U.S. DOE Transuranic Waste Sites*

*This figure is identical to Figure 1-1 in TWBIR Revision 2, page 1-2 (DOE, 1995c).

to the TRU waste sites since the publication of Revision 2.

Revision 2 of the TWBIR included both the TRU waste that is allowed to be disposed of in WIPP and the DOE TRU waste that is not currently allowed to be disposed of in WIPP (Public Law, 1992b). Because the primary purpose of this Revision 3 TWBIR is to support the CCA and PA, it includes only the DOE TRU waste that is currently identified by the sites as being allowed to be disposed of in WIPP.

The TWBIR has been developed from the best available information and acceptable knowledge provided by the DOE TRU waste sites. In support of PA, the TWBIR describes a process for grouping individual waste streams with similar physical and chemical properties into waste profiles, based on their waste matrix code (WMC) (DOE, 1995a) assigned by the DOE TRU waste sites. The individual waste streams are also evaluated to estimate the occurrence and quantities of nonradioactive waste material parameters (WMPs) listed in Table 1-1 (e.g., cellulosics, plastics, iron-base metal/alloys, etc.) that have been identified by SNL/NM as being potentially important to the performance of the WIPP repository. Waste profiles with similar WMCs are then combined across the DOE TRU waste system to provide estimated total volumes and total WMPs.

1.3 WASTE INVENTORY TERMINOLOGY

All terminology in this document is unchanged from the TWBIR Revision 2. A summary of terminology used in this document is provided in this section and in Chapter 5 (Glossary). A list of acronyms and abbreviations used are provided in the front of the document.

Stored Inventory – The part of the TRU inventory currently in retrievable storage at the time of the TWBIR Revision 2 data call for inventory information is known as "stored inventory" in this document. Retrievably stored waste includes waste stored since approximately 1970 in buildings or in berms with earthen cover and does not include any waste that was buried (predominately prior to 1970) (DOE, 1990).

As-Generated Waste – The chemical and physical status of waste when it is generated. The "as-generated" term applies to both stored and projected waste.

Projected Inventory – The part of the TRU waste inventory that has not been generated but is currently estimated to be generated at some time in the future by the TRU waste sites is known as "projected inventory."

Anticipated Inventory – For the TWBIR, this is the sum of the stored and projected inventories, calculated as:

$$\text{Stored Inventory} + \text{Projected Inventory} = \text{Anticipated Inventory}$$

Scaling – The process for adjusting, if needed, the projected inventory to the design limit (disposal inventory) of the WIPP repository is called "scaling."

Stored Inventory + Projected Inventory (scaled as needed) = Disposal Inventory

TABLE 1-1. TECHNICAL DATA NEEDS FOR PERFORMANCE ASSESSMENT WASTE MATERIAL PARAMETERS

Waste Material Parameter	Input Variable in Current PA Models	
	Gas Generation	Mechanical Characteristics
Iron-base metal/alloys	YES	YES
Aluminum-base metal/alloys	-	YES
Other metal/alloys	-	YES
Other inorganic materials	-	YES
Vitrified[1]	-	YES
Cellulosics	YES	YES
Rubber	YES[2]	YES
Plastics	YES[2]	YES
Solidified inorganic material	-	YES
Solidified organic material	-	YES
Cement (solidified)[3,4]	YES	-
Soils[5]	-	YES

[1] Waste material parameter corresponding to treatment, identified by some sites that plan to treat waste in the future.
[2] Only one-half of materials assumed to generate gas.
[3] Percentage of material to generate gas is unknown at the present time.
[4] Information on this waste material parameter is needed for non-PA scoping calculations for assessment of its importance.
[5] May impact colloids.

Disposal Inventory – The inventory volume defined for WIPP emplacement to be used for PA calculations is the "disposal inventory." The LWA defines the total amount of TRU waste allowed for disposal in the WIPP as approximately 175,600 cubic meters (6,200,000 cubic feet) (Public Law, 1992b). The "Agreement for Consultation and Cooperation" (C&C Agreement) limits the RH-TRU inventory to approximately 7,080 cubic meters (250,000 cubic feet) (DOE and State of New Mexico, 1981). Therefore by difference, the CH-TRU inventory will be limited to approximately 168,500 cubic meters (5,950,000 cubic feet) if all of the RH-TRU allowance is filled.

Waste Matrix Code (WMC) - The WMCs were developed by DOE in response to the Federal Facilities Compliance Act (FFCAct) (Public Law, 1992a) as a methodology to aid in categorizing mixed waste streams in the DOE system into a series of five-digit alphanumeric codes (e.g., S3100; Inorganic Process Residues) that represent different physical/chemical matrices (DOE, 1995a).

Final Waste Form – Final waste form of a waste stream refers to the expected physical and chemical form of that stream once the waste has been processed, treated, or repackaged (if necessary) and is ready for disposal. This consists of a series of WMCs that are grouped together. The use of the final waste form helps to group waste streams that are expected to have similar physical and chemical properties at the time of disposal. The final waste form applies to both stored and projected waste. An example of combining three waste streams which either contain particulates or are cemented particulate waste is presented below:

WMC S3100 (inorganic process residues)	Solidified Inorganics
WMC S3110 (inorganic particulates)	
WMC S3150 (solidified process residues)	

Particulate waste may be immobilized prior to shipment to WIPP. If so, all three of these waste streams would be the same basic waste form when emplaced in WIPP and have similar physical and chemical properties. The final waste form for this example is solidified inorganics. Table 1-2 presents all anticipated WMCs for TRU waste and indicates the final waste form typically assigned to each WMC for the TWBIR. There are 11 final waste forms used in this TWBIR. The last two rows in Table 1-2, Excluded and Unknown Waste Streams, group WMCs that will not be accepted at WIPP until additional characterization and/or processing occurs to meet the WIPP Waste Acceptance Criteria (WAC) (DOE, 1996).

Waste Material Parameter – This is one (or more) nonradioactive waste constituent(s) that occurs in a TRU waste stream that is an input parameter into one or more PA models or is required to adequately describe the waste form. The waste material parameters and additional packaging materials that are reported in weight/volume (kg/m^3) and included in the TWBIR are:

WASTE MATERIAL PARAMETERS
- Iron-base metal/alloys
- Aluminum-base metal/alloys
- Other metal/alloys
- Other inorganic materials
- Vitrified
- Cellulosics
- Rubber
- Plastics
- Solidified inorganic material
- Solidified organic material
- Cement (solidified)
- Soils

PACKAGING MATERIALS
- Steel
- Plastic
- Lead (for RH-TRU waste only)

WIPP Waste Profile – The WIPP waste profile represents a summary of TRU wastes at all DOE TRU waste sites that have an identical final waste form.

TABLE 1-2. WASTE MATRIX CODES AND THEIR ANTICIPATED FINAL WASTE FORM

Final Waste Form	Waste Matrix Codes
Solidified Inorganics	L1000[1], L1100[1], L1110[1], L1120[1], L1130[1], L1140[1], L1190[1],1200[1], L1210[1], L1220[1], L1230[1], L1240[1], L1290[1], S3000[2], S3100[3], S3110[3], S3111[3], S3112[3], S3113[3], S3115[3], S3118[3], S3119[3], S3120[1], S3121[1], S3122[1], S3123[1], S3124[1], S3125[1], S3129[1], S3130[1 or 3], S3131[1 or 3], S3132[1 or 3], S3139[1 or 3], S3144[3], S3150, S3160[3], S3190[1 or 3], S3900[2], X6000[4], X6200[5], X6300[6], X6400[5], X6900[4], X7300[3], X7500[8], X7510[8], X7520[8], X7530[8], X7590[8], L9000[2], Z1110, Z1190
Salt	S3000[2], S3140, S3141, S3142, S3143, S3149, S3900[2], L9000[2]
Solidified Organics	L2000[1], L2100[1], L2110[1], L2120[1], L2190[1], L2200[1], L2210[1], L2220[1], L2290[1], L2900[1], S3000[2], S3114[3], S3200[3], S3210[3], S3211[3], S3212[3], S3219[3], S3220[1], S3221[1], S3222[1], S3223[1], S3229[1], S3230[3], S3290[1 or 3], S3900[2], S5340[3], X6000[4], X6100[5], X6190[4], X6900[4], L9000[2], Z1110, Z1190
Soils	S4000, S4100, S4200, S4300, S4900,
Uncategorized Metal (Metal Waste Other Than Lead and/or Cadmium)	S3116, S5000[9], S5100[7], S5110, S5111, S5119, S5190, X6200, X7000[10], X7290, X7400[11], X7430, X7490[11], X7520[8], Z1140, Z1190, Z2100[10]
Lead/Cadmium Metal	S5000[9], S5100[7], S5110, S5112, S5113, S5119, S5190, X6220[8], X7000[10], X7200, X7210, X7211, X7212, X7219, X7220, X7290, X7400[11], X7410[11], X7420[11], X7490[11], Z2100[10]
Inorganic Non-Metal	S3117, S3118, S3160, S5000[9], S5100[7], S5120, S5121, S5122, S5123, S5124, S5125, S5126, S5129, S5190, Z1120, Z1150, Z1190
Combustible	S5000[9], S5300, S5310, S5311, S5312, S5313, S5319, S5320, S5330, S5390, Z1130, Z1190, Z1200
Graphite	S5000[9], S5126
Heterogeneous	S5000[9], S5100[9], S5400, S5420, S5440, S5450, S5460, S5490, X7520[8], Z2900
Filter	S5000[9], S5410
Excluded Waste Streams[12]	X7000, X7100, X7600, X7700
Unknown[13]	S5190, X7900, L9000, S9000, Z9000, U9999

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TABLE 1-2. WASTE MATRIX CODES AND THEIR ANTICIPATED FINAL WASTE FORM (CONTINUED)

[1] Liquid waste streams are assumed to be solidified prior to being sent to WIPP.

[2] WMCs S3000, S3900, and L9000 are placed in "solidified inorganics," "salt," or "solidified organics," depending on the information provided by the TRU waste site.

[3] Particulate waste streams are assumed to be solidified prior to being sent to WIPP.

[4] WMCs X6000 and X6900 are placed in "solidified organics" or "solidified inorganics" depending on the information provided by the TRU waste site.

[5] Liquid lab pack waste is assumed to be solidified prior to being sent to WIPP.

[6] Solid lab packs are assumed to be solidified prior to being sent to WIPP.

[7] WMC S5100 is placed in "uncategorized metal," "lead-cadmium metal," or "inorganic non-metal" depending on the information provided by the site.

[8] Waste stream is assumed to be treated prior to being sent to WIPP.

[9] WMC S5000 is placed in "uncategorized metal," "lead/cadmium metal," "inorganic non-metal," "combustible," "graphite," "heterogeneous," or "filter," depending on the information provided by the site.

[10] WMC Z2100 is placed in "uncategorized metal" or "lead/cadmium metal" depending on the information provided by the site.

[11] WMCs X7400, X7410, X7420, and X7490 are assumed to be drained of liquid and contain only metal waste.

[12] These waste streams are excluded from disposal in WIPP at this time, e.g., PCB and elemental mercury.

[13] If adequate information is provided by the TRU waste site, these WMCs are changed. If there is not enough information, these waste streams remain as "unknown" and are excluded from disposal in WIPP until characterized.

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1.4 METHODOLOGY FOR DEVELOPMENT OF DISPOSAL INVENTORY

Development of the WIPP TRU waste disposal inventory is accomplished by a series of steps starting with the individual waste stream profiles submitted by the TRU waste sites. These waste stream profiles are grouped together, based on similar physical and chemical properties, into common "WIPP waste profiles," which should facilitate discussions with regulatory agencies and stakeholders concerning the disposal waste inventory. The process of grouping similar waste streams is exemplified in Figure 1-2. The waste profiles also contain information on waste material parameters that could affect the performance of the WIPP repository and that may be direct inputs to the PA models.

The CH-TRU anticipated inventory consists of up to 11 overall CH-TRU WIPP final waste forms based on the physical and chemical properties of the waste streams. Because the volume of the CH-TRU anticipated inventory is not sufficient to fill the maximum calculated CH-TRU capacity of WIPP, scaling of the projected CH-TRU inventory is necessary to attain the maximum calculated WIPP CH-TRU disposal inventory of approximately 168,500 cubic meters (5.95 million cubic feet). The scaling factor for CH-TRU waste is computed as follows:

$$\frac{\text{maximum calculated CH-TRU inventory - stored CH-TRU inventory}}{\text{projected CH-TRU inventory}} = \text{CH-TRU scaling factor}$$

The WIPP disposal inventory is the inventory to be used in PA calculations. To calculate the disposal inventory by final waste form for CH-TRU waste, the **projected inventory** is multiplied by the scaling factor, added to the stored inventory for each final waste form, and summed together.

The RH-TRU anticipated inventory is greater than the WIPP C&C Agreement limit (DOE and State of New Mexico, 1981) of approximately 7,080 cubic meters. DOE will abide by the WIPP C&C Agreement for RH-TRU waste volumes and the LWA, which limits the curies of RH-TRU waste allowed in WIPP to 5.1 million curies (Public Law, 1992b). As stated earlier, one purpose of the TWBIR is to report the DOE TRU inventory in such a way that it will facilitate performance assessment by SNL/NM and support development of compliance applications to the appropriate regulatory agencies. Since this is not a WIPP load management document, the RH-TRU inventory has not been scaled back in this document to the regulatory limit. The RH-TRU inventory for WIPP will be averaged across all RH-TRU waste sites and reported as kilograms/cubic meter for the waste material parameters and curies/cubic meter for radionuclides.

1.5 DOCUMENT ORGANIZATION

The TWBIR Revision 3 is organized into chapters of text, figures, tables, and supporting appendices. The contents of remaining chapters in this document are summarized below:

- Chapter 2 provides a summary of the WIPP disposal inventory information previously presented in TWBIR Revision 2.
- Chapter 3 presents supplementary disposal inventory information.
- Chapter 4 provides the document references.

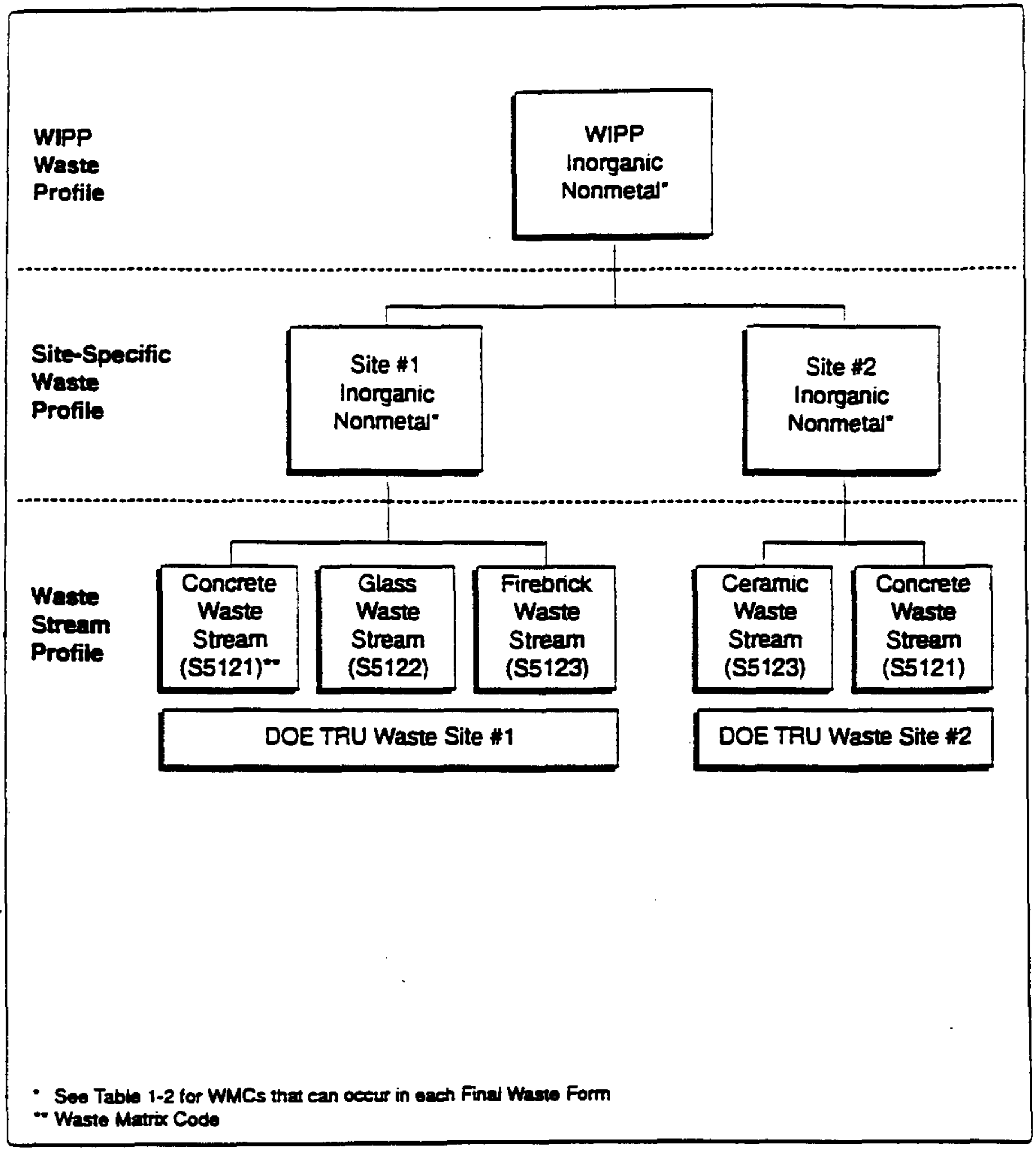

Figure 1-2. Schematic of Waste Stream Profile Methodology*

*This figure is identical to Figure 2-3 of TWBIR Revision 2, page 2-10 (DOE, 1995c).

- Chapter 5 provides a document glossary.
- Appendix A provides the SNL/NM memoranda requesting information to supplement the TWBIR Revision 2.
- Appendix B includes DOE and SNL/NM memoranda that provide information to supplement the TWBIR Revision 2.
- Appendix C provides the site-specific stored radionuclide inventories decayed to December 1995.
- Appendix D provides the correction received from SNL/NM for Cf-252 decayed inventory.

2. SUMMARY OF WIPP DISPOSAL INVENTORY INFORMATION

2.1 INTRODUCTION

The DOE TRU waste sites have assigned an overall final waste form to each waste stream based on the expected physical and chemical form of the waste after the sites process, treat, or repackage the waste (if necessary). Each site provides the stored and projected inventory for each waste stream. The TWBIR generates the WIPP TRU waste inventory by rolling-up the waste stream volumes that have the same final waste form within a site to generate site profiles (see TWBIR Revision 2 [DOE, 1995c] for waste stream and site-specific waste profiles). Then the site-level volumes with the same final waste form are rolled-up to generate the WIPP TRU waste inventory by final waste form (see TWBIR Revision 2 for detailed information on the roll-up methodology).

This chapter summarizes the WIPP-level information for the disposal inventory. The data provided in this chapter are identical to those provided in TWBIR Revision 2. These are the data used by SNL/NM in the WIPP performance assessment to demonstrate regulatory compliance. This chapter will include the following TWBIR Revision 2 information:

- WIPP disposal inventory volumes for each final waste form - taken from Table 3-1 (unchanged) in Section 3.2 of TWBIR Revision 2.
- WIPP disposal inventory waste material parameters - taken from Tables 3-2 and 3-3 (unchanged) in Section 3.3 of TWBIR Revision 2.
- Summary of WIPP anticipated inventory from each site - taken from Tables 4-1 and 4-2 (unchanged) in Chapter 4 of TWBIR Revision 2.

2.2 WIPP DISPOSAL INVENTORY VOLUMES FOR EACH FINAL WASTE FORM

The disposal inventory is defined by the LWA (Public Law, 1992b) and the WIPP C&C Agreement (DOE and the State of New Mexico, 1981) as follows: the maximum allowable WIPP capacity is approximately 175,600 cubic meters, of which RH-TRU disposal inventory is limited to approximately 7,080 cubic meters resulting in a calculated CH-TRU disposal inventory limit of approximately 168,500 cubic meters.

Using volumes for all the retrievably stored and projected defense TRU waste streams (including the mixed and nonmixed TRU waste volumes) a disposal inventory of TRU waste has been developed using the methodology described in Chapter 3 of Revision 2 of the TWBIR. This inventory is presented in Table 2-1 (by final waste forms) and depicts both the anticipated and disposal inventory volumes.

The anticipated CH-TRU inventory volumes are the sum of the stored and projected volumes. Scaling of the disposal inventory is for PA purposes to enable SNL/NM to model a capacity waste load based on currently anticipated profiles.

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TABLE 2-1. TRANSURANIC WASTE DISPOSAL INVENTORY FOR WIPP*

Contact Handled Waste (Cubic Meters)

Final Waste Forms	Stored Volumes	Projected Volumes	Anticipated Volumes	WIPP Disposal Volumes
Combustible	5.8E+03	4.6E+03	1.0E+04	1.4E+04
Filter	2.2E+02	5.1E+02	7.3E+02	1.2E+03
Graphite	5.1E+02	4.8E+01	5.6E+02	6.0E+02
Heterogeneous	2.7E+04	1.3E+04	4.0E+04	5.1E+04
Inorganic Non-Metal	3.1E+03	9.4E+02	4.1E+03	4.9E+03
Lead/Cadmium Metal Waste	3.5E+01	3.3E+02	3.7E+02	6.6E+02
Salt Waste	2.1E+01	3.3E+02	3.5E+02	6.4E+02
Soils	4.1E+02	6.0E+03	6.4E+03	1.2E+04
Solidified Inorganics	9.6E+03	4.5E+03	1.4E+04	1.8E+04
Solidified Organics	9.1E+02	7.5E+01	9.8E+02	1.1E+03
Uncategorized Metal	1.1E+04	2.3E+04	3.4E+04	5.4E+04
Total CH Volumes	**5.8E+04**	**5.4E+04**	**1.1E+05**	**1.6E+05**
Remote Handled Waste				
Combustible	3.6E+01	4.9E+01	8.5E+01	
Heterogeneous	2.3E+03	5.5E+03	7.8E+03	
Inorganic Non-Metal	4.6E+01	2.1E+01	6.8E+01	
Lead/Cadmium Metal Waste	7.1E+00	6.7E+01	7.4E+01	
Solidified Inorganics	1.1E+03	2.3E+02	1.3E+03	
Solidified Organics	3.6E+00	0.0E+00	3.6E+00	
Uncategorized Metal	1.2E+02	1.7E+04	1.8E+04	
Total RH Volumes	**3.6E+03**	**2.3E+04**	**2.7E+04**	
Total TRU Waste Volumes	**6.2E+04**	**7.7E+04**	**1.4E+05**	**1.7E+05**

*This table is identical to Table 3-1 of TWBIR Revision 2, page 3-2 (DOE, 1995c).

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Applying the formula given in Chapter 1:

$$\frac{\underset{\text{(CH-TRU disposal inventory)}}{1.685 \times 10^5 m^3} - \underset{\text{(stored inventory)}}{5.8 \times 10^4 m^3}}{5.4 \times 10^4 m^3 \text{ (projected inventory)}} \approx \underset{\text{(scaling factor)}}{2.05}$$

- Multiply the CH-TRU waste **projected inventory volumes** by the scaling factor for all the final waste forms, and add the stored volumes (which results in the numbers in the "Disposal Inventory" column of Table 2-1).

The CH-TRU waste stream volume on a system-wide final waste form basis is increased by approximately 50 percent to account for the difference between the anticipated inventory and the maximum calculated WIPP CH-TRU disposal inventory.

The RH-TRU WIPP inventory has not been scaled. The RH-TRU anticipated inventory is greater than the amount of RH-TRU waste allowed in the WIPP by the C&C Agreement (DOE and the State of New Mexico, 1981). DOE is committed to abide by all agreements and laws regarding RH-TRU limitations. DOE and SNL/NM will evaluate this inventory to determine the disposal options for all DOE RH-TRU waste. This inventory has not been scaled back to the limit imposed by the C&C Agreement so that all available data are presented to DOE and SNL/NM to conduct modeling and other evaluations to determine the disposition of this waste.

2.3 ROLL-UP OF WIPP WASTE MATERIAL PARAMETERS BY FINAL WASTE FORM

The roll-ups of waste material parameters by final waste forms are developed from the volumes presented in the TWBIR Revision 2. The roll-ups by final waste forms require combining data from several waste streams. A weighted average value for the waste material parameters is calculated from the average densities provided by the TRU waste sites modified by the volume fractions and summed as follows:

$$\text{Average Density of waste material parameter} = \sum \text{Average Density}_i{}^* \times \frac{(\text{Volume TWBIR Stream}_i)}{(\text{Total Volume of Final Waste Form})}$$

*where i is an index representing individual waste streams of the same final waste form

The minimum density is chosen as the smallest minimum density of a particular waste material parameter in the TWBIR Revision 2. The maximum density is chosen in a similar manner, except that the largest maximum density is chosen. Thus, the maximum and minimum values reported in Tables 2-2 and 2-3 are the absolute extreme values reported across the system, and in many cases they only apply to a very small volume of waste. If required, the user can use the data in the TWBIR Revision 2 database to calculate a "weighted average maximum" value to obtain a maximum value that may be more representative of the total inventory.

The waste material parameters that are inputs to the PA models are presented in Table 2-2 for CH-TRU waste and Table 2-3 for RH-TRU waste. These tables represent the waste material parameters for the WIPP disposal inventory.

2.4 SUMMARY OF WIPP ANTICIPATED INVENTORY FROM EACH SITE

Each WIPP waste stream from each TRU waste site is characterized in a waste stream profile in TWBIR Revision 2. Summary tables of CH-TRU and RH-TRU WIPP waste volumes by site are provided in Tables 2-4 and 2-5.

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Table 2-2. WIPP CH-TRU Waste Material Parameter Disposal Inventory*

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	2.8E+03	1.7E+02	0.0E+00
Aluminum Base Metal/Alloys	8.0E+02	1.8E+01	0.0E+00
Other Metal/Alloys	1.6E+03	6.7E+01	0.0E+00
Other Inorganic Materials	1.4E+03	3.1E+01	0.0E+00
Vitrified	2.5E+03	5.5E+01	0.0E+00
Cellulosics	9.6E+02	5.4E+01	0.0E+00
Rubber	6.3E+02	1.0E+01	0.0E+00
Plastics	8.9E+02	3.4E+01	0.0E+00
Solidified Inorganic Material	2.2E+03	5.4E+01	0.0E+00
Solidified Organic Material	1.4E+03	5.6E+00	0.0E+00
Cement (Solidified)	1.2E+03	5.0E+01	0.0E+00
Soils	1.6E+03	4.4E+01	0.0E+00
Container Materials - Kg/m3			
Steel		139	
Plastic/ Liners		26	

*This table is identical to Table 3-2 in TWBIR Revision 2, page 3-4 (DOE, 1995c).

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Table 2-3. WIPP RH-TRU Waste Material Parameter Disposal Inventory*

Waste Material Parameters (Kg/m3	Maximum	Average	Minimum
Iron Base Metal/Alloys	1.7E+03	1.0E+02	0.0E+00
Aluminum Base Metal/Alloys	1.7E+02	7.1E+00	0.0E+00
Other Metal/Alloys	9.1E+02	2.5E+02	0.0E+00
Other Inorganic Materials	2.0E+03	6.4E+01	0.0E+00
Vitrified	2.5E+03	4.7E+00	0.0E+00
Cellulosics	5.7E+02	1.7E+01	0.0E+00
Rubber	4.4E+02	3.3E+00	0.0E+00
Plastics	6.2E+02	1.5E+01	0.0E+00
Solidified Inorganic Material	6.1E+02	2.2E+01	0.0E+00
Solidified Organic Material	8.1E+02	9.3E-01	0.0E+00
Cement (Solidified)	5.8E+02	1.9E+01	0.0E+00
Soils	2.4E+01	1.0E+00	0.0E+00

Container Materials - Kg/m3

Steel	446
Plastic/Liners	3.1
Lead	465
Steel Plug	2145

*This table is identical to Table 3-3 in TWBIR Revision 2, page 3-5 (DOE, 1995c).

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Table 2-4. WIPP CH-TRU Waste Anticipated Inventory By Site*

(Cubic Meters)

Storage/Generator Site	Stored Volumes	Projected Volumes	Anticipated Volumes
Ames Laboratory - Iowa State Univ.	0.0E+00	4.2E-01	4.2E-01
Argonne National Laboratory - East	1.1E+01	1.3E+02	1.4E+02
Argonne National Laboratory - West	6.5E+00	7.4E+02	7.5E+02
Bettis Atomic Power Laboratory	0.0E+00	1.2E+02	1.2E+02
Energy Technology Engineering Center	1.7E+00	0.0E+00	1.7E+00
Hanford (Richland) Site	1.2E+04	3.3E+04	4.6E+04
Idaho National Engineering Laboratory	2.9E+04	0.0E+00	2.9E+04
Lawrence Livermore National Laboratory	2.3E+02	7.1E+02	9.4E+02
Los Alamos National Laboratory	1.1E+04	7.4E+03	1.8E+04
Mound Plant	2.7E+02	0.0E+00	2.7E+02
Nevada Test Site	6.2E+02	9.0E+00	6.3E+02
Oak Ridge National Laboratory	1.3E+03	2.6E+02	1.6E+03
Paducah Gaseous Diffusion Plant	0.0E+00	1.9E+00	1.9E+00
Pantex Plant	6.2E-01	0.0E+00	6.2E-01
Rocky Flats Environmental Technology Site	7.1E+02	4.4E+03	5.1E+03
Sandia National Laboratory - Albuquerque	6.7E+00	7.5E+00	1.4E+01
Savannah River Site	2.9E+03	6.8E+03	9.6E+03
Teledyne Brown Engineering	2.1E-01	0.0E+00	2.1E-01
U.S. Army Material Command	2.5E+00	0.0E+00	2.5E+00
University of Missouri Research Reactor	2.1E-01	8.3E-01	1.0E+00
Total CH Volumes	**5.8E+04**	**5.4E+04**	**1.1E+05**

*This table is identical to Table 4-1 in TWBIR Revision 2, page 4-2 (DOE, 1995c).

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Table 2-5. WIPP RH-TRU Waste Anticipated Inventory By Site*

	(Cubic Meters)		
Storage/Generator Site	**Stored Volumes**	**Projected Volumes**	**Anticipated Volumes**
Argonne National Laboratory - West	1.9E+01	1.3E+03	1.3E+03
Battelle Columbus Laboratories	5.8E+02	0.0E+00	5.8E+02
Bettis Atomic Power Laboratory	0.0E+00	6.7E+00	6.7E+00
Energy Technology Engineering Center	8.9E-01	0.0E+00	8.9E-01
Hanford (Richland) Site	2.0E+02	2.2E+04	2.2E+04
Idaho National Engineering Laboratory	2.2E+02	0.0E+00	2.2E+02
Los Alamos National Laboratory	9.4E+01	9.9E+01	1.9E+02
Oak Ridge National Laboratory	2.5E+03	4.5E+02	2.9E+03
Total RH Volumes	**3.6E+03**	**2.3E+04**	**2.7E+04**
Total TRU Waste Volumes	**6.2E+04**	**7.7E+04**	**1.4E+05**

*This table is identical to Table 4-2 in TWBIR Revision 2, page 4-3 (DOE, 1995c).

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3. SUPPLEMENTAL DISPOSAL INVENTORY INFORMATION

3.1 INTRODUCTION

This chapter summarizes supplemental information about the WIPP disposal inventory that was requested by SNL/NM in support of WIPP PA either after the publication of Revision 2 of the TWBIR or that was not available from the TRU waste sites at the time of publication of Revision 2 of the TWBIR in December 1995 (DOE, 1995c). Appendices A-1 through A-3 are the three memoranda from SNL/NM requesting supplemental information about the WIPP TRU waste inventory.

The first memorandum from SNL/NM (dated November 6, 1995), entitled "CH and RH-TRU Waste Parameters Potentially Important in WIPP PA" (Appendix A-1), was included as Appendix B in Revision 2 of the TWBIR. This memorandum requested information on certain nonradioactive materials present in the TRU waste (nitrates, sulfates, phosphates, cement, and organic ligands), and also requested information on residues present at TRU waste sites other than Rocky Flats Environmental Technology Site (RFETS). The information on residues was provided in Revision 2 of the TWBIR. However, the remainder of the requested information had to be obtained from the sites after the publication of Revision 2 and is presented in this document.

The second and the third memoranda from SNL/NM (dated January 11 and January 30, 1996), both entitled "Information Needed from TWBIR (Revision 2/Addendum)" (Appendices A-2 and A-3), requested additional information about the WIPP disposal radionuclide inventory. This information is also presented in the main body of this document.

The supplemental information provided to SNL/NM in response to the memoranda referenced above is discussed in the following sections:

- Supplemental Radionuclide Information (Section 3.2)
- Supplemental Information for Other Constituents (Section 3.3)

3.2 SUPPLEMENTAL RADIONUCLIDE INFORMATION

In response to the memoranda requesting radionuclide information (Appendices A-2 and A-3), two sets of radionuclide information were provided in support of WIPP PA (Appendices B-1 and B-2). Appendix B-1 is an update of the WIPP disposal radionuclide inventory presented in Table 3-4 of Revision 2 of the TWBIR, while Appendix B-2 presents preliminary activity calculations for seven radionuclides on a waste stream basis. The memoranda reporting these supplemental data and the details of the methodology for calculations are included in Appendices B-1 and B-2. A summary of the information provided by DOE to SNL/NM and the major assumptions used in deriving portions of the data are presented in Sections 3.2.1 and 3.2.2.

3.2.1 Revised WIPP Disposal Radionuclide Inventory

A revised estimate of the WIPP disposal radionuclide inventory (i.e., Table 3-4 in TWBIR Revision 2) was not specifically requested by SNL/NM in the memoranda included in Appendices A-1 through A-3. However, after the publication of TWBIR Revision 2, new and updated radionuclide information became available from four sites (Hanford, Oak Ridge National Laboratory [ORNL], RFETS, and Savannah River Site [SRS]). A review of the new information indicated that it may result in considerable changes to the WIPP disposal radionuclide inventory published in Revision 2 of the TWBIR. Therefore, the disposal radionuclide inventory was recalculated on the basis of the new information and the results provided to SNL/NM in a format identical to Table 3-4 in TWBIR Revision 2 (see Table 3-1). The methodology and the assumptions used for recalculation of the radionuclide inventory are identical to those described in TWBIR Revision 2, except that the new radionuclide information from the four sites was incorporated. The new information from the four sites is summarized below:

- Hanford Site reported corrections to the values for Cf-252, Cm-244, and Cm-245 from their earlier submittals for the Integrated Data Base (IDB) (DOE, 1995b).

- Preliminary sludge sampling data were obtained for the ORNL RH-TRU sludges, which showed that the primary uranium isotope present in these sludges is U-238 (not U-235, as reported in their previous IDB submittals). The uranium curies reported for RH-TRU waste in previous ORNL IDB submittals were redistributed based on the preliminary sludge sampling data. This corrected the previously high estimates of U-235 in the ORNL RH-TRU inventory.

- The RFETS provided undecayed yearly activity data for the radionuclides present in the RFETS residues, which enabled activity decay calculations for these radionuclides. This was not provided for in TWBIR Revision 2; therefore the radionuclide activity from these residues could not be decayed.

- The SRS provided a break-up of radionuclide activity data for SRS waste between on-site and off-site waste (i.e., waste from other sites that was shipped to SRS for storage in the early 1970s). The activity from the off-site waste was included in the WIPP disposal radionuclide inventory but excluded from any extrapolations for SRS projected waste under the assumption that there would be no future accumulation of off-site Pu-238 dominant waste at SRS.

Based on the above information, Table 3-1 provides the revised WIPP disposal radionuclide inventory estimated in curies per cubic meter and total curies for each radionuclide for both CH-TRU and RH-TRU waste. The revised stored radionuclide inventory for each site in decayed curies is provided in Appendix C for both CH-TRU and RH-TRU waste. Appendix C includes the effect of all corrections, additions, or revisions to the site radionuclide inventories used to develop Table 3-1 and is an update of Appendix D in TWBIR Revision 2. All numbers in Appendix C are decayed to December 1995 using the Oak Ridge Isotope Generation and Depletion Code (ORIGEN 2) (Croff, 1980; 1983).

Based on the total curies shown in Table 3-1, it is estimated that approximately 98.9 percent of the total CH-TRU curies is contributed by Pu-238, Pu-239, Pu-240, Pu-241, and Am-241. In contrast, approximately 96.5 percent of the total RH-TRU curies is contributed by Cs-137, Sr-90, Ba-137m, Pu-241, and Y-90. Thus, the remaining radionuclides contribute a very small fraction of the total curies for the repository.

In comparison to TWBIR Revision 2, the most significant change in the revised disposal radionuclide inventory shown in Table 3-1 is the *decrease* in the estimated concentration of Pu-

Table 3-1. WIPP DISPOSAL RADIONUCLIDE INVENTORY FOR THE CCA[1]*

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Ac225	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Ac227	3.61E-06	1.07E-07	6.08E-01	7.57E-04
Ac228	4.43E-06	1.10E-05	7.47E-01	7.77E-02
Ag109m	9.32E-05	NR	1.57E+01	NR
Ag110	4.19E-14	2.46E-13	7.07E-09	1.74E-09
Ag110m	3.15E-12	1.85E-11	5.31E-07	1.31E-07
Am241	2.62E+00	8.42E-01	4.42E+05	5.96E+03
Am242	1.04E-05	NR	1.75E+00	NR
Am242m	1.04E-05	NR	1.75E+00	NR
Am243	1.93E-04	3.23E-08	3.26E+01	2.28E-04
Am245	7.89E-15	4.06E-20	1.33E-09	2.87E-16
At217	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Ba137m	4.53E-02	2.89E+01	7.63E+03	2.04E+05
Bi210	1.52E-05	1.01E-09	2.55E+00	7.16E-06
Bi211	3.61E-06	1.07E-07	6.09E-01	7.58E-04
Bi212	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Bi213	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Bi214	6.91E-05	5.05E-09	1.16E+01	3.58E-05
Bk249	5.44E-10	2.80E-15	9.16E-05	1.98E-11
Bk250	2.59E-16	NR	4.37E-11	NR

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.
[3]The values for Cf252 and Cm248 are different from the values reported in Attachment A in Appendix B-1 because these incorporate the corrections received from SNL/NM for these isotopes (see Appendix D) after Appendix B-1 was finalized.

*This table is an update of Table 3-4, of TWBIR Revision 2, pages 3-30 through 3-36 (DOE, 1995c)

Table 3-1. WIPP DISPOSAL RADIONUCLIDE INVENTORY FOR THE CCA (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
C14	6.43E-05	2.90E-04	1.08E+01	2.05E+00
Cd109	9.31E-05	NR	1.57E+01	NR
Cd113m	1.08E-11	7.71E-11	1.82E-06	5.46E-07
Ce144	3.71E-07	7.24E-04	6.26E-02	5.13E+00
Cf249	3.81E-07	6.31E-07	6.42E-02	4.47E-03
Cf250	1.96E-06	NR	3.30E-01	NR
Cf251	2.24E-08	NR	3.78E-03	NR
Cf252[3]	1.44E-05	1.82E-04	2.43E+00	1.29E+00
Cm242	6.76E-06	NR	1.14E+00	NR
Cm243	1.61E-05	6.99E-03	2.72E+00	4.95E+01
Cm244	1.87E-01	4.45E-02	3.15E+04	3.15E+02
Cm245	6.81E-08	2.07E-10	1.15E-02	1.46E-06
Cm246	6.06E-07	NR	1.02E-01	NR
Cm247	1.91E-14	NR	3.21E-09	NR
Cm248[3]	2.19E-07	2.89E-08	3.69E-02	2.05E-04
Co58	1.81E-18	1.75E-15	3.05E-13	1.24E-11
Co60	3.83E-04	1.47E+00	6.46E+01	1.04E+04
Cr51	NR	4.29E-10	NR	3.04E-06
Cs134	7.97E-08	2.60E-03	1.34E-02	1.84E+01
Cs135	2.98E-09	1.66E-08	5.02E-04	1.17E-04

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.
[3]The values for Cf252 and Cm248 are different from the values reported in Attachment A in Appendix B-1 because these incorporate the corrections received from SNL/NM for these isotopes (see Appendix D) after Appendix B-1 was finalized.

* This table is an update of Table 3-4, of TWBIR Revision 2, pages 3-30 through 3-36 (DOE, 1995c)

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Table 3-1. WIPP DISPOSAL RADIONUCLIDE INVENTORY FOR THE CCA (continued)

Nuclide	CH-TRU Waste (Ci/m³)	RH-TRU Waste (Ci/m³)	CH-TRU Waste (Total Curies²)	RH-TRU Waste (Total Curies²)
Cs137	4.78E-02	3.05E+01	8.06E+03	2.16E+05
Es254	2.51E-16	NR	4.24E-11	NR
Eu150	2.08E-10	NR	3.51E-05	NR
Eu152	7.46E-06	1.73E-01	1.26E+00	1.22E+03
Eu154	6.80E-06	8.34E-02	1.15E+00	5.91E+02
Eu155	5.62E-06	1.67E-02	9.46E-01	1.18E+02
Fe55	1.13E-10	2.38E-05	1.91E-05	1.69E-01
Fe59	1.57E-12	NR	2.64E-07	NR
Fr221	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Fr223	4.98E-08	1.48E-09	8.39E-03	1.04E-05
H3	5.16E-06	9.33E-06	8.69E-01	6.60E-02
I129	4.18E-12	NR	7.05E-07	NR
Kr85	1.20E-06	2.37E-04	2.02E-01	1.68E+00
Mn54	5.05E-09	3.32E-06	8.51E-04	2.35E-02
Nb95	1.51E-14	9.45E-05	2.54E-09	6.69E-01
Nb95m	5.04E-17	3.17E-07	8.50E-12	2.24E-03
Ni59	4.47E-08	NR	7.52E-03	NR
Ni63	5.46E-06	1.40E-04	9.19E-01	9.88E-01
Np237	3.33E-04	4.02E-04	5.61E+01	2.85E+00
Np238	5.20E-08	NR	8.77E-03	NR

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.
[3]The values for Cf252 and Cm248 are different from the values reported in Attachment A in Appendix B-1 because these incorporate the corrections received from SNL/NM for these isotopes (see Appendix D) after Appendix B-1 was finalized.

*This table is an update of Table 3-4, of TWBIR Revision 2, pages 3-30 through 3-36 (DOE, 1995c)

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Table 3-1. WIPP DISPOSAL RADIONUCLIDE INVENTORY FOR THE CCA (continued)

Nuclide	CH-TRU Waste (Ci/m³)	RH-TRU Waste (Ci/m³)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Np239	1.93E-04	3.23E-08	3.26E+01	2.28E-04
Np240m	8.91E-12	3.12E-15	1.50E-06	2.21E-11
Pa231	2.67E-06	2.70E-07	4.51E-01	1.91E-03
Pa233	3.33E-04	4.02E-04	5.61E+01	2.85E+00
Pa234	3.05E-07	1.92E-06	5.14E-02	1.36E-02
Pa234m	2.35E-04	1.48E-03	3.96E+01	1.05E+01
Pb209	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Pb210	1.52E-05	1.01E-09	2.55E+00	7.16E-06
Pb211	3.61E-06	1.07E-07	6.09E-01	7.58E-04
Pb212	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Pb214	6.91E-05	5.05E-09	1.16E+01	3.58E-05
Pd107	4.40E-10	2.45E-09	7.41E-05	1.73E-05
Pm147	4.67E-05	1.52E-03	7.87E+00	1.07E+01
Po210	1.52E-05	1.01E-09	2.55E+00	7.16E-06
Po211	1.01E-08	3.00E-10	1.71E-03	2.12E-06
Po212	1.03E-04	6.66E-06	1.73E+01	4.72E-02
Po213	1.67E-05	1.62E-05	2.82E+00	1.15E-01
Po214	6.91E-05	5.05E-09	1.16E+01	3.57E-05
Po215	3.61E-06	1.07E-07	6.09E-01	7.58E-04
Po216	1.61E-04	1.04E-05	2.71E+01	7.36E-02

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.
[3]The values for Cf252 and Cm248 are different from the values reported in Attachment A in Appendix B-1 because these incorporate the corrections received from SNL/NM for these isotopes (see Appendix D) after Appendix B-1 was finalized.

* This table is an update of Table 3-4, of TWBIR Revision 2, pages 3-30 through 3-36 (DOE, 1995c)

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Table 3-1. WIPP DISPOSAL RADIONUCLIDE INVENTORY FOR THE CCA (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies^2)	RH-TRU Waste (Total Curies^2)
Po218	6.91E-05	5.05E-09	1.16E+01	3.58E-05
Pr144	3.67E-07	7.16E-04	6.18E-02	5.07E+00
Pu236	6.16E-08	NR	1.04E-02	NR
Pu238	1.55E+01	2.05E-01	2.61E+06	1.45E+03
Pu239	4.66E+00	1.45E+00	7.85E+05	1.03E+04
Pu240	1.25E+00	7.15E-01	2.10E+05	5.07E+03
Pu241	1.37E+01	2.00E+01	2.31E+06	1.42E+05
Pu242	6.96E-03	2.11E-05	1.17E+03	1.50E-01
Pu243	1.91E-14	NR	3.21E-09	NR
Pu244	8.92E-12	3.12E-15	1.50E-06	2.21E-11
Ra223	3.61E-06	1.07E-07	6.09E-01	7.58E-04
Ra224	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Ra225	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Ra226	6.91E-05	5.05E-09	1.16E+01	3.58E-05
Ra228	4.43E-06	1.10E-05	7.47E-01	7.77E-02
Rh106	1.72E-07	1.54E-03	2.90E-02	1.09E+01
Rn219	3.61E-06	1.07E-07	6.09E-01	7.58E-04
Rn220	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Rn222	6.91E-05	5.05E-09	1.16E+01	3.58E-05
Ru106	1.72E-07	1.54E-03	2.90E-02	1.09E+01

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.
[3]The values for Cf252 and Cm248 are different from the values reported in Attachment A in Appendix B-1 because these incorporate the corrections received from SNL/NM for these isotopes (see Appendix D) after Appendix B-1 was finalized.

*This table is an update of Table 3-4, of TWBIR Revision 2, pages 3-30 through 3-36 (DOE, 1995c)

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Table 3-1. WIPP DISPOSAL RADIONUCLIDE INVENTORY FOR THE CCA (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Sb125	7.17E-07	2.67E-04	1.21E-01	1.89E+00
Sb126	8.02E-10	4.46E-09	1.35E-04	3.16E-05
Sb126m	5.73E-09	3.18E-08	9.65E-04	2.25E-04
Se79	2.58E-09	1.44E-08	4.35E-04	1.02E-04
Sm151	8.72E-06	5.05E-05	1.47E+00	3.57E-01
Sn119m	2.46E-11	1.35E-10	4.14E-06	9.59E-07
Sn121m	1.58E-07	9.45E-07	2.66E-02	6.69E-03
Sn126	5.73E-09	3.18E-08	9.65E-04	2.25E-04
Sr90	4.07E-02	2.95E+01	6.85E+03	2.09E+05
Ta182	NR	5.95E-12	NR	4.21E-08
Tc99	1.49E-04	8.26E-07	2.52E+01	5.85E-03
Te125m	1.75E-07	6.57E-05	2.95E-02	4.65E-01
Te127	7.72E-13	2.41E-13	1.30E-07	1.71E-09
Te127m	7.88E-13	2.47E-13	1.33E-07	1.75E-09
Th227	3.56E-06	1.06E-07	6.01E-01	7.47E-04
Th228	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Th229	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Th230	4.78E-07	1.07E-06	8.06E-02	7.56E-03
Th231	7.59E-05	6.53E-04	1.28E+01	4.63E+00
Th232	5.42E-06	1.31E-05	9.13E-01	9.25E-02

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.
[3]The values for Cf252 and Cm248 are different from the values reported in Attachment A in Appendix B-1 because these incorporate the corrections received from SNL/NM for these isotopes (see Appendix D) after Appendix B-1 was finalized.

*This table is an update of Table 3-4, of TWBIR Revision 2, pages 3-30 through 3-36 (DOE, 1995c)

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Table 3-1. WIPP DISPOSAL RADIONUCLIDE INVENTORY FOR THE CCA (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Th234	2.35E-04	1.48E-03	3.96E+01	1.05E+01
Tl207	3.61E-06	1.07E-07	6.07E-01	7.56E-04
Tl208	5.77E-05	3.74E-06	9.73E+00	2.65E-02
Tl209	3.69E-07	3.58E-07	6.22E-02	2.53E-03
U232	1.53E-04	NR	2.58E+01	NR
U233	1.06E-02	2.23E-02	1.79E+03	1.58E+02
U234	2.76E-03	6.03E-03	4.65E+02	4.27E+01
U235	7.59E-05	6.53E-04	1.28E+01	4.63E+00
U236	1.98E-06	1.37E-05	3.33E-01	9.68E-02
U237	3.36E-04	4.91E-04	5.66E+01	3.48E+00
U238	2.35E-04	1.48E-03	3.96E+01	1.05E+01
U240	8.91E-12	3.12E-15	1.50E-06	2.21E-11
Y90	4.07E-02	2.95E+01	6.85E+03	2.09E+05
Zr93	3.34E-08	1.86E-07	5.63E-03	1.32E-03
Zr95	6.80E-15	4.27E-05	1.15E-09	3.02E-01
TOTALS	**3.81E+01**	**1.43E+02**	**6.42E+06**	**1.02E+06**

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.
[3]The values for Cf252 and Cm248 are different from the values reported in Attachment A in Appendix B-1 because these incorporate the corrections received from SNL/NM for these isotopes (see Appendix D) after Appendix B-1 was finalized.

*This table is an update of Table 3-4, of TWBIR Revision 2, pages 3-30 through 3-36 (DOE, 1995c)

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238 for the CH-TRU waste in the repository. This is primarily due to the exclusion of the SRS off-site waste from any future extrapolations. Since this off-site waste has a high concentration of Pu-238, excluding it from the extrapolations decreases the amount of Pu-238 in the projected portion of the inventory. It should be noted that this off-site waste is included in the stored waste portion of the disposal radionuclide inventory. The decrease in the Pu-238 also causes a decrease in the total estimated curies for CH-TRU waste in the repository.

Based on the data corrections from Hanford Site to the Cm-244 and Cm-245 inventories, the estimated concentration of Cm-244 has increased, while that of Cm-245 has decreased. Similarly, based on the correction to the reported value of Cf-252 from the Hanford Site, the revised concentration of Cf-252 has decreased significantly from the values estimated in Revision 2 of the TWBIR. The effect of decaying the activity from the RFETS residues has resulted in a minor decrease in the estimated concentration of Pu-241. Since Pu-241 decays to Am-241, the decrease in the Pu-241 concentration is also accompanied by a corresponding increase in the concentration of Am-241.

The major change for the RH-TRU waste from TWBIR Revision 2 is the decrease in the estimated concentration of U-235 and an increase in the concentration of U-238. Both are a result of the preliminary sludge sampling data from ORNL mentioned earlier.

3.2.2 Activity Calculations for Waste Streams

As documented in the SNL/NM memoranda in Appendices A-2 and A-3, data on radionuclide activity on a waste stream basis was requested for 21 radionuclides. However, the request was subsequently limited to seven radionuclides by SNL/NM WIPP PA staff (Am-241, Cm-244, Pu-238, Pu-239, Pu-240, Pu-241, and U-234). Appendix B-2 presents the results provided to SNL/NM by DOE/CAO in response to this data request.

Since many sites did not have the ability to provide radionuclide data on a detailed waste stream basis for every waste stream in TWBIR Revision 2, the radionuclide activities for many individual waste streams (especially for projected waste) were not reported by the sites for TWBIR Revision 2. Therefore, the radionuclide activity data for the WIPP disposal inventory cannot be directly obtained on a waste stream basis by running queries on the TWBIR Revision 2 database. Due to the unavailability of detailed radionuclide data on a waste stream basis for many waste streams, the WIPP disposal radionuclide inventory presented in all revisions of the TWBIR has always been developed on the basis of the site-level radionuclide inventories reported by the sites in the IDB.

For the sake of consistency with the revised WIPP disposal radionuclide inventory in Attachment A of Appendix B-1 (which is also based on the site-level IDB data), assumptions were required in order to estimate the waste stream radionuclide activities presented in Appendix B-2. These assumptions can be found in Appendix B-2 and are not reproduced here. Thus, it should be noted that the data in Appendix B-2 are *derived* on the basis of assumptions and not directly obtainable from the TWBIR Revision 2 database. Because of the unavailability of the radionuclide data on a waste stream basis, some of the waste streams from small sites are not included in the activity table in Appendix B-2. Efforts are currently underway to ensure that the sites will be able to provide radionuclide data on a waste stream basis for most waste streams in future updates of the TWBIR so that radionuclide activity data for the WIPP disposal inventory can be directly obtained from the TWBIR database.

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3.3 SUPPLEMENTAL INFORMATION FOR OTHER CONSTITUENTS

SNL/NM and DOE/CAO requested supplemental information on several constituents in TRU waste (see Appendix A-1) that were not able to be estimated based on the information reported by the TRU waste sites in Revision 2 of the TWBIR (DOE, 1995c). The information requested can be divided into three general categories which were requested on solidified waste forms destined for disposal in WIPP:

- Complexing Agents
- Nitrate, Sulfate, and Phosphate
- Cement

The TWBIR team worked with those major sites that generate/store most of the solidified waste forms: Los Alamos National Laboratory (LANL), RFETS/INEL, and ORNL. A summary of the results of these supplemental information requests is provided in Section 3.3.1, 3.3.2 and 3.3.3 and the memoranda reporting the data are located in Appendices B-3 through B-7. The detailed methodology for calculating the estimates of these physical/chemical constituents are provided in each memorandum in these Appendices.

3.3.1 Estimate of Complexing Agents in Transuranic Solidified Waste Forms Scheduled for Disposal in WIPP

The information on complexing agents in the waste was provided in a series of three memoranda to DOE/CAO. The initial memorandum, entitled "Preliminary Estimate of Complexing Agents in TRU Waste Forms Scheduled for Disposal in WIPP," provided in Appendix B-3, represents the earliest estimate of complexing agents in the TRU Waste. The Appendix B-3 memorandum was superseded by the second estimate, entitled "Current Estimate of Complexing Agents in Transuranic Solidified Waste Forms Scheduled for Disposal in WIPP," provided in Appendix B-4. After the Appendix B-4 memorandum was issued, preliminary information from the January 1996 data submittal from INEL was received. The data submittal indicated that over 90% of the stored waste at INEL would be vitrified, a process that should destroy complexing agents in TRU waste. Based on the preliminary data from INEL, the estimated amount of complexing agents due to RFETS waste stored at INEL could be reduced from that reported in Appendix B-4. A synopsis of the INEL information is reported in the third memorandum that estimates complexing agents in the waste, entitled "Revision of Current Estimate of Complexing Agents in Transuranic Solidified Waste Forms Scheduled for Disposal in WIPP," provided in Appendix B-5.

Table 3-2 provides a summary of the anticipated mass (in kilograms) of complexing agents in TRU waste reported by RFETS/INEL, LANL, and Hanford. The estimates in Table 3-2 include the anticipated reduction in mass of complexing agents reported from RFETS/INEL based on the preliminary data for proposed vitrification of waste at INEL (Appendix B-5). In addition to the mass of complexing agents reported in Table 3-2, ORNL has provided an estimate of total organic carbon (TOC) in their RH-TRU sludges (Table 3-3). ORNL does not have any analytical data to quantitatively estimate which organic chemicals are responsible for the TOC content of the sludges. However, ORNL has provided a list of chemicals, summarized in Table 3-3, that could contribute to the TOC value reported (see Table 1 in Appendix B-4). It is estimated that most of the TOC in the tanks is not associated with complexing agents, but that has not been verified at this time. As a conservatism, PA calculations can assume that any complexing agents listed in Table 3-3 could form the bulk of the TOC in the ORNL RH-TRU tanks.

Table 3-2. Estimates of Complexing Agents in Transuranic Waste from RFETS, INEL, LANL, and Hanford*

Compound	Low Estimate (kg)	Recommended Estimate (kg)	High Estimate (kg)
Ascorbic Acid	18	30	34
Acetic Acid	27	44	50
Sodium Acetate	141	282	333
Citric Acid	1110	1120	1130
Sodium Citrate	51	102	120
Oxalic Acid	13700	13700	13700
EDTA	3	6	7
8-Hydroxyquinoline	6	12	14
Tributyl Phosphate	102	111	115
1,10 Phenanthroline	0.03	0.06	0.07
Dihexyl-n,n-diethyl carbamoylmethyl phosphonate	9	18	22

* Refer to Appendices B-4 and B-5 for methodology of calculated estimates.

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Table 3-3. Estimate of Total Organic Carbon (TOC) in ORNL Transuranic Sludge Tanks and Possible Complexing Agents that can Contribute to TOC.

Total Organic Carbon in ORNL Transuranic Sludge = 3691 kg

Possible Complexing Agents and Other Organic Compounds* in ORNL RH-TRU Sludges:

Acetic Acid
Acetone
Adogen-364-HP (~triluarylamine)
Carbon tetrachloride
Deodorized mineral spirits (Amsco)
2,5-di-tert-butylhydroquinone (DBHQ)
Diethylbenzene (DEB)
Diethylenetriaminepentaacetic acid (DPTA)
Di (2-ethylhexyl) phosphoric acid (HDEHP)
Di-isopropylbenzene (DIPB)
Ethanol
Ether
Ethylenediaminetetraacetic acid (EDTA)
2-ethyl-1-hexanol
α-hydroxyisobutyric acid
Isopropanol
Methanol
n-dodecane
n-paraffin (NPH)
Oxalic Acid
Thenoyltrifluoroacetone (TTA)
Tributylphosphate (TBP)
Trichloroethylene (TCE)
Xylene

*Adapted from Table 1 in Appendix B-4.

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3.3.2 Estimate of Nitrate, Sulfate, and Phosphate Content in Transuranic Solidified Wastes for Disposal in WIPP

Estimates of nitrate and sulfate in solidified TRU final waste forms were provided in the memorandum entitled "Preliminary Estimate for SNL/NM Performance Assessment Calculations of Nitrate, Sulfate, and Phosphate in Transuranic Solidified Wastes Destined for Disposal in WIPP," provided in Appendix B-6. In that memorandum, it is estimated that densities for the overall disposal inventory are as follows: 9.2 kilograms/cubic meter for nitrate and 3.6 kilograms/cubic meter for sulfate. No estimate of phosphate was reported due to lack of sufficient information.

3.3.3 Estimate of Cement in TRU Solidified Waste Forms for Disposal in WIPP

An estimate of cement (portland-based) in solidified TRU final waste forms was calculated in the memorandum entitled "Estimate of Cement Content in TRU Solidified Waste Forms Scheduled for Disposal in WIPP," provided in Appendix B-7. The estimated density of cement over the entire disposal inventory is 48.6 kilogram/cubic meter. This estimate includes both CH-TRU and RH-TRU final waste forms. The portland cement reported is both reacted and unreacted cement in the waste. There are no data available to estimate the percentage of reacted versus unreacted cement in the waste.

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4. REFERENCES

Croff, A. G., 1983, "ORIGEN2: A Versatile Computer Code for Calculating the Nuclide Compositions and Characteristics of Nuclear Materials," *Nuclear Technology*, Vol. 62, pp. 335-352, November 1983.

Croff, A. G., 1980, *A User's Manual for the ORIGEN2 Code*, ORNL/TM-7175, Oak Ridge National Laboratory, July 1980.

DOE – See U.S. Department of Energy.

EPA – See U.S. Environmental Protection Agency.

SNL/NM – See Sandia National Laboratory/NM.

Public Law, 1992a, Public Law 102-386, 1992, *Federal Facilities Compliance Act of 1992*.

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Public Law, 1979, Public Law 96-164, 1979, *National Security Programs*, 93 Stat. 1259, 1265.

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U.S. Department of Energy, 1990, *Final Supplement Environmental Impact Statement*, Volume 3, DOE/EIS-0026-FS, January 1990.

U.S. Department of Energy, 1988, *Radioactive Waste Management*, DOE Order 5820.2A, U.S. Department of Energy, Washington, D.C., September 26, 1988.

U.S. Department of Energy and State of New Mexico, 1981, "Agreement for Consultation and Cooperation Between the Department of Energy and the State of New Mexico on the Waste Isolation Pilot Plant," July 1, 1981 (dated April 18, 1988).

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U.S. Environmental Protection Agency, 1996, *Criteria for the Certification and Recertification of the Waste isolation Pilot Plant's Compliance With the 40 CFR Part 191 Disposal Regulations*, Final Rule, 40 CFR 194, Federal Register, February 9, 1996.

U.S. Environmental Protection Agency, 1993, *Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes*, 40 CFR 191, Final Rule, Federal Register, Vol. 58, Page 66398, December 20, 1993.

U.S. Environmental Protection Agency, 1980, *Listing of Hazardous Waste*, 40 Code of Federal Regulations, Part 261, May 19, 1980.

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5. GLOSSARY

40 CFR Part 191, Protection of Environment. EPA: Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes – The EPA's environmental standards for the storage (Subpart A) and disposal (Subpart B) of spent nuclear fuel, and high-level and TRU radioactive wastes. This is the primary post-closure standard that applies to WIPP.

Anticipated Inventory – The sum of the stored and projected inventories, as defined in this document.

As-Generated Waste – The chemical and physical status of waste when it is generated.

Buried Waste – TRU waste buried in shallow trenches prior to the 1970 Atomic Energy Commission policy that required TRU waste to be retrievably stored.

Code of Federal Regulations (CFR) – (1) A codification of the general and permanent rules published in the **Federal Register** by the department and agencies of the federal government. The CFR is divided into 50 titles that represent broad areas subject to federal regulation. It is issued quarterly and revised annually. (2) All federal regulations in force are published annually in codified form in the CFR.

Contact-Handled (CH) TRU Waste – Packaged TRU wastes with an external surface dose rate of less than 200 mrem per hour.

Defense Waste – (1) Radioactive waste from any activity performed in whole or in part in support of DOE atomic energy defense activities; excludes waste under purview of the Nuclear Regulatory Commission or generated by the commercial nuclear power industry. (2) Nuclear waste derived mostly from the manufacture of nuclear weapons, weapons-related research programs, the operation of naval reactors, and the decontamination of nuclear weapons production facilities.

Department of Energy Site – A DOE-owned or -controlled tract used for DOE operations. Either a tract owned by DOE or a tract leased or otherwise made available to the federal government under terms that afford to DOE rights of access and control substantially equal to those that DOE would possess if it were the holder of the fee (or pertinent interest therein) as agent of and on behalf of the government. One or more DOE operations/program activities are carried out within the boundaries of the described tract.

Disposal – Emplacement of waste in a manner that assures isolation from the biosphere for the foreseeable future with no intent of retrieval and that requires deliberate action to regain access to the waste. For example, disposal of wastes in a mined geologic repository occurs when all of the shafts to the repository area are backfilled and sealed.

Disposal Inventory – The inventory volume defined for WIPP emplacement to be used for PA calculations is the "disposal inventory." The LWA defines the total amount of TRU waste allowed in the WIPP as 6,200,000 cubic feet (approximately 176,000 cubic meters) (Public Law, 1992b). The "Agreement for Consultation and Cooperation" (C&C Agreement) limits the RH-TRU inventory to 250,000 cubic feet (approximately 7,080 cubic meters) (DOE and State of New

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Mexico, 1981). Therefore by difference, the CH-TRU inventory is limited to 5,950,000 cubic feet (approximately 168,500 cubic meters).

Final Waste Form – Consists of a series of WMCs that for PA purposes have similar physical and chemical properties.

Integrated Data Base (IDB) – The latest version of the IDB, the *Integrated Data Base for [1995]: U.S. Spent Fuel and Radioactive Waste Inventories, Projections, and Characteristics* (DOE, 1995b).

Land Withdrawal Act - The 1992 legislation passed by the U.S. Congress withdrawing the surface land and underlying minerals at the WIPP site from public use, transferring the property from the DOI to the DOE, and enabling the start of the WIPP Test Phase. The LWA sets prerequisites to be met before the start of the Test Phase, such as the repromulgation by EPA of 40 CFR 191 and the concurrence of EPA with the Test Phase Plan (Public Law, 1992b).

Mixed TRU Waste – TRU waste that contains both radioactive and hazardous components as defined by the Atomic Energy Act and the RCRA as codified in 40 CFR Parts 261.3 (EPA, 1980).

Newly Generated Wastes – See Projected Inventory.

Performance Assessment (PA) – (1) A systematic analysis of the potential risks posed by waste management systems to the public and environment and a comparison of those risks to established performance objectives. (2) An analysis that (a) identifies the processes and events that might affect the disposal system, (b) examines the effects of these processes and events on the performance of the disposal system, and (c) estimates the cumulative releases of radionuclides, considering the associated uncertainties, caused by all significant processes and events. These estimates shall be incorporated into an overall probability distribution of cumulative release to the extent practicable. (3) A term used to denote all activities (qualitative and quantitative) carried out to (a) determine the long-term ability of a site/facility to effectively isolate the waste and ensure the long-term health and safety of the public and (b) provide the basis for demonstrating regulatory compliance.

Projected Inventory – That part of the inventory that has not been generated but is estimated to be generated at some time in the future by the TRU waste generator/storage sites. The estimated timeframe may vary, but is usually between 20 and 30 years. "Newly generated waste" also is sometimes used as a synonym for the projected inventory.

Radioactive – Term used to refer to an unstable atomic nucleus that decays with the spontaneous emission of ionizing radiation (also see "radionuclide").

Radionuclide – (1) A species of atom having an unstable nucleus, that is subject to spontaneous decay or disintegration and usually accompanied by the emission of ionizing radiation. (2) Any nuclide that emits radiation. A nuclide is a species of atom characterized by the constitution of its nucleus and hence by the number of protons, the number of neutron, and the energy content.

Remote-Handled (RH) TRU Waste – Packaged TRU wastes with an external surface dose rate equal to or exceeding 200 mrem per hour.

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Resource Conservation and Recovery Act (RCRA) – (1) Establishes a system for controlling hazardous waste from generation to disposal. (2) A Federal law passed in 1976, and amended under the HSWA of 1984, that established a structure to track and regulate hazardous wastes from the time of generation to disposal. The law requires safe and secure procedures to be used in treating, handling, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent new uncontrolled hazardous waste sites. The law also regulates the disposal of solid waste that may not be considered hazardous. (3) Specifically, Subtitle D of RCRA governs the management of solid waste. (Note: 40 CFR Parts 260-272 are the regulations for complying with RCRA with respect to hazardous waste and hazardous waste treatment, storage, and disposal facilities.)

Scaling – The process for adjusting the anticipated inventory to equal the maximum authorized disposal inventory of the WIPP repository for the purposes of WIPP performance assessment modeling.

Stored Inventory – That part of the TRU waste inventory currently in retrievable storage as of the time of the last data call for inventory information. Retrievably stored waste includes waste stored in buildings or in berms with earthen cover since 1970 and does not include any waste that was buried prior to 1970. Stored inventory can be in the "as-generated" form or "final waste form."

Transuranic – Pertaining to elements that have atomic numbers greater than 92, including neptunium, plutonium, americium, and curium; all are radioactive, are not naturally occurring, and are members of the actinide group.

Transuranic (TRU) Waste – (1) Waste containing alpha-emitting radionuclides with an atomic number greater than 92 and half-lives greater than 20 years, at concentrations of TRU isotopes greater than 100 nanocuries per gram of waste. **This core definition appears in modified form in various relevant documents as follows**: (a) For purposes of management, DOE Order 5820.2A: (i) considers TRU waste, as defined above, "without regard to source or form" *(The proposed revision to the Order [DOE Order 5820.2A Major Issues for Revision, May 6, 1992]* contemplates removing this clause); (ii) allows head of field elements to determine that wastes containing other alpha-emitting radionuclides must be managed as TRU waste; and (iii) adds "at time of assay," implying both that the classification of a waste as TRU waste is to be made based on an assay, and that such classification can be superseded only by another assay. (b) For purposes of setting standards for management and disposal, 40 CFR 191.02(i) adds "except for: (i) high-level wastes; (ii) wastes that the DOE has determined, with the concurrence of the EPA Administrator, do not need the degree of isolation required by this part; or (iii) wastes that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with 10 CFR 61." (2) Waste materials contaminated with U-233 (and its daughter products), with certain isotopes of plutonium, or with other nuclides with atomic numbers greater than 92. In order to be classified as TRU waste, the long-lived alpha activity from subject isotopes must exceed 100 nanocuries per gram of waste material independent of the level of beta-gamma activity. These wastes are produced primarily from reprocessing spent fuel and from the use of plutonium in the fabrication of nuclear weapons. (3) Wastes that are contaminated with radioactive elements heavier than uranium, thus the name trans-(or beyond) uranic.

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Waste Acceptance Criteria (WAC) – The criteria used to determine if waste packages are acceptable. For the purposes of this document, WAC refers to WIPP WAC.

Waste Form – The physical form of the waste such as sludges, combustibles, metals, etc.

TRU **Waste Sites** – The 8 major DOE facilities and several smaller sites throughout the U.S. that generate and store TRU waste.

Waste Isolation Pilot Plant (WIPP) – (1) The project authorized under Section 213 of the DOE National Security and Military Applications of Nuclear Energy Authorization Act of 1980 (Public Law, 1979) to demonstrate the safe and environmentally sound disposal of radioactive waste materials generated by atomic energy defense activities. (2) A research and development facility located near Carlsbad, New Mexico to be used to demonstrate a practical, long-term solution to a complex problem: the safe disposal in deep geologic repositories of TRU waste resulting from DOE activities.

Waste Material Parameter -- A waste material that occurs in TRU waste that is an input parameter into one (or more) current PA model(s) or is required to adequately describe the waste form.

Waste Matrix Code (WMC) – A DOE-developed coding system for grouping waste streams that have similar matrix constituents, especially for treatment objectives. This coding system allows waste streams within the DOE TRU waste system that have similar physical and chemical waste form properties to be categorized together. WMCs also have been called "waste treatability codes" in other DOE documents. An example of a WMC for "heterogeneous waste" is 5400 (DOE, 1995a).

Waste Stream – A flow of waste materials with specific definable characteristics that remain the same throughout the life of the process generating the waste stream.

Waste Stream Profile – A description of a CH-TRU or RH-TRU waste stream destined for shipment to and disposal in WIPP, if authorized under permits and certifications by appropriate regulatory agencies for disposal in the WIPP repository. The waste stream profile is presented in tabular format and is intended to provide a summary of the important information about a particular waste stream.

WIPP Waste Profile – Represents a summary of TRU waste at all DOE TRU waste generator/storage sites that have an identical Final Waste Form.

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APPENDIX A

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APPENDIX A - 1

Sandia National Laboratories

Managed and Operated by Sandia Corporation
a Lockheed Martin Company
Albuquerque, New Mexico 87185-1328

date : November 6, 1995

to : R. L. Bisping, DOE/CAO, WOIC 3, MS-560

from : L. C. Sanchez, Org 6342, MS-1328 (505)848-0685

subject : **CH and RH-TRU Waste Parameters Potentially Important in WIPP PA**

A) **Requested PA Data From TWBIR**

Below you will find an updated list of waste material parameters that have been identified as being potentially important to the performance analysis of the WIPP repository. It is requested that these parameters be be supplied in Rev. 2 of the Transuranic Waste Baseline Inventory Report (TWBIR). Itemized below you will find the two categories of requested waste parameter data.

1) **Non-radioactive Materials**
The non-radioactive materials are those which influence gas generation potential and those that are needed for mechanical models which predict waste consolidation and shear strength properties. The list of the non-radioactive materials is shown in Table 1.

2) **Radionuclide**
At this time there are no new requests for additional radionuclide inventory data beyond those previously reported in Rev. 1 of the WTWBIR. If there are significant inventory increases in radionuclides due to special circumstances (such as inclusion of residues to the TRU inventory), sufficient footnote explanations should be supplied.

Table 1. Justification of TWBIR Nonradioactive Waste Parameters.

Waste Parameter	Input Variable in Current PA Models		Input Variable in PA Models Under Development	Input Variable in Possible Future PA Models
	Gas Generation	Mechanical Characteristics		
Iron-Based Metals and Alloys	X	X	X	X
Aluminum-Based Metals and Alloys (a)		X	X	
Other Metals		X		?
Other Inorganics		X		?
Cellulosics	X	X	X	X
Plastics	½ (b)	X	X (d)	X
Rubbers	½ (b)	X	X (e)	X
Solidified Inorganics		X	X	X
Solidified Organics Matrix		X	X	X
Soils (c)		X	?	?

(a) Future model for PA does not include aluminum.
(b) Only one-half of material is assumed to generate gas.
(c) May impact colloids.
(d) As is.
(e) Percentage of material to generate gas is unknown at the present time.

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B) **Special Request Non-PA Items**

Also wanted at this time is additional information for several waste material characteristics. Although these characteristics have not been identified as waste material parameters to be used for WIPP PA, they are needed for non-PA scoping calculations to assess their influence on PA. Since these items are not currently PA parameters, inventory estimates of these characteristics as "additional information" in the TWBIR or supplied outside of the TWBIR via written correspondence. Below you will find an itemized list of these special request items.

1) **Non-radioactive Materials**
Additional information is needed on the five waste material characteristics (see Table 2): 1) vitrified wastes, 2) nitrates (NO_3^-), 3) sulfates (SO_4^{2-}), 4) phosphorus, and 5) cement. Of these waste parameters, the last four are needed for the gas generation modeling. The nitrates and the sulfates are involved in the denitrification and sulfate reduction processes which breakup the cellulosics, while the phosphorus is a nutrient for biodecay of cellulosics. The estimate of the mass quantities of cement in the waste inventory should include both the cement that is contained in the waste as cement itself (due to D&D activities, etc.,) and the cement found in various sludges. Cement consumes CO_2 due to its content of $Ca(OH)_2$. The estimates for this non-radioactive waste constituent need only be "best estimates" at this present time so that non-PA scoping calculations can be made to determine their importance on overall repository performance. (Do not generate upper-bound estimates that are overly conservative.)

2) **Residues**
"Best estimates" are needed for residues, in addition to those already identified at the Rocky Flats Plant (RFP), that have the possibility of being changed from a resource category to a TRU waste category.

3) **Organic Ligands (Chelating Agents)**
"Best estimates", from currently available information, are needed for major water-soluble organic ligands which are under consideration for the actinide source term (see Table 3). If it is not possible to obtain data from major waste generating sites then supply guidance on how a first-order estimate may be made (from existing information such as process knowledge etc.,) so that non-PA scoping calculations can be performed to identify if the presence of these ligands would have any significant impacts. (Do not generate estimates that are overly conservative.) Requested data is for final form "process-level" quantities used in production only for the key sites. If information on the "process-level" values does not exist at the key sites, then "laboratory-scale" values should be used in the requested assessment of the inventory. Should it be determined that more detailed information on organic ligands will be needed, you will be given a specific written request at a future time. This effort should be performed in parallel with the TWBIR. Technical data should be supplied in memorandum form by the end of February 1996 with supporting documentation by the end of March 1996.

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Table 2. Justification of Special Request Non-PA Non-Radioactive Waste Materials. (a)

Waste Parameter	Input Variable in Current PA Models		Input Variable in PA Models Under Development	Input Variable in Possible Future PA Models
	Gas Generation	Mechanical Characteristics		
Vitrified (b)		X	?	?
Nitrates (NO_3)	X (c)		X	?
Sulfates (SO_4)	X (c)		X	?
Phosphorus	X (c)		X	?
Cement (d)	X		X	?

(a) Information on these additional waste materials are needed for non-PA scoping calculations for assessment of their importance. These waste characteristics can be reported at the "best estimate" level.

(b) New waste parameter corresponding to treatment, identified by some of the sites, to be anticipated in the future.

(c) Input variable is of concern when predicting the rates of microbial action and is used in currently existing reaction path model, which will not become a baseline PA model.

(d) Any concrete or cement (including dry portland cement) that contains calcium oxide.

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Table 3. Justification of Special Request For Info On Organic Complexing Agents. (a)

Ligand (b)	Discussion (c)
1) Total Complexants	The most valuable information at this time is a "best estimate" of the total amount of water soluble complexing agents (ligands) in the TRU waste matrix.
2) Citrate	Preliminary information indicates that citrate (citric acid) may be the largest used ligand at TRU waste generating sites. Hence, inventory quantities are very important.
3) Lactate	This is an important ligand that is produced by bacteria as part of its own metabolism. What is requested here is a "best estimate" of the quantity of lactate that actually exists in the TRU waste matrix (not just an initial amount supplied as part of a waste stream). However, if this information cannot be developed, then supply information on the initial amount.
4) Oxalate	This is an important ligand that is produced by bacteria as part of its own metabolism. What is requested here is a "best estimate" of the quantity of oxalate that actually exists in the TRU waste matrix (not just an initial amount supplied as part of a waste stream). However, if this information cannot be developed, then supply information on the initial amount.
5) EDTA	This ligand (ethylenediaminetetraacetic acid) is also of major importance due to its common use as a cleaning solvent.

(a) Information on these additional waste materials are needed for non-PA scoping calculations for assessment of their importance. The presence of these complexing agents are important for the actinide source term, with respect to increasing the solubility of radionuclides.
(b) These items are ranked in the order of their importance in the actinide source term.
(c) Also supply any available information that TRU waste generation sites may have on the degradation or decay rates of ligands in current (and expected) waste matrixes if possible. In cases where no information is available, supply guidance on estimating first-order quantities.

LCS:6741:lcs/(95-2082)

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Copy to:
P.E. Drez [Drez Environmental Associates]
D. Bretzke [Science Applications International Corporation]
S. Chakraborti [Science Applications International Corporation]
MS-1320, C.F. Novak [Dept. 6119]
MS-1328, H. Jow [Dept. 6741]

MS-1328. M.S. Tierney [Dept. 6741]
MS-1328. D.R. Anderson [Dept. 6749]
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MS-1341. R.F. Weiner [Dept. 6747]
MS-1495. P.E. Sanchez [Dept. 6700]
MS-1328. Day File [Dept. 6741]
MS-1328. L.C. Sanchez [Dept. 6741]
File - SWCF-A WBS 1.1.6.2: PA: PBWAC - WIPP ACTIVITY

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APPENDIX A-2

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Sandia National Laboratories

Managed and Operated by Sandia Corporation
a Lockheed Martin Corporation
Albuquerque, New Mexico 87185-1328

date : January 11, 1996

to : S. Chakraborti [Science Applications International Corporation]

from : L. C. Sanchez, Org 6741, MS-1328, PH-(505)848-0685, Fax-848-0705

subject : **Information Needed from TWBIR (Rev. 2/Addendum)**

I have read Paul Drez's memo [Ref. DEA-1] about the Rev. 2 of the TWBIR [Ref. BIR-1]. When updated values are available, please send me a memo with the WIPP-scale values (CH & RH waste material parameters -- Tables 3-2 & 3-3 and CH & RH disposal radionuclide inventory data -- Table 3-4). [Note -- **because the anticipated volume of RH waste is much greater than the WIPP disposal volume, the proper volume that should be used to determine the average waste material parameters should be a "truncated volume", i.e., the truncated volume is equal to the existing stored waste plus only the necessary amount of projected waste necessary to reach the WIPP disposal volume limit.**] When regenerating Table 3-4, please add extra columns which also display the "total curies" (in addition to the data displaying the curie volumetric densities) for both CH & RH radionuclides. The volumes to be used for these conversions are: 1) ~~6.2E+06~~ cu.ft. = ~~175,584~~. cu.m. for CH-TRU waste and 2) 0.25E+06 cu.ft. = 7,080. cu.m. [the unit conversions for volume were done with the factor 1.0 cu.ft. = 2.832E-02 cu.m. taken from Ref. SNL-1].

5.95E+06 WS 1-12-96

167,504. WS 1-12-96

A second request, which should be documented in a separate memo, is that CH & RH activity loading tables be generated on a per-waste stream basis. The format for the data should look as close to that shown in Table 1 below. It is also needed that the information be made into an ASCII file and placed on a 3.5" diskette (IBM formatted). There are three versions of this table that are needed: 1) values corresponding to stored waste only, 2) values corresponding to projected waste only, and 3) values corresponding to WIPP disposal volume [Note -- remember to use the truncated volumes for the RH waste].

REFERENCES

[DEA-1]
Memo from: P. Drez (Drez Environmental Associates, DEA) to: L.C. Sanchez (Sandia National Laboratories), subject: "BIR Error", dated: January 7, 1996.

[BIR-1]
DOE (U.S. Department of Energy); Transuranic Waste Baseline Inventory Report; DOE/CAO-95-1121; Revision 2; printed December 1995.

[SNL-1]
Sandia WIPP Project. 1992. *Preliminary Performance Assessment for the Waste Isolation Pilot Plant, December 1992. Volume 3: Model Parameters (SAND92-0700/3)*, section: *Conversion Tables For SI and Common English Units*, Table 5, pg. Conversion Tables - 4. SAND92-0700/3. Albuquerque, NM: Sandia National Laboratories.

Table 1. Radionuclide Activity Loading Table
(to be used for human intrusion calculations)

TRU Type	Site ID	Waste Stream ID	Volume of Waste Stream	Curie Loading $\left[\frac{curies}{vol}\right]$	Curie Loading $[curies]$
CH	*LANL*	*LA-?001*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
CH	*LANL*	*LA-?002*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
CH	*LANL*	*LA-?003*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
CH	*LANL*	*LA-?004*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
CH	*LANL*	*LA-?005*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
CH	*LANL*	*LA-?006*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
CH	*LANL*	↓	↓	↓	↓
CH	*LANL*	--	**Σ XXXXX.X**	--	**Σ X.XXE+KK**
CH	*RFETS*	*RF-?001*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
CH	*RFETS*	↓	↓	↓	↓
CH	*RFETS*	--	**Σ XXXXX.X**	--	**Σ X.XXE+KK**
CH	↓	↓	↓	↓	↓
CH	**Total**	--	**Σ XXXXX.X**	--	**Σ X.XXE+KK**
RH	*LANL*	*LA-?001*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
RH	*LANL*	*LA-?002*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
RH	*LANL*	*LA-?003*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
RH	*LANL*	*LA-?004*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
RH	*LANL*	*LA-?005*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
RH	*LANL*	*LA-?006*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
RH	*LANL*	↓	↓	↓	↓
RH	*LANL*	--	**Σ XXXXX.X**	--	**Σ X.XXE+KK**
RH	*RFETS*	*RF-?001*	*XXXX.X*	*X.XXE-KK*	*X.XXE+KK*
RH	*RFETS*	↓	↓	↓	↓
RH	*RFETS*	--	**Σ XXXXX.X**	--	**Σ X.XXE+KK**
RH	↓	↓	↓	↓	↓
RH	**Total**	--	**Σ XXXXX.X**	--	**Σ X.XXE+KK**

LCS:6741:lcs/(96-2096)

Copy to:
MS-1328, H. Jow [Dept. 6741]
MS-1328, R.P. Anderson [Dept. 6749]
MS-1328, Day File [Dept. 6741]
MS-1328, L.C. Sanchez [Dept. 6741]
File - SWCF-A WBS 1.1.6.2:PA:PBWAC - WIPP ACTIVITY

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APPENDIX A-3

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Sandia National Laboratories

Managed and Operated by Sandia Corporation
a Lockheed Martin Corporation
Albuquerque, New Mexico 87185-1328

date : January 30, 1996

to : S. Chakraborti [Science Applications International Corporation]

from : L. C. Sanchez, Org 6741, MS-1328, PH-(505)848-0685, Fax-848-0705

subject : **Information Needed from TWBIR (Rev. 2/Addendum)**

With regards to the two requests previously made (Ref. LCS-1), the first is no longer needed and an update is needed for the second.

Since the data in the TWBIR (Ref. BIR-1) for projected waste material parameters and radionuclide inventory is based on data for stored waste (Ref. SC-1), the first request for data values to be volume averaged using truncated volume is not necessary (i.e., it would yield the same values).

For the second request from Ref. LCS-1, it has been identified that not all the radionuclide data in the TWBIR are incorporated in the radionuclide activity loading tables which are used for the human intrusion calculations (Refs. SNL-1 & JG-1). Instead, an abbreviated list of 21 radionuclides is all that should be used to generate the curie loading table (see Table 1 of Ref. LCS-1). The list of the 21 radionuclides (for both CH and RH) are shown in Table 1 below (this list is based on Table I of Appendix of Ref. EPA-1). Also, since the projected waste data is based on stored data, values generated are needed only for WIPP disposal volumes (data separated for stored and projected data would have yielded the same values).

REFERENCES

[BIR-1]
DOE (U.S. Department of Energy); Transuranic Waste Baseline Inventory Report; DOE/CAO-95-1121; Revision 2; printed December 1995.

[EPA-1]
"Environmental Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste: Final Rule," 40CFR191, *Federal Register*, **50**, 38066 (1985).

[JG-1]Communications with J. Garner [Piru Assoc., SNL/Dept 6749], date: January 30, 1996.

[LCS-1]
Memo from: L.C. Sanchez (Dept. 6741) to: S. Chakraborti (Science Applications International Corporation), subject: "Information Needed from TWBIR (Rev. 2/Addendum)", dated: January 11, 1996.

[SC-1]Communications with S. Chakraborti [Science Applications International Corporation], date: January 25, 1996.

[SNL-1]
Sandia WIPP Project. 1992. *Preliminary Performance Assessment for the Waste Isolation Pilot Plant, December 1992.* (SAND92-0700),

Table 1. Radionuclides That Should Be Used To Generate Curie Loading

	Radionuclide
1	Am-241
2	Cm-248
3	Cs-137
4	Np-237
5	Pa-231
6	Pb-210
7	Pu-238
8	Pu-239
9	Pu-240
10	Pu-242
11	Pu-244
12	Ra-226
13	Sr-90
14	Th-229
15	Th-230
16	Th-232
17	U-233
18	U-234
19	U-235
20	U-236
21	U-238

LCS:6741:lcs/(96-2098)

Copy to:
MS-1328, H. Jow [Dept. 6741]
MS-1328, R.P. Anderson [Dept. 6749]
MS-1328, Day File [Dept. 6741]
MS-1328, L.C. Sanchez [Dept. 6741]
File - SWCF-A WBS 1.1.6.2:PA:PBWAC - WIPP ACTIVITY

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APPENDIX B

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APPENDIX B - 1

United States Government **Department of Energy**

memorandum

Carlsbad Area Office
Carlsbad, New Mexico 88221

DATE: June 4, 1996

REPLY TO ATTN OF: CAO:NTP:RLB:96-1174

SUBJECT: Revised Radionuclide Data in Support of the Compliance Certification Application

TO: Les E. Shephard, Director, Nuclear Waste Management Programs Center, SNL/NM

Please find attached the revised WIPP disposal radionuclide inventory which was previously transmitted to your staff for their use. This inventory has been recalculated on the basis of new radionuclide information recently available from four TRU waste sites: the Hanford site (Hanford), the Oak Ridge National Laboratory (ORNL), the Rocky Flats Environmental Technology Site (RFETS), and the Savannah River Site (SRS). The revised WIPP disposal radionuclide inventory is provided in Attachment A in a format similar to Table.3-4 of Revision 2 of the Transuranic Waste Baseline Inventory Report (TWBIR).

The values in Attachment A were originally based on the extrapolation of the results of preliminary radionuclide decay calculations that were completed by Sandia National Laboratories (SNL) staff on April 8. These preliminary calculations have recently completed the formal quality assurance/quality control (QA/QC) review process by the SNL QA/QC group, and an approved version of these calculations was obtained on Tuesday, April 17. The QA/QC review process produced some changes in the preliminary values, and these changes have been incorporated in Attachment A.

Since the WIPP Performance Assessment (PA) group at SNL required the revised data as soon as possible in support of the Compliance Certification Application (CCA), Attachment A is being supplied as the most current update until the publication of Revision 3 and should be used by the WIPP PA in support of the CCA. As agreed with the SNL WIPP (PA) staff during the videoconference meeting on March 3, 1996, the revised data shown in Attachment A are based on the final waste form volumes published in Revision 2 of the TWBIR. The information in Attachment A will be included in the TWBIR, Rev. 3, as well as that previously supplied on complexing agents, cement content, and nitrate/sulfate/phosphate content, which will be included as an appendix to the TWBIR.

In summary, the revised data in Attachment A incorporates the effect of the following information received from four sites during the past two months:

- Corrections to the values for Cf-252, Cm-244, and Cm-245 reported in earlier Hanford submittals for the IDB.

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- Preliminary sludge sampling data from ORNL for the RH-TRU sludges showing the distribution of different uranium isotopes in the sludge: this enabled the redistribution of the uranium curies from previous Oak Ridge IDB submittals and corrected the previously high estimates of U-235.

- Break-up of radionuclide data for SRS waste between on-site and off-site waste (i.e., waste from Los Alamos and Mound that was shipped to SRS for storage in the early 1970s); this enabled more realistic extrapolation of the amount of Pu-238 and Pu-239 in SRS waste.

A description of the step-by-step methodology used to incorporate the new information from the four sites and to develop the revised inventory is provided in Attachment B.

If you have any questions concerning the enclosed information, please contact Mr. Russ Bisping of my staff at (505) 234-7446.

Don Watkins
Manager
National TRU Program

Attachments

cc w/attachments:
R. Bisping, CAO
G. Basabilvazo, CAO
J. Mewhinney, CAO
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P. Drez, CTAC
J. Harvill, CTAC
R. Anderson, SNL
L. Sanchez, SNL
M. Chu, SNL
M. Marietta, SNL

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ATTACHMENT A

WIPP Disposal Radionuclide Inventory for the CCA[1]

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Ac225	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Ac227	3.61E-06	1.07E-07	6.08E-01	7.57E-04
Ac228	4.43E-06	1.10E-05	7.47E-01	7.77E-02
Ag109m	9.32E-05	NR	1.57E+01	NR
Ag110	4.19E-14	2.46E-13	7.07E-09	1.74E-09
Ag110m	3.15E-12	1.85E-11	5.31E-07	1.31E-07
Am241	2.62E+00	8.42E-01	4.42E+05	5.96E+03
Am242	1.04E-05	NR	1.75E+00	NR
Am242m	1.04E-05	NR	1.75E+00	NR
Am243	1.93E-04	3.23E-08	3.26E+01	2.28E-04
Am245	7.89E-15	4.06E-20	1.33E-09	2.87E-16
At217	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Ba137m	4.53E-02	2.89E+01	7.63E+03	2.04E+05
Bi210	1.52E-05	1.01E-09	2.55E+00	7.16E-06
Bi211	3.61E-06	1.07E-07	6.09E-01	7.58E-04
Bi212	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Bi213	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Bi214	6.91E-05	5.05E-09	1.16E+01	3.58E-05
Bk249	5.44E-10	2.80E-15	9.16E-05	1.98E-11
Bk250	2.59E-16	NR	4.37E-11	NR
C14	6.43E-05	2.90E-04	1.08E+01	2.05E+00

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.

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ATTACHMENT A

WIPP Disposal Radionuclide Inventory for the CCA (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Cd109	9.31E-05	NR	1.57E+01	NR
Cd113m	1.08E-11	7.71E-11	1.82E-06	5.46E-07
Ce144	3.71E-07	7.24E-04	6.26E-02	5.13E+00
Cf249	3.81E-07	6.31E-07	6.42E-02	4.47E-03
Cf250	1.96E-06	NR	3.30E-01	NR
Cf251	2.24E-08	NR	3.78E-03	NR
Cf252	1.42E-03	1.82E-04	2.39E+02	1.29E+00
Cm242	6.76E-06	NR	1.14E+00	NR
Cm243	1.61E-05	6.99E-03	2.72E+00	4.95E+01
Cm244	1.87E-01	4.45E-02	3.15E+04	3.15E+02
Cm245	6.81E-08	2.07E-10	1.15E-02	1.46E-06
Cm246	6.06E-07	NR	1.02E-01	NR
Cm247	1.91E-14	NR	3.21E-09	NR
Cm248	5.31E-07	2.89E-08	8.95E-02	2.05E-04
Co58	1.81E-18	1.75E-15	3.05E-13	1.24E-11
Co60	3.83E-04	1.47E+00	6.46E+01	1.04E+04
Cr51	NR	4.29E-10	NR	3.04E-06
Cs134	7.97E-08	2.60E-03	1.34E-02	1.84E+01
Cs135	2.98E-09	1.66E-08	5.02E-04	1.17E-04
Cs137	4.78E-02	3.05E+01	8.06E+03	2.16E+05

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.

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ATTACHMENT A

WIPP Disposal Radionuclide Inventory for the CCA (continued)

Nuclide	CH-TRU Waste (Ci/m³)	RH-TRU Waste (Ci/m³)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Es254	2.51E-16	NR	4.24E-11	NR
Eu150	2.08E-10	NR	3.51E-05	NR
Eu152	7.46E-06	1.73E-01	1.26E+00	1.22E+03
Eu154	6.80E-06	8.34E-02	1.15E+00	5.91E+02
Eu155	5.62E-06	1.67E-02	9.46E-01	1.18E+02
Fe55	1.13E-10	2.38E-05	1.91E-05	1.69E-01
Fe59	1.57E-12	NR	2.64E-07	NR
Fr221	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Fr223	4.98E-08	1.48E-09	8.39E-03	1.04E-05
H3	5.16E-06	9.33E-06	8.69E-01	6.60E-02
I129	4.18E-12	NR	7.05E-07	NR
Kr85	1.20E-06	2.37E-04	2.02E-01	1.68E+00
Mn54	5.05E-09	3.32E-06	8.51E-04	2.35E-02
Nb95	1.51E-14	9.45E-05	2.54E-09	6.69E-01
Nb95m	5.04E-17	3.17E-07	8.50E-12	2.24E-03
Ni59	4.47E-08	NR	7.52E-03	NR
Ni63	5.46E-06	1.40E-04	9.19E-01	9.88E-01
Np237	3.33E-04	4.02E-04	5.61E+01	2.85E+00
Np238	5.20E-08	NR	8.77E-03	NR
Np239	1.93E-04	3.23E-08	3.26E+01	2.28E-04

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.

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ATTACHMENT A

WIPP Disposal Radionuclide Inventory for the CCA (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Np240m	8.91E-12	3.12E-15	1.50E-06	2.21E-11
Pa231	2.67E-06	2.70E-07	4.51E-01	1.91E-03
Pa233	3.33E-04	4.02E-04	5.61E+01	2.85E+00
Pa234	3.05E-07	1.92E-06	5.14E-02	1.36E-02
Pa234m	2.35E-04	1.48E-03	3.96E+01	1.05E+01
Pb209	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Pb210	1.52E-05	1.01E-09	2.55E+00	7.16E-06
Pb211	3.61E-06	1.07E-07	6.09E-01	7.58E-04
Pb212	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Pb214	6.91E-05	5.05E-09	1.16E+01	3.58E-05
Pd107	4.40E-10	2.45E-09	7.41E-05	1.73E-05
Pm147	4.67E-05	1.52E-03	7.87E+00	1.07E+01
Po210	1.52E-05	1.01E-09	2.55E+00	7.16E-06
Po211	1.01E-08	3.00E-10	1.71E-03	2.12E-06
Po212	1.03E-04	6.66E-06	1.73E+01	4.72E-02
Po213	1.67E-05	1.62E-05	2.82E+00	1.15E-01
Po214	6.91E-05	5.05E-09	1.16E+01	3.57E-05
Po215	3.61E-06	1.07E-07	6.09E-01	7.58E-04
Po216	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Po218	6.91E-05	5.05E-09	1.16E+01	3.58E-05

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.

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ATTACHMENT A

WIPP Disposal Radionuclide Inventory for the CCA (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Pr144	3.67E-07	7.16E-04	6.18E-02	5.07E+00
Pu236	6.16E-08	NR	1.04E-02	NR
Pu238	1.55E+01	2.05E-01	2.61E+06	1.45E+03
Pu239	4.66E+00	1.45E+00	7.85E+05	1.03E+04
Pu240	1.25E+00	7.15E-01	2.10E+05	5.07E+03
Pu241	1.37E+01	2.00E+01	2.31E+06	1.42E+05
Pu242	6.96E-03	2.11E-05	1.17E+03	1.50E-01
Pu243	1.91E-14	NR	3.21E-09	NR
Pu244	8.92E-12	3.12E-15	1.50E-06	2.21E-11
Ra223	3.61E-06	1.07E-07	6.09E-01	7.58E-04
Ra224	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Ra225	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Ra226	6.91E-05	5.05E-09	1.16E+01	3.58E-05
Ra228	4.43E-06	1.10E-05	7.47E-01	7.77E-02
Rh106	1.72E-07	1.54E-03	2.90E-02	1.09E+01
Rn219	3.61E-06	1.07E-07	6.09E-01	7.58E-04
Rn220	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Rn222	6.91E-05	5.05E-09	1.16E+01	3.58E-05
Ru106	1.72E-07	1.54E-03	2.90E-02	1.09E+01
Sb125	7.17E-07	2.67E-04	1.21E-01	1.89E+00

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.

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ATTACHMENT A

WIPP Disposal Radionuclide Inventory for the CCA (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Sb126	8.02E-10	4.46E-09	1.35E-04	3.16E-05
Sb126m	5.73E-09	3.18E-08	9.65E-04	2.25E-04
Se79	2.58E-09	1.44E-08	4.35E-04	1.02E-04
Sm151	8.72E-06	5.05E-05	1.47E+00	3.57E-01
Sn119m	2.46E-11	1.35E-10	4.14E-06	9.59E-07
Sn121m	1.58E-07	9.45E-07	2.66E-02	6.69E-03
Sn126	5.73E-09	3.18E-08	9.65E-04	2.25E-04
Sr90	4.07E-02	2.95E+01	6.85E+03	2.09E+05
Ta182	NR	5.95E-12	NR	4.21E-08
Tc99	1.49E-04	8.26E-07	2.52E+01	5.85E-03
Te125m	1.75E-07	6.57E-05	2.95E-02	4.65E-01
Te127	7.72E-13	2.41E-13	1.30E-07	1.71E-09
Te127m	7.88E-13	2.47E-13	1.33E-07	1.75E-09
Th227	3.56E-06	1.06E-07	6.01E-01	7.47E-04
Th228	1.61E-04	1.04E-05	2.71E+01	7.36E-02
Th229	1.71E-05	1.66E-05	2.88E+00	1.17E-01
Th230	4.78E-07	1.07E-06	8.06E-02	7.56E-03
Th231	7.59E-05	6.53E-04	1.28E+01	4.63E+00
Th232	5.42E-06	1.31E-05	9.13E-01	9.25E-02
Th234	2.35E-04	1.48E-03	3.96E+01	1.05E+01

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.

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ATTACHMENT A

WIPP Disposal Radionuclide Inventory for the CCA (continued)

Nuclide	CH-TRU Waste (Ci/m³)	RH-TRU Waste (Ci/m³)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Tl207	3.61E-06	1.07E-07	6.07E-01	7.56E-04
Tl208	5.77E-05	3.74E-06	9.73E+00	2.65E-02
Tl209	3.69E-07	3.58E-07	6.22E-02	2.53E-03
U232	1.53E-04	NR	2.58E+01	NR
U233	1.06E-02	2.23E-02	1.79E+03	1.58E+02
U234	2.76E-03	6.03E-03	4.65E+02	4.27E+01
U235	7.59E-05	6.53E-04	1.28E+01	4.63E+00
U236	1.98E-06	1.37E-05	3.33E-01	9.68E-02
U237	3.36E-04	4.91E-04	5.66E+01	3.48E+00
U238	2.35E-04	1.48E-03	3.96E+01	1.05E+01
U240	8.91E-12	3.12E-15	1.50E-06	2.21E-11
Y90	4.07E-02	2.95E+01	6.85E+03	2.09E+05
Zr93	3.34E-08	1.86E-07	5.63E-03	1.32E-03
Zr95	6.80E-15	4.27E-05	1.15E-09	3.02E-01
TOTALS	**3.81E+01**	**1.43E+02**	**6.42E+06**	**1.02E+06**

NR = Not reported by sites.
[1]Decayed to December 1995.
[2]Total curies estimated by assuming a volume of 168,500 cubic meters for CH-TRU waste and 7,080 cubic meters for RH-TRU waste.

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ATTACHMENT - B

This attachment summarizes the major changes to the undecayed radionuclide data based on the new information obtained from four sites since the publication of Rev. 2 of the TWBIR. It also summarizes the methodology used to develop the revised WIPP disposal radionuclide inventories shown in Attachment A.

Major Changes in Data

The major changes to the undecayed radionuclide data from the four TRU waste sites (Hanford. Oak Ridge, Rocky Flats, and Savannah River) are summarized below for each site:

- Changes to the Hanford Data - There were a few errors in the undecayed curies reported by the Hanford site for Cf-252, Cm-244, and Cm-245 in their previous IDB site submittals for CH-TRU waste. The corrected estimates of yearly activity for these radionuclides that were provided by the Hanford site have been used for the revised radionuclide inventory calculations. The previous and revised undecayed activity values are shown in Table B-1.

- Changes to the Oak Ridge Data - In previous IDB submittals, Oak Ridge reported a very conservative (high) inventory for U-235 in the Oak Ridge RH-TRU waste due to the absence of any sampling data. Recently available mass spectrometry analytical data for the evaporator feed tank sludges at Oak Ridge have provided new distributions of the different uranium isotopes in the RH-TRU sludges showing that the primary uranium isotope by mass is U-238 (not U-235). Since the original IDB data are reported in terms of curies (i.e., not on a mass basis), the TWBIR team used the mass spectrometry data to develop new yearly estimates of activities for each uranium isotope. The previous and revised undecayed activities for uranium isotopes in Oak Ridge RH-TRU waste are shown in Table B-2.

- Changes to the RFETS residues data - The RFETS residues were not included in any of the previous IDB submittals because they were not categorized as waste. Therefore, no break-ups were available for the yearly undecayed activity contributed by each radionuclide in the residues and consequently, no radionuclide decay calculations could be performed for the residues in Rev. 2 of the TWBIR. Based on recent estimates provided by RFETS, it was possible to divide the total undecayed curies for each radionuclide present in the residues into yearly activities. The yearly break-up of undecayed curies from each of these radionuclides is shown in Table B-3.

- Changes to the SRS data - In previous IDB submittals, SRS had reported the total yearly undecayed curies contributed by each radionuclide in SRS CH-TRU waste and therefore no information was available from the IDB regarding the contribution from off-site waste stored at SRS versus on-site waste that was generated at SRS. Based on recent information available from SRS regarding the on-site versus off-site break-up, the TWBIR team has divided the total yearly undecayed activities reported in previous SRS IDB submittals into yearly undecayed activities from on-site and off-site waste. The original IDB data and the break-ups are shown in Table B-4.

These new estimates of undecayed radionuclide activities for the four sites and unchanged data for all other sites were provided to SNL staff to perform radionuclide activity decay calculations. The undecayed activity data were decayed by SNL staff to the end of 1995 using the code ORIGEN2. The new decayed radionuclide inventory received from SNL staff has been used to develop the revised WIPP disposal radionuclide inventory shown in Attachment A.

Summary of the Methodology

The methodology used for development of the revised radionuclide inventory is the same as that described in Section 3.6 on pages 3-27 through 3-29 of Revision 2 of the TWBIR with the following exceptions:

- Decayed curies have been used for the RFETS residues (instead of the undecayed curies used in Rev. 2 of the TWBIR)

- Unlike Rev. 2 of the TWBIR, the estimated concentration of U-235 in RH-TRU waste in Attachment A is well within transportation limits for Pu-239 FGE and therefore does not require any adjustments.

- The curies and volumes contributed by TRU waste generated off-site but stored at SRS have been excluded from the process of estimating radionuclide activities for SRS waste to be generated in the future. Only the data for waste that has been generated and stored at SRS since 1970 has been used for this estimation. The curies contributed by the off-site waste stored at SRS are added to the WIPP radionuclide inventory (in a manner similar to the RFETS residues) but they are not included in any data extrapolation for future SRS waste.

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TABLE B - 4

SAVANNAH RIVER SITE

PREVIOUS IDB CURIES FOR STORED WASTE AT THE SAVANNAH RIVER SITE (ON-SITE + OFF-SITE WASTE)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Am241	0.00E+00	0.00E+00	4.32E-01	5.28E+00	1.87E+01	1.89E+01	2.58E+01	4.00E+01	5.14E+01	7.05E+01	7.14E+01	1.04E+02	8.08E+01
Np237	0.00E+00	0.00E+00	1.33E-03	1.98E-01	2.89E-01	4.01E-01	2.72E-01	3.37E-01	4.54E-01	1.04E+00	5.78E-01	5.24E-01	8.23E-01
Pu238	0.00E+00	2.08E+06	3.40E+04	1.46E+03	3.87E+03	4.31E+03	6.83E+03	7.89E+03	7.84E+03	2.46E+04	3.48E+04	3.51E+04	4.78E+04
Pu239	0.00E+00	1.27E+02	2.37E+01	3.06E+01	1.13E+02	1.14E+02	1.40E+02	2.30E+02	2.80E+02	1.83E+02	3.92E+02	5.75E+02	4.50E+02
Pu240	0.00E+00	8.84E+01	1.17E+01	7.47E+00	2.73E+01	2.78E+01	3.65E+01	5.87E+01	6.29E+01	4.29E+01	9.89E+01	1.42E+02	1.15E+02
Pu241	0.00E+00	4.50E+03	7.75E+02	2.98E+02	1.08E+03	1.89E+04	2.21E+03	2.17E+03	2.44E+03	1.95E+03	4.08E+03	5.89E+03	4.78E+03
U234	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.11E-02	3.22E-02	2.17E-02	1.07E-02	3.10E-02	6.84E-02	3.89E-03	6.18E-03	0.00E+00
U235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.90E-04	6.55E-04	4.23E-04	2.01E-04	5.83E-04	1.28E-03	7.48E-06	1.18E-04	4.78E-08
U236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.50E-03	5.43E-03	3.80E-03	1.91E-03	5.24E-03	1.15E-02	6.72E-04	1.04E-03	0.00E+00
U238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-06	3.89E-03	8.30E-04	6.28E-06	3.07E-06	4.01E-06	2.33E-06	3.81E-06	3.89E-06

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	TOTAL
Am241	4.08E+01	1.02E+02	2.48E+02	3.37E+02	1.59E+02	5.46E+02	8.63E+01	6.42E+01	1.72E+01	3.78E+00	7.27E-01	5.90E+00	2.11E+03
Np237	2.34E-01	1.77E+00	2.78E-02	1.48E-02	7.54E-02	3.75E-02	3.39E-02	1.38E+00	8.33E-02	1.88E-03	0.00E+00	5.87E-03	8.58E+00
Pu238	4.44E+04	1.33E+04	2.18E+04	8.84E+03	1.44E+04	5.88E+03	1.73E+03	3.00E+03	2.81E+03	1.40E+03	4.70E+03	1.78E+04	5.57E+05
Pu239	2.23E+02	4.82E+02	1.30E+03	1.88E+03	8.68E+02	8.80E+02	4.90E+02	3.58E+02	9.50E+01	1.00E+01	6.84E+00	3.85E+01	9.29E+03
Pu240	6.04E+01	1.18E+02	3.25E+02	4.48E+02	2.08E+02	2.06E+02	1.14E+02	8.47E+01	2.32E+01	2.81E+00	2.46E+00	1.17E+01	2.29E+03
Pu241	2.70E+03	4.51E+03	1.24E+04	1.89E+04	7.98E+03	7.75E+03	4.30E+03	3.22E+03	8.01E+02	1.12E+02	1.38E+02	6.11E+02	1.11E+06
U234	1.85E-02	0.00E+00	7.50E-03	1.84E-02	1.22E-02	9.14E-03	2.27E-04	7.08E-04	0.00E+00	2.28E-04	2.12E-02	1.90E-02	3.00E-01
U235	2.13E-04	9.84E-08	1.43E-04	3.47E-04	2.29E-04	1.73E-04	4.28E-08	1.38E-05	4.32E-08	4.23E-08	4.18E-04	3.83E-04	5.74E-03
U236	2.78E-03	0.00E+00	1.27E-03	3.11E-03	2.06E-03	1.54E-03	3.83E-08	1.18E-04	0.00E+00	3.80E-05	3.90E-05	3.21E-03	4.70E-02
U238	2.71E-04	7.72E-06	7.50E-06	1.10E-05	7.14E-06	6.70E-06	1.33E-07	3.40E-05	3.38E-07	1.32E-07	4.11E-05	4.21E-04	5.70E-03

REVISED UNDECAYED CURIES FOR STORED WASTE AT THE SAVANNAH RIVER SITE (ON-SITE WASTE)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Am241	0.00E+00	0.00E+00	4.32E-01	5.28E+00	1.87E+01	1.89E+01	2.58E+01	4.00E+01	5.14E+01	7.05E+01	7.14E+01	1.04E+02	8.08E+01
Np237	0.00E+00	0.00E+00	1.33E-03	1.98E-01	2.89E-01	4.01E-01	2.72E-01	3.37E-01	4.54E-01	1.04E+00	5.78E-01	5.24E-01	8.23E-01
Pu238	0.00E+00	0.00E+00	4.00E+01	1.46E+03	3.87E+03	4.31E+03	6.83E+03	7.89E+03	7.84E+03	2.46E+04	3.48E+04	3.51E+04	4.79E+04
Pu239	0.00E+00	0.00E+00	2.48E+00	3.06E+01	1.13E+02	1.14E+02	1.40E+02	2.30E+02	2.80E+02	1.83E+02	3.92E+02	5.75E+02	4.50E+02
Pu240	0.00E+00	0.00E+00	5.55E-01	7.47E+00	2.73E+01	2.78E+01	3.65E+01	5.87E+01	6.29E+01	4.29E+01	9.89E+01	1.42E+02	1.16E+02
Pu241	0.00E+00	0.00E+00	2.18E+01	2.98E+02	1.08E+03	1.89E+04	2.21E+03	2.17E+03	2.44E+03	1.95E+03	4.08E+03	5.89E+03	4.78E+03
U234	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.11E-02	3.22E-02	2.17E-02	1.07E-02	3.10E-02	6.84E-02	3.89E-03	6.18E-03	0.00E+00
U235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.90E-04	6.55E-04	4.23E-04	2.01E-04	5.83E-04	1.28E-03	7.48E-06	1.18E-04	4.78E-08
U236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.50E-03	5.43E-03	3.80E-03	1.91E-03	5.24E-03	1.15E-02	6.73E-04	1.04E-03	0.00E+00
U238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-06	3.89E-03	8.30E-04	6.28E-06	3.07E-06	4.01E-06	2.33E-06	3.81E-06	3.89E-06

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	TOTAL
Am241	3.84E+01	1.02E+02	2.48E+02	3.37E+02	1.59E+02	5.46E+02	8.63E+01	6.42E+01	1.72E+01	3.78E+00	2.52E-01	5.90E+00	2.11E+03
Np237	2.31E-01	1.77E+00	2.78E-02	1.48E-02	7.54E-02	3.75E-02	3.39E-02	1.38E+00	8.33E-02	1.88E-03	0.00E+00	5.87E-03	8.58E+00
Pu238	4.44E+04	1.33E+04	2.18E+04	8.84E+03	1.44E+04	5.88E+03	1.73E+03	3.00E+03	2.81E+03	1.40E+03	4.88E+03	1.78E+04	3.14E+05
Pu239	2.16E+02	4.82E+02	1.30E+03	1.88E+03	8.68E+02	8.80E+02	4.90E+02	3.58E+02	9.50E+01	1.00E+01	4.37E+00	3.85E+01	9.13E+03
Pu240	5.87E+01	1.16E+02	3.25E+02	4.45E+02	2.08E+02	2.04E+02	1.14E+02	8.47E+01	2.32E+01	2.81E+00	1.83E+00	1.17E+01	2.21E+03
Pu241	2.63E+03	4.51E+03	1.24E+04	1.89E+04	7.98E+03	7.75E+03	4.30E+03	3.22E+03	8.01E+02	1.12E+02	1.14E+02	6.11E+02	1.06E+06
U234	1.84E-02	0.00E+00	7.50E-03	1.84E-02	1.22E-02	9.14E-03	2.27E-04	7.08E-04	0.00E+00	2.28E-04	2.10E-02	1.90E-02	3.00E-01
U235	3.11E-04	9.84E-08	1.42E-04	3.47E-04	2.29E-04	1.72E-04	4.28E-08	1.38E-05	4.32E-08	4.23E-08	4.14E-04	3.83E-04	5.73E-03
U236	2.76E-03	0.00E+00	1.27E-03	3.11E-03	2.06E-03	1.54E-02	3.83E-08	1.18E-04	0.00E+00	3.80E-05	4.20E-08	3.21E-03	4.88E-02
U238	2.71E-04	7.72E-06	7.60E-06	1.10E-05	7.14E-06	6.70E-06	1.33E-07	3.40E-05	3.38E-07	1.32E-07	7.09E-07	4.21E-04	5.66E-03

REVISED UNDECAYED CURIES FOR STORED WASTE AT THE SAVANNAH RIVER SITE (OFF-SITE WASTE ONLY)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Am241	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Np237	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu238	0.00E+00	2.08E+06	3.49E+04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu239	0.00E+00	1.27E+02	2.12E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu240	0.00E+00	8.84E+01	1.11E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pu241	0.00E+00	4.50E+03	7.54E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U234	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U236	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	TOTAL
Am241	1.40E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.75E-01	0.00E+00	1.87E+00
Np237	3.03E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.03E-03
Pu238	4.37E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.57E-01	0.00E+00	0.00E+00	0.00E+00	7.31E+00	0.00E+00	2.43E+05
Pu239	7.37E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-04	0.00E+00	0.00E+00	0.00E+00	2.87E+00	0.00E+00	1.58E+02
Pu240	1.74E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.20E-06	0.00E+00	0.00E+00	0.00E+00	6.33E-01	0.00E+00	7.98E+01
Pu241	6.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.58E-03	0.00E+00	0.00E+00	0.00E+00	2.39E+01	0.00E+00	5.34E+03
U234	1.19E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.18E-04	0.00E+00	3.37E-04
U235	2.23E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.61E-06	0.00E+00	6.84E-06
U236	2.00E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.68E-06	0.00E+00	5.68E-06
U238	6.98E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.04E-06	0.00E+00	4.04E-06

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TABLE B - 3

Rocky Flats Environmental Technology Site

UNDECAYED YEARLY ACTIVITY DATA FOR THE RFETS RESIDUES							
	1982	1983	1984	1985	1986	1987	1988
Am-241	2.06E+04	2.22E+03	6.81E+03	1.56E+04	9.20E+03	7.81E+03	1.03E+04
Pu-238	1.64E+03	1.77E+02	5.43E+02	1.24E+03	7.34E+02	6.23E+02	8.18E+02
Pu-239	3.50E+04	3.77E+03	1.16E+04	2.64E+04	1.56E+04	1.33E+04	1.75E+04
Pu-240	8.01E+03	8.64E+02	2.65E+03	6.05E+03	3.58E+03	3.04E+03	4.00E+03
Pu-241	2.05E+05	2.21E+04	6.77E+04	1.55E+05	9.15E+04	7.77E+04	1.02E+05
Pu-242	1.01E+00	1.09E-01	3.35E-01	7.65E-01	4.52E-01	3.84E-01	5.05E-01
	1989	1990	1991	1992	1993	1994	TOTALS
Am-241	1.74E+04	1.57E+04	9.38E+02	1.04E+02	3.47E+01	1.81E+03	1.08E+05
Pu-238	1.39E+03	1.25E+03	7.47E+01	8.30E+00	2.77E+00	1.44E+02	8.65E+03
Pu-239	2.96E+04	2.67E+04	1.59E+03	1.77E+02	5.90E+01	3.07E+03	1.84E+05
Pu-240	6.78E+03	6.10E+03	3.65E+02	4.05E+01	1.35E+01	7.02E+02	4.22E+04
Pu-241	1.73E+05	1.56E+05	9.32E+03	1.04E+03	3.45E+02	1.80E+04	1.08E+06
Pu-242	8.57E-01	7.72E-01	4.61E-02	5.12E-03	1.71E-03	8.88E-02	5.33E+00

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TABLE B - 2

Oak Ridge National Laboratory

PREVIOUS VALUES OF URANIUM ISOTOPES IN THE IDB (CURIES)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
U232	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U233	1.25E+00	1.25E+00	1.25E+00	1.25E+00	1.58E+00	1.75E+00	1.29E+00	3.38E+00	1.25E+00	0.00E+00	1.00E-01	0.00E+00	1.00E+00
U234	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U235	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.01E-04	2.84E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U238	3.74E-01	3.74E-01	3.74E-01	3.74E-01	3.74E-01	3.74E-01	3.74E-01	3.74E-01	3.74E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	TOTAL
U232	0.00E+00	0.00E+00	9.28E-02	9.28E-02	9.28E-02	9.28E-02	9.28E-02	9.28E-02	9.28E-02	9.28E-02	9.28E-02	9.28E-02	9.28E-01
U233	0.00E+00	0.00E+00	5.37E+00	5.37E+00	5.37E+00	5.37E+00	5.37E+00	5.37E+00	5.37E+00	5.37E+00	5.37E+00	5.37E+00	6.90E+01
U234	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
U235	0.00E+00	0.00E+00	1.75E+01	1.75E+01	1.75E+01	1.75E+01	1.75E+01	1.75E+01	1.75E+01	1.75E+01	1.75E+01	1.75E+01	1.75E+02
U238	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.37E+00

REVISED UNDECAYED ACTIVITY FOR EACH URANIUM ISOTOPE (CURIES)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
U233	5.58E+00	5.58E+00	5.58E+00	5.58E+00	5.78E+00	5.88E+00	5.60E+00	8.86E+00	5.58E+00	0.00E+00	8.09E-02	0.00E+00	6.08E-01
U234	1.25E-01	1.25E-01	1.25E-01	1.25E-01	1.25E-01	1.25E-01	1.25E-01	1.25E-01	1.25E-01	0.00E+00	4.56E-07	0.00E+00	4.55E-06
U235	5.69E-03	5.69E-03	5.69E-03	5.69E-03	5.69E-03	5.69E-03	5.69E-03	5.69E-03	5.69E-03	0.00E+00	2.07E-08	0.00E+00	2.07E-07
U236	3.45E-03	3.45E-03	3.45E-03	3.45E-03	3.45E-03	3.45E-03	3.45E-03	3.45E-03	3.45E-03	0.00E+00	1.26E-08	0.00E+00	1.28E-07
U238	3.73E-01	3.73E-01	3.73E-01	3.73E-01	3.73E-01	3.73E-01	3.73E-01	3.73E-01	3.73E-01	0.00E+00	1.38E-08	0.00E+00	1.38E-05

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	TOTAL
U233	0.00E+00	0.00E+00	3.83E+01	3.83E+01	3.83E+01	3.83E+01	3.83E+01	3.83E+01	3.83E+01	3.83E+01	3.83E+01	3.83E+01	4.38E+02
U234	0.00E+00	0.00E+00	9.10E-01	9.10E-01	9.10E-01	9.10E-01	9.10E-01	9.10E-01	9.10E-01	9.10E-01	9.10E-01	9.10E-01	1.02E+01
U235	0.00E+00	0.00E+00	5.01E-02	5.01E-02	5.01E-02	5.01E-02	5.01E-02	5.01E-02	5.01E-02	5.01E-02	5.01E-02	5.01E-02	5.53E-01
U236	0.00E+00	0.00E+00	2.51E-02	2.51E-02	2.51E-02	2.51E-02	2.51E-02	2.51E-02	2.51E-02	2.51E-02	2.51E-02	2.51E-02	2.82E-01
U238	0.00E+00	0.00E+00	2.71E+00	2.71E+00	2.71E+00	2.71E+00	2.71E+00	2.71E+00	2.71E+00	2.71E+00	2.71E+00	2.71E+00	3.05E+01

TABLE B - 1
Hanford Site

PREVIOUS UNDECAYED CURIES FOR Cf-252, Cm-244, and Cm-245 IN CH-TRU WASTE AT THE HANFORD SITE

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Cf252	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E+03
Cm244	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Cm245	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.42E-01	0.00E+00	0.00E+00	0.00E+00	7.54E+00

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	TOTAL
Cf252	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.07E+03
Cm244	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.62E-01	6.72E-03	7.58E+01	0.00E+00	0.00E+00	7.66E+01
Cm245	3.59E-01	1.71E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.54E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.68E+01

REVISED UNDECAYED CURIES FOR Cf-252, Cm-244, and Cm-245 IN CH-TRU WASTE AT THE HANFORD SITE

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
Cf252	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-03
Cm244	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.62E+02	0.00E+00	0.00E+00	0.00E+00	3.72E+02
Cm245	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	TOTAL
Cf252	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.08E-03
Cm244	1.70E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.04E+03	7.62E-01	6.72E-03	7.58E+01	0.00E+00	0.00E+00	4.82E+03
Cm245	0.00E+00	1.71E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.71E-03

APPENDIX B - 2

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Department of Energy
Carlsbad Area Office
P. O. Box 3090
Carlsbad, New Mexico 88221

June 12, 1996

To: Dr. Les E. Shephard, Director, SNL

Subject: Preliminary Activities for Selected Radionuclides for CH-TRU Waste Streams

The following information from the Transuranic (TRU) Waste Baseline Inventory Report (TWBIR) team was requested during a meeting with SNL representatives on April 23, 1996. The TWBIR team was requested to calculate the radionuclide activity (total curies) for seven radionuclides (Am-241, Cm-244, Pu-238, Pu-239, Pu-240, Pu-241, and U-234) on a waste stream basis for contact-handled (CH)-TRU waste to be disposed of at the WIPP.

During this meeting, it was agreed that since the radionuclide data used by SNL WIPP PA were based on the site-level radionuclide data from the Integrated Data Base (IDB), the waste stream radionuclide data in curies per cubic meter provided by the DOE sites in Revision 2 of the Transuranic Waste Baseline Inventory Report (TWBIR) would be normalized to the extent necessary for consistency with the IDB data. This letter summarizes the methodology for normalization of the waste stream radionuclide data from the TWBIR Rev. 2 and subsequent scale-up of the normalized data to obtain estimates of the total curies of each of the seven selected radionuclides on a waste stream basis. The results of these calculations are presented in Table 1. Please note that the results in Table 1 are not directly obtainable from the TWBIR database; but all of the data in Table 1 are derived from TWBIR Rev. 2 on the basis of the methodology and assumptions discussed later in this memorandum.

Methodology for Normalization of the Waste Stream Radionuclide Data

The waste stream radionuclide data provided by the sites in TWBIR Rev. 2 were first normalized to be consistent with the site-wide values reported for CH-TRU waste in the IDB using the following step-by-step approach:

- Extraction of Volume and Activity Data from the TWBIR Rev. 2 Database - For each CH-TRU waste stream, the stored and projected final waste form volumes as well as activities in curies per cubic meter (Ci/m^3) reported by the sites for the seven selected radionuclides were obtained from the database. All RH-TRU waste streams, non-WIPP waste streams, and waste streams for which no data were reported by the site were excluded.

CAO:NTP:RLB 96-1199

- Estimation of Undecayed Total Activity for Each Radionuclide at Each Site - The Ci/m^3 value reported for each radionuclide for each waste stream was multiplied by the stored waste volume to obtain the total undecayed activity of each radionuclide for each waste stream. Next, the total undecayed activity for a given radionuclide (e.g., Pu-238) for all waste streams at a given site were added together to obtain the total undecayed activity for each radionuclide at each site.

- Comparison with IDB Values and Normalization - The total undecayed activity estimated above for a given radionuclide at a given site were compared with the values reported for the same radionuclide by the same site in their IDB submittal. Based on this comparison, a normalization factor (NF) was developed for each radionuclide at each site as follows:

$$NF = \frac{\text{Total curies reported by the site in the IDB}}{\text{Total curies estimated from TWBIR Rev. 2 waste stream data}}$$

  The NFs calculated in this fashion are shown in Table 2. The total activity for each radionuclide for each waste stream was then multiplied by the normalization factor to obtain the total normalized undecayed stored curies on a waste stream basis.

- Estimation of Decayed Activities - For each radionuclide at each site, a ratio of the activity decayed to the end of 1995 to the undecayed activity for each of seven selected radionuclides was calculated based on the ORIGEN2 activity decay calculations performed by SNL staff in support of the development of the WIPP disposal radionuclide inventory for the Compliance Certification Application (CCA). The total normalized undecayed stored curies were then multiplied by this calculated ratio to estimate the decayed curies of each radionuclide that are present in the stored volume of each waste stream. Subsequently, the curies from the stored volume were multiplied by the ratio of the projected to the stored volume to obtain the estimated curies for the projected volume of each waste stream.

Methodology for Scale-up of Waste Stream Decayed Activity to WIPP Repository Volume

This step involves scale-up of the estimated decayed activity for each radionuclide present in the stored volume of each waste stream to the WIPP disposal volume for CH-TRU waste, which is 168,500 m^3. Since the total WIPP activity for CH-TRU waste for each radionuclide has already been estimated in an earlier memorandum prepared in support of the CCA, it was assumed that the total WIPP activity in curies for each of the seven radionuclides would be equal, for the sake of consistency, to the values reported in the earlier memorandum. For each

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CAO:NTP:RLB 96-1199

radionuclide, a scale-up factor for activity was calculated as follows:

$$SF_a = \frac{\text{Total WIPP Activity from CCA memo - Total Estimated Activity for Stored Volume (all waste streams)}}{\text{Total Estimated Activity for Projected Volume (for all waste streams)}}$$

These SF_a's are shown in Table 3. The estimated activity in curies for the projected volume for each radionuclide for each waste stream was then multiplied by the appropriate scale-up factor derived above, and the result added to the corresponding estimated stored activity in curies to obtain the "Scaled Curies" at a WIPP level for the waste stream. These are the values reported in Table 1.

Methodology for Scale-up of Waste Stream Volumes to WIPP Repository Volume

The summation of the total stored and projected volumes for all CH-TRU waste streams is less than the WIPP disposal capacity for CH-TRU waste (i.e., 168,500 m^3). However, since the WIPP PA modeling is based on the effect of a full repository (i.e., 168,500 m^3 for CH-TRU waste), it is necessary to scale-up the total volume of each waste stream in order to be consistent with the WIPP PA assumptions. This step involves the scale-up of the total volume of each waste stream to the WIPP disposal capacity for CH-TRU waste. A scale-up factor for volume (common to all waste streams) was calculated as follows:

$$SF_v = \frac{\text{WIPP Capacity for CH-TRU Waste (168,500 m}^3\text{) - Total Stored Volume (all waste streams)}}{\text{Total Projected Volume (for all waste streams)}}$$

This factor is shown in Table 4. The projected volume for each waste stream was then multiplied by the scale-up factor derived above, and the result added to the corresponding stored volume to obtain the "Scaled Volume" at a WIPP level for each waste stream. These are the values reported in Table 1.

If you have any questions concerning the enclosed information, please contact Mr. Russ Bisping of my staff at (505) 234-7446.

Don Watkins
Manager
National TRU Program

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Enclosures

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CAO:NTP:RLB 96-1199

TABLE - 1
SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

	Waste	Scaled	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
SITE	Stream ID#	Volume (m3)	Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
IN	IN-W139.627	12.27	2.84E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W146.699	2.29	8.24E-01	4.91E+02	7.98E-01	6.40E-01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W157.144	49.92	8.51E+00	0.00E+00	1.52E+00	4.22E+01	9.31E+00	1.74E+02	0.00E+00
IN	IN-W157.906	163.70	2.79E+01	0.00E+00	5.00E+00	1.38E+02	3.05E+01	5.69E+02	0.00E+00
IN	IN-W157.907	9.36	3.19E+00	0.00E+00	5.71E-01	1.58E+01	3.49E+00	6.51E+01	0.00E+00
IN	IN-W159.1072	0.68	0.00E+00	0.00E+00	5.05E+02	3.67E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W159.119	0.21	0.00E+00	0.00E+00	5.15E+01	3.74E-01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W159.120	0.42	0.00E+00	0.00E+00	6.17E+02	4.49E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W161.231	97.55	5.22E+00	0.00E+00	1.31E+01	3.63E+02	8.02E+01	1.49E+03	0.00E+00
IN	IN-W161.806	15.79	8.44E-01	0.00E+00	2.12E+00	5.88E+01	1.30E+01	2.42E+02	0.00E+00
IN	IN-W163.1007	0.68	0.00E+00	0.00E+00	5.11E-01	1.42E+01	3.13E+00	5.83E+01	0.00E+00
IN	IN-W163.234	0.42	0.00E+00	0.00E+00	6.25E-01	1.73E+01	3.82E+00	7.13E+01	0.00E+00
IN	IN-W164.1060	1.66	0.00E+00	0.00E+00	2.38E-02	6.60E-01	1.46E-01	2.72E+00	0.00E+00
IN	IN-W164.153	0.89	0.00E+00	0.00E+00	1.27E-02	3.52E-01	7.78E-02	1.45E+00	0.00E+00
IN	IN-W166.151	16.00	4.80E-01	0.00E+00	2.08E+00	5.78E+01	1.27E+01	2.38E+02	0.00E+00
IN	IN-W166.928	56.78	1.70E+00	0.00E+00	7.40E+00	2.05E+02	4.53E+01	8.44E+02	0.00E+00
IN	IN-W167.149	36.68	1.72E+00	0.00E+00	1.05E+00	2.90E+01	6.41E+00	1.19E+02	0.00E+00
IN	IN-W167.926	131.46	6.16E+00	0.00E+00	3.75E+00	1.04E+02	2.30E+01	4.28E+02	0.00E+00
IN	IN-W169.191	4267.12	1.79E+03	0.00E+00	8.48E+01	2.35E+03	5.19E+02	9.67E+03	0.00E+00
IN	IN-W169.192	14.56	6.12E+02	0.00E+00	2.89E+01	8.02E+02	1.77E+02	3.30E+03	0.00E+00
IN	IN-W169.985	41.79	1.76E+01	0.00E+00	8.31E-01	2.30E+01	5.08E+00	9.47E+01	0.00E+00
IN	IN-W170.189	0.68	3.88E+00	0.00E+00	0.00E+00	1.29E+01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W170.938	0.42	2.37E+00	0.00E+00	0.00E+00	7.91E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W171.184	3.54	1.57E+00	0.00E+00	0.00E+00	1.67E+01	0.00E+00	1.16E+02	0.00E+00
IN	IN-W171.801	0.68	3.01E-01	0.00E+00	0.00E+00	3.21E+00	0.00E+00	2.23E+01	0.00E+00
IN	IN-W174.1082	30.37	0.00E+00	0.00E+00	4.35E+02	2.84E-01	5.50E-01	0.00E+00	0.00E+00
IN	IN-W174.154	134.32	0.00E+00	0.00E+00	1.92E+03	1.26E+00	2.43E+00	0.00E+00	0.00E+00
IN	IN-W177.1083	141.02	0.00E+00	0.00E+00	2.32E+03	6.71E-01	4.00E-03	1.88E-01	0.00E+00
IN	IN-W177.156	39.23	0.00E+00	0.00E+00	6.44E+02	1.87E-01	1.11E-03	5.22E-02	0.00E+00
IN	IN-W179.1084	4.58	0.00E+00	0.00E+00	2.99E+01	5.05E-04	2.57E-04	1.64E-02	0.00E+00
IN	IN-W179.158	1.51	0.00E+00	0.00E+00	9.88E+00	1.67E-04	8.48E-05	5.41E-03	0.00E+00
IN	IN-W181.162	9.57	0.00E+00	0.00E+00	1.08E-01	2.99E+00	6.61E-01	1.23E+01	0.00E+00
IN	IN-W186.187	2695.26	2.00E+02	0.00E+00	5.50E+01	1.53E+03	3.37E+02	6.27E+03	0.00E+00
IN	IN-W187.1094	0.68	0.00E+00	0.00E+00	6.84E-02	1.89E+00	4.18E-01	7.79E+00	0.00E+00
IN	IN-W187.121	0.21	0.00E+00	0.00E+00	4.18E-02	1.16E+00	2.56E-01	4.77E+00	0.00E+00
IN	IN-W188.1093	1.04	0.00E+00	0.00E+00	4.26E-02	1.18E+00	2.60E-01	4.85E+00	0.00E+00
IN	IN-W188.160	0.68	0.00E+00	0.00E+00	2.78E-02	7.72E-01	1.70E-01	3.17E+00	0.00E+00
IN	IN-W189.1048	4.99	0.00E+00	0.00E+00	1.36E-01	3.77E+00	8.33E-01	1.55E+01	0.00E+00
IN	IN-W189.131	1.72	0.00E+00	0.00E+00	4.69E-02	1.30E+00	2.87E-01	5.35E+00	0.00E+00
IN	IN-W197.196	2.29	2.09E+02	0.00E+00	5.19E+00	1.44E+02	3.18E+01	5.92E+02	0.00E+00

B2-5

TABLE - 1

SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

	Waste	Scaled	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
SITE	Stream ID#	Volume (m3)	Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
IN	IN-W197.802	510.22	4.67E+02	0.00E+00	1.16E+01	3.21E+02	7.08E+01	1.32E+03	0.00E+00
IN	IN-W197.803	45.23	4.14E+01	0.00E+00	1.03E+00	2.85E+01	6.28E+00	1.17E+02	0.00E+00
IN	IN-W198.202	119.60	2.16E+02	0.00E+00	3.53E+00	9.78E+01	2.16E+01	4.02E+02	0.00E+00
IN	IN-W198.203	0.21	3.75E+01	0.00E+00	6.14E-01	1.70E+01	3.75E+00	7.00E+01	0.00E+00
IN	IN-W198.804	32.82	5.92E+01	0.00E+00	9.69E-01	2.68E+01	5.93E+00	1.10E+02	0.00E+00
IN	IN-W199.1039	0.89	0.00E+00	0.00E+00	1.10E-01	3.04E+00	6.70E-01	1.25E+01	0.00E+00
IN	IN-W199.209	0.21	0.00E+00	0.00E+00	2.57E+00	7.11E+01	1.57E+01	2.92E+02	0.00E+00
IN	IN-W202.1092	0.89	0.00E+00	0.00E+00	7.20E-03	2.00E-01	4.40E-02	8.21E-01	0.00E+00
IN	IN-W202.224	109.62	0.00E+00	0.00E+00	8.88E-01	2.46E+01	5.43E+00	1.01E+02	0.00E+00
IN	IN-W203.1081	0.68	1.28E-01	0.00E+00	5.78E-01	1.38E-02	6.54E-03	1.69E-03	0.00E+00
IN	IN-W203.210	73.22	1.37E+01	0.00E+00	6.22E+01	1.48E+00	7.04E-01	1.82E-01	0.00E+00
IN	IN-W203.211	3.33	1.25E+00	0.00E+00	5.66E+00	1.35E-01	6.40E-02	1.65E-02	0.00E+00
IN	IN-W203.212	0.21	1.30E-02	0.00E+00	5.89E-02	1.41E-03	6.67E-04	1.72E-04	0.00E+00
IN	IN-W204.215	0.89	7.56E+00	0.00E+00	7.68E+00	1.22E-02	4.01E-03	1.80E-01	0.00E+00
IN	IN-W204.216	1.66	1.42E+01	0.00E+00	1.44E+01	2.29E-02	7.52E-03	3.36E-01	0.00E+00
IN	IN-W204.217	0.21	5.90E-01	0.00E+00	5.99E-01	9.55E-04	3.13E-04	1.40E-02	0.00E+00
IN	IN-W205.1086	0.83	0.00E+00	0.00E+00	1.49E-03	4.12E-02	9.09E-03	1.69E-01	0.00E+00
IN	IN-W205.1087	0.21	0.00E+00	0.00E+00	3.72E-02	1.03E+00	2.27E-01	4.24E+00	0.00E+00
IN	IN-W205.220	0.68	0.00E+00	0.00E+00	1.22E-03	3.37E-02	7.43E-03	1.39E-01	0.00E+00
IN	IN-W206.935	10.89	4.82E-01	0.00E+00	5.41E-01	1.50E+01	3.31E+00	6.17E+01	0.00E+00
IN	IN-W206.936	22.46	1.66E+01	0.00E+00	1.86E+01	5.15E+02	1.14E+02	2.12E+03	0.00E+00
IN	IN-W207.238	0.21	0.00E+00	0.00E+00	1.65E+00	4.56E+01	1.01E+01	1.88E+02	0.00E+00
IN	IN-W207.980	0.89	0.00E+00	0.00E+00	4.22E-01	1.17E+01	2.58E+00	4.81E+01	0.00E+00
IN	IN-W207.981	0.42	0.00E+00	0.00E+00	1.97E-01	5.47E+00	1.21E+00	2.25E+01	0.00E+00
IN	IN-W208.242	1.46	2.13E+01	0.00E+00	2.31E+00	6.41E+01	1.42E+01	2.64E+02	0.00E+00
IN	IN-W208.988	2.34	2.06E+00	0.00E+00	2.24E-01	6.20E+00	1.37E+00	2.55E+01	0.00E+00
IN	IN-W209.244	3.12	6.70E-01	0.00E+00	1.10E+01	3.06E+02	6.76E+01	1.26E+03	0.00E+00
IN	IN-W209.994	10.27	1.32E-01	0.00E+00	2.18E+00	6.04E+01	1.33E+01	2.49E+02	0.00E+00
IN	IN-W210.1001	1.10	0.00E+00	0.00E+00	8.83E-02	2.45E+00	5.40E-01	1.01E+01	0.00E+00
IN	IN-W210.247	0.21	0.00E+00	0.00E+00	2.79E-01	7.74E+00	1.71E+00	3.18E+01	0.00E+00
IN	IN-W211.1009	98.47	8.53E+01	0.00E+00	3.64E+01	1.01E+03	2.23E+02	4.15E+03	0.00E+00
IN	IN-W211.249	22.46	3.24E+02	0.00E+00	1.38E+02	3.83E+03	8.46E+02	1.58E+04	0.00E+00
IN	IN-W212.1058	3.44	1.03E-01	0.00E+00	4.75E-02	1.32E+00	2.90E-01	5.41E+00	0.00E+00
IN	IN-W212.251	150.59	7.50E+01	0.00E+00	3.47E+01	9.60E+02	2.12E+02	3.95E+03	0.00E+00
IN	IN-W213.1069	1.93	0.00E+00	0.00E+00	1.01E+03	5.96E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W213.252	0.42	0.00E+00	0.00E+00	3.62E+03	2.14E+01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W213.253	0.21	0.00E+00	0.00E+00	3.62E+01	2.14E-01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W214.1075	0.62	0.00E+00	0.00E+00	4.51E+02	3.93E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W214.755	0.68	0.00E+00	0.00E+00	4.92E+02	4.29E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W214.756	0.21	0.00E+00	0.00E+00	5.01E+01	4.36E-01	0.00E+00	0.00E+00	0.00E+00

M

TABLE - 1
SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

	Waste	Scaled	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
SITE	Stream ID#	Volume (m3)	Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
IN	IN-W216.875	1478.88	4.26E+04	0.00E+00	5.67E+01	1.57E+03	3.47E+02	6.46E+03	0.00E+00
IN	IN-W216.98	555.65	1.60E+04	0.00E+00	2.13E+01	5.90E+02	1.30E+02	2.43E+03	0.00E+00
IN	IN-W216.99	255.01	1.47E+04	0.00E+00	1.95E+01	5.42E+02	1.20E+02	2.23E+03	0.00E+00
IN	IN-W218.109	183.87	3.17E+02	0.00E+00	1.91E+00	5.30E+01	1.17E+01	2.18E+02	0.00E+00
IN	IN-W218.909	101.91	8.77E+01	0.00E+00	3.30E-01	1.47E+01	3.24E+00	6.04E+01	0.00E+00
IN	IN-W220.114	122.80	8.39E+02	0.00E+00	2.49E+00	7.42E+01	1.59E+01	2.84E+02	0.00E+00
IN	IN-W220.925	443.04	3.03E+03	0.00E+00	8.98E+00	2.68E+02	5.74E+01	1.03E+03	0.00E+00
IN	IN-W221.113	11.65	0.00E+00	0.00E+00	6.71E-01	1.86E+01	4.10E+00	7.65E+01	0.00E+00
IN	IN-W221.927	3.65	0.00E+00	0.00E+00	2.10E-01	5.82E+00	1.29E+00	2.40E+01	0.00E+00
IN	IN-W222.116	24.75	3.71E-01	0.00E+00	7.19E+00	1.99E+02	4.40E+01	8.20E+02	0.00E+00
IN	IN-W222.117	39.10	1.17E+00	0.00E+00	2.27E+01	6.30E+02	1.39E+02	2.59E+03	0.00E+00
IN	IN-W222.965	10.61	1.59E-01	0.00E+00	3.08E+00	8.54E+01	1.89E+01	3.52E+02	0.00E+00
IN	IN-W225.127	21.63	9.85E-02	0.00E+00	1.80E-01	4.98E+00	1.10E+00	2.05E+01	0.00E+00
IN	IN-W225.800	1.10	4.99E-03	0.00E+00	9.11E-03	2.53E-01	5.57E-02	1.04E+00	0.00E+00
IN	IN-W228.101	287.33	1.18E+02	0.00E+00	8.74E-01	2.42E+01	5.35E+00	9.96E+01	0.00E+00
IN	IN-W228.102	198.85	1.63E+02	0.00E+00	1.21E+00	3.35E+01	7.40E+00	1.38E+02	0.00E+00
IN	IN-W228.103	31.82	4.36E+00	0.00E+00	3.23E-02	8.94E-01	1.97E-01	3.68E+00	0.00E+00
IN	IN-W228.883	608.82	2.50E+02	0.00E+00	1.85E+00	5.13E+01	1.13E+01	2.11E+02	0.00E+00
IN	IN-W230.229	4.27	2.41E-02	0.00E+00	1.19E+00	3.31E+01	7.31E+00	1.36E+02	0.00E+00
IN	IN-W230.940	14.77	8.32E-02	0.00E+00	4.13E+00	1.14E+02	2.53E+01	4.71E+02	0.00E+00
IN	IN-W240.272	167.65	6.48E+01	0.00E+00	1.32E+01	3.67E+02	8.10E+01	1.51E+03	0.00E+00
IN	IN-W240.931	1.93	7.46E-01	0.00E+00	1.52E-01	4.22E+00	9.32E-01	1.74E+01	0.00E+00
IN	IN-W243.274	174.30	2.95E+01	0.00E+00	1.24E+01	3.43E+02	7.58E+01	1.41E+03	0.00E+00
IN	IN-W243.275	7.28	4.93E+00	0.00E+00	2.07E+00	5.73E+01	1.27E+01	2.36E+02	0.00E+00
IN	IN-W243.808	46.06	7.79E+00	0.00E+00	3.27E+00	9.07E+01	2.00E+01	3.73E+02	0.00E+00
IN	IN-W245.1034	0.21	5.63E-03	0.00E+00	5.94E-02	1.65E+00	3.63E-01	6.77E+00	0.00E+00
IN	IN-W245.301	37.51	5.08E-01	0.00E+00	5.36E+00	1.48E+02	3.28E+01	6.11E+02	0.00E+00
IN	IN-W245.302	133.74	1.81E+00	0.00E+00	1.91E+01	5.29E+02	1.17E+02	2.18E+03	0.00E+00
IN	IN-W247.1038	0.21	2.39E-03	0.00E+00	2.86E-02	7.94E-01	1.75E-01	3.26E+00	0.00E+00
IN	IN-W247.523	173.68	9.96E-01	0.00E+00	1.20E+01	3.31E+02	7.31E+01	1.36E+03	0.00E+00
IN	IN-W247.810	27.51	1.58E-01	0.00E+00	1.89E+00	5.25E+01	1.16E+01	2.16E+02	0.00E+00
IN	IN-W249.1071	2.29	0.00E+00	0.00E+00	1.28E+03	9.02E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W249.527	1.10	0.00E+00	0.00E+00	6.15E+02	4.32E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W249.528	0.21	0.00E+00	0.00E+00	3.89E+01	2.73E-01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W250.259	14.07	1.25E-02	0.00E+00	3.09E+00	8.58E+01	1.89E+01	3.53E+02	0.00E+00
IN	IN-W250.941	50.96	4.54E-02	0.00E+00	1.12E+01	3.11E+02	6.86E+01	1.28E+03	0.00E+00
IN	IN-W252.1000	0.21	5.95E+00	0.00E+00	5.01E+00	1.39E+02	3.07E+01	5.72E+02	0.00E+00
IN	IN-W252.283	117.73	3.37E+01	0.00E+00	2.84E+01	7.86E+02	1.74E+02	3.24E+03	0.00E+00
IN	IN-W252.811	32.82	9.39E+00	0.00E+00	7.91E+00	2.19E+02	4.84E+01	9.02E+02	0.00E+00
IN	IN-W254.1044	0.21	0.00E+00	0.00E+00	3.00E+00	8.31E+01	1.83E+01	3.42E+02	0.00E+00

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TABLE - 1
SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

SITE	Waste Stream ID#	Scaled Volume (m3)	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
IN	IN-W254.289	2.34	0.00E+00	0.00E+00	3.38E-01	9.36E+00	2.07E+00	3.85E+01	0.00E+00
IN	IN-W254.290	7.28	0.00E+00	0.00E+00	1.05E+00	2.91E+01	6.42E+00	1.20E+02	0.00E+00
IN	IN-W256.1062	20.59	1.22E+00	0.00E+00	1.91E+03	1.33E+01	2.78E+01	0.00E+00	0.00E+00
IN	IN-W256.295	5.99	3.56E-01	0.00E+00	5.55E+02	3.87E+00	8.08E+00	0.00E+00	0.00E+00
IN	IN-W257.558	0.21	0.00E+00	0.00E+00	1.14E-02	3.16E-01	6.97E-02	1.30E+00	0.00E+00
IN	IN-W257.947	0.68	0.00E+00	0.00E+00	1.86E-02	5.17E-01	1.14E-01	2.13E+00	0.00E+00
IN	IN-W259.552	10.06	0.00E+00	0.00E+00	0.00E+00	2.27E+00	2.44E-01	0.00E+00	0.00E+00
IN	IN-W259.920	2.50	0.00E+00	0.00E+00	0.00E+00	3.75E+00	4.04E-01	0.00E+00	0.00E+00
IN	IN-W263.520	14.35	0.00E+00	0.00E+00	1.98E+01	8.99E-01	1.39E-03	8.89E-02	0.00E+00
IN	IN-W265.516	7.92	8.49E-02	0.00E+00	2.70E-01	7.49E+00	1.63E+00	3.08E+01	0.00E+00
IN	IN-W265.517	0.62	6.69E-01	0.00E+00	2.13E+00	5.90E+01	1.30E+01	2.43E+02	0.00E+00
IN	IN-W267.1005	1.10	0.00E+00	0.00E+00	1.57E+00	4.35E+01	9.59E+00	1.79E+02	0.00E+00
IN	IN-W267.514	1.25	0.00E+00	0.00E+00	3.57E+00	9.89E+01	2.18E+01	4.07E+02	0.00E+00
IN	IN-W269.510	5.99	3.80E+01	0.00E+00	3.77E+01	3.24E+02	3.26E+01	8.38E-01	0.00E+00
IN	IN-W269.535	20.80	1.32E+02	0.00E+00	1.31E+02	1.12E+03	1.13E+02	2.91E+00	0.00E+00
IN	IN-W271.532	0.89	0.00E+00	0.00E+00	0.00E+00	1.33E+01	2.99E+01	0.00E+00	0.00E+00
IN	IN-W271.533	0.21	0.00E+00	0.00E+00	0.00E+00	1.04E+00	2.33E+00	0.00E+00	0.00E+00
IN	IN-W272.504	0.89	0.00E+00	0.00E+00	7.06E-01	1.96E+01	4.32E+00	8.04E+01	0.00E+00
IN	IN-W272.974	1.66	0.00E+00	0.00E+00	1.32E+00	3.66E+01	8.08E+00	1.51E+02	0.00E+00
IN	IN-W275.502	1.72	1.03E-01	0.00E+00	2.68E-01	7.44E+00	1.64E+00	3.06E+01	0.00E+00
IN	IN-W275.967	5.20	3.13E-01	0.00E+00	8.11E-01	2.25E+01	4.96E+00	9.25E+01	0.00E+00
IN	IN-W276.500	86.75	1.39E+01	0.00E+00	1.11E+01	3.07E+02	6.76E+01	1.26E+03	0.00E+00
IN	IN-W276.966	313.46	5.04E+01	0.00E+00	4.00E+01	1.11E+03	2.44E+02	4.56E+03	0.00E+00
IN	IN-W278.1090	0.89	0.00E+00	0.00E+00	5.70E-03	1.58E-01	3.49E-02	6.50E-01	0.00E+00
IN	IN-W278.495	4.16	0.00E+00	0.00E+00	8.90E-02	2.47E+00	5.44E-01	1.01E+01	0.00E+00
IN	IN-W280.1066	28.50	2.91E-01	0.00E+00	1.81E+04	1.19E+02	2.04E-01	1.30E+01	0.00E+00
IN	IN-W280.448	8.34	8.52E-02	0.00E+00	5.30E+03	3.47E+01	5.98E-02	3.82E+00	0.00E+00
IN	IN-W280.449	0.21	7.08E-04	0.00E+00	4.41E+01	2.88E-01	4.97E-04	3.17E-02	0.00E+00
IN	IN-W281.487	317.82	0.00E+00	0.00E+00	4.58E+03	2.16E+01	1.09E-02	6.99E-01	0.00E+00
IN	IN-W281.488	0.62	0.00E+00	0.00E+00	8.98E+02	4.24E+00	2.15E-03	1.37E-01	0.00E+00
IN	IN-W283.481	0.21	0.00E+00	0.00E+00	5.63E-02	1.56E+00	3.44E-01	6.42E+00	0.00E+00
IN	IN-W283.534	0.68	0.00E+00	0.00E+00	1.84E-01	5.11E+00	1.13E+00	2.10E+01	0.00E+00
IN	IN-W283.963	0.21	0.00E+00	0.00E+00	1.88E-01	5.20E+00	1.15E+00	2.14E+01	0.00E+00
IN	IN-W285.471	63.02	0.00E+00	0.00E+00	0.00E+00	1.66E+01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W285.815	2.34	0.00E+00	0.00E+00	0.00E+00	6.19E-01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W287.460	211.95	4.68E-01	0.00E+00	0.00E+00	5.04E+01	5.84E+02	3.80E+01	0.00E+00
IN	IN-W289.466	25.38	1.31E+01	0.00E+00	0.00E+00	1.38E+02	0.00E+00	0.00E+00	0.00E+00
IN	IN-W291.454	0.68	3.95E-01	0.00E+00	0.00E+00	1.36E-01	5.93E-01	0.00E+00	0.00E+00
IN	IN-W291.455	1.46	8.45E+01	0.00E+00	0.00E+00	2.91E+01	1.27E+02	0.00E+00	0.00E+00
IN	IN-W291.456	634.40	3.68E+02	0.00E+00	0.00E+00	1.27E+02	5.53E+02	0.00E+00	0.00E+00

TABLE - 1

SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

SITE	Waste Stream ID#	Scaled Volume (m3)	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
			Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
IN	IN-W294.1057	0.42	1.16E-01	0.00E+00	1.45E-01	4.03E+00	8.88E-01	1.66E+01	0.00E+00
IN	IN-W294.342	406.85	3.40E+01	0.00E+00	4.26E+01	1.18E+03	2.61E+02	4.86E+03	0.00E+00
IN	IN-W294.814	33.50	2.80E+00	0.00E+00	3.51E+00	9.73E+01	2.15E+01	4.00E+02	0.00E+00
IN	IN-W296.327	3450.30	9.73E+01	0.00E+00	8.37E+01	2.32E+03	5.12E+02	9.54E+03	0.00E+00
IN	IN-W296.329	520.21	4.89E+01	0.00E+00	4.20E+01	1.17E+03	2.57E+02	4.79E+03	0.00E+00
IN	IN-W296.813	47.99	1.35E+00	0.00E+00	1.16E+00	3.22E+01	7.12E+00	1.33E+02	0.00E+00
IN	IN-W298.317	54.70	7.31E+01	0.00E+00	2.19E+01	6.08E+02	1.34E+02	2.50E+03	0.00E+00
IN	IN-W298.812	15.37	2.05E+01	0.00E+00	6.16E+00	1.71E+02	3.77E+01	7.03E+02	0.00E+00
IN	IN-W298.979	0.42	1.85E+00	0.00E+00	5.56E-01	1.54E+01	3.40E+00	6.34E+01	0.00E+00
IN	IN-W300.308	1509.46	2.05E+02	0.00E+00	8.83E+01	2.45E+03	5.40E+02	1.01E+04	0.00E+00
IN	IN-W300.930	4.69	6.36E-01	0.00E+00	2.74E-01	7.60E+00	1.68E+00	3.13E+01	0.00E+00
IN	IN-W302.299	23.45	2.05E+01	0.00E+00	0.00E+00	3.08E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W302.913	84.86	7.43E+01	0.00E+00	0.00E+00	1.11E+01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W304.860	8.75	0.00E+00	0.00E+00	4.77E+02	2.49E+00	5.13E-01	9.79E-01	0.00E+00
IN	IN-W304.861	59.07	0.00E+00	0.00E+00	3.22E+03	1.68E+01	3.46E+00	6.61E+00	0.00E+00
IN	IN-W305.1068	37.44	0.00E+00	0.00E+00	3.61E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W305.828	10.68	0.00E+00	0.00E+00	1.03E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W308.618	503.57	3.17E+03	0.00E+00	1.53E+02	1.13E+03	2.53E+01	4.72E+02	0.00E+00
IN	IN-W308.816	864.91	8.18E+02	0.00E+00	3.95E+01	2.92E+02	6.52E+00	1.21E+02	0.00E+00
IN	IN-W309.609	108.58	1.25E+01	0.00E+00	3.00E+00	8.31E+01	1.83E+01	3.42E+02	0.00E+00
IN	IN-W309.610	352.77	2.03E+01	0.00E+00	4.87E+00	1.35E+02	2.98E+01	5.55E+02	0.00E+00
IN	IN-W311.1013	5.41	6.81E+02	0.00E+00	6.51E+00	1.80E+02	3.98E+01	7.42E+02	0.00E+00
IN	IN-W311.604	1.72	2.17E+02	0.00E+00	2.07E+00	5.74E+01	1.27E+01	2.36E+02	0.00E+00
IN	IN-W312.602	1.10	0.00E+00	0.00E+00	1.78E+00	4.92E+01	1.09E+01	2.02E+02	0.00E+00
IN	IN-W312.942	2.70	0.00E+00	0.00E+00	4.38E+00	1.21E+02	2.68E+01	4.99E+02	0.00E+00
IN	IN-W314.1017	1.04	9.73E-02	0.00E+00	1.46E+00	4.03E+01	8.90E+00	1.66E+02	0.00E+00
IN	IN-W314.606	0.68	6.37E-02	0.00E+00	9.52E-01	2.64E+01	5.82E+00	1.09E+02	0.00E+00
IN	IN-W315.601	0.42	2.99E+01	0.00E+00	1.14E-02	3.16E-01	6.97E-02	1.30E+00	0.00E+00
IN	IN-W317.1028	0.21	1.26E+00	0.00E+00	1.44E-01	3.99E+00	8.80E-01	1.64E+01	0.00E+00
IN	IN-W317.757	39.10	1.19E+02	0.00E+00	1.35E+01	3.75E+02	8.28E+01	1.54E+03	0.00E+00
IN	IN-W317.758	11.51	3.50E+01	0.00E+00	3.98E+00	1.10E+02	2.44E+01	4.54E+02	0.00E+00
IN	IN-W319.583	0.21	0.00E+00	0.00E+00	1.24E+01	3.43E+02	7.57E+01	1.41E+03	0.00E+00
IN	IN-W319.584	0.68	0.00E+00	0.00E+00	4.05E-01	1.12E+01	2.48E+00	4.62E+01	0.00E+00
IN	IN-W321.1023	1.30	0.00E+00	0.00E+00	1.57E+00	4.35E+01	9.60E+00	1.79E+02	0.00E+00
IN	IN-W321.578	0.21	0.00E+00	0.00E+00	2.50E+01	6.94E+02	1.53E+02	2.85E+03	0.00E+00
IN	IN-W322.851	0.89	0.00E+00	0.00E+00	0.00E+00	1.20E+01	2.42E+00	0.00E+00	0.00E+00
IN	IN-W322.952	1.66	0.00E+00	0.00E+00	0.00E+00	2.24E+01	4.53E+00	0.00E+00	0.00E+00
IN	IN-W323.562	0.89	0.00E+00	0.00E+00	1.82E+00	3.28E-01	0.00E+00	2.61E+00	0.00E+00
IN	IN-W325.1076	0.42	0.00E+00	0.00E+00	1.27E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W325.679	0.68	0.00E+00	0.00E+00	2.07E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE - 1
SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

	Waste	Scaled	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM					
SITE	Stream ID#	Volume (m3)	Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
IN	IN-W327.1085	3.54	0.00E+00	0.00E+00	7.43E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W327.735	1.30	0.00E+00	0.00E+00	2.74E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W329.681	0.89	0.00E+00	0.00E+00	1.02E+02	4.37E-02	0.00E+00	0.00E+00	0.00E+00
IN	IN-W329.682	0.21	0.00E+00	0.00E+00	1.60E+02	6.82E-02	0.00E+00	0.00E+00	0.00E+00
IN	IN-W330.677	6.03	0.00E+00	0.00E+00	3.67E+02	2.88E-03	1.46E-03	9.35E-02	0.00E+00
IN	IN-W330.678	1.93	0.00E+00	0.00E+00	1.17E+02	9.21E-04	4.68E-04	2.99E-02	0.00E+00
IN	IN-W332.661	0.68	0.00E+00	0.00E+00	6.89E+00	4.88E-02	0.00E+00	0.00E+00	0.00E+00
IN	IN-W332.962	0.83	0.00E+00	0.00E+00	8.42E+00	5.97E-02	0.00E+00	0.00E+00	0.00E+00
IN	IN-W334.675	1.51	0.00E+00	0.00E+00	0.00E+00	1.30E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W334.961	4.58	0.00E+00	0.00E+00	0.00E+00	3.93E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W336.660	4.16	0.00E+00	0.00E+00	0.00E+00	5.68E-01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W336.820	0.68	0.00E+00	0.00E+00	0.00E+00	9.29E-02	0.00E+00	0.00E+00	0.00E+00
IN	IN-W338.657	0.89	0.00E+00	0.00E+00	0.00E+00	3.83E-01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W338.956	1.04	0.00E+00	0.00E+00	0.00E+00	4.48E-01	0.00E+00	0.00E+00	0.00E+00
IN	IN-W339.655	2.14	0.00E+00	0.00E+00	0.00E+00	2.17E+01	8.60E-02	0.00E+00	0.00E+00
IN	IN-W339.955	7.07	0.00E+00	0.00E+00	0.00E+00	7.19E+01	2.85E-01	0.00E+00	0.00E+00
IN	IN-W341.671	0.21	0.00E+00	0.00E+00	0.00E+00	1.80E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W341.954	0.68	0.00E+00	0.00E+00	0.00E+00	5.89E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W342.652	0.68	5.65E+00	0.00E+00	0.00E+00	4.05E-02	0.00E+00	0.00E+00	0.00E+00
IN	IN-W342.953	0.42	3.45E+00	0.00E+00	0.00E+00	2.48E-02	0.00E+00	0.00E+00	0.00E+00
IN	IN-W345.669	14.35	9.51E+01	0.00E+00	2.25E+01	1.79E+01	1.10E+01	0.00E+00	0.00E+00
IN	IN-W345.819	0.89	5.89E+00	0.00E+00	1.39E+00	1.11E+00	6.84E-01	0.00E+00	0.00E+00
IN	IN-W347.646	51.79	2.06E+00	0.00E+00	0.00E+00	5.84E+01	1.04E+02	0.00E+00	0.00E+00
IN	IN-W347.818	3.44	1.37E-01	0.00E+00	0.00E+00	3.88E+00	6.91E+00	0.00E+00	0.00E+00
IN	IN-W348.1012	2.34	3.28E-02	0.00E+00	3.19E+00	8.84E+01	1.95E+01	3.64E+02	0.00E+00
IN	IN-W348.846	4.16	1.16E-01	0.00E+00	1.13E+01	3.14E+02	6.92E+01	1.29E+03	0.00E+00
IN	IN-W350.650	0.68	0.00E+00	0.00E+00	0.00E+00	3.60E+01	1.07E+02	0.00E+00	0.00E+00
IN	IN-W350.923	0.21	0.00E+00	0.00E+00	0.00E+00	1.10E+01	3.27E+01	0.00E+00	0.00E+00
IN	IN-W351.648	0.89	0.00E+00	0.00E+00	0.00E+00	1.43E+00	4.79E+00	0.00E+00	0.00E+00
IN	IN-W351.922	1.25	0.00E+00	0.00E+00	0.00E+00	2.01E+00	6.72E+00	0.00E+00	0.00E+00
IN	IN-W353.859	0.68	0.00E+00	0.00E+00	0.00E+00	7.53E-02	0.00E+00	0.00E+00	0.00E+00
IN	IN-W353.917	0.21	0.00E+00	0.00E+00	0.00E+00	2.30E-02	0.00E+00	0.00E+00	0.00E+00
IN	IN-W354.1016	0.21	0.00E+00	0.00E+00	3.99E-02	1.11E+00	2.44E-01	4.55E+00	0.00E+00
IN	IN-W354.858	0.68	0.00E+00	0.00E+00	1.31E-01	3.62E+00	7.98E-01	1.49E+01	0.00E+00
IN	IN-W355.1015	1.04	0.00E+00	0.00E+00	1.01E+00	2.79E+01	6.16E+00	1.15E+02	0.00E+00
IN	IN-W355.857	0.89	0.00E+00	0.00E+00	8.60E-01	2.38E+01	5.26E+00	9.81E+01	0.00E+00
IN	IN-W356.1014	3.74	6.31E+01	0.00E+00	3.62E-01	1.00E+01	2.22E+00	4.13E+01	0.00E+00
IN	IN-W356.856	1.30	2.20E+01	0.00E+00	1.26E-01	3.50E+00	7.72E-01	1.44E+01	0.00E+00
IN	IN-W357.1022	0.68	0.00E+00	0.00E+00	9.89E-03	2.74E-01	6.05E-02	1.13E+00	0.00E+00
IN	IN-W357.850	0.21	0.00E+00	0.00E+00	6.05E-03	1.68E-01	3.70E-02	6.89E-01	0.00E+00

B2-10

TABLE - 1
SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

	Waste	Scaled	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
SITE	Stream ID#	Volume (m3)	Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
IN	IN-W358.854	0.89	0.00E+00	0.00E+00	5.56E+02	2.47E+00	4.62E+00	0.00E+00	0.00E+00
IN	IN-W358.855	3.33	0.00E+00	0.00E+00	2.08E+03	9.26E+00	1.73E+01	0.00E+00	0.00E+00
IN	IN-W358.948	0.21	0.00E+00	0.00E+00	4.34E+02	1.93E+00	3.61E+00	0.00E+00	0.00E+00
IN	IN-W359.853	0.83	0.00E+00	0.00E+00	1.10E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
IN	IN-W361.1021	1.51	1.10E-02	0.00E+00	7.65E-01	2.12E+01	4.68E+00	8.73E+01	0.00E+00
IN	IN-W361.849	2.08	3.04E-02	0.00E+00	2.10E+00	5.83E+01	1.29E+01	2.40E+02	0.00E+00
IN	IN-W362.1020	5.37	0.00E+00	0.00E+00	8.63E+00	2.39E+02	5.28E+01	9.84E+02	0.00E+00
IN	IN-W362.848	8.74	0.00E+00	0.00E+00	2.81E+01	7.78E+02	1.72E+02	3.20E+03	0.00E+00
IN	IN-W363.1019	0.89	0.00E+00	0.00E+00	5.76E-01	1.60E+01	3.52E+00	6.57E+01	0.00E+00
IN	IN-W363.847	1.04	0.00E+00	0.00E+00	1.35E+00	3.74E+01	8.25E+00	1.54E+02	0.00E+00
IN	IN-W364.1011	0.89	0.00E+00	0.00E+00	1.43E+00	3.96E+01	8.74E+00	1.63E+02	0.00E+00
IN	IN-W364.844	0.62	0.00E+00	0.00E+00	2.01E+00	5.56E+01	1.23E+01	2.29E+02	0.00E+00
IN	IN-W365.1010	1.30	9.68E+01	0.00E+00	5.77E-01	1.60E+01	3.53E+00	6.58E+01	0.00E+00
IN	IN-W365.842	1.04	2.57E+02	0.00E+00	1.53E+00	4.25E+01	9.38E+00	1.75E+02	0.00E+00
IN	IN-W366.1004	2.08	3.52E-01	0.00E+00	5.01E-01	1.39E+01	3.06E+00	5.71E+01	0.00E+00
IN	IN-W366.841	1.10	1.86E-01	0.00E+00	2.64E-01	7.31E+00	1.61E+00	3.01E+01	0.00E+00
IN.	IN-W367.840	0.21	0.00E+00	0.00E+00	1.03E+01	2.85E+02	6.29E+01	1.17E+03	0.00E+00
IN	IN-W367.973	4.69	0.00E+00	0.00E+00	2.32E+00	6.42E+01	1.42E+01	2.64E+02	0.00E+00
IN	IN-W368.839	0.21	0.00E+00	0.00E+00	2.64E+00	7.31E+01	1.61E+01	3.01E+02	0.00E+00
IN	IN-W368.971	1.10	0.00E+00	0.00E+00	1.39E-01	3.85E+00	8.50E-01	1.58E+01	0.00E+00
IN	IN-W369.837	3.23	5.43E-01	0.00E+00	7.35E-01	2.04E+01	4.49E+00	8.38E+01	0.00E+00
IN	IN-W369.970	9.98	1.68E+00	0.00E+00	2.27E+00	6.29E+01	1.39E+01	2.59E+02	0.00E+00
IN	IN-W370.836	15.16	0.00E+00	0.00E+00	4.22E+00	1.17E+02	2.58E+01	4.81E+02	0.00E+00
IN	IN-W370.929	53.46	0.00E+00	0.00E+00	1.49E+01	4.12E+02	9.10E+01	1.70E+03	0.00E+00
IN	IN-W371.1018	0.21	1.16E+02	0.00E+00	3.23E-01	8.95E+00	1.98E+00	3.68E+01	0.00E+00
IN	IN-W371.831	0.68	3.79E+02	0.00E+00	1.06E+00	2.93E+01	6.46E+00	1.20E+02	0.00E+00
IN	IN-W373.1003	0.68	0.00E+00	0.00E+00	1.24E+00	3.43E+01	7.56E+00	1.41E+02	0.00E+00
IN	IN-W373.830	0.21	0.00E+00	0.00E+00	7.56E-01	2.10E+01	4.63E+00	8.62E+01	0.00E+00
IN	IN-W374.1091	2.08	0.00E+00	0.00E+00	5.32E-01	1.47E+01	3.25E+00	6.07E+01	0.00E+00
IN	IN-W374.829	2.34	0.00E+00	0.00E+00	1.50E-01	4.15E+00	9.17E-01	1.71E+01	0.00E+00
IN	IN-W375.1096	4.48	0.00E+00	0.00E+00	3.38E-02	9.38E-01	2.07E-01	3.86E+00	0.00E+00
IN	IN-W375.827	7.90	0.00E+00	0.00E+00	1.19E-01	3.31E+00	7.30E-01	1.36E+01	0.00E+00
LA	LA-M002	6706.45	7.02E+03	0.00E+00	2.06E+02	4.68E+03	0.00E+00	1.12E-01	3.88E+01
LA	LA-T001	3787.32	0.00E+00	8.14E-03	1.91E+03	1.33E+03	6.21E-01	1.09E+01	0.00E+00
LA	LA-T002	193.71	9.07E+01	0.00E+00	8.55E+00	4.33E+02	0.00E+00	0.00E+00	0.00E+00
LA	LA-T004	12629.26	4.68E+01	4.25E+02	2.55E+05	1.17E+04	2.84E+01	6.03E+02	1.13E+02
LA	LA-T005	8885.76	8.79E+01	8.19E+02	1.98E+05	4.64E+04	1.00E+02	1.71E+03	7.56E+01
LA	LA-T006	543.32	8.38E+01	0.00E+00	3.15E+04	8.64E+02	2.37E+00	5.17E+01	5.44E+00
LA	LA-T007	198.91	0.00E+00	0.00E+00	3.53E+02	1.71E+03	1.12E-01	1.87E+00	1.95E+00
LA	LA-T008	302.83	3.61E-03	0.00E+00	3.53E+02	1.72E+02	2.01E-03	1.24E-01	0.00E+00

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B2-11

TABLE - 1

SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

	Waste	Scaled	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
SITE	Stream ID#	Volume (m3)	Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
LA	LA-T009	438.06	0.00E+00	0.00E+00	1.79E+01	5.24E+02	1.40E+00	4.28E+01	0.00E+00
LA	LA-W001	3126.19	2.74E-03	0.00E+00	5.14E+03	2.42E+03	7.14E-01	1.13E+01	1.07E+01
LA	LA-W003	4968.84	3.42E+02	0.00E+00	2.97E+02	3.30E+03	0.00E+00	3.42E-03	0.00E+00
LA	LA-W004	4880.50	6.00E+01	0.00E+00	4.02E+04	3.04E+04	7.56E+01	1.26E+03	4.68E+01
LA	LA-W005	4828.92	7.97E+01	0.00E+00	8.01E+03	1.90E+05	4.98E+02	8.81E+03	4.68E+01
LA	LA-W006	6097.49	3.36E+04	0.00E+00	1.62E+04	6.31E+04	1.53E+02	2.72E+03	5.64E+01
LA	LA-W009	1989.53	1.21E+03	0.00E+00	1.23E+00	1.19E+02	2.84E-01	4.49E+00	0.00E+00
LA	LA-W066	1.89	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
LA	LA-W067	8.94	1.46E-01	4.61E+00	4.76E+00	3.00E+00	0.00E+00	0.00E+00	0.00E+00
LA	LA-W068	0.42	0.00E+00	0.00E+00	1.76E-01	6.11E-01	0.00E+00	0.00E+00	0.00E+00
LL	LL-M001	119.39	1.94E+02	3.79E+02	3.16E+02	7.52E+01	5.27E+01	1.46E+03	0.00E+00
LL	LL-T001	52.80	3.44E+01	0.00E+00	0.00E+00	3.34E+01	1.86E+01	5.01E+02	0.00E+00
LL	LL-T002	3368.07	3.71E+03	0.00E+00	1.15E+03	2.41E+03	1.62E+03	4.54E+04	0.00E+00
LL	LL-T003	917.30	8.32E+01	0.00E+00	7.50E+01	3.44E+01	3.79E+01	1.03E+03	0.00E+00
LL	LL-T004	20.54	3.59E+01	0.00E+00	1.04E+01	1.25E+01	1.61E+01	4.49E+02	0.00E+00
LL	LL-T005	228.68	7.41E+01	9.85E+02	4.20E+01	1.67E+01	2.04E+01	5.65E+02	0.00E+00
LL	LL-W018	176.59	1.13E+00	0.00E+00	0.00E+00	4.40E-01	1.67E+00	4.45E+01	0.00E+00
LL	LL-W019	39.49	3.04E+01	0.00E+00	0.00E+00	9.15E+00	1.23E+01	3.40E+02	0.00E+00
MD	MD-M001	0.42	0.00E+00	0.00E+00	4.26E-01	9.63E-03	0.00E+00	0.00E+00	0.00E+00
MD	MD-T001	4.16	0.00E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MD	MD-T003	146.94	0.00E+00	0.00E+00	2.42E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MD	MD-T004	26.84	0.00E+00	0.00E+00	8.68E+02	7.72E+00	0.00E+00	0.00E+00	0.00E+00
MD	MD-T005	30.24	0.00E+00	0.00E+00	2.74E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MD	MD-T006	58.59	0.00E+00	0.00E+00	1.97E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MD	MD-T007	23.89	0.00E+00	0.00E+00	1.93E+02	7.34E+00	0.00E+00	0.00E+00	0.00E+00
MD	MD-T008	3.74	0.00E+00	0.00E+00	6.40E+01	8.67E-02	0.00E+00	0.00E+00	0.00E+00
MD	MD-T009	0.21	0.00E+00	0.00E+00	4.04E+00	1.35E+00	0.00E+00	0.00E+00	0.00E+00
MD	MD-T010	0.42	0.00E+00	0.00E+00	2.13E-01	4.82E-03	0.00E+00	0.00E+00	0.00E+00
MD	MD-T012	0.62	0.00E+00	0.00E+00	7.64E+00	4.87E+00	0.00E+00	0.00E+00	0.00E+00
MD	MD-W002	1.87	0.00E+00	0.00E+00	8.50E+00	3.38E-02	0.00E+00	0.00E+00	0.00E+00
MD	MD-W003	1.66	0.00E+00	0.00E+00	9.28E+01	7.97E+00	0.00E+00	0.00E+00	0.00E+00
MD	MD-W017	1.46	0.00E+00	0.00E+00	2.43E+02	4.37E-01	0.00E+00	0.00E+00	0.00E+00
NT	NT-W001	672.55	3.01E+02	2.57E+02	2.05E+02	2.81E+03	1.42E+01	1.67E+02	3.22E-02
NT	NT-W021	5.67	0.00E+00	0.00E+00	1.43E+00	3.17E+01	5.33E+00	8.26E+01	0.00E+00
OR	OR-W041	170.77	4.21E-01	0.00E+00	1.05E+00	4.91E+01	1.99E+01	1.76E+02	1.64E-01
OR	OR-W044	2214.79	6.08E+00	3.45E+03	8.02E+02	7.09E+01	1.61E+03	1.30E+05	5.77E-02
OR	OR-W045	5.41	0.00E+00	0.00E+00	5.09E+01	2.39E+02	3.38E+02	3.39E+03	0.00E+00
OR	OR-W047	154.13	8.38E-01	3.32E+02	1.66E+02	1.32E+01	1.76E+01	1.56E+03	0.00E+00
OR	OR-W048	15.18	0.00E+00	5.87E+01	0.00E+00	6.38E-05	0.00E+00	0.00E+00	0.00E+00
OR	OR-W049	17.68	0.00E+00	0.00E+00	3.00E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00

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TABLE - 1

SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

SITE	Waste Stream ID#	Scaled Volume (m3)	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
			Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
OR	OR-W053	435.76	1.61E+03	7.25E+00	1.97E-05	6.71E+02	7.15E+00	8.93E-01	1.55E+01
RF	RF-MT-0335	2645.01	1.75E+03	0.00E+00	0.00E+00	2.15E+04	2.96E+04	1.72E+05	0.00E+00
RF	RF-MT-0368	19.85	0.00E+00	0.00E+00	0.00E+00	2.90E+02	3.82E+02	2.43E+02	0.00E+00
RF	RF-MT-0438	104.79	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.66E+03	0.00E+00
RF	RF-MT-0491	176.40	1.17E+02	0.00E+00	0.00E+00	1.44E+03	1.98E+03	1.15E+04	0.00E+00
RF	RF-MT-0823	0.21	0.00E+00	0.00E+00	0.00E+00	8.76E+00	6.32E+00	3.32E+01	0.00E+00
RF	RF-MT0001	3.74	1.34E+02	0.00E+00	0.00E+00	1.60E+01	1.16E+01	6.06E+01	0.00E+00
RF	RF-MT0003	0.62	2.92E+00	0.00E+00	0.00E+00	2.43E+00	1.77E+00	9.21E+01	0.00E+00
RF	RF-MT0007	0.83	2.98E+01	0.00E+00	0.00E+00	3.56E+00	2.57E+00	1.35E+01	0.00E+00
RF	RF-MT0320	130.54	3.65E+03	0.00E+00	0.00E+00	6.93E+03	9.41E+03	5.46E+04	0.00E+00
RF	RF-MT0321	55.93	1.16E+02	0.00E+00	0.00E+00	8.98E+01	1.12E+02	6.46E+02	0.00E+00
RF	RF-MT0339	934.74	2.06E+04	0.00E+00	0.00E+00	9.77E+03	1.30E+04	7.49E+04	0.00E+00
RF	RF-MT0374	1.25	0.00E+00	0.00E+00	0.00E+00	6.27E+00	4.54E+00	2.37E+01	0.00E+00
RF	RF-MT0375	0.21	0.00E+00	0.00E+00	0.00E+00	2.45E-01	1.77E-01	9.97E-01	0.00E+00
RF	RF-MT0377	3.54	0.00E+00	0.00E+00	0.00E+00	1.54E+02	1.11E+02	5.81E+02	0.00E+00
RF	RF-MT0440	637.99	0.00E+00	0.00E+00	0.00E+00	2.06E+03	2.71E+03	1.58E+04	0.00E+00
RF	RF-MT0442	1117.64	0.00E+00	0.00E+00	0.00E+00	3.59E+03	4.74E+03	2.76E+04	0.00E+00
RF	RF-MT0444	58.13	0.00E+00	0.00E+00	0.00E+00	3.92E+01	5.04E+01	2.89E+02	0.00E+00
RF	RF-MT0480	1983.22	3.91E+04	0.00E+00	0.00E+00	9.97E+03	1.37E+04	7.95E+04	0.00E+00
RF	RF-MT0800	322.32	7.94E+03	0.00E+00	0.00E+00	6.09E+02	6.55E+02	3.69E+03	0.00E+00
RF	RF-MT0801	108.99	5.10E+02	0.00E+00	0.00E+00	4.25E+02	3.08E+02	1.61E+04	0.00E+00
RF	RF-MT0803	16.64	4.03E+02	0.00E+00	0.00E+00	3.00E+01	3.32E+01	1.88E+02	0.00E+00
RF	RF-MT0807	348.08	8.61E+03	0.00E+00	0.00E+00	6.65E+02	7.10E+02	4.00E+03	0.00E+00
RF	RF-MT0821	0.42	5.39E+00	0.00E+00	0.00E+00	3.27E+00	2.36E+00	1.24E+01	0.00E+00
RF	RF-MT0831	1522.20	1.22E+04	0.00E+00	0.00E+00	3.83E+03	5.04E+03	2.92E+04	0.00E+00
RF	RF-MT0832	2433.05	1.95E+04	0.00E+00	0.00E+00	6.12E+03	8.05E+03	4.66E+04	0.00E+00
RF	RF-MT0833	318.79	2.55E+03	0.00E+00	0.00E+00	7.98E+02	1.05E+03	6.10E+03	0.00E+00
RF	RF-MT0855	11.19	0.00E+00	0.00E+00	0.00E+00	7.09E+00	9.50E+00	5.48E+01	0.00E+00
RF	RF-MT0856	35.91	0.00E+00	0.00E+00	0.00E+00	1.15E+02	1.52E+02	8.86E+02	0.00E+00
RF	RF-MT2116	2.08	1.27E+02	0.00E+00	0.00E+00	7.04E+01	5.56E+01	2.92E+02	0.00E+00
RF-RES	RF-RESIDUES	2800.00	1.19E+05	0.00E+00	8.09E+03	1.84E+05	4.22E+04	7.22E+05	2.03E-01
RF	RF-T010	0.62	2.24E+01	0.00E+00	0.00E+00	2.67E+00	1.93E+00	1.01E+01	0.00E+00
RF	RF-TT0300	44.48	0.00E+00	0.00E+00	0.00E+00	9.96E+02	9.95E+02	5.55E+03	0.00E+00
RF	RF-TT0303	0.21	0.00E+00	0.00E+00	0.00E+00	9.28E+00	6.70E+00	3.51E+01	0.00E+00
RF	RF-TT0312	278.03	0.00E+00	0.00E+00	0.00E+00	3.72E+03	5.11E+03	2.97E+04	0.00E+00
RF	RF-TT0320	29.29	0.00E+00	0.00E+00	0.00E+00	9.61E+02	1.08E+03	6.15E+03	0.00E+00
RF	RF-TT0335	373.65	0.00E+00	0.00E+00	0.00E+00	6.33E+03	8.11E+03	4.66E+04	0.00E+00
RF	RF-TT0338	40.53	0.00E+00	0.00E+00	0.00E+00	6.86E+02	8.79E+02	5.05E+03	0.00E+00
RF	RF-TT0374	0.62	0.00E+00	0.00E+00	0.00E+00	3.14E+00	2.27E+00	1.19E+01	0.00E+00
RF	RF-TT0376	91.34	0.00E+00	0.00E+00	0.00E+00	1.84E+03	2.21E+03	1.27E+04	0.00E+00

TABLE - 1
SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

	Waste	Scaled	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
SITE	Stream ID#	Volume (m3)	Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
RF	RF-TT0438	55.76	0.00E+00	0.00E+00	0.00E+00	8.54E+02	9.83E+02	5.57E+03	0.00E+00
RF	RF-TT0440	149.76	0.00E+00	0.00E+00	0.00E+00	6.90E+02	8.99E+02	5.19E+03	0.00E+00
RF	RF-TT0442	181.82	0.00E+00	0.00E+00	0.00E+00	1.05E+03	1.18E+03	6.71E+03	0.00E+00
RF	RF-TT0480	1446.53	1.53E+04	0.00E+00	0.00E+00	5.00E+03	6.38E+03	3.67E+04	0.00E+00
RF	RF-TT0481	0.21	3.50E+00	0.00E+00	0.00E+00	2.14E+00	1.55E+00	8.10E+00	0.00E+00
RF	RF-TT0490	186.97	0.00E+00	0.00E+00	0.00E+00	3.61E+03	4.26E+03	2.42E+04	0.00E+00
RF	RF-TT0491	16.02	0.00E+00	0.00E+00	0.00E+00	8.10E+02	5.87E+02	3.06E+03	0.00E+00
RF	RF-TT0802	179.15	6.22E+03	0.00E+00	0.00E+00	8.72E+01	1.13E+02	6.52E+02	0.00E+00
RF	RF-TT0821	406.61	4.35E+03	0.00E+00	0.00E+00	9.61E+02	1.27E+03	7.33E+03	0.00E+00
RF	RF-TT0823	159.51	6.69E+02	0.00E+00	0.00E+00	5.76E+01	7.43E+01	4.29E+02	0.00E+00
RF	RF-TT0824	140.24	1.50E+03	0.00E+00	0.00E+00	5.01E+02	6.26E+02	3.59E+03	0.00E+00
RF	RF-TT0825	550.34	5.91E+03	0.00E+00	0.00E+00	1.33E+03	1.72E+03	9.97E+03	0.00E+00
RL	RL-T101	567.94	0.00E+00	0.00E+00	2.02E+01	7.02E+02	1.64E+02	1.01E+03	3.30E-10
RL	RL-T102	200.12	0.00E+00	0.00E+00	2.57E-04	8.96E-03	2.09E-03	1.28E-02	1.90E-06
RL	RL-T103	99.63	0.00E+00	0.00E+00	1.08E+02	3.75E+03	8.75E+02	5.36E+03	0.00E+00
RL	RL-T104	4.99	0.00E+00	0.00E+00	3.67E-04	1.28E-02	2.99E-03	1.83E-02	5.39E-08
RL	RL-T105	80.40	7.03E-02	0.00E+00	1.39E-01	4.85E+00	1.13E+00	6.92E+00	7.40E-05
RL	RL-T106	8.11	0.00E+00	0.00E+00	1.36E-01	4.74E+00	1.11E+00	6.78E+00	0.00E+00
RL	RL-T107	6156.09	2.03E+01	0.00E+00	8.00E+04	1.31E+04	3.05E+03	1.86E+04	1.39E+00
RL	RL-T108	192.62	0.00E+00	0.00E+00	1.38E+01	7.45E+00	1.74E+00	1.06E+01	4.84E-05
RL	RL-T109	19.72	3.76E-01	0.00E+00	2.84E-01	9.88E+00	2.31E+00	1.41E+01	3.85E-02
RL	RL-T110	494.03	1.42E+01	0.00E+00	5.42E+01	1.13E+03	2.65E+02	1.62E+03	2.25E+00
RL	RL-T112	137.74	3.12E+02	0.00E+00	2.29E+01	1.50E+02	3.50E+01	2.15E+02	1.22E+00
RL	RL-T113	42.80	0.00E+00	0.00E+00	4.42E-02	4.95E-01	1.16E-01	7.08E-01	0.00E+00
RL	RL-T114	19.58	0.00E+00	0.00E+00	2.16E+00	7.51E+01	1.75E+01	1.07E+02	0.00E+00
RL	RL-T115	1025.43	0.00E+00	0.00E+00	8.67E+00	3.04E+02	7.08E+01	4.34E+02	6.83E-01
RL	RL-T116	11.02	0.00E+00	0.00E+00	3.55E+00	1.23E+02	2.88E+01	1.77E+02	9.29E-02
RL	RL-T118	261.96	1.95E+02	0.00E+00	2.83E+01	1.22E+02	2.85E+01	1.75E+02	1.38E+00
RL	RL-T120	133.81	0.00E+00	0.00E+00	6.54E-01	2.28E+01	5.32E+00	3.25E+01	9.33E-07
RL	RL-T122	29.30	0.00E+00	0.00E+00	1.26E-01	4.35E+00	1.02E+00	6.23E+00	2.41E+00
RL	RL-T123	0.62	0.00E+00	0.00E+00	3.68E-01	1.28E+01	3.00E+00	1.84E+01	9.86E-02
RL	RL-T125	15.18	0.00E+00	0.00E+00	7.60E-06	2.64E-04	6.17E-05	3.81E-04	0.00E+00
RL	RL-T127	283.60	1.66E+03	0.00E+00	2.29E+01	7.99E+02	1.86E+02	1.14E+03	1.32E-01
RL	RL-T128	0.42	3.64E+00	0.00E+00	5.57E-07	1.94E-05	4.52E-06	2.77E-05	0.00E+00
RL	RL-T129	28.75	0.00E+00	0.00E+00	1.06E+02	1.10E+01	2.55E+00	1.56E+01	1.27E-02
RL	RL-T130	0.21	0.00E+00	0.00E+00	6.69E-04	2.34E-02	5.45E-03	3.33E-02	1.37E-04
RL	RL-T131	30.16	5.20E+01	0.00E+00	6.54E-01	2.28E+01	5.30E+00	3.25E+01	1.36E-02
RL	RL-T132	28.70	0.00E+00	0.00E+00	6.45E+01	2.25E+03	5.26E+02	3.21E+03	4.05E-01
RL	RL-T133	0.21	0.00E+00	0.00E+00	5.41E-02	1.89E+00	4.40E-01	2.69E+00	0.00E+00
RL	RL-T134	0.21	0.00E+00	0.00E+00	2.79E-03	9.72E-02	2.26E-02	1.39E-01	0.00E+00

B2-14

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TABLE - 1
SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

SITE	Waste Stream ID#	Scaled Volume (m3)	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
			Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
RL	RL-T135	0.42	0.00E+00	0.00E+00	1.30E-02	4.54E-01	1.06E-01	6.48E-01	6.86E-03
RL	RL-T137	151.63	1.03E+03	0.00E+00	1.64E+01	5.71E+02	1.33E+02	8.15E+02	1.03E-02
RL	RL-T140	138.11	5.19E+02	0.00E+00	3.93E+00	1.36E+02	3.19E+01	1.95E+02	4.34E+01
RL	RL-T143	403.71	0.00E+00	0.00E+00	1.56E+00	5.41E+01	1.26E+01	7.75E+01	6.37E-02
RL	RL-T145	711.19	0.00E+00	0.00E+00	4.42E+00	1.54E+02	3.59E+01	2.20E+02	1.48E-01
RL	RL-W277	0.60	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RL	RL-W278	0.42	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RL	RL-W279	6.93	0.00E+00	0.00E+00	0.00E+00	3.00E+00	6.95E-01	4.26E+00	0.00E+00
RL	RL-W280	0.21	0.00E+00	0.00E+00	0.00E+00	9.02E-02	2.09E-02	1.28E-01	0.00E+00
RL	RL-W281	0.37	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RL	RL-W282	0.33	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RL	RL-W283	11.65	1.46E+02	0.00E+00	0.00E+00	9.35E-02	0.00E+00	1.77E-01	0.00E+00
RL	RL-W284	0.42	5.23E+00	0.00E+00	0.00E+00	3.34E-03	0.00E+00	6.32E-03	0.00E+00
RL	RL-W285	1.21	0.00E+00	0.00E+00	0.00E+00	1.27E+01	2.99E+00	1.90E+01	0.00E+00
RL	RL-W286	0.21	0.00E+00	0.00E+00	0.00E+00	9.02E-02	2.09E-02	1.28E-01	0.00E+00
RL	RL-W287	0.42	0.00E+00	0.00E+00	0.00E+00	4.38E+00	1.03E+00	6.54E+00	0.00E+00
RL	RL-W288	1.04	0.00E+00	0.00E+00	0.00E+00	1.10E+01	2.58E+00	1.63E+01	0.00E+00
RL	RL-W289	2.08	0.00E+00	0.00E+00	0.00E+00	2.19E+01	5.15E+00	3.27E+01	0.00E+00
RL	RL-W290	2.29	0.00E+00	0.00E+00	0.00E+00	2.41E+01	5.67E+00	3.59E+01	0.00E+00
RL	RL-W291	7.98	0.00E+00	0.00E+00	0.00E+00	8.40E+01	1.97E+01	1.25E+02	0.00E+00
RL	RL-W292	0.21	0.00E+00	0.00E+00	0.00E+00	2.19E+00	5.15E-01	3.27E+00	0.00E+00
RL	RL-W293	1.25	0.00E+00	0.00E+00	0.00E+00	1.31E+01	3.09E+00	1.96E+01	0.00E+00
RL	RL-W294	1.04	0.00E+00	0.00E+00	0.00E+00	1.10E+01	2.58E+00	1.63E+01	0.00E+00
RL	RL-W295	1.87	0.00E+00	0.00E+00	0.00E+00	1.97E+01	4.64E+00	2.94E+01	0.00E+00
RL	RL-W296	3.16	0.00E+00	0.00E+00	0.00E+00	3.33E+01	7.83E+00	4.97E+01	0.00E+00
RL	RL-W297	1.66	0.00E+00	0.00E+00	0.00E+00	1.75E+01	4.12E+00	2.61E+01	0.00E+00
RL	RL-W298	19.34	0.00E+00	0.00E+00	0.00E+00	1.83E+02	4.30E+01	2.88E+02	0.00E+00
RL	RL-W299	0.62	0.00E+00	0.00E+00	0.00E+00	8.15E+00	1.91E+00	1.16E+01	0.00E+00
RL	RL-W300	0.42	0.00E+00	0.00E+00	0.00E+00	5.43E+00	1.27E+00	7.76E+00	0.00E+00
RL	RL-W301	0.62	0.00E+00	0.00E+00	0.00E+00	1.42E+01	3.31E+00	2.03E+01	0.00E+00
RL	RL-W302	0.42	3.89E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RL	RL-W303	0.21	0.00E+00	0.00E+00	0.00E+00	1.24E+00	1.98E-01	0.00E+00	0.00E+00
RL	RL-W304	2.51	1.41E+00	0.00E+00	0.00E+00	5.65E-01	1.26E-01	8.60E-01	0.00E+00
RL	RL-W305	57.01	1.44E+01	0.00E+00	0.00E+00	2.76E+01	1.17E+01	8.75E+01	0.00E+00
RL	RL-W306	15.94	4.07E+00	0.00E+00	0.00E+00	7.98E+00	3.32E+00	2.47E+01	0.00E+00
RL	RL-W307	1.89	7.69E-01	0.00E+00	0.00E+00	2.82E+00	6.64E-01	4.49E+00	0.00E+00
RL	RL-W308	1.79	5.09E-01	0.00E+00	0.00E+00	1.23E+00	4.21E-01	3.05E+00	0.00E+00
RL	RL-W309	0.21	8.46E-02	0.00E+00	0.00E+00	3.11E-01	7.31E-02	4.95E-01	0.00E+00
RL	RL-W310	1.66	4.58E-01	0.00E+00	0.00E+00	1.05E+00	3.77E-01	2.76E+00	0.00E+00
RL	RL-W311	90.93	2.32E+01	0.00E+00	0.00E+00	4.52E+01	1.89E+01	1.41E+02	0.00E+00

B2-16

TABLE - 1
SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

	Waste	Scaled	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
SITE	Stream ID#	Volume (m3)	Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
RL	RL-W312	58.59	1.48E+01	0.00E+00	0.00E+00	2.85E+01	1.21E+01	9.01E+01	0.00E+00
RL	RL-W313	114.07	2.97E+01	0.00E+00	0.00E+00	6.05E+01	2.42E+01	1.80E+02	0.00E+00
RL	RL-W314	117.18	2.97E+01	0.00E+00	0.00E+00	5.70E+01	2.41E+01	1.80E+02	0.00E+00
RL	RL-W315	3.16	8.48E-01	0.00E+00	0.00E+00	1.85E+00	6.96E-01	5.12E+00	0.00E+00
RL	RL-W316	0.21	8.46E-02	0.00E+00	0.00E+00	3.11E-01	7.31E-02	4.95E-01	0.00E+00
RL	RL-W317	16.15	4.16E+00	0.00E+00	0.00E+00	8.29E+00	3.39E+00	2.52E+01	0.00E+00
RL	RL-W318	56.60	1.43E+01	0.00E+00	0.00E+00	2.70E+01	1.16E+01	8.65E+01	0.00E+00
RL	RL-W319	7.56	3.08E+00	0.00E+00	0.00E+00	1.13E+01	2.66E+00	1.80E+01	0.00E+00
RL	RL-W320	56.60	1.43E+01	0.00E+00	0.00E+00	2.70E+01	1.16E+01	8.65E+01	0.00E+00
RL	RL-W321	0.21	8.46E-02	0.00E+00	0.00E+00	3.11E-01	7.31E-02	4.95E-01	0.00E+00
RL	RL-W322	15.94	4.07E+00	0.00E+00	0.00E+00	7.98E+00	3.32E+00	2.47E+01	0.00E+00
RL	RL-W323	14.36	3.65E+00	0.00E+00	0.00E+00	7.05E+00	2.97E+00	2.21E+01	0.00E+00
RL	RL-W324	3.78	1.54E+00	0.00E+00	0.00E+00	5.64E+00	1.33E+00	8.99E+00	0.00E+00
RL	RL-W325	8.66	2.21E+00	0.00E+00	0.00E+00	4.30E+00	1.80E+00	1.34E+01	0.00E+00
RL	RL-W326	56.80	1.43E+01	0.00E+00	0.00E+00	2.73E+01	1.17E+01	8.70E+01	0.00E+00
RL	RL-W327	789.89	2.06E+02	0.00E+00	0.00E+00	4.21E+02	1.68E+02	1.25E+03	0.00E+00
RL	RL-W328	3.78	1.54E+00	0.00E+00	0.00E+00	5.64E+00	1.33E+00	8.99E+00	0.00E+00
RL	RL-W329	57.01	1.44E+01	0.00E+00	0.00E+00	2.76E+01	1.17E+01	8.75E+01	0.00E+00
RL	RL-W330	281.70	7.47E+01	0.00E+00	0.00E+00	1.59E+02	6.12E+01	4.52E+02	0.00E+00
RL	RL-W331	721.16	1.86E+02	0.00E+00	0.00E+00	3.75E+02	1.52E+02	1.13E+03	0.00E+00
RL	RL-W332	0.20	8.14E-02	0.00E+00	0.00E+00	2.99E-01	7.03E-02	4.76E-01	0.00E+00
RL	RL-W333	17.73	4.58E+00	0.00E+00	0.00E+00	9.21E+00	3.74E+00	2.77E+01	0.00E+00
RL	RL-W334	0.21	8.46E-02	0.00E+00	0.00E+00	3.11E-01	7.31E-02	4.95E-01	0.00E+00
RL	RL-W335	2.10	0.00E+00	0.00E+00	0.00E+00	1.18E-01	1.75E-02	0.00E+00	0.00E+00
RL	RL-W336	0.42	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RL	RL-W338	0.21	9.52E-02	0.00E+00	0.00E+00	3.34E-03	1.74E-03	1.50E-02	0.00E+00
RL	RL-W339	0.42	1.90E-01	0.00E+00	0.00E+00	6.68E-03	3.48E-03	3.00E-02	0.00E+00
RL	RL-W340	0.21	9.52E-02	0.00E+00	0.00E+00	3.34E-03	1.74E-03	1.50E-02	0.00E+00
RL	RL-W341	0.21	8.46E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-03	0.00E+00
RL	RL-W342	0.83	3.39E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.90E-03	0.00E+00
RL	RL-W343	0.62	2.54E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.93E-03	0.00E+00
RL	RL-W344	0.21	6.35E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.98E-03	0.00E+00
RL	RL-W345	8.95	2.54E+00	0.00E+00	0.00E+00	6.17E+00	2.10E+00	1.53E+01	0.00E+00
RL	RL-W346	0.42	1.61E+00	0.00E+00	0.00E+00	2.04E-01	5.57E-02	1.84E-01	0.00E+00
RL	RL-W347	0.21	8.04E-01	0.00E+00	0.00E+00	1.02E-01	2.78E-02	9.21E-02	0.00E+00
RL	RL-W348	0.21	8.04E-01	0.00E+00	0.00E+00	1.02E-01	2.78E-02	9.21E-02	0.00E+00
RL	RL-W349	0.21	8.04E-01	0.00E+00	0.00E+00	1.02E-01	2.78E-02	9.21E-02	0.00E+00
RL	RL-W350	0.21	8.04E-01	0.00E+00	0.00E+00	1.02E-01	2.78E-02	9.21E-02	0.00E+00
RL	RL-W351	0.21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RL	RL-W352	0.21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

TABLE - 1

SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

SITE	Waste Stream ID#	Scaled Volume (m3)	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
			Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
RL	RL-W353	0.83	0.00E+00	0.00E+00	0.00E+00	3.22E+00	7.52E-01	4.60E+00	0.00E+00
RL	RL-W354	0.21	0.00E+00	0.00E+00	0.00E+00	8.05E-01	1.88E-01	1.15E+00	0.00E+00
RL	RL-W355	2.08	0.00E+00	0.00E+00	0.00E+00	8.05E+00	1.88E+00	1.15E+01	0.00E+00
RL	RL-W356	1.25	0.00E+00	0.00E+00	0.00E+00	4.83E+00	1.13E+00	6.90E+00	0.00E+00
RL	RL-W357	0.21	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RL	RL-W358	2.50	0.00E+00	0.00E+00	0.00E+00	5.81E-01	1.25E-01	8.25E-01	0.00E+00
RL	RL-W359	16.64	0.00E+00	0.00E+00	0.00E+00	3.87E+00	8.35E-01	5.50E+00	0.00E+00
RL	RL-W360	4.78	0.00E+00	0.00E+00	0.00E+00	1.11E+00	2.40E-01	1.58E+00	0.00E+00
RL	RL-W361	0.62	0.00E+00	0.00E+00	0.00E+00	1.45E-01	3.13E-02	2.06E-01	0.00E+00
RL	RL-W362	16.64	5.72E-01	0.00E+00	0.00E+00	3.21E+01	1.19E+01	8.92E+01	0.00E+00
RL	RL-W363	1.58	5.30E-02	0.00E+00	0.00E+00	2.83E+00	1.09E+00	8.28E+00	0.00E+00
RL	RL-W364	11.69	4.03E-01	0.00E+00	0.00E+00	2.27E+01	8.34E+00	6.28E+01	0.00E+00
RL	RL-W365	64.04	2.22E+00	0.00E+00	0.00E+00	1.26E+02	4.59E+01	3.45E+02	0.00E+00
RL	RL-W366	6.95	2.44E-01	0.00E+00	0.00E+00	1.42E+01	5.06E+00	3.79E+01	0.00E+00
RL	RL-W367	16.64	0.00E+00	0.00E+00	0.00E+00	4.28E+00	1.53E+00	1.01E+01	0.00E+00
RL	RL-W368	4.74	0.00E+00	0.00E+00	0.00E+00	1.13E+00	4.22E-01	2.81E+00	0.00E+00
RL	RL-W369	161.21	6.78E+01	0.00E+00	0.00E+00	2.28E+02	8.09E+01	5.40E+02	0.00E+00
RL	RL-W370	0.42	2.54E-01	0.00E+00	0.00E+00	1.32E+00	3.17E-01	1.97E+00	0.00E+00
RL	RL-W371	21.17	9.30E+00	0.00E+00	0.00E+00	3.36E+01	1.12E+01	7.39E+01	0.00E+00
RL	RL-W372	0.42	2.54E-01	0.00E+00	0.00E+00	1.32E+00	3.17E-01	1.97E+00	0.00E+00
RL	RL-W373	88.45	4.33E+00	0.00E+00	0.00E+00	4.65E+00	1.42E+00	7.79E+00	0.00E+00
RL	RL-W374	2800.78	8.11E+02	0.00E+00	0.00E+00	2.61E+03	1.06E+03	7.37E+03	0.00E+00
RL	RL-W375	272.44	7.96E+01	0.00E+00	0.00E+00	2.61E+02	1.05E+02	7.22E+02	0.00E+00
RL	RL-W376	367.78	1.05E+02	0.00E+00	0.00E+00	3.28E+02	1.38E+02	9.56E+02	0.00E+00
RL	RL-W377	7029.61	2.01E+03	0.00E+00	0.00E+00	6.26E+03	2.63E+03	1.83E+04	0.00E+00
RL	RL-W378	306.06	8.81E+01	0.00E+00	0.00E+00	2.79E+02	1.15E+02	8.00E+02	0.00E+00
RL	RL-W379	0.21	9.52E-02	0.00E+00	0.00E+00	5.63E-01	1.32E-01	8.34E-01	0.00E+00
RL	RL-W380	0.21	9.52E-02	0.00E+00	0.00E+00	5.63E-01	1.32E-01	8.34E-01	0.00E+00
RL	RL-W381	162.79	4.64E+01	0.00E+00	0.00E+00	1.43E+02	6.07E+01	4.22E+02	0.00E+00
RL	RL-W382	423.84	1.21E+02	0.00E+00	0.00E+00	3.78E+02	1.59E+02	1.10E+03	0.00E+00
RL	RL-W383	9.45	4.33E+00	0.00E+00	0.00E+00	2.56E+01	6.01E+00	3.79E+01	0.00E+00
RL	RL-W384	0.62	1.81E+00	0.00E+00	0.00E+00	4.61E-01	1.15E-01	6.38E-01	0.00E+00
RL	RL-W385	12.23	1.35E+01	0.00E+00	0.00E+00	2.67E+01	7.87E+00	4.48E+01	0.00E+00
RL	RL-W386	0.42	5.29E-01	0.00E+00	0.00E+00	1.19E+00	3.13E-01	1.74E+00	0.00E+00
RL	RL-W387	2.83	2.91E+00	0.00E+00	0.00E+00	5.33E+00	1.69E+00	9.73E+00	0.00E+00
RL	RL-W388	20.85	2.45E+01	0.00E+00	0.00E+00	5.13E+01	1.44E+01	8.09E+01	0.00E+00
RL	RL-W389	0.21	2.64E-01	0.00E+00	0.00E+00	5.94E-01	1.57E-01	8.70E-01	0.00E+00
RL	RL-W390	0.62	7.93E-01	0.00E+00	0.00E+00	1.78E+00	4.70E-01	2.61E+00	0.00E+00
RL	RL-W391	0.42	5.29E-01	0.00E+00	0.00E+00	1.19E+00	3.13E-01	1.74E+00	0.00E+00
RL	RL-W392	0.21	0.00E+00	0.00E+00	0.00E+00	3.01E-03	1.74E-03	8.30E-03	0.00E+00

B2-17

TABLE - 1

SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

	Waste	Scaled	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
SITE	Stream ID#	Volume (m3)	Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
RL	RL-W393	67.21	4.13E+02	0.00E+00	0.00E+00	3.98E+01	2.55E+01	1.83E+02	0.00E+00
RL	RL-W394	49.81	3.03E+02	0.00E+00	0.00E+00	2.85E+01	1.86E+01	1.34E+02	0.00E+00
RL	RL-W395	174.45	1.11E+03	0.00E+00	0.00E+00	1.14E+02	6.87E+01	4.89E+02	0.00E+00
RL	RL-W396	0.21	2.00E+00	0.00E+00	0.00E+00	3.47E-01	1.30E-01	8.55E-01	0.00E+00
RL	RL-W397	55.72	3.39E+02	0.00E+00	0.00E+00	3.19E+01	2.09E+01	1.50E+02	0.00E+00
RL	RL-W398	0.21	2.00E+00	0.00E+00	0.00E+00	3.47E-01	1.30E-01	8.55E-01	0.00E+00
RL	RL-W399	23.55	0.00E+00	0.00E+00	0.00E+00	9.16E+01	8.94E+01	1.42E+03	0.00E+00
RL	RL-W400	15.31	0.00E+00	0.00E+00	0.00E+00	6.02E+01	5.83E+01	9.28E+02	0.00E+00
RL	RL-W401	214.86	0.00E+00	0.00E+00	0.00E+00	8.24E+02	8.12E+02	1.29E+04	0.00E+00
RL	RL-W402	14.98	0.00E+00	0.00E+00	0.00E+00	4.08E+01	1.62E+01	1.08E+02	0.00E+00
RL	RL-W403	0.62	0.00E+00	0.00E+00	0.00E+00	4.76E+00	1.11E+00	6.79E+00	0.00E+00
RL	RL-W404	15.81	0.00E+00	0.00E+00	0.00E+00	4.71E+01	1.76E+01	1.17E+02	0.00E+00
RL	RL-W405	0.21	9.10E+00	0.00E+00	0.00E+00	9.02E-02	2.09E-02	1.29E-01	0.00E+00
RL	RL-W406	0.42	0.00E+00	0.00E+00	0.00E+00	7.01E-02	1.74E-02	9.80E-02	0.00E+00
SR	T001-221F-HET	11492.34	9.51E+03	0.00E+00	7.17E+05	2.78E+04	5.56E+03	1.66E+05	0.00E+00
SR	T001-221F-MET	490.50	3.98E+02	0.00E+00	2.99E+04	1.11E+03	2.32E+02	6.95E+03	0.00E+00
SR	T001-221F-VIT	954.27	4.95E+02	4.68E+03	3.71E+04	1.33E+02	2.88E+02	8.66E+03	0.00E+00
SR	T001-221H-HET	6572.31	5.25E+03	0.00E+00	3.93E+05	1.41E+04	3.05E+03	9.18E+04	0.00E+00
SR	T001-221H-MET	95.38	7.54E+01	0.00E+00	5.64E+03	1.97E+02	4.38E+01	1.32E+03	0.00E+00
SR	T001-221H-VIT	3192.47	1.64E+03	1.57E+04	1.23E+05	4.33E+02	9.53E+02	2.87E+04	0.00E+00
SR	T001-235F-HET	1517.71	1.28E+03	0.00E+00	9.65E+04	3.85E+03	7.48E+02	2.22E+04	0.00E+00
SR	T001-235F-VIT	566.20	2.90E+02	2.79E+03	2.17E+04	7.54E+01	1.68E+02	5.07E+03	0.00E+00
SR	T001-772F-HET	104.88	9.72E+01	0.00E+00	7.46E+03	3.51E+02	5.78E+01	1.68E+03	0.00E+00
SR	T001-772F-VIT	50.24	2.57E+01	2.47E+02	1.92E+03	6.71E+00	1.49E+01	4.51E+02	0.00E+00
SR	T001-773A-CLAS	4.58	5.92E+00	0.00E+00	4.73E+02	3.11E+01	3.66E+00	9.97E+01	0.00E+00
SR	T001-773A-HET	1721.93	1.36E+03	0.00E+00	1.02E+05	3.60E+03	7.93E+02	2.39E+04	0.00E+00
SR	T001-773A-MET	210.01	1.65E+02	0.00E+00	1.24E+04	4.28E+02	9.59E+01	2.90E+03	0.00E+00
SR	T001-773A-VIT	100.37	5.14E+01	4.94E+02	3.84E+03	1.34E+01	2.98E+01	9.00E+02	0.00E+00
SR	T003-773A-HET	45.94	0.00E+00	0.00E+00	5.98E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SR	T003-773A-VIT	0.21	1.75E-01	7.85E-01	1.40E+01	9.22E-02	1.08E-01	2.94E+00	0.00E+00
SR	W006-773A-VIT	0.52	1.09E-02	0.00E+00	0.00E+00	2.36E+02	0.00E+00	0.00E+00	0.00E+00
SR	W027-221F-HET	265.62	3.44E+02	0.00E+00	2.75E+04	1.80E+03	2.13E+02	5.79E+03	0.00E+00
SR	W027-221F-MET	1.89	2.45E+00	0.00E+00	1.95E+02	1.28E+01	1.51E+00	4.12E+01	0.00E+00
SR	W027-221F-VIT	33.18	2.79E+01	1.25E+02	2.23E+03	1.47E+01	1.73E+01	4.70E+02	0.00E+00
SR	W027-221H-HET	125.42	1.62E+02	0.00E+00	1.30E+04	8.52E+02	1.00E+02	2.73E+03	0.00E+00
SR	W027-221H-MET	1.89	2.45E+00	0.00E+00	1.95E+02	1.28E+01	1.51E+00	4.12E+01	0.00E+00
SR	W027-221H-VIT	25.88	2.18E+01	9.77E+01	1.74E+03	1.15E+01	1.35E+01	3.66E+02	0.00E+00
SR	W027-235F-HET	34.74	4.50E+01	0.00E+00	3.59E+03	2.36E+02	2.78E+01	7.57E+02	0.00E+00
SR	W027-235F-MET	1.89	2.45E+00	0.00E+00	1.95E+02	1.28E+01	1.51E+00	4.12E+01	0.00E+00
SR	W027-235F-VIT	16.59	1.39E+01	6.26E+01	1.11E+03	7.35E+00	8.63E+00	2.35E+02	0.00E+00

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TABLE - 1

SCALED VOLUME AND ACTIVITIES FOR SELECTED RADIONUCLIDES FOR EACH WASTE STREAM

	Waste	Scaled	SCALED TOTAL CURIES OF EACH RADIONUCLIDE FOR EACH WASTE STREAM						
SITE	Stream ID#	Volume (m3)	Scaled Am-241	Scaled Cm-244	Scaled Pu-238	Scaled Pu-239	Scaled Pu-240	Scaled Pu-241	Scaled U-234
SR	W027-772F-HET	515.42	6.67E+02	0.00E+00	5.33E+04	3.50E+03	4.12E+02	1.12E+04	0.00E+00
SR	W027-772F-MET	32.13	4.16E+01	0.00E+00	3.32E+03	2.18E+02	2.57E+01	7.00E+02	0.00E+00
SR	W027-772F-VIT	10.62	8.93E+00	4.01E+01	7.13E+02	4.70E+00	5.52E+00	1.50E+02	0.00E+00
SR	W027-773A-HET	331.14	4.29E+02	0.00E+00	3.42E+04	2.25E+03	2.65E+02	7.22E+03	0.00E+00
SR	W027-773A-MET	7.56	9.78E+00	0.00E+00	7.81E+02	5.13E+01	6.05E+00	1.65E+02	0.00E+00
SR	W027-773A-VIT	17.25	1.45E+01	6.51E+01	1.16E+03	7.64E+00	8.97E+00	2.44E+02	0.00E+00
SR-OFF	W027-999-HET	27.66	6.85E+01	0.00E+00	1.15E+05	7.87E+01	4.56E+01	9.88E+02	0.00E+00
SR-OFF	W027-999-VIT	31.85	5.12E+01	0.00E+00	8.61E+04	5.91E+00	3.41E+01	7.38E+02	0.00E+00
SR-OFF	W053-773A-VIT	0.52	0.00E+00	0.00E+00	0.00E+00	7.36E+01	0.00E+00	0.00E+00	0.00E+00
TOTALS		168500.00	4.42E+05	3.15E+04	2.61E+06	7.85E+05	2.10E+05	2.31E+06	4.65E+02

Table 2
NORMALIZATION FACTORS (NF)

TOTAL CURIES ESTIMATED FROM BIR REV. 2 WASTE STREAM DATA

	UNDECAYED STORED CURIES OF EACH RADIONUCLIDE						
SITE	Am241	Cm244	Pu238	Pu239	Pu240	Pu241	U234
AE Total	3.90E+01	0.00E+00	7.45E-05	2.14E+01	0.00E+00	1.12E+01	0.00E+00
AL Total	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
AW Total	6.97E+00	0.00E+00	0.00E+00	5.54E-01	0.00E+00	0.00E+00	0.00E+00
BT Total	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ET Total	2.52E-02	0.00E+00	2.02E-02	1.34E-01	3.36E-02	8.40E-01	3.36E-04
IN Total	8.11E+04	9.29E-01	6.34E+04	4.35E+04	1.10E+04	2.38E+05	0.00E+00
LA Total	3.12E+04	2.29E+02	1.36E+05	1.86E+04	4.10E+03	6.97E+04	1.54E-01
LL Total	1.43E+02	8.06E+01	4.18E+01	1.71E+02	7.96E+01	2.44E+03	0.00E+00
MC Total	1.55E-01	0.00E+00	0.00E+00	6.07E-02	0.00E+00	2.77E-01	0.00E+00
MD Total	0.00E+00	0.00E+00	2.44E+03	3.84E+01	5.36E+02	0.00E+00	0.00E+00
NT Total	3.01E+02	4.16E+00	1.49E+02	.2.81E+03	2.61E+01	5.25E+02	5.00E-03
OR Total	1.10E+03	4.51E+00	3.55E+02	1.58E+01	1.82E+01	1.75E+03	1.87E+00
RF Total	6.22E+02	0.00E+00	0.00E+00	1.20E+03	2.76E+02	9.07E+03	0.00E+00
RL Total	9.30E+02	0.00E+00	1.03E+05	3.27E+04	7.35E+03	1.99E+05	3.25E+01
SA Total	1.35E+00	4.33E+00	0.00E+00	2.70E+00	0.00E+00	0.00E+00	0.00E+00
SR Total	7.66E+02	1.69E+01	2.13E+05	1.72E+04	8.76E+02	4.26E+04	0.00E+00
SR-OFF	1.34E+01	3.31E+00	3.73E+03	7.12E+02	1.53E+01	7.45E+02	0.00E+00

	TOTAL UNDECAYED CURIES REPORTED BY THE SITE IN THE IDB						
SITE	Am241	Cm244	Pu238	Pu239	Pu240	Pu241	U234
ARCO	0.00E+00	0.00E+00	3.73E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00
ARMY	0.00E+00	0.00E+00	0.00E+00	1.80E+01	0.00E+00	0.00E+00	0.00E+00
ETEC	4.54E-01	0.00E+00	1.16E-01	1.79E+00	6.12E-01	8.29E+00	0.00E+00
HANF	3.76E+03	4.82E+03	9.06E+04	2.63E+04	6.15E+03	7.08E+04	5.01E+01
INEL	8.79E+04	1.13E+03	6.75E+04	4.01E+04	9.83E+03	2.88E+05	3.36E+00
LANL	8.69E+03	2.23E+02	1.31E+05	7.69E+04	1.00E+02	1.70E+03	0.00E+00
LBL							
LLNL	1.33E+02	7.44E+01	7.75E+01	1.58E+02	6.44E+01	1.97E+03	2.78E-03
MOUND	0.00E+00	0.00E+00	1.68E+03	2.98E+01	0.00E+00	0.00E+00	0.00E+00
MURR	3.24E-01	0.00E+00	0.00E+00	2.46E-02	0.00E+00	6.63E-03	0.00E+00
NEVADA	2.86E+02	3.54E+02	2.16E+02	2.76E+03	1.84E+01	3.31E+02	5.00E-03
ORNL	6.19E+02	2.26E+03	3.98E+03	1.01E+03	9.44E+02	7.84E+04	1.55E+01
PAD							
PANTEX	0.00E+00	0.00E+00	0.00E+00	5.55E-02	0.00E+00	0.00E+00	0.00E+00
RFETS	1.06E+04	0.00E+00	3.56E+02	9.98E+03	7.22E+03	6.58E+04	0.00E+00
RF-RES							
SRS-ON	2.11E+03	1.16E+03	3.14E+05	9.13E+03	2.21E+03	1.06E+05	3.00E-01
SR-OFF	1.87E+00	0.00E+00	2.43E+05	1.58E+02	7.99E+01	5.34E+03	3.37E-04
SR-TOTAL	2.11E+03	1.16E+03	5.57E+05	9.29E+03	2.29E+03	1.11E+05	3.00E-01

Table 2 (continued)
NORMALIZATION FACTORS (NF)

CALCULATION OF IDB/BIR RATIOS (NF)							
SITE	Am241	Cm244	Pu238	Pu239	Pu240	Pu241	U234
RL	4.04E+00	NC	8.81E-01	8.03E-01	8.37E-01	3.56E-01	1.54E+00
IN	1.08E+00	1.22E+03	1.06E+00	9.22E-01	8.97E-01	1.21E+00	NC
LA	2.79E-01	9.74E-01	9.65E-01	4.13E+00	2.44E-02	2.44E-02	0.00E+00
LL	9.31E-01	9.23E-01	1.85E+00	9.26E-01	8.09E-01	8.05E-01	NC
MD	NC	NC	6.90E-01	7.77E-01	0.00E+00	NC	NC
NT	9.49E-01	8.51E+01	1.45E+00	9.83E-01	7.07E-01	6.31E-01	1.00E+00
OR	5.61E-01	5.02E+02	1.12E+01	6.38E+01	5.18E+01	4.47E+01	8.25E+00
RF	1.71E+01	NC	NC	8.29E+00	2.62E+01	7.26E+00	NC
RF-RES							
SR	2.75E+00	6.86E+01	1.47E+00	5.30E-01	2.52E+00	2.49E+00	NC
SR-OFF	1.40E-01	0.00E+00	6.51E+01	2.22E-01	5.21E+00	7.18E+00	NC
SR-TOTAL	2.76E+00	6.86E+01	2.61E+00	5.40E-01	2.62E+00	2.61E+00	NC

NOTE: NC —> Cannot Be Calculated Due to Data Discrepancy

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Table 3

RADIONUCLIDE SCALING FACTORS (SF_a)

TOTAL ESTIMATED ACTIVITY FOR STORED VOLUME (Without Scale-up)						
Stored Am-241	Stored Cm-244	Stored Pu-238	Stored Pu-239	Stored Pu-240	Stored Pu-241	Stored U-234
2.40E+05	2.61E+03	7.55E+05	3.60E+05	6.88E+04	1.08E+06	7.54E+01

TOTAL ESTIMATED ACTIVITY FOR PROJECTED VOLUME (Without Scale-up)						
Proj. Am-241	Proj. Cm-244	Proj. Pu-238	Proj. Pu-239	Proj. Pu-240	Proj. Pu-241	Proj. U-234
5.05E+04	3.35E+03	4.94E+05	2.16E+05	3.75E+04	2.96E+05	3.64E+00

TOTAL WIPP ACTIVITIES (Based on CCA Radionuclide Table)						
Am-241	Cm-244	Pu-238	Pu-239	Pu-240	Pu-241	U-234
4.42E+05	3.15E+04	2.61E+06	7.85E+05	2.10E+05	2.31E+06	4.65E+02

CALCULATED SCALING FACTOR FOR EACH NUCLIDE						
Am-241	Cm-244	Pu-238	Pu-239	Pu-240	Pu-241	U-234
4.01	8.61	3.75	1.97	3.76	4.17	106.94

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Table 4

VOLUME SCALING FACTOR (SF_v)

WIPP CAPACITY FOR CH-TRU WASTE
168500

TOTAL STORED VOLUME FOR ALL WASTE STREAMS
58533.25

TOTAL PROJ. VOLUME FOR ALL WASTE STREAMS WITH RAD DATA
16865.15

VOLUME SCALING FACTOR (SF_v)
6.52

Note: (168500 - 58533.25) / 16865.15 = 6.52

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APPENDIX B - 3

United States Government | Department of Energy

memorandum

Carlsbad Area Office
Carlsbad, New Mexico 88221

DATE: MAR 15 1996

REPLY TO ATTN OF: CAO:NTP:RLB 96-0687

SUBJECT: Preliminary Estimate of Complexing Agents in TRU Solidified Waste Forms Scheduled for Disposal in WIPP

TO: Les E.Shephard, Director, SNL/NM

Attached is a copy of the report containing the preliminary estimates of complexing agents in transuranic (TRU) solidified waste forms scheduled for disposal in the Waste Isolation Pilot Plant (WIPP). This information was requested from the Transuranic (TRU) Waste Baseline Inventory Report (TWBIR) team in support of the Performance Assessment (PA) being conducted by Sandia National Laboratory (SNL). Information has been received from the Rocky Flats Environmental Technology Site (RFETS), the Los Alamos National Laboratory (LANL), and the Oak Ridge National Laboratory (ORNL) on potential complexing agents in their solidified waste forms.

The original scope of this request was to ask the TRU waste generator/storage sites about potential "aqueous-soluble chelating agents" in their solidified waste forms. As this subject was researched, two things were realized. First, in lieu of the term "chelating agent," the term "complexing agent" should be used. "Chelating agents" are a subset of "complexing agents" and as such a more complete assessment would cover the presence of potential "complexing agents." Secondly, it was recognized that "aqueous-soluble" is a relative concept in that essentially everything is "aqueous-soluble" at some concentration level. Therefore, the data provided here are for all complexing agents reported by the sites. These data will allow SNL personnel to determine the cutoff of solubility where certain compounds are no longer considered to be of interest for PA calculations.

The final report at the end of March will contain the necessary attached documentation, references, and elaborated text summaries.

If you have any questions concerning the attached information, please contact Mr. Russ Bisping of my staff at (505) 234-7446.

Don Watkins
Manager
National TRU Program

Attachment

cc w/attachment:
K. Hunter, CAO
M. McFadden, CAO
R. Bisping, CAO
P. Drez, CTAC
J. Harvill, CTAC
L. Sanchez, SNL
M. Chu, SNL
M. Marietta, SNL

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Complexing Agents
Site Summaries

ORNL

ORNL has provided a list of organic compounds which contain some aqueous-soluble compounds that are apparent complexing agents. A copy of the list of all compounds reported by ORNL to the BIR team is attached for completeness (Table 1). The list in Table 1 is from an ORNL report on low-level waste, but the same compounds are anticipated to occur in the TRU waste based on process history. ORNL cannot quantify these compounds in their solidified wastes, but have provided an estimate of Total Organic Carbon (TOC) for each TRU waste tank (Table 2). The sum of the TOC from all the transuranic RH-TRU tanks is approximately 3691 kg. It is anticipated that most of the TOC in the tanks is not associated with complexing agents, but that has not been verified at this time. As a conservatism, SNL/NM can assume that any complexing agents listed in Table 1 could form the bulk of the TOC in the ORNL RH-TRU tanks.

LANL

Los Alamos National Laboratory has provided estimates of four complexing agents that are anticipated to occur in their TRU solidified waste streams and as materials used in decontamination and spill clean-up operations (that would occur with the debris wastes). The quantities of these compounds are listed in Table 3.

RFETS/INEL

The information provided by RFETS will also be used to estimate the amount of complexing agents in the RFETS retrievable waste (post 1970) at Idaho National Engineering Laboratory (INEL). Attached is a listing of chemicals from RFETS that was provided to the BIR team as a basis for potential complexing agents in TRU waste scheduled for shipment to and disposal in WIPP. This same list was originally put together as part of the documentation requested by the State of Nevada to document that less than 1% "complexing" agents occur in RFETS solidified low-level "saltcrete" waste that would be shipped to NTS for disposal.

The list was provided as a yearly estimate of complexing agents used on site at RFETS. It is conservative to assume that all of these complexing agents would reside in the TRU waste. Based on the authors understanding at this time, the inventory of RFETS complexing agents is across the entire site, so this should include material expected to occur in the debris wastes (this will be verified for the final version of this memo). The mass of complexing agents reported in Table 3 for RFETS results from multiplying the yearly estimates (in kilograms) by 20 years of production at RFETS (1970-1989), which includes RFETS waste in storage at INEL.

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Table 1. Organic chemicals used regularly in the TPP (7920) and TURF (7930) and subsequently discharged to the ORNL LLLW system

Chemical	Approximate Annual Usage
Acetic acid	m[a]
Acetone	100 L
Adogen-364-HP (~triluarylamine)	100 L
Carbon tetrachloride	m
Deodorized mineral spirits (Amsco)	1000 L
2,5-di-tert-butylhydroquinone (DBHQ)	m
Diethylbenzene (DEB)	800 L
Diethylenetriaminepentaacetic acid (DPTA)	m
Di (2-ethylhexyl) phosphoric acid (HDEHP)	200 L
Di-isopropylbenzene (DIPB)	100 L
Ethanol	100 L
Ether	m
Ethylenediaminetetraacetic acid (EDTA)	m
2-ethyl-1-hexanol	m
α-hydroxyisobutyric acid	m
Isopropanol	m
Methanol	m
n-dodecane	m
n-paraffin (NPH)	m
Oxalic acid	m
Thenoyltrifluoroacetone (TTA)	m
Tributylphosphate (TBP)	m
Trichloroethylene (TCE)	m
Xylene	m

[a]m = minimal usage: ≤ 10 kg/year or ≤L/year.
Bates, 1988

Table 2. ORNL Total Organic Carbon Estimates

TRU Tanks	Tank No.	Volume (m3)	Mass (kg)	TOC (mg/kg)	TOC (kg)
INACTIVE TANKS					
North Tank Farm	W-03	5.3	5670	5300	30.05
	W-04	18.2	24527	200	4.91
South Tank Farm	W-07	37.5	45715	1300	59.43
	W-08	11.4	14080	8400	118.27
	W-09	0.8	833	2900	2.42
	W-10	28	31650	4900	155.09
Old Hydrofracture Facility	T-01	3	4845	18600	90.12
	T-02	4.6	7328	28000	205.18
	T-03	7.7	14829	9140	135.54
	T-04	5	6242	4620	28.84
	T-09	1.9	2967	7620	22.61
ACTIVE TANKS					
Evaporator Facility	C-2	45.6	63853	3281	209.50
	W-21	27.5	38524	6480	249.64
	W-22	43.5	60939	22.1	1.35
	W-23	64.2	89818	4120	370.05
MVSTs	W-24	52	72861	2940	214.21
	W-25	90.7	126911	2330	295.70
	W-26	59.2	82930	6220	515.82
	W-27	69.1	96707	3135	303.18
	W-28	16.5	23051	2500	57.63
	W-29	46.4	64913	3531	229.21
	W-30	46	64383	3531	227.34
	W-31	26.3	36828	4470	164.62
				Total TOC	3690.69

Table 3. RF/INEL and LANL Complexing Chemicals Estimate

Potential Complexing Agents in Rocky Flats (Including Stored at INEL) and LANL Waste

Compound	RF Mass (kg)	LANL Mass (kg)	Total Mass (kg)
Ascorbic Acid	90	7	97
Acetic Acid	132	10	142
Sodium Acetate	1110		1110
Citric Acid	90	1100.5	1191
Sodium Citrate	400		400
Oxalic Acid	90	13706	13796
EDTA	23		23
8-Hydroxyquinoline	46		46
Tributyl Phosphate	74		74
1,10 Phenanthroline	0.24		0
Dihexyl-n,n-diethylcarbamoyl-methylphosphonate	72		72

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APPENDIX B - 4

United States Government **Department of Energy**

memorandum

Carlsbad Area Office
Carlsbad, New Mexico 88221

DATE: March 29, 1996

REPLY TO ATTN OF: NTP:DW:96-1111

SUBJECT: Current Estimate of Complexing Agents in Transuranic Solidified Waste Forms Scheduled for Disposal in WIPP

TO: Les E. Shephard, Director, SNL/NM

Attached is a copy of the report containing the preliminary estimates of complexing agents in transuranic (TRU) solidified waste forms scheduled for disposal in the Waste Isolation Pilot Plant (WIPP). This information was requested from the TRU Waste Baseline Inventory Report (TWBIR) team in support of the Performance Assessment (PA) being conducted by Sandia National Laboratory (SNL) and is based on input from the following TRU waste sites: Rocky Flats Environmental Technology Site (RFETS), Los Alamos National Laboratory (LANL), Oak Ridge National Laboratory (ORNL), Savannah River Site (SRS), Hanford Operations (Hanford), and Lawrence Livermore National Laboratory (LLNL).

The complexing agent inventories provided in this letter are in response to a Sandia National Laboratory (SNL) request for information from the U. S. Department of Energy (DOE) Carlsbad Area Office (CAO). A copy of the original request for this complexing agent information is contained in Appendix B of Revision 2 of the TWBIR (DOE/CAO-95-1121, December 1995). The documents attached represent the final information requested for this input to the Performance Assessment (PA) and satisfy the commitment on this subject contained in the March 15, 1996, memorandum (CAO:NTP:RLB 96-0687) to respond to SNL before the end of March. It should be specifically noted that all waste inventory volumes quoted are derived from Rev. 2 of the TWBIR.

Tables 1 and 2 provide a summary of Total Organic Carbon (TOC) in the remote-handled (RH)-TRU sludges from ORNL and a list of possible complexing agents that may contribute to the TOC in the sludges. Table 3 provides a summary of specific complexing agents that may be present in the TRU waste for SNL use.

Table 4 summarizes the volume of stored and projected TRU waste that contributes to the estimate of complexing agents in the waste. For contact handled (CH)-TRU waste, greater than 94% of TRU stored and projected final waste forms, greater than 98% of the Solidified Organic final waste forms, and greater than 92% of the Solidified Inorganic final waste forms contribute to the complexing agent estimate. For RH-TRU waste, greater than 86% of TRU stored and projected final waste forms, 100% of the Solidified Organic final waste forms, and 100% of the Solidified Inorganic final waste forms contribute to the complexing agent estimate.

The attached site summary, tables, and background references contain greater detail about the basis for these estimates.

If you have any questions concerning the enclosed information, please contact Mr. Russ Bisping of my staff at (505) 234-7446.

Don Watkins
Manager
National TRU Program

Attachment

cc w/attachment:
R. Bisping, CAO
G. Basabilvazo, CAO
P. Drez, CTAC
L. Sanchez, SNL
M. Chu, SNL
M. Marietta, SNL
J. Harvill, CTAC

SITE SUMMARY

BACKGROUND

Information has been received from all sites that were requested to provide data on potential complexing agents in their solidified waste forms: Rocky Flats Environmental Technology Site (RFETS), Los Alamos National Laboratory (LANL), and Oak Ridge National Laboratory (ORNL). Several transuranic (TRU) waste sites which either generate no solidified waste forms or small quantities have also responded. A copy of the Carlsbad Area Office (CAO) memorandum requesting the complexing agent information from the sites is included (Attachment 1).

The term "complexing agent" is being used in lieu of "chelating agents" in this memo, since chelating agents usually have a certain structure (chelating comes from the Greek work "chele" for claw, as in a crab) and are considered a subset of complexing agents. That is, the acetate ion will "complex" with some metals and increase their solubility but does not have the structure that would label it as a chelating agent. A "commonly" known chelating agent is EDTA (ethylenediaminetetraacetic acid), which contains functional (acetate) anion groups arranged in parallel which resemble a "claw"-like structure for complexing the cations. EDTA has two claw structures at either end of the molecule.

The original scope of this task was to ask the TRU waste sites about "aqueous-soluble" complexing agents in their solidified waste forms. As this task was researched, the authors realized that the term "aqueous-soluble" is only a relative term, since everything is aqueous-soluble at some concentration level. Therefore, every potential chemical compound that has been reported from the TRU waste sites is included and the task of selecting aqueous-soluble compounds is left to the Sandia National Laboratory (SNL) personnel in charge of Performance Assessment (PA) calculations.

TRU WASTE SITE RESPONSES

Oak Ridge National Laboratory (ORNL)

ORNL has provided a list of organic compounds that contain some aqueous-soluble compounds that are apparent complexing agents. A copy of the list of all compounds reported by ORNL to the TRU Waste Baseline Inventory Report (TWBIR) team is attached for completeness (Table 1). The list in Table 1 is from an ORNL report on low-level waste (Kaiser, 1988), but the same compounds are anticipated to occur in the TRU waste based on process history (but not necessarily at the same concentrations). ORNL cannot quantify these compounds in their remote-handled (RH)-TRU solidified wastes, but have provided an estimate of Total Organic Carbon (TOC) for each RH-TRU waste tank (Table 2). The sum of the TOC from all the RH-TRU tanks is approximately 3691 kg. It is anticipated that most of the TOC in the tanks is not associated with complexing agents, but that has not been verified at this time. As a conservatism, SNL can assume that any complexing agents listed in Table 1 could form the bulk of the TOC in the ORNL RH-TRU tanks.

Los Alamos National Laboratory (LANL)

LANL has provided estimates of four complexing agents that are anticipated to occur in their TRU solidified waste streams and as materials used in decontamination and spill clean-up operations (that would occur with the debris wastes) (Attachment 2). The quantities of these compounds are summarized in Table 3.

Rocky Flats Environmental Technology Site (RFETS/INEL)

The information provided by RFETS has been used to estimate the amount of complexing agents in the RFETS retrievable waste (post 1970) at Idaho National Engineering Laboratory (INEL). Attached is a listing of chemicals from RFETS that was provided to the TWBIR team as a basis for potential complexing agents in TRU waste scheduled for shipment to and disposal in WIPP (Table 3). This same list was originally put together as part of the documentation requested by the State of Nevada to document that less than 1% "complexing" agents occur in RFETS solidified low-level "saltcrete" waste that would be shipped to the Nevada Test Site (NTS) for disposal (Attachment 3).

The list was provided as a yearly estimate of complexing agents used on site at RFETS. It is conservative to assume that all of these complexing agents would reside in the TRU waste. The inventory of complexing agents is the best estimate for all TRU waste generated across the entire RFETS site, which includes debris wastes. The mass of complexing agents reported in Table 3 for RFETS are arrived at by multiplying the yearly estimates (in kilograms) by 20 years of production at RFETS (1970-1989), which includes RFETS waste in storage at INEL. The yearly estimates can be found in Attachment 3.

Savannah River Site (SRS)

The SRS has provided information (see letter included as Attachment 4) on three complexing agents used on site in connection with their operations: tributyl phosphate (TBP), tri-octyl phosphine oxide (TOPO), and tri-iso octylamine (TiOA). As discussed in the SRS letter, none of these compounds are expected to be found in SRS TRU waste.

Hanford Operations

Hanford Operations has provided a listing from their database of potential chemicals in their TRU waste. The only chemical that appears on the list that might act as a chelating agent in aqueous solutions and has a reportable quantity associated with the waste is tributyl phosphate (TBP). TBP is reported under three different spellings with a total of 92.5 kg. This value is summarized in Table 3. The entire list of chemicals and the associated quantities (in kg) reported by Hanford are included in Attachment 5.

Lawrence Livermore National Laboratory (LLNL)

LLNL submitted the letter included as Attachment 6 which documents that no chelating agents occur in the LLNL TRU waste streams.

ESTIMATED VOLUME OF TRU WASTE INCLUDED IN COMPLEXING AGENT MEMO

Column 2 of Table 4 contains a list of the total TRU waste destined for disposal in WIPP (stored plus projected to 2022). Column 3 estimates the volume of waste from each major site that has contributed to the estimate of complexing agents in TRU waste. Columns 4 and 5 provide the same data for Solidified Organics and Solidified Inorganics final waste forms. The two rows labeled "PERCENTAGE" provide an estimate of the percentage of waste for which the TRU waste sites have provided data used in estimating the complexing agents in the waste. It should be specifically noted that all waste inventory volumes quoted are derived from Rev. 2 of the TWBIR (DOE, 1995).

REFERENCES

Kaiser, L. L., 1988, "ORNL Inactive Waste Tanks Sampling and Analysis Plan," ORNL/RAP/LTR-88/24, April 29, 1988, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

U. S. Department of Energy, 1995, "Transuranic Waste Baseline Inventory Report (Revision 2)," DOE/CAO-95-1121, December 1995, Carlsbad, New Mexico.

Table 1. Organic Chemicals Used Regularly in the TPP (7920) and TURF (7930) and Subsequently Discharged to the ORNL LLLW System

Chemical	Approximate Annual Usage
Acetic acid	m[a]
Acetone	100 L
Adogen-364-HP (~triluarylamine)	100 L
Carbon tetrachloride	m
Deodorized mineral spirits (Amsco)	1000 L
2,5-di-tert-butylhydroquinone (DBHQ)	m
Diethylbenzene (DEB)	800 L
Diethylenetriaminepentaacetic acid (DPTA)	m
Di (2-ethylhexyl) phosphoric acid (HDEHP)	200 L
Di-isopropylbenzene (DIPB)	100 L
Ethanol	100 L
Ether	m
Ethylenediaminetetraacetic acid (EDTA)	m
2-ethyl-l-hexanol	m
α-hydroxyisobutyric acid	m
Isopropanol	m
Methanol	m
n-dodecane	m
n-paraffin (NPH)	m
Oxalic acid	m
Thenoyltrifluoroacetone (TTA)	m
Tributylphosphate (TBP)	m
Trichloroethylene (TCE)	m
Xylene	m

[a]m = minimal usage: ≤10 kg/year or ≤liters/year.
Bates, 1988

Table 2. ORNL Total Organic Carbon Estimates

TRU TANKS	TANK NO.	VOLUME (m^3)	MASS (kg)	TOC (mg/kg)	TOC (kg)
INACTIVE TANKS					
North Tank Farm	W-03	5.3	5670	5300	30.05
	W-04	18.2	24527	200	4.91
South Tank Farm	W-07	37.5	45715	1300	59.43
	W-08	11.4	14080	8400	118.27
	W-09	0.8	833	2900	2.42
	W-10	28	31650	4900	155.09
Old Hydrofracture Facility	T-01	3	4845	18600	90.12
	T-02	4.6	7328	28000	205.18
	T-03	7.7	14829	9140	135.54
	T-04	5	6242	4620	28.84
	T-09	1.9	2967	7620	22.61
ACTIVE TANKS					
Evaporator Facility	C-2	45.6	63853	3281	209.50
	W-21	27.5	38524	6480	249.64
	W-22	43.5	60939	22.1	1.35
	W-23	64.2	89818	4120	370.05
MVSTs	W-24	52	72861	2940	214.21
	W-25	90.7	126911	2330	295.70
	W-26	59.2	82930	6220	515.82
	W-27	69.1	96707	3135	303.18
	W-28	16.5	23051	2500	57.63
	W-29	46.4	64913	3531	229.21
	W-30	46	64383	3531	227.34
	W-31	26.3	36828	4470	164.62
				Total TOC	3690.69

Table 3. RF/INEL and LANL Complexing Chemicals Estimate

POTENTIAL COMPLEXING AGENTS IN ROCKY FLATS (INCLUDING STORED AT INEL), LANL, HANFORD TRU WASTE

COMPOUND	RF MASS (kg)[1]	LANL MASS (kg)[2]	HANFORD MASS (kg)[3]	TOTAL MASS (kg)
Ascorbic Acid	90	7		97
Acetic Acid	132	10		142
Sodium Acetate	1110			1110
Citric Acid	90	1100.5		1190.5
Sodium Citrate	400			400
Oxalic Acid	90	13706		13796
EDTA	23			23
8-Hydroxyquinoline	46			46
Tributly Phosphate	74		92.5	166.5
1,10 Phenanthroline	0.24			0.24
Dihexyl-n,n-diethylcarbamoyl-methylphosphonate	72			72

[1] Letter from W.F. Weston to E.S. Goldberg, No. 89-RF-3055, dated September 1, 1989 (Attachment 3)
[2] Memorandum from C.L. Foxx to P. Drez dated March 12, 1996 (Attachment 2)
[3] Memorandum from F.M. Coony and M.R. Kerns to L.C. Sanchez through S. Lott, dated January 25, 1996 (Attachment 5)

United States Government — Department of Energy

memorandum

Carlsbad Area Office
Carlsbad, New Mexico 88221

DATE: JAN 5 1996

REPLY TO ATTN OF: CAO:NTP:RLB 96-0605

SUBJECT: Additional Transuranic (TRU) Waste Data Request for Sandia National Laboratories' Waste Isolation Pilot Plan (WIPP) Performance Assessment

TO: Distribution

We have been informed by representatives from Sandia National Laboratories (SNL) working on WIPP Performance Assessment (PA) that they require more information on certain TRU waste-related parameters in order to assess their influence on WIPP PA (see attached copy of relevant pages form SNL memo).

Data for most of these parameters have already been received from the sites either through responses to the Baseline Inventory Report (BIR), Revision 2, questionnaire or by discussions with site representatives. However, since the request from SNL for data on water soluble organic ligands (i.e., chelating agents) was not received in time for inclusion in the BIR Rev. 2 data call, WIPP PA still needs data for this parameter. As per the SNL memo, the data are needed by the end of February 1996, and therefore it is being addressed through this request separately from the upcoming BIR Rev. 3 data call.

As documented in the SNL memo, WIPP PA would like to have "best estimates" that are realistic and not overly conservative. Consequently, all sites that have existing data on chelating agents present in their waste are requested to submit the best available information to the BIR technical staff by February 26, 1996. The details on the nature of the information being requested by WIPP PA are being provided in Table 3 of the attachment.

A representative from SNL WIPP PA will be available at the upcoming BIR, Revision 3, Data Call Meeting to be held in Concord, California, on January 10, 1996. We anticipate that a brief presentation will be made at this meeting by WIPP PA staff explaining the importance of the data followed by any questions from site representatives. If you have any questions/clarifications regarding this matter, please be ready to discuss these at the upcoming meeting in Concord with the SNL WIPP PA representative.

Thank you for your continued cooperation.

Russ Bisping
Russ Bisping
Waste Certification Manager

Attachment

Printed on recycled paper

Table 4. Calculation of Amount of Waste Covered

Major Sites	Total TRU (m³)	Accounted For in Complexing Agent Estimate (m³)	Solidif. Org (m³)	Solidif. Inorg. (m³)
CH-TRU[1]				
RL [9]	45515.43	45515.43	0	23.39
INEL[2]	28606.74	25657.4	789.67	3349.6
LLNL[3]	941.13	941.13	0	20.18
LANL [4]	18405.15	18405.15	30.58	6922.02
NTS [5]	627.91	627.91	0	5.67
ORNL [6]	1560.42	0	0	0
RFETS [7]	5107.92	5107.92	140.93	1423.01
SRS [8]	9648.15	9648.15	0	1369.8
Total Major Sites	110412.85	105903.09	961.18	13113.67
Total CH-TRU	111721.43	111721.43	980	14108.51
PERCENTAGE [10]		94.79%	98.08%	92.95%
RH-TRU[1]				
RL [9]	21729.35	21729.35	0	0
INEL[2]	220.72	196.98	3.56	65.27
LANL [4]	193.13	193.13	0	0
ORNL [6]	2915.64	1243.33	0	1243.33
Total Major Sites	25058.84	23362.79	3.56	1308.6
Total RH-TRU	26930.88	26930.88	3.56	1308.6
PERCENTAGE [10]		86.75%	100.00%	100.00%

(1) Table 4-3 to 4-23, Rev. 2 TWBIR
(2) Non RFETS Waste Subtracted
(3) Letter from K. Hainebach to J. Teak dated March 7, 1996 (Attachment 6)
(4) Memorandum from C.L. Foxx to P. Drez dated March 12, 1996 (Attachment 2)
(5) NTS waste is derived from LLNL only, see (4)
(6) ORNL was only asked to estimate complexing agents in solidified RH-TRU waste per DOE memorandum dated January 5, 1996 (Attachment 1)
(7) Letter from W.F. Weston to E.S. Goldberg, Letter No. 89-RF-3055, dated September 1, 1989 (Attachment 3)
(8) Letter from J. D'Amelio to J. Teak, SWE-SWE-96-0106, dated February 28, 1996 (Attachment 4)
(9) Memorandum from F.M. Coony and M.R. Kerns to L.C. Sanchez through S. Lott, dated January 25, 1996 (Attachment 5)
(10) Volume percentage of total TRU waste, Solidified Organics, and Solidified Inorganics accounted for in complexing agent memorandum.

B) Special Request Non-PA Items

Also wanted at this time is additional information for several waste material characteristics. Although these characteristics have not been identified as waste material parameters to be used for WIPP PA, they are needed for non-PA scoping calculations to assess their influence on PA. Since these items are not currently PA parameters, inventory estimates of these characteristics as "additional information" in the TWBIR or supplied outside of the TWBIR via written correspondence. Below you will find an itemized list of these special request items.

1) **Non-radioactive Materials**
Additional information is needed on the five waste material characteristics (see Table 2): 1) vitrified wastes, 2) nitrates (NO_3^-), 3) sulfates (SO_4^{2-}), 4) phosphorus, and 5) cement. Of these waste parameters, the last four are needed for the gas generation modeling. The nitrates and the sulfates are involved in the denitrification and sulfate reduction processes which breakup the cellulosics, while the phosphorus is a nutrient for biodecay of cellulosics. The estimate of the mass quantities of cement in the waste inventory should include both the cement that is contained in the waste as cement itself (due to D&D activities, etc.,) and the cement found in various sludges. Cement consumes CO_2 due to its content of $Ca(OH)_2$. The estimates for this non-radioactive waste constituent need only be "best estimates" at this present time so that non-PA scoping calculations can be made to determine their importance on overall repository performance. (Do not generate upper-bound estimates that are overly conservative.)

2) **Residues**
"Best estimates" are needed for residues, in addition to those already identified at the Rocky Flats Plant (RFP), that have the possibility of being changed from a resource category to a TRU waste category.

3) **Organic Ligands (Chelating Agents)**
"Best estimates", from currently available information, are needed for major water-soluble organic ligands which are under consideration for the actinide source term (see Table 3). If it is not possible to obtain data from major waste generating sites then supply guidance on how a first-order estimate may be made (from existing information such as process knowledge etc.,) so that non-PA scoping calculations can be performed to identify if the presence of these ligands would have any significant impacts. (Do not generate estimates that are overly conservative.) Requested data is for final form "process-level" quantities used in production only for the key sites. If information on the "process-level" values does not exist at the key sites, then "laboratory-scale" values should be used in the requested assessment of the inventory. Should it be determined that more detailed information on organic ligands will be needed, you will be given a specific written request at a future time. This effort should be performed in parallel with the TWBIR. Technical data should be supplied in memorandum form by the end of February 1996 with supporting documentation by the end of March 1996.

Ligand (b)	Discussion (c)
1) Total Complexants	The most valuable information at this time is a "best estimate" of the total amount of water soluble complexing agents (ligands) in the TRU waste matrix.
2) Citrate	Preliminary information indicates that citrate (citric acid) may be the largest used ligand at TRU waste generating sites. Hence, inventory quantities are very important.
3) Lactate	This is an important ligand that is produced by bacteria as part of its own metabolism. What is requested here is a "best estimate" of the quantity of lactate that actually exists in the TRU waste matrix (not just an initial amount supplied as part of a waste stream). However, if this information cannot be developed, then supply information on the initial amount.
4) Oxalate	This is an important ligand that is produced by bacteria as part of its own metabolism. What is requested here is a "best estimate" of the quantity of oxalate that actually exists in the TRU waste matrix (not just an initial amount supplied as part of a waste stream). However, if this information cannot be developed, then supply information on the initial amount.
5) EDTA	This ligand (ethylenediaminetetraacetic acid) is also of major importance due to its common use as a cleaning solvent.

Table 3. Justification of Special Request For Info On Organic Complexing Agents. (a)

(a) Information on these additional waste materials are needed for non-PA scoping calculations for assessment of their importance. The presence of these complexing agents are important for the actinide source term, with respect to increasing the solubility of radionuclides.
(b) These items are ranked in the order of their importance in the actinide source term.
(c) Also supply any available information that TRU waste generation sites may have on the degradation or decay rates of ligands in current (and expected) waste matrixes if possible. In cases where no information is available, supply guidance on estimating first-order quantities.

LCS:6741:lcs/(95-2082)

Copy to:
P.E. Drez (Drez Environmental Associates)
D. Bretzke (Science Applications International Corporation)
S. Chakraborti (Science Applications International Corporation)
MS-1320, C.F. Novak (Dept. 6119)
MS-1325, H. Jow (Dept. 6741)

JAN 5 1998

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Los Alamos
NATIONAL LABORATORY
memorandum

Waste Management and
Environmental Compliance
NMT-7 MS E501

To/MS: Paul Drez, Drez Environ. Assoc.
Thru: James J. Balkey, NMT-7, MS E501 JJB

From/MS: C. L. Foxx, NMT-7, MS E501 CLF
Phone/FAX: 7-2328/ 7-9201
Symbol: NMT-7-WM/EC-96-035
Date: March 12, 1996

SUBJECT: CHELATING AGENTS IN LANL WASTE

I am certain that I have not captured all chelating agents, but I believe that I have identified and quantified roughly the important materials. The chelators are found in three waste streams:

1) Cemented evaporator bottoms from TA-55
2) Cemented sludge from the TA-50 Pretreatment Plant and dewatered sludge from the TA-50 Liquid Waste Treatment Plant
3) Combustible waste from TA-55

The three streams are summarized below.

It should be noted that waste generation data and analyses exist over the time frame of 1980 through 1995 or shorter intervals to support the estimated values. In some cases, quantitative data is almost nonexistent and the results are qualitative at best. Like Rocky Flats, plutonium processing at LANL attempts to avoid chelating agents which can interfere with recovery operations. From your list of compounds of interest, I am unaware of any significant usage of lactate or EDTA, so they have been eliminated from detailed consideration. I have added ascorbate which has been used as a reducing agent in HCl solutions, but not in nitric acid which attacks and decomposes ascorbate. One of the above streams is not an immobilized stream, but I believe that it is an important contributor of a soluble chelating agent in the form of citrate. If this information is extraneous to your purposes, just ignore it.

Cemented evaporator bottoms from TA-55. The evaporator bottoms are derived from nitric acid solutions some of which (27%) contain oxalate resulting from the precipitation of plutonium oxalate. Because of the pervasive usage of oxalate, it is contained at lower concentrations even in those solutions that do not arise from filtering an oxalate precipitate. Those numbers are based on analytical results. In addition the drums contain on the average, 3.2 liters of analytical solution residues. Those solutions contribute a negligible additional quantity of oxalate and small quantities of ascorbate, citrate and acetate. We have semi-quantitative values from the analytical organization for those chelators, based on the quantities used in the analytical processes that give rise to the residues. We know that 28 liters of solution went into a drum of cemented waste on the average from 1980 through June of 1988. Since that time, the average has been 43 liters of solution. In addition we have information regarding the number of drums generated from May, 1987 through April, 1995. The drum numbers and alternate cemented forms for the remaining years are estimated. The totals based on those data and estimates are shown here.

oxalate	1600 kg	90.04 / 88.04	= 1632	
ascorbate	7 kg	176.14 / 175.14	= 7.04	≈ 7
citrate	0.5 kg	192.14/191.14	= 0.5	≈ 0.5
acetate	10 kg	60.05 / 59.05		≈ 10

Cemented sludge from the TA-50 Pretreatment Plant and dewatered sludge from the TA-50 Liquid Waste Treatment Plant. Based on experience at the liquid waste treatment plant with upsets in the treatment process due to the presence of chelators in the waste stream, it has been assumed that TA-55 is the only significant source of chelating agents in the sludge generated at that facility. Three waste lines carry liquids from TA-55 to TA-50. The industrial waste line is thought to be reasonably free of chelating agents. The evaporator distillate in the process acid waste line is unlikely to contain significant quantities of chelators because the distillation process creates a sharp reduction in the content of nonvolatile solution species.

The process caustic waste line solution is dominated by oxalate filtrates in hydrochloric acid that have been subjected to caustic treatment and filtration. Under the conditions of that treatment the oxalate and ascorbate (used historically) are soluble and follow the solution to TA-50 for a ferrofloculation treatment. The solution is used to neutralize the nitric acid distillate. Because there is an excess of nitric acid, the neutralization is completed with the addition of stock sodium hydroxide. I have assumed that the short term excess of nitric acid decomposes the ascorbate leaving only the oxalate. I have estimated the oxalate concentration in the hydroxide filtrate at 0.075 moles/liter. If this number drives the calculation then we should sample the solution in the caustic holding tank at TA-50 and get a representative value.

Volumes of caustic solution generated by TA-55 were available for the years 1983 and 1986 through 1992. Volumes for all other years were estimated. I am assuming that the oxalate will appear in the sludges due to the low solubility of calcium oxalate and because the floculations have relatively high concentrations of calcium. In addition magnesium and aluminum oxalates are insoluble in a caustic environment. The oxalate precipitates will be found in the cemented sludge, whenever generated, and in the dewatered sludge from the early and middle 80's. These oxalates will also be found in the cement-filled corrugated metal pipe (CMP) waste stream generated at DP site when plutonium operations were located there. The total of oxalate in those waste streams is 11,800 kg. = 12070

Combustible waste from TA-55. The combustible waste stream contains rags that were used in decontamination and spill clean-up operations. In spill clean-up the rags from the first pass are nearly always TRU waste as measured on our MEGAS assay instrument. The rags are dampened with a solution labeled "versene". Versene is a name for EDTA. In the very early days of the laboratory versene solution may have contained EDTA, but it had been changed to sodium citrate solution by the time I arrived in 1969. Drums of combustible waste do not usually contain only decontamination rags and often contain no such rags. However our waste management personnel apparently used a unique identifier over about a four year period (1987 to 1991) for the decontamination rags. Each item also had a net disposal weight associated with it. Thus I was able to get a handle on the weight of decon rags generated in that time frame. The rags were discarded not dripping but distinctly damp. I dampened some cheesecloth, weighing before and after, to estimate the weight of solution contained in the rags. Knowing the weight of solution and the concentration of the citrate, I was able to calculate a weight of citrate in the discarded rags. In May, 1991 the usage of citrate for decontamination was restricted to certain matrices. I was able to locate records for versene solution preparation from 1989 into early 1991 and then again for the past year so I could understand usage before and after 1991. From that I have estimated the usage for the remaining years. With that information, I have estimated that the citrate contained in the combustible waste stream from 1971 to 2033 will be 1100 kg.

Cy: Andy Montoya, NMT-7, MS E501
NMT-7 File

ATTACHMENT 3

CORRES. CONTROL
OUTGOING LTR. NO.

RF 3055

DIST.

HAHN, D.J.
ER, C.P.
ROT, R.J.
TZ, E.R.
R.C.
ER, E.H.
ER, J.E.
W.A.
TT, J.F.
ERS, G.W.
KER, J.H.
NON, W.M.
TON, W.F. X
NIAK, B.D.
IG, E.R.
HER, D.H.
NVAL, G.J.
ERA, D.W.
MAN, L.K.
ERT, J.L.
J.B.
MAN, R.B.
MANN, R.L.
EG, D.M. X X
DENBURG, G.E.
MLEY, K.B. X
N, E.R. X X
R.L.
ER, H.L.
ASQUEZ, R.N.

RES. CONTROL X X
TRACT ADMIN.
X X
X X
X X
X X

SSIFICATION
CLASSIFIED X X
FIDENTIAL
RET

UTH. CLASSIFIER SIG.

N REPLY TO LTR. NO.

APPROVALS

& TYPIST INITIALS
ELD
469 (Rev. 4/89)

Rocky Flats Plant
Aerospace Operations
Rockwell International Corporation
P.O. Box 464
Golden, Colorado 80402-0464
(303) 966-7000
Contractor to U.S. Department of Energy

SEP 01 1989

89-RF-3055

Edward S. Goldberg
Acting Area Manager, RFO

Attn: Mark Van Der Puy

APPLICATION TO SHIP SALTCRETE

Attached is a copy of the re-formatted Application to Ship Waste for saltcrete. This application addresses all the comments from the Nevada Operations Office document attached to your letter 1245-RF-89.

Please refer any questions regarding the attached application to E.L. D'Amico at (303) 966-5362 or P.M. Arnold at FTS 320-2056.

W.F. Weston, Director
Plutonium Operations

Orig. and 3 cc - E.S. Goldberg
Enc.

Table 8 (continued)
Reference Documents/Results Outlining Compliance
to the General Waste Form Criteria

		Boxes." specifies Waste Operations personnel to visually inspect for and remove any excessive particulate from each stored saltcrete box.
Gases	Not Applicable	Saltcrete is not a gaseous waste and does not contain radioactive gases.
Stabilization	WO-5004	As described in WO-5004, "Waste Treatment Spray Dryer and Saltcrete Process," cement is added to the salt waste stream to immobilize the particulate, solidify the liquids and moderate oxidizing characteristics.
Etiologic Agents	Not Applicable	Saltcrete does not contain pathogens, infectious wastes or other etiologic agents.
Chelating Agents	Quantity and type of complexing agents used per year at Rocky Flats: Ascorbic Acid: 4.5 kg Acetic Acid: 6.6 kg Sodium Acetate: 55.5 kg Citric Acid: 4.5 kg Sodium Citrate: 20.0 kg Oxalic Acid: 4.5 kg EDTA: 1.15 kg	Between 5/15/87 and 5/7/88, 917 triwall boxes of saltcrete were produced. The estimated saltcrete generation for any given year is between 1200 to 1600 triwalls. The average net weight of one triwall box of saltcrete is approximately 1600 pounds. Total weight of saltcrete produced between 5/15/87 and 5/7/88 is 917 boxes * 1600 pounds * 1 kg/2.2 pounds = 6.67×10^5 kg. As a worst case, if it is assumed that all 106.36 kg of complexing agents are

Table 8 (continued)
Reference Documents/Results Outlining Compliance
to the General Waste Form Criteria

	8-Hydroxyquinoline: 2.3 kg Tributyl Phosphate: 3.7 kg 1,10 Phenanthroline: 0.012 kg dihexyl-n,n-diethylcarbamoyl methylphosphonate: 3.6 kg Total: 106.36 kg	disposed of with the saltcrete, then, $106.36/6.67*10^{5}=1.59*10^{-4}$ is the weight fraction of the complexing agents with respect to the saltcrete. Therefore, Rocky Flats' total yearly usage of complexing agents amounts to only 0.0159 weight percent of the total saltcrete production between 5/15/87 and 5/7/88. This extremely conservative estimate is well under the NTS limit of 1 weight percent.
GCD Waste	Not Applicable	Saltcrete does not meet any of the guidelines to be identified as a GCD' waste.
Bulk LLW	Not Applicable	Saltcrete is not a bulk LLW.

4. **Additional Mixed Waste Form Criteria**

Table 9 references the documents (procedures, specifications, etc.) or test/analysis results that specify compliance to the Additional Mixed Waste Form Criteria outlined in Section 2.2.2 of NVO-325.

Table 9
Reference Documents/Results Outlining Compliance
to the Additional Mixed Waste Form Criteria

Criterion	Compliance Documents or Results	Comments
Treated Waste	Not Applicable	Saltcrete is a treated waste that meets the land disposal restrictions and

ATTACHMENT 4

Westinghouse
Savannah River Company

P O Box 616
Aiken SC 29802

February 28, 1996

SWE-SWE-96-0106
F/WSWE/XXX/ARNR
Response Required: N/A
Key Words: TRU Waste
Record Retention: Permanent

Jim Teak
Advanced Sciences, Incorporated
6739 Academy Road, N. E.
Albuquerque, New Mexico 87106-3345

Dear Mr. Teak:

FY96 TRANSURANIC WASTE BASELINE INVENTORY REPORT (TWBIR): RESPONSE TO THE TWBIR MEETING MINUTES REGARDING CHELATING AGENTS AND CONCRETE STABILIZATION (U)

The Savannah River Site (SRS) has reviewed its waste practices to determine whether chelating agents are present in retrievably stored TRU waste. SRS also has reviewed these practices to determine whether concrete has been used to solidify/stabilize TRU waste. These reviews revealed that SRS TRU waste streams do not currently contain chelating agents/complexants nor has SRS used concrete to solidify/stabilize TRU waste.

The Separations processes and the analytical/research laboratories at SRS have used chelating agents in the separation of plutonium from irradiated uranium and other materials. For example, tri-butyl phosphate (TBP) is the complexing agent used in SRS's PUREX process and many other laboratory processes. Also, agents such as tri-octyl phosphine oxide (TOPO) and tri-iso octylamine (TiOA) have been used or investigated through the years. However, none of these chelating agents/complexants has entered SRS TRU waste. The complexants are dissolved in organic solvents for use as liquid/liquid extractants in the separation process. These solvents are recycled until depleted and then discarded to SRS's solvent waste tanks in the Waste Disposal Facility. This means that SRS organic liquid streams have not entered the production lines (e.g., HB and FB-Lines) where most of SRS TRU waste is generated. Further, a small amount of liquid TBP containing TRU nuclides is generated by SRS laboratories. This laboratory waste is discarded to liquid waste streams, which are eventually disposed in SRS's High Level Waste Tanks. So, none of these liquid streams that contain complexants have entered SRS solid TRU waste streams.

SRS has not used concrete to solidify/stabilize TRU waste. The processes that generate slurries, which require stabilization, do not contain TRU radionuclides (e.g., plating of depleted uranium). For other processes that generate slurries, the waste is disposed in SRS's High Level Waste Tanks. Even the Low Level Waste (LLW) sludge generated by SRS's Effluent Treatment Facility (ETF) is disposed in the High Level Waste Tanks and is eventually ted to SRS's Saltstone Facility or the Defense Waste Processing Facility (DWPF). Finally, SRS does not expect to generate TRU waste containing chelating agents nor anticipate using concrete to solidify/stabilize TRU waste in the near-future.

Please direct your questions to L. Williams (803) 557-6759

Sincerely,

Joseph A. D'Amelio
TRU Engineering Manager

JAD:lw

cc: A. Gibbs, 724-21E
W. T. Goldston, 705-3C
F. H. Gunnels, 705-3C
S. J. Mackmull, 703-A
S. J. Mentrup, 724-21E
D. Ormond, 703-A
L. Williams, 705-3C
Records Management, 705-3C
SWE Files, 705-3C

ATTACHMENT 5

To: L. C. Sanchez, SNL January 25, 1996

Thru: Sheila Lott, CTAC

From: F. M. Coony and M. R. Kerns, Hanford Site

RE: Additional TRU Waste Data Request for Sandia National Laboratories' Waste Isolation Pilot Plan Performance Assessment

References: 1) Memorandum, Russ Bisping, DOE/CAO to Distribution, same subject, dated January 5, 1996.

2) Trip Report, F. M. Coony to K. L. Hladek, January 15, 1996

The Reference 1 memo requests additional data on waste soluble organic ligands (i.e. chelating agents) from the generating sites by February 28, 1996.

Hanford's approach for responding to the additional data request is presented in the Reference 2 trip report. The first item of this approach is to provide SNL, through CTAC, a list of all hazardous constituents, and their quantities, that have been reported in solid TRU wastes at Hanford since 1987, the date of the By-Product Rule.

The list of hazardous constituents and their quantities, from Hanford's record container tracking system, are presented in Table 2. The chemical names have been truncated to 30 characters. Hanford can provide complete names if needed. In some cases, the constituent is listed more than once because the constituent is spelled differently in the container tracking system. A quantity of 0.00 kg means typically that the constituent has been identified solely because it is a listed hazardous waste under RCRA. In these cases, the quantity is either absent or minimal.

Please evaluate this list of constituents, and indicate, in the space provided for each constituent, if the constituent is a soluble organic ligand. The suggested nomenclature is the following:

- N/A (meaning not soluble organic legend)
- C (meaning citrate
- L (meaning lactate)
- OX (meaning oxalate)
- EDTA (meaning ethylenediaminetetraacedid acids

Please indicate any other relevant information by footnotes.

To meet the requested due date, please provide a response to me (by fax) no later than February 5, 1996. Please copy CTAC on the response.

If you have any questions, please contact Mike Coony at 509-376-9774 or Mark Kerns at 509-372-2383.

MASS
(KG)

Table 2. Quantities of Hanford Constituents

[illegible]	[illegible]	[illegible]
1,1,1-TRICHLOROETHANE	0.00	
2-BUTOXYETHANOL	0.02	
ACETONE	0.00	
ACID	0.14	
ALUMINUM NITRATE	0.10	
ALUMINUM NITRATE MONOHYDRATE	3.80	
AMERCOAT 234	0.05	
AMMONIUM CHLORIDE	0.01	
ARSENIC	0.02	
ASBESTOS	27.00	
BARIUM	1.88	
BERYLLIUM	0.17	
BIS(2-ETHYLHEXYL)PHTHALATE	0.82	
BISPHENOL A RESIN	0.54	
BUTYL ALCOHOL	0.41	
BUTYL GLYCIDYL ETHER	0.11	
CADMIUM	99.17	
CADMIUM HYDROXIDE	0.10	
CALCIUM CHLOROFLUOROPHOSPHATE	0.83	
CALCIUM HYDROXIDE	0.08	
CARBON TETRACHLORIDE	87.88	
CARBONTETRACHLORIDE	95.90	
CHLOROFORM	0.00	
CHROMIUM	14.52	
COPPER	0.00	
COPPER SULFATE	0.38	
CRESYLIC ACID	0.00	
CUPROUS CYANIDE	0.21	
CYANIDE SOLUTIONS	0.21	
CYCLOHEXANE	0.00	
DI(2-ETHYLHEXYL)PHTHALATE	0.08	
DI-OCTYL PHTHALATE	0.40	
DIOCTYL PHTHALATE	0.20	
DIOCTYL PHTHALATE (DOP)	8.47	
ETHANOL	0.20	
FERRIC NITRATE	4.38	
FORMIC ACID	0.21	
HEXONE	0.10	
HYDRAULIC FLUID	328.20	
HYDROCHLORIC ACID	0.07	

MASS
(KG)

[illegible]	[illegible]	[illegible]
KEROSINE	0.00	
LEAD	8,915.59	
LEAD ACID	0.27	
LEAD CHROMATE	28.97	
LEAD CHROMATE OXIDE	1.54	
LEAD CHROMATE,CHLORIN.PARAFFIN	1.33	
LEAD CHROMATES	0.05	
LEAD SHIELDING	5,587.50	
LIGHT AROMATIC NAPHTHA	0.30	
MERCURY	1.51	
MERCURY METAL	0.00	
METHYL ETHYL KETONE	0.00	
METHYL ISOBUTYL KETONE	0.00	
METHYLENE CHLORIDE	8.03	
NICKEL HYDROXIDE	0.10	
NITRIC ACID	1.21	
OIL	0.00	
PCB	130.13	
PHOSPHORIC ACID	0.33	
PHTHALIC ACID BENZYL BUTYL EST	0.00	
PHTHALIC ACID BIS(2-ETHYLHEXYL	0.00	
PHTHALIC ACID, BIS(2-ETHYLHEXY	0.05	
POTASSIUM CYANIDE	0.21	
POTASSIUM FLUORIDE	0.00	
POTASSIUM HYDROXIDE	5.80	
RESIDUAL TANK FARM CORE SAMPLE	0.80	
SELENIUM	1.10	
SILVER	0.00	
SODIUM	0.13	
SODIUM CYANIDE	0.21	
SODIUM FLUORIDE	1.08	
SODIUM HYDROXIDE	24.37	
SODIUM NITRATE	173.00	
SODIUM SULFATE	3.92	
STRIPCOAT	34.08	
SULFAMIC ACID	0.04	
SULFURIC ACID	1.53	
THENOYL TRIFLUOROACETONE	0.00	
TRI BUTYL PHOSPHATE	49.30	
TRIBUTYL PHOSPHATE	43.13	
TRIBUTYLPHOSPHATE	0.07	

MASS
(Kg)

[illegible]	[illegible]
TRICHLOROETHENE	3.28
TRIISOOCTYLAMINE	0.00
TRIMETHYLBENZENE	1.01
TRIOCTYLPHOSPHINE OXIDE	0.00
VANADIUM PENTOXIDE AQUEOUS SOL	0.21
XYLENE	4.23

ATTACHMENT 6

Lawrence Livermore National Laboratory

WASTE CERTIFICATION PROGRAM
WCP96-055

March 7, 1996

Jim Teak
Advanced Sciences Incorporated
6739 Academy Road NE
Albuquerque, NM 87109

Dear Jim,

This is in response to the CAO request concerning the presence of organic ligands (chelating agents) in TRU waste. I have consulted with Joe Magana, a chemist working in LLNL's Plutonium Facility. He tells me that there are no chelating agents in LLNL's TRU waste.

Sincerely yours,

Kem Hainebach

Kem Hainebach, Ph. D.
Waste Certification Engineer
Environmental Protection Department

KH:lh
c: Robert Fischer

M

APPENDIX B - 5

United States Government **Department of Energy**

memorandum

Carlsbad Area Office
Carlsbad, New Mexico 88221

DATE: June 26, 1996

REPLY TO ATTN OF: CAO:NTP:DW 96-1528

SUBJECT: Revision of Current Estimate of Complexing Agents in Transuranic Solidified Waste Forms Scheduled for Disposal in WIPP

TO: Dr. Les E. Shephard, Director, Nuclear Waste Management Programs Center, SNL

The mass of potential complexing agents in transuranic (TRU) waste generated at the Rocky Flats Environmental Technology Site (RFETS) and currently stored at RFETS and Idaho National Engineering Laboratory (INEL) was previously estimated in our March 29, 1996 memorandum, CAO:NTP:DW 96-1111, (Subject: "Current Estimate of Complexing Agents in Transuranic Solidified Waste Forms Scheduled for Disposal in WIPP"). Per our May 3, 1996 discussion, this information has been revised based on assumed or anticipated activities to be performed on the waste prior to final waste form generation.

The assumed or anticipated activities upon which these revisions were made are based on the preliminary submittal by INEL for Revision 3 of the TRU Waste Baseline Inventory Report (TWBIR). From this submittal, a very high percentage of INEL waste will be thermally treated and most complexing agents should therefore be destroyed by the treatment. A methodology is presented for estimating the amount of complexing agents that will be destroyed by the proposed thermal treatment at INEL. Using Ethylene Diamine Tetraaccetic Acid (EDTA) as an example, the original estimate of 23 kg in RFETS waste (stored at INEL and RFETS) has been reduced to a recommended value of 5.9 kg with a high range estimate of 6.9 kg and a low range estimate of 2.9 kg. All other complexing agents reported from RFETS (including that in storage at INEL) in the previous letter should also be reduced by the same methodology.

The original inventory estimates provided in the above referenced letter were based on the following information contained in the original transmittal:

- Estimates provided by the TRU waste sites on the amount of anticipated complexing agents in TRU waste which are summarized in Tables 1, 2, and 3 from TRU waste site memoranda in Attachments 1 through 6.

- Volumes from Revision 2 of the Transuranic Waste Baseline Inventory Report (TWBIR) used in Table 4.

In Revision 2 of the TWBIR, the volumes used for waste stored at the INEL were assumed to be unprocessed through any type of treatment (i.e., thermal) that would destroy potential complexing agents. There was a small percentage of RFETS waste (~33%) stored at INEL scheduled for processing by thermal treatment in the TWBIR, Revision 2. Because these percentages of waste scheduled for thermal treatment were low, no credit was assumed in the original letter for the destruction of potential complexing agents occurring in RFETS TRU waste stored at INEL. This assumption also provided a conservative estimate of the potential complexing agents in TRU waste.

However, the INEL preliminary submittal received for Revision 3 of the TWBIR contains a much higher percentage of waste that will be processed thermally prior to shipment to WIPP for disposal. This much higher percentage of RFETS TRU waste that will be thermally processed will make a significant impact on the calculated amounts of potential complexing agents in TRU waste.

As stated in the original letter, most of the complexing agents were expected in the solidified waste forms, particularly in the solidified inorganic waste forms, since Sandia National Laboratory/New Mexico (SNL/NM) was only requesting information on "aqueous-soluble" complexing agents.

The RFETS estimate (Attachment 3 of the original letter) included all known sources (as of the time frame of the RFETS memo) of complexing agents regardless of what waste forms the chemicals occurred in the waste. Discussions with RFETS indicate the most likely occurrences of complexing agents in the waste would be:

Solidified Lab Waste> Solidified Inorganic Sludges> Debris Wastes

Based on the above relative occurrence for complexing agents, three estimates of the effects of extensive planned thermal treatment of RFETS waste at INEL can be made to modify the mass of chelating agents estimated in the original letter.

Tables AD-1, AD-2, and AD-3 summarize the calculations of the amount of decrease of complexing agents for RFETS in storage at INEL using EDTA as an example:

ASSUMPTIONS

- As stated in the original letter, RFETS was in production for 20 years (1971-1990) during which retrievably stored (post 1970) production waste would have been generated. Buried waste is not part of the WIPP inventory in the TWBIR.
- RFETS stopped shipments of waste to INEL initially in October 1988, then shipped additional quantities of waste from March to August 1989.

- Assuming that RFETS essentially caught up on their backlog of waste during the second shipping period and a modest lag of 2 months from date of closure to actual shipping, effectively provides the beginning of July 1989 as the date for TRU waste accumulation at RFETS.

- Therefore, it is assumed that 18 months (1.5 years) of production waste still exists at RFETS in storage and 18.5 years of post 1970 production waste is in storage at INEL.

CALCULATIONS

As shown in Table AD-1 (for Solidified Lab waste - Content Codes 004 and 113), using EDTA as an example:

- 347.7 m^3 of CH-TRU waste is in storage at INEL.

- 280.1 m^3 will be vitrified, and

- 67.5 m^3 will be set aside for direct shipment to WIPP (including 0.33 m^3 for macroencapsulation)

- Therefore, 80.58% will be vitrified

- RFETS provided an EDTA generation rate of 1.15 kg/year (Attachment 3 of Original Complexing Agent Memo)

- 1.15 kg/year x 18.5 years = 21.3 kg EDTA at INEL in storage

- 1.15 kg/year x 18.5 years generation in storage at INEL x 80.58% vitrification of waste = 17.1 kg of EDTA destroyed by vitrification

- Therefore, 4.1 kg of EDTA (21.3 minus 17.1 kg) will be left in the untreated waste at INEL scheduled for shipment and disposal in WIPP

- The total EDTA in RFETS waste (both in storage at INEL and RFETS) = 4.1 kg (untreated waste at INEL) + 1.15 kg/year x 1.5 years (in storage at RFETS) = 5.9 kg

Since Content Codes 004 and 113 are the waste forms most likely to have the complexing agents, 5.9 kg of EDTA is the RECOMMENDED VALUE for performance assessment.

Using similar methodology in Tables AD-2 and AD-3, estimates of EDTA (after treatment at INEL) are 6.9 kg (assuming the distribution of treatment for all inorganic solidified waste forms - 75.68% treated) and 2.9 kg (assuming the distribution of treatment for all RFETS waste in storage at INEL - 94.44% treated).

The value of 5.9 kg of EDTA is the recommended value, since Content Codes 004 and 113 are the waste forms expected to contain the majority of the complexing agents. The other two values, 6.9 kg for inorganic solidified waste and 2.9 kg for all treated RFETS waste, should be considered lower and upper bounds on this analysis. In particular, the 2.9 kg is a nonconservative estimate because INEL is planning to vitrify almost all their debris waste, particularly the organic debris waste, which may contain some EDTA from wipeup of spills, but is expected to be the least contributor to the overall complexing agents in the waste.

All other complexing agents from RFETS should be reduced by the same percentages for those values reported in Table 3 of the original complexing agent letter.

If you have any questions concerning the attached information, please contact Mr. Russ Bisping of my staff at (505) 234-7446.

Don Watkins
Manager
National TRU Program

Attachment

cc w/attachment:
R. Bisping, CAO
S. Chakraborti, CTAC
J. Harvill, CTAC
P. Drez, DEA
R. Anderson, SNL
L. Sanchez, SNL
M. Chu, SNL
M. Marietta, SNL

TABLE AD-1

DETAILS OF EDTA CALCULATIONS
(BASIS: ROCKY FLATS WASTE AT INEL WITH IDCs 004 AND 113)

						UNPROCESSED WASTE VOLUMES (m^3)				
FFCA_ID	**WS_ID**	**CC**	**Total Vol**	**CH Vol**	**RH Vol**	**CH_Direct Ship**	**RH_Direct Ship**	**Vitrified**	**Amalg**	**Macro**
IN-W157	ID-RFO-004T	4	226.8	226.8	0.0	54.3	0.0	172.3	0.0	0.2
IN-W195	ID-RFO-113	113	2.5	2.5	0.0	0.0	0.0	2.5	0.0	0.0
IN-W221	ID-RFO-113T	113	14.4	14.4	0.0	12.9	0.0	1.5	0.0	0.0
IN-W229	ID-RFO-004	4	103.9	103.9	0.0	0.0	0.0	103.8	0.0	0.1
			347.7	**347.7**	**0.0**	**67.2**	**0.0**	**280.1**	**0.0**	**0.3**

TOTAL EDTA IN RF WASTE AT INEL ---> 21.3 kg
(1.15 kg/yr for 18.5 years)
PERCENT VITRIFIED ---------> 80.6%
AMOUNT VITRIFIED (80.58% of 21.3 kg)--> 17.1 kg
AMOUNT IN UNTREATED INEL WASTE----> 4.1 kg

TOTAL EDTA IN RF WASTE AT RF -------> 1.7 kg
(1.15 kg/yr for 1.5 years)

NEW EDTA ESTIMATE -----> 5.9 kg

TABLE AD-2

DETAILS OF REVISED EDTA CALCULATIONS
(BASIS: ALL ROCKY FLATS SLUDGES AT INEL)

						UNPROCESSED WASTE VOLUMES (m^3)				
FFCA_ID	WS_ID	CC	Total Vol	CH Vol	RH Vol	CH_Direct Ship	RH_Direct Ship	Vitrified	Amalg	Macro
IN-W216	ID-RFO-001T	1	2531.8	2531.8	0.0	775.3	0.0	1741.6	0.0	14.9
IN-W190	ID-RFO-001	1	58.9	58.9	0.0	0.0	0.0	58.6	0.0	0.3
IN-W221	ID-RFO-113T	113	14.4	14.4	0.0	12.9	0.0	1.5	0.0	0.0
IN-W195	ID-RFO-113	113	2.5	2.5	0.0	0.0	0.0	2.5	0.0	0.0
IN-W228	ID-RFO-002T	2	1296.8	1296.8	0.0	15.3	0.0	1260.9	12.4	8.2
IN-W191	ID-RFO-002	2	342.4	342.4	0.0	0.0	0.0	336.9	3.3	2.2
IN-W157	ID-RFO-004T	4	226.8	226.8	0.0	54.3	0.0	172.3	0.0	0.2
IN-W229	ID-RFO-004	4	103.9	103.9	0.0	0.0	0.0	103.8	0.0	0.1
IN-W218	ID-RFO-007T	7	461.5	461.5	0.0	461.5	0.0	0.0	0.0	0.0
IN-W192	ID-RFO-007	7	464.3	464.3	0.0	0.0	0.0	464.3	0.0	0.0
IN-X001	ID-RFO-095N	95	4.9	4.9	0.0	0.0	0.0	4.9	0.0	0.0
IN-W375	ID-RFO-995TN	995	19.3	19.3	0.0	0.0	0.0	19.3	0.0	0.0
IN-X002	ID-RFO-995N	995	68.8	68.8	0.0	0.0	0.0	68.8	0.0	0.0
	TOTALS		**5596.4**	**5596.4**	**0.0**	**1319.3**	**0.0**	**4235.5**	**15.7**	**25.9**

TOTAL EDTA IN RF WASTE AT INEL —> 21.3 kg
(1.15 kg/yr for 18.5 years)
PERCENT VITRIFIED ---------> 75.7%
AMOUNT VITRIFIED (75.68% of 21.3 kg)--> 16.1 kg
AMOUNT IN UNTREATED INEL WASTE----> 5.2 kg

TOTAL EDTA IN RF WASTE AT RF -------> 1.7 kg
(1.15 kg/yr for 1.5 years)

NEW EDTA ESTIMATE ------> 6.9 kg

TABLE AD-3

DETAILS OF EDTA CALCULATIONS
(BASIS. ALL ROCKY FLATS WASTE AT INEL)

						UNPROCESSED WASTE VOLUMES (m3)				
FFCA_ID	WS_ID	CC	Total Vol	CH Vol	RH Vol	CH_Direct Ship	RH_Direct Ship	Vitrified	Amalg	Macro
IN-W307	ID-RFO-000	0	136.7	136.7	0.0	0.0	0.0	135.8	0.0	1.0
IN-W308	ID-RFO-000T	0	4139.7	4139.7	0.0	0.0	0.0	4110.7	0.0	29.0
IN-W216	ID-RFO-001T	1	2531.8	2531.8	0.0	775.3	0.0	1741.6	0.0	14.9
IN-W190	ID-RFO-001	1	58.9	58.9	0.0	0.0	0.0	58.6	0.0	0.3
IN-W167	ID-RFO-112T	112	164.1	164.1	0.0	120.2	0.0	43.9	0.0	0.0
IN-W168	ID-RFO-112	112	5.1	5.1	0.0	0.0	0.0	5.1	0.0	0.0
IN-W221	ID-RFO-113T	113	14.4	14.4	0.0	12.9	0.0	1.5	0.0	0.0
IN-W195	ID-RFO-113	113	2.5	2.5	0.0	0.0	0.0	2.5	0.0	0.0
IN-W166	ID-RFO-114T	114	70.8	70.8	0.0	56.2	0.0	14.6	0.0	0.0
IN-W165	ID-RFO-114	114	4.0	4.0	0.0	0.0	0.0	4.0	0.0	0.0
IN-W370	ID-RFO-115TN	115	67.2	67.2	0.0	40.7	0.0	26.5	0.0	0.0
IN-X006	ID-RFO-115N	115	1.1	1.1	0.0	0.0	0.0	1.1	0.0	0.0
IN-W186	ID-RFO-116T	116	2696.6	2696.6	0.0	0.6	0.0	2696.0	0.0	0.0
IN-W185	ID-RFO-116	116	371.1	371.1	0.0	0.0	0.0	371.1	0.0	0.0
IN-W300	ID-RFO-117T	117	1520.2	1520.2	0.0	14.8	0.0	1493.2	0.0	12.2
IN-W299	ID-RFO-117	117	147.5	147.5	0.0	0.0	0.0	146.4	0.0	1.2
IN-W240	ID-RFO-118T	118	174.6	174.6	0.0	7.8	0.0	163.3	0.0	3.5
IN-W241	ID-RFO-118	118	6.4	6.4	0.0	0.0	0.0	6.2	0.0	0.1
IN-W206	ID-RFO-119T	119	383.3	383.3	0.0	36.3	0.0	347.0	0.0	0.0
IN-W232	ID-RFO-119	119	69.2	69.2	0.0	0.0	0.0	69.2	0.0	0.0
IN-W230	ID-RFO-122T	122	18.2	18.2	0.0	10.0	0.0	8.3	0.0	0.0
IN-W231	ID-RFO-122	122	12.3	12.3	0.0	0.0	0.0	12.3	0.0	0.0
IN-W250	ID-RFO-123T	123	63.8	63.8	0.0	37.1	0.0	20.2	0.0	6.5
IN-W251	ID-RFO-123	123	2.3	2.3	0.0	0.0	0.0	2.1	0.0	0.2
IN-W312	ID-RFO-124TN	124	3.2	3.2	0.0	2.3	0.0	0.8	0.0	0.0
IN-W228	ID-RFO-002T	2	1296.8	1296.8	0.0	15.3	0.0	1260.9	12.4	8.2
IN-W191	ID-RFO-002	2	342.4	342.4	0.0	0.0	0.0	336.9	3.3	2.2
IN-W282	ID-RFO-241	241	24.2	24.2	0.0	0.0	0.0	24.1	0.0	0.0
IN-W283	ID-RFO-241T	241	1.1	1.1	0.0	0.0	0.0	1.1	0.0	0.0
IN-W196	ID-RFO-290	290	0.2	0.2	0.0	0.0	0.0	0.2	0.0	0.0
IN-W222	ID-RFO-292T	292	110.5	110.5	0.0	42.2	0.0	68.3	0.0	0.0
IN-W215	ID-RFO-292	292	4.9	4.9	0.0	0.0	0.0	4.9	0.0	0.0
IN-W309	ID-RFO-003T	3	569.4	569.4	0.0	160.7	0.0	408.7	0.0	0.0
IN-W310	ID-RFO-003	3	1001.9	1001.9	0.0	0.0	0.0	1001.9	0.0	0.0
IN-W276	ID-RFO-300T	300	391.8	391.8	0.0	151.4	0.0	240.4	0.0	0.0
IN-W274	ID-RFO-300	300	18.4	18.4	0.0	0.0	0.0	18.4	0.0	0.0
IN-W275	ID-RFO-301T	301	6.4	6.4	0.0	0.8	0.0	5.5	0.0	0.0

TABLE AD-3

DETAILS OF EDTA CALCULATIONS
(BASIS: ALL ROCKY FLATS WASTE AT INEL)

FFCA_ID	WS_ID	CC	Total Vol	CH Vol	RH Vol	CH_Direct Ship	RH_Direct Ship	Vitrified	Amalg	Macro
IN-W273	ID-RFO-301	301	1.3	1.3	0.0	0.0	0.0	1.3	0.0	0.0
IN-W184	ID-RFO-302	302	55.4	55.4	0.0	0.0	0.0	49.8	0.0	5.5
IN-W225	ID-RFO-302T	302	22.2	22.2	0.0	0.0	0.0	20.0	0.0	2.2
IN-W369	ID-RFO-303TN	303	12.3	12.3	0.0	9.1	0.0	3.2	0.0	0.0
IN-W368	ID-RFO-310TN	310	3.4	3.4	0.0	0.2	0.0	3.2	0.0	0.0
IN-X007	ID-RFO-310N	310	0.2	0.2	0.0	0.0	0.0	0.2	0.0	0.0
IN-W367	ID-RFO-311TN	311	4.4	4.4	0.0	0.0	0.0	4.4	0.0	0.0
IN-W272	ID-RFO-312T	312	1.9	1.9	0.0	1.9	0.0	0.0	0.0	0.0
IN-W298	ID-RFO-320T	320	74.6	74.6	0.0	21.4	0.0	51.7	0.0	1.5
IN-W297	ID-RFO-320	320	28.6	28.6	0.0	0.0	0.0	28.0	0.0	0.6
IN-W207	ID-RFO-328T	328	1.5	1.5	0.0	0.0	0.0	1.5	0.0	0.0
IN-W233	ID-RFO-328	328	0.2	0.2	0.0	0.0	0.0	0.2	0.0	0.0
IN-W169	ID-RFO-330T	330	5774.6	5774.6	0.0	18.7	0.0	5756.0	0.0	0.0
IN-W158	ID-RFO-330	330	3150.6	3150.6	0.0	0.0	0.0	3150.6	0.0	0.0
IN-W208	ID-RFO-335T	335	26.2	26.2	0.0	2.5	0.0	23.7	0.0	0.0
IN-W234	ID-RFO-335	335	16.5	16.5	0.0	0.0	0.0	16.5	0.0	0.0
IN-W197	ID-RFO-336T	336	778.3	778.3	0.0	20.4	0.0	758.0	0.0	0.0
IN-W160	ID-RFO-336	336	1452.4	1452.4	0.0	0.0	0.0	1452.4	0.0	0.0
IN-W198	ID-RFO-337T	337	170.4	170.4	0.0	37.5	0.0	132.9	0.0	0.0
IN-W217	ID-RFO-337	337	352.9	352.9	0.0	0.0	0.0	352.9	0.0	0.0
IN-W209	ID-RFO-338T	338	60.2	60.2	0.0	3.4	0.0	56.8	0.0	0.0
IN-W235	ID-RFO-338	338	240.7	240.7	0.0	0.0	0.0	240.7	0.0	0.0
IN-W252	ID-RFO-339T	339	160.2	160.2	0.0	13.4	0.0	0.0	0.0	146.9
IN-W253	ID-RFO-339	339	4.9	4.9	0.0	0.0	0.0	0.3	0.0	4.6
IN-W210	ID-RFO-360T	360	3.4	3.4	0.0	0.0	0.0	3.4	0.0	0.0
IN-W237	ID-RFO-360	360	50.4	50.4	0.0	0.0	0.0	50.4	0.0	0.0
IN-W373	ID-RFO-361TN	361	0.2	0.2	0.0	0.0	0.0	0.2	0.0	0.0
IN-W366	ID-RFO-370TN	370	2.5	2.5	0.0	0.0	0.0	2.5	0.0	0.0
IN-X008	ID-RFO-370N	370	4.9	4.9	0.0	0.0	0.0	4.9	0.0	0.0
IN-W161	ID-RFO-371T	371	111.4	111.4	0.0	16.7	0.0	94.6	0.0	0.0
IN-W162	ID-RFO-371	371	183.5	183.5	0.0	0.0	0.0	183.5	0.0	0.0
IN-W266	ID-RFO-372N	372	0.8	0.8	0.0	0.0	0.0	0.8	0.0	0.0
IN-W267	ID-RFO-372TN	372	3.0	3.0	0.0	0.0	0.0	3.0	0.0	0.0
IN-W265	ID-RFO-374T	374	53.2	53.2	0.0	9.5	0.0	43.6	0.0	0.0
IN-W264	ID-RFO-374	374	368.0	368.0	0.0	0.0	0.0	368.0	0.0	0.0
IN-W163	ID-RFO-375T	375	0.8	0.8	0.0	0.0	0.0	0.8	0.0	0.0
IN-W223	ID-RFO-375	375	3.2	3.2	0.0	0.0	0.0	3.2	0.0	0.0
IN-W211	ID-RFO-376T	376	460.2	460.2	0.0	215.4	0.0	244.8	0.0	0.0
IN-W238	ID-RFO-376	376	94.7	94.7	0.0	0.0	0.0	94.7	0.0	0.0
IN-W365	ID-RFO-391TN	391	4.7	4.7	0.0	0.0	0.0	4.7	0.0	0.0
IN-W3[illegible]	ID-RFO-392TN	392	1.5	1.5	0.0	0.0	0.0	1.5	0.0	0.0

TABLE AD-3

DETAILS OF EDTA CALCULATIONS
(BASIS: ALL ROCKY FLATS WASTE AT INEL)

FFCA_ID	WS_ID	CC	Total Vol	CH Vol	RH Vol	CH_Direct Ship	RH_Direct Ship	Vitrified	Amalg	Macro
IN-W348	ID-RFO-393TN	393	10.0	10.0	0.0	3.8	0.0	6.1	0.0	0.0
IN-W157	ID-RFO-004T	4	226.8	226.8	0.0	54.3	0.0	172.3	0.0	0.2
IN-W229	ID-RFO-004	4	103.9	103.9	0.0	0.0	0.0	103.8	0.0	0.1
IN-W311	ID-RFO-409T	409	6.6	6.6	0.0	2.3	0.0	4.2	0.0	0.0
IN-W356	ID-RFO-410TN	410	4.7	4.7	0.0	0.0	0.0	4.7	0.0	0.0
IN-W355	ID-RFO-411TN	411	1.3	1.3	0.0	0.0	0.0	1.3	0.0	0.0
IN-W354	ID-RFO-412TN	412	0.2	0.2	0.0	0.0	0.0	0.2	0.0	0.0
IN-W314	ID-RFO-414T	414	1.1	1.1	0.0	0.0	0.0	1.1	0.0	0.0
IN-W371	ID-RFO-416TN	416	0.2	0.2	0.0	0.0	0.0	0.2	0.0	0.0
IN-W363	ID-RFO-420TN	420	2.3	2.3	0.0	0.0	0.0	2.3	0.0	0.0
IN-W362	ID-RFO-421TN	421	21.4	21.4	0.0	0.0	0.0	21.4	0.0	0.0
IN-W361	ID-RFO-422TN	422	5.1	5.1	0.0	0.0	0.0	5.1	0.0	0.0
IN-W357	ID-RFO-425TN	425	0.4	0.4	0.0	0.0	0.0	0.4	0.0	0.0
IN-X009	ID-RFO-425N	425	1.3	1.3	0.0	0.0	0.0	1.3	0.0	0.0
IN-W320	ID-RFO-430	430	1.9	1.9	0.0	0.0	0.0	1.9	0.0	0.0
IN-W321	ID-RFO-430T	430	4.2	4.2	0.0	0.0	0.0	4.2	0.0	0.0
IN-W318	ID-RFO-431	431	0.4	0.4	0.0	0.0	0.0	0.4	0.0	0.0
IN-W319	ID-RFO-431T	431	0.8	0.8	0.0	0.0	0.0	0.8	0.0	0.0
IN-W317	ID-RFO-432T	432	51.5	51.5	0.0	12.9	0.0	38.6	0.0	0.0
IN-W316	ID-RFO-432	432	8.9	8.9	0.0	0.0	0.0	8.9	0.0	0.0
IN-W243	ID-RFO-440T	440	247.7	247.7	0.0	56.2	0.0	191.5	0.0	0.0
IN-W242	ID-RFO-440	440	95.4	95.4	0.0	0.0	0.0	95.4	0.0	0.0
IN-W244	ID-RFO-441	441	164.7	164.7	0.0	0.0	0.0	164.7	0.0	0.0
IN-W245	ID-RFO-441T	441	169.0	169.0	0.0	0.0	0.0	169.0	0.0	0.0
IN-W247	ID-RFO-442T	442	199.5	199.5	0.0	79.3	0.0	120.2	0.0	0.0
IN-W248	ID-RFO-442	442	138.4	138.4	0.0	0.0	0.0	138.4	0.0	0.0
IN-W199	ID-RFO-460T	460	1.3	1.3	0.0	0.0	0.0	1.3	0.0	0.0
IN-W254	ID-RFO-463T	463	10.2	10.2	0.0	0.0	0.0	0.6	0.0	9.5
IN-W255	ID-RFO-463	463	1.1	1.1	0.0	0.0	0.0	0.1	0.0	1.0
IN-W183	ID-RFO-464	464	3.8	3.8	0.0	0.0	0.0	3.1	0.0	0.8
IN-W189	ID-RFO-464T	464	6.1	6.1	0.0	0.0	0.0	4.9	0.0	1.2
IN-W296	ID-RFO-480T	480	5243.4	5243.4	0.0	85.2	0.0	5132.0	0.0	26.2
IN-W295	ID-RFO-480	480	6688.0	6688.0	0.0	0.0	0.0	6654.6	0.0	33.4
IN-W294	ID-RFO-481T	481	443.2	443.2	0.0	11.4	0.0	428.3	0.0	3.5
IN-W293	ID-RFO-481	481	164.3	164.3	0.0	0.0	0.0	163.1	0.0	1.3
IN-W212	ID-RFO-490T	490	2512.4	2512.4	0.0	3.4	0.0	2509.0	0.0	0.0
IN-W239	ID-RFO-490	490	873.4	873.4	0.0	0.0	0.0	873.4	0.0	0.0
IN-W313	ID-RFO-005	5	13.6	13.6	0.0	0.0	0.0	13.6	0.0	0.0
IN-W315	ID-RFO-005T	5	0.6	0.6	0.0	0.0	0.0	0.6	0.0	0.0
IN-W218	ID-RFO-007T	7	461.5	461.5	0.0	461.5	0.0	0.0	0.0	0.0
IN-W192	ID-RFO-007	7	464.3	464.3	0.0	0.0	0.0	464.3	0.0	0.0

TABLE AD-3

DETAILS OF EDTA CALCULATIONS
(BASIS: ALL ROCKY FLATS WASTE AT INEL)

FFCA_ID	WS_ID	CC	Total Vol	CH Vol	RH Vol	CH_Direct Ship	RH_Direct Ship	Vitrified	Amalg	Macro
IN-W164	ID-RFO-700T	700	1.9	1.9	0.0	0.6	0.0	1.3	0.0	0.0
IN-W270	ID-RFO-090	90	28.6	28.6	0.0	0.0	0.0	28.6	0.0	0.0
IN-W205	ID-RFO-900T	900	0.8	0.8	0.0	0.4	0.0	0.0	0.0	0.4
IN-W227	ID-RFO-900	900	92.4	92.4	0.0	0.0	0.0	92.4	0.0	0.0
IN-X001	ID-RFO-095N	95	4.9	4.9	0.0	0.0	0.0	4.9	0.0	0.0
IN-W277	ID-RFO-950	950	1065.0	1065.0	0.0	0.0	0.0	1006.6	0.0	58.4
IN-W278	ID-RFO-950T	950	14.0	14.0	0.0	0.0	0.0	13.2	0.0	0.8
IN-W374	ID-RFO-960TN	960	9.8	9.8	0.0	0.2	0.0	9.5	0.0	0.0
IN-X003	ID-RFO-960N	960	681.4	681.4	0.0	0.0	0.0	681.4	0.0	0.0
IN-W202	ID-RFO-970T	970	109.9	109.9	0.0	0.0	0.0	109.9	0.0	0.0
IN-W224	ID-RFO-970	970	91.3	91.3	0.0	0.0	0.0	91.3	0.0	0.0
IN-W180	ID-RFO-976	976	63.8	63.8	0.0	0.0	0.0	63.8	0.0	0.0
IN-W188	ID-RFO-976T	976	1.1	1.1	0.0	0.0	0.0	1.1	0.0	0.0
IN-W181	ID-RFO-978T	978	9.5	9.5	0.0	0.0	0.0	9.5	0.0	0.0
IN-W182	ID-RFO-978	978	25.4	25.4	0.0	0.0	0.0	25.4	0.0	0.0
IN-W187	ID-RFO-980T	980	0.2	0.2	0.0	0.0	0.0	0.2	0.0	0.0
IN-W261	ID-RFO-990	990	99.6	99.6	0.0	0.0	0.0	99.6	0.0	0.0
IN-W375	ID-RFO-995TN	995	19.3	19.3	0.0	0.0	0.0	19.3	0.0	0.0
IN-X002	ID-RFO-995N	995	68.8	68.8	0.0	0.0	0.0	68.8	0.0	0.0
IN-W306	ID-RFO-9999T	9999	4492.5	4489.3	3.2	0.0	3.2	4354.5	0.0	134.8
IN-W352	ID-RFO-9999	9999	2993.7	2991.5	2.1	0.0	2.1	2901.7	0.0	89.8
	TOTALS		**58402.2**	**58396.9**	**5.3**	**2626.5**	**5.3**	**55152.7**	**15.7**	**601.9**

TOTAL EDTA IN RF WASTE AT INEL --> 21.3 kg
(1.15 kg/yr for 18.5 years)
PERCENT VITRIFIED --------> 94.4%
AMOUNT VITRIFIED (94.44% of 21.3 kg)--> 20.1 kg
AMOUNT IN UNTREATED INEL WASTE----> 1.2 kg

TOTAL EDTA IN RF WASTE AT RF ------> 1.7 kg
(1.15 kg/yr for 1.5 years)

NEW EDTA ESTIMATE -----> 2.9 kg

APPENDIX B - 6

United States Government | Department of Energy

memorandum

Carlsbad Area Office
Carlsbad, New Mexico 88221

DATE: FEB 2 0 1996

REPLY TO ATTN OF: NTP:DW:96-0655

SUBJECT: Preliminary Estimate for SNL/NM Performance Assessment Calculations of Nitrate, Sulfate, and Phosphate Content in Transuranic Solidified Wastes Destined for Disposal in WIPP

TO: Dr. Les Shephard, SNL/NM

Attached is a copy of the report containing the preliminary estimates for the nitrate, sulfate, and phosphate contents in solidified transuranic (TRU) wastes destined for the Waste Isolation Pilot Plant (WIPP). This information was requested by your staff from the Transuranic (TRU) Waste Baseline Inventory Report (TWBIR) team in support of the Performance Assessment efforts.

Briefly, the enclosed document provides estimates of the average density and total mass of nitrate and sulfate in TRU waste to be disposed of at the WIPP. These values have been estimated based on data obtained from the TRU waste generator/storage sites during the TWBIR preparation process. From these data, the average densities scaled over the entire WIPP disposal inventory are 9.2 kg/m^3 for nitrate and 3.6 kg/m^3 for sulfate. The total masses scaled over the entire WIPP disposal inventory are 1.6E+06 kg for nitrate and 6.3E+05 kg for sulfate. These densities and masses are for combined CH and RH TRU waste inventories. No value for phosphate has been proposed due to the lack of sufficient information. Trace quantities of inorganic phosphate might be expected in some of the sludges and solidification agents, but no supporting analytical data are available to support a specific value. This is discussed in the enclosed report.

If you have any questions concerning the attached information, please contact Mr. Russ Bisping of my staff at (505) 234-7446.

Russell Bisping for

Don Watkins
Manager
National TRU Program

Attachment

cc w/enclosure:
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Preliminary Estimates of Nitrate, Sulfate, and Phosphate Content in Transuranic Solidified Wastes

I. INTRODUCTION

This report provides preliminary estimates of the amount of nitrate, sulfate, and phosphate expected to be in the transuranic (TRU) inventory that will be transported to and disposal of at the Waste Isolation Pilot Plant (WIPP) (Appendix B: DOE, 1995). Tables 1 and 2 of this report provide the volumetric basis for the nitrate and sulphate estimates, and Tables 3, 4, and 5 provide the calculational methodology. No quantifiable sources of phosphate have been identified in the Inorganic Solidified final waste forms at present. Trace quantities might be expected in some of the sludges and solidification agents, but no data currently exist to support this.

II. BACKGROUND

These **PRELIMINARY** estimates are made based on the following:

- Values presented are those expected for the final waste forms to be disposed of at WIPP.
- Information has been requested from sites based on Solidified Inorganic and Solidified Organic waste forms only, and is the best available data from the TRU waste generator/storage sites:
  - The main source of nitrate is anticipated to be from the Solidified Inorganic waste forms, which in most cases, are sludges produced from the neutralization/solidification of nitric acid-based solutions used at the TRU waste generator/storage sites. Nitrates are very soluble in aqueous solutions and generally do not produce precipitates in the sludges. The nitrates are generally thought to be present as ions sorbed on precipitates or as interstitial solution trapped in the precipitated sludges prior to solidification.

    Minor amounts of nitrate, as evaporites, are anticipated in the debris waste forms that will be acceptable for WIPP disposal, but insufficient data are available to estimate the amount of such TRU waste at this time.
  - The main sources of sulfates are anticipated to be: 1) chemicals (e.g. iron sulfates) added to the inorganic solutions at the time of flocculation and precipitation of sludges, and 2) the use of Envirostone [a gypsum ($CaSO_4$) based solidification material] for solidification of inorganic and/or organic solutions/sludges at some TRU waste generator/storage sites.

- No quantifiable sources of phosphate have been identified in the Solidified Inorganic final waste forms at present. Trace quantities might be expected in some of the sludges and solidification agents, but no supporting analytical data are available. The quantities of inorganic phosphate are anticipated to be low in inorganic sludges based on process histories at TRU waste sites.

Analytical data in Attachment 2 provide only "less than 0.0025" weight percent values for phosphate, which are similar to the 0.001 weight percent estimate provided by LANL in Attachment 1. These values are too low to make any reliable estimate of phosphate in TRU waste, but indicate that the quantities will be very small, compared with the nitrate and sulfate values reported. The phosphate value of "40%" reported on page A2-7 is an analytical error. Based on process knowledge and the lack of cations to support such a large value of phosphate in that particular analysis, no such value is possible.

III. GENERAL VOLUME CALCULATIONS

A. Nitrate

1. Nitrate Assumptions

The amount of nitrate is estimated on the basis of the volumes of Solidified Inorganics, which are calculated as explained below:

- Table 1 lists (in Column 2) the final waste form volumes of Solidified Inorganics for Contact-Handled (CH) TRU and Remote Handled (RH) TRU from Figures 3-9 and 3-16 of Revision 2 of the TWBIR (DOE, 1995) for the anticipated WIPP inventory (stored plus projected volumes until 2022).

- Footnotes in Columns 3 and 4 indicate why certain volumes of waste have been eliminated from further consideration in the calculations:

  - Footnote 1 eliminates those volumes of chemically precipitated Solidified Inorganics for which no nitrate estimates in the waste are available. An estimate of the nitrate contribution from these Solidified Inorganics will be accounted for in the scaling process.

  - Footnote 2 eliminates the volume of Solidified Inorganics from SRS from further consideration because it is a "vitrified" waste form which should not contain any significant amount of nitrates due to the thermal treatment proposed for that waste form.

- Footnote 3 eliminates from further consideration those volumes of Solidified Inorganics which represent non-precipitated particulates (e.g., incinerator ash, graphite fines, etc.) which have been cemented to meet the WIPP WAC; nitrates are not expected to be present in these particulates.

- Rocky Flats Environmental Technology Site (RFETS) and Los Alamos National Laboratory (LANL) have provided analytical data/estimates for nitrate in Solidified Inorganics. The RFETS data has been used also for the RFETS waste stored at INEL.

2. Nitrate Mass Calculations

Table 3 contains in Column 1 a list of those waste streams that contain the volume of waste from each TRU waste generator/storage site listed in Column 4 of Table 1. The additional data provided are:

- Column 2 lists the Item Description Codes (IDCs) for waste streams produced at RFETS and/or stored at INEL. The RF111 designation is for Content Code 111 from RFETS, where the IDC is not specified.

- Column 3 lists the stored + projected volume for each waste stream.

- Column 4 lists the sum of the waste material parameters (WMP) for each waste stream from the individual Waste Stream Profiles in Revision 2 of the TWBIR. Exceptions to this rule are listed in footnotes in Table 3.

- Column 5 lists the mass of the waste for each waste stream which is the product of multiplying Columns 3 and 4.

- Column 6 lists the values of nitrate used for each waste stream. The sources of the these values are:

  - For RFETS, the nitrate values are from Appendix I of Revision 2 of the TWBIR. The 8% values for IDC 001 has also been applied to IDCs 002 and 007 at both RFETS and INEL. All these IDCs represent "older" methods of solidification where the sludges contain portland cement mainly as a sorbent interlayered with sludge which did not contain diatomaceous earth (see Clements, 1982 for drawings).

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The 4% value listed in Appendix I of the TWBIR for IDC 807 represents a "newer" method of solidification where diatomaceous earth is used as a vacuum filtration agent and portland cement is mixed with the resulting sludge to form a "monolithic" solidified final waste form. The dilution with diatomaceous earth and additional portland cement lowers the overall nitrate value of the final waste form.

- For waste stream IN-W315.601, Clements (1982) indicates that the waste stream is made up of approximately 60% $NaNO_3$ and 30% KNO_3 (assumed weight percents). This calculates as 62% nitrate.

- Attachment 1 represents a memo from LANL that provides estimates for nitrates in the waste streams. Note that the Envirostone process only accounts for a small percentage of stored volume for 3 of the waste streams. The values quoted in Column 6 are based on the small percentage of Envirostone solidification agent in the overall waste streams.

- Column 7 represents the mass of nitrates in kg which is the product of multiplying Columns 5 and 6.

B. Sulfate

1. Sulfate Assumptions

- To determine the amount of solidified wastes that need to be considered for calculating the sulfate content of the WIPP inventory (Table 2), the volume of Solidified Organics must be added to the volume of Solidified Inorganics from Table 1:

  - The Solidified Organics from Figures 3-10 and 3-17 of Revision 2 of the TWBIR (DOE, 1995) have been added to Table 1 (above) to produce Table 2

  - LANL has used an Envirostone (gypsum-based) process for solidification of inorganic sludges in the past (approximately 9% of 4888 m^3 in storage at LANL) but plan to eliminate the process in the future and only use portland-based cement for solidification (as was used in the past prior to usage of the Envirostone)

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- Since the mid 1980's, RFETS has used an Envirostone solidification process for their organic sludges. Therefore, some of their waste in storage and projected contain large amounts of sulfate, as well as some Solidified Organics in storage at INEL.

- LLNL is the only other TRU waste site known to be using Envirostone for the solidification of organic liquids/sludges (approximately 7 m^3 stored/projected).

2. Sulfate Mass Calculations

The sulfate calculations presents in Table 4 follow the same format as the nitrate calculations in Table 3. The origin of the values used for sulfate in the RFETS, INEL, LLNL, and LANL waste streams are summarized below:

- **RFETS/INEL**
  - The 0.11% sulfate value is an average of the three analyses marked "7412 Sludge" in Attachment 2 which are applied to IDCs 001 and 002, and at half that value for IDCs 800 and 803 (as explained in the nitrate section).

  - The sulfate value of 0.02% is derived from the Attachment 2 analysis marked "374 Waste Sludge - Dried Sludge". This value is used for IDC 007 and at half value for IDC 807.

  - The sulfate value (25.1%) for the Envirostone solidification of organic sludges (IDC 801) is derived from an average value in Attachment 3, which represents guidelines for mixing constituents together for IDC 801 and IDC 700 (at INEL only in storage).

- **LANL**
  - The values for sulfate quoted in Column 7 are derived from data provided in Attachment 1. As with the nitrate calculations, the percentage of waste in each waste stream solidified by Envirostone versus portland cement is used to calculated the overall sulfate value for each waste stream.

- **LLNL**
  - No value for sulfate was requested from LLNL for their one Solidified Organic waste stream. The same value for Envirostone-solidified waste at RFETS (25.1%) was assumed for the LLNL waste stream.

IV. SUMMARY CALCULATIONS

Table 5 presents the summary calculations for determining the density (kg/m^3) of nitrate and sulfate in the overall WIPP inventory and scaling of the density to take into account those chemically precipitated waste streams for which data was not available. SNL/NM should use the scaled densities for their calculations. The last column in Table 5 provides the estimated mass of nitrate and sulfate if the design capacity of WIPP for CH-TRU and RH-TRU are fully utilized based on the scaled densities for nitrate and sulfate.

V. REFERENCES

Clements, 1982, "Content Code Assessments for INEL Contact-Handled Stored Transuranic Wastes," WM-F1-82-021, Idaho Falls, Idaho.

U. S. Department of Energy, 1995, "Transuranic Waste Baseline Inventory Report (Revision 2)," DOE/CAO-95-1121, Carlsbad, New Mexico.

TABLE 1. TRU VOLUMES FOR NITRATE CALCULATIONS
(SOLIDIFIED INORGANICS ONLY)

TRU WASTE SITE	TOTAL VOLUME (STORED + PROJECTED) (m^3)	VOLUMES WITH NITRATE DATA OR WITH PARTICULATES (m^3)	VOLUMES OF SLUDGES WITH NITRATE DATA (m^3)
Hanford (CH)	23.39	(TO BE SCALED)[1]	(TO BE SCALED)[1]
ANL-E (CH)	5.20	(TO BE SCALED)[1]	(TO BE SCALED)[1]
NTS (CH)	5.67	(TO BE SCALED)[1]	(TO BE SCALED)[1]
SRS (CH)	1369.8	1369.8	[2]
RFETS (CH)	1423.01	1389.52	229.63[3]
INEL (CH)	4344.44	3900.39	3598.84[3]
Mound (CH)	6.03	(TO BE SCALED)[1]	(TO BE SCALED)[1]
LANL(CH)	6922.02	6922.02	6922.02
AL (CH)	0.42	(TO BE SCALED)[1]	(TO BE SCALED)[1]
LLNL (CH)	20.18	(TO BE SCALED)[1]	(TO BE SCALED)[1]
CH TOTAL	14120.15	13581.73	10750.49
ORNL (RH)	1243.33	(TO BE SCALED)[1]	(TO BE SCALED)[1]
INEL (RH)	65.27	65.27	65.27
ANL-E (RH)	30.26	(TO BE SCALED)[1]	(TO BE SCALED)[1]
RH TOTAL	1338.86	65.27	65.27
TRU TOTAL	15459.01	13647.0	10815.76

1 Eliminates those volumes of chemically precipitated solidified inorganics for which no nitrate estimates in the waste are available. An estimate of the nitrate contribution from these solidified inorganics will be accounted for in the scaling process.

2 Eliminates the volume of Solidified Inorganics from SRS from further consideration because it is a "vitrified" waste form which should not contain any significant amount of nitrates due to the thermal treatment proposed for that waste form.

3 Eliminates from further consideration those volumes of Solidified Inorganics which represent non-precipitated particulates (e.g., incinerator ash, graphite fines, etc.) which have been cemented to meet the WIPP WAC and nitrates are not expected to be present in the particulates.

TABLE 2. TRU VOLUMES FOR SULFATE CALCULATIONS

TRU WASTE SITE	FINAL WASTE FORM	TOTAL VOLUME (m^3)	VOLUME WITH SULFATE DATA (m^3)
Hanford (CH)	Solidif. Inorg.	23.39	(TO BE SCALED)[1]
ANL-E (CH)	Solidif. Inorg.	5.20	(TO BE SCALED)[1]
NTS (CH)	Solidif. Inorg.	5.67	(TO BE SCALED)[1]
SRS (CH)	Solidif. Inorg.	1369.8	(TO BE SCALED)[1]
RFETS (CH)	Solidif. Inorg.	1423.01	229.63
INEL (CH)	Solidif. Inorg.	4344.44	3598.42
Mound (CH)	Solidif. Inorg.	6.03	(T BE SCALED)[1]
LANL (CH)	Solidif. Inorg.	6922.02	6922.02
AL (CH)	Solidif. Inorg.	0.42	(TO BE SCALED)[1]
LLNL (CH)	Solidif. Inorg.	20.18	(TO BE SCALED)[1]
RFETS (CH)	Solidif. Org.	140.93	108.99
Hanford (CH)	Solidif. Org.	76.13	(TO BE SCALED)[1]
LANL (CH)	Solidif. Org.	30.58	(TO BE SCALED)[1]
INEL (CH)	Solidif. Org.	789.67	2.55
ANL-E (CH)	Solidif. Org.	0.21	(TO BE SCALED)[1]
LLNL (CH)	Solidif. Org.	6.86	6.86
CH TOTAL		15164.53	10868.93
ORNL (RH)	Solidif. Inorg.	1243.33	(TO BE SCALED)[1]
INEL (RH)	Solidif. Inorg.	65.27	65.27
ANL-E (RH)	Solidif. Inorg.	30.26	(TO BE SCALED)[1]
INEL (RH)	Solidif. Org.	3.56	(TO BE SCALED)[1]
RH TOTAL		1342.42	65.27
TRU TOTAL		16506.95	10933.74

1 No sulfate data available from these sites for any waste streams.

TABLE 3 : NITRATE CALCULATION

Waste Stream	IDCs	Volume (m3)	Sum WMP (kg/m3)	Mass Waste (kg)	% Nitrate (weight%)	Nitrate (kg)
RF-MT0001	001	3.74	781.9	2924.31	8	233.94
RF-MT0800	800	104.42	775.2	80946.38	4	3237.86
RF-MT0803	803	4.99	635.2	3169.65	4	126.79
RF-MT0807	807	115.02	819.6	94270.39	4	3770.82
RF-T010	800/803/807	0.62	796.1	493.58	4	19.74
TOTAL RFETS		228.79		181804.31		7389.14
IN-W216.875	001/002	1478.88	819.6	1212090.05	8	96967.20
IN-W216.877	001/002	43.91	571.4	25090.17	8	2007.21
IN-W216.98	001/002	555.65	726.6	403735.29	8	32298.82
IN-W218.909*	007	101.91	544.3	55469.61	8	4437.57
IN-W220.114	RF111	122.80	725.6	89103.68	4	3564.15
IN-W220.925	RF111	443.04	819.6	363115.58	4	14524.62
IN-W228.101	002	287.33	317.3	91169.81	8	7293.58
IN-W228.883	002	608.82	358.0	217957.56	8	17436.60
IN-W228.886	002	21.36	249.6	5331.46	8	426.52
IN-W315.601**	005	0.42	664.0	278.88	62	172.91
TOTAL INEL		3664.12		2463342.09		179129.19
LA-M002		3606.81	1296.0	4674425.76	8.8	411349.47
LA-T006		86.53	1004.8	86945.34	8.8	7651.19
LA-W003		1836.58	1339.3	2459731.59	8.7	213996.65
LA-W006		1392.10	1004.8	1398782.08	8.7	121694.04
TOTAL LANL		6922.02		8619884.78		754691.35
TOTAL TRU		10814.93		11265031.18		941209.68

* INEL did not report waste material parameters for this waste stream. The value for this IDC at RFETS was assumed.

** This waste stream was reported in Clements (1983) to be 60% $NaNO_3$ and 30% KNO_3. The weight of the waste for this IDC was used from Clements (1983), since no value was quoted in Revision 2 of the TWBIR.

TABLE 4 : SULFATE CALCULATION

Waste Stream	IDCs	Waste Form	Volume (m3)	Sum WMP (kg/m3)	Mass Waste (kg)	% sulfate (weight%)	Sulfate (kg)
RF-MT0001	001	Sol. Inorg.	3.74	781.9	2924.31	0.11	3.22
RF-MT007	007	Sol. Inorg.	0.83	544.3	452.86	0.02	0.09
RF-MT0800	800	Sol. Inorg.	104.42	775.2	80946.38	0.055	44.52
RF-MT0801	801	Sol. Org.	108.99	877.1	95595.13	25.1	23994.38
RF-MT0803	803	Sol. Inorg.	4.99	635.2	3169.65	0.055	1.74
RF-MT0807	807	Sol. Inorg.	115.02	819.6	94270.39	0.01	9.43
RF-T010	800/803/807	Sol. Inorg.	0.62	796.1	493.58	0.055	0.27
TOTAL RFETS			338.61		277852.30		24053.65
IN-W164.1060*	700	Sol. Org.	1.66	877.1	1455.99	25.1	365.45
IN-W164.153*	700	Sol. Org.	0.89	877.1	780.62	25.1	195.94
IN-W216.875	001/002	Sol. Inorg.	1478.88	819.6	1212090.05	0.11	1333.30
IN-W216.877	001/002	Sol. Inorg.	43.91	571.4	25090.17	0.11	27.60
IN-W216.98	001/002	Sol. Inorg.	555.65	726.6	403735.29	0.11	444.11
IN-W218.909*	007	Sol. Inorg.	101.91	544.3	55469.61	0.02	11.09
IN-W220.114	RF111	Sol. Inorg.	122.80	725.6	89103.68	0.055	49.01
IN-W220.925	RF111	Sol. Inorg.	443.04	819.6	363115.58	0.055	199.71
IN-W228.101	002	Sol. Inorg.	287.33	317.3	91169.81	0.11	100.29
IN-W228.883	002	Sol. Inorg.	608.82	358.0	217957.56	0.11	239.75
IN-W228.886	002	Sol. Inorg.	21.36	249.6	5331.46	0.11	5.86
TOTAL INEL			3666.25		2465299.82		2972.11
LA-M002		Sol. Inorg.	3606.81	1296.0	4674425.76	1.4	65441.96
LA-T006		Sol. Inorg.	86.53	1004.8	86945.34	1.7	1478.07
LA-W003		Sol. Inorg.	1836.58	1339.3	2459731.59	5.5	135285.24
LA-W006		Sol. Inorg.	1392.10	1004.8	1398782.08	8.1	113301.35
TOTAL LANL			6922.02		8619884.78		315506.62
LL-W019**		Sol. Org	6.86	268.0	1838.48	25.1	461.46
TOTAL LLNL			6.86		1838.48		461.46
TOTAL TRU			10933.74		11364875.38		342993.84

* INEL did not report waste material parameters for this waste stream. The value for this IDC at RFETS was assumed.
** Sulfate value for LLNL Solidified Organics was assumed to be the same as for RFETS Solidified Organics (IDC 801).

TABLE 5. NITRATE/SULFATE DENSITY CALCULATIONS

Constituent	Volume Solidified Waste (m3)	Mass Solidified Waste (kg)	Mass Constituent (kg)	Anticipated Waste Volume (m3)	WIPP Average Density of Constituents (kg/m3)	% Sludge Used in Calculations (%)	WIPP Average Scaled Density of Constituents (kg/m3)	Total Mass of Constituent for WIPP Design Capacity (kg)
Footnotes	1	2	3	4	5	6	7	8
Nitrate	10815.76	11265484	941245.9	1.19E+05	7.91	85.6	9.24	1.62E+06
Sulfate	10933.74	11364875	342993.8	1.19E+05	2.88	80	3.60	6.33E+05

1. "Total TRU" Volumes for Tables 3 and 4.
2. "Total TRU" Mass from Tables 3 and 4.
3. "Total TRU" Nitrate/Sulfate from Tables 3 and 4.
4. Anticipated Volume of CH-and RH-TRU Waste *(stored + projected to 2022)* from Table 3-1 in Rev. 2 of TWBIR. RH-TRU anticipated volume is limited to 7080 m3, the design capacity of WIPP.
5. "Mass of Constituent" column *divided by* "*Anticipated Waste Volume*" column.
6. Calculated from Table 1 "Total TRU" data. Nitrate = subtract 10815.76 from 13647 to yield particulate waste (2831.24). Subtract 2831.24 from 15459.01 to get total chemically precipitated waste (12627.77). Divide 10815.76 by 12627.77 and multiply by 100%. Sulfate is calculated in a similar manner.
7. Divide "Density of Constituent" by "% Sludge Used in Calculations."
8. Multiply "Scaled Density of Constituent" by 175,600 m3 (design capacity of WIPP).

ATTACHMENT 1

TELEPHONE CONFERENCE SUMMARY

Parties: Paul Drez, DEA/CTAC
Davis Christenson, LANL

For Solidified Inorganics waste stream LA-T006; LA-W003; LA-W006; and LA-M002 assume the following composition for final waste form:

Envirostone-based solidified waste forms:

Nitrate 8.2%
Sulfate 38.5%
Phosphate 0.001%

Portland Cement-based solidified waste forms:

Nitrate 8.8%
Sulfate 1.4%
Phosphate 0.001%

LA-M002 has only used portland cement; the other three have use portland cement until 1985 and then Envirostone:

	Stored Wasted		Projected Waste	
WS#	Portland	Envirostone	Portland	Envirostone
LA-T006	84.5%	15.5%	100%	0%
LA-W006	54.65%	45.35%	100%	0%
LA-W003	84.5%	15.5%	100%	0%
LA-M002	100%	0%	100%	0%

ATTACHMENT 2

D61472-01

LABORATORY SAMPLE RESULTS

7412 Sludge

DATE 04/10/80
PAGE 1

SAMPLE-ID	00-008395	OJC NUMBER	97038000
ENTRY DATE	11-01-79	ACCOUNT CHARGED	8037
COMPLETION DATE	04-10-80	BUILDING	559
		CLASS	SSP1
CUSTOMER	P. T. GODESAIBOIS		

** ATOMIC ABSORPTION SPECTROMETRY RESULTS

CA		86512.	PPM(W)	FE		61597.	PPM(W)
GA	<	50.	PPM(W)	K		6162.	PPM(W)
NA		65501.	PPM(W)	SI		3659.	PPM(W)

** PLUTONIUM CHEMISTRY LABORATORY RESULTS

CL(-)		0.16	%(W)	CO3=		0.36	%(W)
F(-)		57.	PPM(W)	H2O		61.0	%(W)
NO3		4.2	%(W)	PO4	<	0.0025	%(W)
SO4		0.085	%(W)				

** SEMI-QUANTATIVE EMISSION SPEC RESULTS

AG		50.	PPM(W)	AL		20000.	PPM(W)
AS	<	50.	PPM(W)	B		100.	PPM(W)
BA		100.	PPM(W)	BE		50.	PPM(W)
BI	<	50.	PPM(W)	CA	>	200000.	PPM(W)
CD	<	1000.	PPM(W)	CE	<	500.	PPM(W)
CO	<	50.	PPM(W)	CR		500.	PPM(W)
CS	<	1000.	PPM(W)	CU		4000.	PPM(W)
FE		50000.	PPM(W)	GE	<	10.	PPM(W)
HG	<	10.	PPM(W)	K		40000.	PPM(W)
LI	<	1000.	PPM(W)	MG		10000.	PPM(W)
MN		500.	PPM(W)	MO		500.	PPM(W)
NA		50000.	PPM(W)	NB	<	50.	PPM(W)
NI		2000.	PPM(W)	P	<	1000.	PPM(W)
PB	<	50.	PPM(W)	RB	<	500.	PPM(W)
SB	<	50.	PPM(W)	SI		100000.	PPM(W)
SN	<	10.	PPM(W)	SR		10000.	PPM(W)
TA	<	50.	PPM(W)	TE	<	100.	PPM(W)
TH	<	500.	PPM(W)	TI		500.	PPM(W)
TL	<	500.	PPM(W)	U	<	500.	PPM(W)
V	<	5.	PPM(W)	W	<	1000.	PPM(W)
ZN	<	500.	PPM(W)	ZR	<	50.	PPM(W)

** RADIOCHEMISTRY LABORATORY RESULTS

AM	0.0000317	G/G

061472-01 LABORATORY SAMPLE RESULTS DATE 04/10/90
PAGE 2

SAMPLE-ID 00-008395

** RADIOCHEMISTRY LABORATORY RESULTS (CONTINUED)

PU	0.0000223	G/G	U	0.0017	G/G

AUTHORIZED SIGNATURE

Howell

061472-01	LABORATORY SAMPLE RESULTS	DATE 04/10/80
	7412 Sludge	PAGE 1

SAMPLE-ID	00-008396	DJO NUMBER	97038000
ENTRY DATE	11-01-79	ACCOUNT CHARGED	8037
COMPLETION DATE	04-10-80	BUILDING	559
		CLASS	SSP1
CUSTOMER	P. T. GODESAIBOIS		

** ATOMIC ABSORPTION SPECTROMETRY RESULTS

CA		194587.	PPM(W)	FE		47915.	PPM(W)
GA	<	50.	PPM(W)	MG		9581.	PPM(W)
NA		105060.	PPM(W)	SI		158.	PPM(W)

** PLUTONIUM CHEMISTRY LABORATORY RESULTS

CL(-)		0.15	%(W)	CO3=		0.74	%(W)
F(-)		101.	PPM(W)	H2O		55.0	%(W)
NO3		8.0	%(W)	PO4	<	0.0025	%(W)
SO4		0.096	%(W)				

** SEMI-QUANTATIVE EMISSION SPEC RESULTS

AG		10.	PPM(W)	AL		10000.	PPM(W)
AS	<	50.	PPM(W)	B		100.	PPM(W)
BA		500.	PPM(W)	BE		1000.	PPM(W)
BI	<	50.	PPM(W)	CA	>	200000.	PPM(W)
CD	<	1000.	PPM(W)	CE	<	500.	PPM(W)
CO	<	50.	PPM(W)	CR		500.	PPM(W)
CS	<	1000.	PPM(W)	CU		500.	PPM(W)
FE		50000.	PPM(W)	GE	<	10.	PPM(W)
HG	<	10.	PPM(W)	K		40000.	PPM(W)
LI	<	1000.	PPM(W)	MG		50000.	PPM(W)
MN		500.	PPM(W)	MO		200.	PPM(W)
NA		50000.	PPM(W)	NB	<	50.	PPM(W)
NI		1000.	PPM(W)	P	<	1000.	PPM(W)
PB		50.	PPM(W)	PU	<	100.	PPM(W)
RB	<	500.	PPM(W)	SB	<	50.	PPM(W)
SI		100000.	PPM(W)	SN	<	10.	PPM(W)
SR		10000.	PPM(W)	TA	<	50.	PPM(W)
TE	<	100.	PPM(W)	TH	<	500.	PPM(W)
TI		500.	PPM(W)	TL	<	500.	PPM(W)
U	<	500.	PPM(W)	V	<	5.	PPM(W)
W	<	1000.	PPM(W)	ZN	<	500.	PPM(W)
ZR	<	50.	PPM(W)				

ATTACHMENT 2

D61472-01 LABORATORY SAMPLE RESULTS DATE 04/10/90
PAGE 2

SAMPLE-ID 00-008396

** RADIOCHEMISTRY LABORATORY RESULTS

AM	0.00000546	G/G			
PU	0.0000389	G/G	U	0.000195	G/G

AUTHORIZED SIGNATURE

Hawkes

061472-01 LABORATORY SAMPLE RESULTS DATE 04/10/80
7412 Sludge PAGE 1

SAMPLE-ID	00-008397	DJO NUMBER	97038000
ENTRY DATE	11-01-79	ACCOUNT CHARGED	8037
COMPLETION DATE	04-10-80	BUILDING	559
		CLASS	SSPL
CUSTOMER	P. T. GODESAIBOIS		

** ATOMIC ABSORPTION SPECTROMETRY RESULTS

CA		121661.	PPM(W)	FE		49286.	PPM(W)
GA	<	50.	PPM(W)	MG		18377.	PPM(W)
NA		100179.	PPM(W)	SI		217.	PPM(W)

** PLUTONIUM CHEMISTRY LABORATORY RESULTS

CL(-)		1.5	%(W)	CO3=		0.59	%(W)
F(-)		143.	PPM(W)	H2O		60.2	%(W)
NO3		9.1	%(W)	PO4	<	0.0025	%(W)
SO4		0.14	%(W)				

** SEMI-QUANTATIVE EMISSION SPEC RESULTS

AG		40000.	PPM(W)	AL		10000.	PPM(W)
AS	<	50.	PPM(W)	B		100.	PPM(W)
BA		50.	PPM(W)	BE		1000.	PPM(W)
BI	<	50.	PPM(W)	CA		200000.	PPM(W)
CD	<	1000.	PPM(W)	CE	<	500.	PPM(W)
CO	<	50.	PPM(W)	CR		500.	PPM(W)
CS	<	1000.	PPM(W)	CU		1000.	PPM(W)
FE		50000.	PPM(W)	GE	<	10.	PPM(W)
HG	<	10.	PPM(W)	K		40000.	PPM(W)
LI	<	1000.	PPM(W)	MG		100000.	PPM(W)
MN		100.	PPM(W)	MO		200.	PPM(W)
NA		60000.	PPM(W)	NB	<	50.	PPM(W)
NI		500.	PPM(W)	P	<	1000.	PPM(W)
PB		50.	PPM(W)	PU	<	100.	PPM(W)
RB	<	500.	PPM(W)	SB	<	50.	PPM(W)
SI		100000.	PPM(W)	SN	<	10.	PPM(W)
SR		10000.	PPM(W)	TA	<	50.	PPM(W)
TE	<	100.	PPM(W)	TH	<	500.	PPM(W)
TI		300.	PPM(W)	TL	<	500.	PPM(W)
U	<	500.	PPM(W)	V	<	5.	PPM(W)
W	<	1000.	PPM(W)	ZN	<	500.	PPM(W)
ZR	<	50.	PPM(W)				

061472-01 LABORATORY SAMPLE RESULTS DATE 04/10/RC
PAGE 2

SAMPLE-ID 00-008397

** RADIOCHEMISTRY LABORATORY RESULTS

AM	0.000628	MG/G			
PU	0.00000481	G/G	U	0.000561	G/G

AUTHORIZED SIGNATURE

Hrusel

ATTACHMENT 2

Rockwell International

Energy Systems Group
Rocky Flats Plant
P.O. Box 464
Golden, Colorado 80401

ANALYTICAL REPORT

To
C.T. Hewitt 374
File

Account No. 371

Date 7-24-81

Lab. No. M81-1109

Reported by

Approved A.M. Miller
A.M. Miller

Sample Description

374 Waste Sludge — Dried sludge

Analysis Results

A characterization of the 374 waste sludge was requested. The analysis of a composited sample is given. All results are in %.

Ca	11
Mg	3.8
Si	5.8
Al	0.4
Cr	0.12
Fe	0.9
K	0.25
Na	0.8
C	13
S	0.36
SO_4	0.02
Cl	1.3
F	0.5
PO_4	40
NO_3	6.6
CO_3	0.04
HCO_3	0.33

The cations greater than 1% were determined by A^2 and those less than 1% by emission spectroscopy. The anions, except for HCO_3, CO_3, and NO_3 were determined on a nitric acid leach of the sludge. Eighteen percent of the sludge was soluble in water, and 36% soluble in nitric acid.

CORRES. CONTROL
OUTGOING LTR NO
88 RF 1089

DIST		
SANCHINI, D. J.		
BADER, C. P.		
CAMPBELL, G.W.		
HOOD, R. C.		
KINZER, J. E.		
KIRBY, W. A.		
McNETT, J. F.		
MEYERS, C.W.		
SHANNON, W.M.		
SMITH, R.E.		
WEIDNER, C.W.		
WESTON, W.F.	X	
WILSON, G.L.		
WOZNIAK, B.D.		
YOUNG, E.R.		
BETCHER, D.H.		
CARNIVAL, G.J.		
HARMAN, L.K.		
HEBERT, J.L.		
HOEY, J.B.		
HOFFMAN, R.B.		
KRIEG, D.M.	X	X
LIM, B.W.		
LOUDENBURG, G.E.		
NAIMON, E.R.	X	
NEWBY, R.L.		
ROECKER, J.H.		
VELASQUEZ, R.R.		
CORRES. CONTROL		
BRETZKE, C.D.	X	
REINHART, W.D.	X	
PAYNTER, J.K.	X	X
HICKLE, E.L.	X	
CLASSIFICATION		
UNCLASSIFIED	X	X
CONFIDENTIAL		
SECRET		

AUTH. CLASSIFIER SIG.
DATE 4/6/88
IN REPLY TO LTR NO C521-RF-87
JKP/jk

Rocky Flats Plant
North American Space Operations
Rockwell International Corporation
P.O. Box 454
Golden, Colorado 80402-0464
(303) 966-7000
Contractor to U.S. Department of Energy

Rockwell International

April 4, 1988

88-RF-1089

Albert E. Whiteman
Area Manager
DOE, RFAO

ENGINEERING PARAMETERS FOR ROCKY FLATS WASTE FORMS

This information is for the attention of W. C. Rask.

Attached are the engineering parameters for Rocky Flats waste forms that were requested in the letter from J. B. Tollison to distribution, dated March 1, 1988. Information is included for all thirteen Rocky Flats waste forms, which will be transported in the TRUPACT-II container.

If you have questions regarding the enclosed information, contact Jim Alexander at (303) 966-7585 or Jeff Paynter at (303) 966-5252. With your approval please forward to DOE/AL, Waste Transportation.

E. R. Naimon, Manager
Waste Operations
Rocky Flats Plant
Aerospace Operations

Orig. and 3 cc - A. E. Whiteman
Enc.

ENGINEERING PARAMETERS FOR TRUPACT-II

Waste Stream - - TRU SOLIDIFIED ORGANIC WASTE (WF-112)

For data in Section 1, Secondary Container, and Section 2, Arrangement of Secondary Containers, see the General Engineering Parameters for TRUPACT II.

3 WASTE MATERIAL INFORMATION:

3.1 Structural:

3.1.1 Maximum and Minimum Weight - -

Drums: 750 lb max. / 530 lb avg. / 200 lb. min. (including the weight of the drum)

3.1.2 Acceptable Projectile Envelope - - NA, solid monolith cast in the liner inside the drum.

3.2 Thermal:

3.2.1 Quantity of Radionuclides - - Isotopic Composition (Mix Group 9, TRUPACT-II Spec.):

Isotope	Fraction
Pu-238	TRACE
Pu-239	0.930
Pu-240	0.058
Pu-241	0.004
Pu-242	TRACE
Am-241	TRACE
OTHER	0.007

Max. radionuclides (Weapons Grade Pu): 200 grams/drum

Maximum decay heat (Pu): 0.4 watts/drum
(Am): 0.3 watts/drum
Total: 0.7 watts/drum

3.2.2 Chemical Form - -

	min.	max.	ave.
oils	10 %	30 %	
trichloroethane and trichlorotrifluoroethane	5 %	10 %	
carbon tetrachloride	2 %	5 %	
emulsifier (a polyethyl glycol ester)	5 %	10 %	
water	5 %	15 %	
gypsum cement	40 %	50 %	200 lb
total liquid (32 gallons)			250 lb

APPENDIX B - 7

United States Government | Department of Energy

memorandum

Carlsbad Area Office
Carlsbad, New Mexico 88221

DATE: April 4, 1996

REPLY TO ATTN OF: CAO:NTP:DW:96-1126

SUBJECT: Estimate of Cement Content in TRU Solidified Waste Forms Scheduled for Disposal in WIPP

TO: Les Shephard, Director, SNL

Attached is a summary of the best estimate of portland cement in stored and projected volumes of solidified waste streams listed in Revision 2 of the Transuranic (TRU) Waste Baseline Inventory Report (TWBIR). This information was requested from the TWBIR team in support of the Performance Assessment team.

These values have been scaled (similar to the methodology used for waste material parameters in the TWBIR) to the full volume of the Waste Isolation Pilot Plant (WIPP) repository. The total estimated weight of portland cement in these scaled solidified waste forms is 8.54E+06 kg. Dividing this value by 6.2E+06 ft^3 (~175,600 m^3), the maximum capacity of WIPP, yields a portland cement density in the overall combined contact-handled (CH) and remote-handled (RH) transuranic (TRU) waste of 48.6 kg/m^3. The portland cement reported is both reacted and unreacted cement in the waste. There are no data available to estimate the percentage of reacted versus unreacted cement.

The basic methodology was to perform a sort of the Revision 2 database that supports the TWBIR for all Solidified Inorganic and Solidified Organic waste streams. This sort resulted in 221 waste streams. Some waste streams were eliminated from further consideration for the following reasons:

- Data about most Rocky Flats waste streams (both residue and nonresidue waste streams) are for waste in current form only and not in final form. The item description code (IDC) for many particulate waste streams will change to final form because the waste is in a cemented final form. A total of 91 current-form RF TRU waste streams were eliminated because of this constraint. (the final form of these waste streams, however, is included in the portland cement estimate.)

- The Solidified Inorganic waste streams listed from Savannah River Site are all vitrified and therefore do not contain any portland cement. A total of 20 waste streams were eliminated because of this constraint.

If you have any questions concerning the attached information, please contact Mr. Russ Bisping of my staff at (505) 234-7446.

Don Watkins
Manager
National TRU Program

Attachment

cc w/attachment:
M. McFadden, CAO
K. Hunter, CAO
R. Bisping, CAO
P. Drez, CTAC
J. Harvill, CTAC
L. Sanchez, SNL
M. Chu, SNL
M. Marietta, SNL

Calculation Summary

At the bottom of Table 1 the total kilograms of portland cement is summarized for CH-TRU and RH-TRU waste for both stored plus projected waste (in "Total kg" column) and projected only waste (in "Projected kg" column). The TOTAL SCALED portland cement is calculated as follows:

CH-TRU "Total kg" + 2.05 * CH-TRU "Projected kg" + RH-TRU "Total Kg" = TOTAL SCALED kg of portland cement, or

5.28E+06 + 2.05(1.34E+06) + 5.05E+05 = 8.54E+06 kg portland cement

The total density of portland cement is calculated as follows:

8.54E+06 kg/175,600 m^3 = 48.6 kg/ m^3 portland cement

Table 1. Estimate of Portland Cement in TRU Waste for Disposal in the WIPP

[illegible]	Waste Type	Handling	[illegible]	[illegible]	Solidification	Cement (kg/m³)	Stored (m³)	Projected (m³)	Total kg	Projected kg	
W017.10	MTRU	RH	Solidified	Inorganics	salt(1)	n/a					
W016.20	MTRU	RH	Solidified	Inorganics	encapsulated metal(2)	n/a					
W020.13	MTRU	RH	Solidified	Inorganics	evaporitic salt/sludge(3)	73.1	1.8	1.8	263.16	131.58	
W022.22	MTRU	RH	Solidified	Inorganics	sludge/particulates(3)	73.1	0	0.9	65.79	65.79	
[illegible]216.877	MTRU	RH	Solidified	Inorganics	BIR	[illegible]	[illegible]	0	[illegible]	0	
[illegible]228.886	MTRU	RH	Solidified	Inorganics	BIR	[illegible]	[illegible]	0	[illegible]	0	
W042	MTRU	RH	Solidified	Inorganics	BIR	396.6	[illegible]	0	[illegible]	0	
W046	MTRU	RH	Solidified	Inorganics	BIR	396.6	[illegible]	206.[illegible]	[illegible]	[illegible]1897.[illegible]	
[illegible]317.1029	MTRU	RH	Solidified	Organics	resins(3)	[illegible]	[illegible]	0	[illegible]	0	
W038	MTRU	CH	Solidified	Inorganics	acid lab packs(3)	[illegible]	4.[illegible]	0	350.[illegible]	0	
W040	MTRU	CH	Solidified	Inorganics	evaporitic salt/sludge(3)	[illegible]			0	0	
W005	MTRU	CH	Solidified	Inorganics	nitric acid liquids(3)	[illegible]	0	0.4	29.24	29.24	
[illegible]146.699	MTRU	CH	Solidified	Inorganics	Assumed IN-W216.98	27[illegible]	2.3	0	629.74	0	
[illegible]159.1072	MTRU	CH	Solidified	Inorganics	evaporitic salt/sludge	n/a					
[illegible]163.1007	MTRU	CH	Solidified	Inorganics	Ash(3)	[illegible]	0.7	0	[illegible]	0	
[illegible]166.151	MTRU	CH	Solidified	Inorganics	BIR	[illegible]	16	0	[illegible]	0	
[illegible]166.928	MTRU	CH	Solidified	Inorganics	BIR	83.6	56.8	0	4748.48	0	
[illegible]174.1082	MTRU	CH	Solidified	Inorganics	Florco(4)	n/a					
[illegible]174.154	MTRU	CH	Solidified	Inorganics	Florco(4)	n/a					
[illegible]177.1003	MTRU	CH	Solidified	Inorganics	Florco(4)	n/a					
[illegible]177.156	MTRU	CH	Solidified	Inorganics	Florco(4)	n/a					
[illegible]179.1081	MTRU	CH	Solidified	Inorganics	BIR(5)	394.[illegible]	4.6	0	1813.32	0	
[illegible]179.158	MTRU	CH	Solidified	Inorganics	BIR(5)	325	[illegible]	0	[illegible]	0	
[illegible]181.162	MTRU	CH	Solidified	Inorganics	BIR	308.[illegible]	[illegible]	0	2964.4[illegible]	0	
[illegible]182.1094	MTRU	CH	Solidified	Inorganics	Assumed IN-W222.116	102	0.[illegible]	0	[illegible]	0	
[illegible]188.1093	MTRU	CH	Solidified	Inorganics	BIR	30[illegible]	[illegible]	0	30[illegible]	0	
[illegible]188.160	MTRU	CH	Solidified	Inorganics	BIR	[illegible]	0	0	[illegible]	131.8	
[illegible]216.875	MTRU	CH	Solidified	Inorganics	BIR	[illegible]	14[illegible]	0	[illegible]	0	
[illegible]216.98	MTRU	CH	Solidified	Inorganics	BIR	[illegible]	[illegible]	0	[illegible]	0	
[illegible]218.909	MTRU	CH	Solidified	Inorganics	Assumed RF-M10007	130.6	101.[illegible]	0	[illegible]	0	
[illegible]219.914	MTRU	CH	Solidified	Inorganics	Grinding Sludge(3)	[illegible]	[illegible]	0	[illegible]	0	
[illegible]220.114	MTRU	CH	Solidified	Inorganics	BIR	[illegible]	122.[illegible]	0	[illegible]	0	
[illegible]220.925	MTRU	CH	Solidified	Inorganics	BIR	308.[illegible]	44[illegible]	0	[illegible]6798.4	0	
[illegible]221.113	MTRU	CH	Solidified	Inorganics	BIR(6)	122.673	11.6	0	[illegible].006	0	
[illegible]221.927	MTRU	CH	Solidified	Inorganics	BIR(6)	109.129	[illegible]	0	39[illegible].864	0	
[illegible]222.116	MTRU	CH	Solidified	Inorganics	BIR	102	[illegible]	0	2519.4	0	
[illegible]222.965	MTRU	CH	Solidified	Inorganics	BIR	[illegible]	[illegible]	0	[illegible]	0	
[illegible]228.101	MTRU	CH	Solidified	Inorganics	BIR	[illegible]	[illegible]	0	[illegible]	0	
[illegible]228.881	MTRU	CH	Solidified	Inorganics	BIR	132.[illegible]	60[illegible]	0	[illegible].64	0	
[illegible]247.523	MTRU	CH	Solidified	Inorganics	no solidification used	n/a					
[illegible]257.947	MTRU	CH	Solidified	Inorganics	Diatomaceous earth(7)	n/a					
[illegible]263.520	MTRU	CH	Solidified	Inorganics	no solidification used	n/a					
[illegible]315.601	MTRU	CH	Solidified	Inorganics	Wet Salt-Assumed INW216.875	308.[illegible]	0.4	0	123.32	0	
[illegible]332.661	TRU	CH	Solidified	Inorganics	Plaster(8)	n/a					
[illegible]332.962	TRU	CH	Solidified	Inorganics	Plaster(8)	n/a					
[illegible]337.846	TRU	CH	Solidified	Inorganics	Vermiculite(9)	n/a					
[illegible]341.818	TRU	CH	Solidified	Inorganics	Vermiculite(9)	n/a					
[illegible]348.1012	TRU	CH	Solidified	Inorganics	Particulates(3)	[illegible]	2.[illegible]	0	16[illegible]	0	
[illegible]353.859	TRU	CH	Solidified	Inorganics	Liquid(3)	[illegible]	[illegible]	0	[illegible]	0	
[illegible]353.917	TRU	CH	Solidified	Inorganics	Liquid(3)	[illegible]	[illegible]	0	[illegible].62	0	
[illegible]375.1096	TRU	CH	Solidified	Inorganics	Sludge- Assumed IN-W216.875	308.[illegible]	[illegible]	0	[illegible]	0	
[illegible]002	MTRU	CH	Solidified	Inorganics	(10)	69[illegible]	3033.[illegible]	[illegible]	[illegible]2.4	[illegible]16.9	
[illegible]003	MTRU	CH	Solidified	Inorganics	(10)	[illegible]	1079.[illegible]	[illegible]	[illegible].666	[illegible].69	
[illegible]006	MTRU	CH	Solidified	Inorganics	(10)	30[illegible]	301.[illegible]	[illegible]	[illegible]6.2361	[illegible].19	
[illegible]006	TRU	CH	Solidified	Inorganics	(10)	314.[illegible]	4.[illegible]	[illegible]	44096.94	41923.6	
[illegible]001	TRU	CH	Solidified	Inorganics	(10)	100	14.[illegible]	[illegible]	2020	580	

B7-4

Table 1. Estimate of Portland Cement in TRU Waste for Disposal in the WIPP

IPR ID	Waste type	Handling	[illegible]	Solidification	Cement (kg/m³)	Stored (m³)	Projected (m³)	Total kg	Projected kg
(001	TRU	CH	Solidified Inorganics	Sludge - Assumed IN-W179.1084	394.2	4.2	0	1655.64	0
V002	MTRU	CH	Solidified Inorganics	Florco(4)	n/a				
/021	TRU	CH	Solidified Inorganics	Mainly debris	n/a				
IT0001	MTRU	CH	Solidified Inorganics	BIR	187.6	3.7	0	694.12	0
IT0007	MTRU	CH	Solidified Inorganics	BIR	130.6	0.8	0	104.48	0
IT0800	MTRU	CH	Solidified Inorganics	BIR	193.8	65.5	38.9	20232.72	7538.82
IT0803	MTRU	CH	Solidified Inorganics	BIR	55.6	2.9	2.1	278	116.76
IT0807	MTRU	CH	Solidified Inorganics	BIR	71.7	73.4	41.6	8245.5	2982.72
T0377	MTRU	CH	Solidified Inorganics	Particulate(3)	73.1	3.3	0	241.23	0
T0806	MTRU	CH	Solidified Inorganics	BIR	73.1	0	1110.7	81192.17	81192.17
T0823	TRU	CH	Solidified Inorganics	BIR	17.5	7.1	23.1	528.5	404.25
T0806	TRU	CH	Solidified Inorganics	BIR	73.1	0	202.2	14780.82	14780.82
110	TRU	CH	Solidified Inorganics	BIR	140.2	0.6	0	84.12	0
T0802	TRU	CH	Solidified Inorganics	BIR(6)	68.32	7.5	26	2288.72	1776.32
281	MTRU	CH	Solidified Inorganics	Vermiculite(9)	n/a				
383	TRU	CH	Solidified Inorganics	Vermiculite(9)	n/a				
394	TRU	CH	Solidified Inorganics	Vermiculite(9)	n/a				
039	MTRU	CH	Solidified Organics	resins(3)	73.1	0.2	0	14.62	0
157 144	MTRU	CH	Solidified Organics	BIR(6)	187.88	49.9	0	9375.212	0
151 906	MTRU	CH	Solidified Organics	BIR(6)	212.768	163.7	0	34830.1216	0
164 1060	MTRU	CH	Solidified Organics	Envirostone(11)	n/a				
164 153	MTRU	CH	Solidified Organics	Envirostone(11)	n/a				
167 149	MTRU	CH	Solidified Organics	calc-silicate(12)	n/a				
167 926	MTRU	CH	Solidified Organics	calc-silicate(12)	n/a				
109 610	MTRU	CH	Solidified Organics	calc-silicate(12)	n/a				
117 757	MTRU	CH	Solidified Organics	resins(3)	73.1	39.1	0	2858.21	0
117 758	MTRU	CH	Solidified Organics	resins(3)	73.1	11.5	0	840.65	0
19 584	MTRU	CH	Solidified Organics	resins(3)	73.1	0.7	0	51.17	0
11 1023	MTRU	CH	Solidified Organics	resins(3)	73.1	1.3	0	95.03	0
12	TRU	CH	Solidified Organics	(10)	693	1.5	29.1	21205.8	20166.3
19	MTRU	CH	Solidified Organics	Envirostone(11)	n/a				
T0003	MTRU	CH	Solidified Organics	calc-silicate(12)	n/a				
T0801	MTRU	CH	Solidified Organics	Envirostone(11)	n/a				
T0375	MTRU	CH	Solidified Organics	Oil Dri(13)	n/a				
T0809	TRU	CH	Solidified Organics	BIR	32	0	35.2	1126.4	1126.4
280	MTRU	CH	Solidified Organics	paint(14)	n/a				
282	MTRU	CH	Solidified Organics	Mainly debris	n/a				
285	MTRU	CH	Solidified Organics	Conweb pads(15)	n/a				
286	MTRU	CH	Solidified Organics	Oil Dri(13)	n/a				
326	MTRU	CH	Solidified Organics	Conweb pads(15)	n/a				
329	MTRU	CH	Solidified Organics	PCB waste(16)	n/a				
333	MTRU	CH	Solidified Organics	PCB waste(16)	n/a				
338	MTRU	CH	Solidified Organics	Conweb pads(15)	n/a				
344	MTRU	CH	Solidified Organics	Diatomaceous earth(7)	n/a				
345	MTRU	CH	Solidified Organics	Conweb pads(15)	n/a				
348	MTRU	CH	Solidified Organics	animal waste	n/a				
361	TRU	CH	Solidified Organics	Vermiculite(9)	n/a				
380	TRU	CH	Solidified Organics	Diatomaceous earth(7)	n/a				
						RH-TRU Total		505118.2	82095.27 kg
						CH-TRU Total		5282085.787	1344061.99 kg
Cement equals Stored + Projected plus 2.05 times Projected for CH TRU						TOTAL SCALED			8542531.067 kg
us Stored + Projected for RH-TRU									

B7-5

Table 1. Estimate of Portland Cement in TRU Waste for Disposal in the WIPP

[illegible]	Solidification	Cement (kg/m³)	Stored (m³)	Projected (m³)	Total kg	Projected kg	
ılt waste, does not contain any portland cement							
ıcapsulated metal waste, does not contain any portland cement							
ssume RF-M10806 for final form cement density							
orco (clay) is used as sorbent not portland cement							
ıe portland cement for this waste stream in the BIR occurs in the "Other Inorganic Material"							
ıly 61% of the solidification agent reported as cement in the TWBIR is portland cement							
·atomaceous earth is used as the sorbent in this waste stream							
ıster of Paris used as solidification agent							
·rmiculite used as sorbent in this waste stream							
ıasis for portland cement are values reported in TWBIR supplemented with information provided by LANL							
for previous WIPP memo on nitrate, sulfate, and phosphate							
·olidification agent is Envirostone (a gypsum-based process) that does not contain portland cement							
·olidification agent is a calcium-silicate process that does not use portland cement							
)il Dri is used as sorbent							
olidified organics is paint, contains no portland cement							
olidification agent/sorbent is conwed pads (plastic fiber absorbent) +/- vermiculite							
'CB containing waste, excluded from current WIPP inventory							

Attachment 4 of 4

APPENDIX C

APPENDIX C

SITE-SPECIFIC STORED RADIONUCLIDE INVENTORIES

CH Curies on a Site-by-Site[1] Basis (Decayed to the End of 1995)

Nuclide	ARCO	ARMY	ETEC	HANF	INEL	LBL
Ac225			2.23E-15	1.31E-01	1.52E+00	5.45E-06
Ac227		1.98E-15	4.08E-14	1.02E-04	3.86E-02	1.35E-19
Ac228			2.87E-18	5.60E-02	3.08E-01	1.69E-19
Ag109m						
Ag110				5.08E-10	3.55E-09	
Ag110m				3.81E-08	2.67E-07	
Am241			5.19E-01	4.73E+03	9.01E+04	9.17E-02
Am243				9.02E-02	3.80E-01	3.85E-02
Am245					1.12E-09	3.60E-14
At217			2.23E-15	1.31E-01	1.52E+00	5.45E-06
Ba137m			1.99E-01	6.46E+02	5.71E+01	
Bi210	5.22E-15		2.05E-15	5.30E-06	2.70E-02	8.96E-03
Bi211		1.98E-15	4.08E-14	1.02E-04	3.87E-02	1.35E-19
Bi212			1.10E-18	5.19E-02	2.62E+01	8.59E-20
Bi213			2.23E-15	1.31E-01	1.52E+00	5.45E-06
Bi214	6.86E-13		4.56E-14	3.15E-05	4.80E-02	3.37E-02
Bk249					7.70E-05	2.48E-09
Bk250						8.68E-08
C14				1.60E+00	1.66E-01	
Cd109						
Cd113m				1.25E-09	3.20E-08	
Ce144				4.41E-03	3.15E-02	

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	ARCO	ARMY	ETEC	HANF	INEL	LBL
Cf249					1.02E-02	3.10E-03
Cf250						1.97E-04
Cf251						
Cf252				3.55E-05	2.19E-03	
Cm242					2.73E-08	
Cm243				1.52E-02		
Cm244				3.70E+03	4.91E+02	8.70E-02
Cm245				1.71E-03	9.09E-06	2.27E-06
Cm246					1.53E-03	4.83E-07
Cm247						
Cm248				8.13E-09	4.73E-07	
Co58					1.22E-14	
Co60					6.23E+01	
Cs134				2.45E-04	1.20E-03	
Cs135				1.91E-07	8.08E-06	
Cs137			2.11E-01	6.83E+02	6.04E+01	
Es254						8.67E-08
Eu150					3.50E-05	
Eu152				7.34E-07	1.62E-01	
Eu154				6.22E-05	6.42E-01	
Eu155				1.06E-03	3.82E-01	
Fe55					1.91E-05	
Fe59					3.38E-21	
Fr221			2.23E-15	1.31E-01	1.52E+00	5.45E-06
Fr223		2.73E-17	5.63E-16	1.41E-06	5.33E-04	1.86E-21
H3					8.02E-01	
I129						

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	ARCO	ARMY	ETEC	HANF	INEL	LBL
Kr85						
Mn54					8.49E-04	
Nb95				1.80E-11	2.38E-09	
Nb95m				6.00E-14	7.95E-12	
Ni59						
Ni63					9.06E-05	
Np237			9.49E-07	2.72E-01	8.53E-01	6.32E-06
Np239				9.02E-02	3.80E-01	3.85E-02
Np240m				5.84E-10	3.50E-14	
Pa231		1.88E-13	6.72E-13	4.84E-04	1.33E-05	1.99E-18
Pa233			9.49E-07	2.72E-01	8.53E-01	6.32E-06
Pa234			6.06E-17	7.62E-03	1.50E-04	2.40E-14
Pa234m			4.66E-14	5.86E+00	1.16E-01	1.84E-11
Pb209			2.23E-15	1.31E-01	1.52E+00	5.45E-06
Pb210	5.22E-15		2.05E-15	5.30E-06	2.70E-02	8.96E-03
Pb211		1.98E-15	4.08E-14	1.02E-04	3.87E-02	1.35E-19
Pb212			1.10E-18	5.19E-02	2.62E+01	8.59E-20
Pb214	6.86E-13		4.56E-14	3.15E-05	4.80E-02	3.37E-02
Pd107				2.82E-08	1.19E-06	
Pm147				4.78E-02	2.63E+00	
Po210	1.42E-15		2.05E-15	5.30E-06	2.70E-02	8.96E-03
Po211		5.53E-18	1.14E-16	2.87E-07	1.08E-04	3.78E-22
Po212			7.04E-19	3.32E-02	1.68E+01	
Po213			2.19E-15	1.28E-01	1.49E+00	5.33E-06
Po214	6.86E-13		4.56E-14	3.15E-05	4.80E-02	3.37E-02
Po215		1.98E-15	4.08E-14	1.02E-04	3.87E-02	1.35E-19
Po216			1.10E-18	5.19E-02	2.62E+01	8.59E-20

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	ARCO	ARMY	ETEC	HANF	INEL	LBL
Po218	6.86E-13	1.40E-11	4.56E-14	3.15E-05	4.80E-02	3.37E-02
Pr144				4.36E-03	3.12E-02	
Pu236					1.04E-02	
Pu238	3.70E+02		1.11E-01	8.05E+04	5.98E+04	2.32E-04
Pu239		1.80E+01	1.79E+00	2.63E+04	4.01E+04	8.45E-06
Pu240			6.12E-01	6.15E+03	9.82E+03	5.14E-03
Pu241			6.22E+00	3.78E+04	1.50E+05	4.48E-07
Pu242			5.00E-05	3.80E-01	9.45E-01	1.01E-02
Pu243						
Pu244				5.85E-10	3.50E-14	
Ra223		1.98E-15	4.08E-14	1.02E-04	3.87E-02	1.35E-19
Ra224			1.10E-18	5.19E-02	2.62E+01	8.59E-20
Ra225			2.23E-15	1.31E-01	1.52E+00	5.45E-06
Ra226	6.86E-13		4.56E-14	3.15E-05	4.80E-02	3.37E-02
Ra228			2.87E-18	5.60E-02	3.08E-01	1.69E-19
Rh106				2.17E-03	1.12E-02	
Rn219		1.98E-15	4.08E-14	1.02E-04	3.87E-02	1.35E-19
Rn220			1.10E-18	5.19E-02	2.62E+01	8.59E-20
Rn222	6.86E-13		4.56E-14	3.15E-05	4.80E-02	3.37E-02
Ru106				2.17E-03	1.12E-02	
Sb125				5.91E-04	3.53E-03	
Sb126				5.13E-08	2.17E-06	
Sb126m				3.67E-07	1.55E-05	
Se79				1.66E-07	7.00E-06	
Sm151				6.14E-04	2.39E-02	
Sn119m				2.95E-07	2.10E-06	
Sn121m				1.20E-05	4.38E-04	

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	ARCO	ARMY	ETEC	HANF	INEL	LBL
Sn126				3.67E-07	1.55E-05	
Sr90			2.00E-01	6.92E+02	1.96E+00	
Tc99				9.51E-06	2.16E-03	
Te125m				1.44E-04	8.62E-04	
Te127				3.95E-09	1.02E-07	
Te127m				4.03E-09	1.04E-07	
Th227		1.95E-15	4.02E-14	1.01E-04	3.82E-02	1.33E-19
Th228			1.10E-18	5.19E-02	2.62E+01	8.59E-20
Th229			2.23E-15	1.31E-01	1.52E+00	5.45E-06
Th230	4.75E-09		5.25E-11	8.11E-03	2.08E-02	1.50E-13
Th231		1.77E-08	1.06E-08	1.71E+00	6.17E-02	3.32E-14
Th232			1.61E-17	6.71E-02	3.30E-01	5.33E-19
Th234			4.66E-14	5.86E+00	1.16E-01	1.84E-11
Tl207		1.97E-15	4.07E-14	1.02E-04	3.86E-02	1.34E-19
Tl208			3.95E-19	1.86E-02	9.42E+00	3.09E-20
Tl209			4.83E-17	2.82E-03	3.28E-02	1.18E-07
U232					2.53E+01	
U233			1.20E-11	8.00E+01	8.99E+02	4.81E-03
U234	1.05E-03		1.93E-06	5.37E+01	6.17E+00	4.73E-09
U235		1.77E-08	1.06E-08	1.71E+00	6.17E-02	3.32E-14
U236			1.09E-07	2.49E-03	5.27E-03	1.81E-09
U237			1.53E-04	9.26E-01	3.67E+00	1.10E-11
U238			4.66E-14	5.86E+00	1.16E-01	1.84E-11
U240				5.84E-10	3.50E-14	
Y90			2.00E-01	6.92E+02	1.96E+00	
Zr93				2.14E-06	9.06E-05	
Zr95				8.09E-12	1.07E-09	

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	ARCO	ARMY	ETEC	HANF	INEL	LBL
Total by Site	3.70E+02	1.80E+01	1.01E+01	1.62E+05	3.51E+05	5.08E-01

Nuclide	LANL	LLNL	MOUND	MURR	NTS	ORNL
Ac225	8.06E-02	9.81E-13		1.59E-13	2.41E-03	2.07E-01
Ac227	2.32E-01	3.32E-10	4.13E-12	1.83E-17	2.09E-04	9.85E-03
Ac228	1.59E-03	1.60E-16			1.90E-16	7.12E-04
Ag109m	6.56E+00					
Ag110	2.87E-11				5.55E-11	
Ag110m	2.16E-09				4.18E-09	
Am241	9.11E+03	1.44E+02		3.24E-01	2.84E+02	1.61E+03
Am243	3.83E+00	2.45E-02			1.22E+00	1.16E+01
Am245	1.95E-15				5.29E-14	1.49E-10
At217	8.06E-02	9.81E-13		1.59E-13	2.41E-03	2.07E-01
Ba137m	4.55E+01	1.57E-06			3.41E-01	2.20E+03
Bi210	2.80E-01	2.38E-13	7.23E-10		6.69E-02	1.26E+00
Bi211	2.32E-01	3.32E-10	4.13E-12	1.83E-17	2.09E-04	9.85E-03
Bi212	1.32E-03	6.13E-17			1.64E-02	2.84E-01
Bi213	8.06E-02	9.81E-13		1.59E-13	2.41E-03	2.07E-01
Bi214	9.04E-01	9.47E-12	6.88E-09	1.94E-22	2.50E-01	6.49E+00
Bk249	1.35E-10				3.65E-09	1.03E-05
Bk250					4.11E-11	9.51E-13
C14	2.00E-07				2.50E-04	
Cd109	6.55E+00					
Cd113m	7.42E-07				6.50E-09	
Ce144	3.04E-04				7.88E-04	
Cf249	9.64E-04				1.14E-02	2.82E-02

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CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	LANL	LLNL	MOUND	MURR	NTS	ORNL
Cf250					3.18E-01	1.49E-03
Cf251	1.58E-03					
Cf252					1.70E-02	1.60E-01
Cm242	3.42E-17	1.70E-04				1.39E-03
Cm243	1.09E+00					
Cm244	1.57E+02	6.54E+01			2.28E+02	1.06E+03
Cm245	1.60E-06				9.44E-06	3.35E-05
Cm246	4.01E-02	5.22E-04			6.14E-04	1.60E-05
Cm247	1.34E-09					
Cm248					3.57E-06	2.55E-02
Co58	1.22E-13					
Co60	2.14E-04					1.84E-06
Cs134	4.24E-03				4.03E-04	
Cs135	2.05E-04				1.20E-06	
Cs137	4.81E+01	1.66E-06			3.60E-01	2.33E+03
Es254					4.11E-11	
Eu150						
Eu152	4.18E-04	1.33E-06			1.06E+00	6.18E-04
Eu154	2.45E-02	5.25E-07			4.28E-01	
Eu155	2.31E-01				3.80E-03	
Fe55						
Fe59	1.35E-16					1.87E-07
Fr221	8.06E-02	9.81E-13		1.59E-13	2.41E-03	2.07E-01
Fr223	3.20E-03	4.58E-12	5.70E-14	2.53E-19	2.89E-06	1.36E-04
H3					6.46E-02	
I129						
Kr85					1.96E-01	

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CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	LANL	LLNL	MOUND	MURR	NTS	ORNL
Mn54	5.48E-08					
Nb95	1.76E-11				1.51E-17	
Nb95m	5.89E-14				5.05E-20	
Ni59						
Ni63						1.09E-04
Np237	3.24E-02	4.71E-04		2.28E-04	5.78E-03	7.27E-01
Np239	3.83E+00	2.45E-02			1.22E+00	1.16E+01
Np240m	1.94E-07				9.99E-07	1.10E-09
Pa231	1.24E-03	1.54E-08	3.24E-11	8.98E-16	5.00E-04	3.14E-01
Pa233	3.24E-02	4.71E-04		2.28E-04	5.78E-03	7.27E-01
Pa234	3.07E-05	3.94E-05		1.51E-10	2.13E-07	5.54E-05
Pa234m	2.36E-02	3.03E-02		1.16E-07	1.64E-04	4.26E-02
Pb209	8.06E-02	9.81E-13		1.59E-13	2.41E-03	2.07E-01
Pb210	2.80E-01	2.38E-13	7.23E-10		6.69E-02	1.26E+00
Pb211	2.32E-01	3.32E-10	4.13E-12	1.83E-17	2.09E-04	9.85E-03
Pb212	1.32E-03	6.13E-17			1.64E-02	2.84E-01
Pb214	9.04E-01	9.47E-12	6.88E-09	1.94E-22	2.50E-01	6.49E+00
Pd107	3.03E-05				1.78E-07	
Pm147	2.00E+00				1.05E-01	1.94E-02
Po210	2.80E-01	1.97E-13	7.23E-10		6.69E-02	1.26E+00
Po211	6.50E-04	9.28E-13	1.16E-14	5.13E-20	5.86E-07	2.76E-05
Po212	8.48E-04	3.93E-17			1.05E-02	1.82E-01
Po213	7.89E-02	9.60E-13		1.55E-13	2.36E-03	2.02E-01
Po214	9.04E-01	9.47E-12	6.87E-09		2.50E-01	6.49E+00
Po215	2.32E-01	3.32E-10	4.13E-12	1.83E-17	2.09E-04	9.85E-03
Po216	1.32E-03	6.13E-17			1.64E-02	2.84E-01
Po218	9.05E-01	9.47E-12	6.88E-09	1.94E-22	2.50E-01	6.49E+00

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CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	LANL	LLNL	MOUND	MURR	NTS	ORNL
Pr144	3.00E-04				7.79E-04	
Pu236	5.37E-17					
Pu238	1.15E+05	7.65E+01	1.53E+03		1.95E+02	3.50E+03
Pu239	7.69E+04	1.58E+02	2.98E+01	2.46E-02	2.76E+03	1.01E+03
Pu240	1.00E+02	6.44E+01			1.88E+01	9.48E+02
Pu241	1.62E+03	1.63E+03		6.32E-03	2.40E+02	4.79E+04
Pu242	4.85E+02	2.02E-02			8.70E-02	2.37E-01
Pu243	1.34E-09					
Pu244	1.94E-07				1.00E-06	1.10E-09
Ra223	2.32E-01	3.32E-10	4.13E-12	1.83E-17	2.09E-04	9.85E-03
Ra224	1.32E-03	6.13E-17			1.64E-02	2.84E-01
Ra225	8.06E-02	9.81E-13		1.59E-13	2.41E-03	2.07E-01
Ra226	9.05E-01	9.47E-12	6.88E-09	1.94E-22	2.50E-01	6.49E+00
Ra228	1.59E-03	1.60E-16			1.90E-16	7.12E-04
Rh106	9.97E-04				8.76E-04	
Rn219	2.32E-01	3.32E-10	4.13E-12	1.83E-17	2.09E-04	9.85E-03
Rn220	1.32E-03	6.13E-17			1.64E-02	2.84E-01
Rn222	9.05E-01	9.47E-12	6.88E-09	1.94E-22	2.50E-01	6.49E+00
Ru106	9.97E-04				8.76E-04	
Sb125	4.67E-02				1.37E-03	
Sb126	5.52E-05				3.23E-07	
Sb126m	3.94E-04				2.31E-06	
Se79	1.78E-04				1.04E-06	
Sm151	6.00E-01				3.75E-03	
Sn119m	1.66E-08				2.97E-08	
Sn121m	1.09E-02				7.17E-05	
Sn126	3.94E-04				2.31E-06	

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CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	LANL	LLNL	MOUND	MURR	NTS	ORNL
Sr90	4.44E+01				3.10E-01	1.48E+03
Tc99	1.02E-02				5.99E-05	1.78E+01
Te125m	1.14E-02				3.33E-04	
Te127	7.45E-10				2.29E-12	
Te127m	7.60E-10				2.34E-12	
Th227	2.29E-01	3.27E-10	4.07E-12	1.81E-17	2.06E-04	9.72E-03
Th228	1.32E-03	6.13E-17			1.64E-02	2.84E-01
Th229	8.06E-02	9.81E-13		1.59E-13	2.41E-03	2.07E-01
Th230	4.90E-04	3.06E-08	3.35E-06	1.35E-18	9.98E-07	2.45E-04
Th231	5.27E-01	5.93E-04	2.68E-07	4.45E-11	6.15E-05	8.15E-03
Th232	2.29E-03	9.37E-16			8.19E-16	8.57E-04
Th234	2.36E-02	3.03E-02		1.16E-07	1.64E-04	4.26E-02
Tl207	2.31E-01	3.31E-10	4.12E-12	1.83E-17	2.09E-04	9.82E-03
Tl208	4.76E-04	2.20E-17			5.89E-03	1.02E-01
Tl209	1.74E-03	2.12E-14		3.43E-15	5.20E-05	4.47E-03
U232	5.50E-18				1.65E-02	2.90E-01
U233	4.46E+01	5.95E-09		1.78E-09	1.81E+00	1.77E+02
U234	5.84E+00	3.17E-03	5.52E-02	2.98E-13	1.25E-02	1.57E+01
U235	5.27E-01	5.93E-04	2.68E-07	4.45E-11	6.15E-05	8.15E-03
U236	2.99E-06	7.63E-06			4.20E-06	3.40E-04
U237	3.98E-02	4.00E-02		1.55E-07	5.88E-03	1.18E+00
U238	2.36E-02	3.03E-02		1.16E-07	1.64E-04	4.26E-02
U240	1.94E-07				9.99E-07	1.10E-09
Y90	4.45E+01				3.10E-01	1.48E+03
Zr93	2.30E-03				1.35E-05	
Zr95	7.93E-12				6.81E-18	

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	LANL	LLNL	MOUND	MURR	NTS	ORNL
Total by Site	2.03E+05	2.14E+03	1.56E+03	3.55E-01	3.74E+03	6.38E+04

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	PAD	PANT	RFETS	RF-Res	SR-On	SR-Off	TOTAL
Ac225	4.01E-07		3.55E-11	2.14E-09	1.31E-05	1.02E-10	1.94E+00
Ac227	1.27E-12	4.83E-17	1.58E-10	1.62E-08	3.70E-07	2.89E-10	2.80E-01
Ac228			1.49E-14	7.07E-13	1.01E-02	2.13E-14	3.76E-01
Ag109m							6.56E+00
Ag110							4.14E-09
Ag110m							3.11E-07
Am241			1.10E+04	1.19E+05	3.58E+03	1.20E+02	2.40E+05
Am243					7.55E-01		1.80E+01
Am245							1.27E-09
At217	4.01E-07		3.55E-11	2.14E-09	1.31E-05	1.02E-10	1.94E+00
Ba137m					7.11E+00		2.96E+03
Bi210			4.54E-12	1.08E-09	1.69E-07	9.40E-07	1.65E+00
Bi211	1.27E-12	4.83E-17	1.58E-10	1.62E-08	3.70E-07	2.89E-10	2.81E-01
Bi212			4.98E-15	3.82E-13	9.18E-03	1.93E-14	2.66E+01
Bi213	4.01E-07		3.55E-11	2.14E-09	1.31E-05	1.02E-10	1.94E+00
Bi214			9.77E-11	1.35E-08	1.51E-06	5.79E-06	7.72E+00
Bk249							8.73E-05
Bk250							8.68E-08
C14							1.77E+00
Cd109							6.55E+00
Cd113m							7.81E-07
Ce144					8.72E-13		3.70E-02
Cf249							5.39E-02
Cf250							3.20E-01
Cf251							1.58E-03
Cf252					3.62E-01		3.61E+01
Cm242							1.56E-03

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	PAD	PANT	RFETS	RF-Res	SR-On	SR-Off	TOTAL
Cm243							1.11E+00
Cm244					6.15E+02		6.32E+03
Cm245							1.77E-03
Cm246							4.28E-02
Cm247							1.34E-09
Cm248					1.61E-04		3.35E-02
Co58							1.34E-13
Co60					3.56E-01		6.27E+01
Cs134					3.18E-06		6.09E-03
Cs135							2.15E-04
Cs137					7.52E+00		3.12E+03
Es254							8.68E-08
Eu150							3.50E-05
Eu152							1.22E+00
Eu154					2.83E-04		1.10E+00
Eu155					3.13E-06		6.18E-01
Fe55							1.91E-05
Fe59							1.87E-07
Fr221	4.01E-07		3.55E-11	2.14E-09	1.31E-05	1.02E-10	1.94E+00
Fr223	1.75E-14	6.67E-19	2.19E-12	2.23E-10	5.10E-09	3.99E-12	3.87E-03
H3							8.66E-01
I129					1.17E-07		1.17E-07
Kr85							1.96E-01
Mn54					1.00E-10		8.49E-04
Nb95							2.41E-09
Nb95m							8.06E-12
Ni59					1.25E-03		1.25E-03

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	PAD	PANT	RFETS	RF-Res	SR-On	SR-Off	TOTAL
Ni63					1.53E-01		1.53E-01
Np237	5.49E+01		1.70E-02	3.19E-01	8.59E+00	3.58E-03	6.58E+01
Np239					7.55E-01		1.80E+01
Np240m					1.59E-11		1.20E-06
Pa231	2.09E-11	2.31E-15	2.70E-09	1.59E-07	1.68E-06	1.65E-09	3.16E-01
Pa233	5.49E+01		1.70E-02	3.19E-01	8.59E+00	3.58E-03	6.58E+01
Pa234			1.94E-17	9.23E-12	7.37E-06	5.26E-08	7.90E-03
Pa234m			1.49E-14	7.10E-09	5.67E-03	4.04E-05	6.08E+00
Pb209	4.01E-07		3.55E-11	2.14E-09	1.31E-05	1.02E-10	1.94E+00
Pb210			4.54E-12	1.08E-09	1.69E-07	9.40E-07	1.65E+00
Pb211	1.27E-12	4.83E-17	1.58E-10	1.62E-08	3.70E-07	2.89E-10	2.81E-01
Pb212			4.98E-15	3.82E-13	9.18E-03	1.93E-14	2.66E+01
Pb214			9.77E-11	1.35E-08	1.51E-06	5.79E-06	7.72E+00
Pd107							3.17E-05
Pm147					1.24E-05		4.79E+00
Po210			4.50E-12	1.08E-09	1.69E-07	9.40E-07	1.65E+00
Po211	3.56E-15	1.35E-19	4.43E-13	4.53E-11	1.04E-09	8.10E-13	7.86E-04
Po212			3.19E-15	2.45E-13	5.88E-03	1.24E-14	1.70E+01
Po213	3.93E-07		3.47E-11	2.10E-09	1.28E-05	9.94E-11	1.90E+00
Po214			9.77E-11	1.35E-08	1.51E-06	5.79E-06	7.72E+00
Po215	1.27E-12	4.83E-17	1.58E-10	1.62E-08	3.70E-07	2.89E-10	2.81E-01
Po216			4.98E-15	3.82E-13	9.18E-03	1.93E-14	2.66E+01
Po218			9.77E-11	1.35E-08	1.51E-06	5.79E-06	7.73E+00
Pr144					8.62E-13		3.66E-02
Pu236							1.04E-02
Pu238			3.43E+02	8.09E+03	2.86E+05	2.01E+05	7.56E+05
Pu239	5.57E+01	5.55E-02	9.98E+03	1.84E+05	9.13E+03	1.58E+02	3.51E+05

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	PAD	PANT	RFETS	RF-Res	SR-On	SR-Off	TOTAL
Pu240			7.22E+03	4.22E+04	2.21E+03	7.97E+01	6.88E+04
Pu241			5.23E+04	7.22E+05	6.02E+04	1.73E+03	1.07E+06
Pu242			9.63E-05	5.33E+00	3.75E-01		4.93E+02
Pu243							1.34E-09
Pu244					1.59E-11		1.20E-06
Ra223	1.27E-12	4.83E-17	1.58E-10	1.62E-08	3.70E-07	2.89E-10	2.81E-01
Ra224			4.98E-15	3.82E-13	9.18E-03	1.93E-14	2.66E+01
Ra225	4.01E-07		3.55E-11	2.14E-09	1.31E-05	1.02E-10	1.94E+00
Ra226			9.77E-11	1.35E-08	1.51E-06	5.79E-06	7.73E+00
Ra228			1.49E-14	7.07E-13	1.01E-02	2.13E-14	3.76E-01
Rh106					1.84E-10		1.52E-02
Rn219	1.27E-12	4.83E-17	1.58E-10	1.62E-08	3.70E-07	2.89E-10	2.81E-01
Rn220			4.98E-15	3.82E-13	9.18E-03	1.93E-14	2.66E+01
Rn222			9.77E-11	1.35E-08	1.51E-06	5.79E-06	7.73E+00
Ru106					1.84E-10		1.52E-02
Sb125					2.60E-05		5.22E-02
Sb126					2.41E-08		5.78E-05
Sb126m					1.72E-07		4.12E-04
Se79							1.86E-04
Sm151					3.13E-04		6.28E-01
Sn119m							2.44E-06
Sn121m							1.14E-02
Sn126					1.72E-07		4.12E-04
Sr90					6.98E+00		2.22E+03
Tc99					4.50E-06		1.78E+01
Te125m					6.34E-06		1.27E-02
Te127							1.07E-07

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	PAD	PANT	RFETS	RF-Res	SR-On	SR-Off	TOTAL
Te127m							1.09E-07
Th227	1.25E-12	4.77E-17	1.56E-10	1.60E-08	3.64E-07	2.85E-10	2.77E-01
Th228			4.98E-15	3.82E-13	9.18E-03	1.93E-14	2.66E+01
Th229	4.01E-07		3.55E-11	2.14E-09	1.31E-05	1.02E-10	1.94E+00
Th230			1.16E-07	8.88E-06	6.87E-04	1.66E-03	3.20E-02
Th231	3.29E-07	1.09E-10	4.78E-05	1.56E-03	5.83E-03	1.04E-05	2.31E+00
Th232			1.02E-13	2.55E-12	2.13E-02	4.79E-14	4.22E-01
Th234			1.49E-14	7.10E-09	5.67E-03	4.04E-05	6.08E+00
Tl207	1.27E-12	4.82E-17	1.58E-10	1.61E-08	3.69E-07	2.88E-10	2.80E-01
Tl208			1.79E-15	1.37E-13	3.30E-03	6.94E-15	9.55E+00
Tl209	8.67E-09		7.66E-13	4.63E-11	2.83E-07	2.19E-12	4.19E-02
U232							2.56E+01
U233	1.42E-03		1.95E-07	6.56E-06	8.93E-03	1.78E-07	1.20E+03
U234			4.81E-03	2.03E-01	1.06E+01	1.50E+01	1.07E+0?
U235	3.29E-07	1.09E-10	4.78E-05	1.56E-03	5.83E-03	1.04E-05	2.31E+00
U236			9.17E-04	1.07E-02	4.77E-02	1.12E-04	6.75E-02
U237			1.28E+00	1.77E+01	1.48E+00	4.23E-02	2.64E+01
U238			1.49E-14	7.10E-09	5.67E-03	4.04E-05	6.08E+00
U240					1.59E-11		1.20E-06
Y90					6.98E+00		2.22E+03
Zr93							2.41E-03
Zr95							1.09E-09
TOTAL	1.66E+02	5.55E-02	8.08E+04	1.08E+06	3.62E+05	2.03E+05	2.51E+06

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

CH-TRU Curies on a Site-by-Site Basis (continued)

ABBREVIATIONS

ARCO	ARCO Medical Center, Pennsylvania
ARMY	US Army Materiel Command
ETEC	Energy Technology Engineering Center
HANF	Hanford
INEL	Idaho National Engineering Laboratory
KAPL	Knolls Atomic Power Laboratory
LANL	Los Alamos National Laboratory
LBL	Lawrence Berkeley Laboratory
LLNL	Lawrence Livermore National Laboratory
Mound	Mound Facility
MURR	University of Missouri
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
PAD	Paducah
PANT	Pantex
RFETS	Rocky Flats Environmental Technology Site (All waste except residues)
RF-Res	Rocky Flats Environmental Technology Site - Residues Only
SR-On	Savannah River Site, waste generated on-site
SR-Off	Savannah River Site, waste that was generated off-site but currently stored at Savannah River

[1]Argonne National Laboratory-East, Argonne National Laboratory-West, and Teledyne Brown Engineering are not included because no data were received. Data from Sandia National Laboratory-Albuquerque are reported under RH-TRU waste because although the final waste form is expected to be CH-TRU waste, the stored waste is remotely handled at the site.

RH Curies on a Site-by-Site[1] Basis
(Decayed to the End of 1995)

Nuclide	ETEC	HANF	INEL	KAPL	LANL
Ac225	3.07E-18	5.45E-04	1.76E-04	4.11E-18	
Ac227	1.05E-16	1.70E-05	2.61E-07	1.35E-18	4.60E-07
Ac228		1.60E-03	3.87E-05		
Ag110			4.13E-09		9.88E-10
Ag110m			3.11E-07		7.43E-08
Am241	5.85E-02	1.93E+02	4.68E+01	5.07E-02	
Am243			6.91E-04		
Am245					
At217	3.07E-18	5.45E-04	1.76E-04	4.11E-18	
Ba137m	2.48E+00	6.61E+03	1.80E+03	5.40E+01	1.28E+02
Bi210		2.33E-07	6.06E-12	1.87E-16	5.61E-17
Bi211	1.05E-16	1.70E-05	2.61E-07	1.35E-18	4.60E-07
Bi212		1.49E-03	2.65E-05		
Bi213	3.07E-18	5.45E-04	1.76E-04	4.11E-18	
Bi214		1.16E-06	3.26E-10	1.24E-14	7.25E-15
Bk249					
C14			4.00E-02		
Cd113m			1.15E-07		8.88E-07
Ce144			3.98E+00	1.56E+00	1.60E-02
Cf249					
Cf250					
Cf252					
Cm243			1.45E-02		
Cm244			9.63E-02		
Cm245					
Cm246					
Cm248					

[1]Argonne National Laboratory-West is not included in this table because no radionuclide data were received fr the site.

RH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	ETEC	HANF	INEL	KAPL	LANL
Co58			4.37E-11		
Co60	2.30E+00	3.36E+02	1.31E+01	2.75E-01	4.17E+00
Cr51			1.08E-05		
Cs134			5.38E+01	4.73E+00	2.42E-02
Cs135			2.36E-05		1.91E-04
Cs137	2.62E+00	6.98E+03	1.90E+03	5.71E+01	1.35E+02
Eu152			1.14E-01		5.09E-04
Eu154			7.92E-01	1.40E+00	3.50E-02
Eu155			3.35E-01	1.81E-01	1.77E+00
Fe55			5.97E-01		
Fr221	3.07E-18	5.45E-04	1.76E-04	4.11E-18	
Fr223	1.45E-18	2.35E-07	3.60E-09	1.87E-20	6.34E-09
H3			1.43E-01		
Kr85			5.95E+00		
Mn54			8.31E-02		
Nb95			5.28E-12		2.14E-14
Nb95m			1.76E-14		7.15E-17
Ni63			3.50E+00		
Np237	2.26E-08	1.58E-03	8.10E-04	2.25E-08	
Np239			6.91E-04		
Np240m					
Pa231	6.68E-15	6.21E-05	1.42E-06	7.51E-17	2.39E-06
Pa233	2.26E-08	1.58E-03	8.10E-04	2.25E-08	
Pa234		1.33E-05	1.80E-06	4.48E-18	2.60E-08
Pa234m		1.03E-02	1.38E-03	3.45E-15	2.00E-05
Pb209	3.07E-18	5.45E-04	1.76E-04	4.11E-18	
Pb210		2.33E-07	6.06E-12	1.87E-16	5.61E-17

[1]Argonne National Laboratory-West is not included in this table because no radionuclide data were received from the site.

RH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	ETEC	HANF	INEL	KAPL	LANL
Pb211	1.05E-16	1.70E-05	2.61E-07	1.35E-18	4.60E-07
Pb212		1.49E-03	2.65E-05		
Pb214		1.16E-06	3.26E-10	1.24E-14	7.25E-15
Pd107			3.49E-06		2.83E-05
Pm147			1.49E+01	4.34E+00	1.13E+01
Po210		2.33E-07	4.06E-12	8.21E-17	1.60E-17
Po211	2.94E-19	4.77E-08	7.30E-10	3.78E-21	1.29E-09
Po212		9.54E-04	1.70E-05		
Po213	3.00E-18	5.33E-04	1.72E-04	4.02E-18	
Po214		1.16E-06	3.26E-10	1.24E-14	7.25E-15
Po215	1.05E-16	1.70E-05	2.61E-07	1.35E-18	4.60E-07
Po216		1.49E-03	2.65E-05		
Po218		1.16E-06	3.26E-10	1.24E-14	7.25E-15
Pr144			3.93E+00	1.54E+00	1.59E-02
Pu238		4.67E+01	6.09E+01	9.27E-01	3.90E+00
Pu239	4.00E-01	3.35E+02	2.98E+01	3.30E-03	9.28E+01
Pu240		1.67E+02	1.13E+01	3.10E-03	
Pu241		4.67E+03	4.82E+01	7.77E-01	
Pu242		4.92E-03	1.01E-03	1.56E-05	
Pu244					
Ra223	1.05E-16	1.70E-05	2.61E-07	1.35E-18	4.60E-07
Ra224		1.49E-03	2.65E-05		
Ra225	3.07E-18	5.45E-04	1.76E-04	4.11E-18	
Ra226		1.16E-06	3.26E-10	1.24E-14	7.25E-15
Ra228		1.60E-03	3.87E-05		
Rh106			6.64E-02	4.98E-01	3.38E-01
Rn219	1.05E-16	1.70E-05	2.61E-07	1.35E-18	4.60E-07

[1]Argonne National Laboratory-West is not included in this table because no radionuclide data were received fr the site.

RH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	ETEC	HANF	INEL	KAPL	LANL
Rn220		1.49E-03	2.65E-05		
Rn222		1.16E-06	3.26E-10	1.24E-14	7.25E-15
Ru106			6.64E-02	4.98E-01	3.38E-01
Sb125			9.81E-01	5.33E-01	2.79E+00
Sb126			6.35E-06		5.15E-05
Sb126m			4.53E-05		3.68E-04
Se79			2.05E-05		1.66E-04
Sm151			7.23E-02		5.82E-01
Sn119m			2.33E-06		5.20E-07
Sn121m			1.36E-03		1.09E-02
Sn126			4.53E-05		3.68E-04
Sr90	2.62E+00	6.46E+03	1.70E+03	5.70E+01	1.24E+02
Ta182			1.49E-07		
Tc99			1.18E-03		9.54E-03
Te125m			2.39E-01	1.30E-01	6.88E-01
Te127			5.78E-09		1.31E-10
Te127m			5.91E-09		1.34E-10
Th227	1.03E-16	1.68E-05	2.57E-07	1.33E-18	4.53E-07
Th228		1.49E-03	2.65E-05		
Th229	3.07E-18	5.45E-04	1.76E-04	4.11E-18	
Th230		2.42E-04	1.37E-06	4.36E-11	5.01E-11
Th231	4.73E-10	1.46E-01	5.41E-03	4.53E-12	8.78E-03
Th232		1.96E-03	7.51E-05	4.68E-21	
Th234		1.03E-02	1.38E-03	3.45E-15	2.00E-05
Tl207	1.05E-16	1.70E-05	2.60E-07	1.35E-18	4.58E-07
Tl208		5.35E-04	9.52E-06		
Tl209	6.63E-20	1.18E-05	3.79E-06	8.88E-20	

[1]Argonne National Laboratory-West is not included in this table because no radionuclide data were received from the site.

RH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	ETEC	HANF	INEL	KAPL	LANL
U233	6.55E-14	4.15E-01	3.91E-01	7.62E-14	
U234		1.29E+00	1.51E-01	4.98E-06	1.11E-05
U235	4.73E-10	1.46E-01	5.41E-03	4.53E-12	8.78E-03
U236		8.63E-05	3.52E-06	1.24E-10	
U237		1.15E-01	1.18E-03	1.91E-05	
U238		1.03E-02	1.38E-03	3.45E-15	2.00E-05
U240					
Y90	2.62E+00	6.46E+03	1.70E+03	5.70E+01	1.24E+02
Zr93			2.65E-04		2.15E-03
Zr95			2.38E-12		9.64E-15
TOTAL	**1.31E+01**	**3.23E+04**	**7.39E+03**	**2.43E+02**	**6.30E+02**

Nuclide	NTS	ORNL	SRS	SNL/NM	WVDP	TOTAL
Ac225	8.80E-14	3.02E-01	2.96E-15	6.40E-18	7.44E-15	3.03E-01
Ac227	9.88E-13	7.17E-04	4.20E-13	2.77E-20		7.35E-04
Ac228	3.63E-18	8.73E-02				8.89E-02
Ag110						5.12E-09
Ag110m						3.85E-07
Am241	4.85E-01	2.41E+02	6.79E-02	1.02E-02	5.39E-01	4.82E+02
Am243		9.98E-05	1.60E-05			8.07E-04
Am245		8.61E-16				8.61E-16
At217	8.80E-14	3.02E-01	2.96E-15	6.40E-18	7.44E-15	3.03E-01
Ba137m		9.25E+03	6.49E+00		5.06E+01	1.79E+04
Bi210		2.39E-07	1.24E-16		1.51E-12	4.72E-07
Bi211	9.88E-13	7.19E-04	4.20E-13	2.77E-20		7.37E-04
Bi212	2.08E-18	8.51E-02				8.66E-02

[1]Argonne National Laboratory-West is not included in this table because no radionuclide data were received frc the site.

RH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	NTS	ORNL	SRS	SNL/NM	WVDP	TOTAL
Bi213	8.80E-14	3.02E-01	2.96E-15	6.40E-18	7.44E-15	3.03E-01
Bi214		1.66E-06	1.64E-14	7.34E-20	2.38E-11	2.82E-06
Bk249		5.94E-11				5.94E-11
C14		6.12E+00				6.15E+00
Cd113m						1.00E-06
Ce144		1.20E+01				1.75E+01
Cf249		1.34E-02				1.34E-02
Cf250	1.81E-01					1.81E-01
Cf252		3.86E+00				3.86E+00
Cm243		1.48E+02				1.48E+02
Cm244	1.55E+02	9.44E+02	4.68E+00			1.10E+03
Cm245		4.39E-06				4.39E-06
Cm246	3.95E-04					3.95E-04
Cm248		6.14E-04				6.14E-04
Co58						4.37E-11
Co60		6.17E+02				9.73E+02
Cr51						1.08E-05
Cs134		9.56E+00				6.81E+01
Cs135						2.15E-04
Cs137		9.78E+03	6.86E+00		5.35E+01	1.89E+04
Eu152		3.66E+03				3.66E+03
Eu154		1.77E+03				1.77E+03
Eu155		3.51E+02				3.53E+02
Fe55						5.97E-01
Fr221	8.80E-14	3.02E-01	2.96E-15	6.40E-18	7.44E-15	3.03E-01
Fr223	1.36E-14	9.90E-06	5.80E-15	3.82E-22		1.01E-05
H3		7.71E-02				2.20E-01

[1]Argonne National Laboratory-West is not included in this table because no radionuclide data were received from the site.

RH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	NTS	ORNL	SRS	SNL/NM	WVDP	TOTAL
Kr85						5.95E+00
Mn54						8.31E-02
Nb95		2.01E+00				2.01E+00
Nb95m		6.72E-03				6.72E-03
Ni63						3.50E+00
Np237	3.19E-06	8.39E+00	1.43E-05	1.01E-08	1.49E-06	8.39E+00
Np239		9.98E-05	1.60E-05			8.07E-04
Np240m		6.62E-11				6.62E-11
Pa231	6.39E-12	8.11E-05	2.67E-11	5.21E-19		1.47E-04
Pa233	3.19E-06	8.39E+00	1.43E-05	1.01E-08	1.49E-06	8.39E+00
Pa234	3.31E-21	3.96E-02				3.96E-02
Pa234m	2.54E-18	3.05E+01				3.05E+01
Pb209	8.80E-14	3.02E-01	2.96E-15	6.39E-18	7.44E-15	3.03E-01
Pb210		2.39E-07	1.24E-16		1.51E-12	4.72E-07
Pb211	9.88E-13	7.19E-04	4.20E-13	2.77E-20		7.37E-04
Pb212	2.08E-18	8.51E-02				8.66E-02
Pb214		1.66E-06	1.64E-14	7.34E-20	2.38E-11	2.82E-06
Pd107						3.18E-05
Pm147			1.34E+00			3.19E+01
Po210		2.39E-07	3.40E-17		1.51E-12	4.72E-07
Po211	2.77E-15	2.01E-06	1.18E-15	7.74E-23		2.06E-06
Po212	1.34E-18	5.45E-02				5.55E-02
Po213	8.61E-14	2.95E-01	2.89E-15	6.26E-18	7.28E-15	2.96E-01
Po214		1.66E-06	1.64E-14	7.34E-20	2.38E-11	2.82E-06
Po215	9.88E-13	7.19E-04	4.20E-13	2.77E-20		7.37E-04
Po216	2.08E-18	8.51E-02				8.66E-02
Po218		1.66E-06	1.64E-14	7.34E-20	2.38E-11	2.82E-06

[1]Argonne National Laboratory-West is not included in this table because no radionuclide data were received fr the site.

RH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	NTS	ORNL	SRS	SNL/NM	WVDP	TOTAL
Pr144		1.18E+01				1.73E+01
Pu238		2.82E+01	8.83E+00	4.92E-06	1.98E+01	1.69E+02
Pu239	2.36E+00	9.86E+01	1.06E-02	2.00E-06		5.59E+02
Pu240	2.54E-01	1.07E+00	5.06E-04			1.79E+02
Pu241	6.60E-05	3.98E-07				4.71E+03
Pu242	4.27E-09					5.94E-03
Pu244		6.63E-11				6.63E-11
Ra223	9.88E-13	7.19E-04	4.20E-13	2.77E-20		7.37E-04
Ra224	2.08E-18	8.51E-02				8.66E-02
Ra225	8.80E-14	3.02E-01	2.96E-15	6.40E-18	7.44E-15	3.03E-01
Ra226		1.66E-06	1.64E-14	7.34E-20	2.38E-11	2.82E-06
Ra228	3.63E-18	8.73E-02				8.89E-02
Rh106		3.21E+01				3.30E+01
Rn219	9.88E-13	7.19E-04	4.20E-13	2.77E-20		7.37E-04
Rn220	2.08E-18	8.51E-02				8.66E-02
Rn222		1.66E-06	1.64E-14	7.34E-20	2.38E-11	2.82E-06
Ru106		3.21E+01				3.30E+01
Sb125						4.30E+00
Sb126						5.78E-05
Sb126m						4.13E-04
Se79						1.86E-04
Sm151						6.55E-01
Sn119m						2.85E-06
Sn121m						1.23E-02
Sn126						4.13E-04
Sr90		3.53E+04	6.85E+00		1.96E+01	4.36E+04
Ta182						1.49E-07

[1]Argonne National Laboratory-West is not included in this table because no radionuclide data were received from the site.

RH-TRU Curies on a Site-by-Site Basis (continued)

Nuclide	NTS	ORNL	SRS	SNL/NM	WVDP	TOTAL
Tc99						1.07E-02
Te125m						1.06E+00
Te127						5.91E-09
Te127m						6.04E-09
Th227	9.74E-13	7.09E-04	4.14E-13	2.73E-20		7.27E-04
Th228	2.08E-18	8.51E-02				8.66E-02
Th229	8.80E-14	3.02E-01	2.96E-15	6.40E-18	7.44E-15	3.03E-01
Th230		6.64E-04	1.13E-10	2.54E-16	1.92E-08	9.07E-04
Th231	3.71E-08	5.53E-01	1.26E-06	9.85E-15		7.13E-01
Th232	1.24E-17	9.92E-02	1.24E-22			1.01E-01
Th234	2.54E-18	3.05E+01				3.05E+01
Tl207	9.85E-13	7.17E-04	4.19E-13	2.76E-20		7.35E-04
Tl208	7.49E-19	3.06E-02				3.11E-02
Tl209	1.90E-15	6.52E-03	6.39E-17	1.38E-19	1.61E-16	6.54E-03
U233	1.40E-10	4.36E+02	6.26E-11	6.67E-14	2.76E-11	4.36E+02
U234	2.02E-23	1.02E+01	2.51E-05	2.81E-11	4.94E-04	1.17E+01
U235	3.71E-08	5.53E-01	1.26E-06	9.85E-15		7.13E-01
U236	5.24E-08	2.82E-01	7.54E-12			2.82E-01
U237	1.62E-09	9.74E-12				1.16E-01
U238	2.54E-18	3.05E+01				3.05E+01
U240		6.62E-11				6.62E-11
Y90		3.53E+04	6.85E+00		1.96E+01	4.36E+04
Zr93						2.41E-03
Zr95		9.06E-01				9.06E-01
Total by Site	**1.58E+02**	**9.81E+04**	**4.20E+01**	**1.02E-02**	**1.64E+02**	**1.39E+05**

[1]Argonne National Laboratory-West is not included in this table because no radionuclide data were received fr the site.

RH-TRU Curies on a Site-by-Site Basis (continued)

ABBREVIATIONS

ETEC	Energy Technology Engineering Center
HANF	Hanford
INEL	Idaho National Engineering Laboratory
KAPL	Knolls Atomic Power Laboratory
LANL	Los Alamos National Laboratory
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
SRS	Savannah River Site
SNL/NM	Sandia National Laboratory-Albuquerque
WVDP	West Valley Demonstration Plant

[1]Argonne National Laboratory-West is not included in this table because no radionuclide data were received from the site.

APPENDIX D

Sandia National Laboratories

Managed and Operated by Sandia Corporation
a Lockheed Martin Corporation
Albuquerque, New Mexico 87185-1328

date : June 20, 1996

to : Russ Bisping (DOE/NTP/CAO)

from : L. C. Sanchez, Org 6848, MS-1328, PH-(505)848-0685, Fax-848-0705

subject : **Correction for Cf252 Decayed Inventory**

Per a request from the TWBIR Team [CH-1], a detailed check was made on the data that was used to perform decay calculations for the stored Cf252 inventory from the Hanford site [SNL-1]. The result of the data check was that the undecayed Cf252 stored CH-TRU inventory for the year 1982 should be 1.08E-03 Ci. The value that was erroneously used for the decay calculations was 1.08E+03 Ci. This means that the Cf252 and it principal decay daughters (Cm248 and Pu240) are overestimated (see Table 1). The WIPP disposal radionuclide inventory in the electronic database should be adjusted to correct these errors. Since Cf252 has a halflife less than 20 yr and the buildup (ingrowth) activities of Cm248 and Pu240 are very small, they have a negligible effect of the EPA Unit calculations (i.e., activity loading) -- they represent a change in the calculated EPA Unit of less than one part in a million (see Table 4 of Ref. SNL-3). Thus, it not necessary for SNL WIPP PA CCA calculations to re-adjust the activity loading values presented in Refs. CCA-2 and CCA-3.

Table 1.
Activity Calculations Performed With Analytical Solution to BATEMAN Equation (a)

Nuclide			Solution Using Analytical Solution to Bateman Equation, Decayed to the Year 1995	
ID (b)	Decay Mode (c)	Half-Life [sec] (d)	Existing Inventory [Curies] (e)	Correct Inventory [Curies] (f)
Cf252	α, γ, SF	8.3250E+07	3.5482E+01 (g)	3.5482E-05
Cm248	α, SF	1.0700E+13	8.1266E-03 (h)	8.1266E-09
Pu240	α, γ, SF	2.0630E+11	8.2980E-06 (i)	8.2980E-12

(a) Calculations correspond only to the 1982 inventory of stored Cf252 at Hanford for CH-TRU. These values indicated that the decay calculations of Ref. SNL-1 overestimated the inventory (on a WIPP-Scale basis) of Cf252 (and to an lesser extent for the first two daughters of Cf252, namely - Cm248 and Pu240). The calculations presented here correspond to 1.08E+03 Ci for the "Existing Inventory" and 1.08E-03 Ci for the "Correct Inventory" at year = 1982 for the undecayed stored Hanford CH-TRU. The Existing Inventory value was that value used in Ref. SNL-1. Activity values presented here for Cm248 and Pu240 correspond only to ingrowth activities from Cf252 only.

(b) Radionuclides are Cf252 and its first two daughters (these are incorporated into the WIPP PA database to yield Ref. CCA-2).

(c) Decay mode information taken from Ref. GE-1.

(d) Halflife values are those incorporated in ORIGEN2, see Ref. SNL-2.

(e) "Existing Inventory" values correspond to 1982 Hanford CH-TRU inventory (originating from Cf252) decayed to the base year of 1995. The undecayed Cf252 inventory was 1.08E+03. Decay calculations were performed using Ref. KA-1b.

(f) "Correct Inventory" values correspond to 1982 Hanford CH-TRU inventory (originating from Cf252) decayed to the base year of 1995. The undecayed Cf252 inventory was 1.08E-03. Decay calculations were performed using Ref. KA-1b.

(g) Using this value in the TWBID resulted in a total decayed WIPP-Scale stored Cf252 inventory of 36.1 Ci [Ref. CH-2] (98.3 % of this value was from the incorrect value from the 1982 Hanford inventory). Thus, correcting the undecayed 1982 Hanford value for Cf252 will result in a substantial lowering of the stored and projected inventory of Cf252. Since Cf252 has a halflife less than 20 yr, it does not contribute to the EPA Unit value and does not effect WIPP PA CCA calculations.

(h) Using this ingrowth value in the TWBID resulted in a total decayed WIPP-Scale stored Cm248 inventory of 3.35E-02 Ci [Ref. CH-2] (24.3 % of this value was from the incorrect value from the 1982 Hanford inventory). Thus, correcting the undecayed 1982 Hanford value for Cf252 will result in a substantial lowering of the stored and projected inventory of Cm248. Since the total activity change due to the ingrowth of Cm248 from Cf252 is very small it has a negligible contribution to the EPA Unit (see Table 4 of Ref. SNL-3) and does not affect PA calculations.

(i) Using this ingrowth value in the TWBID resulted in a total decayed WIPP-Scale stored Cm248 inventory of 6.87E+04 Ci [Ref. CH-2] (less than 2.0E-08 % of this value was from the incorrect value from the 1982 Hanford inventory). Thus, correcting the undecayed 1982 Hanford value for Cf252 will result in a negligible lowering of the stored and projected inventory of Pu240 (or any further decay daughters from Cf252). Since the total activity change due to the ingrowth of Pu240 from Cf252 is very small it has a negligible contribution to the EPA Unit (see Table 4 of Ref. SNL-3) and does not affect PA calculations.

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[CH-1]Personal communications (phone) with Sayan Chakraborti (SAIC/CTAC); Subject: "Error in Cf252 Inventory"; date: June 19, 1996.

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[GE-1]General Electric Company (Nuclear Energy Operations), **Nuclides and Isotopes**, Fourteenth Edition, 1989.

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LCS:6848:lcs/(96-2113)

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File - SWCF-A WBS 1.1.6.2; PA; PBWAC - WIPP ACTIVITY