

**ATTACHMENT F: TRANSURANIC WASTE INVENTORY UPDATE REPORT, 2003
TO
APPENDIX DATA**

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ACRONYMS AND ABBREVIATIONS

2	AE	Argonne National Laboratory – East site identifier
3	ANL-E	Argonne National Laboratory East
4	ANL-W	Argonne National Laboratory West
5	AL	Ames Laboratory site identifier
6	AM	ARCO Medical Products Company site identifier
7	AW	Argonne National Laboratory - West Side identifier
8	BC	Battelle Columbus Laboratory site identifier
9	BAPL	Bettis Atomic Power Laboratory
10	BCL	Battelle Columbus Laboratory
11	BL	Babcock and Wilcox Lynchberg site identifier
12	BLIP	Brookhaven Linear Isotope Production
13	BT	Bettis Atomic Power Laboratory site identifier
14	C&C Agreement	Agreement for Consultation and Cooperation between the Department of
15		Energy and the State of New Mexico on the Waste Isolation Pilot Plant
16	Ca	Calcium
17	CAO	Carlsbad Area Office
18	CBFO	Carlsbad Field Office
19	CCA	Compliance Certification Application
20	CFR	Code of Federal Regulations
21	CH	Contact-handled
22	CPR	Cellulosic, Plastic, and Rubber Materials
23	CRA-2004	Compliance Recertification Application
24	CY	Calendar Year
25	D&D	Decontamination and Decommissioning
26	DOE	U.S. Department of Energy
27	DOR	Direct Oxide Reduction
28	EDTA	ethylenediaminetetraacetic acid
29	EPA	U.S. Environmental Protection Agency
30	ER	Environmental restoration or electro-refining (salts)
31	ERMS	Electronic Records Management System
32	ET	Energy Technology Engineering Center site identifier
33	FFCAct	Federal Facilities Compliance Act
34	ft ³	Cubic feet
35	FR	Framatome (Richland) site identifier
36	GE	General Electric Vallecitos Nuclear Center site identifier
37	HEPA	High Efficiency Particulate Air
38	IDB	Integrated Database
39	IDC	Item Description Code
40	IN	Idaho National Engineering and Environmental Laboratory site identifier
41	INEEL	Idaho National Engineering and Environmental Laboratory
42	IT	Inhalation Toxicology Research Institute (now known as Lovelace
43		Respiratory Research Institute, LRRI) site identifier
44	JASPER	Joint Actinide Shock Physics Experimental Research
45	K	Potassium
46	KA	Knolls Atomic Power Laboratory-Schenectady site identifier

1	KAPL	Knolls Atomic Power Laboratory
2	kg	Kilograms
3	KN	Knolls Atomic Power Laboratory – Nuclear Fuels Service site identifier
4	LA	Los Alamos National Laboratory site identifier
5	LANL	Los Alamos National Laboratory
6	LANL-CO	Los Alamos National Laboratory – Carlsbad Operations
7	LB	Lawrence Berkeley National Laboratory site identifier
8	LBNL	Lawrence Berkeley National Laboratory
9	LECO	Trade name for manufacture of crucibles, furnaces and analytical
10		instrumentation
11	LL	Lawrence Livermore National Laboratory site identifier
12	LLNL	Lawrence Livermore National Laboratory
13	LRRI	Lovelace Respiratory Research Institute
14	LWA	Land Withdrawal Act
15	m ³	cubic meters
16	MC	U.S. Army Material Command site identifier
17	MgO	Magnesium Oxide
18	mrem	Millirem
19	MSE	Molten Salt Extraction
20	MU	University of Missouri Research Reactor site identifier
21	MURR	University of Missouri Research Reactor
22	NT	Nevada Test Site site identifier
23	NTS	Nevada Test Site
24	NWMP	Nuclear Waste Management Program
25	OP	Overpack
26	OR	Oak Ridge National Laboratory site identifier
27	ORIGEN2	Oak Ridge Isotope Generation and Depletion Code
28	ORNL	Oak Ridge National Laboratory
29	OSR	Offsite Source Recovery
30	ORP	Office of River Protection
31	PA	Performance Assessment
32	PA	Paducah Gaseous Diffusion Plant site identifier (in waste profiles only)
33	PCB	Polychlorinated Biphenyls
34	PE	Polyethylene
35	PGDP	Paducah Gaseous Diffusion Plant
36	POC	Pipe Overpack Component
37	Pu	Plutonium
38	PX	Pantex Plant site identifier
39	QA	Quality Assurance
40	RCRA	Resource Conservation and Recovery Act
41	RF	Rocky Flats Environmental Technology site identifier
42	RFETS	Rocky Flats Environmental Technology Site
43	RH	Remote-handled
44	RL	Hanford (Richland Operations Office) site identifier
45	RP	Hanford (Office of River Protection) site identifier
46	SA	Sandia National Laboratories site identifier

1	SBW	Sodium-bearing waste
2	SNL	Sandia National Laboratories
3	SP	Separations Process Research Unit site identifier
4	SPRU	Separations Process Research Unit
5	SQAP	Software Quality Assurance Plan
6	SR	Savannah River Site site identifier
7	SRS	Savannah River Site
8	STTP	Source Term Test Program
9	SWB	Standard Waste Box
10	TDOP	Ten Drum Overpack
11	TOC	Total Organic Carbon
12	TRU	Transuranic
13	TRUPACT II	Transuranic Package Transporter – II
14	TWBID	Transuranic Waste Baseline Inventory Database, Rev. 2.1
15	TWBIR	Transuranic Waste Baseline Inventory Report
16	TWIUR	Transuranic Waste Inventory Update Report
17	USAMC	U.S. Army Material Command
18	WAC	Waste Acceptance Criteria
19	WHO	Waste Handling Operations
20	WIPP	Waste Isolation Pilot Plant
21	WIR	Waste Incidental to Reprocessing
22	WM	Waste Material
23	WMC	Waste Matrix Code
24	WMP	Waste Material Parameter
25	WP	WIPP repository site identifier
26	WTWBIR	WIPP Transuranic Waste Baseline Inventory Report
27	WV	West Valley Demonstration Project site identifier
28	WWIS	WIPP Waste Information System
29	Zn	Zinc
30	Zn-Mg	Zinc-Magnesium (metal alloy)

31 **ABBREVIATED NAMES**

32	TWBIR Revision 3	Transuranic Waste Baseline Inventory Report, Revision 3
33		(DOE 1996a)
34	TWBIR Revision 2	Transuranic Waste Baseline Inventory Report, Revision 2
35		(DOE 1995b)
36	TWBID Revision 2.1	Transuranic Waste Baseline Inventory Database (LANL
37		2003a)
38	2003 Update Report	Transuranic Waste Inventory Update Report – 2003 (this
39		document)
40	Computational Methodology	Transuranic Waste Inventory Update Report – 2003
41		Computational methodology (LANL 2003b)

PREFACE

1
2 The information in this report summarizes the U.S. Department of Energy's (DOE's) transuranic
3 (TRU) waste inventory, projections, and characteristics, and reports emplaced waste. Revision 0
4 of the Waste Isolation Pilot Plant (WIPP) Transuranic Waste Baseline Inventory Report
5 (WTWBIR) published in June 1994 (DOE 1994), was the first attempt ever made by the DOE
6 complex to report all of its TRU waste at the waste stream level. The waste data reported in
7 Revision 0 were considered preliminary until the DOE TRU waste generator/storage sites
8 completed quality checks of the data. Data changes resulting from the site reviews were
9 contained in Revision 1 of the WTWBIR (DOE 1995a). Subsequently, two additional baseline
10 reports, Transuranic Waste Baseline Inventory Report (TWBIR) Revisions 2 and 3 (DOE 1995b
11 and DOE 1996a), were published in 1995 and 1996 to include WIPP and non-WIPP wastes and
12 other additional characteristic information.

13 This document, the Transuranic Waste Inventory Update Report, 2003, is the first update report
14 to these baselines primarily focused on support of performance assessment (PA) in support of the
15 Compliance Recertification Application (CRA-2004) and U.S. Environmental Protection Agency
16 (EPA) concerns related to repository operation. The primary differences between previous data
17 submittals and this update are:

- 18 • This report accounts for the Idaho National Engineering and Environmental Laboratory
19 (INEEL) Advanced Mixed Waste Treatment Facility process by which 55-gallon drums
20 are compacted and put into 100-gallon drums and disregards those calculations related to
21 future waste incineration described in the TWBIR Revision 3 (DOE 1996a) that never
22 went into operation.
- 23 • This report includes 7,095 m³ (250,595 ft³) of stored Hanford tank waste that was added
24 to the inventory in December 2002.
- 25 • This report also addresses the waste that has been emplaced since the WIPP opened in
26 1999.

27 Finally, this report includes updates to all site Waste Stream Profiles that were reported in
28 TWBIR Revision 2 (DOE 1995b). The TRU waste sites provided updated Waste Stream
29 Profiles which contain parameters that are important to the PA. The updated Waste Stream
30 Profiles for non-WIPP, WIPP, and emplaced waste streams are given in Annexes I, J, and K,
31 respectively. The information contained in these profiles is considered the best estimate as of the
32 inventory date, September 30, 2002, because more TRU waste characterization data are now
33 available. However, a caveat to the profile information is warranted because the profiles contain
34 the TRU waste site's best estimates of their TRU waste inventory. Due to the nature of the
35 information, some inconsistencies remain in the profiles. A thorough review of the profiles was
36 conducted during the CRA-2004 review, resulting in identification of specific inconsistencies in
37 the waste stream information. All inconsistencies that were identified by the CRA-2004
38 reviewers are anticipated to have no significant impact on the PA calculations. The TRU Waste
39 Baseline Inventory Waste Profile forms only reflect the data as reported by the TRU Waste Sites.
40 During the process of generating the TRU Waste Baseline Inventory Report for the CRA,
41 priority was given to developing data on those parameters considered important to performance

- 1 assessment (PA). Work is now in progress to correct noted inconsistencies in the forms. SNL
- 2 will evaluate whether any of the individual or cumulative corrections of the reported
- 3 inconsistencies have an impact on PA.

1 **DATA-F-1.0 INTRODUCTION**

2 **DATA-F-1.1 Background**

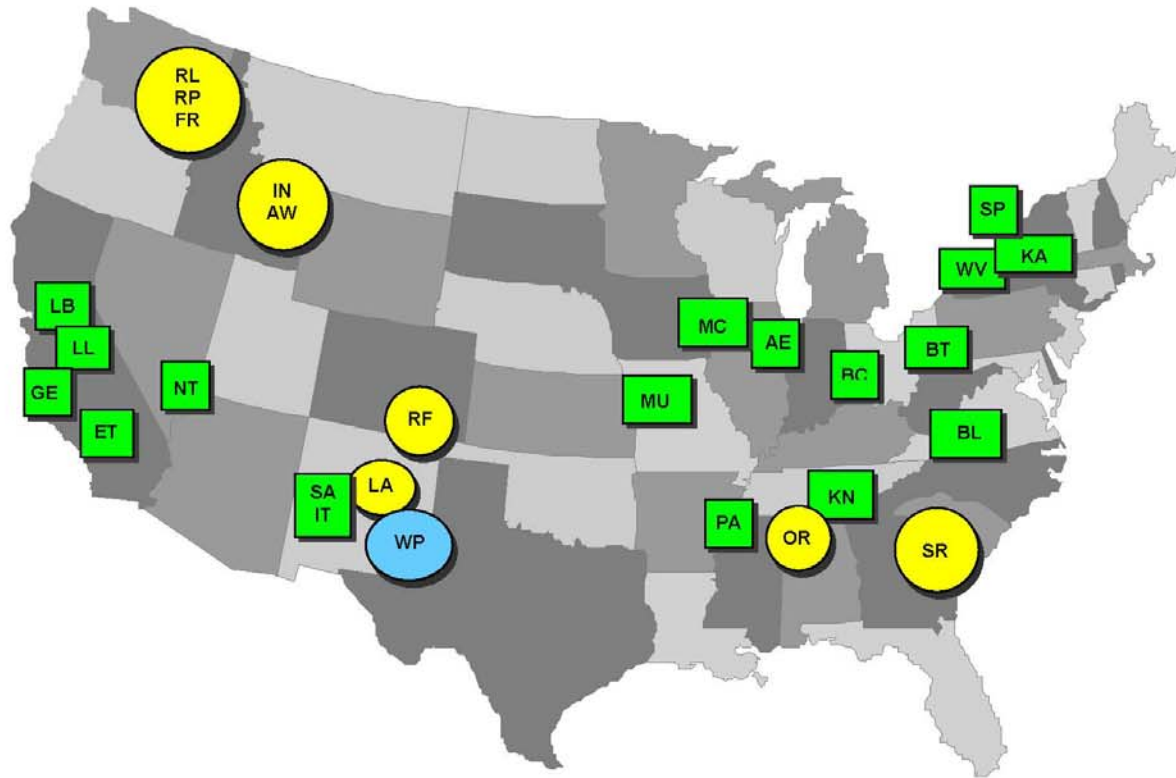
3 The U.S. Department of Energy's (DOE's) Waste Isolation Pilot Plant (WIPP) opened on March
4 26, 1999, becoming the nation's first deep geologic repository for the permanent disposal of
5 defense-generated TRU waste. This waste is currently retrievably stored at 27 sites across the
6 country (see Figure DATA-F-1). From the WIPP's opening through the inventory date
7 (September 30, 2002), 1255 shipments of TRU waste were safely characterized, transported, and
8 disposed in the WIPP.

9 TRU waste is defined as "...waste containing more than 100 nanocuries of alpha-emitting
10 transuranic isotopes per gram of waste, with half-lives greater than 20 years..." (U.S. Congress
11 1996). TRU wastes are classified as either contact-handled- (CH-) waste or remote-handled-
12 (RH-) waste, depending on the dose rate at the surface of the waste container. CH-TRU wastes
13 are packaged TRU wastes with an external surface dose rate less than 200 millirem (mrem) per
14 hour, while RH-TRU wastes are packaged TRU wastes with an external surface dose rate of 200
15 mrem or greater per hour (Pub. L. No. 102-579, 110 Stat. 2422 (1992), as amended by 104-201
16 (1996)). Unless otherwise indicated, for the purpose of this attachment, all references to TRU
17 waste include TRU waste and mixed TRU waste (waste that contains both radioactive and
18 hazardous components, as defined by the Atomic Energy Act [U.S. Congress 1954] and the
19 Resource Conservation and Recovery Act [RCRA] as codified in Title 40 Code of Federal
20 Regulations [CFR] Part 261.3 [EPA 1980]).

21 The DOE is committed to demonstrating compliance with all applicable regulations for the
22 permanent disposal of TRU defense wastes in the WIPP repository. These regulations are the
23 environmental standards for management and disposal of TRU defense wastes as mandated in 40
24 CFR Part 191 (EPA 1993) and Part 194 (EPA 1996), and the RCRA regulations. Compliance
25 demonstration through PA calculations for CRA-2004 will be based on the inventory of existing
26 and currently projected waste streams compiled in this document.

27 The purpose of the WIPP TRU Waste Baseline Inventory Report (WTWBIR) Revision 0 (DOE
28 1994) and Revision 1 (DOE 1995a) was to provide data to be included in the PA processes for
29 the WIPP. The Transuranic Waste Baseline Inventory Report, Revision 2 (hereafter referred to
30 as TWBIR Revision 2) (DOE 1995b) expanded the original purpose of Revisions 0 and 1 to
31 include support for the WIPP Land Withdrawal Act (LWA) (Pub. L. No. 102-579, 110 Stat. 2422
32 (1992), as amended by 104-201 (1996)) by providing the total DOE TRU waste inventory. The
33 TWBIR Revision 2 included a chapter and an appendix that discussed the total DOE TRU waste
34 inventory, including nondefense, commercial, polychlorinated biphenyl (PCB)-contaminated,
35 and buried (predominately pre-1970) TRU wastes that were not planned at the time for disposal
36 in WIPP.

37 The Transuranic Waste Baseline Inventory Report, Revision 3 (hereafter referred to as TWBIR
38 Revision 3) (DOE 1996a) was based on the TWBIR Revision 2 data, which were supplemented
39 by data in several memoranda issued during early calendar year (CY) 1996. These memoranda
40 summarize additional data requested by the DOE to support PA modeling.



AE	Argonne National Laboratory-East	MU	University of Missouri Research Reactor	SR	Savannah River Site
AW	Argonne National Laboratory-West	NT	Nevada Test Site	WV	West Valley Demonstration Project
BC	Battelle Columbus Laboratories	OR	Oak Ridge National Laboratory	WP	Waste Isolation Pilot Plant
BT	Bettis Atomic Power Laboratory	PA	Paducah Gaseous Diffusion Plant		
BL	Babcock & Wilcox-Lynchburg	RF	Rocky Flats Environmental Technology Site		
ET	Energy Technology Engineering Center	RL	Hanford Site (Richland Operations Office)		
FR	Framatome	RP	Hanford Site (Office of River Protection)		
GE	General Electric Vallecitos Nuclear Center	SA	Sandia National Laboratories		
IN	Idaho National Engineering and Environmental Laboratory	SP	Separations Process Research Unit		
IT	Inhalation Toxicology Research Institute (known as Lovelace Respiratory Research Institute)				
KA	Knolls Atomic Power Laboratory				
KN	Knolls Atomic Power Laboratory-Nuclear Fuels Services				
LA	Los Alamos National Laboratory				
LB	Lawrence Berkeley Laboratory				
LL	Lawrence Livermore National Laboratory				
MC	U.S. Army Material Command				

Figure DATA-F-1. U.S. Department of Energy TRU Waste Sites.

1 The primary purpose of TWBIR Revision 3 was to provide the summary data from TWBIR
2 Revision 2) and the supplemental information used in the PA for the development of the
3 Compliance Certification Application (CCA) (DOE 1996b) that was delivered to the
4 Environmental Protection Agency (EPA), and to support the LWA. The supplemental
5 information was generated from specific data requests to the TRU waste sites since the
6 publication of the TWBIR Revision 2. These supplemental data included: radionuclides, data
7 estimates for complexing agents, oxyanions, and cement content in solidified waste.

8 **DATA-F-1.2 Purpose and Objectives**

9 The purpose of this Transuranic Waste Inventory Update Report – 2003 (hereafter referred to as
10 the 2003 Update Report) is to document the total inventory of DOE TRU waste as defined by the
11 DOE TRU waste sites. The primary purpose of this document is to provide the summary data
12 and the supplemental information required for the PA in support of the CRA-2004 which is to be
13 delivered to the EPA for the five-year recertification as required by the LWA (Pub. L. No. 102-
14 579, 110 Stat. 2422 (1992), as amended by 104-201 (1996)). Knowing that the WIPP waste
15 inventory numbers have changed as a result of characterization activities and improved
16 estimation processes, the EPA has requested that an update to the CCA inventory be included in
17 the CRA-2004. In a letter from the EPA dated August 6, 2002 (EPA 2002), one of the items
18 requested was “Waste inventory (actual inventory to date plus revisions to the estimated
19 inventory as expressed in the Baseline Inventory Report).” This inventory update provides these
20 changes.

21 The TWBIR Revision 2 (DOE 1995b) contained the waste profiles for all waste streams reported
22 by the generator sites at that time, including some TRU waste streams that are unacceptable for
23 disposal at WIPP. The waste stream profiles resided in two appendices in TWBIR Revision 2:
24 Appendix O reported the “Non-WIPP” waste streams and Appendix P reported the “WIPP”
25 waste streams. For the 2003 Update Report, Annex I reports the Non-WIPP waste streams and
26 Annex J reports the WIPP waste streams, and Annex K reports the “emplaced waste.” Although
27 all TRU waste streams currently reported by the sites are accounted for in the current database
28 and are reported in the 2003 Update Report, the non-WIPP waste streams do not contribute to the
29 volume and scaling calculations. Hence, the non-WIPP waste streams will not contribute to
30 inventory for the CRA-2004 PA calculations.

31 The objectives of the 2003 Update Report are to:

- 32 1. Define the DOE TRU waste inventory;
- 33 2. Provide the required information and data for use in the calculations for the CRA-2004;
34 and
- 35 3. Maintain a consistent DOE complex-wide methodology for tracking TRU waste. A
36 consistent methodology in support of the CRA-2004 provides a common frame of
37 reference for discussion of TRU waste issues with regulatory organizations.

1 **DATA-F-1.3 Sources of Transuranic Waste Information**

2 The TRU waste inventory is taken from existing information about the waste, which has been
3 provided by the TRU waste sites. In addition, information obtained from site Acceptable
4 Knowledge Summary Reports has been incorporated to provide the most up to date data on
5 waste streams that are currently being shipped to WIPP. Particular focus on data collection
6 involved discussion with TRU waste sites about changes to the inventory since the certification
7 of WIPP. Sites visits and onsite interviews facilitated data collection and ensured data were
8 accurately represented. At the conclusion of data collection, each site was asked to provide
9 information concerning what had changed since the baseline data collection and why the changes
10 took place.

11 The information found in the TWBIR Revision 2 (DOE 1995b) has not been updated since the
12 publication of that document. The TWBIR Revision 3 (DOE 1996a) used the same data plus
13 other supplemental data that were needed for PA calculations. In addition, the WIPP has been
14 open and receiving waste since March 1999. Therefore, data from the emplaced waste through
15 September 30, 2002, are included in this report as obtained from the WIPP Waste Information
16 System (WWIS).

17 The changes to the inventory since 1996 were requested from and provided by the TRU waste
18 sites. Each site has verified the data that were entered into the database and has been asked to
19 explain what the changes are in their current inventory when compared to TWBIR Revision 2
20 and 3 and why the inventory changed.

21 **DATA-F-1.4 Document Organization**

22 The 2003 Update Report (Appendix DATA, Attachment F) is organized into sections of text,
23 figures, tables, and supporting annexes that are consistent with the TWBIR Revision 3 (DOE
24 1996a). The contents of remaining sections in this document are summarized below:

- 25 • Section DATA-F-2.0 presents the approach and methods used for gathering and
26 compiling the WIPP waste disposal inventory information including the quality assurance
27 program applied to the inventory project activities. A description of the TWBID
28 Revision 2.1 database, analysis methods, and records used to document data and analysis
29 results are also included in this chapter.
- 30 • Section DATA-F-3.0 presents summaries of inventory information including the waste
31 volumes, waste material parameters (WMPs), packaging materials, chemical components,
32 radiological components, discussion regarding the non-WIPP and future potential TRU
33 waste, and discussion regarding the materials used to emplace the waste in the WIPP.
- 34 • Section DATA-F-4.0 provides the references used in the preparation of this document.

35 **DATA-F-2.0 METHODS AND APPROACH**

36 This 2003 Update Report provides the information needed for the PA calculations to be
37 generated as part of the completion of the WIPP CRA-2004. The work was performed by Los
38 Alamos National Laboratory—Carlsbad Operations (LANL-CO) and Sandia National

1 Laboratories (SNL). The role of SNL was to perform the PA calculations and provide
2 documented results for the CRA-2004. The role of LANL-CO was to provide the updated
3 inventory in support of the CRA-2004 PA. The technical work performed and documentation
4 produced was under the controls provided by the SNL Quality Assurance (QA) Program
5 developed for the SNL Nuclear Waste Management Program (NWMP). Inventory personnel:

- 6 1. collected TRU waste stream information from the TRU waste sites via site visits and
7 additional communication, as needed;
- 8 2. compiled the data into a qualified electronic database;
- 9 3. performed analyses of the data in support of the CRA-2004 PA; and
- 10 4. published the results as official NWMP records acceptable for use in WIPP PA
11 calculations.

12 The process is illustrated in Figure DATA-F-2 along with the controlling aspects of the SNL QA
13 program. Figure DATA-F-2 also illustrates the governing SNL QA program procedures
14 implemented in each step of the process.

15 The sections below describe the four basic process steps leading to the issuance of this report.
16 Section DATA-F-2.1 discusses data collection, compilation and verification. Section DATA-F-
17 2.2 discusses the development of the qualified electronic database, the Transuranic Waste
18 Baseline Inventory Database Revision 2.1 [hereafter referred to as TWBID Revision 2.1] (LANL
19 2003a), that contains the TRU waste inventory data as of September 30, 2002. Section DATA-
20 F-2.3 discusses the analyses performed in support of the CRA-2004 PA, and Section DATA-F-
21 2.4 discusses the process of documentation in the SNL WIPP Records Center.

22 **DATA-F-2.1 Data Collection, Compilation and Verification**

23 The sections that follow describe the process of data collection, entry, and verification used to
24 ensure data quality was maintained throughout the TRU waste inventory process. The data
25 requirements found in Section DATA-F-2.1.1 were specifically called out by SNL to address the
26 PA data needs. The data were then collected from the TRU waste sites, entered into the TWBID
27 Revision 2.1 (LANL 2003a), and independently reviewed and verified by data entry personnel
28 and the sites themselves. The process by which data were gathered, entered, reviewed, and
29 verified is described in Sections DATA-F-2.2.2 through DATA-F-2.2.4.

30 All of the activities described in this section were governed by SNL procedure SP 9-6 Baseline
31 Inventory Report (BIR) Change Report Data Collection and Entry (SNL 2003b). A collection of
32 the documents compiled for each site is provided in Table DATA-F-1 including their respective
33 Electronic Records Management System number (ERMS #).

34 **DATA-F-2.1.1 Data Requirements**

35 The data requirements for the 2003 Update Report were called out in a series of communications
36 shown in Annexes G and H.

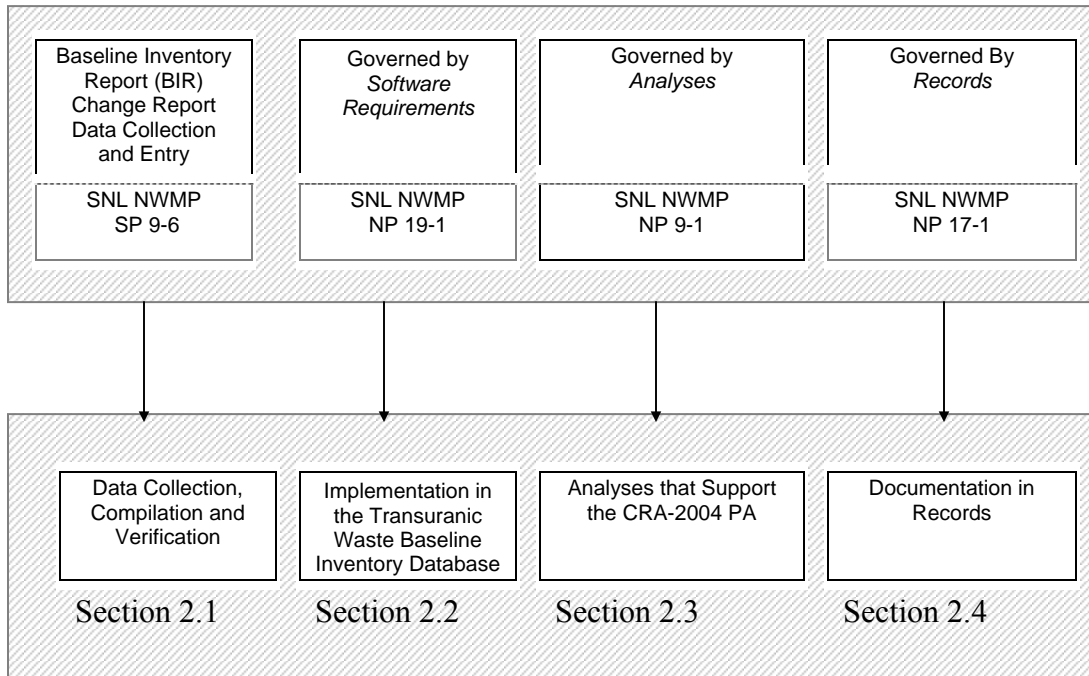


Figure DATA-F-2. Quality Methods for Generating the Transuranic Waste Inventory Update Report – 2003

Specifically, the data requirements for PA were given in Giambalvo (2002) and include the following:

- Waste stream volumes;
- Inventory of radionuclides on a waste stream basis for both CH- and RH-TRU waste and that the radionuclides reported be decayed to a common base year;
- Inventory of all non-radioactive waste material parameters that were previously tracked in the TWBIR Revision 3 (DOE 1996a). In addition, identify whether waste streams contain pyrochemical salts;
- Inventory of any other non-radioactive waste materials that are discovered to account for a significant portion of a waste stream as a result of changes to the inventory;
- Inventory of cellulosic, plastic, and rubber (CPR) materials, and other biodegradable materials used to facilitate emplacement of waste and MgO in the WIPP;
- Inventory of organic complexing agents and oxyanions (sulfate, nitrate, and phosphate; and
- Waste stream level inventories of radionuclides and non-radioactive waste material parameters for waste currently emplaced in the WIPP.

In addition to the seven data requirements listed above, the following was requested:

- 1 • A breakdown of the volume of the waste in the inventory into categories of stored,
2 projected, and anticipated.

3 ***DATA-F-2.1.2 Collection Method***

4 The EPA is mainly concerned with what has changed in the TRU waste inventory since the CCA
5 (DOE 1996b) that resulted in the certification of the WIPP. To appropriately capture these
6 changes, each TRU waste site was sent a copy of their data (in the form of waste profiles from
7 the TWBIR Revision 2 (DOE 1995b) that they had submitted in 1995 for the CCA (DOE
8 1996b). With this transmittal to the site, guidance was provided delineating what the sites
9 needed to address. The sites were requested to mark the changes on these profiles. The data
10 were provided, followed by discussions focused on clarifying questions to ensure the data were
11 correct. The data were entered into the electronic database, the TWBID Revision 2.1 (LANL
12 2003a), and qualified under SNL NP 19-1, Software Requirements (SNL 2002a). Upon
13 completion of data entry, each site was provided with a signature sheet requesting that the DOE
14 site representative responsible for TRU waste verify the data.

15 The methodology used to collect data and enter data into the TWBID Revision 2.1 (LANL
16 2003a) from DOE TRU waste sites is captured in procedure SP-9-6, Baseline Inventory Report
17 (BIR) Change Report Data Collection and Entry (SNL 2003b). The process described in this
18 procedure was initiated by a data call based on a request for modification of waste profile
19 information that was included in the TWBIR Revision 2 (DOE 1995b). This data call was
20 followed by a second data call specifically requesting data required by SNL (Giambalvo 2002).
21 During the time these data calls were issued, LANL-CO visited sites to facilitate data collection
22 and worked with the sites to assist with questions and issues as they came up.

23 ***DATA-F-2.1.3 Implementation in the Transuranic Waste Baseline Inventory Database,*** 24 ***Revision 2.1***

25 Preliminary data collected from the sites included database disks, notes from discussions with
26 waste management personnel, email correspondence, site literature, and data spreadsheets. After
27 data were gathered, they were submitted to the SNL WIPP Records Center.

28 These data were used to update the TWBID Revision 2.1 (LANL 2003a) by deletion of waste
29 streams that were no longer maintained, modification of waste streams, and addition of new
30 waste streams. Waste stream profile information was modified for sites that either had additional
31 information or had modified TWBIR Revision 2 (DOE 1995b) waste streams. When data
32 discrepancies were found or sites requested changes to data after preliminary data were entered
33 into the database, change information was collected on forms found in procedure SP-9-6,
34 Baseline Inventory Report (BIR) Change Report Data Collection and Entry (SNL 2003b). The
35 database was changed to reflect this new information, accordingly.

36 ***DATA-F-2.1.4 Validation and Verification of Data***

37 Upon completion of data entry, an independent review of all changes that were made to the
38 database was conducted. This review was documented in the database. When all changes were
39 completed, the database record was sent back to the sites for final verification and authentication

1 by the site DOE representative. The verified results were entered into the SNL WIPP Records
2 Center, as were the signed forms from each of the DOE TRU waste sites.

3 Additional records were collected from the DOE TRU waste sites after the inventory was
4 verified and authenticated by DOE site representatives. Records were received from each site
5 explaining changes that had occurred with their inventory since the baseline data collection was
6 performed in 1995. These records were also entered into the SNL WIPP Records Center.

7 **DATA-F-2.2 Transuranic Waste Baseline Inventory Database**

8 Data tables included in this report were generated by a Microsoft Access 2000 database
9 application known as the TWBID Revision 2.1 (LANL 2003a). TWBID Revision 2.1 was used
10 to manage, maintain, and perform calculations on inventory data.

11 The sections that follow describe the database and its development. Section DATA-F-2.2.1
12 describes the origins of the database. Section DATA-F-2.2.2 describes the database in general
13 terms. Section DATA-F-2.2.3 describes configuration control.

14 All of the activities described in this section were governed by the SNL QA procedure, NP 19-1
15 Software Requirements (SNL 2002a).

16 ***DATA-F-2.2.1 Origins of the Transuranic Waste Baseline Inventory Database***

17 The database used to generate TWBIR Revision 3 (DOE 1996a) (TWBIR.mdb, dated 1/29/1996)
18 was used as a baseline for TWBID Revision 2.1 (LANL 2003a). The database was originally
19 provided in Microsoft® Access 2.0 format, and was subsequently converted to Microsoft®
20 Access 2000 format. Structural changes were then made to the new version to accommodate
21 new requirements. These changes were captured in Microsoft® Visual Source Safe (see Section
22 DATA-F-2.2.3, below).

23 Development of the TWBID Revision 2.1 (LANL 2003a) was governed by the SNL QA
24 procedure, NP 19-1 Software Requirements (SNL 2002a). NP 19-1 outlines a process whereby a
25 software QA plan (the SQAP) is written for the software product. Following the SQAP, the
26 requirements for the product are defined and documented, the design of the product is created
27 and documented, the product is implemented and its implementation is documented, a plan for
28 testing the product is written, the product is tested and its verification and validation is
29 documented, and the installation of the product is documented. The product and its
30 documentation are reviewed at each step in this process by a technical, QA, and management
31 reviewer.

32 Each of these steps was completed for the TWBID Revision 2.1 (LANL 2003a). Table DATA-
33 F-3 provides references and ERMS identifiers for the QA documents for the TWBID Revision
34 2.1 (LANL 2003a).

35 ***DATA-F-2.2.2 Database Description***

36 The TWBID Revision 2.1 (LANL 2003a) consists of two main interface database files that link
37 to a third, common data file. The first interface file, TWBID.mdb, contains the interface forms

1 that data entry personnel use to browse, add, modify, or delete waste streams and related
2 information. Users must log in to this interface in order to gain access to modify the data. A
3 central file, TWBID.mdw, which contains username, password, and permission information,
4 manages authentication. The second interface file, REPORTS.mdb, contains the database
5 objects (tables, queries, reports, macros, and modules) required to generate the tables and reports
6 used within the 2003 Update Report. The third file, TWBID_Data.mdb, contains the raw data
7 used by both the TWBID.mdb and REPORTS.mdb databases. This data file is “linked” to the
8 other two by using the table-linking feature intrinsic to Microsoft® Access 2000. By utilizing
9 linked tables, a multiple-user, client-server environment was established for the TWBID
10 Revision 2.1.

11 The Microsoft® Access Database files are hosted on a Windows NT 4.0 Server, and are
12 protected by a Windows NT File System permission structure, allowing only approved database
13 users to have access to the files. In addition, there are database-level access controls established
14 using the Workgroup security function inherent in Microsoft® Access.

15 The tables in the database have no predefined relationships using primary and foreign key values
16 to automatically associate data existing in separate tables. All functionality that relates and
17 manipulates data across tables is established through table joins specified within the database
18 queries themselves.

19 ***DATA-F-2.2.3 Configuration Management***

20 The TWBID Revision 2.1 (LANL 2003a) software was placed under configuration control on
21 November 17, 2002 as version 3.01. TWBID Revision 2.1 has undergone several iterative
22 revisions and has been under strict configuration control since that date. The current version of
23 the TWBID Revision 2.1 software is 3.12 (at the point of the publication of this document).

24 In addition, the data used by the TWBID is also under strict configuration control. Versions of
25 the data were captured at designated points throughout the data entry process. At the point of
26 publication of this document, the current data version was D.4.09.

27 The tool used to maintain configuration control of the TWBID Revision 2.1 is Microsoft®
28 Visual SourceSafe Version 6.0. The Visual SourceSafe database maintains an archive of all
29 revisions to the TWBID Revision 2.1 software, and allows for easy retrieval of any revision
30 throughout the development and data entry processes. All changes to the TWBID Revision 2.1
31 database software (not the source code) were approved per procedure NP 19-1, Software
32 Requirements (SNL 2002a). A hardcopy printout of the data from the database was generated
33 for each version update and entered in the SNL WIPP Records Center.

34 ***DATA-F-2.3 Analysis Methods***

35 In addition to collecting and processing data from the TRU waste sites and securing the site data
36 in a qualified database for future use, analyses were performed on the data to support the CRA-
37 2004 PA. For example, in preparation of this report, volume data from waste streams was rolled
38 up into stored, projected, and anticipated categories; WMPs were rolled up to provide average

1 waste material densities in the repository; radionuclides were decay-corrected to the end of
2 calendar year 2001; and radionuclide activities were scaled for the full repository.

3 All of the analyses performed in support of the CRA-2004 PA were governed by SNL procedure
4 NP 9-1 Analyses (SNL 2001). NP 9-1 requires that an analysis plan governing the work is
5 written. The analysis plan governing the analysis in support of the CRA-2004 PA is AP-092,
6 Analysis Plan for Transuranic Waste Inventory Update Report, 2003 (SNL 2002b). AP-092
7 specifies that the first step in the analyses in support of the CRA-2004 PA is documentation of
8 the computational methods that will be used to perform the required analyses. Those methods
9 were documented in Transuranic Waste Inventory Update Report, 2003 Computational
10 Methodology [hereafter referred to as the Computational Methodology] (LANL 2003b).

11 The sections that follow describe the radionuclide decay calculations (Section DATA-F-2.3.1),
12 the roll-up and scaling calculations (Section DATA-F-2.3.2), and calculations of chemical
13 components in the repository (Section DATA-F-2.3.3).

14 ***DATA-F-2.3.1 Radionuclide Decay Calculations***

15 One of the data requirements for the radionuclide inventory (see Section DATA-F-2.1.1) for the
16 PA is that all radionuclides reported by waste stream in TWBID Revision 2.1 (LANL 2003a)
17 will be decayed to a common base year. However, the site-provided data consisted of
18 radionuclide activity concentrations at the date of assay for the waste stream (if the waste stream
19 was assayed) or at the date that the site calculated the activity concentrations. Therefore, the
20 radionuclide activity concentration data reported by the sites was exported from the TWBID
21 Revision 2.1 into an external application that performed the radionuclide decay calculations and
22 then imported back into the TWBID Revision 2.1 for storage.

23 The process of exporting the data from TWBID Revision 2.1 so that it can be decayed and
24 importing the decayed data back into TWBID Revision 2.2 was governed by SNL procedure NP
25 9-1 Analyses: Appendix C, Routine Calculations (SNL 2001). Documentation of that calculation
26 is provided in Unit Conversion and Data Transfer Between the TWBID Revision 2.1 Version
27 3.12 and ORIGEN2, Version 2.2 for the Transuranic Waste Inventory Update Report, 2003
28 (LANL 2003c).

29 The external application used for the radionuclide decay calculations was ORIGEN 2.2. The
30 software code, ORIGEN 2.2 (Croff 1983; Croff 1980) is an isotope generation and depletion
31 code that uses the matrix exponential solution method. The software was developed and is
32 distributed by the Radiation Safety Information Computational Center at the Oak Ridge National
33 Laboratory (ORNL).

34 The software was acquired to calculate the inventory of radionuclides decayed to the common
35 base year, December 31, 2001. Qualification of ORIGEN 2.2 in support of these analyses was
36 performed under SNL procedure, NP 19-1 Software Requirements (SNL 2002a). The steps
37 involved in qualification of software under NP 19-1 were described in Section DATA-F-2.2.1.
38 Each of the steps was completed for ORIGEN 2.2. Table DATA-F-4 gives the reader references
39 and ERMS identifiers for the QA documents for ORIGEN 2.2. While the ORIGEN 2.2 software

1 has many capabilities, the qualification of ORIGEN 2.2 (Croff 1983; Croff 1980) under the SNL
2 QA program is limited to radionuclide buildup and decay calculations.

3 ***DATA-F-2.3.2 Roll-up and Scaling Calculations***

4 The roll-up and scaling calculations performed in support of this report were performed within
5 the TWBID Revision 2.1 (LANL 2003a). As discussed in Section DATA-F-2.2.2, TWBID
6 Revision 2.1 was qualified as software under SNL procedure NP 19-1, Software Requirements.
7 That qualification included the qualification of the queries and reports designed to produce the
8 roll-up and scaled information specified in Giambalvo (2002).

9 The computational methods that apply to the roll-up and scaling calculations were defined in the
10 Computational Methodology (LANL 2003b). This document was used as the basis for drafting
11 the design documentation required for software qualification of TWBID Revision 2.1. The
12 queries that have been qualified for use in TWBID Revision 2.1 produce the data that are
13 tabulated throughout this report and documented in records submitted to the SNL WIPP Records
14 Center.

15 ***DATA-F-2.3.3 Chemical Component Calculations***

16 A final requirement set forth in Giambalvo (2002) is that this report supply information about the
17 chemical components of the waste like that supplied in support of the CCA PA in the TWBIR
18 Revision 3 (DOE 1996a). This includes a calculation of the mass of organic ligands (complexing
19 agents), the mass of oxyanions (nitrate, sulfate, and phosphate), and the mass of cement expected
20 in the disposal volume for WIPP.

21 The calculation of the mass of organic ligands, oxyanions, and cement in the disposal volume for
22 WIPP was governed by SNL procedure NP 9-1, Analyses. Each of these masses was calculated
23 by hand following the processes outlined in NP 9-1 and each is documented in reports that were
24 reviewed by three reviewers (technical, management, and QA), and then submitted to the SNL
25 WIPP Records Center. The reports are discussed briefly in Sections DATA-F-3.2.3.1, DATA-F-
26 3.2.3.2, and DATA-F-3.2.3.3. Appendix DATA, Attachment F, Annex A contains the results of
27 an analysis of the inventory for pyrochemical salts.

28 Table DATA-F-5 gives the reader ERMS identifiers for the reports on organic ligands,
29 oxyanions, and cement.

30 ***DATA-F-2.4 Records***

31 The entire process of data collection, database development, and analysis leading up to the
32 publication of this report has been documented in the SNL WIPP Records Center. The following
33 sections give the reader a roadmap for the official records that support this body of work. All
34 records have been submitted to the SNL WIPP Records Center in accordance with SNL
35 procedure NP 17-1, Records (SNL 2003a).

1 ***DATA-F-2.4.1 Records Related to Data***

2 The most extensive set of records pertaining to this body of work are the records related to the
3 data collected from the sites. These data were collected as described in Section DATA-F-2.1,
4 with the initial data call being issued to the sites by CBFO (Gist 2002). This initial data call is
5 stored in the SNL WIPP Records Center under identifiers listed in Table DATA-F-1. The site
6 responses were collected and reviewed to ensure the data were authenticated by signature and
7 date prior to submittal to the SNL WIPP Records Center with the ERMS numbers shown in
8 Table DATA-F--1.

9 A technical review of these records and a subsequent accuracy check to make sure that the data
10 had been entered correctly into the TWBID Revision 2.1 (LANL 2003a) were then performed.
11 Any modifications made at the time of this review were documented in the site data records
12 listed in Table DATA-F-1.

13 Upon completion of the technical review that determined that site data had been entered correctly
14 in the TWBID Revision 2.1, a final series of checks was performed to ascertain the completeness
15 and consistency of the data. The methods applied for the completeness and consistency checks
16 were based on a number of database queries documented in the corrections packages listed in
17 Table DATA-F-2. The corrections for completeness and consistency were made incrementally
18 in a series of three steps. Before each step, the proposed changes were reviewed. Then they
19 were implemented. Verification of the changes was printed and submitted as authenticated
20 records to the SNL WIPP Records Center as shown in Table DATA-F-1.

21 Finally when the accuracy and completeness checks on the database were complete, an electronic
22 file of the data from the TWBID Revision 2.1 was sent to the sites for final verification and
23 authentication. Their concurrence with the data in the TWBID Revision 2.1 was also submitted
24 to records.

25 ***DATA-F-2.4.2 Records Related to Software Qualification***

26 The records related to the qualification of the TWBID Revision 2.1 (LANL 2003a) are listed in
27 Table DATA-F-3. The records related to qualification of ORIGEN 2.2 are listed in Table
28 DATA-F-4.

29 ***DATA-F-2.4.3 Records Related to Analyses***

30 The records related to analyses have been discussed individually in Section 2.3 of this
31 attachment and are listed for the reader's convenience in Table DATA-F-5.

32 **DATA-F-3.0 TRANSURANIC WASTE INVENTORY**

33 This section presents the TRU waste inventory that was collected on behalf of the DOE in
34 support of CRA-2004. The data are stored in an electronic database, the TWBID Revision 2.1
35 Version 3.12 (LANL 2003a), which has been qualified for use in PA calculations as discussed in
36 Section 2 of this attachment.

Table DATA-F-1. Records Related to Data Collection and Processing for the Transuranic Waste Inventory Update Report 2003

Document	ERMS#
Initial Memorandum for Data Call-Gist 2002	525955, 525962, 526065, 526077, 526094, 526113, 526167, 526410, 526598, 526526, 526540, 526558, 526568, 526592, 526609, 526679, 526698, 526739, 526768, 526782, 526428, 526447, 525956, 526054
Data Package For Ames	525948
Data Package For ARCO	526059
Data Package For Mound	525953 and 525958
Data Package For Pantex	525937
Data Package For Teledyne Brown	525934
Data Package For MURR	526555
Data Package For AW	526407 and 528082
Data Package For BC	526424
Data Package For BT	526164 and 528084
Data Package For BL	526051
Data Package For ET	526444 and 528054
Data Package For FR	525983
Data Package For IN	526765 (CH), 526179 (RH) and 528085
Data Package For KA	526087
Data Package For KN	525960 and 526104
Data Package For LA	526504 and 528065
Data Package For LB	526523
Data Package For LL	526536
Data Package For MC	525940
Data Package For NT (Jasper)	526576
Data Package For NT	526565
Data Package For OR	526589 and 528046
Data Package For PA	526074
Data Package For RF	526779 and 528074
Data Package For RL	526736
Data Package For RP	526473
Data Package For SA/IT	526606 and 526799
Data Package For SP	526063
Data Package For SR	526680
Data Package For GE	526463
Data Package For WV	526695
Data Package For WP	528118

1

1 **Table DATA-F-2. Records Related to Computational Methods**

Document Type	ERMS #
Transuranic Waste Inventory Update Report, 2003 Computational Methodology Revision 2	527821
Data Corrections in the TWBID Revision 2.1 Database – Data Screening Package	528538
Data Corrections in the TWBID Revision 2.1 Databases – Volume Package	528542
Data Corrections in the TWBID Revision 2.1 Databases – Waste Material Parameter Package	529603 and 529596
Data Corrections in the TWBID Revision 2.1 Databases – Radionuclide Package	528543

2 **Table DATA-F-3. QA Documents for the TWBID Revision 2.1 (Records Package 526290)**

Document Type	ERMS #
Software QA Plan	526292
Requirements Document	526293
Design Document	530621
Implementation Document	530621
Verification and Validation Plan	530623
Validation Document	530623
User's Manual	530622

3 **Table DATA-F-4. QA Documents for ORIGEN2 Version 2.2 (Records Package 525783)**

Document Type	ERMS #
Access Control Memorandum	528200
Requirements Document	525785
Code Classification of ORIGEN2, Version 2.2	525790
Implementation Document	525788
Verification and Validation Plan	525786
Validation Document	525786

1 **Table DATA-F-5. Records Related to Inventory Analyses in Support of the CRA-2004 PA**
 2 **(Records Package 525272)**

Document Type	ERMS #
Analysis Plan Governing Work	525797
Documentation of Waste Material Parameter Roll-up	530767
Documentation of Radionuclide Inventory Roll-up	530992
Calculation of Organic Ligand Masses	531319
Calculation of Oxyanion Masses	530984
Calculation of Cement Masses	531562

3 This presentation of the TRU waste inventory for CRA-2004 consists of summaries of the
 4 inventory information collected from the generator sites and the information calculated from the
 5 data submitted by the sites in support of the PA calculations for CRA-2004. Section DATA-F-
 6 3.1 presents the volume information provided by the sites for CH- and RH-TRU waste and the
 7 volume roll-ups to the WIPP repository capacity needed for PA. Section DATA-F-3.2 presents
 8 the non-radiological waste inventory as reported by the sites and as needed for PA. This
 9 includes roll-ups of the waste materials (Section DATA-F-3.2.1), roll-ups of the packaging
 10 materials (Section DATA-F-3.2.2), and information about the chemical components of the waste
 11 (Section DATA-F-3.2.3). Section DATA-F-3.3 presents the radionuclide inventory reported by
 12 the sites and WIPP-level roll-ups of the radionuclide data needed for PA.

13 Section DATA-F-3.4 presents a discussion of the non-WIPP and future potential waste, and
 14 provides the total volumes of the non-WIPP wastes, with the exception of the pre-1970 buried
 15 waste. Waste profiles are provided for these waste streams in Appendix DATA, Attachment F,
 16 Annex I. Appendix DATA, Attachment F, Section DATA-F-3.5 provides data for the materials
 17 used to facilitate waste emplacement at the WIPP. The material in Appendix DATA,
 18 Attachment F, Sections DATA-F-3.4 and DATA-F-3.5 is provided for completeness but is not
 19 used to support the WIPP PA.

20 In addition to the summary information presented in this section, a complete TRU waste
 21 inventory for all waste streams at all of the sites has been prepared in support of the CRA. That
 22 inventory is presented in Appendix DATA, Attachment F, Annexes I, J, and K. Appendix
 23 DATA, Attachment F, Annex I presents individual waste stream profiles for all of the waste
 24 streams that have been designated as Non-WIPP waste streams, as discussed in Appendix
 25 DATA, Attachment F, Section DATA-F-3.4. Annex J presents individual waste stream profiles
 26 for all WIPP waste streams planned for emplacement in the WIPP. Appendix DATA,
 27 Attachment F, Annex K presents individual waste stream profiles for all WIPP waste streams
 28 that were emplaced in the WIPP as of September 30, 2002.

29 Annex B presents the comparisons of 2003 volume, WMP, and radionuclide data to TWBIR
 30 Revision 3 data. Appendix DATA, Attachment F, Annex C presents the crosswalk of waste
 31 streams between TWBIR Revision 2 and the 2003 Update Report, and explanations for these
 32 changes. Appendix DATA, Attachment F, Annex D presents the packaging materials.

1 **DATA-F-3.1 Transuranic Waste Volume Inventory**

2 The volume information requested from the sites was broken down as follows:

- 3 • stored waste – waste that currently exists at the site, regardless of whether it is in its final
- 4 form, and
- 5 • projected waste – waste that will be generated in the future.

6 Data for emplaced wastes were obtained from the WWIS. The total waste stream volume
 7 collected from the sites included stored (v_s) and projected (v_p) components as applicable for each
 8 TRU waste stream. The sites also reported both “As Generated” and “Final Form” waste
 9 volumes for their waste streams (see Glossary for definitions). This “Final Form” volume
 10 accounts for the entire waste container (the volume the waste container occupies in the
 11 repository). Since PA only considers the waste volume that will be disposed in the WIPP, only
 12 the “Final Form” volumes were used in the calculation of actual (reported by the site) and scaled
 13 (used in PA) waste volumes.

14 Table DATA-F-6 presents the CH-TRU waste anticipated inventory volumes reported by the
 15 sites. Table DATA-F-7 presents the RH-TRU waste anticipated inventory volume reported by
 16 the sites. The data presented in Tables DATA-F-6 and DATA-F-7 were derived by summing the
 17 waste-stream-level data into a site-level roll-up. For each site, all stored waste stream volumes
 18 (v_s) were summed to arrive at the total stored volume for the site, V_s . All projected waste stream
 19 volumes (v_p) were summed to arrive at the total projected volume for the site, V_p . The sum of the
 20 total stored volume and the total projected volume is the anticipated volume, V_a .

$$21 \qquad \qquad \qquad V_s + V_p = V_a, \qquad \qquad \qquad (1)$$

22 where

- 23 V_a is the total anticipated volume at the site
- 24 V_s is the total stored volume at the site
- 25 V_p is the total projected volume at the site.

26 ***DATA-F-3.1.1 Waste Isolation Pilot Plant-Level Roll-Up of Waste Inventory for*** 27 ***Performance Assessment***

28 Performance assessments conducted in support of the WIPP have been predicated on the
 29 assumption that the WIPP repository will be filled to its design capacity at the time of closure.
 30 The design capacity for WIPP is 175,564 m³ (6,200,000 ft³) (U.S. Congress 1996) with a limit of
 31 7079 m³ (250,000 ft³) for RH-TRU waste as imposed by the Consultation and Cooperation
 32 Agreement (DOE and State of New Mexico 1981). The volume of anticipated plus emplaced
 33 (CH-TRU and RH-TRU) waste reported by the sites in support of the CRA-2004 is less than and
 34 more than, respectively, the design capacity for WIPP. Therefore, scaling the CH- and RH-TRU
 35 waste volumes (up and down, respectively) to the design capacity for each in the WIPP is
 36 necessary for PA. The scaled inventory for PA is referred to as the disposal volume

Table DATA-F-6. WIPP CH-TRU Waste Anticipated Inventory By Site

TRU Waste Site	Stored Volumes (m ³)	Projected Volumes (m ³)	Anticipated Volumes (m ³)
Argonne National Laboratory - East	1.1 × 10 ²	7.9 × 10 ¹	1.9 × 10 ²
Argonne National Laboratory - West	6.0 × 10 ⁰	3.8 × 10 ¹	4.4 × 10 ¹
Battelle Columbus Laboratories	5.2 × 10 ⁰	0.0 × 10 ⁰	5.2 × 10 ⁰
Bettis Atomic Power Laboratory	1.9 × 10 ¹	0.0 × 10 ⁰	1.9 × 10 ¹
Energy Technology Engineering Center	2.3 × 10 ⁰	0.0 × 10 ⁰	2.3 × 10 ⁰
Hanford (Richland-RL)	1.3 × 10 ⁴	1.3 × 10 ⁴	2.5 × 10 ⁴
Hanford (River Protection-RP)	3.9 × 10 ³	0.0 × 10 ⁰	3.9 × 10 ³
Idaho National Engineering & Environmental Laboratory	6.1 × 10 ⁴	1.2 × 10 ²	6.1 × 10 ⁴
Knolls Atomic Power Laboratory - Nuclear Fuel Services	5.5 × 10 ¹	1.7 × 10 ²	2.3 × 10 ²
Lawrence Livermore National Laboratory	3.5 × 10 ²	2.1 × 10 ³	2.4 × 10 ³
Los Alamos National Laboratory	1.2 × 10 ⁴	3.3 × 10 ³	1.5 × 10 ⁴
Nevada Test Site	6.2 × 10 ²	4.6 × 10 ²	1.1 × 10 ³
Oak Ridge National Laboratory	0.0 × 10 ⁰	4.5 × 10 ²	4.5 × 10 ²
Paducah Gaseous Diffusion Plant	5.7 × 10 ⁰	5.7 × 10 ⁰	1.1 × 10 ¹
Rocky Flats Environmental Technology Site	5.4 × 10 ³	2.7 × 10 ³	8.1 × 10 ³
Sandia National Laboratories - Albuquerque	2.4 × 10 ¹	0.0 × 10 ⁰	2.4 × 10 ¹
Savannah River Site (SRS)	1.3 × 10 ⁴	2.4 × 10 ³	1.5 × 10 ⁴
U.S. Army Material Command	2.5 × 10 ⁰	0.0 × 10 ⁰	2.5 × 10 ⁰
University of Missouri Research Reactor	1.5 × 10 ⁰	0.0 × 10 ⁰	1.5 × 10 ⁰
Totals	1.1 × 10 ⁵	2.5 × 10 ⁴	1.3 × 10 ⁵
Emplaced Volume			
Waste Isolation Pilot Plant	7.7 × 10 ³	0.0 × 10 ⁰	7.7 × 10 ³
Grand Totals	1.2 × 10 ⁵	2.5 × 10 ⁴	1.4 × 10 ⁵

1 as described in the Glossary. The CH-TRU waste was scaled up since the anticipated volume is
2 less than the allowable capacity. The RH-TRU waste was scaled down because the anticipated
3 volume of RH-TRU waste exceeded the allowable limit. Scaling is performed only on projected
4 waste.

5 Table DATA-F-8 presents the volume scaling factors. The following sections discuss the
6 calculation of the WIPP-level roll-up for CH- and RH-TRU waste.

7 DATA-F-3.1.1.1 Calculation of Waste Isolation Pilot Plant-Level Roll-Up for Contact-
8 Handled- Transuranic Waste

9 The WIPP disposal limit for CH-TRU waste is 168,485 m³ (5,950,000 ft³). Since the total
10 reported volume of CH-TRU waste is less than the WIPP limit, the projected volume was scaled
11 so the total volume equaled the CH-TRU waste disposal limit for WIPP. The scaling

Table DATA-F-7. WIPP RH-TRU Waste Anticipated Inventory By Site

TRU Waste Site	Stored Volumes (m ³)	Projected Volumes (m ³)	Anticipated Volumes (m ³)
Argonne National Laboratory – East	1.5×10^1	1.0×10^2	1.2×10^2
Argonne National Laboratory - West	2.4×10^1	6.9×10^1	9.3×10^1
Battelle Columbus Laboratories	4.4×10^1	1.8×10^0	4.6×10^1
Bettis Atomic Power Laboratory	2.0×10^0	0.0×10^0	2.0×10^0
Energy Technology Engineering Center	5.0×10^0	0.0×10^0	5.0×10^0
Hanford (Richland-RL)	3.8×10^2	9.4×10^3	9.8×10^3
Hanford (River Protection-RP)	4.5×10^3	0.0×10^0	4.5×10^3
Idaho National Engineering & Environmental Laboratory	2.2×10^2	0.0×10^0	2.2×10^2
Knolls Atomic Power Laboratory - Schenectady	0.0×10^0	1.4×10^2	1.4×10^2
Los Alamos National Laboratory	1.2×10^2	0.0×10^0	1.2×10^2
Oak Ridge National Laboratory	0.0×10^0	6.6×10^2	6.6×10^2
Sandia National Laboratories - Albuquerque	4.6×10^0	0.0×10^0	4.6×10^0
Savannah River Site	0.0×10^0	2.3×10^1	2.3×10^1
Totals	5.3×10^3	1.0×10^4	1.6×10^4

1 factor for CH-TRU waste was calculated using the following equation applied to WIPP waste
2 streams .

3 The CH-TRU waste volume scaling factor was calculated as follows:

$$4 \quad SF_{CH} = (CH\text{-TRU Design Capacity in m}^3 - V_s - V_e) / V_p, \quad (2)$$

5 where

6 SF_{CH} is the scaling factor for the CH-TRU waste volume

7 V_s is the total stored volume over all waste streams and all sites for CH-TRU waste

8 V_p is the total projected volume over all waste streams and all sites for CH-TRU
9 waste

10 V_e is the total emplaced volume for CH-TRU waste over all waste streams and all
11 sites as of September 30, 2002.

12 The disposal inventory for a single CH-TRU waste stream was obtained by multiplying the CH-
13 TRU waste projected volume by the appropriate scaling factor and adding that value to the stored
14 and emplaced volumes for each waste stream.

$$15 \quad V_{CH\text{-Disposal}} = SF_{CH} (V_p) + v_s + v_e, \quad (3)$$

16 where

- 1 $V_{\text{CH-Disposal}}$ is the disposal volume for CH-TRU waste for a single waste stream
- 2 SF_{CH} is the scaling factor for the CH-TRU waste volume
- 3 V_p is the projected inventory volume for a single CH-TRU waste stream before
- 4 scaling
- 5 V_s is the stored inventory volume for a single CH-TRU waste stream before
- 6 scaling
- 7 V_e is the emplaced inventory volume for a CH-TRU single waste stream before
- 8 scaling.

9 Table DATA-F-8 shows the calculation for the CH-TRU waste scaling factor and the CH-TRU
 10 waste volumes. The total CH-TRU waste disposal inventory, $V_{\text{CH-Disposal}}$, is the sum of the scaled
 11 CH-TRU waste stream volumes. The scaled waste stream volumes for the CH-TRU waste
 12 streams included in the estimate of volume for PA are given in Appendix DATA, Attachment F,
 13 Annex E, Table DATA-F-E-1. All volume and scaling calculated results were derived from the
 14 data and information that were reported in the updated TWBID Revision 2.1 (LANL 2003a) for
 15 each CH-TRU waste stream. The volume rollups and scaling calculations were performed under
 16 the SNL QA program as described in the Computational Methodology (LANL 2003b).

17 DATA-F-3.1.1.2 Calculation of Waste Isolation Pilot Plant-level Roll-up for Remote-Handled
 18 Transuranic Waste

19 The WIPP disposal limit for RH-TRU waste is 7,079 m³ (250,000 ft³) (U.S. DOE and State of
 20 New Mexico 1981). The reported volume of stored RH-TRU waste is less than the disposal limit
 21 but the sum of the stored and projected volumes is greater than the disposal limit. Since the total
 22 reported volume of RH-TRU waste is greater than the WIPP limit, the projected volume was
 23 scaled down so the total volume for PA equaled the RH-TRU waste disposal limit for WIPP.
 24 The scaling factor for RH-TRU waste was obtained after RH-TRU waste streams designated as
 25 Non-WIPP waste streams were removed for WIPP waste streams.

26 The scaling factor for RH-TRU waste was calculated using the following equation:

$$27 \quad SF_{\text{RH}} = (\text{RH-TRU Design Capacity in m}^3 - V_s - V_e) / V_p, \quad (4)$$

28 where

- 29 SF_{RH} is the scaling factor for the RH-TRU waste volume
- 30 V_s is the total stored volume over all waste streams and all sites for RH-TRU
- 31 waste
- 32 V_e is the total emplaced volume over all waste streams and all sites for RH-TRU
- 33 waste
- 34 V_p is the total projected volume over all waste streams and all sites for RH waste.

35 There is currently no RH-TRU waste emplaced in the WIPP, so the total RH-TRU waste
 36 emplaced volume, V_e , is zero.

37 The disposal inventory for a single RH-TRU waste stream was then obtained by multiplying the
 38 RH-TRU waste projected volume by the appropriate scaling factor and adding that value to the
 39 stored and emplaced volumes for each waste stream.

$$V_{\text{RH-Disposal}} = SF_{\text{RH}} (v_p) + v_s + v_e, \quad (5)$$

2 where

3 $V_{\text{RH-Disposal}}$ is the disposal volume for RH-TRU waste for a single waste stream
 4 SF_{RH} is the scaling factor for the RH-TRU waste volume
 5 v_s is the stored inventory volume for a single RH-TRU waste stream before
 6 scaling
 7 v_e is the emplaced inventory volume for a single RH-TRU waste stream before
 8 scaling
 9 v_p is the projected inventory volume for a single RH-TRU waste stream before
 10 scaling

11 Table DATA-F-8 shows the calculation for the RH-TRU waste scaling factor and the RH-TRU
 12 waste volumes. The total RH-TRU waste disposal inventory, $V_{\text{RH-Disposal}}$, is the sum of the scaled
 13 RH-TRU waste stream inventories. The scaled waste stream volumes for the RH-TRU waste
 14 streams included in the estimate of volume for PA is given in Appendix DATA, Attachment F,
 15 Annex E, Table DATA-F-E-2. All volume and scaling calculated results were derived from the
 16 data and information that were reported in the updated TWBID Revision 2.1 (LANL 2003a) for
 17 each RH-TRU waste stream. The volume rollups and scaling calculations were performed under
 18 the SNL QA program as described in the Computational Methodology (LANL 2003b).

19 The total disposal inventory for the WIPP repository is the sum of the disposal volumes for CH-
 20 and RH-TRU wastes for all waste streams after scaling ($V_{\text{CH-Disposal}}$ and $V_{\text{RH-Disposal}}$).

21 **DATA-F-3.2 Non-Radiological Transuranic Waste Inventory**

22 This section presents the non-radiological TRU waste inventory that was collected on behalf of
 23 the DOE in support of the CRA. Section DATA-F-3.2.1 presents the inventory of waste
 24 materials. Section DATA-F-3.2.2 presents the inventory of packaging materials, and DATA-F-
 25 3.2.3 presents the inventory of chemical components.

26 The DOE has many reasons for obtaining and tracking non-radiological information about the
 27 TRU waste inventory destined for WIPP. For example, the DOE tracks the waste materials that
 28 go into the repository (i.e., CPR materials) because they may affect gas generation in the
 29 repository. As another example, the DOE tracks the chemical components of the waste going
 30 into the repository because they affect the solubility of actinides in the waste. The DOE needs to
 31 know the non-radiological properties of the waste not only for PA but also to support safe and
 32 economical transportation of the waste and operation of the facility.

1

Table DATA-F-8. Volume Scaling Factors

CH-WASTE	
WIPP capacity for waste	$1.68 \times 10^5 \text{ m}^3$
Total stored volume	$1.09 \times 10^5 \text{ m}^3$
Total projected volume	$2.48 \times 10^4 \text{ m}^3$
Total emplaced volume	$7.72 \times 10^3 \text{ m}^3$
Volume scaling factor (SF_{CH})	2.11×10^0
Note: $\frac{(1.68 \times 10^5) - ((1.09 \times 10^5) + (7.72 \times 10^3))}{(2.48 \times 10^4)} = 2.11 \times 10^0$	
RH-WASTE	
WIPP capacity for waste	$7.08 \times 10^3 \text{ m}^3$
Total stored volume	$5.29 \times 10^3 \text{ m}^3$
Total projected volume	$1.04 \times 10^4 \text{ m}^3$
Total emplaced volume	$0.00 \times 10^0 \text{ m}^3$
Volume scaling factor (SF_{RH})	1.72×10^{-1}
Note: $\frac{(7.08 \times 10^3) - ((5.29 \times 10^3) + (0.00 \times 10^0))}{(1.04 \times 10^4)} = 1.72 \times 10^{-1}$	

2 The DOE has established a system of tracking the non-radiological waste inventory destined for
 3 WIPP. It involves a description of the waste streams in terms of their waste matrix codes
 4 (WMCs), their WMPs, and their final waste forms.

5 The WMPs, final waste forms, and WMCs are defined in the Glossary, and were previously
 6 described in the TWBIR Revision 2 (DOE 1995b). The final waste forms and WMCs are also
 7 described in detail in the DOE Waste Treatability Group Guidance (DOE 1995c).

8 The following WMP descriptions were excerpted from the TWBIR Revision 2 and are operative
 9 in this document:

- 10 • Iron-base metal/alloys – This designation is meant to include iron and steel alloys in the
 11 waste and does not include the waste container materials. This also includes an iron-base
 12 metallic phase associated with any vitrification process, if applicable;
- 13 • Aluminum-base metal/alloys – Aluminum or aluminum-base alloys in the waste
 14 materials;
- 15 • Other metal/alloys – All other metals found in the waste materials (e.g., copper, lead,
 16 zirconium, tantalum, etc.). The lead portion of lead rubber gloves/aprons is also included
 17 in this category;
- 18 • Other inorganic material – Includes inorganic non-metal waste materials such as
 19 concrete, glass, firebrick, ceramics, graphite, sand, and inorganic sorbents;

- 1 • Vitrified material – This refers to waste that has been melted or fused at high
2 temperatures with glass forming additives such as soil or silica in appropriate proportions
3 to result in a homogeneous glass-like matrix. (Note that any unoxidized metallic phases,
4 if present, are included in the iron-base metal/alloys waste material parameter.);
- 5 • Cellulosic material – Includes those materials generally derived from high polymer plant
6 carbohydrates. Examples are paper, cardboard, kimwipes, wood, cellophane, cloth, etc;
- 7 • Rubber material – Includes natural or manmade elastic latex materials. Examples are
8 Hypalon®, neoprene, surgeons’ gloves, leaded-rubber gloves (rubber part only), etc;
- 9 • Plastic material – Includes generally manmade materials, often derived from petroleum
10 feedstock. Examples are polyethylene, polyvinylchloride, Lucite®, Teflon®, etc;
- 11 • Solidified inorganic material – Includes any homogeneous materials consisting of sludge
12 or aqueous-base liquids that are solidified with cement, Envirostone®, or other
13 solidification agents. Examples are wastewater treatment sludge, cemented aqueous
14 liquids, and inorganic particulates, etc. If a TRU waste site has not reported cement used
15 as part of the solidification process in the cement (solidified) waste material parameter,
16 the density of the cement is included in this field;
- 17 • Solidified organic material – Includes cemented organic resins, solidified organic liquids,
18 and sludges;
- 19 • Cement (solidified) – Includes the cement used in solidifying liquids, particulates, and
20 sludges. If for a solidified final waste form this field is left blank, it means that either
21 cement is not the solidifying agent or that the cement is included in the solidified
22 inorganic material waste material parameter, and
- 23 • Soil – Generally consists of naturally occurring soils that have been contaminated with
24 inorganic radioactive waste materials.

25 Packaging material parameters are described in further detail in Section DATA-F-3.2.2 and in
26 Annex D. Packaging material parameters were reported from the material parameter
27 descriptions described in the TWBIR Revision 2. These parameters were determined by weights
28 defined as follows:

- 29 • Steel – The weight of the steel part of the packaging from container information provided
30 by the TRU waste generator/storage sites. Any necessary overpacking is included in the
31 weight;
- 32 • Plastic – The weight of any plastic packaging submitted by the TRU waste sites. When
33 weight of a rigid liner is not given, a 90-mil high density polyethylene (HDPE) liner is
34 assumed; and
- 35 • Lead – The weight of the lead shielding in a RH-TRU canister is assumed if not provided
36 by the TRU waste generator/storage sites.

1 Final waste form refers to the expected physical and chemical form of that waste stream after it
2 is ready for disposal (i.e., once the waste has been processed, treated, or repackaged as
3 necessary). Each final waste form consists of one or more WMCs that are grouped together.
4 The WMCs associated with each of the final waste forms listed below are included in the
5 TWBIR Revision 3 (DOE 1996a, Table 1-2). The purpose of the final waste form is to group
6 waste streams that are expected to have similar physical and chemical properties at the time of
7 disposal. A final waste form was assigned to all reported WIPP waste streams by each of the
8 sites. The final waste forms are:

- 9 • Solidified inorganic material,
- 10 • Salt,
- 11 • Solidified organic material,
- 12 • Soil,
- 13 • Uncategorized metal (metal waste other than lead and/or cadmium) ,
- 14 • Lead/cadmium metal,
- 15 • Inorganic non-metal,
- 16 • Combustible material,
- 17 • Graphite,
- 18 • Heterogeneous debris,
- 19 • Filter material,
- 20 • Excluded waste streams (excluded from disposal at WIPP), and
- 21 • Unknown (excluded from disposal at WIPP).

22 The purpose of the WMCs is to aid in categorizing mixed waste streams into groups based on
23 their different physical and chemical characteristics. The sites assign the WMCs for all of their
24 mixed waste streams and generally assign them for their non-mixed waste streams, as well. The
25 WMC system description and terminology used by the sites and the DOE is detailed in the DOE
26 Waste Treatability Group Guidance. The WMCs are numerous, and are therefore not all listed
27 here. However, the summary category groups (referred to as matrix parameter categories in the
28 DOE Waste Treatability Group Guidance) are debris (S5000), homogeneous solids (S3000), and
29 soil/gravel (S4000).

30 There are several WMCs in each of these summary category groups. For example, within the
31 debris (S5000) summary category group, there are inorganic debris (S5100), organic debris
32 (S5300), heterogeneous debris (S5400), and unknown/other debris (S5900). Within the
33 inorganic debris group (S5100), there are metal debris (S5110), inorganic nonmetal debris

1 (S5120), and unknown/other inorganic debris (S5190). Within the metal debris (S5110) group,
2 there are metal debris without lead or cadmium (S5111) and so on. These are detailed in the
3 DOE Waste Treatability Group Guidance document.

4 ***DATA-F-3.2.1 Waste Materials***

5 As part of the data call for this 2003 Update Report, the sites were asked to provide information
6 about the materials contained in the waste. For each waste stream they were asked to designate a
7 final waste form and to provide the density of each of the WMPs in the waste stream. The sites
8 were asked to provide minimum, maximum, and average values for the WMPs in each waste
9 stream. In some cases the sites provided all of the information required; in other cases, they did
10 not.

11 For those waste streams where the site did not provide information regarding WMPs, the WMPs
12 were estimated using the methods described in the Computational Methodology (LANL 2003b)
13 and in the WMP corrections packages as identified in Table DATA-F-2. In summary, when
14 partial information was provided (i.e., the minimum value or maximum value but not the
15 average), it was used to calculate the average WMPs density (which was needed for PA). When
16 no WMPs density information was given for a waste stream, the average density was inferred by
17 identifying an analogous waste stream, and mapping the WMP from that waste stream into the
18 waste stream that lacked WMPs.

19 For example, when information for a waste stream at a site was missing, the other waste streams
20 from that site were reviewed to identify waste streams with similar final waste forms, WMCs,
21 and waste stream descriptions. If a similar waste stream was identified, the WMPs from that
22 waste stream (source) were attributed to the waste stream that lacked WMPs (destination waste
23 stream). If there were no similar waste streams reported by that site, the other sites were
24 examined to identify an appropriate similar waste regardless of its site of origin. Then the
25 WMPs from the similar waste stream were copied (source to destination waste stream). In both
26 cases, the packaging material parameters were edited using the waste packaging densities
27 discussed in Section DATA-F-3.2.2 as appropriate for the type of container(s) in the destination
28 waste stream.

29 In some cases, more than one similar waste stream was identified. In these instances, an average
30 of the WMPs from similar streams was calculated and used. It was not necessary to calculate an
31 average set of WMPs based on final waste form, as discussed in the Computational Methodology
32 (LANL 2003b).

33 Waste streams were sometimes comprised of more than one container type (for example, 55-
34 gallon drums and standard waste boxes (SWBs)). In these instances, when the site provided only
35 one set of WMPs, those WMPs were used for both container types; except for the packaging
36 material parameters which were corrected for the container type using the waste packaging
37 densities given in Section DATA-F-3.2.2. The TWBID Revision 2.1 contains the WMPs list for
38 every container type in a waste stream. However, the waste profiles in Annexes I and J (non-
39 WIPP and WIPP waste streams, respectively) have a weighted average of the WMPs for all
40 container types used in a waste stream. If the site provided a WMPs list for each container type,

1 those lists were maintained in the TWBID Revision 2.1 and a weighted average of the WMPs for
 2 all container types was used in the waste profiles.

3 In some cases, the sites provided incomplete WMP data from which the needed data could be
 4 inferred. Specifically, the WMP average densities were inferred from minimum and maximum
 5 WMP data. However, the minimum and maximum values will not be used for CRA PA and
 6 therefore were not reported. There are three cases in which WMP data were inferred. If
 7 maximum and minimum WMP values were reported, but no average density was reported, the
 8 average density was calculated as one half the sum of the maximum and minimum WMPs. If
 9 only a minimum WMP was reported, the minimum was assigned as the average density. If only
 10 a maximum WMP was reported, the average was calculated as one half the maximum WMP
 11 value, and assumed that the minimum was zero.

12 DATA-F-3.2.1.1 Roll-Up of Final Waste Form Volumes

13 Table DATA-F-9 presents a roll-up of the final waste form volumes for CH- and RH-TRU
 14 waste. Every WIPP waste stream in the TWBID Revision 2.1 (LANL 2003a) has been assigned
 15 a final waste form. The total volume for each of the final waste form categories is calculated by
 16 summing the actual (not scaled) waste stream volume components (emplaced, stored, and
 17 projected) with the same final waste form designation for all waste streams destined for WIPP.

18 DATA-F-3.2.1.2 Waste Material Parameter average Densities for Each Final Waste Form

19 Tables DATA-F-10 through DATA-F-29 present the WMP average densities for each final waste
 20 form in CH- and RH-TRU waste. Tables DATA-F-10 through DATA-F-20 are for CH-TRU
 21 waste. Tables DATA-F-21 through DATA-F-29 are for RH-TRU waste. These tables include
 22 the rolled up WMP average densities for each final waste form and the rolled up waste volumes
 23 by site that contributed to the total final waste form volume. These volumes are broken out into
 24 stored and projected volumes, and the total volume of waste by site for each final waste form.
 25 The emplaced volume is given by site, with the WIPP being the only applicable site. The final
 26 waste forms that have an emplaced waste CH-TRU waste volume are combustible, filter,
 27 heterogeneous, inorganic non-metal, lead/cadmium metal, salt, solidified inorganics, and
 28 uncategorized metal. There is no RH-TRU waste emplaced at this time.

29 For example, Table DATA-F-10 presents the WMP average densities for all CH-TRU waste
 30 streams with the combustible final waste form designation. The table shows roll-ups for stored,
 31 projected, and emplaced CH-TRU waste with the combustible final waste form designation for
 32 each site. This information is derived by summing the component volumes for each CH-TRU
 33 waste stream in the combustible category at each site.

34 Calculation of the WMP average densities in a final waste form requires combining data from
 35 the individual waste streams with the same final waste form designation as follows:

$$\begin{aligned}
 36 \quad & WMP_{m_i^j} = WMP_{p_i^j} \times v_i^j \\
 37 \quad & WMP_{M^j} = \sum WMP_{m_i^j} \\
 38 \quad & WMP_{p_i^j} = WMP_{M^j} / V^j,
 \end{aligned} \tag{6}$$

1 where

- 2 $^{WM}m_i^j$ is the mass of the waste material (WM) in waste stream i with a final waste
- 3 form designation j
- 4 $^{WM}p_i^j$ is the average density of the WM in waste stream i with a final form
- 5 designation j
- 6 v_i^j is the volume of waste stream i (stored + projected + emplaced) with a final
- 7 form designation of j
- 8 $^{WM}M^j$ is the total mass of WM in all waste streams with a final form designation of j
- 9 V^j is the total volume of all waste streams with a final form designation of j
- 10 $^{WM}P^j$ is the average density of the WM in all waste streams the final form
- 11 designation j.

12 Portions of some waste streams have been shipped to the WIPP and emplaced and others have
 13 yet to be characterized and shipped. If there was no emplaced waste for a waste stream as of the
 14 inventory date, then the emplaced volume in the equation above for that waste stream was zero.
 15 If there was no emplaced waste for any of the waste streams within the final waste forms
 16 considered, the total emplaced volume for the final waste form was also zero.

17 There are several notable differences in the WMP average densities for the roll-ups by final
 18 waste form when compared to the TWBIR Revision 3 (DOE 1996a). These changes are
 19 tabulated and discussed in Appendix DATA, Attachment F, and Annex B.2.

20 DATA-F-3.2.1.3 Waste Isolation Pilot Plant-Scale Waste Material Parameter Densities

21 Performance assessments conducted in support of the WIPP have been predicated on the
 22 assumption that waste materials are distributed homogeneously throughout the repository. As a
 23 result, a WIPP-scale average value for waste material densities is needed for PA. The WIPP-
 24 scale WMP average densities for CH- and RH-TRU wastes in support of the CRA are presented
 25 in Tables DATA-A-30 and DATA-F-31, respectively. These are equivalent to TWBIR Revision
 26 3 (DOE 1996a) Tables 2-2 and 2-3, respectively. Note also that the TWBIR Revision 3 Tables
 27 2-2 and 2-3 are the same as TWBIR Revision 2 (DOE 1995b, Tables 3-2 and 3-3, respectively).
 28 Although these tables in TWBIR Revisions 2 and 3 contain the minimum, maximum, and
 29 average densities for the WMP, this report contains only the average densities of the waste
 30 because only average values are used in PA.

31 WMPs were combined, or “rolled up,” for the whole repository according to the Computational
 32 Methodology (LANL 2003b). Specifically, the roll-up of WMP average densities required
 33 combining data from all of the WIPP waste streams reported by the sites. A weighted average
 34 value for the WMP based on the individual waste stream volumes in the total inventory was
 35 calculated from the WMP average densities provided by the sites as shown below:

$$\begin{aligned}
 36 \quad & ^{WM}m_i = ^{WM}p_i \times v_i \\
 37 \quad & ^{WM}M = \sum ^{WM}m_i \qquad (7) \\
 38 \quad & ^{WM}P = ^{WM}M / V,
 \end{aligned}$$

1 where

- 2 m_i^{WM} is the mass of the WM in waste stream i
 3 ρ_i^{WM} is the average density of the WM in waste stream i
 4 v_i is the actual (not-scaled) volume of waste stream i (stored + projected +
 5 emplaced)
 6 M^{WM} is the total mass of WM in all waste streams
 7 V is the actual (not-scaled) volume of all waste streams
 8 P^{WM} is the average density of the WM in all waste streams.

9 DATA-F-3.2.1.4 Additional Information Received After Transuranic Waste Baseline Inventory
 10 Database, Revision 2.1, Version 3.12, Data Version 4.09

11 After the TWBID, Revision 2.1 was configured for PA calculations, a typographical error was
 12 discovered in six of LANL's waste streams. The final form of these waste streams was listed as
 13 "solidified organic material" but should have been "solidified inorganic material" to match the
 14 waste matrix code. Therefore, the solidified organic material reported in Table DATA-F-9 and
 15 the volume identified for LANL in Table DATA-F-19 would decrease by 3,827 m³. The
 16 solidified inorganic material reported in Table DATA-F-9 and the volume identified for LANL
 17 in Table DATA-F-18 would increase by 3,827 m³. Volumes will also be affected in Tables
 18 DATA-F-B-12 and DATA-F-B-13 as well as the analyses for solidified inorganic material and
 19 solidified organic material in Appendix DATA, Attachment F, Annex B, Section DATA-F-B-
 20 1.4.

1 **Table DATA-F-9. Transuranic Waste Inventory By Final Waste Form For WIPP**

Final Waste Forms	Stored Waste	Projected Waste	Emplaced Waste	Total Waste
Contact Handled Waste Volumes (m³)				
Combustible Material	4.3×10^3	1.9×10^3	6.1×10^2	6.8×10^3
Filter Material	9.9×10^2	5.9×10^2	3.4×10^2	1.9×10^3
Graphite	1.2×10^2	1.3×10^0	0.0×10^0	1.3×10^2
Heterogeneous Debris	4.9×10^4	9.7×10^3	5.7×10^2	5.9×10^4
Inorganic Non-Metal	1.1×10^4	6.8×10^1	9.7×10^2	1.2×10^4
Lead/Cadmium Metal	1.4×10^2	3.2×10^1	8.1×10^1	2.6×10^2
Salt	1.5×10^2	1.9×10^2	1.5×10^3	1.8×10^3
Soil	3.0×10^2	6.0×10^3	0.0×10^0	6.3×10^3
Solidified Inorganic Material ¹	3.5×10^4	7.3×10^2	3.3×10^3	3.9×10^4
Solidified Organic Material ¹	5.2×10^3	3.8×10^2	0.0×10^0	5.5×10^3
Uncategorized Metal	2.4×10^3	5.1×10^3	3.6×10^2	7.9×10^3
Total CH-TRU Waste Volumes	1.1×10^5	2.5×10^4	7.7×10^3	1.4×10^5
Remote-Handled Waste Volumes (m³)				
Combustible Material	1.8×10^1	8.9×10^{-1}	0.0×10^0	1.9×10^1
Filter Material	8.9×10^0	8.9×10^0	0.0×10^0	1.8×10^1
Heterogeneous Debris	6.1×10^2	3.8×10^3	0.0×10^0	4.4×10^3
Inorganic Non-Metal	4.3×10^1	4.4×10^1	0.0×10^0	8.6×10^1
Lead/Cadmium Metal	1.2×10^1	7.1×10^0	0.0×10^0	1.9×10^1
Soil	0.0×10^0	2.0×10^2	0.0×10^0	2.0×10^2
Solidified Inorganic Material	4.5×10^3	3.3×10^2	0.0×10^0	4.8×10^3
Solidified Organic Material	9.5×10^0	0.0×10^0	0.0×10^0	9.5×10^0
Uncategorized Metal	8.4×10^1	6.1×10^3	0.0×10^0	6.1×10^3
Total RH-TRU Waste Volumes	5.3×10^3	1.0×10^4	0.0×10^0	1.6×10^4
Total TRU Waste Volumes (m³)	1.1×10^5	3.5×10^4	7.7×10^3	1.6×10^5

Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

¹See Section DATA-F-3.2.1.4 for additional information.

2

1 **Table DATA-F-10. WIPP CH-TRU Waste Profiles – Combustible Material**

Final Waste Form: Combustible Material			
TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Argonne National Laboratory – East	9.0×10^1	6.6×10^1	1.6×10^2
Argonne National Laboratory - West	5.4×10^0	4.4×10^0	9.8×10^0
Battelle Columbus Laboratories	5.2×10^0	0.0×10^0	5.2×10^0
Hanford (Richland-RL)	9.8×10^1	0.0×10^0	9.8×10^1
Los Alamos National Laboratory	2.9×10^3	1.4×10^3	4.3×10^3
Rocky Flats Environmental Technology Site	1.2×10^3	4.5×10^2	1.6×10^3
TRU Waste Site Total	4.3×10^3	1.9×10^3	6.2×10^3
Emplaced Waste Volumes (m³)			
Site	Stored	Projected	Total
Waste Isolation Pilot Plant	6.1×10^2	0.0×10^0	6.1×10^2
Emplaced Waste Total	6.1×10^2	0.0×10^0	6.1×10^2
Total Waste Volume (m³)			
	4.9×10^3	1.9×10^3	6.8×10^3
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		1.5×10^1	
Aluminum-Base Metal/Alloys		8.4×10^{-1}	
Other Metal/Alloys		7.9×10^0	
Other Inorganic Material		1.0×10^1	
Cellulosic Material		2.0×10^1	
Rubber Material		1.3×10^1	
Plastic Material		4.9×10^1	
Solidified Inorganic Material		9.4×10^{-1}	
Cement (Solidified)		4.8×10^{-2}	
Vitrified Material		0.0×10^0	
Solidified Organic Material		1.2×10^1	
Soil		8.8×10^{-1}	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-11. WIPP Contact-Handled Waste Profiles – Filter Material**

Final Waste Form:	Filter Material		
TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Hanford (Richland-RL)	2.2×10^1	0.0×10^0	2.2×10^1
Lawrence Livermore National Laboratory	1.9×10^2	4.5×10^2	6.4×10^2
Los Alamos National Laboratory	3.3×10^2	0.0×10^0	3.3×10^2
Rocky Flats Environmental Technology Site	4.5×10^2	1.4×10^2	5.8×10^2
TRU Waste Site Total	9.9×10^2	5.9×10^2	1.6×10^3
Emplaced Waste volumes (m³)			
Site	Stored	Projected	Total
Waste Isolation Pilot Plant	3.4×10^2	0.0×10^0	3.4×10^2
Emplaced Waste Total	3.4×10^2	0.0×10^0	3.4×10^2
Total Waste Volume (m³)			
Total Waste Volume (m ³)	1.3×10^3	5.9×10^2	1.9×10^3
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		4.5×10^1	
Aluminum-Base Metal/Alloys		1.8×10^1	
Other Metal/Alloys		5.7×10^0	
Other Inorganic Material		1.6×10^1	
Cellulosic Material		4.6×10^1	
Rubber Material		6.2×10^0	
Plastic Material		1.6×10^1	
Solidified Inorganic Material		6.0×10^{-1}	
Cement (Solidified)		0.0×10^0	
Vitrified Material		0.0×10^0	
Solidified Organic Material		3.5×10^{-1}	
Soil		4.8×10^0	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

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Table DATA-F-12. WIPP CH-TRU Waste Profiles – Graphite

Final Waste Form: Graphite

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Rocky Flats Environmental Technology Site	1.2×10^2	1.3×10^0	1.3×10^2
TRU Waste Site Total	1.2×10^2	1.3×10^0	1.3×10^2
Total Waste Volume (m³)			
	1.2×10^2	1.3×10^0	1.3×10^2
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		1.9×10^1	
Aluminum-Base Metal/Alloys		0.0×10^0	
Other Metal/Alloys		0.0×10^0	
Other Inorganic Material		1.7×10^2	
Cellulosic Material		8.6×10^1	
Rubber Material		0.0×10^0	
Plastic Material		2.3×10^1	
Solidified Inorganic Material		7.1×10^0	
Cement (Solidified)		0.0×10^0	
Vitriified Material		0.0×10^0	
Solidified Organic Material		0.0×10^0	
Soil		0.0×10^0	

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Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-13. WIPP CH-TRU Waste Profiles – Heterogeneous Debris**

Final Waste Form: Heterogeneous Debris			
TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Argonne National Laboratory - West	6.2×10^{-1}	3.4×10^1	3.4×10^1
Bettis Atomic Power Laboratory	1.9×10^1	0.0×10^0	1.9×10^1
Energy Technology Engineering Center	1.5×10^0	0.0×10^0	1.5×10^0
Hanford (Richland-RL)	1.2×10^4	2.1×10^3	1.4×10^4
Idaho National Engineering & Environmental Laboratory	2.0×10^4	2.3×10^1	2.0×10^4
Knolls Atomic Power Laboratory - Nuclear Fuel Services	5.5×10^1	1.7×10^2	2.3×10^2
Lawrence Livermore National Laboratory	1.3×10^2	1.4×10^3	1.6×10^3
Los Alamos National Laboratory	2.1×10^3	1.4×10^3	3.5×10^3
Nevada Test Site	6.1×10^2	4.6×10^2	1.1×10^3
Oak Ridge National Laboratory	0.0×10^0	4.5×10^2	4.5×10^2
Rocky Flats Environmental Technology Site	1.0×10^3	1.2×10^3	2.2×10^3
Sandia National Laboratories - Albuquerque	2.4×10^1	0.0×10^0	2.4×10^1
Savannah River Site	1.3×10^4	2.4×10^3	1.5×10^4
U.S. Army Material Command	2.5×10^0	0.0×10^0	2.5×10^0
University of Missouri Research Reactor	1.5×10^0	0.0×10^0	1.5×10^0
TRU Waste Site Total	4.9×10^4	9.7×10^3	5.9×10^4
Emplaced Waste Volumes (m³)			
Site	Stored	Projected	Total
Waste Isolation Pilot Plant	5.7×10^2	0.0×10^0	5.7×10^2
Emplaced Waste Total	5.7×10^2	0.0×10^0	5.7×10^2
Total Waste Volume (m³)	4.9×10^4	9.7×10^3	5.9×10^4
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		2.4×10^2	
Aluminum-Base Metal/Alloys		3.3×10^1	
Other Metal/Alloys		5.7×10^1	
Other Inorganic Material		5.6×10^1	
Cellulosic Material		1.2×10^2	
Rubber Material		3.2×10^1	
Plastic Material		9.0×10^1	
Solidified Inorganic Material		3.6×10^0	
Cement (Solidified)		0.0×10^0	
Vitrified Material		0.0×10^0	
Solidified Organic Material		1.8×10^0	
Soil		4.2×10^0	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-14. WIPP CH-TRU Waste Profiles – Inorganic Non-Metal**

Final Waste Form: Inorganic Non-Metal			
TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Hanford (Richland-RL)	1.1×10^1	3.0×10^1	4.2×10^1
Idaho National Engineering & Environmental Laboratory	1.1×10^4	0.0×10^0	1.1×10^4
Paducah Gaseous Diffusion Plant	5.7×10^0	5.7×10^0	1.1×10^1
Rocky Flats Environmental Technology Site	6.5×10^2	3.2×10^1	6.8×10^2
TRU Waste Site Total	1.1×10^4	6.8×10^1	1.1×10^4
Emplaced Waste Volumes (m³)			
Site	Stored (m ³)	Projected (m ³)	Total (m ³)
Waste Isolation Pilot Plant	9.7×10^2	0.0×10^0	9.7×10^2
Emplaced Waste Total	9.7×10^2	0.0×10^0	9.7×10^2
Total Waste Volume (m³)			
	1.2×10^4	6.8×10^1	1.2×10^4
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		4.2×10^0	
Aluminum-Base Metal/Alloys		1.2×10^{-2}	
Other Metal/Alloys		5.0×10^0	
Other Inorganic Material		5.5×10^1	
Cellulosic Material		1.9×10^1	
Rubber Material		1.1×10^{-1}	
Plastic Material		2.7×10^0	
Solidified Inorganic Material		9.0×10^{-1}	
Cement (Solidified)		0.0×10^0	
Vitriified Material		7.1×10^1	
Solidified Organic Material		2.7×10^{-5}	
Soil		1.8×10^{-3}	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-15. WIPP CH-TRU Waste Profiles – Lead/Cadmium Metal**

Final Waste Form: Lead/Cadmium Metal

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Hanford (Richland-RL)	1.7×10^1	1.4×10^1	3.1×10^1
Los Alamos National Laboratory	3.7×10^0	0.0×10^0	3.7×10^0
Rocky Flats Environmental Technology Site	1.2×10^2	1.8×10^1	1.4×10^2
TRU Waste Site Total	1.4×10^2	3.2×10^1	1.8×10^2
Emplaced Waste Volumes (m³)			
Site	Stored	Projected	Total
Waste Isolation Pilot Plant	8.1×10^1	0.0×10^0	8.1×10^1
Emplaced Waste Total	8.1×10^1	0.0×10^0	8.1×10^1
Total Waste Volume (m³)	2.2×10^2	3.2×10^1	2.6×10^2
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		9.2×10^2	
Aluminum-Base Metal/Alloys		1.8×10^1	
Other Metal/Alloys		1.5×10^2	
Other Inorganic Material		1.8×10^1	
Cellulosic Material		5.0×10^0	
Rubber Material		3.3×10^0	
Plastic Material		9.3×10^0	
Solidified Inorganic Material		8.2×10^{-1}	
Cement (Solidified)		0.0×10^0	
Vitriified Material		0.0×10^0	
Solidified Organic Material		1.1×10^{-2}	
Soil		1.6×10^{-1}	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

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Table DATA-F-16. WIPP CH-TRU Waste Profiles – Salt

Final Waste Form: Salt

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Lawrence Livermore National Laboratory	1.2×10^0	1.5×10^1	1.6×10^1
Los Alamos National Laboratory	1.3×10^2	1.7×10^2	3.0×10^2
Rocky Flats Environmental Technology Site	2.5×10^1	0.0×10^0	2.5×10^1
TRU Waste Site Total	1.5×10^2	1.9×10^2	3.4×10^2
Emplaced Waste Volumes (m³)			
Site	Stored	Projected	Total
Waste Isolation Pilot Plant	1.5×10^3	0.0×10^0	1.5×10^3
Emplaced Waste Total	1.5×10^3	0.0×10^0	1.5×10^3
Total Waste Volume (m³)	1.6×10^3	1.9×10^2	1.8×10^3
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		9.3×10^0	
Aluminum-Base Metal/Alloys		5.7×10^{-2}	
Other Metal/Alloys		3.1×10^0	
Other Inorganic Material		2.1×10^2	
Cellulosic Material		1.4×10^2	
Rubber Material		4.1×10^{-2}	
Plastic Material		8.9×10^{-1}	
Solidified Inorganic Material		1.3×10^1	
Cement (Solidified)		0.0×10^0	
Vitriified Material		0.0×10^0	
Solidified Organic Material		1.2×10^1	
Soil		1.5×10^0	

2

Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

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Table DATA-F-17. WIPP CH-TRU Waste Profiles – Soil

Final Waste Form: Soil

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Hanford (Richland-RL)	1.1×10^2	5.9×10^3	6.0×10^3
Idaho National Engineering & Environmental Laboratory	0.0×10^0	9.7×10^1	9.7×10^1
Los Alamos National Laboratory	1.9×10^2	0.0×10^0	1.9×10^2
TRU Waste Site Total	3.0×10^2	6.0×10^3	6.3×10^3
Total Waste Volume (m³)			
	3.0×10^2	6.0×10^3	6.3×10^3
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		2.4×10^{-2}	
Aluminum-Base Metal/Alloys		9.1×10^{-3}	
Other Metal/Alloys		6.4×10^{-2}	
Other Inorganic Material		9.1×10^{-1}	
Cellulosic Material		1.5×10^{-1}	
Rubber Material		2.7×10^{-2}	
Plastic Material		1.4×10^{-1}	
Solidified Inorganic Material		1.8×10^0	
Cement (Solidified)		1.8×10^0	
Vitrified Material		0.0×10^0	
Solidified Organic Material		5.0×10^0	
Soil		3.2×10^2	

2

Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-18. WIPP CH-TRU Waste Profiles – Solidified Inorganic Material¹**

Final Waste Form: Solidified Inorganic Material

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Argonne National Laboratory - East	2.4×10^1	1.3×10^1	3.7×10^1
Hanford (Richland-RL)	1.9×10^2	3.0×10^1	2.2×10^2
Hanford (River Protection-RP)	3.9×10^3	0.0×10^0	3.9×10^3
Idaho National Engineering & Environmental Laboratory	2.9×10^4	0.0×10^0	2.9×10^4
Lawrence Livermore National Laboratory	1.4×10^1	1.8×10^2	1.9×10^2
Los Alamos National Laboratory	6.5×10^2	2.4×10^2	8.9×10^2
Nevada Test Site	5.7×10^0	0.0×10^0	5.7×10^0
Rocky Flats Environmental Technology Site	8.1×10^2	2.7×10^2	1.1×10^3
Savannah River Site	2.4×10^1	0.0×10^0	2.4×10^1
TRU Waste Site Total	3.5×10^4	7.3×10^2	3.6×10^4
Emplaced Waste Volumes (m³)			
Site	Stored	Projected	Total
Waste Isolation Pilot Plant	3.3×10^3	0.0×10^0	3.3×10^3
Emplaced Waste Total	3.3×10^3	0.0×10^0	3.3×10^3
Total Waste Volume (m³)	3.8×10^4	7.3×10^2	3.9×10^4
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		9.5×10^{-1}	
Aluminum-Base Metal/Alloys		2.9×10^{-2}	
Other Metal/Alloys		1.4×10^0	
Other Inorganic Material		3.3×10^1	
Cellulosic Material		7.6×10^0	
Rubber Material		1.3×10^{-2}	
Plastic Material		3.8×10^0	
Solidified Inorganic Material		2.5×10^2	
Cement (Solidified)		9.8×10^1	
Vitrified Material		4.6×10^{-2}	
Solidified Organic Material		2.7×10^0	
Soil		4.2×10^0	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09
 3 ¹See Section DATA-F-3.2.1.4 for additional information.

1 **Table DATA-F-19. WIPP CH-TRU Waste Profiles – Solidified Organic Material¹**

Final Waste Form: Solidified Organic Material

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Energy Technology Engineering Center	8.4×10^{-1}	0.0×10^0	8.4×10^{-1}
Hanford (Richland-RL)	2.3×10^0	3.4×10^2	3.4×10^2
Idaho National Engineering & Environmental Laboratory	1.1×10^3	0.0×10^0	1.1×10^3
Lawrence Livermore National Laboratory	8.1×10^0	4.8×10^0	1.3×10^1
Los Alamos National Laboratory	3.9×10^3	2.7×10^1	3.9×10^3
Rocky Flats Environmental Technology Site	1.4×10^2	4.4×10^0	1.4×10^2
TRU Waste Site Total	5.2×10^3	3.8×10^2	5.5×10^3
Total Waste Volume (m³)			
	5.2×10^3	3.8×10^2	5.5×10^3
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		3.9×10^{-1}	
Aluminum-Base Metal/Alloys		1.9×10^{-1}	
Other Metal/Alloys		2.8×10^{-1}	
Other Inorganic Material		2.7×10^1	
Cellulosic Material		3.7×10^{-1}	
Rubber Material		2.5×10^{-1}	
Plastic Material		7.1×10^0	
Solidified Inorganic Material		1.4×10^2	
Cement (Solidified)		3.8×10^1	
Vitrified Material		0.0×10^0	
Solidified Organic Material		3.3×10^2	
Soil		3.6×10^1	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09
 3 ¹See Section DATA-F-3.2.1.4 for additional information.

1 **Table DATA-F-20. WIPP CH-TRU Waste Profiles – Uncategorized Metal**

Final Waste Form: Uncategorized Metal

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Hanford (Richland-RL)	1.1×10^2	4.4×10^3	4.5×10^3
Idaho National Engineering & Environmental Laboratory	9.4×10^0	0.0×10^0	9.4×10^0
Los Alamos National Laboratory	1.5×10^3	3.2×10^1	1.5×10^3
Rocky Flats Environmental Technology Site	7.9×10^2	6.7×10^2	1.5×10^3
TRU Waste Site Total	2.4×10^3	5.1×10^3	7.5×10^3
Emplaced Waste Volume (m³)			
Site	Stored	Projected	Total
Waste Isolation Pilot Plant	3.6×10^2	0.0×10^0	3.6×10^2
Emplaced Waste Total	3.6×10^2	0.0×10^0	3.6×10^2
Total Waste Volume (m³)	2.8×10^3	5.1×10^3	7.9×10^3
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		8.8×10^1	
Aluminum-Base Metal/Alloys		5.3×10^0	
Other Metal/Alloys		8.5×10^1	
Other Inorganic Material		1.2×10^0	
Cellulosic Material		2.3×10^0	
Rubber Material		1.5×10^0	
Plastic Material		7.5×10^0	
Solidified Inorganic Material		7.7×10^0	
Cement (Solidified)		0.0×10^0	
Vitrified Material		0.0×10^0	
Solidified Organic Material		6.7×10^{-1}	
Soil		6.1×10^{-2}	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-21. WIPP RH-TRU Waste Profiles – Combustible Material**

Final Waste Form: Combustible Material

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Battelle Columbus Laboratories	1.7×10^1	8.9×10^{-1}	1.8×10^1
Hanford (Richland-RL)	8.9×10^{-1}	0.0×10^0	8.9×10^{-1}
TRU Waste Site Total	1.8×10^1	8.9×10^{-1}	1.9×10^1
Total Waste Volume (m³)			
	1.8×10^1	8.9×10^{-1}	1.9×10^1
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		8.7×10^0	
Aluminum-Base Metal/Alloys		7.6×10^0	
Other Metal/Alloys		6.3×10^0	
Other Inorganic Material		9.2×10^0	
Cellulosic Material		3.9×10^1	
Rubber Material		2.3×10^1	
Plastic Material		9.2×10^1	
Solidified Inorganic Material		0.0×10^0	
Cement (Solidified)		1.7×10^1	
Vitrified Material		0.0×10^0	
Solidified Organic Material		1.5×1^0	
Soil		1.4×10^0	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

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Table DATA-F-22. WIPP RH-TRU Waste Profiles – Filter Material

Final Waste Form: Filter Material

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Argonne National Laboratory - West	1.8×10^0	8.9×10^0	1.1×10^1
Battelle Columbus Laboratories	5.3×10^0	0.0×10^0	5.3×10^0
Hanford (Richland-RL)	1.8×10^0	0.0×10^0	1.8×10^0
TRU Waste Site Total	8.9×10^0	8.9×10^0	1.8×10^1
Total Waste Volume (m³)			
	8.9×10^0	8.9×10^0	1.8×10^1
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		3.3×10^1	
Aluminum-Base Metal/Alloys		1.7×10^1	
Other Metal/Alloys		4.3×10^1	
Other Inorganic Material		1.1×10^2	
Cellulosic Material		7.3×10^1	
Rubber Material		1.9×10^1	
Plastic Material		6.3×10^0	
Solidified Inorganic Material		0.0×10^0	
Cement (Solidified)		7.7×10^0	
Vitrified Material		0.0×10^0	
Solidified Organic Material		1.2×10^1	
Soil		0.0×10^0	

2

Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-23. WIPP RH-TRU Waste Profiles – Heterogeneous Debris**

Final Waste Form: Heterogeneous Debris			
TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Argonne National Laboratory - East	1.5×10^1	1.0×10^2	1.2×10^2
Argonne National Laboratory - West	6.2×10^0	3.6×10^1	4.3×10^1
Bettis Atomic Power Laboratory	2.0×10^0	0.0×10^0	2.0×10^0
Energy Technology Engineering Center	8.9×10^{-1}	0.0×10^0	8.9×10^{-1}
Hanford (Richland-RL)	2.6×10^2	3.2×10^3	3.5×10^3
Idaho National Engineering & Environmental Laboratory	2.0×10^2	0.0×10^0	2.0×10^2
Knolls Atomic Power Laboratory - Schenectady	0.0×10^0	1.4×10^2	1.4×10^2
Los Alamos National Laboratory	1.2×10^2	0.0×10^0	1.2×10^2
Oak Ridge National Laboratory	0.0×10^0	2.7×10^2	2.7×10^2
Sandia National Laboratories - Albuquerque	4.6×10^0	0.0×10^0	4.6×10^0
Savannah River Site	0.0×10^0	2.3×10^1	2.3×10^1
TRU Waste Site Total	6.1×10^2	3.8×10^3	4.4×10^3
Total Waste Volume (m³)			
	6.1×10^2	3.8×10^3	4.4×10^3
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		1.2×10^2	
Aluminum-Base Metal/Alloys		8.0×10^0	
Other Metal/Alloys		3.5×10^1	
Other Inorganic Material		4.7×10^1	
Cellulosic Material		1.6×10^1	
Rubber Material		1.1×10^1	
Plastic Material		1.6×10^1	
Solidified Inorganic Material		3.6×10^1	
Cement (Solidified)		0.0×10^0	
Vitrified Material		0.0×10^0	
Solidified Organic Material		1.4×10^1	
Soil		3.5×10^1	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-24. WIPP RH-TRU Waste Profiles – Inorganic Non-Metal**

Final Waste Form: Inorganic Non-Metal

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Battelle Columbus Laboratories	1.4 × 10 ¹	8.9 × 10 ⁻¹	1.5 × 10 ¹
Hanford (Richland-RL)	2.8 × 10 ¹	4.3 × 10 ¹	7.1 × 10 ¹
TRU Waste Site Total	4.3 × 10 ¹	4.4 × 10 ¹	8.6 × 10 ¹
Total Waste Volume (m³)			
	4.3 × 10 ¹	4.4 × 10 ¹	8.6 × 10 ¹
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys	1.6 × 10 ²		
Aluminum-Base Metal/Alloys	2.1 × 10 ¹		
Other Metal/Alloys	4.8 × 10 ¹		
Other Inorganic Material	9.9 × 10 ²		
Cellulosic Material	3.9 × 10 ⁰		
Rubber Material	1.8 × 10 ⁰		
Plastic Material	2.4 × 10 ¹		
Solidified Inorganic Material	1.5 × 10 ¹		
Cement (Solidified)	3.1 × 10 ⁰		
Vitrified Material	0.0 × 10 ⁰		
Solidified Organic Material	2.8 × 10 ⁻¹		
Soil	7.1 × 10 ⁰		

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-25. WIPP RH-TRU Waste Profiles – Lead/Cadmium Metal**

Final Waste Form: Lead/Cadmium Metal

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Hanford (Richland-RL)	1.2×10^1	7.1×10^0	1.9×10^1
TRU Waste Site Total	1.2×10^1	7.1×10^0	1.9×10^1
Total Waste Volume (m³)			
	1.2×10^1	7.1×10^0	1.9×10^1
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		5.4×10^3	
Aluminum-Base Metal/Alloys		0.0×10^0	
Other Metal/Alloys		7.4×10^1	
Other Inorganic Material		0.0×10^0	
Cellulosic Material		0.0×10^0	
Rubber Material		0.0×10^0	
Plastic Material		0.0×10^0	
Solidified Inorganic Material		0.0×10^0	
Cement (Solidified)		0.0×10^0	
Vitriified Material		0.0×10^0	
Solidified Organic Material		0.0×10^0	
Soil		0.0×10^0	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1

Table DATA-F-26. WIPP RH-TRU Waste Profiles – Soil

Final Waste Form: Soil

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Oak Ridge National Laboratory	0.0 × 10 ⁰	2.0 × 10 ²	2.0 × 10 ²
TRU Waste Site Total	0.0 × 10 ⁰	2.0 × 10 ²	2.0 × 10 ²
Total Waste Volume (m³)			
	0.0 × 10 ⁰	2.0 × 10 ²	2.0 × 10 ²
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		0.0 × 10 ⁰	
Aluminum-Base Metal/Alloys		0.0 × 10 ⁰	
Other Metal/Alloys		0.0 × 10 ⁰	
Other Inorganic Material		0.0 × 10 ⁰	
Cellulosic Material		0.0 × 10 ⁰	
Rubber Material		0.0 × 10 ⁰	
Plastic Material		0.0 × 10 ⁰	
Solidified Inorganic Material		0.0 × 10 ⁰	
Cement (Solidified)		0.0 × 10 ⁰	
Vitriified Material		0.0 × 10 ⁰	
Solidified Organic Material		0.0 × 10 ⁰	
Soil		1.3 × 10 ³	

2

Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-27. WIPP RH-TRU Waste Profiles – Solidified Inorganic Material**

Final Waste Form: Solidified Inorganic Material

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Argonne National Laboratory - West	1.6×10^1	2.3×10^1	3.9×10^1
Battelle Columbus Laboratories	1.8×10^0	0.0×10^0	1.8×10^0
Hanford (Richland-RL)	1.5×10^1	1.2×10^2	1.3×10^2
Hanford (River Protection-RP)	4.5×10^3	0.0×10^0	4.5×10^3
Idaho National Engineering & Environmental Laboratory	8.9×10^{-1}	0.0×10^0	8.9×10^{-1}
Oak Ridge National Laboratory	0.0×10^0	1.9×10^2	1.9×10^2
TRU Waste Site Total	4.5×10^3	3.3×10^2	4.8×10^3
Total Waste Volume (m³)			
	4.5×10^3	3.3×10^2	4.8×10^3
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		6.8×10^0	
Aluminum-Base Metal/Alloys		0.0×10^0	
Other Metal/Alloys		3.4×10^{-2}	
Other Inorganic Material		6.9×10^{-1}	
Cellulosic Material		3.5×10^{-3}	
Rubber Material		0.0×10^0	
Plastic Material		1.6×10^{-2}	
Solidified Inorganic Material		9.2×10^1	
Cement (Solidified)		2.4×10^0	
Vitrified Material		1.8×10^{-1}	
Solidified Organic Material		3.1×10^{-2}	
Soil		4.1×10^{-3}	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-28. WIPP RH-TRU Waste Profiles – Solidified Organic Material**

Final Waste Form: Solidified Organic Material

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Battelle Columbus Laboratories	5.3×10^0	0.0×10^0	5.3×10^0
Energy Technology Engineering Center	4.1×10^0	0.0×10^0	4.1×10^0
TRU Waste Site Total	9.5×10^0	0.0×10^0	9.5×10^0
Total Waste Volume (m³)			
	9.5×10^0	0.0×10^0	9.5×10^0
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		4.9×10^1	
Aluminum-Base Metal/Alloys		0.0×10^0	
Other Metal/Alloys		0.0×10^0	
Other Inorganic Material		1.2×10^1	
Cellulosic Material		2.0×10^1	
Rubber Material		4.2×10^0	
Plastic Material		2.0×10^1	
Solidified Inorganic Material		0.0×10^0	
Cement (Solidified)		1.4×10^2	
Vitrified Material		0.0×10^0	
Solidified Organic Material		1.7×10^2	
Soil		0.0×10^0	

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 **Table DATA-F-29. WIPP RH-TRU Waste Profiles – Uncategorized Metal**

Final Waste Form: Uncategorized Metal

TRU Waste Site Volumes (m³)			
Site	Stored	Projected	Total
Battelle Columbus Laboratories	8.9×10^{-1}	0.0×10^0	8.9×10^{-1}
Hanford (Richland-RL)	6.1×10^1	6.1×10^3	6.1×10^3
Idaho National Engineering & Environmental Laboratory	2.2×10^1	0.0×10^0	2.2×10^1
TRU Waste Site Total	8.4×10^1	6.1×10^3	6.1×10^3
Total Waste Volume (m³)			
	8.4×10^1	6.1×10^3	6.1×10^3
Waste Material Parameters		Average Density (kg/m³)	
Iron-Base Metal/Alloys		1.8×10^2	
Aluminum-Base Metal/Alloys		4.5×10^{-1}	
Other Metal/Alloys		5.6×10^1	
Other Inorganic Material		4.0×10^1	
Cellulosic Material		7.5×10^{-2}	
Rubber Material		5.2×10^{-2}	
Plastic Material		7.8×10^{-2}	
Solidified Inorganic Material		3.1×10^{-3}	
Cement (Solidified)		0.0×10^0	
Vitrified Material		0.0×10^0	
Solidified Organic Material		0.0×10^0	
Soil		6.2×10^{-2}	

2

1 **Table DATA-F-30. WIPP CH-TRU Waste Material Parameter Disposal Inventory**

Waste Material Parameters	Average Density (kg/m ³)
Iron-Base Metal/Alloys	1.1 × 10 ²
Aluminum-Base Metal/Alloys	1.4 × 10 ¹
Other Metal/Alloys	3.0 × 10 ¹
Other Inorganic Material	4.2 × 10 ¹
Cellulosic Material	5.8 × 10 ¹
Rubber Material	1.4 × 10 ¹
Plastic Material	4.2 × 10 ¹
Solidified Inorganic Material	7.7 × 10 ¹
Cement (Solidified)	2.9 × 10 ¹
Vitrified Material	6.2 × 10 ⁰
Solidified Organic Material	1.6 × 10 ¹
Soil	1.9 × 10 ¹
Container Materials	
Steel	1.7 × 10 ²
Plastic	1.6 × 10 ¹
Lead	1.4 × 10 ⁻²

2 Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

3 **Table DATA-F-31. WIPP RH-TRU Waste Material Parameter Disposal Inventory**

Waste Material Parameters	Average Density (kg/m ³)
Iron-Base Metal/Alloys	1.1 × 10 ²
Aluminum-Base Metal/Alloys	2.5 × 10 ⁰
Other Metal/Alloys	3.2 × 10 ¹
Other Inorganic Material	3.5 × 10 ¹
Cellulosic Material	4.5 × 10 ⁰
Rubber Material	3.1 × 10 ⁰
Plastic Material	4.9 × 10 ⁰
Solidified Inorganic Material	3.9 × 10 ¹
Cement (Solidified)	8.7 × 10 ⁻¹
Vitrified Material	5.7 × 10 ⁻²
Solidified Organic Material	4.0 × 10 ⁰
Soil	2.6 × 10 ¹
Container Materials	
Steel	4.8 × 10 ²
Plastic	1.4 × 10 ⁰
Lead	4.4 × 10 ²

Source: TWBID Revision 2.1, Version 3.12, Data Version 4.09

1 ***DATA-F-3.2.2 Packaging Materials***

2 The PA assumption that materials are distributed homogeneously throughout the repository also
3 applies to packaging materials. As a result, a WIPP-scale average value for packaging material
4 densities is needed for PA. The WIPP-scale packaging (container) material average densities for
5 CH- and RH-TRU wastes in support of the CRA are presented in Tables DATA-F-30 and
6 DATA-F-31, respectively. These are equivalent to the TWBIR Revision 3 (DOE 1996a), Tables
7 2-2 and 2-3, respectively. Note also that the TWBIR Revision 3 Tables 2-2 and 2-3 are the same
8 as TWBIR Revision 2 (DOE 1995b), Tables 3-2 and 3-3, respectively.

9 Analysis of the packaging material data submitted by the sites identified inconsistencies in
10 reporting among the sites. Therefore, adjustments were made at the waste stream level to
11 achieve consistency among the waste streams. In particular, a consistent set of densities for
12 packaging materials for different types of containers was used unless otherwise noted by the site.
13 Table 1-3 of the TWBIR Revision 2 identified the packaging materials and packaging material
14 densities for the waste containers that were being used at that time. These values were used in
15 this 2003 Update Report as well. Since the time of the TWBIR Revision 2, the sites have begun
16 using ten-drum overpacks (TDOPs) for packaging waste. The calculated packaging material
17 densities for TDOPs are presented in Appendix DATA, Attachment F, Annex D, Packaging
18 Materials.

19 In addition, sites are also reporting that they use 85 and 100-gallon drums. This is possible
20 because Section 2.1 in the pending update to the TRAMPAC document (DOE 2002b) has been
21 revised to add the 85-gallon drum as an authorized payload container for shipment in the
22 TRUPACT II (the 85-gallon drum is currently authorized for shipment in the Half PACT), and to
23 add the 100-gallon drum as an authorized payload container in the Half PACT (the 100-gallon
24 drum is currently authorized for shipment in the TRUPACT II). This section of the TRAMPAC
25 document has also been revised to specify a range of sizes (75 to 88 gallons) for a container
26 identified as an “85-gallon drum.”

27 Table DATA-F-32 is a summary of the assumed waste packaging material densities for some
28 common final form container types reported by the sites. The packaging material densities in
29 Table DATA-F-32 for 55-, 85-, and 100-gallon drums, SWBs, RH-TRU canisters, and TDOPs
30 are calculated as shown in Appendix DATA, Attachment F, Annex D.

31 ***DATA-F-3.2.3 Chemical Components in Solidified Transuranic Waste***

32 As part of the data call for this 2003 Update Report, the sites were asked to provide information
33 about the chemical components of the waste. The sites were asked about complexing agents
34 (acetate, citrate, oxylate, EDTA), oxyanions (nitrate, sulfate, and phosphate), cement, and
35 pyrochemical salts.

1

Table DATA-F-32. Assumed Packaging Material Densities¹

Container Configuration	Steel (kg/m ³)	Plastic (kg/m ³)	Lead (kg/m ³)	Volume (m ³) ²
55-gallon drum	131	37	0	0.208
SWB (direct load)	154	1.2	0	1.89
SWB (overpack 4 55-gal. drums)	211	16	0	1.89
RH-TRU Waste Canister (direct load)	434	0	464	0.89
RH-TRU Waste Canister (overpack 3 55-gal. drums)	526	26	464	0.89
85-gallon drum	114	0	0	0.322
100-gallon drum	114	81	0	0.379
Ten-Drum Overpacks	218	16	0	4.79

2
3¹ This table was used when sites did not report container volumes.² Container volumes differ from WWIS container volumes.

4 This section presents the summary of the chemical components that are present in the solidified
5 TRU waste inventory in support of the CRA. Specifically, complexing agents, oxyanions, and
6 cement are calculated as the sum of the constituents found in anticipated waste scheduled for
7 delivery to WIPP and any waste that has already been placed in the repository. The information
8 provided is based on input from the TWBIR Revision 3 (DOE 1996a) and updates received from
9 Rocky Flats Environmental Technology Site (RFETS), Los Alamos National Laboratory
10 (LANL), Idaho National Engineering and Environmental Laboratory (INEEL), Hanford-
11 Richland Operations (Hanford RL) and Hanford-Office of River Protection (Hanford RP). The
12 methods used to estimate the masses of cement, complexing agents, and oxyanions are discussed
13 in Leigh and Lott (2003), Crawford and Leigh (2003), and Leigh and Sparks-Roybal (2003),
14 respectively. A brief discussion of pyrochemical salts is presented in Appendix DATA,
15 Attachment F, Annex A.

16 DATA-F-3.2.3.1 Cement Content in Solidified Transuranic Waste

17 The PA for the CRA requires an estimate of the mass of cement in waste expected for disposal in
18 the repository. An estimate of the cement mass for the CCA was given in Appendix B-7 of the
19 TWBIR Revision 3 (DOE 1996a). While the waste stream volumes reported by the generator
20 sites in the 2003 Update Report have changed when compared to the TWBIR Revision 3
21 volumes, the waste streams identified by the sites at the time of the TWBIR Revision 3 as
22 containing cement have not changed. On the whole, the TRU waste generator sites did not report
23 any new information about cement in this 2003 Update Report. As a result, the mass of cement
24 in the repository was calculated for the PA in support of the CRA as the sum of the mass of
25 cement reported in the TWBIR Revision 3 adjusting for the new waste stream volumes from this
26 update.

27 The total estimated mass of cement in the scaled solidified waste streams for this 2003 Update
28 Report is 1.20×10^7 kg (2.65×10^7 lb). This estimate of cement mass in the WIPP repository is
29 larger than the estimate made for the CCA (8.54×10^6 kg [1.88×10^7 lb]). The increase in

1 cement mass is primarily because of larger volumes projected for existing waste streams. The
 2 calculations for cement masses are given in Leigh and Lott (2003).

3 **DATA-F-3.2.3.2 Complexing Agents in Solidified Transuranic Waste**

4 The DOE tracks the mass of complexing agents going into the repository because of their impact
 5 on solubility of actinides in the waste. In the latest request by DOE for data from the sites, none
 6 of the sites updated or modified their estimates of complexing agents in the waste streams that
 7 had been reported previously in the TWBIR Revision 3 (DOE 1996a). When applicable, the
 8 sites did report the expected masses of complexing agents in waste streams added to their
 9 inventory since publication of the TWBIR Revision 3. As a result, the mass of complexing
 10 agents in the repository was calculated for the PA in support of the CRA as the sum of the mass
 11 of complexing agents reported in the TWBIR Revision 3 plus the mass of complexing agents
 12 reported by the sites for their new waste streams.

13 The TWBIR Revision 3 contained information on complexing agents that was used in the PA in
 14 support of the CCA. TWBIR Revision 3 presented two estimates for complexing agents in the
 15 WIPP repository; one assuming reduction of complexing agents due to thermal treatment and
 16 one without the thermal treatment assumption. Since publication of the TWBIR Revision 3, the
 17 DOE's strategy for wastes at the INEEL has changed, and incineration operations for INEEL
 18 TRU waste did not occur as planned. Therefore, the data reported in Appendix B-4 of the
 19 TWBIR Revision 3 without the thermal treatment assumption is used in the current calculation of
 20 mass of complexing agents.

21 Only two sites reported complexing agents in new waste streams; RFETS and Hanford RP. For
 22 their new waste streams, RFETS reported that ethylenediaminetetraacetic acid (EDTA) might be
 23 present at trace levels (< 1 wt%) in their waste. Hanford RP identified sodium acetate and
 24 sodium oxalate in their new waste streams. The total mass of acetic acid, sodium acetate, citric
 25 acid, sodium citrate, oxalic acid, sodium oxalate, and sodium EDTA estimated for the WIPP
 26 repository are reported in Table DATA-F-33.

27 **Table DATA-F-33. Mass of Potential Complexing Agents in the WIPP Repository**

Compound	RFETS (kg)	LANL(kg)	Hanford RP (kg)	Total (kg)
Acetic Acid	132	10	---	142
Sodium Acetate	1,110	---	7,400	8,510
Citric Acid	90	1,100.5	---	1,190.5
Sodium Citrate	400	---	---	400
Oxalic Acid	90	13,706	---	13,796
Sodium Oxalate	---	---	33,940	33,940
EDTA	25.6	---	---	25.6

Source: Crawford and Leigh (2003)

28 Only a slight increase in EDTA was reported with this updated information over that reported in
 29 1996 (DOE 1996a). The increase comes from one waste stream at RFETS that reported trace
 30 amounts of EDTA present in the waste and is reported as the upper limit of expected

1 concentration. Waste from Hanford RP waste tanks is included in Table DATA-F-33 as well,
 2 and represents a significant increase in sodium acetate and sodium oxalate that had not been
 3 reported for the TRU inventory in 1996 (DOE 1996a).

4 **DATA-F-3.2.3.3 Mass of Oxyanions in Solidified Transuranic Waste**

5 The PA for the CRA requires an estimate of the mass of nitrate, sulfate, and phosphate in waste
 6 expected for disposal in the repository. An estimate of the oxyanion masses for the CCA was
 7 given in Appendix B-6 of the TWBIR Revision 3 (DOE 1996a). The TRU waste sites did not
 8 report any new information about oxyanions for this 2003 Update Report with the exception of
 9 new waste streams reported by Hanford RP and LANL and revised values for a waste stream at
 10 RFETS. Therefore, the mass of nitrate, sulfate, and phosphate in the repository was calculated
 11 for the PA in support of the CRA as the sum of the mass of nitrate, sulfate, and phosphate in the
 12 TWBIR Revision 3 adjusting for the new waste stream volumes from this update plus the mass
 13 of nitrate, sulfate, and phosphate reported by the sites for their new waste streams. Table
 14 DATA-F-34 presents the mass of nitrate, sulfate, and phosphate in the WIPP repository for the
 15 CRA. The calculations for oxyanion masses are given in Leigh and Sparks-Roybal (2003).

16 The estimate of nitrate mass in the WIPP repository (2.51×10^6 kg [5.53×10^6 lb]) is larger than
 17 the estimate made for the CCA which was 1.62×10^6 kg (3.57×10^6 lb). The increase in nitrate
 18 mass is due primarily to larger volumes projected for existing waste streams and the added waste
 19 streams from Hanford RP. The estimate of sulfate mass in the WIPP repository (4.21×10^5 kg
 20 [9.28×10^5 lb]) is less than the estimate made for the CCA which was 6.33×10^5 kg (1.39×10^6
 21 lb).

22 The estimate of phosphate mass in the WIPP repository (1.05×10^5 kg [2.31×10^5 lb]) is
 23 significant when compared to the CCA. There was no phosphate of reportable quantity given by
 24 the generator sites in the TWBIR Revision 3. The primary source of phosphate in the current
 25 estimate is the tank waste from Hanford RP which is now a waste stream to be disposed at
 26 WIPP.

27 **Table DATA-F-34. Mass of Oxyanions and Cement In the WIPP Disposal Inventory**

Chemical Component	Mass Contained in the Disposal Inventory (kg)
Nitrate	2.51×10^6
Sulfate	4.21×10^5
Phosphate	1.05×10^5
Cement	1.20×10^7

Sources: Leigh and Lott (2003); Leigh and Sparks-Roybal (2003)

28 **DATA-F-3.2.3.4 Pyrochemical Salts in Waste Isolation Pilot Plant Transuranic Waste**

29 Five waste streams at LANL, one waste stream at Lawrence Livermore National Laboratory
 30 (LLNL), and seven waste streams at RFETS have been identified as containing pyrochemical
 31 salts. Direct oxide reduction (DOR) salts have been identified in two waste streams at LANL
 32 (LA-TA-55-39 and LA-TA-55-53), the LLNL waste stream (LL-T004) and in two RFETS waste

1 streams (RF-TT454X and RF-TT433X). The pyrochemical salt waste streams are given in
2 Appendix DATA, Attachment F, Annex A.

3 **DATA-F-3.3 Transuranic Waste Radionuclide Inventory**

4 As part of the data call for this 2003 Update Report, the sites were asked to provide information
5 about the radiological components in the waste they intend to ship to WIPP. For each waste
6 stream they were asked to specify the radionuclide activity concentrations (in Ci/m³), to provide
7 the generation or last assay date for each waste stream. In some cases, the sites provided all of
8 the information required; in other cases, they did not.

9 For those waste streams where the site did not provide adequate information regarding the
10 radiological components of the waste, radionuclide activities were estimated using the methods
11 described in the Computational Methodology (LANL 2003b) and in the radionuclide correction
12 package as identified in Table DATA-F-2. Radionuclide data for comparable waste streams at
13 the same site were mapped into waste streams with missing data. For 73 waste streams without
14 data, this mapping was accomplished by first matching to the site, the handling (RH or CH), and
15 the WMC. Then, if there were no matches, the waste description was used to find a comparable
16 waste stream. In this way, a waste stream requiring radionuclide data was matched to a waste
17 stream that was generated by the same or very similar process. Seven waste streams without data
18 were matched to waste streams with WMCs that were identical through the first two digits. Three
19 waste streams without data were soil waste at Hanford and were matched to another Hanford soil
20 waste stream. Two waste streams, from LANL, were found to have no similar waste stream in
21 the present inventory but were reported in the TWBIR Revision 2 (DOE 1995b) inventory. Data
22 from the TWBIR Revision 2 were used to fill out the radionuclide data for these two waste
23 streams.

24 All of the radionuclide data were decayed to a common base year of CY 2001 (December 31,
25 2001) using Oak Ridge National Laboratory Isotope Generation and Depletion Code, Version 2.2
26 (hereafter referred to as ORIGEN 2.2) (Croff 1983; Croff 1980). ORIGEN 2.2 is a computer
27 code that calculates the buildup and decay of radionuclides. ORIGEN 2.2 was qualified
28 according to SNL procedure, NP 19-1, Software Requirements (SNL 2002a) for the decay
29 calculations that were done for the TRU waste radionuclide inventory. ORIGEN 2.2 uses a
30 matrix exponential method to solve a large system of coupled, linear, first-order ordinary
31 differential equations with constant coefficients.

32 The ORIGEN 2.2 half-life data are contained within libraries that remain unchanged since their
33 use (via ORIGEN 2.1; ORNL 2002) for the TWBIR Revision 3 (DOE 1996a) in 1996. The
34 results obtained for data in 1996 using ORIGEN 2.1 and those that would be obtained using the
35 current version of ORIGEN 2.2 for 1996 data would be identical. Therefore, the only differences
36 expected between the data obtained in 1996 using ORIGEN 2.1 and those reported for the 2003
37 Update Report using ORIGEN 2.2 are those related to time.

38 Updated waste stream volumes were used to calculate waste stream radionuclide activity from
39 the decayed ORIGEN 2.2 radionuclide activity concentrations as shown in the following
40 equation:

1
$$a(\text{RN})_{\text{Disposal}} = \alpha(\text{RN}) \cdot v_{\text{Disposal}}, \tag{8}$$

2 where

- 3 $a(\text{RN})_{\text{Disposal}}$ is the activity of the radionuclide RN in the scaled waste stream volume,
- 4 $\alpha(\text{RN})$ is the decayed radionuclide activity in Ci/m³ from ORIGEN 2.2 for
- 5 radionuclide RN, and
- 6 v_{Disposal} is the waste stream disposal volume for CH-TRU or RH-TRU waste.

7 More information on how v_{Disposal} was calculated can be found in Section DATA-F-3.1.

8 The WIPP-scale radionuclide activities were calculated as shown in the following equations for
 9 both CH- and RH-TRU wastes. In the first step, the activities of each radionuclide in the scaled
 10 waste stream volumes ($a(\text{RN})_{\text{Disposal}}$) are summed for all waste streams to give the total activity
 11 for each radionuclide in CH-TRU and RH-TRU waste in the repository. In the second step, the
 12 total activity for each radionuclide in CH-TRU and RH-TRU waste in the repository is divided
 13 by the volume limit (168,485 m³ [5,950,000 ft³] for CH-TRU waste and 7,079 m³ [250,000 ft³]
 14 for RH-TRU waste) to give the activity concentration for a radionuclide in CH-TRU or RH-TRU
 15 waste in the repository.

16
$$A(\text{RN}) = \sum a(\text{RN})_{\text{Disposal}}$$

 17
$$\hat{A}(\text{RN}) = A(\text{RN})/\text{Limit}, \tag{9}$$

18 where

- 19 $A(\text{RN})$ is the total activity (Ci) for a radionuclide in CH-TRU or RH-TRU waste in
- 20 the repository (after scaling)
- 21 $\hat{A}(\text{RN})$ is the activity concentration for a radionuclide in CH-TRU or RH-TRU
- 22 waste in the repository (Ci/m³)
- 23 $a(\text{RN})_{\text{Disposal}}$ is the activity (Ci) of the radionuclide RN in the scaled waste stream
- 24 volume,
- 25 Limit is 168,485 m³ (5,950,000 ft³) for CH-waste and 7,079 m³ (250,000 ft³) for
- 26 RH-TRU waste.

27 **DATA-F-3.3.1 Site-Level Roll-up of Radionuclide Activities**

28 Tables DATA-F-35 and DATA-F-36 provide the site-specific radionuclide inventory estimates
 29 in total curies decayed through 2001 for CH-TRU and RH-TRU waste, respectively. The data
 30 shown in Tables DATA-F-35 and DATA-F-36 are the radionuclide inventories as the sum of the
 31 actual stored and projected volumes (not scaled) reported by the site.

32 **DATA-F-3.3.2 Waste-Stream-Level Radionuclide Activities**

33 The radionuclide activities in the scaled waste stream volumes for the CH-TRU waste streams
 34 included in the estimate of volume for PA are given in Appendix DATA, Attachment F, Annex
 35 E, Table DATA-F-E-1. The radionuclide activities in the scaled waste stream volumes for the

1 RH-TRU waste streams included in the estimate of volume for PA are given in Appendix
2 DATA, Attachment F, Annex E, Table DATA-F-E-2.

3 ***DATA-F-3.3.3 Waste Isolation Pilot Plant-Level Roll-up of Radionuclide Activities***

4 Table DATA-F-37 presents the WIPP-level roll-up of radionuclide activities for the disposal
5 inventory (scaled for a full WIPP repository) in Ci/m³ and total Ci decayed through 2001 for both
6 CH-TRU and RH-TRU waste. Table DATA-F-37 corresponds to Table 3-1, TWBIR Revision 3
7 (DOE 1996a). The waste-stream-level radionuclide activities provide the decayed (through
8 December 31, 2001) radionuclide inventory by waste stream for all the waste streams included in
9 Appendix DATA, Attachment F, Annex J.

10 A comparison of TWBIR Revision 3, Table 3-1 data to the data reported in Table DATA-F-37
11 can be found in Appendix DATA, Attachment F, Annex B Table DATA-F-B-27 for CH-TRU
12 waste and Table DATA-F-B-28 for RH-TRU waste. A review of the results for CH-TRU waste
13 indicates that although there is a substantial change in some radionuclides from 1995 to 2001,
14 with the exception of ²³⁹Pu and ²⁴⁰Pu the activities for the dominant five radionuclides (²⁴¹Am,
15 ²³⁸Pu, ²³⁹Pu, ²⁴⁰Pu, and ²⁴¹Pu) have decreased. The overall activity for all radionuclides has
16 decreased by 17 percent. The results for RH-TRU waste show substantial variations in
17 individual radionuclide activity. An overall increase in activity of 30 percent was observed with
18 this update. Five radionuclides made up 99.0 percent of the CH-TRU waste curies in the
19 TWBIR Revision 3 and the same five make up 97.2 percent of the total CH-TRU waste curies in
20 this report. The five most abundant RH-TRU waste isotopes in the TWBIR Revision 3 (^{137m}Ba,
21 ¹³⁷Cs, ²⁴¹Pu, ⁹⁰Sr, and ⁹⁰Y) are still the most abundant in the 2003 Update Report. These five
22 radionuclides made up 96.1 percent of the RH-TRU waste curies in the TWBIR Revision 3 and
23 make up 97.6 percent of the total RH-TRU waste curies in the 2003 Update Report.

24 **DATA-F-3.4 Non-Waste Isolation Pilot Plant and Future Potential Waste**

25 This section identifies waste streams not included in the WIPP inventory used for PA. The waste
26 permitted to come to WIPP is restricted by radionuclide activity limits, volume, and waste
27 generated only from defense activities. Non-WIPP waste streams in Appendix DATA,
28 Attachment F, Annex I are summarized in Section DATA-F-3.4.1.

29 Other restrictions to the waste result from how the waste has been managed at the TRU waste
30 sites. There are some materials that have not been declared TRU waste by the DOE TRU waste
31 sites at this time that may become TRU waste in the future. Some waste has been identified in
32 the TRU inventory but the option for processing has not been determined at this time. These
33 possible future waste streams may ultimately become eligible for shipment to WIPP and are
34 discussed in Section DATA-F-3.4.2.

Table DATA-F-35. CH-TRU Waste Curies on a Site-by-Site Basis ¹

Radionuclide	AE	AW	MC	BC	BT	ET	IN	KN	LA	LL	MU	NT	OR	PA	RF	RL	RP	SA	SR	WP	Total Of Curies
²²⁵ Ac	1.6 × 10 ⁻⁴	1.0 × 10 ⁻⁹	1.7 × 10 ⁻¹⁵	---	---	1.2 × 10 ⁻¹⁴	1.1 × 10 ⁰	---	1.4 × 10 ⁻³	---	1.5 × 10 ⁻¹²	2.7 × 10 ⁻³	2.2 × 10 ⁻¹	1.4 × 10 ⁻⁹	5.4 × 10 ⁻⁹	---	---	1.1 × 10 ⁻⁶	1.9 × 10 ⁻⁹	9.8 × 10 ⁻⁵	1.3 × 10 ⁰
²²⁷ Ac	2.1 × 10 ⁻⁷	2.4 × 10 ⁻¹¹	3.2 × 10 ⁻¹⁵	---	---	5.3 × 10 ⁻¹⁴	4.1 × 10 ⁻⁶	---	1.3 × 10 ⁻³	---	3.6 × 10 ⁻¹⁶	2.0 × 10 ⁻⁴	2.4 × 10 ⁻¹	6.0 × 10 ⁻¹⁴	3.9 × 10 ⁻⁶	---	---	8.3 × 10 ⁻⁴	2.4 × 10 ⁻⁷	3.7 × 10 ⁻⁴	2.4 × 10 ⁻¹
²²⁸ Ac	4.9 × 10 ⁻⁵	---	---	---	---	3.8 × 10 ⁻¹⁸	4.8 × 10 ⁰	---	9.4 × 10 ⁻⁷	---	---	1.9 × 10 ⁻¹⁵	1.1 × 10 ⁻³	---	5.4 × 10 ⁻¹³	---	---	3.7 × 10 ⁻³	9.1 × 10 ⁻¹³	8.8 × 10 ⁻⁷	4.8 × 10 ⁰
^{109m} Ag	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.3 × 10 ⁻⁴	---	---	1.3 × 10 ⁻⁴
¹¹⁰ Ag	---	---	---	---	---	---	---	---	---	---	---	---	2.1 × 10 ⁻¹¹	---	---	---	---	---	---	---	2.1 × 10 ⁻¹¹
^{110m} Ag	---	---	---	---	---	---	---	---	---	---	---	---	1.6 × 10 ⁻⁹	---	---	---	---	---	---	---	1.6 × 10 ⁻⁹
²⁴¹ Am	6.1 × 10 ¹	1.0 × 10 ⁻¹	1.6 × 10 ⁻¹	6.5 × 10 ⁰	8.4 × 10 ⁻³	2.3 × 10 ⁻¹	1.6 × 10 ⁵	7.8 × 10 ¹	6.8 × 10 ³	2.5 × 10 ³	2.2 × 10 ⁰	3.7 × 10 ²	2.5 × 10 ³	---	2.6 × 10 ⁴	3.3 × 10 ⁴	5.2 × 10 ²	9.0 × 10 ⁰	8.7 × 10 ³	1.2 × 10 ⁵	3.6 × 10 ⁵
²⁴² Am	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	4.7 × 10 ⁻²	---	---	4.7 × 10 ⁻²
^{242m} Am	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	4.8 × 10 ⁻²	---	---	4.8 × 10 ⁻²
²⁴³ Am	---	---	---	---	4.0 × 10 ⁻⁵	---	6.4 × 10 ⁻³	---	3.8 × 10 ⁻³	---	---	1.2 × 10 ⁰	9.4 × 10 ⁰	---	---	---	---	1.4 × 10 ⁻²	---	4.8 × 10 ⁻³	1.1 × 10 ¹
²⁴⁵ Am	---	---	---	---	---	---	---	---	2.0 × 10 ⁻¹³	---	---	---	6.2 × 10 ⁻¹¹	---	---	---	---	---	---	---	6.2 × 10 ⁻¹¹
²¹⁷ At	1.6 × 10 ⁴	1.0 × 10 ⁻⁹	1.7 × 10 ⁻¹⁵	---	---	1.2 × 10 ⁻¹⁴	1.1 × 10 ⁰	---	1.4 × 10 ⁻³	---	1.5 × 10 ⁻¹²	2.7 × 10 ⁻³	2.2 × 10 ⁻¹	1.4 × 10 ⁻⁹	5.4 × 10 ⁻⁹	---	---	1.1 × 10 ⁻⁶	1.9 × 10 ⁻⁹	9.9 × 10 ⁻⁵	1.3 × 10 ⁰
^{137m} Ba	3.4 × 10 ⁰	2.8 × 10 ⁻¹	---	---	2.0 × 10 ¹	1.5 × 10 ⁻²	---	---	1.1 × 10 ⁻²	---	---	2.6 × 10 ⁻²	3.4 × 10 ³	---	1.5 × 10 ⁻²	3.4 × 10 ²	1.3 × 10 ³	7.3 × 10 ¹	---	3.6 × 10 ⁻⁴	5.2 × 10 ³
²¹⁰ Bi	6.2 × 10 ⁻¹⁰	1.7 × 10 ⁻¹⁴	---	---	---	9.3 × 10 ⁻¹²	2.7 × 10 ⁻⁸	---	1.0 × 10 ⁻⁶	---	---	9.8 × 10 ⁻²	1.2 × 10 ⁰	5.5 × 10 ⁻⁵	2.6 × 10 ⁻⁸	---	---	1.1 × 10 ⁻²	5.2 × 10 ⁻⁶	2.4 × 10 ⁻⁷	1.3 × 10 ⁰
²¹¹ Bi	2.1 × 10 ⁻⁷	2.4 × 10 ⁻¹¹	3.2 × 10 ⁻¹⁵	---	---	5.3 × 10 ⁻¹⁴	4.0 × 10 ⁻⁶	---	1.3 × 10 ⁻³	---	3.6 × 10 ⁻¹⁶	2.0 × 10 ⁻⁴	2.4 × 10 ⁻¹	6.0 × 10 ⁻¹⁴	3.8 × 10 ⁻⁶	---	---	8.2 × 10 ⁻⁴	2.4 × 10 ⁻⁷	3.7 × 10 ⁻⁴	2.4 × 10 ⁻¹
²¹² Bi	4.2 × 10 ⁻¹	---	---	---	---	2.3 × 10 ⁻¹⁸	4.2 × 10 ⁰	---	1.7 × 10 ⁻⁶	---	---	1.6 × 10 ⁻²	5.0 × 10 ⁻¹	---	3.1 × 10 ⁻¹³	---	---	8.5 × 10 ⁻³	8.7 × 10 ⁻¹³	4.4 × 10 ⁻⁷	5.1 × 10 ⁰
²¹³ Bi	1.6 × 10 ⁻⁴	1.0 × 10 ⁻⁹	1.7 × 10 ⁻¹⁵	---	---	1.2 × 10 ⁻¹⁴	1.1 × 10 ⁰	---	1.4 × 10 ⁻³	---	1.5 × 10 ⁻¹²	2.7 × 10 ⁻³	2.2 × 10 ⁻¹	1.4 × 10 ⁻⁹	5.4 × 10 ⁻⁹	---	---	1.1 × 10 ⁻⁶	1.9 × 10 ⁻⁹	9.8 × 10 ⁻⁵	1.3 × 10 ⁰
²¹⁴ Bi	4.3 × 10 ⁻⁹	1.8 × 10 ⁻¹²	---	---	---	7.6 × 10 ⁻¹¹	2.9 × 10 ⁻⁷	---	2.3 × 10 ⁻⁶	---	2.7 × 10 ⁻²⁰	2.5 × 10 ⁻¹	2.8 × 10 ⁰	3.1 × 10 ⁻⁴	2.3 × 10 ⁻⁷	---	---	5.0 × 10 ⁻²	2.8 × 10 ⁻⁵	7.8 × 10 ⁻⁶	3.1 × 10 ⁰
²⁴⁹ Bk	---	---	---	---	---	---	---	---	1.4 × 10 ⁻⁸	---	---	---	4.3 × 10 ⁻⁶	---	---	---	---	---	---	---	4.3 × 10 ⁻⁶
²⁵⁰ Bk	---	---	---	---	---	---	---	---	---	---	---	---	1.7 × 10 ⁻¹²	---	---	---	---	---	---	---	1.7 × 10 ⁻¹²
¹⁴ C	---	---	---	---	5.3 × 10 ⁻⁴	---	---	---	---	---	---	2.5 × 10 ⁻⁴	2.1 × 10 ⁻⁴	---	---	1.1 × 10 ⁰	9.9 × 10 ⁻²	---	---	---	1.2 × 10 ⁰
¹⁰⁹ Cd	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.3 × 10 ⁻⁴	---	---	1.3 × 10 ⁻⁴
¹⁴⁴ Ce	---	---	---	---	---	---	---	---	---	---	---	---	1.2 × 10 ⁻⁷	---	---	---	---	3.6 × 10 ⁻⁴	---	---	3.6 × 10 ⁻⁴
²⁴⁹ Cf	---	---	---	---	7.6 × 10 ⁻¹³	---	---	---	1.2 × 10 ⁻⁴	---	---	1.1 × 10 ⁻²	3.1 × 10 ⁻²	---	---	---	---	---	---	---	4.2 × 10 ⁻²
²⁵⁰ Cf	---	---	---	---	---	---	---	---	---	---	---	1.4 × 10 ⁻¹	1.9 × 10 ⁻²	---	---	---	---	---	---	---	1.6 × 10 ⁻¹
²⁵¹ Cf	---	---	---	---	3.6 × 10 ⁻¹⁴	---	---	---	---	---	---	---	1.7 × 10 ⁻⁴	---	---	---	---	---	---	---	1.7 × 10 ⁻⁴
²⁵² Cf	---	---	---	---	---	---	3.0 × 10 ⁻³	---	---	---	---	8.3 × 10 ⁻²	5.7 × 10 ⁻²	---	---	---	---	---	---	---	1.4 × 10 ⁻¹
²⁴² Cm	---	---	---	---	---	---	---	---	---	---	---	---	4.3 × 10 ⁻¹⁰	---	---	---	---	3.9 × 10 ⁻²	---	---	3.9 × 10 ⁻²
²⁴³ Cm	---	---	---	---	4.5 × 10 ⁻⁵	---	---	---	---	---	---	4.6 × 10 ⁻⁴	---	---	---	---	---	4.0 × 10 ⁻¹	---	---	4.0 × 10 ⁻¹
²⁴⁴ Cm	---	---	---	---	2.5 × 10 ⁻³	---	---	---	3.3 × 10 ³	2.6 × 10 ³	---	2.3 × 10 ⁰	1.7 × 10 ³	---	---	---	---	4.8 × 10 ⁰	---	---	7.6 × 10 ³
²⁴⁵ Cm	---	---	---	---	2.7 × 10 ⁻⁷	---	---	---	2.5 × 10 ⁻⁷	---	---	1.5 × 10 ⁻⁵	4.0 × 10 ⁻³	---	---	---	---	---	---	---	4.0 × 10 ⁻³

Table DATA-F-35. CH-TRU Waste Curies on a Site-by-Site Basis ¹ — Continued

Radionuclide	AE	AW	MC	BC	BT	ET	IN	KN	LA	LL	MU	NT	OR	PA	RF	RL	RP	SA	SR	WP	Total Of Curies		
²⁴⁶ Cm	---	---	---	---	4.6 × 10 ⁻⁸	---	---	---	---	---	---	5.2 × 10 ⁻⁴	7.4 × 10 ⁻¹	---	---	---	---	---	---	---	7.4 × 10 ⁻¹		
²⁴⁷ Cm	---	---	---	---	1.1 × 10 ⁻¹³	---	---	---	---	---	---	---	1.3 × 10 ⁻¹⁰	---	---	---	---	---	---	---	---	1.3 × 10 ⁻¹⁰	
²⁴⁸ Cm	---	---	---	---	1.9 × 10 ⁻¹³	---	6.8 × 10 ⁻⁷	---	---	---	---	4.1 × 10 ⁻⁵	4.3 × 10 ⁻²	---	---	---	---	---	---	---	---	4.3 × 10 ⁻²	
²⁵⁰ Cm	---	---	---	---	---	---	---	---	---	---	---	---	3.2 × 10 ⁻¹¹	---	---	---	---	---	---	---	---	3.2 × 10 ⁻¹¹	
⁶⁰ Co	---	---	---	---	9.3 × 10 ⁻¹	---	---	---	8.1 × 10 ⁻⁸	---	---	---	3.5 × 10 ⁻³	---	---	---	---	4.8 × 10 ⁻²	---	1.5 × 10 ⁻⁷	9.8 × 10 ⁻¹		
¹³⁴ Cs	---	---	---	---	---	---	---	---	2.2 × 10 ⁻¹⁰	---	---	---	8.1 × 10 ⁻⁴	---	---	---	---	1.9 × 10 ⁻²	---	---	---	2.0 × 10 ⁻²	
¹³⁷ Cs	3.6 × 10 ⁰	3.0 × 10 ⁻¹	---	---	2.1 × 10 ¹	1.6 × 10 ⁻²	---	---	1.1 × 10 ⁻²	---	---	2.8 × 10 ⁻²	3.7 × 10 ³	---	1.6 × 10 ⁻²	3.5 × 10 ²	1.4 × 10 ³	7.8 × 10 ¹	---	3.9 × 10 ⁻⁴	5.5 × 10 ³		
¹⁵² Eu	---	---	---	---	9.3 × 10 ⁻¹	---	---	---	6.8 × 10 ⁻⁸	---	---	9.2 × 10 ⁻¹	4.1 × 10 ⁻²	---	---	---	---	---	---	---	---	1.9 × 10 ⁰	
¹⁵⁴ Eu	---	---	---	---	9.3 × 10 ⁻¹	---	---	---	3.0 × 10 ⁻⁷	---	---	3.4 × 10 ⁻¹	1.2 × 10 ⁻¹	---	---	---	---	1.3 × 10 ⁻¹	---	---	---	1.5 × 10 ⁰	
¹⁵⁵ Eu	---	---	---	---	---	---	---	---	2.7 × 10 ⁻⁵	---	---	---	3.1 × 10 ⁻²	---	---	---	---	1.8 × 10 ⁻³	---	---	---	3.3 × 10 ⁻²	
²²¹ Fr	1.6 × 10 ⁻⁴	1.0 × 10 ⁻⁹	1.7 × 10 ⁻¹⁵	---	---	1.2 × 10 ⁻¹⁴	1.1 × 10 ⁰	---	1.4 × 10 ⁻³	---	1.5 × 10 ⁻¹²	2.7 × 10 ⁻³	2.2 × 10 ⁻¹	1.4 × 10 ⁻⁹	5.4 × 10 ⁻⁹	---	---	1.1 × 10 ⁻⁶	1.9 × 10 ⁻⁹	9.8 × 10 ⁻⁵	1.3 × 10 ⁰		
²²³ Fr	2.9 × 10 ⁻⁹	3.3 × 10 ⁻¹³	4.4 × 10 ⁻¹⁷	---	---	7.3 × 10 ⁻¹⁶	5.6 × 10 ⁻⁸	---	1.7 × 10 ⁻⁵	---	4.9 × 10 ⁻¹⁸	2.8 × 10 ⁻⁶	3.3 × 10 ⁻³	8.2 × 10 ⁻¹⁶	5.3 × 10 ⁻⁸	---	---	1.1 × 10 ⁻⁵	3.3 × 10 ⁻⁹	5.1 × 10 ⁻⁶	3.3 × 10 ⁻³		
¹⁵² Gd	---	---	---	---	---	---	---	---	4.1 × 10 ⁻²¹	---	---	3.9 × 10 ⁻¹⁴	1.9 × 10 ⁻¹⁵	---	---	---	---	---	---	---	---	4.1 × 10 ⁻¹⁴	
³ H	---	---	---	---	---	---	---	---	2.1 × 10 ²	---	---	5.2 × 10 ⁻²	---	---	---	3.4 × 10 ⁰	---	1.8 × 10 ⁻²	---	---	---	2.2 × 10 ²	
¹²⁹ I	---	---	---	---	7.0 × 10 ⁻⁶	---	---	---	---	---	---	---	---	---	---	---	5.0 × 10 ⁻⁴	---	---	---	---	5.1 × 10 ⁻⁴	
⁸⁵ Kr	---	---	---	---	---	---	---	---	---	---	---	1.4 × 10 ⁻¹	---	---	---	---	---	3.2 × 10 ⁻¹	---	---	---	4.6 × 10 ⁻¹	
²² Na	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3.9 × 10 ⁻⁷	---	3.9 × 10 ⁻⁷	
⁵⁹ Ni	---	---	---	---	7.6 × 10 ⁻²	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	7.6 × 10 ⁻²
⁶³ Ni	---	---	---	---	3.7 × 10 ⁰	---	---	---	---	---	---	---	1.2 × 10 ⁻⁴	---	---	---	---	---	---	---	---	---	3.7 × 10 ⁰
²³⁷ Np	6.9 × 10 ⁻¹	3.3 × 10 ⁻⁸	4.0 × 10 ⁻⁷	---	5.6 × 10 ⁻⁵	9.9 × 10 ⁻⁷	8.8 × 10 ⁻¹	---	4.0 × 10 ⁻²	---	4.7 × 10 ⁻⁴	6.5 × 10 ⁻³	8.0 × 10 ⁻¹	4.1 × 10 ⁻²	2.5 × 10 ⁻¹	---	3.2 × 10 ⁻³	1.4 × 10 ⁻¹	4.8 × 10 ⁻²	5.4 × 10 ⁻¹	---	3.4 × 10 ⁰	
²³⁸ Np	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.4 × 10 ⁻⁴
²³⁹ Np	---	---	---	---	---	---	6.3 × 10 ⁻³	---	3.7 × 10 ⁻³	---	---	1.2 × 10 ⁰	9.2 × 10 ⁰	---	---	---	---	---	---	---	---	1.0 × 10 ¹	
^{240m} Np	---	---	---	---	---	---	5.1 × 10 ⁻¹⁴	---	1.8 × 10 ⁻⁷	---	---	1.0 × 10 ⁻⁶	5.7 × 10 ⁻⁹	---	---	---	---	---	---	---	---	1.2 × 10 ⁻⁶	
²³¹ Pa	9.9 × 10 ⁻⁷	1.6 × 10 ⁻⁹	4.0 × 10 ⁻¹⁴	---	---	4.1 × 10 ⁻¹³	2.2 × 10 ⁻⁵	---	2.9 × 10 ⁻⁶	---	8.8 × 10 ⁻¹⁵	5.1 × 10 ⁻⁴	5.7 × 10 ⁻¹	4.8 × 10 ⁻¹³	2.3 × 10 ⁻⁵	---	---	5.6 × 10 ⁻³	1.0 × 10 ⁻⁶	5.0 × 10 ⁻⁴	---	5.8 × 10 ⁻¹	
²³³ Pa	6.9 × 10 ⁻¹	3.3 × 10 ⁻⁸	4.0 × 10 ⁻⁷	---	---	9.8 × 10 ⁻⁷	8.7 × 10 ⁻¹	---	4.0 × 10 ⁻²	---	4.7 × 10 ⁻⁴	6.4 × 10 ⁻³	7.9 × 10 ⁻¹	4.1 × 10 ⁻²	2.5 × 10 ⁻¹	---	---	1.4 × 10 ⁻¹	4.8 × 10 ⁻²	5.3 × 10 ⁻¹	---	3.4 × 10 ⁰	

Table DATA-F-35. CH-TRU Waste Curies on a Site-by-Site Basis ¹ — Continued

Radionuclide	AE	AW	MC	BC	BT	ET	IN	KN	LA	LL	MU	NT	OR	PA	RF	RL	RP	SA	SR	WP	Total Of Curies
²³⁴ Pa	6.7 × 10 ⁻⁵	3.5 × 10 ⁻¹⁰	---	---	---	5.4 × 10 ⁻¹⁸	3.0 × 10 ⁻⁵	---	2.7 × 10 ⁻⁴	---	3.1 × 10 ⁻¹⁰	2.0 × 10 ⁻⁷	8.7 × 10 ⁻⁵	---	2.3 × 10 ⁻⁴	---	---	1.2 × 10 ⁻⁵	---	8.4 × 10 ⁻³	9.1 × 10 ⁻³
^{234m} Pa	5.2 × 10 ⁻²	2.7 × 10 ⁻⁷	---	---	---	4.1 × 10 ⁻¹⁵	2.3 × 10 ⁻²	---	2.0 × 10 ⁻¹	---	2.4 × 10 ⁻⁷	1.5 × 10 ⁻⁴	6.7 × 10 ⁻²	---	1.8 × 10 ⁻¹	---	---	8.9 × 10 ⁻³	---	6.5 × 10 ⁰	7.0 × 10 ⁰
²⁰⁹ Pb	1.6 × 10 ⁻⁴	1.0 × 10 ⁻⁹	1.7 × 10 ⁻¹⁵	---	---	1.2 × 10 ⁻¹⁴	1.1 × 10 ⁰	---	1.4 × 10 ⁻³	---	1.5 × 10 ⁻¹²	2.7 × 10 ⁻³	2.2 × 10 ⁻¹	1.4 × 10 ⁻⁹	5.4 × 10 ⁻⁹	---	---	1.1 × 10 ⁻⁶	1.9 × 10 ⁻⁹	9.8 × 10 ⁻⁵	1.3 × 10 ⁰
²¹⁰ Pb	6.3 × 10 ⁻¹⁰	1.7 × 10 ⁻¹⁴	---	---	---	9.4 × 10 ⁻¹²	2.7 × 10 ⁻⁸	---	1.0 × 10 ⁻⁶	---	---	9.9 × 10 ⁻²	1.2 × 10 ⁰	5.5 × 10 ⁻⁵	2.6 × 10 ⁻⁸	---	---	1.1 × 10 ⁻²	5.3 × 10 ⁻⁶	2.4 × 10 ⁻⁷	1.3 × 10 ⁰
²¹¹ Pb	2.1 × 10 ⁻⁷	2.4 × 10 ⁻¹¹	3.2 × 10 ⁻¹⁵	---	---	5.3 × 10 ⁻¹⁴	4.0 × 10 ⁻⁶	---	1.3 × 10 ⁻³	---	3.6 × 10 ⁻¹⁶	2.0 × 10 ⁻⁴	2.4 × 10 ⁻¹	6.0 × 10 ⁻¹⁴	3.8 × 10 ⁻⁶	---	---	8.2 × 10 ⁻⁴	2.4 × 10 ⁻⁷	3.7 × 10 ⁻⁴	2.4 × 10 ⁻¹
²¹² Pb	4.2 × 10 ⁻¹	---	---	---	---	2.3 × 10 ⁻¹⁸	4.1 × 10 ⁰	---	1.7 × 10 ⁻⁶	---	---	1.6 × 10 ⁻²	4.9 × 10 ⁻¹	---	3.1 × 10 ⁻¹³	---	---	8.5 × 10 ⁻³	8.7 × 10 ⁻¹³	4.4 × 10 ⁻⁷	5.1 × 10 ⁰
²¹⁴ Pb	4.3 × 10 ⁻⁹	1.8 × 10 ⁻¹²	---	---	---	7.7 × 10 ⁻¹¹	2.9 × 10 ⁻⁷	---	2.3 × 10 ⁻⁶	---	2.7 × 10 ⁻²⁰	2.5 × 10 ⁻¹	2.8 × 10 ⁰	3.1 × 10 ⁻⁴	2.3 × 10 ⁻⁷	---	---	5.0 × 10 ⁻²	2.8 × 10 ⁻⁵	7.8 × 10 ⁻⁶	3.1 × 10 ⁰
¹⁴⁷ Pm	---	---	---	---	9.3 × 10 ⁻¹	---	---	---	---	---	---	---	9.5 × 10 ⁻²	---	---	---	---	6.9 × 10 ⁻¹	---	---	1.7 × 10 ⁰
²¹⁰ Po	6.3 × 10 ⁻¹⁰	5.5 × 10 ⁻¹⁵	---	---	---	9.4 × 10 ⁻¹²	2.7 × 10 ⁻⁸	---	1.0 × 10 ⁻⁶	---	---	9.9 × 10 ⁻²	1.2 × 10 ⁰	5.5 × 10 ⁻⁵	2.6 × 10 ⁻⁸	---	---	1.1 × 10 ⁻²	5.3 × 10 ⁻⁶	1.3 × 10 ⁻⁷	1.3 × 10 ⁰
²¹¹ Po	6.4 × 10 ⁻¹⁰	7.4 × 10 ⁻¹⁴	9.7 × 10 ⁻¹⁸	---	---	1.6 × 10 ⁻¹⁶	1.2 × 10 ⁻⁸	---	3.8 × 10 ⁻⁶	---	1.1 × 10 ⁻¹⁸	6.1 × 10 ⁻⁷	7.2 × 10 ⁻⁴	1.8 × 10 ⁻¹⁶	1.2 × 10 ⁻⁸	---	---	2.5 × 10 ⁻⁶	7.2 × 10 ⁻¹⁰	1.1 × 10 ⁻⁶	7.3 × 10 ⁻⁴
²¹² Po	2.7 × 10 ⁻¹	---	---	---	---	1.5 × 10 ⁻¹⁸	2.6 × 10 ⁰	---	1.1 × 10 ⁻⁶	---	---	1.0 × 10 ⁻²	3.2 × 10 ⁻¹	---	2.0 × 10 ⁻¹³	---	---	5.4 × 10 ⁻³	5.6 × 10 ⁻¹³	2.8 × 10 ⁻⁷	3.2 × 10 ⁰
²¹³ Po	1.6 × 10 ⁻⁴	9.8 × 10 ⁻¹⁰	1.7 × 10 ⁻¹⁵	---	---	1.2 × 10 ⁻¹⁴	1.1 × 10 ⁰	---	1.4 × 10 ⁻³	---	1.5 × 10 ⁻¹²	2.7 × 10 ⁻³	2.2 × 10 ⁻¹	1.4 × 10 ⁻⁹	5.3 × 10 ⁻⁹	---	---	1.1 × 10 ⁻⁶	1.8 × 10 ⁻⁹	9.6 × 10 ⁻⁵	1.3 × 10 ⁰
²¹⁴ Po	4.3 × 10 ⁻⁹	1.8 × 10 ⁻¹²	---	---	---	7.7 × 10 ⁻¹¹	2.9 × 10 ⁻⁷	---	2.3 × 10 ⁻⁶	---	2.7 × 10 ⁻²⁰	2.5 × 10 ⁻¹	2.8 × 10 ⁰	3.1 × 10 ⁻⁴	2.3 × 10 ⁻⁷	---	---	5.0 × 10 ⁻²	2.8 × 10 ⁻⁵	7.8 × 10 ⁻⁶	3.1 × 10 ⁰
²¹⁵ Po	2.1 × 10 ⁻⁷	2.4 × 10 ⁻¹¹	3.2 × 10 ⁻¹⁵	---	---	5.3 × 10 ⁻¹⁴	4.0 × 10 ⁻⁶	---	1.3 × 10 ⁻³	---	3.6 × 10 ⁻¹⁶	2.0 × 10 ⁻⁴	2.4 × 10 ⁻¹	6.0 × 10 ⁻¹⁴	3.8 × 10 ⁻⁶	---	---	8.2 × 10 ⁻⁴	2.4 × 10 ⁻⁷	3.7 × 10 ⁻⁴	2.4 × 10 ⁻¹
²¹⁶ Po	4.2 × 10 ⁻¹	---	---	---	---	2.3 × 10 ⁻¹⁸	4.1 × 10 ⁰	---	1.7 × 10 ⁻⁶	---	---	1.6 × 10 ⁻²	4.9 × 10 ⁻¹	---	3.1 × 10 ⁻¹³	---	---	8.5 × 10 ⁻³	8.7 × 10 ⁻¹³	4.4 × 10 ⁻⁷	5.1 × 10 ⁰
²¹⁸ Po	4.2 × 10 ⁻⁹	1.7 × 10 ⁻¹²	---	---	---	7.5 × 10 ⁻¹¹	2.8 × 10 ⁻⁷	---	2.3 × 10 ⁻⁶	---	2.7 × 10 ⁻²⁰	2.5 × 10 ⁻¹	2.8 × 10 ⁰	3.0 × 10 ⁻⁴	2.3 × 10 ⁻⁷	---	---	4.9 × 10 ⁻²	2.7 × 10 ⁻⁵	7.7 × 10 ⁻⁶	3.1 × 10 ⁰
¹⁴⁴ Pr	---	---	---	---	---	---	---	---	---	---	---	---	1.1 × 10 ⁻⁷	---	---	---	---	3.5 × 10 ⁻⁴	---	---	3.5 × 10 ⁻⁴
²³⁶ Pu	2.1 × 10 ⁻⁷	---	---	---	---	---	4.4 × 10 ⁻⁴	---	---	---	---	---	---	---	---	---	---	---	---	---	4.4 × 10 ⁻⁴
²³⁸ Pu	1.4 × 10 ¹	1.5 × 10 ²	---	1.8 × 10 ³	9.3 × 10 ⁻¹	1.2 × 10 ⁻²	6.9 × 10 ⁴	1.3 × 10 ¹	9.9 × 10 ⁴	5.5 × 10 ²	---	1.6 × 10 ²	5.3 × 10 ³	---	2.7 × 10 ³	1.1 × 10 ⁵	2.2 × 10 ¹	1.7 × 10 ⁰	1.0 × 10 ⁶	5.4 × 10 ³	1.3 × 10 ⁶
²³⁹ Pu	1.9 × 10 ²	1.2 × 10 ²	6.1 × 10 ⁻²	2.9 × 10 ¹	7.3 × 10 ⁻⁴	2.1 × 10 ⁻¹	5.7 × 10 ⁴	1.6 × 10 ²	1.1 × 10 ⁴	3.1 × 10 ³	5.3 × 10 ⁻²	2.9 × 10 ³	1.3 × 10 ³	2.7 × 10 ⁻¹	7.4 × 10 ⁴	7.2 × 10 ⁴	3.2 × 10 ³	4.6 × 10 ⁰	2.0 × 10 ⁵	1.4 × 10 ⁵	5.6 × 10 ⁵
²⁴⁰ Pu	1.0 × 10 ²	7.0 × 10 ⁻¹	---	7.5 × 10 ⁰	1.5 × 10 ⁻³	8.1 × 10 ⁻²	7.6 × 10 ³	5.3 × 10 ¹	3.7 × 10 ³	1.4 × 10 ³	---	6.3 × 10 ¹	1.3 × 10 ³	---	1.7 × 10 ⁴	1.9 × 10 ⁴	2.7 × 10 ²	5.0 × 10 ⁻¹	4.9 × 10 ³	3.1 × 10 ⁴	8.6 × 10 ⁴
²⁴¹ Pu	2.6 × 10 ²	6.2 × 10 ⁻¹	1.9 × 10 ⁻¹	3.6 × 10 ²	1.6 × 10 ⁻¹	8.9 × 10 ⁻¹	5.1 × 10 ⁴	2.8 × 10 ²	3.1 × 10 ⁴	4.3 × 10 ⁴	---	1.4 × 10 ³	4.3 × 10 ⁴	---	1.8 × 10 ⁵	1.1 × 10 ⁶	5.4 × 10 ²	6.7 × 10 ⁰	9.7 × 10 ⁴	3.4 × 10 ⁵	1.9 × 10 ⁶
²⁴² Pu	6.9 × 10 ⁻²	8.8 × 10 ⁻⁶	---	1.2 × 10 ⁻³	1.2 × 10 ⁻⁵	2.0 × 10 ⁻⁶	1.2 × 10 ¹	4.1 × 10 ⁻⁴	8.2 × 10 ⁻¹	---	---	8.9 × 10 ⁻²	3.8 × 10 ⁻¹	---	1.7 × 10 ⁰	4.0 × 10 ⁰	7.7 × 10 ⁻³	7.7 × 10 ⁻⁸	---	3.0 × 10 ⁰	2.2 × 10 ¹
²⁴³ Pu	---	---	---	---	---	---	---	---	---	---	---	---	1.3 × 10 ⁻¹⁰	---	---	---	---	---	---	---	1.3 × 10 ⁻¹⁰
²⁴⁴ Pu	---	---	---	---	6.6 × 10 ⁻¹³	---	5.0 × 10 ⁻¹⁴	---	1.8 × 10 ⁻⁷	---	---	1.0 × 10 ⁻⁶	5.7 × 10 ⁻⁹	---	---	---	---	---	---	---	1.2 × 10 ⁻⁶

Table DATA-F-35. CH-TRU Waste Curies on a Site-by-Site Basis ¹ — Continued

Radionuclide	AE	AW	MC	BC	BT	ET	IN	KN	LA	LL	MU	NT	OR	PA	RF	RL	RP	SA	SR	WP	Total Of Curies
²²³ Ra	2.1 × 10 ⁻⁷	2.4 × 10 ⁻¹¹	3.2 × 10 ⁻¹⁵	---	---	5.3 × 10 ⁻¹⁴	4.1 × 10 ⁻⁶	---	1.3 × 10 ⁻³	---	3.6 × 10 ⁻¹⁶	2.0 × 10 ⁻⁴	2.4 × 10 ⁻¹	6.0 × 10 ⁻¹⁴	3.9 × 10 ⁻⁶	---	---	8.3 × 10 ⁻⁴	2.4 × 10 ⁻⁷	3.7 × 10 ⁻⁴	2.4 × 10 ⁻¹
²²⁴ Ra	4.2 × 10 ⁻¹	---	---	---	---	2.3 × 10 ⁻¹⁸	4.1 × 10 ⁰	---	1.7 × 10 ⁻⁶	---	---	1.6 × 10 ⁻²	4.9 × 10 ⁻¹	---	3.1 × 10 ⁻¹³	---	---	8.5 × 10 ⁻³	8.7 × 10 ⁻¹³	4.4 × 10 ⁻⁷	5.1 × 10 ⁰
²²⁵ Ra	1.6 × 10 ⁻⁴	1.0 × 10 ⁻⁹	1.7 × 10 ⁻¹⁵	---	---	1.2 × 10 ⁻¹⁴	1.1 × 10 ⁰	---	1.4 × 10 ⁻³	---	1.5 × 10 ⁻¹²	2.7 × 10 ⁻³	2.2 × 10 ⁻¹	1.4 × 10 ⁻⁹	5.4 × 10 ⁻⁹	---	---	1.1 × 10 ⁻⁶	1.9 × 10 ⁻⁹	9.9 × 10 ⁻⁵	1.3 × 10 ⁰
²²⁶ Ra	4.3 × 10 ⁻⁹	1.8 × 10 ⁻¹²	---	---	---	7.7 × 10 ⁻¹¹	2.9 × 10 ⁻⁷	---	2.3 × 10 ⁻⁶	---	2.8 × 10 ⁻²⁰	2.5 × 10 ⁻¹	2.9 × 10 ⁰	3.1 × 10 ⁻⁴	2.3 × 10 ⁻⁷	---	---	5.1 × 10 ⁻²	2.8 × 10 ⁻⁵	7.9 × 10 ⁻⁶	3.2 × 10 ⁰
²²⁸ Ra	5.8 × 10 ⁻⁵	---	---	---	---	4.4 × 10 ⁻¹⁸	5.7 × 10 ⁰	---	1.1 × 10 ⁻⁶	---	---	2.2 × 10 ⁻¹⁵	1.3 × 10 ⁻³	---	6.4 × 10 ⁻¹³	---	---	4.3 × 10 ⁻³	1.1 × 10 ⁻¹²	1.0 × 10 ⁻⁶	5.7 × 10 ⁰
¹⁰⁶ Rh	---	---	---	---	---	---	---	---	8.5 × 10 ⁻¹¹	---	---	---	2.4 × 10 ⁻⁵	---	---	---	---	1.1 × 10 ⁻⁴	---	---	1.3 × 10 ⁻⁴
²¹⁹ Rn	2.1 × 10 ⁻⁷	2.4 × 10 ⁻¹¹	3.2 × 10 ⁻¹⁵	---	---	5.3 × 10 ⁻¹⁴	4.0 × 10 ⁻⁶	---	1.3 × 10 ⁻³	---	3.6 × 10 ⁻¹⁶	2.0 × 10 ⁻⁴	2.4 × 10 ⁻¹	6.0 × 10 ⁻¹⁴	3.8 × 10 ⁻⁶	---	---	8.2 × 10 ⁻⁴	2.4 × 10 ⁻⁷	3.7 × 10 ⁻⁴	2.4 × 10 ⁻¹
²²⁰ Rn	4.2 × 10 ⁻¹	---	---	---	---	2.3 × 10 ⁻¹⁸	4.1 × 10 ⁰	---	1.7 × 10 ⁻⁶	---	---	1.6 × 10 ⁻²	4.9 × 10 ⁻¹	---	3.1 × 10 ⁻¹³	---	---	8.5 × 10 ⁻³	8.7 × 10 ⁻¹³	4.4 × 10 ⁻⁷	5.1 × 10 ⁰
²²² Rn	4.3 × 10 ⁻⁹	1.8 × 10 ⁻¹²	---	---	---	7.7 × 10 ⁻¹¹	2.9 × 10 ⁻⁷	---	2.3 × 10 ⁻⁶	---	2.7 × 10 ⁻²⁰	2.5 × 10 ⁻¹	2.8 × 10 ⁰	3.1 × 10 ⁻⁴	2.3 × 10 ⁻⁷	---	---	5.0 × 10 ⁻²	2.8 × 10 ⁻⁵	7.8 × 10 ⁻⁶	3.1 × 10 ⁰
¹⁰⁶ Ru	---	---	---	---	---	---	---	---	8.6 × 10 ⁻¹¹	---	---	---	2.4 × 10 ⁻⁵	---	---	---	---	1.1 × 10 ⁻⁴	---	---	1.3 × 10 ⁻⁴
¹²⁵ Sb	---	---	---	---	---	---	---	---	2.9 × 10 ⁻⁶	---	---	---	2.4 × 10 ⁻³	---	---	---	---	---	---	---	2.4 × 10 ⁻³
⁷⁹ Se	---	---	---	---	1.3 × 10 ⁻⁴	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.3 × 10 ⁻⁴
¹⁴⁷ Sm	---	---	---	---	---	---	---	---	---	---	---	---	2.0 × 10 ⁻¹⁰	---	---	---	---	4.6 × 10 ⁻¹¹	---	---	2.5 × 10 ⁻¹⁰
¹⁵¹ Sm	---	---	---	---	1.0 × 10 ⁻¹	---	---	---	---	---	---	---	---	---	---	---	5.6 × 10 ¹	2.7 × 10 ⁻¹	---	---	5.7 × 10 ¹
⁹⁰ Sr	2.6 × 10 ⁰	1.5 × 10 ⁰	---	---	2.1 × 10 ¹	1.2 × 10 ⁻²	---	---	---	---	---	9.5 × 10 ⁻⁵	2.2 × 10 ³	---	---	1.4 × 10 ²	5.3 × 10 ⁴	7.4 × 10 ¹	---	---	5.5 × 10 ⁴
⁹⁹ Tc	5.8 × 10 ⁰	---	---	---	4.7 × 10 ⁻³	---	---	2.5 × 10 ⁻²	---	---	---	---	3.1 × 10 ¹	2.9 × 10 ⁰	---	4.1 × 10 ⁻³	8.9 × 10 ¹	1.6 × 10 ⁻³	---	---	1.3 × 10 ²
¹²³ Te	---	---	---	---	---	---	---	---	---	---	---	---	3.2 × 10 ⁻⁵	---	---	---	---	---	---	---	3.2 × 10 ⁻⁵
^{123m} Te	---	---	---	---	---	---	---	---	---	---	---	---	2.4 × 10 ⁻¹⁹	---	---	---	---	---	---	---	2.4 × 10 ⁻¹⁹
^{125m} Te	---	---	---	---	---	---	---	---	7.1 × 10 ⁻⁷	---	---	---	5.8 × 10 ⁻⁴	---	---	---	---	---	---	---	5.8 × 10 ⁻⁴
²²⁷ Th	2.1 × 10 ⁻⁷	2.4 × 10 ⁻¹¹	3.1 × 10 ⁻¹⁵	---	---	5.2 × 10 ⁻¹⁴	4.0 × 10 ⁻⁶	---	1.2 × 10 ⁻³	---	3.5 × 10 ⁻¹⁶	2.0 × 10 ⁻⁴	2.3 × 10 ⁻¹	5.9 × 10 ⁻¹⁴	3.8 × 10 ⁻⁶	---	---	8.1 × 10 ⁻⁴	2.3 × 10 ⁻⁷	3.6 × 10 ⁻⁴	2.4 × 10 ⁻¹
²²⁸ Th	4.2 × 10 ⁻¹	---	---	---	---	2.3 × 10 ⁻¹⁸	4.2 × 10 ⁰	1.7 × 10 ⁻⁴	1.7 × 10 ⁻⁶	---	---	1.6 × 10 ⁻²	5.0 × 10 ⁻¹	---	3.2 × 10 ⁻¹³	---	---	8.5 × 10 ⁻³	8.8 × 10 ⁻¹³	4.4 × 10 ⁻⁷	5.1 × 10 ⁰
²²⁹ Th	1.6 × 10 ⁻⁴	1.0 × 10 ⁻⁹	1.7 × 10 ⁻¹⁵	---	---	1.2 × 10 ⁻¹⁴	1.1 × 10 ⁰	---	1.4 × 10 ⁻³	---	1.5 × 10 ⁻¹²	2.7 × 10 ⁻³	2.3 × 10 ⁻¹	1.4 × 10 ⁻⁹	5.4 × 10 ⁻⁹	---	---	1.1 × 10 ⁻⁶	1.9 × 10 ⁻⁹	9.9 × 10 ⁻⁵	1.3 × 10 ⁰
²³⁰ Th	1.3 × 10 ⁻⁶	8.9 × 10 ⁻⁹	---	---	---	2.8 × 10 ⁻⁸	1.6 × 10 ⁻⁴	---	5.6 × 10 ⁻⁵	---	4.8 × 10 ⁻¹⁷	1.2 × 10 ⁻⁶	3.2 × 10 ⁻³	5.6 × 10 ⁻²	9.1 × 10 ⁻⁵	---	---	8.5 × 10 ⁻⁶	7.0 × 10 ⁻³	4.9 × 10 ⁻⁵	6.6 × 10 ⁻²
²³¹ Th	2.9 × 10 ⁻³	7.3 × 10 ⁻⁵	4.7 × 10 ⁻¹⁰	---	---	2.8 × 10 ⁻⁹	8.1 × 10 ⁻²	---	5.8 × 10 ⁻³	---	2.1 × 10 ⁻¹⁰	1.5 × 10 ⁻⁴	1.0 × 10 ⁻²	3.5 × 10 ⁻⁹	9.0 × 10 ⁻²	---	---	1.2 × 10 ⁻²	3.9 × 10 ⁻³	1.2 × 10 ⁻¹	3.3 × 10 ⁻¹
²³² Th	6.2 × 10 ⁻⁵	5.1 × 10 ⁻¹⁹	---	---	5.6 × 10 ⁻¹⁴	1.1 × 10 ⁻¹⁷	6.6 × 10 ⁰	2.9 × 10 ⁻⁵	1.1 × 10 ⁻⁶	---	---	4.9 × 10 ⁻¹⁵	1.3 × 10 ⁻³	---	1.8 × 10 ⁻¹²	4.4 × 10 ⁻²	---	3.9 × 10 ⁻³	1.8 × 10 ⁻¹²	2.6 × 10 ⁻⁶	6.6 × 10 ⁰

Table DATA-F-35. CH-TRU Waste Curies on a Site-by-Site Basis ¹ — Continued

Radionuclide	AE	AW	MC	BC	BT	ET	IN	KN	LA	LL	MU	NT	OR	PA	RF	RL	RP	SA	SR	WP	Total Of Curies	
²³⁴ Th	5.2 × 10 ⁻²	2.7 × 10 ⁻⁷	---	---	---	4.1 × 10 ⁻¹⁵	2.3 × 10 ⁻²	---	2.1 × 10 ⁻¹	---	2.4 × 10 ⁻⁷	1.5 × 10 ⁻⁴	6.7 × 10 ⁻²	---	1.8 × 10 ⁻¹	---	---	8.9 × 10 ⁻³	---	6.5 × 10 ⁰	7.0 × 10 ⁰	
²⁰⁷ Tl	2.1 × 10 ⁻⁷	2.4 × 10 ⁻¹¹	3.2 × 10 ⁻¹⁵	---	---	5.3 × 10 ⁻¹⁴	4.0 × 10 ⁻⁶	---	1.3 × 10 ⁻³	---	3.5 × 10 ⁻¹⁶	2.0 × 10 ⁻⁴	2.3 × 10 ⁻¹	5.9 × 10 ⁻¹⁴	3.8 × 10 ⁻⁶	---	---	8.1 × 10 ⁻⁴	2.3 × 10 ⁻⁷	3.7 × 10 ⁻⁴	2.4 × 10 ⁻¹	
²⁰⁸ Tl	1.5 × 10 ⁻¹	---	---	---	---	8.2 × 10 ⁻¹⁹	1.5 × 10 ⁰	---	6.1 × 10 ⁻⁷	---	---	5.7 × 10 ⁻³	1.8 × 10 ⁻¹	---	1.1 × 10 ⁻¹³	---	---	3.1 × 10 ⁻³	3.1 × 10 ⁻¹³	1.6 × 10 ⁻⁷	1.8 × 10 ⁰	
²⁰⁹ Tl	3.5 × 10 ⁻⁶	2.2 × 10 ⁻¹¹	3.8 × 10 ⁻¹⁷	---	---	2.7 × 10 ⁻¹⁶	2.4 × 10 ⁻²	---	3.1 × 10 ⁻⁵	---	3.3 × 10 ⁻¹⁴	6.0 × 10 ⁻⁵	4.9 × 10 ⁻³	3.1 × 10 ⁻¹¹	1.2 × 10 ⁻¹⁰	---	---	2.4 × 10 ⁻⁸	4.1 × 10 ⁻¹¹	2.2 × 10 ⁻⁶	2.9 × 10 ⁻²	
²³² U	4.1 × 10 ⁻¹	---	---	---	1.3 × 10 ⁻⁵	---	3.6 × 10 ⁻⁴	1.7 × 10 ⁻⁴	7.3 × 10 ⁻⁷	---	---	1.6 × 10 ⁻²	4.9 × 10 ⁻¹	---	---	---	---	---	---	---	9.1 × 10 ⁻¹	
²³³ U	1.1 × 10 ⁻¹	1.1 × 10 ⁻⁵	6.9 × 10 ⁻¹²	---	---	2.9 × 10 ⁻¹¹	8.8 × 10 ²	1.5 × 10 ⁻²	5.7 × 10 ⁻¹	---	8.0 × 10 ⁻⁹	1.8 × 10 ⁰	1.4 × 10 ²	2.3 × 10 ⁻⁶	1.0 × 10 ⁻⁵	5.3 × 10 ¹	1.1 × 10 ⁻⁵	2.4 × 10 ⁻³	2.3 × 10 ⁻⁶	2.7 × 10 ⁻¹	1.1 × 10 ³	
²³⁴ U	9.1 × 10 ⁻³	1.2 × 10 ⁻³	---	---	2.0 × 10 ⁻³	2.4 × 10 ⁻⁴	2.6 × 10 ⁰	1.1 × 10 ⁻³	7.6 × 10 ⁻¹	---	2.7 × 10 ⁻¹²	1.2 × 10 ⁻²	2.1 × 10 ¹	---	8.9 × 10 ⁻¹	3.3 × 10 ¹	1.3 × 10 ¹	1.9 × 10 ⁻¹	6.3 × 10 ¹	1.3 × 10 ⁰	1.3 × 10 ²	
²³⁵ U	2.9 × 10 ⁻³	7.4 × 10 ⁻⁵	4.8 × 10 ⁻¹⁰	---	2.6 × 10 ⁻⁵	2.8 × 10 ⁻⁹	8.2 × 10 ⁻²	5.1 × 10 ⁻⁵	5.8 × 10 ⁻³	---	2.1 × 10 ⁻¹⁰	1.5 × 10 ⁻⁴	1.0 × 10 ⁻²	3.5 × 10 ⁻⁹	9.1 × 10 ⁻²	3.9 × 10 ⁻¹	5.8 × 10 ⁻¹	1.2 × 10 ⁻²	4.0 × 10 ⁻³	1.2 × 10 ⁻¹	1.3 × 10 ⁰	
²³⁶ U	6.7 × 10 ⁻⁵	2.1 × 10 ⁻⁸	---	---	3.0 × 10 ⁻⁴	3.3 × 10 ⁻⁸	2.9 × 10 ⁻³	---	2.6 × 10 ⁻³	---	---	1.2 × 10 ⁻⁵	8.1 × 10 ⁻⁴	---	6.0 × 10 ⁻³	1.6 × 10 ⁻⁵	1.0 × 10 ⁻¹	7.4 × 10 ⁻⁸	3.0 × 10 ⁻³	4.5 × 10 ⁻³	1.3 × 10 ⁻¹	
²³⁷ U	6.3 × 10 ⁻³	1.5 × 10 ⁻⁵	4.6 × 10 ⁻⁶	---	---	2.2 × 10 ⁻⁵	1.3 × 10 ⁰	---	7.5 × 10 ⁻¹	---	---	6.0 × 10 ⁻³	1.1 × 10 ⁰	---	4.3 × 10 ⁰	---	---	1.6 × 10 ⁻⁴	2.4 × 10 ⁰	8.5 × 10 ⁰	1.8 × 10 ¹	
²³⁸ U	5.2 × 10 ⁻²	2.7 × 10 ⁻⁷	---	---	1.2 × 10 ⁻⁷	4.2 × 10 ⁻¹⁵	2.3 × 10 ⁻²	4.0 × 10 ⁻³	2.1 × 10 ⁻¹	---	2.4 × 10 ⁻⁷	1.6 × 10 ⁻⁴	6.8 × 10 ⁻²	---	1.8 × 10 ⁻¹	4.0 × 10 ⁰	1.3 × 10 ¹	9.0 × 10 ⁻³	---	6.5 × 10 ⁰	2.4 × 10 ¹	
²⁴⁰ U	---	---	---	---	---	---	5.0 × 10 ⁻¹⁴	---	1.8 × 10 ⁻⁷	---	---	1.0 × 10 ⁻⁶	5.6 × 10 ⁻⁹	---	---	---	---	---	---	---	1.2 × 10 ⁻⁶	
⁹⁰ Y	2.6 × 10 ⁰	1.5 × 10 ⁰	---	---	2.1 × 10 ¹	1.1 × 10 ⁻²	---	---	---	---	---	9.4 × 10 ⁻⁵	2.2 × 10 ³	---	---	1.4 × 10 ²	5.3 × 10 ⁴	7.3 × 10 ¹	---	---	5.5 × 10 ⁴	
⁶⁵ Zn	---	---	---	---	---	---	---	---	---	---	---	---	1.1 × 10 ⁻¹⁰	---	---	---	---	---	---	---	---	1.1 × 10 ⁻¹⁰
⁹³ Zr	---	---	---	---	1.1 × 10 ⁻³	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1.1 × 10 ⁻³
Total:	6.5 × 10 ²	2.7 × 10 ²	4.0 × 10 ⁻¹	2.2 × 10 ³	9.3 × 10 ¹	1.5 × 10	3.5 × 10 ⁵	5.8 × 10 ²	1.6 × 10 ⁵	5.3 × 10 ⁴	2.22 × 10 ⁰	4.86 × 10 ³	6.68 × 10 ⁴	3.36 × 10 ⁰	2.96 × 10 ⁵	1.33 × 10 ⁶	1.13 × 10 ⁵	3.27 × 10 ²	1.33 × 10 ⁶	6.38 × 10 ⁵	4.34 × 10 ⁶	

¹Decayed through December 31, 2001

Table DATA-F-36. RH-TRU Waste Curies on a Site-by-Site Basis ¹

Radionuclide	AE	AW	BC	BT	ET	IN	KA	LA	OR	RL	RP	SA	SR	Total Of Curies
²²⁵ Ac	4.6×10^{-7}	1.2×10^{-4}	---	---	3.2×10^{-14}	2.2×10^{-13}	9.6×10^{-10}	6.1×10^{-15}	2.1×10^{-1}	---	---	4.6×10^{-12}	---	2.1×10^{-1}
²²⁷ Ac	2.9×10^{-8}	3.3×10^{-8}	---	---	1.8×10^{-8}	2.1×10^{-8}	4.9×10^{-8}	2.4×10^{-8}	2.3×10^{-5}	---	---	4.4×10^{-9}	---	2.3×10^{-5}
²²⁸ Ac	1.1×10^{-15}	1.2×10^{-14}	---	---	9.2×10^{-18}	2.4×10^{-16}	3.5×10^{-11}	1.0×10^{-16}	8.3×10^{-1}	---	---	1.2×10^{-18}	---	8.3×10^{-1}
¹¹⁰ Ag	---	---	---	---	---	---	---	---	1.1×10^{-10}	---	---	---	---	1.1×10^{-10}
^{110m} Ag	---	---	---	---	---	---	---	---	8.5×10^{-9}	---	---	---	---	8.5×10^{-9}
²⁴¹ Am	1.0×10^1	1.2×10^1	8.6×10^1	2.5×10^0	6.5×10^{-1}	3.0×10^1	3.0×10^{-2}	2.5×10^{-2}	3.2×10^2	4.5×10^3	1.1×10^4	2.1×10^1	---	1.6×10^4
²⁴² Am	---	5.0×10^{-3}	---	---	---	---	---	---	---	---	---	---	---	5.0×10^{-3}
^{242m} Am	---	5.0×10^{-3}	2.0×10^{-1}	---	---	---	---	---	---	---	---	---	---	2.1×10^{-1}
²⁴³ Am	3.2×10^{-5}	5.4×10^{-4}	6.7×10^{-1}	1.2×10^{-2}	---	---	5.3×10^{-5}	---	3.3×10^{-1}	---	---	---	4.1×10^{-2}	1.0×10^0
²¹⁷ At	4.6×10^{-7}	1.2×10^{-4}	---	---	3.2×10^{-14}	2.2×10^{-13}	9.6×10^{-10}	6.1×10^{-15}	2.1×10^{-1}	---	---	4.6×10^{-12}	---	2.1×10^{-1}
^{137m} Ba	4.3×10^1	1.6×10^3	---	6.2×10^3	9.2×10^0	1.9×10^2	7.2×10^1	1.5×10^1	1.5×10^4	2.6×10^5	1.2×10^5	4.6×10^2	5.8×10^1	4.0×10^5
²¹⁰ Bi	7.0×10^{-11}	4.3×10^{-11}	---	---	9.8×10^{-16}	9.2×10^{-11}	2.5×10^{-9}	9.1×10^{-12}	1.2×10^{-6}	---	---	1.8×10^{-11}	2.1×10^{-13}	1.2×10^{-6}
²¹¹ Bi	2.9×10^{-8}	3.3×10^{-8}	---	---	1.8×10^{-8}	2.1×10^{-8}	4.8×10^{-8}	2.4×10^{-8}	2.2×10^{-5}	---	---	4.3×10^{-9}	---	2.3×10^{-5}
²¹² Bi	1.1×10^{-15}	5.6×10^{-15}	---	---	5.4×10^{-18}	9.8×10^{-17}	1.0×10^{-5}	1.0×10^{-16}	1.6×10^1	---	---	3.2×10^{-19}	---	1.6×10^1
²¹³ Bi	4.6×10^{-7}	1.2×10^{-4}	---	---	3.2×10^{-14}	2.2×10^{-13}	9.6×10^{-10}	6.1×10^{-15}	2.1×10^{-1}	---	---	4.6×10^{-12}	---	2.1×10^{-1}
²¹⁴ Bi	3.8×10^{-10}	7.2×10^{-10}	---	---	1.7×10^{-14}	1.8×10^{-9}	9.5×10^{-9}	3.6×10^{-11}	7.9×10^{-6}	---	---	3.5×10^{-10}	3.5×10^{-12}	7.9×10^{-6}
¹⁴ C	---	---	---	1.6×10^{-1}	---	---	1.9×10^{-3}	---	4.8×10^{-4}	4.9×10^0	1.0×10^0	---	---	6.1×10^0
^{113m} Cd	5.9×10^{-1}	---	---	---	---	---	---	---	---	---	---	---	---	5.9×10^{-1}
¹⁴¹ Ce	---	4.3×10^{-19}	---	---	---	---	---	---	---	---	---	---	---	4.3×10^{-19}
¹⁴⁴ Ce	2.0×10^{-9}	7.3×10^0	---	---	---	---	---	---	6.2×10^{-7}	---	---	---	---	7.3×10^0
²⁴⁹ Cf	---	---	---	2.3×10^{-10}	---	---	4.0×10^{-12}	---	4.9×10^{-3}	---	---	---	---	4.9×10^{-3}
²⁵⁰ Cf	---	---	---	---	---	---	---	---	8.7×10^{-2}	---	---	---	---	8.7×10^{-2}
²⁵¹ Cf	---	---	---	1.1×10^{-11}	---	---	5.0×10^{-14}	---	9.3×10^{-4}	---	---	---	---	9.3×10^{-4}
²⁵² Cf	---	---	---	---	---	---	1.9×10^{-15}	---	1.0×10^{-1}	---	---	---	---	1.0×10^{-1}
²⁴² Cm	1.5×10^{-21}	4.2×10^{-3}	---	---	---	---	---	---	8.9×10^{-12}	---	---	---	---	4.2×10^{-3}
²⁴³ Cm	---	1.4×10^{-4}	4.6×10^{-1}	1.3×10^{-2}	---	---	1.5×10^{-5}	---	3.1×10^{-7}	---	---	3.8×10^{-2}	---	5.1×10^{-1}

Table DATA-F-36. RH-TRU Waste Curies on a Site-by-Site Basis ¹— Continued

Radionuclide	AE	AW	BC	BT	ET	IN	KA	LA	OR	RL	RP	SA	SR	Total Of Curies
²⁴⁴ Cm	1.9×10^{-1}	4.4×10^{-3}	6.8×10^1	7.6×10^{-1}	---	---	1.5×10^{-3}	---	1.2×10^3	---	---	4.2×10^{-1}	---	1.3×10^3
²⁴⁵ Cm	---	---	1.1×10^{-2}	8.1×10^{-5}	---	---	4.9×10^{-7}	---	6.9×10^{-6}	---	---	---	---	1.1×10^{-2}
²⁴⁶ Cm	---	---	1.6×10^{-4}	1.4×10^{-5}	---	---	6.3×10^{-8}	---	3.9×10^0	---	---	---	---	3.9×10^0
²⁴⁷ Cm	---	---	---	3.2×10^{-11}	---	---	1.5×10^{-13}	---	7.1×10^{-10}	---	---	---	5.5×10^1	5.5×10^1
²⁴⁸ Cm	---	---	---	5.8×10^{-11}	---	---	3.0×10^{-13}	---	1.1×10^{-2}	---	---	---	---	1.1×10^{-2}
⁶⁰ Co	2.2×10^{-1}	1.7×10^1	5.0×10^2	2.8×10^2	---	---	---	---	1.7×10^2	8.8×10^2	---	3.3×10^{-2}	---	1.8×10^3
¹³⁴ Cs	8.8×10^{-5}	2.5×10^1	2.7×10^{-4}	---	---	---	---	---	4.5×10^{-3}	---	---	1.6×10^1	---	4.2×10^1
¹³⁵ Cs	---	---	---	---	---	---	4.0×10^{-4}	---	---	---	---	---	---	4.0×10^{-4}
¹³⁷ Cs	4.5×10^1	1.7×10^3	2.3×10^3	6.4×10^3	9.8×10^0	2.0×10^2	7.7×10^1	1.6×10^1	1.6×10^4	2.8×10^5	1.2×10^5	4.9×10^2	6.2×10^1	4.3×10^5
¹⁵² Eu	1.7×10^{-4}	---	1.4×10^{-2}	2.8×10^2	---	---	---	---	2.4×10^3	---	---	---	---	2.7×10^3
¹⁵⁴ Eu	8.2×10^{-3}	3.6×10^0	3.8×10^{-1}	2.8×10^2	---	---	---	---	8.2×10^2	---	---	1.3×10^0	---	1.1×10^3
¹⁵⁵ Eu	1.0×10^{-2}	2.2×10^1	---	---	---	---	---	7.9×10^{-3}	8.2×10^1	---	---	---	---	1.0×10^2
⁵⁵ Fe	1.5×10^{-1}	---	---	---	---	---	---	---	---	---	---	---	---	1.5×10^{-1}
²²¹ Fr	4.6×10^{-7}	1.2×10^{-4}	---	---	3.2×10^{-14}	2.2×10^{-13}	9.6×10^{-10}	6.1×10^{-15}	2.1×10^{-1}	---	---	4.6×10^{-12}	---	2.1×10^{-1}
²²³ Fr	4.0×10^{-10}	4.5×10^{-10}	---	---	2.4×10^{-10}	2.9×10^{-10}	6.6×10^{-10}	3.3×10^{-10}	3.1×10^{-7}	---	---	6.0×10^{-11}	---	3.1×10^{-7}
¹⁵² Gd	1.7×10^{-17}	---	---	---	---	---	---	---	1.1×10^{-10}	---	---	---	---	1.1×10^{-10}
³ H	---	6.8×10^{-4}	---	---	---	---	---	---	2.6×10^{-1}	6.4×10^0	---	---	---	6.7×10^0
¹²⁹ I	---	---	---	2.1×10^{-3}	---	---	3.7×10^{-5}	---	---	1.9×10^{-3}	8.0×10^{-2}	---	---	8.4×10^{-2}
⁸⁵ Kr	4.1×10^{-1}	---	---	---	---	---	---	---	---	---	---	---	---	4.1×10^{-1}
⁵⁴ Mn	2.5×10^{-9}	2.1×10^0	---	---	---	---	---	---	---	---	---	---	---	2.1×10^0
²² Na	---	3.3×10^{-1}	---	---	---	---	---	---	---	---	---	---	---	3.3×10^{-1}
^{93m} Nb	9.2×10^{-4}	---	---	---	---	---	1.2×10^{-4}	---	---	---	---	---	---	1.0×10^{-3}
⁹⁵ Nb	---	2.4×10^{-13}	---	---	---	---	---	---	---	---	---	---	---	2.4×10^{-13}
^{95m} Nb	---	8.1×10^{-16}	---	---	---	---	---	---	---	---	---	---	---	8.1×10^{-16}
⁵⁹ Ni	---	---	---	2.3×10^1	---	---	1.7×10^{-4}	---	---	---	---	---	---	2.3×10^1
⁶³ Ni	---	---	---	1.1×10^3	---	---	1.9×10^{-2}	---	---	---	---	---	---	1.1×10^3
²³⁷ Np	1.7×10^{-3}	1.9×10^{-3}	1.2×10^{-2}	1.7×10^{-2}	2.6×10^{-6}	6.8×10^{-5}	8.5×10^{-4}	1.6×10^{-7}	1.8×10^{-3}	2.6×10^{-6}	6.4×10^{-1}	9.0×10^{-4}	---	6.7×10^{-1}

Table DATA-F-36. RH-TRU Waste Curies on a Site-by-Site Basis ¹— Continued

Radionuclide	AE	AW	BC	BT	ET	IN	KA	LA	OR	RL	RP	SA	SR	Total Of Curies
²³⁸ Np	---	2.5 × 10 ⁻⁵	---	---	---	---	---	---	---	---	---	---	---	2.5 X 10 ⁻⁵
²³⁹ Np	3.1 × 10 ⁻⁵	5.3 × 10 ⁻⁴	---	---	---	---	5.2 × 10 ⁻⁵	---	3.2 X 10 ⁻¹	---	---	---	4.1 X 10 ⁻²	3.7 X 10 ⁻¹
^{240m} Np	---	---	---	---	---	---	1.7 × 10 ⁻¹²	---	6.5 X 10 ⁻³	---	---	---	---	6.5 X 10 ⁻³
²³¹ Pa	8.9 × 10 ⁻⁸	3.7 × 10 ⁻⁷	---	---	1.5 × 10 ⁻⁷	2.0 × 10 ⁻⁷	9.7 × 10 ⁻⁸	6.6 X 10 ⁻⁸	9.9 X 10 ⁻⁵	---	---	5.8 X 10 ⁻⁸	5.3 X 10 ⁻¹⁹	1.0 X 10 ⁻⁴
²³³ Pa	1.6 × 10 ⁻³	1.9 × 10 ⁻³	---	---	2.6 × 10 ⁻⁶	6.7 × 10 ⁻⁵	8.4 × 10 ⁻⁴	1.6 X 10 ⁻⁷	1.8 X 10 ⁻³	---	---	9.0 X 10 ⁻⁴	---	7.1 X 10 ⁻³
²³⁴ Pa	7.8 × 10 ⁻⁸	5.9 × 10 ⁻⁷	---	---	2.9 × 10 ⁻⁶	1.4 × 10 ⁻¹⁵	4.1 × 10 ⁻¹⁰	5.7 X 10 ⁻¹⁰	1.6 X 10 ⁻²	---	---	2.4 X 10 ⁻⁷	---	1.6 X 10 ⁻²
^{234m} Pa	6.0 × 10 ⁻⁵	4.6 × 10 ⁻⁴	---	---	2.2 × 10 ⁻³	1.1 × 10 ⁻¹²	3.1 × 10 ⁻⁷	4.3 X 10 ⁻⁷	1.3 X 10 ¹	---	---	1.8 X 10 ⁻⁴	---	1.3 X 10 ¹
²⁰⁹ Pb	4.6 × 10 ⁻⁷	1.2 × 10 ⁻⁴	---	---	3.2 × 10 ⁻¹⁴	2.2 × 10 ⁻¹³	9.6 × 10 ⁻¹⁰	6.1 X 10 ⁻¹⁵	2.1 X 10 ⁻¹	---	---	4.6 X 10 ⁻¹²	---	2.1 X 10 ⁻¹
²¹⁰ Pb	7.0 × 10 ⁻¹¹	4.3 × 10 ⁻¹¹	---	---	9.9 × 10 ⁻¹⁶	9.3 × 10 ⁻¹¹	2.5 × 10 ⁻⁹	9.2 X 10 ⁻¹²	1.2 X 10 ⁻⁶	---	---	1.8 X 10 ⁻¹¹	2.1 X 10 ⁻¹³	1.2 X 10 ⁻⁶
²¹¹ Pb	2.9 × 10 ⁻⁸	3.3 × 10 ⁻⁸	---	---	1.8 × 10 ⁻⁸	2.1 × 10 ⁻⁸	4.8 × 10 ⁻⁸	2.4 X 10 ⁻⁸	2.2 X 10 ⁻⁵	---	---	4.3 X 10 ⁻⁹	---	2.3 X 10 ⁻⁵
²¹² Pb	1.1 × 10 ⁻¹⁵	5.6 × 10 ⁻¹⁵	---	---	5.4 × 10 ⁻¹⁸	9.8 × 10 ⁻¹⁷	1.0 × 10 ⁻⁵	1.0 X 10 ⁻¹⁶	1.6 X 10 ¹	---	---	3.2 X 10 ⁻¹⁹	---	1.6 X 10 ¹
²¹⁴ Pb	3.9 × 10 ⁻¹⁰	7.2 × 10 ⁻¹⁰	---	---	1.7 × 10 ⁻¹⁴	1.8 × 10 ⁻⁹	9.5 × 10 ⁻⁹	3.6 X 10 ⁻¹¹	7.9 X 10 ⁻⁶	---	---	3.5 X 10 ⁻¹⁰	3.5 X 10 ⁻¹²	7.9 X 10 ⁻⁶
¹⁰⁷ Pd	---	---	---	---	---	---	1.7 × 10 ⁻⁵	---	---	---	---	---	---	1.7 X 10 ⁻⁵
¹⁴⁷ Pm	3.0 × 10 ⁻²	3.7 × 10 ²	---	2.8 × 10 ²	---	---	5.9 × 10 ⁻²	---	---	---	---	7.0 X 10 ⁰	2.2 X 10 ⁰	6.6 X 10 ²
²¹⁰ Po	7.0 × 10 ⁻¹¹	4.3 × 10 ⁻¹¹	---	---	9.9 × 10 ⁻¹⁶	9.3 × 10 ⁻¹¹	2.0 × 10 ⁻⁹	9.2 X 10 ⁻¹²	1.2 X 10 ⁻⁶	---	---	1.8 X 10 ⁻¹¹	2.1 X 10 ⁻¹³	1.2 X 10 ⁻⁶
²¹¹ Po	8.8 × 10 ⁻¹¹	1.0 × 10 ⁻¹⁰	---	---	5.4 × 10 ⁻¹¹	6.3 × 10 ⁻¹¹	1.5 × 10 ⁻¹⁰	7.2 X 10 ⁻¹¹	6.8 X 10 ⁻⁸	---	---	1.3 X 10 ⁻¹¹	---	6.9 X 10 ⁻⁸
²¹² Po	6.8 × 10 ⁻¹⁶	3.5 × 10 ⁻¹⁵	---	---	3.5 × 10 ⁻¹⁸	6.3 × 10 ⁻¹⁷	6.6 × 10 ⁻⁶	6.6 X 10 ⁻¹⁷	1.0 X 10 ¹	---	---	2.1 X 10 ⁻¹⁹	---	1.0 X 10 ¹
²¹³ Po	4.5 × 10 ⁻⁷	1.1 × 10 ⁻⁴	---	---	3.1 × 10 ⁻¹⁴	2.2 × 10 ⁻¹³	9.4 × 10 ⁻¹⁰	6.0 X 10 ⁻¹⁵	2.1 X 10 ⁻¹	---	---	4.5 X 10 ⁻¹²	---	2.1 X 10 ⁻¹
²¹⁴ Po	3.9 × 10 ⁻¹⁰	7.2 × 10 ⁻¹⁰	---	---	1.7 × 10 ⁻¹⁴	1.8 × 10 ⁻⁹	9.5 × 10 ⁻⁹	3.6 X 10 ⁻¹¹	7.9 X 10 ⁻⁶	---	---	3.5 X 10 ⁻¹⁰	3.5 X 10 ⁻¹²	7.9 X 10 ⁻⁶
²¹⁵ Po	2.9 × 10 ⁻⁸	3.3 × 10 ⁻⁸	---	---	1.8 × 10 ⁻⁸	2.1 × 10 ⁻⁸	4.8 × 10 ⁻⁸	2.4 X 10 ⁻⁸	2.2 X 10 ⁻⁵	---	---	4.3 X 10 ⁻⁹	---	2.3 X 10 ⁻⁵
²¹⁶ Po	1.1 × 10 ⁻¹⁵	5.5 × 10 ⁻¹⁵	---	---	5.4 × 10 ⁻¹⁸	9.8 × 10 ⁻¹⁷	1.0 × 10 ⁻⁵	1.0 X 10 ⁻¹⁶	1.6 X 10 ¹	---	---	3.2 X 10 ⁻¹⁹	---	1.6 X 10 ¹
²¹⁸ Po	3.8 × 10 ⁻¹⁰	7.1 × 10 ⁻¹⁰	---	---	1.6 × 10 ⁻¹⁴	1.7 × 10 ⁻⁹	9.3 × 10 ⁻⁹	3.5 X 10 ⁻¹¹	7.8 X 10 ⁻⁶	---	---	3.5 X 10 ⁻¹⁰	3.5 X 10 ⁻¹²	7.8 X 10 ⁻⁶
¹⁴⁴ Pr	2.0 × 10 ⁻⁹	7.1 × 10 ⁰	---	---	---	---	---	---	6.1 X 10 ⁻⁷	---	---	---	---	7.1 X 10 ⁰
²³⁸ Pu	9.2 × 10 ⁰	1.2 × 10 ⁰	7.8 × 10 ¹	2.8 × 10 ²	1.5 × 10 ⁻²	2.7 × 10 ³	2.8 × 10 ⁰	1.3 X 10 ⁻²	2.5 X 10 ²	1.1 X 10 ³	1.0 X 10 ¹	4.2 X 10 ⁰	3.6 X 10 ⁰	4.5 X 10 ³
²³⁹ Pu	1.8 × 10 ¹	4.2 × 10 ¹	1.0 × 10 ¹	2.2 × 10 ⁻¹	1.1 × 10 ⁰	3.5 × 10 ¹	7.6 × 10 ⁻³	2.5 X 10 ⁰	1.4 X 10 ²	2.3 X 10 ³	4.2 X 10 ³	2.8 X 10 ⁰	4.8 X 10 ⁻⁶	6.8 X 10 ³
²⁴⁰ Pu	3.8 × 10 ⁰	2.3 × 10 ¹	1.6 × 10 ¹	4.5 × 10 ⁻¹	2.7 × 10 ⁻¹	3.3 × 10 ¹	1.9 × 10 ⁻³	2.7 X 10 ⁻²	3.4 X 10 ¹	1.3 X 10 ³	1.0 X 10 ³	4.3 X 10 ⁻¹	---	2.4 X 10 ³
²⁴¹ Pu	3.0 × 10 ¹	7.2 × 10 ²	1.3 × 10 ³	4.8 × 10 ¹	2.2 × 10 ⁰	6.6 × 10 ¹	2.7 × 10 ⁻¹	2.2 X 10 ⁻¹	1.5 X 10 ²	1.4 X 10 ⁵	1.8 X 10 ⁴	2.5 X 10 ⁻²	---	1.6 X 10 ⁵

Table DATA-F-36. RH-TRU Waste Curies on a Site-by-Site Basis ¹— Continued

Radionuclide	AE	AW	BC	BT	ET	IN	KA	LA	OR	RL	RP	SA	SR	Total Of Curies
²⁴² Pu	---	5.5×10^{-4}	4.8×10^{-2}	3.5×10^{-3}	---	1.0×10^{-3}	7.2×10^{-6}	1.6×10^{-5}	7.1×10^{-2}	4.4×10^{-1}	2.2×10^{-1}	---	---	7.8×10^{-1}
²⁴³ Pu	---	---	---	---	---	---	1.5×10^{-13}	---	7.0×10^{-10}	---	---	---	5.4×10^1	5.4×10^1
²⁴⁴ Pu	---	---	---	2.0×10^{-10}	---	---	1.7×10^{-12}	---	6.4×10^{-3}	---	---	---	---	6.4×10^{-3}
²²³ Ra	2.9×10^{-8}	3.3×10^{-8}	---	---	1.8×10^{-8}	2.1×10^{-8}	4.9×10^{-8}	2.4×10^{-8}	2.3×10^{-5}	---	---	4.4×10^{-9}	---	2.3×10^{-5}
²²⁴ Ra	1.1×10^{-15}	5.5×10^{-15}	---	---	5.4×10^{-18}	9.8×10^{-17}	1.0×10^{-5}	1.0×10^{-16}	1.6×10^1	---	---	3.2×10^{-19}	---	1.6×10^1
²²⁵ Ra	4.6×10^{-7}	1.2×10^{-4}	---	---	3.2×10^{-14}	2.2×10^{-13}	9.6×10^{-10}	6.1×10^{-15}	2.1×10^{-1}	---	---	4.6×10^{-12}	---	2.1×10^{-1}
²²⁶ Ra	3.9×10^{-10}	7.3×10^{-10}	---	---	1.7×10^{-14}	1.8×10^{-9}	9.6×10^{-9}	3.6×10^{-11}	8.0×10^{-6}	---	---	3.6×10^{-10}	3.6×10^{-12}	8.0×10^{-6}
²²⁸ Ra	1.3×10^{-15}	1.4×10^{-14}	---	---	1.1×10^{-17}	2.8×10^{-16}	4.1×10^{-11}	1.2×10^{-16}	9.8×10^{-1}	---	---	1.4×10^{-18}	---	9.8×10^{-1}
¹⁰⁶ Rh	3.6×10^{-7}	---	---	---	---	---	---	1.3×10^{-10}	2.2×10^{-3}	3.9×10^{-1}	---	---	---	4.0×10^{-1}
²¹⁹ Rn	2.9×10^{-8}	3.3×10^{-8}	---	---	1.8×10^{-8}	2.1×10^{-8}	4.8×10^{-8}	2.4×10^{-8}	2.2×10^{-5}	---	---	4.3×10^{-9}	---	2.3×10^{-5}
²²⁰ Rn	1.1×10^{-15}	5.6×10^{-15}	---	---	5.4×10^{-18}	9.8×10^{-17}	1.0×10^{-5}	1.0×10^{-16}	1.6×10^1	---	---	3.2×10^{-19}	---	1.6×10^1
²²² Rn	3.9×10^{-10}	7.2×10^{-10}	---	---	1.7×10^{-14}	1.8×10^{-9}	9.5×10^{-9}	3.6×10^{-11}	7.9×10^{-6}	---	---	3.5×10^{-10}	3.5×10^{-12}	7.9×10^{-6}
¹⁰⁶ Ru	3.6×10^{-7}	---	---	---	---	---	---	1.3×10^{-10}	2.3×10^{-3}	3.9×10^{-1}	---	---	---	4.0×10^{-1}
¹²⁵ Sb	3.7×10^{-3}	5.0×10^0	2.8×10^{-3}	---	---	---	---	5.5×10^{-4}	1.3×10^{-2}	---	---	---	---	5.0×10^0
¹²⁶ Sb	1.2×10^{-4}	---	---	---	---	---	4.7×10^{-5}	---	---	---	---	---	---	1.7×10^{-4}
^{126m} Sb	8.7×10^{-4}	---	---	---	---	---	3.4×10^{-4}	---	---	---	---	---	---	1.2×10^{-3}
⁷⁹ Se	---	---	---	4.0×10^{-2}	---	---	1.0×10^{-4}	---	---	2.8×10^{-2}	---	---	---	6.7×10^{-2}
¹⁴⁷ Sm	9.3×10^{-10}	3.5×10^{-8}	---	---	---	---	4.4×10^{-13}	---	---	---	---	4.7×10^{-10}	4.0×10^{-10}	3.7×10^{-8}
¹⁵¹ Sm	2.0×10^0	3.5×10^1	---	3.1×10^1	---	---	1.2×10^0	---	---	3.5×10^2	2.4×10^2	---	---	6.6×10^2
^{121m} Sn	---	---	---	---	---	---	3.0×10^{-3}	---	---	---	---	---	---	3.0×10^{-3}
¹²⁶ Sn	8.7×10^{-4}	---	---	---	---	---	3.4×10^{-4}	---	---	---	---	---	---	1.2×10^{-3}
⁹⁰ Sr	2.6×10^1	1.3×10^3	1.5×10^3	6.4×10^3	9.5×10^0	---	7.3×10^1	---	5.6×10^4	1.9×10^5	7.5×10^4	4.9×10^2	5.8×10^1	3.3×10^5
⁹⁹ Tc	1.1×10^{-2}	---	4.4×10^{-1}	1.4×10^0	---	---	2.1×10^{-2}	---	6.5×10^{-9}	6.6×10^{-3}	1.6×10^2	---	---	1.6×10^2
^{125m} Te	8.9×10^{-4}	1.2×10^0	---	---	---	---	---	1.3×10^{-4}	3.1×10^{-3}	---	---	---	---	1.2×10^0
²²⁷ Th	2.8×10^{-8}	3.2×10^{-8}	---	---	1.7×10^{-8}	2.0×10^{-8}	4.7×10^{-8}	2.3×10^{-8}	2.2×10^{-5}	---	---	4.3×10^{-9}	---	2.2×10^{-5}
²²⁸ Th	1.1×10^{-15}	5.6×10^{-15}	---	---	5.5×10^{-18}	9.9×10^{-17}	1.0×10^{-5}	1.0×10^{-16}	1.6×10^1	---	---	3.2×10^{-19}	---	1.6×10^1
²²⁹ Th	4.6×10^{-7}	1.2×10^{-4}	---	---	3.2×10^{-14}	2.2×10^{-13}	9.6×10^{-10}	6.1×10^{-15}	2.1×10^{-1}	---	---	4.6×10^{-12}	---	2.1×10^{-1}

Table DATA-F-36. RH-TRU Waste Curies on a Site-by-Site Basis ¹— Continued

Radionuclide	AE	AW	BC	BT	ET	IN	KA	LA	OR	RL	RP	SA	SR	Total Of Curies
²³⁰ Th	9.8 × 10 ⁻⁸	5.6 × 10 ⁻⁷	---	---	1.4 × 10 ⁻¹¹	1.8 × 10 ⁻⁶	1.4 × 10 ⁻⁶	5.5 X 10 ⁻⁹	2.2 X 10 ⁻³	---	---	3.3 X 10 ⁻⁷	3.1 X 10 ⁻⁹	2.2 X 10 ⁻³
²³¹ Th	1.5 × 10 ⁻⁴	2.9 × 10 ⁻³	---	---	8.9 × 10 ⁻⁴	1.3 × 10 ⁻³	7.1 × 10 ⁻⁵	9.9 X 10 ⁻⁵	2.7 X 10 ⁻¹	---	---	5.4 X 10 ⁻⁴	1.2 X 10 ⁻¹⁴	2.8 X 10 ⁻¹
²³² Th	2.0 × 10 ⁻¹⁵	4.7 × 10 ⁻¹⁴	---	1.7 × 10 ⁻¹¹	2.9 × 10 ⁻¹⁷	1.2 × 10 ⁻¹⁵	4.1 × 10 ⁻¹¹	1.5 X 10 ⁻¹⁶	1.0 X 10 ⁰	4.3 X 10 ⁻²	---	7.8 X 10 ⁻¹⁸	---	1.1 X 10 ⁰
²³⁴ Th	6.0 × 10 ⁻⁵	4.6 × 10 ⁻⁴	---	---	2.2 × 10 ⁻³	1.1 × 10 ⁻¹²	3.1 × 10 ⁻⁷	4.4 X 10 ⁻⁷	1.3 X 10 ¹	---	---	1.8 X 10 ⁻⁴	---	1.3 X 10 ¹
²⁰⁷ Tl	2.9 × 10 ⁻⁸	3.3 × 10 ⁻⁸	---	---	1.8 × 10 ⁻⁸	2.1 × 10 ⁻⁸	4.8 × 10 ⁻⁸	2.4 X 10 ⁻⁸	2.2 X 10 ⁻⁵	---	---	4.3 X 10 ⁻⁹	---	2.2 X 10 ⁻⁵
²⁰⁸ Tl	3.8 × 10 ⁻¹⁶	2.0 × 10 ⁻¹⁵	2.3 × 10 ⁻³	---	2.0 × 10 ⁻¹⁸	3.5 × 10 ⁻¹⁷	3.7 × 10 ⁻⁶	3.7 X 10 ⁻¹⁷	5.6 X 10 ⁰	---	---	1.2 X 10 ⁻¹⁹	---	5.6 X 10 ⁰
²⁰⁹ Tl	1.0 × 10 ⁻⁸	2.6 × 10 ⁻⁶	---	---	7.1 × 10 ⁻¹⁶	4.9 × 10 ⁻¹⁵	2.1 × 10 ⁻¹¹	1.3 X 10 ⁻¹⁶	4.7 X 10 ⁻³	---	---	1.0 X 10 ⁻¹³	---	4.7 X 10 ⁻³
²³² U	---	---	7.3 × 10 ⁻⁴	4.0 × 10 ⁻³	---	---	3.4 × 10 ⁻⁵	---	1.5 X 10 ¹	---	---	---	---	1.5 X 10 ¹
²³³ U	1.8 × 10 ⁻⁴	2.1 × 10 ⁻¹	1.3 × 10 ⁻⁶	---	7.6 × 10 ⁻¹¹	1.0 × 10 ⁻⁹	3.9 × 10 ⁻⁷	7.9 X 10 ⁻¹²	1.3 X 10 ²	8.5 X 10 ⁰	2.3 X 10 ⁰	1.9 X 10 ⁻⁸	---	1.5 X 10 ²
²³⁴ U	7.8 × 10 ⁻⁴	1.0 × 10 ⁻²	2.8 × 10 ⁻²	6.0 × 10 ⁻¹	4.0 × 10 ⁻⁷	5.5 × 10 ⁻²	4.8 × 10 ⁻³	2.0 X 10 ⁻⁵	1.4 X 10 ¹	9.2 X 10 ⁰	1.5 X 10 ¹	7.4 X 10 ⁻³	8.4 X 10 ⁻⁵	3.9 X 10 ¹
²³⁵ U	1.6 × 10 ⁻⁴	2.9 × 10 ⁻³	4.1 × 10 ⁻⁴	7.8 × 10 ⁻³	9.0 × 10 ⁻⁴	1.4 × 10 ⁻³	7.2 × 10 ⁻⁵	1.0 X 10 ⁻⁴	2.8 X 10 ⁻¹	5.3 X 10 ⁻¹	5.6 X 10 ⁻¹	5.5 X 10 ⁻⁴	1.3 X 10 ⁻¹⁴	1.4 X 10 ⁰
²³⁶ U	3.1 × 10 ⁻⁶	1.6 × 10 ⁻⁴	5.4 × 10 ⁻³	8.9 × 10 ⁻²	9.4 × 10 ⁻⁸	6.8 × 10 ⁻⁶	6.8 × 10 ⁻⁴	1.1 X 10 ⁻⁷	4.9 X 10 ⁻²	8.3 X 10 ⁻¹	1.2 X 10 ⁰	6.3 X 10 ⁻⁸	---	2.2 X 10 ⁰
²³⁷ U	7.3 × 10 ⁻⁴	1.8 × 10 ⁻²	---	---	5.4 × 10 ⁻⁵	1.6 × 10 ⁻³	6.6 × 10 ⁻⁶	5.5 X 10 ⁻⁶	3.7 X 10 ⁻³	---	---	6.1 X 10 ⁻⁷	---	2.4 X 10 ⁻²
²³⁸ U	6.1 × 10 ⁻⁵	4.6 × 10 ⁻⁴	8.0 × 10 ⁻³	3.6 × 10 ⁻⁵	2.2 × 10 ⁻³	1.1 × 10 ⁻¹²	3.2 × 10 ⁻⁷	4.4 X 10 ⁻⁷	1.3 X 10 ¹	4.5 X 10 ⁰	1.3 X 10 ²	1.8 X 10 ⁻⁴	---	1.4 X 10 ²
²⁴⁰ U	---	---	---	---	---	---	1.7 × 10 ⁻¹²	---	6.4 X 10 ⁻³	---	---	---	---	6.4 X 10 ⁻³
⁹⁰ Y	2.5 × 10 ¹	1.3 × 10 ³	---	6.4 × 10 ³	9.4 × 10 ⁰	---	7.2 × 10 ¹	---	5.5 X 10 ⁴	1.8 X 10 ⁵	7.5 X 10 ⁴	4.8 X 10 ²	5.7 X 10 ¹	3.2 X 10 ⁵
⁹¹ Y	---	4.7 × 10 ⁻¹²	---	---	---	---	---	---	---	---	---	---	---	4.7 X 10 ⁻¹²
⁹³ Zr	1.3 × 10 ⁻³	---	---	3.4 × 10 ⁻¹	---	---	2.6 × 10 ⁻³	---	---	---	---	---	---	3.4 X 10 ⁻¹
⁹⁵ Zr	---	1.1 × 10 ⁻¹³	---	---	---	---	---	---	---	---	---	---	---	1.1 X 10 ⁻¹³
Total:	2.1 × 10 ²	7.2 × 10 ³	5.8 × 10 ³	2.8 × 10 ⁴	4.2 × 10 ¹	3.3 × 10 ³	3.0 × 10 ²	3.3 X 10 ¹	1.5 X 10 ⁵	1.1 X 10 ⁶	4.3 X 10 ⁵	2.0 X 10 ³	3.5 X 10 ²	1.7 X 10 ⁶

¹Decayed through December 31, 2001

Table DATA-F-37. WIPP Disposal Radionuclide Inventory for the CRA^{1,2}

Radionuclide	CH Concentration (Ci/m ³)	RH Concentration (Ci/m ³)	CH-TRU Curies	RH-TRU Curies
²²⁵ Ac	9.2×10^{-6}	5.2×10^{-6}	1.6×10^0	3.7×10^{-2}
²²⁷ Ac	3.0×10^{-6}	5.7×10^{-10}	5.1×10^{-1}	4.0×10^{-6}
²²⁸ Ac	2.8×10^{-5}	2.0×10^{-5}	4.8×10^0	1.4×10^{-1}
^{109m} Ag	7.5×10^{-10}	NR	1.3×10^{-4}	NR
¹¹⁰ Ag	2.6×10^{-16}	2.7×10^{-15}	4.4×10^{-11}	1.9×10^{-11}
^{110m} Ag	2.0×10^{-14}	2.1×10^{-13}	3.3×10^{-9}	1.5×10^{-9}
²⁴¹ Am	2.4×10^0	1.9×10^0	4.0×10^5	1.4×10^4
²⁴² Am	2.8×10^{-7}	1.2×10^{-7}	4.7×10^{-2}	8.5×10^{-4}
^{242m} Am	2.8×10^{-7}	2.8×10^{-5}	4.8×10^{-2}	2.0×10^{-1}
²⁴³ Am	1.3×10^{-4}	1.0×10^{-4}	2.1×10^1	7.2×10^{-1}
²⁴⁵ Am	7.8×10^{-16}	NR	1.3×10^{-10}	NR
²¹⁷ At	9.2×10^{-6}	5.2×10^{-6}	1.6×10^0	3.7×10^{-2}
^{137m} Ba	5.4×10^{-2}	4.7×10^1	9.1×10^3	3.4×10^5
²¹⁰ Bi	1.5×10^{-5}	3.0×10^{-11}	2.6×10^0	2.1×10^{-7}
²¹¹ Bi	3.0×10^{-6}	5.6×10^{-10}	5.0×10^{-1}	4.0×10^{-6}
²¹² Bi	3.5×10^{-5}	3.8×10^{-4}	5.8×10^0	2.7×10^0
²¹³ Bi	9.2×10^{-6}	5.2×10^{-6}	1.6×10^0	3.7×10^{-2}
²¹⁴ Bi	3.7×10^{-5}	1.9×10^{-10}	6.3×10^0	1.4×10^{-6}
²⁴⁹ Bk	5.4×10^{-11}	NR	9.1×10^{-6}	NR
²⁵⁰ Bk	2.2×10^{-17}	NR	3.7×10^{-12}	NR
¹⁴ C	7.2×10^{-6}	2.9×10^{-4}	1.2×10^0	2.1×10^0
¹⁰⁹ Cd	7.6×10^{-10}	NR	1.3×10^{-4}	NR
^{113m} Cd	NR	2.3×10^{-5}	NR	1.6×10^{-1}
¹⁴¹ Ce	NR	5.3×10^{-23}	NR	3.8×10^{-19}
¹⁴⁴ Ce	2.1×10^{-9}	2.6×10^{-4}	3.6×10^{-4}	1.8×10^0
²⁴⁹ Cf	4.5×10^{-7}	1.2×10^{-7}	7.6×10^{-2}	8.4×10^{-4}
²⁵⁰ Cf	1.1×10^{-6}	2.1×10^{-6}	1.8×10^{-1}	1.5×10^{-2}
²⁵¹ Cf	2.2×10^{-9}	2.3×10^{-8}	3.6×10^{-4}	1.6×10^{-4}
²⁵² Cf	1.2×10^{-6}	2.5×10^{-6}	2.1×10^{-1}	1.8×10^{-2}
²⁴² Cm	2.3×10^{-7}	1.0×10^{-7}	3.9×10^{-2}	7.2×10^{-4}
²⁴³ Cm	2.4×10^{-6}	6.9×10^{-5}	4.0×10^{-1}	4.9×10^{-1}
²⁴⁴ Cm	6.9×10^{-2}	3.8×10^{-2}	1.2×10^4	2.7×10^2
²⁴⁵ Cm	5.0×10^{-8}	1.5×10^{-6}	8.4×10^{-3}	1.1×10^{-2}
²⁴⁶ Cm	9.2×10^{-6}	9.5×10^{-5}	1.6×10^0	6.7×10^{-1}
²⁴⁷ Cm	1.7×10^{-15}	1.3×10^{-3}	2.8×10^{-10}	9.4×10^0
²⁴⁸ Cm	5.4×10^{-7}	2.6×10^{-7}	9.1×10^{-2}	1.8×10^{-3}

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**Table DATA-F-37. WIPP Disposal Radionuclide Inventory for the CRA^{1,2}—
Continued**

Radionuclide	CH Concentration (Ci/m ³)	RH Concentration (Ci/m ³)	CH-TRU Curies	RH-TRU Curies
²⁵⁰ Cm	3.9×10^{-16}	NR	6.6×10^{-11}	NR
⁶⁰ Co	5.9×10^{-6}	2.4×10^{-1}	9.9×10^{-1}	1.7×10^3
¹³⁴ Cs	1.2×10^{-7}	4.8×10^{-3}	2.1×10^{-2}	3.4×10^1
¹³⁵ Cs	NR	9.8×10^{-9}	NR	6.9×10^{-5}
¹³⁷ Cs	5.7×10^{-2}	5.2×10^1	9.7×10^3	3.7×10^5
¹⁵² Eu	1.2×10^{-5}	9.8×10^{-2}	2.0×10^0	7.0×10^2
¹⁵⁴ Eu	9.8×10^{-6}	6.0×10^{-2}	1.7×10^0	4.2×10^2
¹⁵⁵ Eu	4.0×10^{-7}	2.6×10^{-3}	6.7×10^{-2}	1.9×10^1
⁵⁵ Fe	NR	5.9×10^{-6}	NR	4.2×10^{-2}
²²¹ Fr	9.2×10^{-6}	5.2×10^{-6}	1.6×10^0	3.7×10^{-2}
²²³ Fr	4.1×10^{-8}	7.7×10^{-12}	6.9×10^{-3}	5.5×10^{-8}
¹⁵² Gd	2.6×10^{-19}	2.8×10^{-15}	4.4×10^{-14}	2.0×10^{-11}
³ H	1.3×10^{-3}	1.6×10^{-4}	2.2×10^2	1.2×10^0
¹²⁹ I	3.0×10^{-9}	1.2×10^{-5}	5.1×10^{-4}	8.2×10^{-2}
⁸⁵ Kr	2.7×10^{-6}	1.6×10^{-5}	4.6×10^{-1}	1.1×10^{-1}
⁵⁴ Mn	NR	2.6×10^{-4}	NR	1.8×10^0
²² Na	2.3×10^{-12}	4.2×10^{-5}	3.9×10^{-7}	3.0×10^{-1}
^{93m} Nb	NR	3.9×10^{-8}	NR	2.8×10^{-4}
⁹⁵ Nb	NR	1.1×10^{-17}	NR	7.5×10^{-14}
^{95m} Nb	NR	3.6×10^{-20}	NR	2.5×10^{-16}
⁵⁹ Ni	4.5×10^{-7}	3.3×10^{-3}	7.6×10^{-2}	2.3×10^1
⁶³ Ni	2.2×10^{-5}	1.6×10^{-1}	3.7×10^0	1.1×10^3
²³⁷ Np	2.8×10^{-5}	9.4×10^{-5}	4.8×10^0	6.7×10^{-1}
²³⁸ Np	1.4×10^{-9}	6.1×10^{-10}	2.4×10^{-4}	4.3×10^{-6}
²³⁹ Np	1.2×10^{-4}	8.9×10^{-6}	2.1×10^1	6.3×10^{-2}
^{240m} Np	7.8×10^{-12}	1.6×10^{-7}	1.3×10^{-6}	1.1×10^{-3}
²³¹ Pa	7.2×10^{-6}	2.5×10^{-9}	1.2×10^0	1.8×10^{-5}
²³³ Pa	2.8×10^{-5}	3.3×10^{-7}	4.8×10^0	2.3×10^{-3}
²³⁴ Pa	5.5×10^{-8}	4.0×10^{-7}	9.3×10^{-3}	2.8×10^{-3}
^{234m} Pa	4.2×10^{-5}	3.1×10^{-4}	7.1×10^0	2.2×10^0
²⁰⁹ Pb	9.2×10^{-6}	5.2×10^{-6}	1.6×10^0	3.7×10^{-2}
²¹⁰ Pb	1.6×10^{-5}	3.0×10^{-11}	2.6×10^0	2.1×10^{-7}
²¹¹ Pb	3.0×10^{-6}	5.6×10^{-10}	5.0×10^{-1}	4.0×10^{-6}
²¹² Pb	3.5×10^{-5}	3.8×10^{-4}	5.8×10^0	2.7×10^0
²¹⁴ Pb	3.7×10^{-5}	1.9×10^{-10}	6.3×10^0	1.4×10^{-6}
¹⁰⁷ Pd	NR	4.1×10^{-10}	NR	2.9×10^{-6}
¹⁴⁷ Pm	1.1×10^{-5}	5.0×10^{-2}	1.8×10^0	3.5×10^2

**Table DATA-F-37. WIPP Disposal Radionuclide Inventory for the CRA^{1,2}—
Continued**

Radionuclide	CH Concentration (Ci/m ³)	RH Concentration (Ci/m ³)	CH-TRU Curies	RH-TRU Curies
²¹⁰ Po	1.6×10^{-5}	3.0×10^{-11}	2.6×10^0	2.1×10^{-7}
²¹¹ Po	9.1×10^{-9}	1.7×10^{-12}	1.5×10^{-3}	1.2×10^{-8}
²¹² Po	2.2×10^{-5}	2.4×10^{-4}	3.7×10^0	1.7×10^0
²¹³ Po	9.0×10^{-6}	5.1×10^{-6}	1.5×10^0	3.6×10^{-2}
²¹⁴ Po	3.7×10^{-5}	1.9×10^{-10}	6.3×10^0	1.4×10^{-6}
²¹⁵ Po	3.0×10^{-6}	5.6×10^{-10}	5.0×10^{-1}	4.0×10^{-6}
²¹⁶ Po	3.5×10^{-5}	3.8×10^{-4}	5.8×10^0	2.7×10^0
²¹⁸ Po	3.7×10^{-5}	1.9×10^{-10}	6.2×10^0	1.3×10^{-6}
¹⁴⁴ Pr	2.1×10^{-9}	2.5×10^{-4}	3.5×10^{-4}	1.8×10^0
²³⁶ Pu	2.6×10^{-9}	NR	4.4×10^{-4}	NR
²³⁸ Pu	9.6×10^0	5.1×10^{-1}	1.6×10^6	3.6×10^3
²³⁹ Pu	3.9×10^0	7.6×10^{-1}	6.6×10^5	5.4×10^3
²⁴⁰ Pu	6.4×10^{-1}	2.4×10^{-1}	1.1×10^5	1.7×10^3
²⁴¹ Pu	1.4×10^1	1.6×10^1	2.4×10^6	1.1×10^5
²⁴² Pu	1.6×10^{-4}	6.7×10^{-5}	2.7×10^1	4.7×10^{-1}
²⁴³ Pu	1.6×10^{-15}	1.3×10^{-3}	2.7×10^{-10}	9.3×10^0
²⁴⁴ Pu	7.7×10^{-12}	1.6×10^{-7}	1.3×10^{-6}	1.1×10^{-3}
²²³ Ra	3.0×10^{-6}	5.6×10^{-10}	5.1×10^{-1}	4.0×10^{-6}
²²⁴ Ra	3.5×10^{-5}	3.8×10^{-4}	5.8×10^0	2.7×10^0
²²⁵ Ra	9.2×10^{-6}	5.2×10^{-6}	1.6×10^0	3.7×10^{-2}
²²⁶ Ra	3.8×10^{-5}	2.0×10^{-10}	6.4×10^0	1.4×10^{-6}
²²⁸ Ra	3.4×10^{-5}	2.4×10^{-5}	5.7×10^0	1.7×10^{-1}
¹⁰⁶ Rh	9.4×10^{-10}	9.6×10^{-6}	1.6×10^{-4}	6.8×10^{-2}
²¹⁹ Rn	3.0×10^{-6}	5.6×10^{-10}	5.0×10^{-1}	4.0×10^{-6}
²²⁰ Rn	3.5×10^{-5}	3.8×10^{-4}	5.8×10^0	2.7×10^0
²²² Rn	3.7×10^{-5}	1.9×10^{-10}	6.3×10^0	1.4×10^{-6}
¹⁰⁶ Ru	9.5×10^{-10}	9.6×10^{-6}	1.6×10^{-4}	6.8×10^{-2}
¹²⁵ Sb	3.0×10^{-8}	6.2×10^{-4}	5.0×10^{-3}	4.4×10^0
¹²⁶ Sb	NR	5.9×10^{-9}	NR	4.2×10^{-5}
^{126m} Sb	NR	4.2×10^{-8}	NR	3.0×10^{-4}
⁷⁹ Se	7.8×10^{-10}	6.3×10^{-6}	1.3×10^{-4}	4.5×10^{-2}
¹⁴⁷ Sm	2.8×10^{-15}	9.7×10^{-13}	4.8×10^{-10}	6.9×10^{-9}
¹⁵¹ Sm	3.4×10^{-4}	8.2×10^{-2}	5.7×10^1	5.8×10^2
^{121m} Sn	NR	7.3×10^{-8}	NR	5.2×10^{-4}
¹²⁶ Sn	NR	4.2×10^{-8}	NR	3.0×10^{-4}
⁹⁰ Sr	3.4×10^{-1}	3.5×10^1	5.8×10^4	2.5×10^5
⁹⁹ Tc	9.9×10^{-4}	2.3×10^{-2}	1.7×10^2	1.6×10^2

**Table DATA-F-37. WIPP Disposal Radionuclide Inventory for the CRA^{1,2}—
Continued**

Radionuclide	CH Concentration (Ci/m ³)	RH Concentration (Ci/m ³)	CH-TRU Curies	RH-TRU Curies
¹²³ Te	4.0×10^{-10}	NR	6.8×10^{-5}	NR
^{123m} Te	3.0×10^{-24}	NR	5.0×10^{-19}	NR
^{125m} Te	7.2×10^{-9}	1.5×10^{-4}	1.2×10^{-3}	1.1×10^0
²²⁷ Th	2.9×10^{-6}	5.5×10^{-10}	4.9×10^{-1}	3.9×10^{-6}
²²⁸ Th	3.5×10^{-5}	3.9×10^{-4}	5.9×10^0	2.7×10^0
²²⁹ Th	9.2×10^{-6}	5.2×10^{-6}	1.6×10^0	3.7×10^{-2}
²³⁰ Th	6.0×10^{-7}	5.3×10^{-8}	1.0×10^{-1}	3.8×10^{-4}
²³¹ Th	2.1×10^{-6}	7.4×10^{-6}	3.5×10^{-1}	5.2×10^{-2}
²³² Th	3.9×10^{-5}	3.1×10^{-5}	6.6×10^0	2.2×10^{-1}
²³⁴ Th	4.2×10^{-5}	3.1×10^{-4}	7.1×10^0	2.2×10^0
²⁰⁷ Tl	3.0×10^{-6}	5.6×10^{-10}	5.0×10^{-1}	3.9×10^{-6}
²⁰⁸ Tl	1.2×10^{-5}	1.4×10^{-4}	2.1×10^0	9.7×10^{-1}
²⁰⁹ Tl	2.0×10^{-7}	1.1×10^{-7}	3.4×10^{-2}	8.1×10^{-4}
²³² U	9.8×10^{-6}	3.6×10^{-4}	1.6×10^0	2.5×10^0
²³³ U	7.3×10^{-3}	4.8×10^{-3}	1.2×10^3	3.4×10^1
²³⁴ U	1.0×10^{-3}	3.1×10^{-3}	1.7×10^2	2.2×10^1
²³⁵ U	7.8×10^{-6}	1.3×10^{-4}	1.3×10^0	9.4×10^{-1}
²³⁶ U	7.7×10^{-7}	2.0×10^{-4}	1.3×10^{-1}	1.4×10^0
²³⁷ U	1.3×10^{-4}	2.5×10^{-6}	2.2×10^1	1.8×10^{-2}
²³⁸ U	1.5×10^{-4}	1.8×10^{-2}	2.4×10^1	1.3×10^2
²⁴⁰ U	7.6×10^{-12}	1.5×10^{-7}	1.3×10^{-6}	1.1×10^{-3}
⁹⁰ Y	3.4×10^{-1}	3.4×10^1	5.7×10^4	2.4×10^5
⁹¹ Y	NR	1.2×10^{-16}	NR	8.1×10^{-13}
⁶⁵ Zn	1.4×10^{-15}	NR	2.3×10^{-10}	NR
⁹³ Zr	6.7×10^{-9}	4.8×10^{-5}	1.1×10^{-3}	3.4×10^{-1}
⁹⁵ Zr	NR	4.8×10^{-18}	NR	3.4×10^{-14}
Total:	3.2×10^1	1.9×10^2	5.3×10^6	1.3×10^6

NR=Not Reported

¹ Decayed through 2001² Total curies estimated by assuming 168,485 m³ for CH-TRU Waste and 7,079 m³ for RH-TRU Waste

1 **DATA-F-3.4.1 Non-Defense TRU Waste-Waste Isolation Pilot Plant Future Potential Waste**

2 The DOE has several categories of waste that are currently not acceptable for disposal in WIPP.

3 These are summarized below:

- 4 • Non-Defense Waste—The National Security Programs (Public Law 96-164, 1980,
5 National Security and Military Applications of Nuclear Energy Authorization Act of

1 1980, 93 Stat. 1259), which authorized the construction of the WIPP, states that the WIPP
2 is to be a defense waste repository. Therefore, those wastes that are identified as non-
3 defense are not currently allowed to be disposed in the WIPP. Waste streams from sites
4 for which a defense determination has not been made are identified in Table DATA-F-38
5 and in Table DATA-F-39.

1

Table DATA-F-38. Non-Defense TRU Waste (Final Waste Form)

Waste Stream ID	Waste Stream Name	Stored Volumes (m ³)	Projected Volumes (m ³)	Anticipated Volumes (m ³)
Non-defense TRU Waste				
FM-MOX-MT0	Framatome MOX Fuel Plant D&D Mixed TRU Waste	4.2×10^{-1}	0.0×10^0	4.2×10^{-1}
FM-MOX-T01	Framatome MOX Fuel Plant D&D TRU Waste	6.9×10^0	0.0×10^0	6.9×10^0
LA-OS-00-02	Isotopic sources waiting determination of eligibility for WIPP disposal	0.0×10^0	1.6×10^2	1.6×10^2
LA-TA-00-06	Containers waiting assignment to waste streams	4.5×10^1	0.0×10^0	4.5×10^1
LB-T001	LBL -Waste	6.2×10^{-1}	1.0×10^0	1.7×10^0
RL-W684	327 TRU RH heterogeneous S5420 Non-mixed	8.9×10^{-1}	0.0×10^0	8.9×10^{-1}
VN-CHT001		0.0×10^0	2.0×10^1	2.0×10^1
VN-RHT001		0.0×10^0	1.2×10^1	1.2×10^1
Totals		5.3×10^1	1.9×10^2	2.4×10^2

2
3**Table DATA-F-39. Possible Future Waste for WIPP**

Waste Stream ID	Waste Stream Name	Stored Volumes (m ³)	Projected Volumes (m ³)	Anticipated Volumes (m ³)
BL-001	Reactor Fuel Test Specimens	4.5×10^1	0.0×10^0	4.5×10^1
LA-TA-00-01	Containers waiting assignment to waste streams	7.7×10^1	0.0×10^0	7.7×10^1
LA-TA-00-02	Containers waiting assignment to waste streams	1.1×10^2	0.0×10^0	1.1×10^2
LA-TA-00-03	Containers waiting assignment to waste streams	7.7×10^0	0.0×10^0	7.7×10^0
LA-TA-00-04	Containers waiting assignment to waste streams	2.1×10^2	0.0×10^0	2.1×10^2
LA-TA-00-05	Containers waiting assignment to waste streams	4.2×10^2	0.0×10^0	4.2×10^2
LA-TA-00-06	Containers waiting assignment to waste streams	4.5×10^1	0.0×10^0	4.5×10^1
LA-TA-00-07	Containers waiting assignment to waste streams	1.8×10^1	0.0×10^0	1.8×10^1
PA-B015	Transuranic and Technetium Wastes - Liquid	2.5×10^0	0.0×10^0	2.5×10^0
PA-W014	Transuranic Waste Liquid	4.2×10^{-1}	0.0×10^0	4.2×10^{-1}
RF-MT0503		1.7×10^0	0.0×10^0	1.7×10^0
RF-MT0505		2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
RF-MT0529		2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
RF-MT0533		3.1×10^0	0.0×10^0	3.1×10^0
RF-MT0535		6.3×10^{-1}	0.0×10^0	6.3×10^{-1}
RF-TT0533		8.3×10^{-1}	0.0×10^0	8.3×10^{-1}
RL-W284	201C Unknown form CH RCRA MTRU w/ met	4.2×10^{-1}	0.0×10^0	4.2×10^{-1}
RL-W332	2345Z Unknown form CH St MTRU	1.9×10^0	0.0×10^0	1.9×10^0

1

Table DATA-F-39. Possible Future Waste for WIPP — Continued

Waste Stream ID	Waste Stream Name	Stored Volumes (m ³)	Projected Volumes (m ³)	Anticipated Volumes (m ³)
RL-W357	KAPL Unknown form CH/r TRU	2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
RL-W366	202A Unknown form CH TRU	1.5×10^0	8.3×10^{-1}	2.3×10^0
RL-W382	2345Z Unknown form CH TRU	1.9×10^1	6.1×10^1	8.0×10^1
RL-W391	308 Combustible unknown form CH TRU	4.2×10^{-1}	0.0×10^0	4.2×10^{-1}
RL-W471	202A MTRU CH unknown forms S9000 Mixed RCRA w/ org, met, Hg	1.9×10^0	0.0×10^0	1.9×10^0
RL-W472	202A MTRU CH unknown forms S9000 Mixed RCRA w/ met	2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
RL-W556	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ org, met, Hg	4.2×10^{-1}	0.0×10^0	4.2×10^{-1}
RL-W557	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ org, ign	2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
RL-W558	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ org	2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
RL-W559	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ met, ign	2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
RL-W560	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ met	4.0×10^0	0.0×10^0	4.0×10^0
RL-W561	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ met, Hg, cor	2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
RL-W562	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ met, Hg	1.0×10^0	0.0×10^0	1.0×10^0
RL-W577	2345Z TRU RH unknown forms S9000 Non-mixed	2.7×10^0	0.0×10^0	2.7×10^0
RL-W578	2345Z TRU RH unknown forms U9999 Non-mixed	5.3×10^0	0.0×10^0	5.3×10^0
RL-W609	324 MTRU CH unknown forms S9000 Mixed RCRA w/org, met, Hg	2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
RL-W650	325 TRU CH unknown forms S9000 Non-mixed	2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
RL-W651	325 MTRU CH unknown forms S9000 Mixed RCRA w/org, met	1.0×10^0	0.0×10^0	1.0×10^0
RL-W652	325 MTRU CH unknown forms S9000 Mixed RCRA w/org	3.8×10^0	0.0×10^0	3.8×10^0
RL-W667	325 TRU RH unknown forms S9000 Non-mixed	8.9×10^{-1}	0.0×10^0	8.9×10^{-1}
RL-W722	MCGEE TRU CH unknown forms S9000 Non-mixed	2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
SR-T001-WSB-3	Unknown	0.0×10^0	1.4×10^2	1.4×10^2
VN-CHT001		0.0×10^0	2.0×10^1	2.0×10^1
VN-RHT001		0.0×10^0	1.2×10^1	1.2×10^1

Table DATA-F-39. Possible Future Waste for WIPP — Continued

Waste Stream ID	Waste Stream Name	Stored Volumes (m ³)	Projected Volumes (m ³)	Anticipated Volumes (m ³)
WV-M007	TRU General Waste	1.1×10^1	0.0×10^0	1.1×10^1
WV-T004	Fissile Material - Other	6.2×10^{-1}	0.0×10^0	6.2×10^{-1}
WV-T020	PPC/XC2 PPE and DAW	0.0×10^0	2.3×10^2	2.3×10^2
	Totals	1.2×10^3	6.7×10^2	1.9×10^3
WV-M005	TRU Filters	6.0×10^1	4.6×10^1	1.1×10^2
WV-M008	TRU Concrete	2.1×10^{-1}	0.0×10^0	2.1×10^{-1}
WV-M010	TRU Spent Absorbents	8.3×10^{-1}	0.0×10^0	8.3×10^{-1}
WV-M013	Sweeping Compound	1.9×10^0	0.0×10^0	1.9×10^0
WV-M015	Chemical Process Cell General Waste	6.0×10^0	0.0×10^0	6.0×10^0
WV-T001	Fissile Material -Solids	3.7×10^1	0.0×10^0	3.7×10^1
WV-T006	TRU General Waste	1.0×10^1	1.0×10^1	2.1×10^1
WV-T009	TRU General Laboratory Waste	1.0×10^1	2.1×10^1	3.1×10^1
WV-T011	TRU Glove Boxes	1.0×10^1	0.0×10^0	1.0×10^1
WV-T014	Chemical Process Cell Vessels	1.1×10^1	0.0×10^0	1.1×10^1
WV-T016	Chemical Process Cell Miscellaneous Equipment	8.5×10^0	0.0×10^0	8.5×10^0
WV-T017	Spent Filter Media	2.5×10^0	0.0×10^0	2.5×10^0
WV-T018	Head End Cell Debris	5.4×10^1	2.6×10^1	8.0×10^1
WV-T019	FRS Pool Filters	0.0×10^0	2.1×10^1	2.1×10^1
WV-T021	RHWF Process	0.0×10^0	8.1×10^1	8.1×10^1
WV-W024	TRU Lead	1.9×10^1	0.0×10^0	1.9×10^1
	Totals	1.2×10^3	6.7×10^2	1.9×10^3

- 1 • Pre-1970 buried TRU Waste—Several sites (i.e., LANL, SRS, SNL, Hanford Site,
2 INEEL, Oak Ridge National Laboratory, and West Valley Demonstration Project) have
3 TRU wastes that were buried prior to 1970. The final disposition of the buried pre-1970
4 TRU waste at DOE sites is still undecided.
- 5 • Classified Waste—Some classified TRU waste is now acceptable to be disposed of at
6 WIPP. TRU-contaminated classified materials are materials used in weapons production.
7 These materials are classified for security and national defense purposes due to their
8 physical shape or form. TRU-contaminated classified materials include graphite shapes,
9 metal shapes, tooling, and plastic shapes. The same characterization and associated QA
10 activities, as currently required under the WIPP program, will be implemented for the
11 characterization of classified materials in waste. The primary change associated with the
12 proposed acceptance at WIPP of classified materials in waste is the security qualifications
13 of the responsible parties implementing the waste characterization requirements and the
14 associated QA requirements. Due to national security requirements, responsible parties

1 for waste characterization and related QA activities will possess a DOE “Q” clearance.
2 Site and CBFO personnel will accomplish waste characterization and related QA
3 activities in accordance with currently approved requirements.

- 4 • Polychlorinated Biphenyls (PCBs) —The U.S. Environmental Protection Agency, Region
5 6, Dallas, Texas office approved the disposal of non-liquid polychlorinated biphenyl-
6 contaminated TRU waste (PCB/TRU waste) and PCB/TRU waste mixed with hazardous
7 waste (PCB/TRU mixed waste) at the WIPP in May 2003. However, at the time the
8 inventory data was prepared for the PA, this approval had not been received, therefore
9 PCB-contaminated TRU waste > 50ppm was not included in this updated inventory data.
- 10 • RH-TRU waste that exceeds 23,000 Curies/m³ (650 Curies/ft³)—This limit is from the
11 LWA (Pub. L. No. 102-579, 110 Stat. 2422 (1992), as amended by 104-201 (1996)).
- 12 • Waste streams that have unknown waste matrices —There are waste streams at the TRU
13 waste sites that have not been characterized and therefore the determination cannot be
14 made regarding the make up of the waste stream. These wastes are assigned unknown
15 WMCs or final forms and have no known WMPs or radionuclide content.

16 ***DATA-F-3.4.2 Other Possible Future Waste Isolation Pilot Plant Waste***

17 There are several other categories of material that eventually may become waste acceptable at
18 WIPP. These include the following wastes.

- 19 • One category of potential future waste may come from waste streams that have been
20 currently declared “unknown.” These waste streams are summarized in Table DATA-F-
21 39. These wastes have not been characterized adequately to determine the final waste
22 form and/or other significant parameters. If these wastes are characterized, and if they
23 meet the WAC (DOE 2002a), they will be included in the WIPP inventory in the future.
- 24 • Babcock and Wilcox in Lynchburg, Virginia, currently has approximately 45 m³ (1,590
25 ft³) of TRU waste that requires a defense determination, in on-site storage silos of which
26 a portion may be possible future TRU waste. Virtually all of the material was generated
27 from the Light Water Reactor Extended Burn-up Program. That program was
28 responsible for sending test elements of reactor fuel to various hot cells, including the one
29 at Lynchburg. The waste consists mostly of cellulosic material, rubber material, and
30 lead-lined gloves.
- 31 • Another potential TRU waste site is the Brookhaven National Laboratory (BNL). BNL
32 has identified an existing legacy 17,500-lb concrete vault stored at the Hazardous Waste
33 Management Facility as TRU waste based on recalculation of ²³⁹Pu curie content. The
34 vault holds five plutonium foils (TRU waste) and other non-TRU waste constituents
35 including Brookhaven Linear Isotope Production (BLIP) waste and cesium and cobalt
36 sources embedded in concrete. The vault must now be managed as TRU waste.
- 37 • There are four waste streams at the SRS that were not listed in Table DATA-F-39. These
38 waste streams will account for nearly $9.6 \times 10^3 \text{ m}^3$ ($3.3 \times 10^5 \text{ ft}^3$) of possible future TRU

1 waste for WIPP. These waste streams will come from proposed facilities at SRS. Those
 2 waste streams are SR-T001-WSB-1, SR-T001-WSB-2, SR-W026-PDCF-1, and SR-
 3 W026-MFFF-1.

- 4 • Sodium-Bearing Waste (SBW) at INEEL requires a declaration that it is waste incidental
 5 to reprocessing (WIR). Several treatment options are being considered with the final
 6 treatment option to be selected in the near future. For this update, the SBW is included in
 7 the Non-WIPP TRU waste and has been entered using the bounding case for RH-TRU
 8 waste. That is, the case in which RH-TRU waste is generated from the calcine process.
- 9 • Beryllium Block Waste from the INEEL is a waste stream that includes beryllium blocks
 10 and outer shim control cylinders from the Advanced Test Reactor. The radionuclide
 11 concentrations are too great to be considered in this update but may be considered in the
 12 future.

13 **DATA-F-3.5 Emplacement Materials**

14 The inventory of CPR materials used by WIPP Waste Handling Operations (WHO) to facilitate
 15 waste emplacement was estimated to support the CRA-2004 PA. Other materials that were not
 16 accounted for by the sites in their waste/ packaging material parameter data submissions were
 17 also estimated. Finally, the mass of magnesium oxide (MgO) used as backfill was estimated for
 18 the full repository. The results of these estimations were summarized in a letter to SNL
 19 (Crawford 2003a).

20 The estimates for CPR materials, other emplacement materials, and MgO are based on the
 21 number and type of waste containers emplaced in the WIPP as of the inventory date, September
 22 30, 2002.

23 The TRUPACT-II Authorized Methods for Payload Control (TRAMPAC), Revision 19c
 24 (NMED 2002) allows certain container types to be transported in the Transuranic Package
 25 Transporter-II (TRUPACT-II). These are 55-gallon drums, 100-gallon drums, SWB, and ten-
 26 drum overpacks (TDOP).

27 The WIPP was designed to receive both CH- and RH-TRU waste. CH-TRU waste that has been
 28 emplaced in the WIPP since the repository opened is in seven-packs of 55-gallon drums and/or
 29 pipe overpack components (POCs), SWBs, and TDOPs. RH-TRU waste has not been shipped to
 30 the WIPP to date.

31 WIPP WHO uses several materials to facilitate the emplacement of TRU waste, and MgO is used
 32 as barrier. Plastic and cellulosic materials are used to emplace CH-TRU waste. The MgO is
 33 placed on top of the containers and comes in a woven plastic bag called a “supersack.” RH-TRU
 34 waste will be emplaced in boreholes in the salt and then a shield plug, which consists of concrete
 35 (cement), steel, and plastic, will be installed to seal the canister into the borehole and provide
 36 shielding. There are no rubber materials used for waste emplacement.

37 The materials used to emplace CH-TRU waste are:

- 1 • Polyethylene (PE) slip-sheets for the seven-packs of 55-gallon drums and/or POCs and
2 the MgO supersacks (plastics);
- 3 • Fiberboard slip-sheet for the SWB and TDOP (cellulosic material);
- 4 • Woven polypropylene supersacks containing MgO (plastic material/MgO);
- 5 • Cardboard stabilizers for the supersacks (cellulosic material); and
- 6 • Stretch wrap for the seven-packs (plastic material).

7 The materials that will be used to emplace RH-TRU waste are:

- 8 • Shield plug (cement components);
- 9 • Shield plug (steel components); and
- 10 • Shield plug (plastic components).

11 Data on the MgO and other emplacement materials were obtained from WIPP WHO drawings
12 and procedures, from WWIS personnel, from the WIPP CH-TRU Waste Safety Analysis Report,
13 and from the internet. These sources are referenced in a letter to SNL (Crawford 2003a).

14 For CH-TRU waste, the total mass of each of the emplacement materials (plastic, cellulosic, and
15 MgO) as of the inventory date was calculated. These total masses were then divided by the total
16 volume of the emplaced waste (as of the inventory date September 30, 2002) to obtain the
17 density of these materials in the WIPP as of the inventory date. These densities were then scaled
18 to a full repository based on the volume limit for CH-TRU waste of 168,485 m³ (5,950,000 ft³).

19 The total masses of the emplacement materials (cement, steel, and plastic) that will be used for
20 RH-TRU waste emplaced in the WIPP in the future were calculated. This was done by first
21 determining the total number of RH-TRU waste shield plugs that will be used in the repository.
22 The total mass of each shield plug component for the repository was then calculated by
23 determining the mass of each component for each shield plug and multiplying that mass by the
24 number of plugs to be used.

25 The estimates for CPR and MgO, as well as for the steel and cement used in the RH-TRU waste
26 shield plug, are provided in Table DATA-F-40.

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Table DATA-F-40. Estimates of Materials Used to Facilitate Emplacement of Waste in the WIPP

Material Parameter	Mass used for CH Waste (kg) ¹	Density used for CH Waste (kg/m ³) ¹	CH Mass-Scaled to CH Limit ² (kg)	RH Mass-for the WIPP (kg)	Total (CH+RH) WIPP Mass (kg)
Cellulosic Material (fibreboard slip-sheets)	2.03×10^3	2.63×10^{-1}	4.44×10^4	N/A	4.44×10^4
Cellulosic Material (cardboard stabilizers)	7.02×10^3	9.09×10^{-1}	1.53×10^5	N/A	1.53×10^5
Total Cellulosic Material	9.06×10^3	1.17×10^0	1.98×10^5	N/A	1.98×10^5
Plastic (slip-sheets)	1.02×10^5	1.33×10^1	2.23×10^6	N/A	2.23×10^6
Plastic (poly bag)	6.24×10^3	8.08×10^{-1}	1.36×10^5	N/A	1.36×10^5
Plastic (shrink wrap)	3.56×10^3	4.62×10^{-1}	7.78×10^4	N/A	7.78×10^4
Plastic (RH shield plug)				1.73×10^5	1.73×10^5
Total Plastic Material	1.12×10^5	1.45×10^1	2.45×10^6	1.73×10^5	2.62×10^6
Rubber Material	N/A	N/A	N/A	N/A	N/A
Cement (RH-TRU Waste shield plug)	N/A	N/A	N/A	6.33×10^6	6.33×10^6
Steel (RH-TRU Waste shield plug)	N/A	N/A	N/A	7.95×10^4	7.95×10^4
Magnesium Oxide	3.20×10^6	4.14×10^2	6.98×10^7	N/A	6.98×10^7

¹ These are the masses and densities of the materials that were used to facilitate emplacement of waste in the WIPP as of September 30, 2002. There was no RH-TRU waste emplaced as of that date.

² The CH-TRU waste limit is 1.68×10^5 m³.

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