DOE/TRU-2006-3344

TRANSURANIC WASTE
BASELINE INVENTORY REPORT – 2004
Revision 0

U.S. Department of Energy
Carlsbad Field Office

TRANSURANIC WASTE BASELINE INVENTORY REPORT - 2004

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1.0 INTRODUCTION

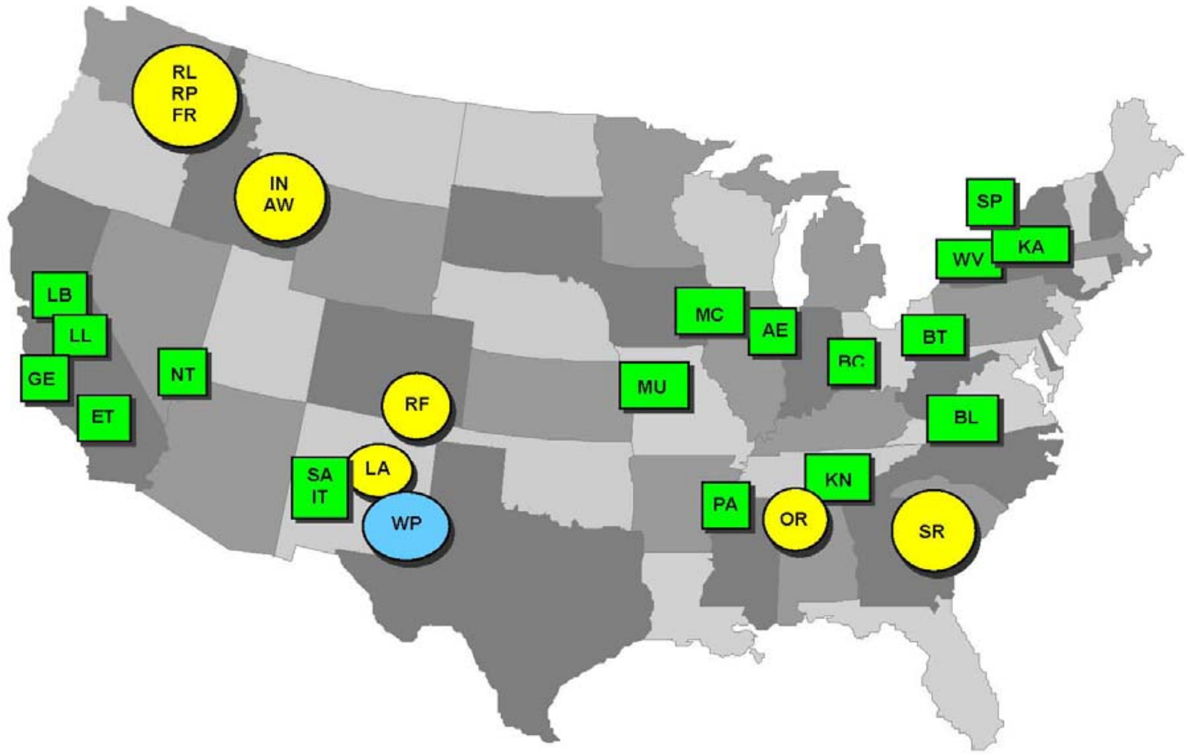
1.1 Background

The U.S. Department of Energy's (DOE's) Waste Isolation Pilot Plant (WIPP) opened on March 26, 1999, becoming the nation's first deep geologic repository for the permanent disposal of defense-generated transuranic (TRU) waste. At the time of data cut off for the Compliance Recertification Application 2004 (CRA-2004) (September 30, 2002), the waste was in retrievable storage at 27 sites across the country (see Figure 1), pending disposal at the WIPP. From the WIPP's opening through the inventory cut off date (September 30, 2002), 1,255 shipments of TRU waste were safely characterized, transported, and disposed in the WIPP.

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

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

The purpose of the *WIPP TRU Waste Baseline Inventory Report* (WTWBIR) Revision 0 (DOE 1994) and Revision 1 (DOE 1995a) was to provide data to be included in the PA modeling calculations for the WIPP. The *Transuranic Waste Baseline Inventory Report*, Revision 2 (hereafter referred to as TWBIR Revision 2) (DOE 1995b) expanded the original purpose of Revisions 0 and 1 to include support for the WIPP Land Withdrawal Act (LWA) (U.S. Congress 1996) by providing an estimate of the total DOE TRU waste inventory. The TWBIR Revision 2 included a chapter and an appendix that discussed the total estimated DOE TRU waste inventory, including non-defense, commercial, polychlorinated biphenyl (PCB)-contaminated, and buried (predominately pre-1970) TRU wastes that were not planned at the time for disposal in WIPP. Since that time, Idaho National Engineering and Environmental Laboratory (INEEL), now the Idaho National Laboratory (INL), is preparing to ship pre-1970 buried waste to WIPP.



AE Argonne National Laboratory-East
AW Argonne National Laboratory-West
BC Battelle Columbus Laboratories
BT Bettis Atomic Power Laboratory
BL Babcock & Wilcox-Lynchburg
ET Energy Technology Engineering Center
FR Framatome
GE General Electric Vallecitos Nuclear Center
IN Idaho National Engineering and Environmental Laboratory
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
MU University of Missouri Research Reactor
NT Nevada Test Site
OR Oak Ridge National Laboratory
PA Paducah Gaseous Diffusion Plant
RF Rocky Flats Environmental Technology Site
RL Hanford Site (Richland Operations Office)
RP Hanford Site (Office of River Protection)
SA Sandia National Laboratories
SP Separations Process Research Unit
SR Savannah River Site
WV West Valley Demonstration Project
WP Waste Isolation Pilot Plant

Ovals and circles represent large quantity sites; squares represent small quantity sites; WIPP is shown in blue.

Figure 1. U.S. Department of Energy TRU Waste Sites

The *Transuranic Waste Baseline Inventory Report*, Revision 3 (hereafter referred to as TWBIR Revision 3) (DOE 1996a) was based on the TWBIR Revision 2 (DOE 1995b) data, which were supplemented by data in several memoranda issued during early calendar year (CY) 1996. These memoranda summarize additional data requested by the DOE to support PA modeling calculations.

The primary purpose of TWBIR Revision 3 (DOE 1996a) was to provide the summary data from TWBIR Revision 2 (DOE 1995b) and the supplemental information used in the PA for the development of the Compliance Certification Application (CCA) (DOE 1996b) that was delivered to the Environmental Protection Agency (EPA), to comply with the LWA (U.S. Congress 1996). The supplemental information was generated from specific data requests to the TRU waste sites since the publication of the TWBIR Revision 2. These supplemental data included estimates for complexing agents, oxyanions, and cement content in solidified waste that were first included in the 2003 Update Report, Appendix DATA Attachment F of the *Compliance Recertification Application 2004* (DOE 2004c).

The purpose of this *Transuranic Waste Baseline Inventory Report - 2004,* for the 2004 WIPP Compliance Recertification Application (hereafter referred to as the TWBIR - 2004) is to document the total estimated inventory of DOE TRU waste as defined by the DOE TRU waste sites. This document is a revision of Attachment F found in the Appendix DATA of the CRA-2004 (DOE 2004c). The primary purpose of this document is to provide the summary data required for the PA modeling calculations in support of the CRA-2004 that were used in the Performance Assessment Baseline Calculation (PABC) (Leigh et al. 2005a; Leigh et al. 2005b). Knowing that the WIPP waste inventory information has changed as a result of characterization activities, improved estimation processes, and emplacement of waste in WIPP, the EPA requested that an update to the CCA (DOE 1996b) inventory be included in the CRA-2004. This information was subsequently updated at EPA's request (Cotsworth 2005). TWBIR - 2004 provides the changes that were made to the inventory estimate that was submitted as part of the PABC.

1.2 Purpose and Objectives

The TWBIR Revision 2 (DOE 1995b) contained the TRU Waste Baseline Inventory Waste Profiles (waste profiles) for all waste stream identifications (ID) (referred to waste stream in this report) reported by the TRU waste sites at that time, including some TRU waste streams that were unacceptable for disposal at WIPP. The waste profiles resided in two appendices in TWBIR Revision 2 (DOE 1995b). Appendix O reported the "Non-WIPP" waste streams and Appendix P reported the "WIPP" waste streams. For the TWBIR - 2004, Appendix I reports the "non-WIPP" waste streams, Appendix J reports the "WIPP" waste streams, and Appendix K reports the "emplaced waste." Although all TRU waste streams currently reported by the sites are accounted for in the current database (TWBID Revision 2.1, see Section 2.1.3) and are reported in the TWBIR - 2004, the non-WIPP waste streams do not contribute to the volume and scaling calculations. Hence, the non-WIPP waste streams did not contribute to the estimated TRU waste inventory for the PABC (Leigh et al. 2005a; Leigh et al. 2005b).

The objectives of the TWBIR - 2004 are to:

1. Estimate and describe the DOE TRU waste inventory;

2. Provide the required CRA information (Appendix DATA Attachment F and specific information requested by the EPA [Cotsworth 2005]) that were used to support the March 2006 WIPP recertification in a stand alone document; and

3. Provide updated information used in the PABC inventory.

To effectively keep track of the changes in the TRU waste inventory, site TRU waste inventory information will be monitored for changes as an ongoing process and will be reflected in subsequent issues of this document.

1.3 Sources of Transuranic Waste Information

For this revision, the TRU waste inventory estimate was developed using existing information about the waste, which was provided by the TRU waste sites. In addition, information obtained from site Acceptable Knowledge (AK) Summary Reports was incorporated to provide the most current information on waste streams being characterized and shipped to WIPP. Particular focus on data collection involved discussion with TRU waste sites about changes to the inventory since the certification of WIPP in 1998. Site visits and onsite interviews facilitated data collection and ensured data were accurately represented.

This report includes information taken from the TWBIR Revisions 2 and 3, the WIPP Waste Information System (WWIS), and information provided by the TRU waste sites. The information found in the TWBIR Revision 2 (DOE 1995b) has not been updated since the publication of that document. The TWBIR Revision 3 (DOE 1996a) used the same data plus other supplemental data that were needed for the CCA PA calculations. The WIPP has been open and receiving waste since March 1999. Therefore, data from the emplaced waste through September 30, 2002, as obtained from the WWIS are included in this report.

1.4 Document Organization

TWBIR - 2004 is organized to be consistent with the TWBIR Revision 3 (DOE 1996a). The contents of remaining sections in this document are summarized below.

- Section 2.0 presents the approach and methods used for gathering and compiling the WIPP waste disposal estimated inventory information, including data entry into the *Transuranic Waste Baseline Inventory Database Revision 2.1, Version 3.13, Data Version D.4.16* (LANL 2005) (hereafter referred to as TWBID Revision 2.1) and a description of the records system used to document the data, as well as analysis methods and results.

- Section 3.0 presents summaries of inventory information including the waste volumes, waste material parameters (WMPs), packaging materials, chemical components, radiological components, discussion regarding the non-WIPP and future potential TRU waste, and discussion regarding the materials used to emplace the waste in the WIPP.

2.0 METHODS AND APPROACH

This document provides the information that was first reported as part of the WIPP CRA-2004 (DOE 2004c) and includes, as requested by the EPA, selected 2004 updates (Cotsworth 2005). The work was performed by Los Alamos National Laboratory – Carlsbad Operations (LANL-CO) and Sandia National Laboratories (SNL). The role of LANL-CO was to provide the updated inventory estimate and associated analyses using inventory information to support the PABC (Leigh et al. 2005a; Leigh et al. 2005b). The role of SNL was to perform the PA calculations, and provide documented results for the PABC. The technical work performed and documentation produced was governed by the SNL WIPP Quality Assurance (QA) Program developed for the SNL Nuclear Waste Management Program (NWMP). Under the SNL QA Program, LANL-CO Inventory personnel:

1. Collected TRU waste stream information from the TRU waste sites via site visits and additional communication, as needed;

2. Entered the information into the Transuranic Waste Baseline Inventory Database (TWBID) Revision 2.1 (LANL 2005), a quality assured electronic database;

3. Performed analyses of the information in support of the CRA-2004 (DOE 2004c) PA and PABC; and

4. Submitted the above results as official WIPP records acceptable for use in WIPP PA calculations.

The following sections describe the four basic process steps leading to the issuance of this report. Section 2.1 discusses information collection, compilation, verification, and validation. Section 2.2 explains the analyses that were performed to provide the information needed to support the PABC calculations (DOE 2004c; Leigh et al. 2005a; Leigh et al. 2005b). An extensive discussion on the evolution of the TWBID, a detailed discussion of the analyses and topics required supporting the PA, and listings of the supporting documents in the SNL WIPP Records Center are given in Appendix M.

2.1 Collection, Compilation, Verification, and Validation of Inventory Information

The sections that follow describe the process of information collection, entry, verification, and validation used to ensure quality was maintained throughout the TRU waste inventory process. The information provided in Section 2.1.1 was specifically called out by SNL to address the PA information needs (Giambalvo 2002). The information was then collected from the TRU waste sites, entered into the TWBID Revision 2.1 (LANL 2005), and independently reviewed and verified by inventory personnel and validated by the sites. The process, by which information was collected, entered, reviewed, verified, and validated is described in Sections 2.1.2 through 2.1.4.

All of the activities described in this section were governed by SNL Procedure SP 9-6, *Baseline Inventory Report (BIR) Change Report Data Collection and Entry* (SNL 2003b). A collection of the documents compiled for each site is provided in Appendix M, including their respective Electronic Records Management System number (ERMS #).

2.1.1 Information Requested for the Performance Assessment

The information requested for the TWBIR - 2004 were called out in a series of communications shown in Appendices G and H. The specific information needs for PA were given in Giambalvo (2002) and include the following:

- Waste stream volumes, broken down into categories of stored, projected, and anticipated waste (sum of stored and projected);
- Inventory of radionuclides by waste stream for both CH- and RH-TRU waste with the requirement 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, identification of all waste streams containing 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 cellulosics, plastics, and rubber (CPR) and other biodegradable materials used to facilitate emplacement of waste and magnesium oxide (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.

2.1.2 Collection Method

For purposes of recertification, the EPA was primarily concerned with changes in the TRU waste inventory since the initial WIPP CCA (DOE 1996b) and certification. Each TRU waste site was sent a copy of their inventory information originally submitted in 1995 for the CCA, in the form of waste profiles from the TWBIR Revision (DOE 1995b). Guidance was included describing the information that each site needed to provide for the PA.

The sites were requested to indicate changes on the waste profiles, including any necessary explanation. The information from the updated waste profiles was entered into the TWBID Revision 2.1 (LANL 2005), independently verified, and were qualified under SNL NP 19-1, *Software Requirements* (SNL 2004). Upon completion, each site's update waste profile was returned to the appropriate DOE site representative for verification and signature.

Figure 2 illustrates the steps involved in data collection, processing, and reporting.

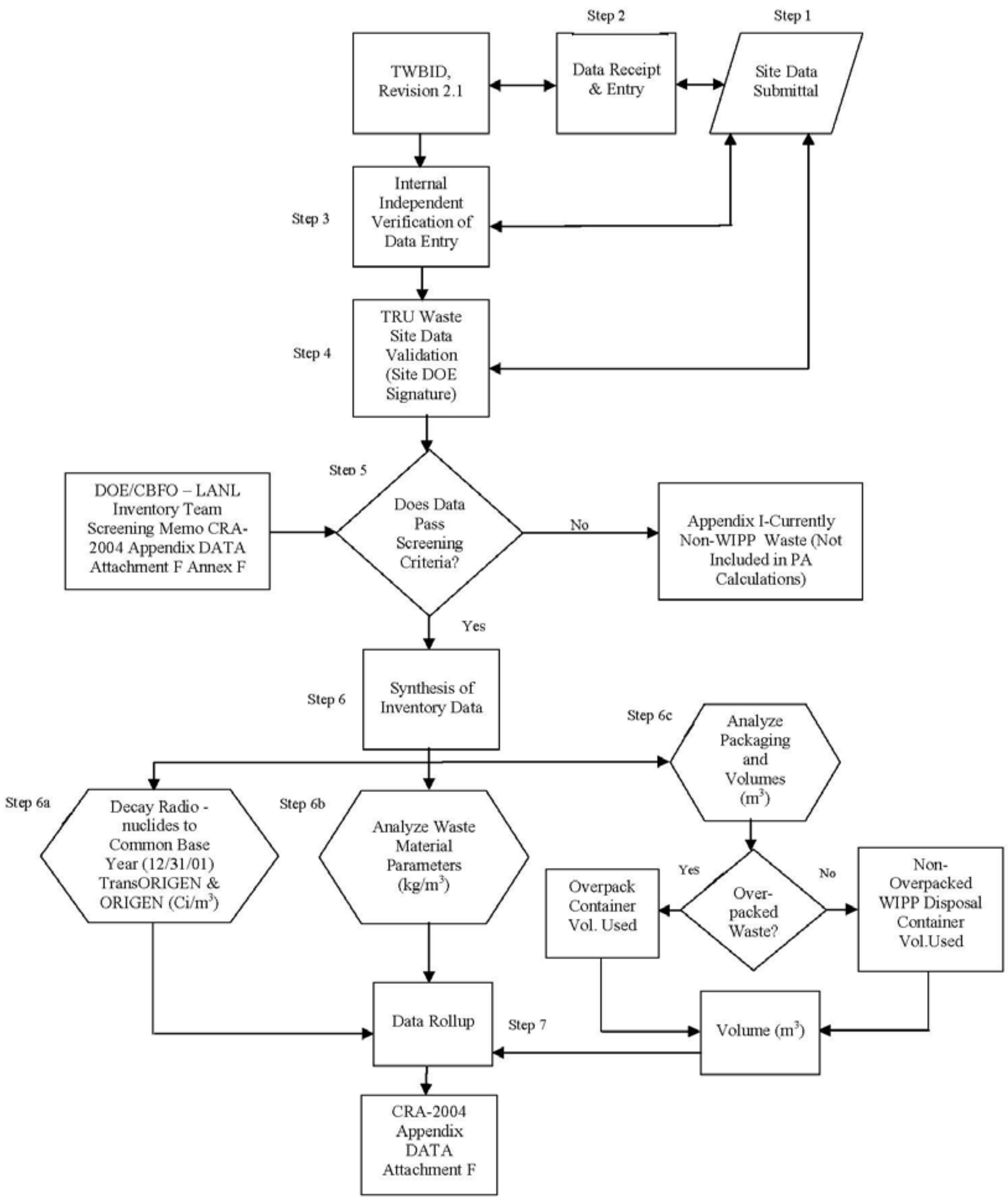


Figure 2. TRU Waste Inventory Process Flow Chart

The methodology used to collect information from the TRU waste sites and to enter this information into the TWBID Revision 2.1 (LANL 2005) is captured in procedure SP-9-6, *Baseline Inventory Report (BIR) Change Report Data Collection and Entry* (SNL 2003b). The process described in this procedure was initiated by a data call based on a request for updating the waste profile information that was included in the TWBIR Revision 2 (DOE 1995b). A second data call specifically requested information required by SNL (Giambalvo 2002). During this time, LANL-CO visited sites to facilitate collection of inventory information, and assist with questions and issues.

As a result of EPA's Completeness Review in 2003, the information from two large quantity sites was subsequently updated with new information and processing. This occurred during the review of the inventory information that was submitted as Attachment F to Appendix DATA of the CRA-2004 (DOE 2004c). An email from Hanford Richland Operations Office (Hanford RL) identified several waste profiles and associated waste streams that they failed to delete when this information was initially submitted. An analysis was performed (Lott 2004a) for these waste profiles, which were subsequently deleted, and therefore supporting the basis for this report.

In addition to the changes in the Hanford information, INL began processing pre-1970 buried waste for shipment to WIPP. Inventory information was collected from the site to update waste stream information on the IN-Z001 buried waste that had been included in the inventory update for the CRA-2004 as possible future waste but "non-WIPP shippable." The site responded to an email request for direction on how the waste stream would be reported in final form. Subsequent discussion and email exchanges resulted in the determination of the IN-Z001 to be separated into five waste streams by expected content based on AK documentation being collected at the site (Lott 2004b).

2.1.3 Implementation of the Transuranic Waste Baseline Inventory Database, Revision 2.1

Inventory information collected from the sites included electronic media containing inventory information, notes from discussions with site waste management personnel, email correspondence, and site literature. The collected inventory information was then compiled and used to update the TWBID Revision 2.1 (LANL 2005) by deletion of waste profiles and associated waste streams that were no longer maintained and/or assimilated into other waste profiles, modification of waste streams, and addition of new waste streams. This information was submitted to the SNL WIPP Records Center.

Waste stream profile information was modified for sites that either had additional information or had modified TWBIR Revision 2 (DOE 1995b) waste streams. When discrepancies were found or sites requested changes to inventory information after preliminary inventory information was entered into the database, change information was documented on forms found in Procedure SP-9-6, *Baseline Inventory Report (BIR) Change Report Data Collection and Entry* (SNL 2003b). The inventory information in the database was updated to reflect this new information and the documentation supporting the changes was submitted to the SNL Records Center.

2.1.4 Inventory Information Verification and Validation

After inventory information was entered and/or updated into the TWBID, an independent review was conducted of all changes that were made to the database. This review was tracked and documented in the database. When all changes were completed, the database record (waste profiles) were sent back to the sites for final verification and validation, and authentication by the DOE site representative. Documentation of validation was submitted to the SNL WIPP Records Center.

Additional records were collected from sites after the inventory was validated and authenticated by DOE site representatives. Records were received from each site explaining changes that had occurred with their inventory since the baseline data collection was performed in 1995. These records were also entered into the SNL WIPP Records Center and excerpts from these records are provided in Appendix C to this report.

2.2 Analysis Methods

In addition to collecting and processing information from the TRU waste sites and securing the site information in a qualified database for future use, analyses were performed on the information to support the CRA-2004 (DOE 2004c) PA and PABC (Leigh et al. 2005a; Leigh et al. 2005b). For example, volume data from waste streams were rolled up into stored, projected, and anticipated categories; WMPs were rolled up to provide average waste material densities in the repository; radionuclides were decay-corrected to the end of calendar year 2001; and radionuclide activities were scaled for the full repository. Appendix M provides a detailed listing of all of the analyses that were required to produce the report that was submitted to EPA as Attachment F to Appendix DATA of the CRA-2004 (DOE 2004c), as well as the reports that supported the PABC.

The analyses were performed in accordance with AP-092, *Analysis Plan for the Transuranic Waste Inventory Update Report*, *2003* (SNL 2003a), and two additional analysis plans: AP-112 *Analysis Plan for CRA Response Activities* (SNL 2005a), and AP-113 *Analysis Plan for Inventory Reconciliation: Compliance Recertification Application* (SNL 2005b). AP-112 was written to respond to EPA questions during the CRA-2004 Completeness Review. AP-113 was written to address internal review comments on the document but that have had no impact on PA calculation (Crawford and Leigh 2004). AP-113 was updated as necessary as the information in TWBID Revision 2.1 (LANL 2005) was updated. Section 3.2.3, Chemical Components in Transuranic Waste, including cement analysis and revisions to oxyanions and complexing agents, and Section 3.5, Emplacement Materials, have been revised as needed according to AP-113.

2.2.1 Radionuclide Decay Calculations

One of the needs for the radionuclide inventory information (see Section 2.1.1) for the PA is that all radionuclides reported by waste stream in TWBID Revision 2.1 (LANL 2005) be decayed to a common time frame. However, the site data provided consisted of radionuclide activity concentrations at the date of assay (if the waste stream was assayed) or at the date that the site calculated the activity concentrations. In order to make the radionuclide information complete, the radionuclide activity concentration reported by the sites was exported from the TWBID Revision 2.1 into an external application (ORIGEN, ORNL 2002) where the radionuclide decay calculations were performed, and then imported back into the TWBID Revision 2.1. See Appendix M for more discussion concerning radionuclide decay calculation and reporting.

2.2.2 Roll-up and Scaling Calculations

The roll-up and scaling calculations performed in support of this report were performed in the TWBID Revision 2.1 (LANL 2005). The computational methods that apply to the roll-up and scaling calculations were defined in the Computational Methodology (LANL 2003). This methodology document was used as the basis for drafting the design documentation required for software qualification of TWBID Revision 2.1. The queries that have been qualified for use in TWBID Revision 2.1 produce the data that are tabulated throughout this report and are documented in records submitted to the SNL WIPP Records Center.

2.2.3 Chemical Component Calculations

A final request for information set forth in Giambalvo (2002) was that this report supply information about the chemical components of the waste such as that supplied in support of the CCA PA in the TWBIR Revision 3 (DOE 1996a). This included a calculation of the mass of organic ligands (complexing agents), the mass of oxyanions (nitrate, sulfate, and phosphate), and the mass of cement expected in the disposal volume for WIPP including the breakout of these components by waste stream.

The calculation of the estimated mass of organic ligands, oxyanions, and cement in the disposal volume for WIPP was governed by SNL Procedure NP 9-1, *Analyses* (SNL 2001). The reports are discussed in Sections 3.2.3.1, 3.2.3.2, and 3.2.3.3. Appendix A contains the results of an analysis of the inventory for pyrochemical salts. The waste streams containing the specific chemical components can be found in Appendix L.

2.3 Records

The entire process of data collection, database development, and analysis leading up to the publication of this report has been documented and submitted to the SNL WIPP Records Center in accordance with SNL Procedure NP 17-1, *Records* (SNL 2003c). A detailed discussion of the records that have been used to generate this report can be found in Appendix M.

3.0 TRANSURANIC WASTE INVENTORY ESTIMATES

This section presents the estimated TRU waste inventory that was collected on behalf of the DOE in support of CRA-2004 (2004c) and was subsequently updated for the PABC (Leigh et al. 2005a; Leigh et al. 2005b). The inventory information is stored in an electronic database, the TWBID Revision 2.1, Version 3.13, Data Version D.4.16 (LANL 2005), which has been qualified as discussed generally in Section 2 and in detail in Appendix M of this report.

This presentation of the TRU waste inventory consists of summaries of the inventory information collected from the TRU waste sites and the information calculated from the data submitted by the sites. Section 3.1 presents the volume information provided by the sites for

CH- and RH-TRU waste and the volume roll-ups to the WIPP repository capacity needed for PA. Section 3.2 presents the non-radiological waste inventory as reported by the sites and as needed for PA. This includes roll-ups of the waste materials (Section 3.2.1), roll-ups of the packaging materials (Section 3.2.2), and information about the chemical components of the waste (Section 3.2.3). Section 3.3 presents the radionuclide inventory reported by the sites and WIPP-level roll-ups of the radionuclide data needed for PA.

Section 3.4 presents a discussion of the non-WIPP and future potential waste, and provides the total volumes of the non-WIPP wastes. Section 3.10 provides information for the materials used to facilitate waste emplacement at the WIPP. The complete TRU waste inventory for all waste streams at all of the sites has been prepared in support of the CRA-2004 (DOE 2004c) and the PABC (Leigh et al. 2005a; Leigh et al. 2005b). That inventory is presented by site by waste stream in Appendices I, J, and K. Appendix I presents individual waste stream profiles for all of the waste streams that have been designated as non-WIPP waste streams, as discussed in Section 3.7. Appendix J presents individual waste stream profiles for all WIPP waste streams planned for emplacement in the WIPP. Appendix K presents individual waste stream profiles for all WIPP waste streams that were emplaced in the WIPP as of September 30, 2002.

3.1 Transuranic Waste Volume Inventory Estimates

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

- stored waste – waste that currently exists at the TRU waste site, regardless of whether it is in its final form,
- projected waste – waste that will be generated in the future, and
- anticipated waste – stored plus projected.

Information for emplaced wastes was obtained from the WWIS. The total waste stream volume collected from the sites included stored (v_s) and projected (v_p) components as applicable for each TRU waste stream. The sites also reported both "As Generated" and "Final Form" (as opposed to "Final Waste Form") waste volumes for their waste streams (see Glossary for definitions). The "Final Form" volume accounts for the payload container (the volume the waste container occupies in the repository). Since PA only considers the waste volume that will be disposed in the WIPP, only the "Final Form" volumes were used of actual (reported by the site) and scaled (used in PA) waste volumes.

Table 1 presents the CH-TRU waste anticipated inventory volumes reported by the sites. Table 2 presents the RH-TRU waste anticipated inventory volume reported by the sites. The data presented in Tables 1 and 2 were derived by summing the waste-stream-level data into a site-level roll-up. For each site, all stored waste stream volumes (v_s) were summed to arrive at the total stored volume for the site, V_s. All projected waste stream volumes (v_p) were summed to arrive at the total projected volume for the site, V_p. The sum of the total stored volume and the total projected volume is the anticipated volume, V_a.

$$\boldsymbol{V_a = V_s + V_p} \qquad (1)$$

Where

V_a is the total anticipated volume
V_s is the total stored volume
V_p is the total projected volume.

Table 1. WIPP CH-TRU Waste Anticipated Inventory By Site

TRU Waste Site	Stored Volumes (Cubic Meters)	Projected Volumes (Cubic Meters)	Anticipated Volumes (Cubic Meters)
Argonne National Laboratory - East	1.1E+02	8.0E+01	1.9E+02
Argonne National Laboratory - West	6.0E+00	3.8E+01	4.4E+01
Battelle Columbus Laboratories	5.2E+00	0.0E+00	5.2E+00
Bettis Atomic Power Laboratory	1.9E+01	0.0E+00	1.9E+01
Energy Technology Engineering Center	2.3E+00	0.0E+00	2.3E+00
Hanford (Richland) Site	1.3E+04	5.5E+03	1.8E+04
Hanford (River Protection) Site	3.9E+03	0.0E+00	3.9E+03
Idaho National Engineering and Environmental Laboratory	6.1E+04	1.8E+04	7.8E+04
Knolls Atomic Power Laboratory - Nuclear Fuel Services	5.5E+01	1.7E+02	2.3E+02
Lawrence Livermore National Laboratory	3.5E+02	2.1E+03	2.4E+03
Los Alamos National Laboratory	1.2E+04	3.3E+03	1.5E+04
Nevada Test Site	6.2E+02	4.6E+02	1.1E+03
Oak Ridge National Laboratory	0.0E+00	4.5E+02	4.5E+02
Paducah Gaseous Diffusion Plant	5.7E+00	5.7E+00	1.1E+01
Rocky Flats Environmental Technology Site	5.4E+03	2.8E+03	8.1E+03
Sandia National Laboratories - Albuquerque	2.4E+01	0.0E+00	2.4E+01
Savannah River Site	1.3E+04	2.4E+03	1.5E+04
U.S. Army Material Command	2.5E+00	0.0E+00	2.5E+00
University of Missouri Research Reactor	1.5E+00	0.0E+00	1.5E+00
Totals	**1.1E+05**	**3.5E+04**	**1.4E+05**
Emplaced Volume			
Waste Isolation Pilot Plant	7.7E+03		7.7E+03
Grand Totals	**1.2E+05**	**3.5E+04**	**1.5E+05**

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

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

TRU Waste Site	Stored Volumes (Cubic Meters)	Projected Volumes (Cubic Meters)	Anticipated Volumes (Cubic Meters)
Argonne National Laboratory - East	1.5E+01	1.0E+02	1.2E+02
Argonne National Laboratory - West	2.4E+01	6.9E+01	9.3E+01
Battelle Columbus Laboratories	4.4E+01	1.8E+00	4.6E+01
Bettis Atomic Power Laboratory	2.0E+00	0.0E+00	2.0E+00
Energy Technology Engineering Center	5.0E+00	0.0E+00	5.0E+00
Hanford (Richland) Site	3.8E+02	1.1E+03	1.5E+03
Hanford (River Protection) Site	4.5E+03	0.0E+00	4.5E+03
Idaho National Engineering and Environmental Laboratory	2.2E+02	0.0E+00	2.2E+02
Knolls Atomic Power Laboratory - Schenectady	0.0E+00	1.4E+02	1.4E+02
Los Alamos National Laboratory	1.3E+02	0.0E+00	1.3E+02
Oak Ridge National Laboratory	0.0E+00	6.6E+02	6.6E+02
Sandia National Laboratories - Albuquerque	4.6E+00	0.0E+00	4.6E+00
Savannah River Site	0.0E+00	2.3E+01	2.3E+01
Totals	**5.3E+03**	**2.1E+03**	**7.4E+03**

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

3.1.1 Waste Isolation Pilot Plant-Level Roll-Up of Waste Inventory for Performance Assessment

The PA conducted in support of the WIPP recertification was predicated on the assumption that the WIPP repository will be filled to its design capacity at the time of closure. The design capacity for WIPP is 175,564 m^3 (6,200,000 ft^3) (U.S. Congress 1996) with a limit of 7,079 m^3 (250,000 ft^3) for RH-TRU waste as imposed by the Consultation and Cooperation Agreement (C&C Agreement) (DOE and State of New Mexico 1988), therefore the CH-TRU disposal limit is 168,485 m^3 (5,950,000 ft^3). The volume of anticipated plus emplaced waste (CH-TRU and RH-TRU) reported by the sites in support of the CRA-2004 (DOE 2004c) and the PABC (Leigh et al. 2005a; Leigh et al. 2005b) is less than the design capacity for the WIPP for CH-TRU waste, but more than the WIPP design capacity for RH-TRU waste. Therefore, scaling the CH- and RH-TRU waste volumes (up and down, respectively) to the design capacity for CH- and RH-TRU waste in the WIPP is necessary for PA. The scaled inventory for PA is referred to as the disposal volume as described in the Glossary. The CH-TRU waste was scaled up since the anticipated volume is less than the allowable capacity. The RH-TRU waste was scaled down because the anticipated volume of RH-TRU waste exceeded the allowable limit. Scaling is performed only on projected waste.

Table 3 presents the volume scaling factors. The following sections discuss the calculation of the WIPP-level roll-up for CH- and RH-TRU waste.

Table 3. Volume Scaling Factors

CH WASTE	
WIPP capacity for waste	1.68E+05 m^3
Total stored volume	1.09E+05 m^3
Total projected volume	3.47E+04 m^3
Total emplaced volume	7.72E+03 m^3
Volume scaling factor (SF CH)	1.48E+00
Note: $\frac{1.68E+05 - (1.09E+05 + 7.72E+03)}{(3.47E+04)} = 1.48E+00$	

RH WASTE	
WIPP capacity for waste	7.08E+03 m^3
Total stored volume	5.29E+03 m^3
Total projected volume	2.08E+03 m^3
Total emplaced volume	0.00E+00 m^3
Volume scaling factor (SF RH)	8.61E-01
Note: $\frac{7.08E+03 - (5.29E+03 + 0.00E+00)}{(2.08E+03)} = 8.61E-01$	

Data Source: TWBID Revision 2.1, Version 3.1, Data Version D.4.16, LANL 2005.

3.1.1.1 Calculation of Waste Isolation Pilot Plant-Level Roll-Up for Contact-Handled Transuranic Waste

The WIPP disposal limit for CH-TRU waste is 168,485 m^3 (5,950,000 ft^3). Since the total reported volume of CH-TRU waste is less than the WIPP limit, the projected volume was scaled so the total volume equaled the CH-TRU waste disposal limit for WIPP. The scaling factor for CH-TRU waste was calculated using the following equation applied to WIPP waste streams.

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

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

Where

SF_{CH} is the scaling factor for the CH-TRU waste volume as of September 30, 2002
V_s is the total stored volume over all waste streams and all sites for CH-TRU waste
V_e is the total emplaced volume over all waste streams and all sites for CH-TRU waste
V_p is the total projected volume over all waste streams and all sites for CH-TRU waste

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

$$v_{CH\text{-}Disposal} = SF_{CH}\,(v_p) + v_s + v_e \qquad (3)$$

Where

$v_{CH\text{-}Disposal}$ is the disposal volume for CH-TRU waste for a single waste stream
SF_{CH} is the scaling factor for the CH-TRU waste volume
v_p is the projected inventory volume for a single CH-TRU waste stream before scaling
v_s is the stored inventory volume for a single CH-TRU waste stream
v_e is the emplaced inventory volume for a CH-TRU single waste stream

The total CH-TRU waste disposal inventory, $V_{CH\text{-}Disposal}$, is the sum of the scaled CH-TRU waste stream volumes. The scaled waste stream volumes for the CH-TRU waste streams included in the estimate of volume for the PABC are given in Appendix E, Table E-1. All volume and scaling calculated results were derived from the information that was reported in the updated TWBID Revision 2.1 (LANL 2005) for each CH-TRU waste stream. The volume rollups and scaling calculations were performed under the SNL QA program as described in the Computational Methodology (LANL 2003).

3.1.2 Calculation of Waste Isolation Pilot Plant-Level Roll-up for Remote-Handled TransuranicWaste

The WIPP disposal limit for RH-TRU waste is 7,079 m^3 (250,000 ft^3) (U.S. DOE and State of New Mexico 1988). The reported volume of stored RH-TRU waste is less than the disposal limit but the sum of the stored and projected volumes is greater than the disposal limit. Since the total reported volume of RH-TRU waste is greater than the WIPP limit, the projected volume was scaled down so the total volume for PA equaled the RH-TRU waste disposal limit for WIPP. The scaling factor for RH-TRU waste was obtained after RH-TRU waste streams designated as non-WIPP waste streams (Appendix I) were removed for WIPP waste streams.

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

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

Where

SF_{RH}	is the scaling factor for the RH-TRU waste volume as of September 30, 2002
V_s	is the total stored volume over all waste streams and all sites for RH-TRU waste
V_e	is the total emplaced volume over all waste streams and all sites for RH-TRU waste
V_p	is the total projected volume over all waste streams and all sites for RH waste

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

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

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

Where

$v_{RH\text{-}Disposal}$	is the disposal volume for RH-TRU waste for a single waste stream
SF_{RH}	is the scaling factor for the RH-TRU waste volume
v_s	is the stored inventory volume for a single RH-TRU waste stream
v_e	is the emplaced inventory volume for a single RH-TRU waste stream
v_p	is the projected inventory volume for a single RH-TRU waste stream before scaling

Table 3 shows the calculation for the RH-TRU waste scaling factor and the RH-TRU waste volumes. The total RH-TRU waste disposal inventory, $V_{RH\text{-}Disposal}$, is the sum of the scaled RH-TRU waste stream inventories. The scaled waste stream volumes for the RH-TRU waste streams included in the estimate of volume for the PABC is given in Appendix E, Table E-2. All volume and scaling calculated results were derived from the information that was reported in the updated TWBID Revision 2.1 (LANL 2005) for each RH-TRU waste stream. The volume rollups and scaling calculations were performed under the SNL QA program as described in the Computational Methodology (LANL 2003).

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

3.2 Non-Radiological Aspects of the Transuranic Waste Inventory Estimate

This section presents the non-radiological aspects of the TRU waste inventory that was collected on behalf of the DOE in support of the CRA-2004 (DOE 2004c) and the PABC (Leigh et al. 2005a; Leigh et al. 2005b). Section 3.2.1 presents the estimated inventory of waste materials. Section 3.2.2 presents the estimated inventory of packaging materials, and Section 3.2.3 presents the estimated inventory of chemical components.

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

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

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

The following WMP descriptions were excerpted from the TWBIR Revision 2 (DOE 1995b) and are operative in this document:

- Iron-base metal/alloys – This designation is meant to include iron and steel alloys in the waste and does not include the waste container materials. This also includes an iron-base metallic phase associated with any vitrification process, if applicable;

- Aluminum-base metal/alloys – Aluminum or aluminum-base alloys in the waste materials;

- Other metal/alloys – All other metals found in the waste materials (such as copper, lead, zirconium, and tantalum). The lead portion of lead rubber gloves/aprons is also included in this category;

- Other inorganic material – Includes inorganic non-metal waste materials such as concrete, glass, firebrick, ceramics, graphite, sand, and inorganic sorbents;

- Vitrified material – This refers to waste that has been melted or fused at high temperatures with glass-forming additives such as soil or silica in appropriate proportions to result in a homogeneous glass-like matrix (note that any unoxidized metallic phases, if present, are included in the iron-base metal/alloys waste material parameter);

- Cellulosic material – Includes those materials generally derived from high polymer plant carbohydrates. Examples are paper, cardboard, kimwipes, wood, cellophane, and cloth;

- Rubber material – Includes natural or manmade elastic latex materials. Examples are Hypalon®, neoprene, surgeons' gloves, and leaded-rubber gloves (rubber part only);

- Plastic material – Includes generally manmade materials, often derived from petroleum feedstock. Examples are polyethylene, polyvinylchloride, Lucite®, and Teflon®;

- Solidified inorganic material – Includes any homogeneous materials consisting of sludge or aqueous-base liquids that are solidified with cement, Envirostone®, or other solidification agents. Examples are wastewater treatment sludge, cemented aqueous liquids, and inorganic particulates. If a TRU waste site has not reported cement used as part of the solidification process in the cement (solidified) waste material parameter, the density of the cement may be included in this field;

- Solidified organic material – Includes cemented organic resins, solidified organic liquids, and sludges;

- Cement (solidified) – Includes the cement used in solidifying liquids, particulates, and sludges. If the field for a solidified final waste form is left blank, it means that either cement is not the solidifying agent or that the cement is included in another waste material parameter field such as solidified inorganic material or other inorganic materials; and

- Soil – Generally consists of naturally occurring soils that have been contaminated with radioactive waste materials at a high enough level to be considered TRU waste.

Packaging material parameters are described in further detail in Section 3.2.2 and Appendix D. Packaging material parameters were reported from the material parameter descriptions described in the TWBIR Revision 2 (DOE 1995b). These parameters were determined by weights defined as follows:

- Steel – The weight of the steel part of the packaging from container information provided by the TRU waste sites. Any necessary overpacking is included in the weight;

- Plastic – The weight of any plastic packaging submitted by the TRU waste sites. When the weight of a rigid liner is not given, a 90-mil high density polyethylene (HDPE) liner is assumed; and

- Lead – The weight of the lead shielding in an RH-TRU canister is assumed if not provided by the TRU waste sites (see Appendix D for details).

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

- Solidified inorganic material,

- Salt,

- Solidified organic material,

- Soil,

- Uncategorized metal (metal waste other than lead and/or cadmium),

- Lead/cadmium metal,
- Inorganic non-metal,
- Combustible material,
- Graphite,
- Heterogeneous debris,
- Filter material,
- Excluded waste streams (excluded from disposal at WIPP), and
- Unknown (excluded from disposal at WIPP).

The purpose of the WMCs is to aid in categorizing mixed waste streams into groups based on their different physical and chemical characteristics. The sites assign the WMCs for all of their mixed waste streams and generally assign them for their non-mixed waste streams as well. The WMC system description and terminology used by the sites and the DOE is detailed in the *DOE Waste Treatability Group Guidance* (DOE 1995c). The WMCs are numerous and are therefore not all listed here. However, the summary category groups (referred to as matrix parameter categories in the "DOE Waste Treatability Group Guidance") are debris (S5000), homogeneous solids (S3000), and soil/gravel (S4000).

There are several WMCs in each of these summary category groups. For example, the debris (S5000) summary category group is divided into inorganic debris (S5100), organic debris (S5300), heterogeneous debris (S5400), and unknown/other debris (S5900). The inorganic debris group (S5100) is divided into metal debris (S5110), inorganic nonmetal debris (S5120), and unknown/other inorganic debris (S5190). The metal debris (S5110) group is divided into metal debris without lead or cadmium (S5111), and so on. These are detailed in DOE 1995c.

3.2.1 Waste Materials

As part of the data call for TWBIR - 2004, the sites were asked to provide information about the materials contained in the waste. For each waste stream, they were asked to designate a final waste form and to provide the average density of each of the WMPs in the waste stream. In some cases, the sites provided minimum and maximum WMP densities.

For those waste streams where the site did not provide information regarding WMPs, the WMPs were estimated using the methods described in the Computational Methodology (LANL 2003) and in the WMP correction packages as identified in Appendix M. In summary, when partial information was provided (i.e., the minimum value or maximum value but not the average), it was used to calculate the average WMP densities (which were needed for PABC). When WMP density information was not provided for a waste stream, the average density was inferred by identifying an analogous waste stream, and mapping the WMP densities from that waste stream into the waste stream that lacked WMPs. For some sites such as LANL, where WMPs were reported in TWBIR Revision 2 (DOE 1995b), WMPs were traced back to that document. If this historic information was not available, the other waste streams from that site were reviewed to identify waste streams with similar final waste forms, WMCs, and waste stream descriptions. If a similar waste stream was identified, the WMP densities from that waste stream (source) were attributed to the waste stream that lacked WMP densities (destination waste stream). In both cases, the packaging material parameters were edited using the waste packaging densities discussed in Section 3.2.2 as appropriate for the type of container(s) in the assigned waste stream.

Waste streams were sometimes comprised of more than one container type (for example, 55-gallon drums and standard waste boxes [SWBs]). In these instances, when the site provided only one set of WMP densities, those WMP densities were used for both container types, except for the packaging material parameters, which were modified for the container type using the waste packaging densities given in Section 3.2.2. The waste profiles in Appendices I and J (non-WIPP and WIPP waste streams, respectively) have a weighted average of the WMP densities for all container types used in a waste stream. If the site provided a WMP list for each container type, those lists were maintained in the TWBID Revision 2.1 and a weighted average of the WMPs for all container types was used in the waste profiles generated by TWBID, Revision 2.1, Data Version D.4.16 (LANL 2005).

In some cases, the sites provided incomplete WMP information from which the needed densities could be inferred. Specifically, the WMP average densities were inferred from minimum and maximum WMP data. However, the minimum and maximum values were not used for the CRA-2004 (DOE 2004c) PA or for the PABC (Leigh et al. 2005a; Leigh et. al. 2005b) and they were not reported in the TRU waste inventory estimate.

3.2.1.1 Roll-Up of Final Waste Form Volumes

Table 4 presents a roll-up of the final waste form volumes for CH- and RH-TRU waste. Every WIPP waste stream in the TWBID Revision 2.1 (LANL 2005) has been assigned a final waste form. The total volume for each of the final waste form categories is calculated by summing the unscaled waste stream volume components (emplaced, stored, and projected) with the same final waste form designation for all waste streams, from all sites, destined for WIPP.

Table 4. Transuranic Waste Inventory for WIPP

Final Waste Forms	Stored Volumes	Projected Volumes	Emplaced Volumes	Anticipated Volumes
Contact Handled Waste (cubic meters)				
Combustible	4.3E+03	1.9E+03	6.1E+02	6.8E+03
Filter	9.9E+02	5.9E+02	3.4E+02	1.9E+03
Graphite	1.2E+02	1.3E+00	0.0E+00	1.3E+02
Heterogeneous Debris	4.9E+04	1.4E+04	5.7E+02	6.3E+04
Inorganic Non-Metal	1.2E+04	6.8E+01	9.7E+02	1.2E+04
Lead/Cadmium Metal	1.4E+02	3.2E+01	8.1E+01	2.6E+02
Salt	1.6E+02	1.9E+02	1.5E+03	1.8E+03
Soils	3.0E+02	9.7E+01	0.0E+00	4.0E+02
Solidified Inorganics	3.9E+04	9.0E+03	3.3E+03	5.1E+04
Solidified Organics	1.3E+03	3.9E+03	0.0E+00	5.2E+03
Uncategorized Metal	2.4E+03	5.1E+03	3.6E+02	7.9E+03
Total CH Volumes	**1.1E+05**	**3.5E+04**	**7.7E+03**	**1.5E+05**
Remote Handled Waste (cubic meters)				
Combustible	1.8E+01	8.9E-01	0.0E+00	1.9E+01
Filter	8.9E+00	8.9E+00	0.0E+00	1.8E+01
Heterogeneous Debris	6.1E+02	9.5E+02	0.0E+00	1.6E+03
Inorganic Non-Metal	4.3E+01	4.4E+01	0.0E+00	8.6E+01
Lead/Cadmium Metal	1.2E+01	7.1E+00	0.0E+00	1.9E+01
Soils	0.0E+00	2.0E+02	0.0E+00	2.0E+02
Solidified Inorganics	4.5E+03	3.3E+02	0.0E+00	4.8E+03
Solidified Organics	9.5E+00	0.0E+00	0.0E+00	9.5E+00
Uncategorized Metal	8.4E+01	5.4E+02	0.0E+00	6.2E+02
RH Total Volumes	5.3E+03	2.1E+03	0.0E+00	7.4E+03
Total TRU Waste Volumes	**1.1E+05**	**3.7E+04**	**7.7E+03**	**1.6E+05**

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

3.2.1.2 Waste Material Parameter Average Densities for Each Final Waste Form

Tables 5 through 24 present the WMP average densities for each final waste form in CH-TRU and RH-TRU waste. Tables 5 through 15 present CH-TRU waste. Tables 16 through 24 present RH-TRU waste. These tables include the rolled up WMP average densities for each final waste form and the rolled up waste volumes by site that contributed to the total final waste form volume. These volumes are broken out into stored and projected volumes, and the total volume of waste by site for each final waste form. The emplaced volume is shown separately. The final waste forms that have an emplaced waste CH-TRU waste volume are combustible, filter, heterogeneous, inorganic non-metal, lead/cadmium metal, salt, solidified inorganics, and uncategorized metal. No RH-TRU waste is emplaced at the WIPP at this time.

For example, Table 5 presents the WMP average densities for all CH-TRU waste streams with the combustible final waste form designation. The table shows roll-ups for stored, projected, and emplaced CH-TRU waste with the combustible final waste form designation for each site. This information is derived by summing the component volumes for each CH-TRU waste stream in the combustible category at each site.

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

$$
\begin{aligned}
{}^{WM}m_i^j &= ({}^{WM}p_i^j)(v_i^j) \\
{}^{WM}M^j &= \sum {}^{WM}m_i^j \\
{}^{WM}P^j &= {}^{WM}M^j / V^j
\end{aligned}
\qquad (6)
$$

Where

${}^{WM}m_i^j$	is the mass of the waste material (WM) in waste stream i with a final form designation j
${}^{WM}p_i^j$	is the average density of the WM in waste stream i with a final form designation j
v_i^j	is the volume of waste stream i (stored + projected + emplaced) with a final form designation j
${}^{WM}M^j$	is the total mass of WM in all waste streams with a final form designation j
V^j	is the total volume of all waste streams with a final form designation j
${}^{WM}P^j$	is the average density of the WM in all waste streams with a final form designation j.

At the time of the inventory cutoff date (September 30, 2002, portions of some waste streams had been shipped to the WIPP and emplaced and others were yet to be characterized and shipped. If there was no emplaced waste for a waste stream as of the inventory date, then the emplaced volume in the equation above for that waste stream was zero. If there was no emplaced waste for any of the waste streams within the final waste forms considered, the total emplaced volume for the final waste form was also zero.

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

3.2.1.3 WIPP-Scale Waste Material Parameter Densities

Performance assessments conducted in support of the WIPP have been predicated on the assumption that waste materials are distributed homogeneously throughout the repository. As a result, a WIPP-scale average estimated value for waste material densities is needed for PA. The estimated WIPP-scale WMP average densities for CH- and RH-TRU wastes in support of the PABC (Leigh et al. 2005a; Leigh et al. 2005b) are presented in Tables 25 and 26, respectively. These are equivalent to CRA-2004 (DOE 2004c) Tables F25 and F26 in Attachment F to Appendix DATA of TWBIR Revision 3 (DOE 1996a) Tables 2-2 and 2-3, respectively. Note also that the TWBIR Revision 3 (DOE 1996a) Tables 2-2 and 2-3 are the same as TWBIR Revision 2 (DOE 1995b, Tables 3-2 and 3-3, respectively). Although these tables in TWBIR Revisions 2 and 3 contain the minimum, maximum, and average densities for the WMP, this report contains only one value of density of the waste representing the best estimate for the WMP.

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

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

Where

${}^{WM}m_i$	is the mass of the WM in waste stream i
${}^{WM}p_i$	is the density of the WM in waste stream i
v_i	is the unscaled volume of waste stream i (stored + projected + emplaced)
${}^{WM}M$	is the total mass of WM in all waste streams
V	is the unscaled volume of all waste streams
${}^{WM}P$	is the average density of the WM in all waste streams

Table 5. WIPP Contact-Handled TRU Waste Profiles - Combustible			
Final Waste Form: Combustible			
Generator Site Waste / **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Argonne National Laboratory - East	9.0E+01	6.6E+01	1.6E+02
Argonne National Laboratory - West	5.4E+00	4.4E+00	9.8E+00
Battelle Columbus Laboratories	5.2E+00	0.0E+00	5.2E+00
Hanford (Richland) Site	9.8E+01	0.0E+00	9.8E+01
Los Alamos National Laboratory	2.9E+03	1.4E+03	4.3E+03
Rocky Flats Environmental Technology Site	1.2E+03	4.5E+02	1.6E+03
Generator Site Waste Total	**4.3E+03**	**1.9E+03**	**6.2E+03**
Emplaced Waste / **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Waste Isolation Pilot Plant	6.1E+02	0.0E+00	6.1E+02
Emplaced Waste Total	**6.1E+02**	**0.0E+00**	**6.1E+02**
Total Waste Volume	**4.9E+03**	**1.9E+03**	**6.8E+03**
Waste Material Parameters	**Average Density (kg/m^3)**		
Iron-Base Metal/Alloys	6.2E+01		
Aluminum-Base Metal/Alloys	6.9E-01		
Other Metal/Alloys	1.4E+01		
Other Inorganic Materials	1.0E+01		
Cellulosics	3.0E+01		
Rubber	1.2E+01		
Plastics	4.4E+01		
Solidified, Inorganic Matrix	6.6E-01		
Cement (Solidified)	4.8E-02		
Vitrified	0.0E+00		
Solidified, Organic Matrix	1.2E+01		
Soils	6.9E-01		

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 6. WIPP Contact Handled TRU Waste Profiles - Filter

Final Waste Form: Filter

Generator Site Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Hanford (Richland) Site	2.2E+01	0.0E+00	2.2E+01
Lawrence Livermore National Laboratory	1.9E+02	4.5E+02	6.4E+02
Los Alamos National Laboratory	3.3E+02	0.0E+00	3.3E+02
Rocky Flats Environmental Technology Site	4.5E+02	1.4E+02	5.8E+02
Generator Site Waste Total	**9.9E+02**	**5.9E+02**	**1.6E+03**
Emplaced Waste			
Site	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Waste Isolation Pilot Plant	3.4E+02	0.0E+00	3.4E+02
Emplaced Waste Total	**3.4E+02**	**0.0E+00**	**3.4E+02**
Total Waste Volume	**1.3E+03**	**5.9E+02**	**1.9E+03**

Waste Material Parameters	**Average Density (kg/m^3)**
Iron-Base Metal/Alloys	8.5E+01
Aluminum-Base Metal/Alloys	1.8E+01
Other Metal/Alloys	5.1E+01
Other Inorganic Materials	1.7E+01
Cellulosics	4.7E+01
Rubber	6.2E+00
Plastics	1.5E+01
Solidified, Inorganic Matrix	5.9E-01
Cement (Solidified)	0.0E+00
Vitrified	0.0E+00
Solidified, Organic Matrix	3.3E-01
Soils	4.7E+00

Data Source: TWBID Revision 2.1, Version 3.13, Data Version 4.1.16, LANL 2005

Table 7. WIPP Contact Handled TRU Waste Profiles - Graphite

Final Waste Form: Graphite			
Generator Site Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Rocky Flats Environmental Technology Site	1.2E+02	1.3E+00	1.3E+02
Generator Site Waste Total	**1.2E+02**	**1.3E+00**	**1.3E+02**
Total Waste Volume	**1.2E+02**	**1.3E+00**	**1.3E+02**

Waste Material Parameters	**Average Density (kg/m^3)**
Iron-Base Metal/Alloys	1.9E+01
Aluminum-Base Metal/Alloys	0.0E+00
Other Metal/Alloys	0.0E+00
Other Inorganic Materials	1.7E+02
Cellulosics	8.6E+01
Rubber	0.0E+00
Plastics	2.3E+01
Solidified, Inorganic Matrix	7.1E+00
Cement (Solidified)	0.0E+00
Vitrified	0.0E+00
Solidified, Organic Matrix	0.0E+00
Soils	0.0E+00

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 8. WIPP Contact Handled TRU Waste Profiles - Heterogeneous Debris

Final Waste Form:	**Heterogeneous Debris**		
Generator Site Waste	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Site			
Argonne National Laboratory - West	6.2E-01	3.4E+01	3.4E+01
Bettis Atomic Power Laboratory	1.9E+01	0.0E+00	1.9E+01
Energy Technology Engineering Center	1.5E+00	0.0E+00	1.5E+00
Hanford (Richland) Site	1.2E+04	6.8E+02	1.3E+04
Idaho National Engineering and Environmental Laboratory	2.0E+04	5.6E+03	2.5E+04
Knolls Atomic Power Laboratory - Nuclear Fuel Services	5.5E+01	1.7E+02	2.3E+02
Lawrence Livermore National Laboratory	1.3E+02	1.4E+03	1.6E+03
Los Alamos National Laboratory	2.1E+03	1.4E+03	3.5E+03
Nevada Test Site	6.1E+02	4.6E+02	1.1E+03
Oak Ridge National Laboratory	0.0E+00	4.5E+02	4.5E+02
Rocky Flats Environmental Technology Site	1.0E+03	1.2E+03	2.2E+03
Sandia National Laboratories - Albuquerque	2.4E+01	0.0E+00	2.4E+01
Savannah River Site	1.3E+04	2.4E+03	1.5E+04
U.S. Army Material Command	2.5E+00	0.0E+00	2.5E+00
University of Missouri Research Reactor	1.5E+00	0.0E+00	1.5E+00
Generator Site Waste Total	**4.9E+04**	**1.4E+04**	**6.3E+04**
Emplaced Waste			
Site	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Waste Isolation Pilot Plant	5.7E+02	0.0E+00	5.7E+02
Emplaced Waste Total	**5.7E+02**	**0.0E+00**	**5.7E+02**
Total Waste Volume	**4.9E+04**	**1.4E+04**	**6.3E+04**

Waste Material Parameters	**Average Density (kg/m^3)**
Iron-Base Metal/Alloys	2.4E+02
Aluminum-Base Metal/Alloys	3.1E+01
Other Metal/Alloys	5.7E+01
Other Inorganic Materials	5.3E+01
Cellulosics	1.2E+02
Rubber	3.0E+01
Plastics	8.4E+01
Solidified, Inorganic Matrix	3.5E+00
Cement (Solidified)	1.5E-01
Vitrified	0.0E+00
Solidified, Organic Matrix Soils	3.4E+00
Soils	8.7E+01

Data Source: TWBID Revision 2.1, Version 3.13 Data Version D.4.16, LANL 2005.

Table 9. WIPP Contact Handled TRU Waste Profiles - Inorganic Non-Metal

Final Waste Form: **Inorganic Non-Metal**			
Generator Site Waste / **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Hanford (Richland) Site	1.1E+01	3.0E+01	4.1E+01
Idaho National Engineering and Environmental Laboratory	1.1E+04	0.0E+00	1.1E+04
Paducah Gaseous Diffusion Plant	5.7E+00	5.7E+00	1.1E+01
Rocky Flats Environmental Technology Site	6.5E+02	3.2E+01	6.8E+02
Generator Site Waste Total	**1.2E+04**	**6.8E+01**	**1.2E+04**
Emplaced Waste / **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Waste Isolation Pilot Plant	9.7E+02	0.0E+00	9.7E+02
Emplaced Waste Total	**9.7E+02**	**0.0E+00**	**9.7E+02**
Total Waste Volume	**1.3E+04**	**6.8E+01**	**1.3E+04**
Waste Material Parameters	**Average Density (kg/m^3)**		
Iron-Base Metal/Alloys	4.2E+00		
Aluminum-Base Metal/Alloys	1.2E-02		
Other Metal/Alloys	5.0E+00		
Other Inorganic Materials	5.5E+01		
Cellulosics	1.9E+01		
Rubber	1.1E-01		
Plastics	2.7E+00		
Solidified, Inorganic Matrix	9.0E-01		
Cement (Solidified)	0.0E+00		
Vitrified	7.1E+01		
Solidified, Organic Matrix	2.7E-05		
Soils	1.8E-03		

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 10. WIPP Contact Handled TRU Waste Profiles - Lead/Cadmium Metal

Final Waste Form: **Lead/Cadmium Metal**

Generator Site Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Hanford (Richland) Site	1.7E+01	1.4E+01	3.1E+01
Los Alamos National Laboratory	3.7E+00	0.0E+00	3.7E+00
Rocky Flats Environmental Technology Site	1.2E+02	1.8E+01	1.4E+02
Generator Site Waste Total	**1.4E+02**	**3.2E+01**	**1.8E+02**
Emplaced Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Waste Isolation Pilot Plant	8.1E+01	0.0E+00	8.1E+01
Emplaced Waste Total	**8.1E+01**	**0.0E+00**	**8.1E+01**
Total Waste Volume	**2.2E+02**	**3.2E+01**	**2.6E+02**

Waste Material Parameters	**Average Density (kg/m^3)**
Iron-Base Metal/Alloys	9.3E+02
Aluminum-Base Metal/Alloys	1.8E+01
Other Metal/Alloys	1.5E+02
Other Inorganic Materials	1.7E+01
Cellulosics	4.8E+00
Rubber	3.3E+00
Plastics	9.1E+00
Solidified, Inorganic Matrix	8.2E-01
Cement (Solidified)	0.0E+00
Vitrified	0.0E+00
Solidified, Organic Matrix	1.1E-02
Soils	1.6E-01

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 11. WIPP Contact Handled TRU Waste Profiles - Salt

Final Waste Form: Salt			
Generator Site Waste / **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Lawrence Livermore National Laboratory	1.2E+00	1.5E+01	1.6E+01
Los Alamos National Laboratory	1.3E+02	1.7E+02	3.0E+02
Rocky Flats Environmental Technology Site	2.5E+01	0.0E+00	2.5E+01
Generator Site Waste Total	**1.6E+02**	**1.9E+02**	**3.4E+02**
Emplaced Waste / **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Waste Isolation Pilot Plant	1.5E+03	0.0E+00	1.5E+03
Emplaced Waste Total	**1.5E+03**	**0.0E+00**	**1.5E+03**
Total Waste Volume	**1.7E+03**	**1.9E+02**	**1.8E+03**
Waste Material Parameters	**Average Density (kg/m^3)**		
Iron-Base Metal/Alloys	9.7E+00		
Aluminum-Base Metal/Alloys	5.7E-02		
Other Metal/Alloys	3.6E+00		
Other Inorganic Materials	2.1E+02		
Cellulosics	1.4E+02		
Rubber	4.1E-02		
Plastics	8.9E-01		
Solidified, Inorganic Matrix	9.7E+00		
Cement (Solidified)	0.0E+00		
Vitrified	0.0E+00		
Solidified, Organic Matrix	1.2E+01		
Soils	1.5E+00		

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 12. WIPP Contact Handled TRU Waste Profiles - Soils

Final Waste Form:	**Soils**			
Generator Site Waste		**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Site				
Hanford (Richland) Site		1.1E+02	0.0E+00	1.1E+02
Idaho National Engineering and Environmental Laboratory		0.0E+00	9.7E+01	9.7E+01
Los Alamos National Laboratory		1.9E+02	0.0E+00	1.9E+02
	Generator Site Waste Total	**3.0E+02**	**9.7E+01**	**4.0E+02**
Total Waste Volume		**3.0E+02**	**9.7E+01**	**4.0E+02**
Waste Material Parameters		**Average Density (kg/m^3)**		
Iron-Base Metal/Alloys		7.2E+01		
Aluminum-Base Metal/Alloys		0.0E+00		
Other Metal/Alloys		8.8E+00		
Other Inorganic Materials		1.5E+01		
Cellulosics		1.8E+01		
Rubber		2.9E-01		
Plastics		2.4E+00		
Solidified, Inorganic Matrix		2.4E+01		
Cement (Solidified)		2.9E+01		
Vitrified		0.0E+00		
Solidified, Organic Matrix		5.5E+01		
Soils		5.8E+02		

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 13. WIPP Contact Handled TRU Waste Profiles - Solidified Inorganics

Final Waste Form: Solidified Inorganics			
Generator Site Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Argonne National Laboratory - East	2.4E+01	1.3E+01	3.7E+01
Hanford (Richland) Site	1.9E+02	3.0E+01	2.2E+02
Hanford (River Protection) Site	3.9E+03	0.0E+00	3.9E+03
Idaho National Engineering and Environmental Laboratory	2.9E+04	8.3E+03	3.8E+04
Lawrence Livermore National Laboratory	1.4E+01	1.8E+02	1.9E+02
Los Alamos National Laboratory	4.5E+03	2.4E+02	4.7E+03
Nevada Test Site	5.7E+00	0.0E+00	5.7E+00
Rocky Flats Environmental Technology Site	8.1E+02	2.7E+02	1.1E+03
Savannah River Site	2.4E+01	0.0E+00	2.4E+01
Generator Site Waste Total	**3.9E+04**	**9.0E+03**	**4.8E+04**
Emplaced Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Waste Isolation Pilot Plant	3.3E+03	0.0E+00	3.3E+03
Emplaced Waste Total	**3.3E+03**	**0.0E+00**	**3.3E+03**
Total Waste Volume	**4.2E+04**	**9.0E+03**	**5.1E+04**
Waste Material Parameters	**Average Density (kg/m^3)**		
Iron-Base Metal/Alloys	3.6E+00		
Aluminum-Base Metal/Alloys	2.6E-02		
Other Metal/Alloys	2.9E+00		
Other Inorganic Materials	2.7E+01		
Cellulosics	6.1E+00		
Rubber	2.1E-02		
Plastics	3.2E+00		
Solidified, Inorganic Matrix	2.4E+02		
Cement (Solidified)	1.1E+02		
Vitrified	3.5E-02		
Solidified, Organic Matrix	1.0E+01		
Soils	1.6E+02		

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 14. WIPP Contact Handled TRU Waste Profiles -Solidified Organics

Final Waste Form: Solidified Organics			
Generator Site Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Energy Technology Engineering Center	8.4E-01	0.0E+00	8.4E-01
Hanford (Richland) Site	2.3E+00	3.4E+02	3.4E+02
Idaho National Engineering and Environmental Laboratory	1.1E+03	3.5E+03	4.7E+03
Lawrence Livermore National Laboratory	8.1E+00	4.8E+00	1.3E+01
Los Alamos National Laboratory	2.9E+01	2.7E+01	5.6E+01
Rocky Flats Environmental Technology Site	1.4E+02	4.4E+00	1.4E+02
Generator Site Waste Total	**1.3E+03**	**3.9E+03**	**5.2E+03**
Total Waste Volume	**1.3E+03**	**3.9E+03**	**5.2E+03**

Waste Material Parameters	**Average Density (kg/m^3)**
Iron-Base Metal/Alloys	7.9E-01
Aluminum-Base Metal/Alloys	6.1E-02
Other Metal/Alloys	3.5E-01
Other Inorganic Materials	2.9E+01
Cellulosics	1.3E-01
Rubber	3.5E-02
Plastics	1.2E+02
Solidified, Inorganic Matrix	6.6E+02
Cement (Solidified)	4.3E+01
Vitrified	0.0E+00
Solidified, Organic Matrix	7.9E+02
Soils	6.4E+02

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 15. WIPP Contact Handled TRU Waste Profiles - Uncategorized Metal

Final Waste Form: **Uncategorized Metal**			
Generator Site Waste / **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Hanford (Richland) Site	1.1E+02	4.4E+03	4.5E+03
Idaho National Engineering and Environmental Laboratory	9.4E+00	0.0E+00	9.4E+00
Los Alamos National Laboratory	1.5E+03	3.2E+01	1.5E+03
Rocky Flats Environmental Technology Site	7.9E+02	6.7E+02	1.5E+03
Generator Site Waste Total	**2.4E+03**	**5.1E+03**	**7.5E+03**
Emplaced Waste / **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Waste Isolation Pilot Plant	3.6E+02	0.0E+00	3.6E+02
Emplaced Waste Total	**3.6E+02**	**0.0E+00**	**3.6E+02**
Total Waste Volume	**2.8E+03**	**5.1E+03**	**7.9E+03**

Waste Material Parameters	**Average Density (kg/m^3)**
Iron-Base Metal/Alloys	1.1E+02
Aluminum-Base Metal/Alloys	5.3E+00
Other Metal/Alloys	1.0E+02
Other Inorganic Materials	2.4E+00
Cellulosics	1.1E+01
Rubber	1.6E+00
Plastics	7.4E+00
Solidified, Inorganic Matrix	7.7E+00
Cement (Solidified)	0.0E+00
Vitrified	0.0E+00
Solidified, Organic Matrix	6.4E-01
Soils	8.7E-03

Data Source: TWBID Revision 2.1,Version 3.13, Data Version D.4.16, LANL 2005.

Table 16. WIPP Remote Handled TRU Waste Profiles - Combustible

Final Waste Form: Combustible			
Generator Site Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Battelle Columbus Laboratories	1.7E+01	8.9E-01	1.8E+01
Hanford (Richland) Site	8.9E-01	0.0E+00	8.9E-01
Generator Site Waste Total	**1.8E+01**	**8.9E-01**	**1.9E+01**
Total Waste Volume	**1.8E+01**	**8.9E-01**	**1.9E+01**
Waste Material Parameters	**Average Density (kg/m^3)**		
Iron-Base Metal/Alloys	8.7E+00		
Aluminum-Base Metal/Alloys	7.6E+00		
Other Metal/Alloys	6.3E+00		
Other Inorganic Materials	9.2E+00		
Cellulosics	3.9E+01		
Rubber	2.3E+01		
Plastics	9.2E+01		
Solidified, Inorganic Matrix	0.0E+00		
Cement (Solidified)	1.7E+01		
Vitrified	0.0E+00		
Solidified, Organic Matrix	1.5E+00		
Soils	1.4E+00		

Data Source: TWBID Revision 2.1,Version 3.13, Data Version D.4.16, LANL 2005.

Table 17. WIPP Remote Handled TRU Waste Profiles - Filter

Final Waste Form: Filter

Generator Site Waste Site	Stored (cubic meters)	Projected (cubic meters)	Total (cubic meters)
Argonne National Laboratory - West	1.8E+00	8.9E+00	1.1E+01
Battelle Columbus Laboratories	5.3E+00	0.0E+00	5.3E+00
Hanford (Richland) Site	1.8E+00	0.0E+00	1.8E+00
Generator Site Waste Total	**8.9E+00**	**8.9E+00**	**1.8E+01**
Total Waste Volume	**8.9E+00**	**8.9E+00**	**1.8E+01**

Waste Material Parameters	Average Density (kg/m^3)
Iron-Base Metal/Alloys	3.3E+01
Aluminum-Base Metal/Alloys	1.7E+01
Other Metal/Alloys	4.3E+01
Other Inorganic Materials	1.1E+02
Cellulosics	7.3E+01
Rubber	1.9E+01
Plastics	6.3E+00
Solidified, Inorganic Matrix	0.0E+00
Cement (Solidified)	7.7E+00
Vitrified	0.0E+00
Solidified, Organic Matrix	1.2E+01
Soils	0.0E+00

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 18. WIPP Remote Handled TRU Waste Profiles - Heterogeneous Debris

Final Waste Form: Heterogeneous Debris

Generator Site Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Argonne National Laboratory - East	1.5E+01	1.0E+02	1.2E+02
Argonne National Laboratory - West	6.2E+00	3.6E+01	4.3E+01
Bettis Atomic Power Laboratory	2.0E+00	0.0E+00	2.0E+00
Energy Technology Engineering Center	8.9E-01	0.0E+00	8.9E-01
Hanford (Richland) Site	2.6E+02	3.8E+02	6.5E+02
Idaho National Engineering and Environmental Laboratory	2.0E+02	0.0E+00	2.0E+02
Knolls Atomic Power Laboratory -Schenectady	0.0E+00	1.4E+02	1.4E+02
Los Alamos National Laboratory	1.2E+02	0.0E+00	1.2E+02
Oak Ridge National Laboratory	0.0E+00	2.7E+02	2.7E+02
Sandia National Laboratories - Albuquerque	4.6E+00	0.0E+00	4.6E+00
Savannah River Site	0.0E+00	2.3E+01	2.3E+01
Generator Site Waste Total	**6.1E+02**	**9.5E+02**	**1.6E+03**
Total Waste Volume	**6.1E+02**	**9.5E+02**	**1.6E+03**

Waste Material Parameters	**Average Density (kg/m^3)**
Iron-Base Metal/Alloys	1.7E+02
Aluminum-Base Metal/Alloys	2.2E+01
Other Metal/Alloys	4.5E+01
Other Inorganic Materials	1.7E+01
Cellulosics	4.2E+01
Rubber	3.0E+01
Plastics	3.5E+01
Solidified, Inorganic Matrix	5.6E+00
Cement (Solidified)	0.0E+00
Vitrified	0.0E+00
Solidified, Organic Matrix	2.6E+00
Soils	7.0E+01

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 19. WIPP Remote Handled TRU Waste Profiles - Inorganic Non-Metal

Final Waste Form: Inorganic Non-Metal			
Generator Site Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Battelle Columbus Laboratories	1.4E+01	8.9E-01	1.5E+01
Hanford (Richland) Site	2.8E+01	4.3E+01	7.1E+01
Generator Site Waste Total	**4.3E+01**	**4.4E+01**	**8.6E+01**
Total Waste Volume	**4.3E+01**	**4.4E+01**	**8.6E+01**
Waste Material Parameters	**Average Density (kg/m^3)**		
Iron-Base Metal/Alloys	1.6E+02		
Aluminum-Base Metal/Alloys	2.1E+01		
Other Metal/Alloys	4.8E+01		
Other Inorganic Materials	9.9E+02		
Cellulosics	3.9E+00		
Rubber	1.8E+00		
Plastics	2.4E+01		
Solidified, Inorganic Matrix	1.5E+01		
Cement (Solidified)	3.1E+00		
Vitrified	0.0E+00		
Solidified, Organic Matrix	2.8E-01		
Soils	7.1E+00		

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 20. WIPP Remote Handled TRU Waste Profiles - Lead/Cadmium Metal

Final Waste Form: Lead/Cadmium Metal			
Generator Site Waste / **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Hanford (Richland) Site	1.2E+01	7.1E+00	1.9E+01
Generator Site Waste Total	**1.2E+01**	**7.1E+00**	**1.9E+01**
Total Waste Volume	**1.2E+01**	**7.1E+00**	**1.9E+01**
Waste Material Parameters	**Average Density (kg/m^3)**		
Iron-Base Metal/Alloys	5.4E+03		
Aluminum-Base Metal/Alloys	0.0E+00		
Other Metal/Alloys	7.4E+01		
Other Inorganic Materials	0.0E+00		
Cellulosics	0.0E+00		
Rubber	0.0E+00		
Plastics	0.0E+00		
Solidified, Inorganic Matrix	0.0E+00		
Cement (Solidified)	0.0E+00		
Vitrified	0.0E+00		
Solidified, Organic Matrix	0.0E+00		
Soils	0.0E+00		

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 21. WIPP Remote Handled TRU Waste Profiles - Soils

Final Waste Form: Soils			
Generator Site Waste	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Site			
Oak Ridge National Laboratory	0.0E+00	2.0E+02	2.0E+02
Generator Site Waste Total	**0.0E+00**	**2.0E+02**	**2.0E+02**
Total Waste Volume	**0.0E+00**	**2.0E+02**	**2.0E+02**
Waste Material Parameters	**Average Density (kg/m^3)**		
Iron-Base Metal/Alloys	0.0E+00		
Aluminum-Base Metal/Alloys	0.0E+00		
Other Metal/Alloys	0.0E+00		
Other Inorganic Materials	0.0E+00		
Cellulosics	0.0E+00		
Rubber	0.0E+00		
Plastics	0.0E+00		
Solidified, Inorganic Matrix	0.0E+00		
Cement (Solidified)	0.0E+00		
Vitrified	0.0E+00		
Solidified, Organic Matrix	0.0E+00		
Soils	1.3E+03		

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 22. WIPP Remote Handled TRU Waste Profiles - Solidified Inorganics

Final Waste Form: Solidified Inorganics

Generator Site Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Argonne National Laboratory - West	1.6E+01	2.3E+01	3.9E+01
Battelle Columbus Laboratories	1.8E+00	0.0E+00	1.8E+00
Hanford (Richland) Site	1.5E+01	1.2E+02	1.3E+02
Hanford (River Protection) Site	4.5E+03	0.0E+00	4.5E+03
Idaho National Engineering and Environmental Laboratory	8.9E-01	0.0E+00	8.9E-01
Oak Ridge National Laboratory	0.0E+00	1.9E+02	1.9E+02
Generator Site Waste Total	**4.5E+03**	**3.3E+02**	**4.8E+03**
Total Waste Volume	**4.5E+03**	**3.3E+02**	**4.8E+03**

Waste Material Parameters	**Average Density (kg/m^3)**
Iron-Base Metal/Alloys	6.8E+00
Aluminum-Base Metal/Alloys	0.0E+00
Other Metal/Alloys	3.4E-02
Other Inorganic Materials	6.9E-01
Cellulosics	3.5E-03
Rubber	0.0E+00
Plastics	1.6E-02
Solidified, Inorganic Matrix	9.2E+01
Cement (Solidified)	2.4E+00
Vitrified	1.8E-01
Solidified, Organic Matrix	3.1E-02
Soils	4.1E-03

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 23. WIPP Remote Handled TRU Waste Profiles - Solidified Organics

Final Waste Form: Solidified Organics			
Generator Site Waste / **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Battelle Columbus Laboratories	5.3E+00	0.0E+00	5.3E+00
Energy Technology Engineering Center	4.1E+00	0.0E+00	4.1E+00
Generator Site Waste Total	**9.5E+00**	**0.0E+00**	**9.5E+00**
Total Waste Volume	**9.5E+00**	**0.0E+00**	**9.5E+00**
Waste Material Parameters	**Average Density (kg/m^3)**		
Iron-Base Metal/Alloys	4.9E+01		
Aluminum-Base Metal/Alloys	0.0E+00		
Other Metal/Alloys	0.0E+00		
Other Inorganic Materials	1.2E+01		
Cellulosics	2.0E+01		
Rubber	4.2E+00		
Plastics	2.0E+01		
Solidified, Inorganic Matrix	0.0E+00		
Cement (Solidified)	1.4E+02		
Vitrified	0.0E+00		
Solidified, Organic Matrix	1.7E+02		
Soils	0.0E+00		

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 24. WIPP Remote Handled TRU Waste Profiles - Uncategorized Metal

Final Waste Form: Uncategorized Metal

Generator Site Waste **Site**	**Stored (cubic meters)**	**Projected (cubic meters)**	**Total (cubic meters)**
Battelle Columbus Laboratories	8.9E-01	0.0E+00	8.9E-01
Hanford (Richland) Site	6.1E+01	5.4E+02	6.0E+02
Idaho National Engineering and Environmental Laboratory	2.2E+01	0.0E+00	2.2E+01
Generator Site Waste Total	**8.4E+01**	**5.4E+02**	**6.2E+02**
Total Waste Volume	**8.4E+01**	**5.4E+02**	**6.2E+02**

Waste Material Parameters	**Average Density (kg/m^3)**
Iron-Base Metal/Alloys	3.6E+01
Aluminum-Base Metal/Alloys	4.5E-03
Other Metal/Alloys	5.6E+02
Other Inorganic Materials	4.3E-01
Cellulosics	7.4E-01
Rubber	5.1E-01
Plastics	7.8E-01
Solidified, Inorganic Matrix	3.1E-02
Cement (Solidified)	0.0E+00
Vitrified	0.0E+00
Solidified, Organic Matrix	0.0E+00
Soils	6.1E-01

Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 25. WIPP CH-TRU Waste Material Parameter Disposal Inventory

Waste Material Parameters	Average Density (kg/m^3)
Iron-Base Metal/Alloys	1.1E+02
Aluminum-Base Metal/Alloys	1.4E+01
Other Metal/Alloys	3.2E+01
Other Inorganic Materials	4.0E+01
Cellulosics	6.0E+01
Rubber	1.3E+01
Plastics	4.3E+01
Solidified, Inorganic Matrix	1.1E+02
Cement (Solidified)	3.9E+01
Vitrified	5.8E+00
Solidified, Organic Matrix	3.3E+01
Soils	1.1E+02
Container Materials	
Steel	1.7E+02
Plastic	1.7E+01
Lead	1.3E-02

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 26. WIPP RH-TRU Waste Material Parameter Disposal Inventory

Waste Material Parameters	Average Density (kg/m^3)
Iron-Base Metal/Alloys	5.9E+01
Aluminum-Base Metal/Alloys	5.0E+00
Other Metal/Alloys	5.7E+01
Other Inorganic Materials	1.6E+01
Cellulosics	9.3E+00
Rubber	6.7E+00
Plastics	8.0E+00
Solidified, Inorganic Matrix	6.2E+01
Cement (Solidified)	1.9E+00
Vitrified	1.2E-01
Solidified, Organic Matrix	8.3E-01
Soils	5.0E+01
Container Materials	
Steel	5.4E+02
Plastic	3.1E+00
Lead	4.2E+02

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

3.2.2 Packaging Materials

The PA assumption that materials are distributed homogeneously throughout the repository also applies to packaging materials. As a result, a WIPP-scale average value for packaging material densities is needed for PA. The WIPP-scale packaging (container) material densities for CH- and RH-TRU wastes in support of the PABC (Leigh et al. 2005a; Leigh et al. 2005b) are presented in Table 27. This information is equivalent to that presented in Table 1-3 in TWBIR Revision 2 (DOE 1995b).

Analysis of the packaging material information submitted by the sites identified inconsistencies in reporting among the sites. Therefore, adjustments were made at the waste-stream level to achieve consistency among the waste streams. In particular, a consistent set of densities for packaging materials for different types of containers was used unless otherwise reported by the site. Table 1-3 of the TWBIR Revision 2 (DOE 1995b) identified the packaging materials and packaging material densities for the waste containers that were being used at that time. These values were also used in TWBIR - 2004. Since the time of the TWBIR Revision 2, the sites have begun using ten-drum overpacks (TDOPs) for packaging waste. The calculated packaging material densities for TDOPs are presented in Appendix D, Packaging Materials.

In addition, sites have also reported that they use 85- and 100-gallon drum overpacks. The CH Transuranic Package Transporter-II (TRUPACT-II) Authorized Methods for Payload Control (TRAMPAC) document (DOE 2004b) has been revised to add the 85-gallon drum as an authorized payload container for shipment in the TRUPACT-II, and to add the 100-gallon drum as an authorized payload container in the HalfPACT and the TRUPACT-II. The applicable section of the TRAMPAC document has also been revised to specify a range of sizes (75 to 88 gallons) for a container identified as an “85-gallon drum.”

Development of the TRUPACT-III is underway, which will allow shipment of standard large boxes (SLBs) to WIPP for disposal. The CPR estimates for SLBs have not been included in this inventory estimate, but will be included in the next update where applicable.

3.2.3 Chemical Components in Transuranic Waste

As part of the data call for TWBIR - 2004, the sites were asked to provide information about the chemical components of the waste. The sites were asked about complexing agents (acetate, citrate, oxylate, ethylenediaminetetraacetic acid (EDTA), oxyanions (nitrate, sulfate, and phosphate), cement, and pyrochemical salts.

Table 27. Assumed Packaging Material Densities[1]

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-gallon drums)	211	16	0	1.89
RH-TRU Waste Canister (direct load)	434	0	464	0.89
RH-TRU Waste Canister (overpack 3 55-gallon drums)	525	26	464	0.89
85-gallon drum	114	0	0	0.322
100-gallon drum	114	0	0	0.379
Ten-Drum Overpacks	218	16	0	4.79

[1] This table was used when sites did not report container volumes. Information in this table was taken from DOE (1995) and Appendix D of this document.

[2.] Container volumes differ from WWIS container volumes.

This section presents the summary of the chemical components that are present in the solidified TRU waste inventory in support of the PABC (Leigh et al. 2005a; Leigh; et al. 2005b). Specifically, complexing agents, oxyanions, and cement are calculated as the sum of the constituents found in anticipated waste scheduled for delivery to WIPP and any waste that has already been placed in the repository. The information provided is based on input from the TWBIR Revision 3 (DOE 1996a), TWBID Revision 2.1 (DOE 1995b), and analyses of this information. The methods used to estimate the masses of cement, complexing agents, and oxyanions are discussed in Howard (2005) for cement, Crawford and Leigh (2003) for complexing agents, and Crawford (2005) for oxyanions, respectively. A brief discussion of pyrochemical salts is presented in Appendix A.

3.2.3.1 Cement Content in Solidified Transuranic Waste

The PA for the CRA-2004 (DOE 2004c) and the PABC (Leigh et al. 2005a; Leigh et al. 2005b) required an estimate of the mass of cement in waste expected for disposal in the repository. This estimate was updated for the PABC and is reported in this report. An estimate of the cement mass for the CCA (DOE 1996b) was given in Appendix B-7 of the TWBIR Revision 3 (DOE 1996a). While the waste stream volumes reported by the TRU waste sites in TWBIR - 2004 have changed when compared to the TWBIR Revision 3 volumes, the waste streams identified by the sites at the time of the TWBIR Revision 3 as containing cement have not changed. However, the sites have not reported cement densities consistently over time. Therefore an analysis (Howard 2005) was performed to identify waste streams that contained cement using newly reported cement densities where they were available and assigning cement densities to waste streams where cement was listed in waste descriptions but not reported as waste material parameters. The total estimated mass of cement in the scaled solidified waste streams for TWBIR - 2004 is 8.80×10^6 kg (1.94×10^7 lb) (see Table 29). This estimate of cement mass in the WIPP repository is slightly larger than the estimate made for the CCA (DOE 1996b) (8.54×10^6 kg [1.88×10^7 lb]).

3.2.3.2 Complexing Agents (Organic Ligands) in Transuranic Waste

The DOE tracks the mass of complexing agents going into the repository because of their impact on solubility of actinides in the waste. In the latest request by DOE for data from the sites, none of the sites updated or modified their estimates of complexing agents in the waste streams that had been reported previously in the TWBIR Revision 3 (DOE 1996a). When applicable, the sites did report the expected masses of complexing agents in waste streams added to their inventory since publication of the TWBIR Revision 3.

The TWBIR Revision 3 (DOE 1996a) contained information on complexing agents that was used in the PA in support of the CCA (DOE 1996b). TWBIR Revision 3 presented two estimates for complexing agents in the WIPP repository: one assuming reduction of complexing agents due to thermal treatment and one without that assumption. Since publication of the TWBIR Revision 3, the DOE's strategy for wastes at the INL has changed, and incineration operations for INL TRU waste did not occur as planned. Therefore, the data reported in Appendix B-4 of the TWBIR Revision 3 without the thermal treatment assumption was used in the calculation of mass of complexing agents for the CRA-2004 (DOE 2004c) and the PABC (Leigh et al. 2005a; Leigh et al. 2005b) as reported in Table 28.

The inventory information reported in TWBIR Revision 3 (DOE 1996a) did not provide a breakout of the waste streams that contained complexing agents. Therefore, an analysis was completed (Crawford 2004) to delineate this waste stream information. Appendix L, Table L-1, includes the waste streams containing complexing agents with the waste-stream specific information supplied by the sites for the CRA-2004 (DOE 2004c) and the PABC inventory (Crawford 2004).

Only two sites reported complexing agents in waste streams: Rocky Flats Environmental Technology Site (RFETS) and Hanford Office of River Protection (Hanford RP). For their new waste streams, RFETS reported that EDTA might be present at trace levels (< 1 wt%) in their waste. Hanford RP identified sodium acetate and sodium oxalate in their new waste streams. The total mass of acetic acid, sodium acetate, citric acid, sodium citrate, oxalic acid, sodium oxalate, and sodium EDTA estimated for the WIPP repository are reported in Table 28.

Table 28. 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

Data Source: Crawford and Leigh (2003)

Only a slight increase in EDTA was reported with this updated information over that reported in TWBIR Revision 3 (DOE 1996a). The increase comes from one waste stream at RFETS that contains trace amounts of EDTA and is reported as the upper limit of expected concentration. Waste from Hanford RP waste tanks is also included in Table 28, and represents a significant increase in sodium acetate and sodium oxalate that had not been reported for the TRU inventory in TWBIR Revision 3.

3.2.3.3 Mass of Oxyanions in Transuranic Waste

The PABC (Leigh et al. 2005a; Leigh et al. 2005b) required an estimate of the mass of nitrate, sulfate, and phosphate in waste expected for disposal in the repository. An estimate of the oxyanion masses for the CCA (DOE 1996b) was given in Appendix B-6 of the TWBIR Revision 3 (DOE 1996a). The TRU waste sites did not report any new information about oxyanions for TWBIR - 2004, with the exception of waste streams reported by Hanford RP and LANL, and revised values for a waste stream at RFETS. An analysis was completed to determine the oxyanions by waste stream (Crawford 2005). The mass of nitrate, sulfate, and phosphate in the repository was calculated for the PABC as the sum of the mass of nitrate, sulfate, and phosphate in the TWBIR Revision 3 (DOE 1996a) adjusted for the new waste stream volumes from this update plus the mass of these elements reported by the sites for their new waste streams. Appendix L, Table L-2, includes the waste streams with the waste-stream specific information about the mass of nitrate, sulfate, and phosphate that was supplied by the sites for TWBIR - 2004. Table 29 presents the mass of nitrate, sulfate, phosphate and cement for disposal in the WIPP repository for the PABC.

The estimate of nitrate mass in the WIPP repository (2.67×10^6 kg [5.88×10^6 lb]) is larger than the estimate made for the CCA (DOE 1996b) which was 1.62×10^6 kg (3.57×10^6 lb). The increase in nitrate mass is due primarily to larger volumes projected for existing waste streams and the added waste streams from Hanford RP. The estimate of sulfate mass in the WIPP repository (4.43×10^5 kg [9.76×10^5 lb]) is less than the estimate made for the CCA, which was 6.33×10^5 kg (1.39×10^6 lb). The estimate of phosphate mass in the WIPP repository (1.05×10^5 kg [2.31×10^5 lb]) is significant when compared to the CCA. There was no phosphate of reportable quantity given by the generator sites in the TWBIR Revision 3 (DOE 1996a). The primary source of phosphate in the current estimate is the tank waste from Hanford RP.

Table 29. Mass of Oxyanions and Cement In the WIPP Disposal Inventory

Chemical Component	Mass Contained in the Disposal Inventory (kg)
Nitrate	2.67×10^6
Sulfate	4.43×10^5
Phosphate	1.05×10^5
Cement	8.80×10^6

Data Sources: Crawford (2005) and Howard (2005)

3.2.3.4 Pyrochemical Salts in Waste Isolation Pilot Plant Transuranic Waste

Five waste streams at LANL, one waste stream at Lawrence Livermore National Laboratory (LLNL), and seven waste streams at RFETS have been identified as containing pyrochemical salts. The pyrochemical salt waste streams are reported in Appendix A.

3.3 Transuranic Waste Radionuclide Inventory

The sites were asked to provide information about the radiological components in the waste they intend to ship to WIPP. For each waste stream they were asked to specify the radionuclide activity concentrations (in Ci/m^3) and to provide the generation or last assay date for each waste stream. In some cases, the sites provided all of the information required; in other cases, they did not.

Where the sites did not provide adequate information regarding the radiological components of a waste stream, radionuclide activities were estimated using the methods described in the Computational Methodology (LANL 2003) and in the radionuclide correction package as identified in Table M.5 in Appendix M. As more information became available regarding TWBIR Revision 2 (DOE 1995b) waste streams and how they had been reassigned for TWBIR - 2004, the historic radionuclide data were used to define radionuclide activity concentrations (Sparks 2004; Trone 2004; Leigh and Trone 2004).

When no other radionuclide information was available, radionuclide data for comparable waste streams at the same site were mapped into waste streams with missing data. For 73 waste streams without data, this mapping was accomplished by first matching handling (RH and CH) and then the WMC for each site. Then, if there were no matches, the waste description was used to find a comparable waste stream. In this way, a waste stream requiring radionuclide data was matched to a waste stream that was generated by the same or very similar process.

All of the radionuclide data were decayed to a common base year of CY 2001 (December 31, 2001) using Oak Ridge National Laboratory Isotope Generation and Depletion Code, Version 2.2 (hereafter referred to as ORIGEN 2.2) (Croff 1983; Croff 1980). ORIGEN 2.2 is a computer code that calculates the buildup and decay of radionuclides. ORIGEN 2.2 uses a matrix exponential method to solve a large system of coupled, linear, first-order ordinary differential equations with constant coefficients.

The ORIGEN 2.2 half-life data are identical to the half-life data used (via ORIGEN 2.1; ORNL 2002) for the TWBIR Revision 3 (DOE 1996a) in 1996. The results obtained for data in 1996 using ORIGEN 2.1 and those obtained using the current version of ORIGEN 2.2 for 1996 data would be identical. Therefore, the only differences expected between the data obtained in 1996 using ORIGEN 2.1 and those reported for TWBIR - 2004 using ORIGEN 2.2 are those related to time.

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

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

Where

$a(RN)_{Disposal}$	is the activity of the radionuclide RN in the scaled waste stream volume
$\alpha(RN)$	is the decayed radionuclide activity in Ci/m^3 from ORIGEN 2.2 for radionuclide RN
$v_{Disposal}$	is the waste stream disposal volume for CH-TRU or RH-TRU waste

More information on how $v_{Disposal}$ was calculated can be found in Section 3.1.

The WIPP-scale (see section 3.1.1 for discussion on WIPP-Level roll-up scaling) radionuclide activities were calculated as shown in the following equations for both CH- and RH-TRU wastes. In the first step, the activities of each radionuclide in the scaled waste stream volumes ($a(RN)_{Disposal}$) are summed for all waste streams to give the total activity for each radionuclide in CH- and RH-TRU waste in the repository. In the second step, the total activity for each radionuclide in CH- and RH-TRU waste in the repository is divided by the volume limit (168,485 m^3 [5,950,000 ft^3] for CH-TRU waste and 7,079 m^3 [250,000 ft^3] for RH-TRU waste) to give the activity concentration for a radionuclide in CH- or RH-TRU waste in the repository.

$$A(RN) = \Sigma\, a(RN)_{Disposal}$$

$$\hat{A}(RN) = A(RN)/Limit \qquad (9)$$

Where

A(RN)	is the total activity (Ci) for a radionuclide in CH- or RH-TRU waste in the repository (after scaling)
Â(RN)	is the activity concentration for a radionuclide in CH- or RH-TRU waste in the repository (Ci/m^3)
$a(RN)_{Disposal}$	is the activity (Ci) of the radionuclide RN in the scaled waste stream volume
Limit	is 168,485 m^3 (5,950,000 ft^3) for CH-TRU waste and 7,079 m^3 (250,000 ft^3) for RH-TRU waste

3.4 Site-Level Roll-up of Radionuclide Activities

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

3.5 Waste-Stream-Level Radionuclide Activities

The radionuclide activities (Ci) in the scaled waste stream volumes for the CH-TRU waste streams included in the estimate of volume for the PABC (Leigh et al. 2005a; Leigh et al. 2005b) are given in Appendix E, Table E-1. The radionuclide activities (Ci) in the scaled waste stream volumes for the RH-TRU waste streams included in the estimate of volume for PABC are given in Appendix E, Table E-2.

3.6 Waste Isolation Pilot Plant-Level Roll-up of Radionuclide Activities

The waste profiles in Appendices I, J, and K include radionuclide concentrations for each waste stream. These radionuclide concentrations have been decayed to a common base year, but are not scaled for a full repository.

Table 32 presents the WIPP-level roll-up of radionuclide activities for the disposal inventory (scaled for a full WIPP repository) in Ci/$m^3$and total Ci decayed through CY 2001 for both CH-TRU and RH-TRU waste. Table 32 corresponds to Table 3-1 in TWBIR Revision 3 (DOE 1996a).

A comparison of TWBIR Revision 3, Table 3-1 (DOE 1996a) radionuclide information to the radionuclide information reported in Table 32 is given in Appendix B, Table B-27 for CH-TRU waste and Table B-28 for RH-TRU waste. The overall activity for all radionuclides has decreased by nearly 25 percent. Five radionuclides made up 99 percent of the CH-TRU waste curies in the TWBIR Revision 3 and the same five make up 97 percent of the total CH-TRU waste curies in this report. The results for

RH-TRU waste show substantial variations in individual radionuclide activity. An overall increase in activity of 60 percent was observed with this update. The five most abundant RH-TRU waste isotopes in the TWBIR Revision 3 (^{137m}Ba, ^{137}Cs, ^{241}Pu, ^{90}Sr, and ^{90}Y) are still the most abundant in the TWBIR - 2004. These five radionuclides made up 96 percent of the RH-TRU waste curies in the TWBIR Revision 3 and make up 98 percent of the total RH-TRU waste curies in TWBIR - 2004.

Table 30. CH-TRU Waste Curies on a Site-by-Site Basis*

Nuclide	AE	AW	Army	Battelle	Bettis	ETEC	INEEL	K-NFS	LANL	LLNL
Ac-225	1.6E-04	1.0E-09	1.7E-15	—	—	1.2E-14	1.0E+00	—	8.3E-04	—
Ac-227	2.1E-07	2.5E-11	3.2E-15	—	—	5.3E-14	4.4E-04	—	1.3E-03	—
Ac-228	4.9E-05	—	—	—	—	3.8E-18	1.8E+00	—	9.4E-07	—
Ag-109m	—	—	—	—	—	—	—	—	—	—
Ag-110	—	—	—	—	—	—	—	—	—	—
Ag-110m	—	—	—	—	—	—	—	—	—	—
Am-241	6.2E+01	1.0E-01	1.6E-01	6.5E+00	8.4E-03	2.3E-01	2.4E+05	7.8E+01	5.7E+03	2.5E+03
Am-242	—	—	—	—	—	—	—	—	—	—
Am-242	—	—	—	—	—	—	—	—	—	—
Am-243	—	—	—	—	4.0E-05	—	4.2E+01	—	3.8E-03	—
Am-245	—	—	—	—	—	—	—	—	2.0E-13	—
At-217	1.6E-04	1.0E-09	1.7E-15	—	—	1.3E-14	1.0E+00	—	8.3E-04	—
Ba-137m	3.4E+00	2.8E-01	—	—	2.1E+01	1.5E-02	—	—	1.1E-02	—
Bi-210	6.2E-10	1.7E-14	—	—	—	9.3E-12	1.1E-05	—	7.4E-06	—
Bi-211	2.1E-07	2.4E-11	3.2E-15	—	—	5.3E-14	4.3E-04	—	1.3E-03	—
Bi-212	4.2E-01	—	—	—	—	2.3E-18	1.6E+00	—	1.7E-06	—
Bi-213	1.6E-04	1.0E-09	1.7E-15	—	—	1.2E-14	1.0E+00	—	8.2E-04	—
Bi-214	4.3E-09	1.8E-12	—	—	—	7.6E-11	4.2E-05	—	2.8E-05	—
Bk-249	—	—	—	—	—	—	—	—	1.4E-08	—
Bk-250	—	—	—	—	—	—	—	—	—	—
C-14	—	—	—	—	5.3E-04	—	—	—	—	—
Cd-109	—	—	—	—	—	—	—	—	—	—
Ce-144	—	—	—	—	—	—	—	—	—	—
Cf-249	—	—	—	—	7.6E-13	—	—	—	1.3E-04	—
Cf-250	—	—	—	—	—	—	—	—	—	—
Cf-251	—	—	—	—	3.6E-14	—	—	—	—	—
Cf-252	—	—	—	—	—	—	3.1E-03	—	—	—
Cm-242	—	—	—	—	—	—	—	—	—	—
Cm-243	—	—	—	—	4.5E-05	—	—	—	—	—
Cm-244	—	—	—	—	2.5E-03	—	—	—	2.8E+01	2.7E+03
Cm-245	—	—	—	—	2.7E-07	—	—	—	2.5E-07	—
Cm-246	—	—	—	—	4.6E-08	—	—	—	—	—
Cm-247	—	—	—	—	1.1E-13	—	—	—	—	—
Cm-248	—	—	—	—	1.9E-13	—	6.8E-07	—	—	—
Cm-250	—	—	—	—	—	—	—	—	—	—
Co-60	—	—	—	—	9.3E-01	—	—	—	8.2E-08	—
Cs-134	—	—	—	—	—	—	—	—	2.2E-10	—
Cs-137	3.6E+00	3.0E-01	—	—	2.1E+01	1.6E-02	—	—	1.1E-02	—
Eu-152	—	—	—	—	9.3E-01	—	—	—	6.8E-08	—
Eu-154	—	—	—	—	9.3E-01	—	—	—	3.0E-07	—
Eu-155	—	—	—	—	—	—	—	—	2.7E-05	—
Fr-221	1.6E-04	1.0E-09	1.7E-15	—	—	1.2E-14	1.0E+00	—	8.3E-04	—

* Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 30. CH-TRU Waste Curies on a Site-by-Site Basis*—Continued

Nuclide	MURR	NTS	ORNL	Pad	RFETS	Hanford	Hanf-RP	SNL	SRS	WIPP	Total
Ac-225	1.5E-12	2.7E-03	2.3E-01	1.4E-09	5.4E-09	—	—	1.1E-06	1.9E-09	9.9E-05	**1.2E+00**
Ac-227	3.6E-16	2.0E-04	2.4E-01	6.0E-14	3.9E-06	—	—	8.3E-04	2.4E-07	3.7E-04	**2.4E-01**
Ac-228	—	1.9E-15	1.1E-03	—	5.4E-13	—	—	3.7E-03	9.1E-13	8.8E-07	**1.8E+00**
Ag-109m	—	—	—	—	—	—	—	1.3E-04	—	—	**1.3E-04**
Ag-110	—	—	2.1E-11	—	—	—	—	—	—	—	**2.1E-11**
Ag-110m	—	—	1.6E-09	—	—	—	—	—	—	—	**1.6E-09**
Am-241	2.2E+00	3.7E+02	2.5E+03	—	2.6E+04	3.0E+04	5.2E+02	9.1E+00	8.7E+03	1.2E+05	**4.3E+05**
Am-242	—	—	—	—	—	—	—	4.7E-02	—	—	**4.7E-02**
Am-242	—	—	—	—	—	—	—	4.8E-02	—	—	**4.8E-02**
Am-243	—	1.2E+00	9.4E+00	—	—	—	—	1.4E-02	—	4.8E-03	**5.2E+01**
Am-245	—	—	6.2E-11	—	—	—	—	—	—	—	**6.2E-11**
At-217	1.5E-12	2.7E-03	2.3E-01	1.4E-09	5.4E-09	—	—	1.1E-06	1.9E-09	9.9E-05	**1.2E+00**
Ba-137m	—	2.6E-02	3.5E+03	—	1.5E-02	3.3E+02	1.3E+03	7.3E+01	—	3.6E-04	**5.2E+03**
Bi-210	—	9.8E-02	1.2E+00	5.5E-05	2.6E-08	—	—	1.1E-02	5.2E-06	2.4E-07	**1.3E+00**
Bi-211	3.6E-16	2.0E-04	2.4E-01	6.0E-14	3.8E-06	—	—	8.2E-04	2.4E-07	3.7E-04	**2.4E-01**
Bi-212	—	1.6E-02	5.0E-01	—	3.1E-13	—	—	8.5E-03	8.7E-13	4.4E-07	**2.5E+00**
Bi-213	1.5E-12	2.7E-03	2.2E-01	1.4E-09	5.4E-09	—	—	1.1E-06	1.9E-09	9.8E-05	**1.2E+00**
Bi-214	2.7E-20	2.5E-01	2.8E+00	3.1E-04	2.3E-07	—	—	5.0E-02	2.8E-05	7.8E-06	**3.1E+00**
Bk-249	—	—	4.3E-06	—	—	—	—	—	—	—	**4.3E-06**
Bk-250	—	—	1.7E-12	—	—	—	—	—	—	—	**1.7E-12**
C-14	—	2.5E-04	2.1E-04	—	—	1.1E+00	9.9E-02	—	—	—	**1.2E+00**
Cd-109	—	—	—	—	—	—	—	1.3E-04	—	—	**1.3E-04**
Ce-144	—	—	1.2E-07	—	—	—	—	3.6E-04	—	—	**3.6E-04**
Cf-249	—	1.1E-02	3.1E-02	—	—	—	—	—	—	—	**4.2E-02**
Cf-250	—	1.4E-01	1.9E-02	—	—	—	—	—	—	—	**1.6E-01**
Cf-251	—	—	1.7E-04	—	—	—	—	—	—	—	**1.7E-04**
Cf-252	—	8.3E-02	5.7E-02	—	—	—	—	—	—	—	**1.4E-01**
Cm-242	—	—	4.3E-10	—	—	—	—	3.9E-02	—	—	**3.9E-02**
Cm-243	—	4.6E-04	—	—	—	—	—	4.0E-01	—	—	**4.0E-01**
Cm-244	—	2.3E+00	1.7E+03	—	—	—	—	4.8E+00	—	—	**4.4E+03**
Cm-245	—	1.5E-05	4.0E-03	—	—	—	—	—	—	—	**4.0E-03**
Cm-246	—	5.2E-04	7.4E-01	—	—	—	—	—	—	—	**7.4E-01**
Cm-247	—	—	1.3E-10	—	—	—	—	—	—	—	**1.3E-10**
Cm-248	—	4.1E-05	4.3E-02	—	—	—	—	—	—	—	**4.3E-02**
Cm-250	—	—	3.2E-11	—	—	—	—	—	—	—	**3.2E-11**
Co-60	—	—	3.5E-03	—	—	—	—	4.8E-02	—	1.5E-07	**9.8E-01**
Cs-134	—	—	8.1E-04	—	—	—	—	1.9E-02	—	—	**2.0E-02**
Cs-137	—	2.8E-02	3.7E+03	—	1.6E-02	3.3E+02	1.4E+03	7.8E+01	—	3.9E-04	**5.5E+03**
Eu-152	—	9.2E-01	4.1E-02	—	—	—	—	—	—	—	**1.9E+00**
Eu-154	—	3.4E-01	1.2E-01	—	—	—	—	1.3E-01	—	—	**1.5E+00**
Eu-155	—	—	3.1E-02	—	—	—	—	1.8E-03	—	—	**3.3E-02**
Fr-221	1.5E-12	2.7E-03	2.3E-01	1.4E-09	5.4E-09	—	—	1.1E-06	1.9E-09	9.8E-05	**1.2E+00**

* Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 30. CH-TRU Waste Curies on a Site-by-Site Basis*—Continued

Nuclide	AE	AW	Army	Battelle	Bettis	ETEC	INEEL	K-NFS	LANL	LLNL
Fr-223	2.9E-09	3.3E-13	4.4E-17	—	—	7.3E-16	6.0E-06	—	1.7E-05	—
Gd-152	—	—	—	—	—	—	—	—	4.1E-21	—
H-3	—	—	—	—	—	—	—	—	2.1E+02	—
I-129	—	—	—	—	7.0E-06	—	—	—	—	—
Kr-85	—	—	—	—	—	—	—	—	—	—
Na-22	—	—	—	—	—	—	—	—	—	—
Ni-59	—	—	—	—	7.6E-02	—	—	—	—	—
Ni-63	—	—	—	—	3.7E+00	—	—	—	—	—
Np-237	6.9E-01	3.3E-08	4.0E-07	—	5.6E-05	9.9E-07	2.4E+00	—	4.3E-02	—
Np-238	—	—	—	—	—	—	—	—	—	—
Np-239	—	—	—	—	—	—	4.1E+01	—	3.7E-03	—
Np-240m	—	—	—	—	—	—	5.1E-14	—	1.8E-07	—
Pa-231	9.9E-07	1.6E-09	4.0E-14	—	—	4.1E-13	1.2E-03	—	9.5E-07	—
Pa-233	6.9E-01	3.3E-08	4.0E-07	—	—	9.8E-07	2.3E+00	—	4.3E-02	—
Pa-234	6.7E-05	3.5E-10	—	—	—	5.4E-18	4.7E-02	—	2.4E-04	—
Pa-234m	5.2E-02	2.7E-07	—	—	—	4.1E-15	3.6E+01	—	1.9E-01	—
Pb-209	1.6E-04	1.0E-09	1.7E-15	—	—	1.2E-14	1.0E+00	—	8.3E-04	—
Pb-210	6.3E-10	1.7E-14	—	—	—	9.4E-12	1.1E-05	—	7.5E-06	—
Pb-211	2.1E-07	2.4E-11	3.2E-15	—	—	5.3E-14	4.3E-04	—	1.3E-03	—
Pb-212	4.2E-01	—	—	—	—	2.3E-18	1.6E+00	—	1.7E-06	—
Pb-214	4.3E-09	1.8E-12	—	—	—	7.7E-11	4.2E-05	—	2.8E-05	—
Pm-147	—	—	—	—	9.3E-01	—	—	—	—	—
Po-210	6.3E-10	5.5E-15	—	—	—	9.4E-12	1.1E-05	—	7.5E-06	—
Po-211	6.4E-10	7.4E-14	9.7E-18	—	—	1.6E-16	1.3E-06	—	3.9E-06	—
Po-212	2.7E-01	—	—	—	—	1.5E-18	9.9E-01	—	1.1E-06	—
Po-213	1.6E-04	9.8E-10	1.7E-15	—	—	1.2E-14	9.9E-01	—	8.1E-04	—
Po-214	4.3E-09	1.8E-12	—	—	—	7.7E-11	4.2E-05	—	2.8E-05	—
Po-215	2.1E-07	2.4E-11	3.2E-15	—	—	5.3E-14	4.3E-04	—	1.3E-03	—
Po-216	4.2E-01	—	—	—	—	2.3E-18	1.5E+00	—	1.7E-06	—
Po-218	4.2E-09	1.7E-12	—	—	—	7.5E-11	4.1E-05	—	2.8E-05	—
Pr-144	—	—	—	—	—	—	—	—	—	—
Pu-236	2.1E-07	—	—	—	—	—	3.3E-03	—	—	—
Pu-238	1.4E+01	1.5E+02	—	1.8E+03	9.3E-01	1.2E-02	7.7E+04	1.3E+01	9.6E+04	5.5E+02
Pu-239	1.9E+02	1.2E+02	6.1E-02	2.9E+01	7.3E-04	2.1E-01	6.6E+04	1.6E+02	3.8E+03	3.1E+03
Pu-240	1.0E+02	7.0E-01	—	7.5E+00	1.5E-03	8.2E-02	1.6E+04	5.3E+01	3.1E+02	1.4E+03
Pu-241	2.6E+02	6.2E-01	1.9E-01	3.6E+02	1.6E-01	8.9E-01	1.3E+05	2.8E+02	2.3E+03	4.3E+04
Pu-242	6.9E-02	8.8E-06	—	1.2E-03	1.2E-05	2.0E-06	1.2E+00	4.1E-04	1.8E-01	—
Pu-243	—	—	—	—	—	—	—	—	—	—
Pu-244	—	—	—	—	6.6E-13	—	5.0E-14	—	1.8E-07	—
Ra-223	2.1E-07	2.5E-11	3.2E-15	—	—	5.3E-14	4.4E-04	—	1.3E-03	—
Ra-224	4.2E-01	—	—	—	—	2.3E-18	1.5E+00	—	1.7E-06	—
Ra-225	1.6E-04	1.0E-09	1.7E-15	—	—	1.3E-14	1.0E+00	—	8.3E-04	—

***Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 30. CH-TRU Waste Curies on a Site-by-Site Basis*—Continued

Nuclide	MURR	NTS	ORNL	Pad	RFETS	Hanford	Hanf-RP	SNL	SRS	WIPP	Total
Fr-223	4.9E-18	2.8E-06	3.3E-03	8.2E-16	5.3E-08	—	—	1.1E-05	3.3E-09	5.1E-06	**3.3E-03**
Gd-152	—	3.9E-14	1.9E-15	—	—	—	—	—	—	—	**4.1E-14**
H-3	—	5.2E-02	—	—	—	3.4E+00	—	1.8E-02	—	—	**2.2E+02**
I-129	—	—	—	—	—	—	5.1E-04	—	—	—	**5.1E-04**
Kr-85	—	1.4E-01	—	—	—	—	—	3.2E-01	—	—	**4.6E-01**
Na-22	—	—	—	—	—	—	—	—	—	3.9E-07	**3.9E-07**
Ni-59	—	—	—	—	—	—	—	—	—	—	**7.6E-02**
Ni-63	—	—	1.2E-04	—	—	—	—	—	—	—	**3.7E+00**
Np-237	4.7E-04	6.5E-03	8.0E-01	4.1E-02	2.5E-01	—	3.2E-03	1.4E-01	4.8E-02	5.4E-01	**4.9E+00**
Np-238	—	—	—	—	—	—	—	2.4E-04	—	—	**2.4E-04**
Np-239	—	1.2E+00	9.3E+00	—	—	—	—	1.4E-02	—	4.8E-03	**5.2E+01**
Np-240m	—	1.0E-06	5.7E-09	—	—	—	—	—	—	—	**1.2E-06**
Pa-231	8.8E-15	5.1E-04	5.7E-01	4.8E-13	2.3E-05	—	—	5.6E-03	1.0E-06	5.0E-04	**5.8E-01**
Pa-233	4.7E-04	6.4E-03	7.9E-01	4.1E-02	2.5E-01	—	—	1.4E-01	4.8E-02	5.4E-01	**4.9E+00**
Pa-234	3.1E-10	2.0E-07	8.7E-05	—	2.3E-04	—	—	1.2E-05	—	8.4E-03	**5.6E-02**
Pa-234m	2.4E-07	1.6E-04	6.7E-02	—	1.8E-01	—	—	8.9E-03	—	6.5E+00	**4.3E+01**
Pb-209	1.5E-12	2.7E-03	2.3E-01	1.4E-09	5.4E-09	—	—	1.1E-06	1.9E-09	9.8E-05	**1.2E+00**
Pb-210	—	9.9E-02	1.2E+00	5.5E-05	2.6E-08	—	—	1.1E-02	5.3E-06	2.4E-07	**1.3E+00**
Pb-211	3.6E-16	2.0E-04	2.4E-01	6.0E-14	3.8E-06	—	—	8.2E-04	2.4E-07	3.7E-04	**2.4E-01**
Pb-212	—	1.6E-02	5.0E-01	—	3.1E-13	—	—	8.5E-03	8.7E-13	4.4E-07	**2.5E+00**
Pb-214	2.7E-20	2.5E-01	2.9E+00	3.1E-04	2.3E-07	—	—	5.0E-02	2.8E-05	7.8E-06	**3.2E+00**
Pm-147	—	—	9.5E-02	—	—	—	—	6.9E-01	—	—	**1.7E+00**
Po-210	—	9.9E-02	1.2E+00	5.5E-05	2.6E-08	—	—	1.1E-02	5.3E-06	1.3E-07	**1.3E+00**
Po-211	1.1E-18	6.1E-07	7.2E-04	1.8E-16	1.2E-08	—	—	2.5E-06	7.2E-10	1.1E-06	**7.3E-04**
Po-212	—	1.0E-02	3.2E-01	—	2.0E-13	—	—	5.4E-03	5.6E-13	2.8E-07	**1.6E+00**
Po-213	1.5E-12	2.7E-03	2.2E-01	1.4E-09	5.3E-09	—	—	1.1E-06	1.8E-09	9.6E-05	**1.2E+00**
Po-214	2.7E-20	2.5E-01	2.9E+00	3.1E-04	2.3E-07	—	—	5.0E-02	2.8E-05	7.8E-06	**3.2E+00**
Po-215	3.6E-16	2.0E-04	2.4E-01	6.0E-14	3.8E-06	—	—	8.2E-04	2.4E-07	3.7E-04	**2.4E-01**
Po-216	—	1.6E-02	5.0E-01	—	3.1E-13	—	—	8.5E-03	8.7E-13	4.4E-07	**2.5E+00**
Po-218	2.7E-20	2.5E-01	2.8E+00	3.0E-04	2.3E-07	—	—	4.9E-02	2.7E-05	7.7E-06	**3.1E+00**
Pr-144	—	—	1.1E-07	—	—	—	—	3.5E-04	—	—	**3.5E-04**
Pu-236	—	—	—	—	—	—	—	—	—	—	**3.3E-03**
Pu-238	—	1.7E+02	5.3E+03	—	2.7E+03	1.1E+05	2.2E+01	1.7E+00	1.0E+06	5.4E+03	**1.3E+06**
Pu-239	5.3E-02	2.9E+03	1.3E+03	2.7E-01	7.4E+04	4.8E+04	3.3E+03	4.6E+00	2.0E+05	1.4E+05	**5.4E+05**
Pu-240	—	6.3E+01	1.3E+03	—	1.7E+04	1.4E+04	2.7E+02	5.0E-01	4.9E+03	3.1E+04	**8.6E+04**
Pu-241	—	1.4E+03	4.3E+04	—	1.8E+05	9.7E+05	5.5E+02	6.7E+00	9.7E+04	3.4E+05	**1.8E+06**
Pu-242	—	8.9E-02	3.8E-01	—	1.7E+00	3.7E+00	7.7E-03	7.7E-08	—	3.0E+00	**1.0E+01**
Pu-243	—	—	1.3E-10	—	—	—	—	—	—	—	**1.3E-10**
Pu-244	—	1.0E-06	5.7E-09	—	—	—	—	—	—	—	**1.2E-06**
Ra-223	3.6E-16	2.0E-04	2.4E-01	6.0E-14	3.9E-06	—	—	8.3E-04	2.4E-07	3.7E-04	**2.4E-01**
Ra-224	—	1.6E-02	4.9E-01	—	3.1E-13	—	—	8.5E-03	8.7E-13	4.4E-07	**2.5E+00**
Ra-225	1.5E-12	2.7E-03	2.3E-01	1.4E-09	5.4E-09	—	—	1.1E-06	1.9E-09	9.9E-05	**1.2E+00**

*Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 30. CH-TRU Waste Curies on a Site-by-Site Basis*—Continued

Nuclide	AE	AW	Army	Battelle	Bettis	ETEC	INEEL	K-NFS	LANL	LLNL
Ra-226	4.3E-09	1.8E-12	—	—	—	7.7E-11	4.2E-05	—	2.8E-05	—
Ra-228	5.8E-05	—	—	—	—	4.4E-18	2.1E+00	—	1.1E-06	—
Rh-106	—	—	—	—	—	—	—	—	8.5E-11	—
Rn-219	2.1E-07	2.4E-11	3.2E-15	—	—	5.3E-14	4.3E-04	—	1.3E-03	—
Rn-220	4.2E-01	—	—	—	—	2.3E-18	1.6E+00	—	1.7E-06	—
Rn-222	4.3E-09	1.8E-12	—	—	—	7.7E-11	4.2E-05	—	2.8E-05	—
Ru-106	—	—	—	—	—	—	—	—	8.6E-11	—
Sb-125	—	—	—	—	—	—	—	—	2.9E-06	—
Se-79	—	—	—	—	1.3E-04	—	—	—	—	—
Sm-147	—	—	—	—	—	—	—	—	—	—
Sm-151	—	—	—	—	1.0E-01	—	—	—	—	—
Sr-90	2.6E+00	1.5E+00	—	—	2.1E+01	1.2E-02	—	—	7.4E-03	—
Tc-99	5.8E+00	—	—	—	4.7E-03	—	—	2.5E-02	—	—
Te-123	—	—	—	—	—	—	—	—	—	—
Te-123m	—	—	—	—	—	—	—	—	—	—
Te-125m	—	—	—	—	—	—	—	—	7.1E-07	—
Th-227	2.1E-07	2.4E-11	3.1E-15	—	—	5.2E-14	4.3E-04	—	1.2E-03	—
Th-228	4.2E-01	—	—	—	—	2.3E-18	1.6E+00	1.7E-04	1.7E-06	—
Th-229	1.6E-04	1.0E-09	1.7E-15	—	—	1.3E-14	1.0E+00	—	8.3E-04	—
Th-230	1.3E-06	8.9E-09	—	—	—	2.8E-08	6.3E-03	—	4.1E-03	—
Th-231	2.9E-03	7.3E-05	4.7E-10	—	—	2.8E-09	1.8E+00	—	2.6E-03	—
Th-232	6.2E-05	5.1E-19	—	—	5.6E-14	1.1E-17	2.4E+00	2.9E-05	1.1E-06	—
Th-234	5.2E-02	2.7E-07	—	—	—	4.1E-15	3.6E+01	—	1.9E-01	—
Tl-207	2.1E-07	2.4E-11	3.2E-15	—	—	5.3E-14	4.3E-04	—	1.3E-03	—
Tl-208	1.5E-01	—	—	—	—	8.2E-19	5.6E-01	—	6.1E-07	—
Tl-209	3.5E-06	2.2E-11	3.8E-17	—	—	2.7E-16	2.2E-02	—	1.8E-05	—
U-232	4.1E-01	—	—	—	1.3E-05	—	2.7E-03	1.7E-04	7.3E-07	—
U-233	1.1E-01	1.1E-05	6.9E-12	—	—	2.9E-11	8.3E+02	1.5E-02	3.1E-01	—
U-234	9.1E-03	1.2E-03	—	—	2.0E-03	2.4E-04	2.4E+01	1.1E-03	1.6E+01	—
U-235	2.9E-03	7.4E-05	4.8E-10	—	2.6E-05	2.8E-09	1.8E+00	5.1E-05	2.7E-03	—
U-236	6.7E-05	2.1E-08	—	—	3.0E-04	3.3E-08	9.0E-01	—	4.2E-04	—
U-237	6.3E-03	1.5E-05	4.6E-06	—	—	2.2E-05	3.1E+00	—	5.7E-02	—
U-238	5.2E-02	2.7E-07	—	—	1.2E-07	4.2E-15	3.7E+01	4.0E-03	1.9E-01	—
U-240	—	—	—	—	—	—	5.0E-14	—	1.8E-07	—
Y-90	2.6E+00	1.5E+00	—	—	2.1E+01	1.2E-02	—	—	7.3E-03	—
Zn-65	—	—	—	—	—	—	—	—	—	—
Zr-93	—	—	—	—	1.1E-03	—	—	—	—	—
TOTAL	**6.5E+02**	**2.7E+02**	**4.1E-01**	**2.2E+03**	**9.3E+01**	**1.5E+00**	**5.2E+05**	**5.8E+02**	**1.1E+05**	**5.3E+04**

*Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 30. CH-TRU Waste Curies on a Site-by-Site Basis*—Continued

Nuclide	MURR	NTS	ORNL	Pad	RFETS	Hanford	Hanf-RP	SNL	SRS	WIPP	Total
Ra-226	2.8E-20	2.5E-01	2.9E+00	3.1E-04	2.3E-07	—	—	5.1E-02	2.8E-05	7.9E-06	**3.2E+00**
Ra-228	—	2.2E-15	1.3E-03	—	6.4E-13	—	—	4.3E-03	1.1E-12	1.0E-06	**2.1E+00**
Rh-106	—	—	2.4E-05	—	—	—	—	1.1E-04	—	—	**1.3E-04**
Rn-219	3.6E-16	2.0E-04	2.4E-01	6.0E-14	3.8E-06	—	—	8.2E-04	2.4E-07	3.7E-04	**2.4E-01**
Rn-220	—	1.6E-02	5.0E-01	—	3.1E-13	—	—	8.5E-03	8.7E-13	4.4E-07	**2.5E+00**
Rn-222	2.7E-20	2.5E-01	2.9E+00	3.1E-04	2.3E-07	—	—	5.0E-02	2.8E-05	7.9E-06	**3.2E+00**
Ru-106	—	—	2.4E-05	—	—	—	—	1.1E-04	—	—	**1.3E-04**
Sb-125	—	—	2.4E-03	—	—	—	—	—	—	—	**2.4E-03**
Se-79	—	—	—	—	—	—	—	—	—	—	**1.3E-04**
Sm-147	—	—	2.1E-10	—	—	—	—	4.6E-11	—	—	**2.5E-10**
Sm-151	—	—	—	—	—	—	5.6E+01	2.7E-01	—	—	**5.7E+01**
Sr-90	—	9.5E-05	2.2E+03	—	—	1.2E+02	5.3E+04	7.4E+01	—	—	**5.5E+04**
Tc-99	—	—	3.1E+01	3.0E+00	—	6.8E-04	8.9E+01	1.6E-03	—	—	**1.3E+02**
Te-123	—	—	3.2E-05	—	—	—	—	—	—	—	**3.2E-05**
Te-123m	—	—	2.4E-19	—	—	—	—	—	—	—	**2.4E-19**
Te-125m	—	—	5.8E-04	—	—	—	—	—	—	—	**5.8E-04**
Th-227	3.5E-16	2.0E-04	2.3E-01	5.9E-14	3.8E-06	—	—	8.1E-04	2.3E-07	3.6E-04	**2.4E-01**
Th-228	—	1.6E-02	5.0E-01	—	3.2E-13	—	—	8.6E-03	8.8E-13	4.4E-07	**2.5E+00**
Th-229	1.5E-12	2.7E-03	2.3E-01	1.4E-09	5.4E-09	—	—	1.1E-06	1.9E-09	9.9E-05	**1.2E+00**
Th-230	4.8E-17	1.2E-06	3.2E-03	5.6E-02	9.1E-05	—	—	8.5E-06	7.0E-03	4.9E-05	**7.6E-02**
Th-231	2.1E-10	1.5E-04	1.0E-02	3.5E-09	9.0E-02	—	—	1.2E-02	3.9E-03	1.2E-01	**2.0E+00**
Th-232	—	4.9E-15	1.3E-03	—	1.8E-12	4.4E-02	—	4.0E-03	1.8E-12	2.6E-06	**2.5E+00**
Th-234	2.4E-07	1.6E-04	6.7E-02	—	1.8E-01	—	—	8.9E-03	—	6.5E+00	**4.3E+01**
Tl-207	3.6E-16	2.0E-04	2.4E-01	5.9E-14	3.8E-06	—	—	8.1E-04	2.3E-07	3.7E-04	**2.4E-01**
Tl-208	—	5.8E-03	1.8E-01	—	1.1E-13	—	—	3.1E-03	3.1E-13	1.6E-07	**8.9E-01**
Tl-209	3.3E-14	6.0E-05	4.9E-03	3.1E-11	1.2E-10	—	—	2.4E-08	4.1E-11	2.2E-06	**2.7E-02**
U-232	—	1.6E-02	4.9E-01	—	—	—	—	—	—	—	**9.2E-01**
U-233	8.0E-09	1.8E+00	1.4E+02	2.3E-06	1.0E-05	5.3E+01	1.1E-05	2.4E-03	2.4E-06	2.7E-01	**1.0E+03**
U-234	2.7E-12	1.2E-02	2.1E+01	—	8.9E-01	3.3E+01	1.3E+01	1.9E-01	6.3E+01	1.3E+00	**1.7E+02**
U-235	2.1E-10	1.5E-04	1.0E-02	3.5E-09	9.1E-02	3.9E-01	5.8E-01	1.2E-02	4.0E-03	1.2E-01	**3.0E+00**
U-236	—	1.3E-05	8.1E-04	—	6.0E-03	1.6E-05	1.1E-01	7.4E-08	3.0E-03	4.5E-03	**1.0E+00**
U-237	—	6.0E-03	1.1E+00	—	4.4E+00	—	—	1.7E-04	2.4E+00	8.5E+00	**1.9E+01**
U-238	2.4E-07	1.6E-04	6.8E-02	—	1.8E-01	4.0E+00	1.3E+01	9.0E-03	—	6.5E+00	**6.1E+01**
U-240	—	1.0E-06	5.6E-09	—	—	—	—	—	—	—	**1.2E-06**
Y-90	—	9.4E-05	2.2E+03	—	—	1.2E+02	5.3E+04	7.3E+01	—	—	**5.5E+04**
Zn-65	—	—	1.1E-10	—	—	—	—	—	—	—	**1.1E-10**
Zr-93	—	—	—	—	—	—	—	—	—	—	**1.1E-03**
TOTAL	**2.2E+00**	**4.9E+03**	**6.7E+04**	**3.4E+00**	**3.0E+05**	**1.2E+06**	**1.1E+05**	**3.3E+02**	**1.3E+06**	**6.4E+05**	**4.3E+06**

*Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 31. RH-TRU Waste Curies on a Site-by-Site Basis*

Nuclide	AE	AW	Battelle	Bettis	ETEC	INEEL	KAPL
Ac-225	4.6E-07	1.2E-04	—	—	3.2E-14	2.2E-13	9.6E-10
Ac-227	2.9E-08	6.5E-08	—	—	1.8E-08	2.1E-08	4.9E-08
Ac-228	1.1E-15	1.2E-14	—	—	9.2E-18	2.4E-16	3.5E-11
Ag-110	—	—	—	—	—	—	—
Ag-110m	—	—	—	—	—	—	—
Am-241	1.0E+01	1.2E+01	8.6E+01	2.5E+00	6.5E-01	3.0E+01	3.0E-02
Am-242	—	5.0E-03	—	—	—	—	—
Am-242m	—	5.1E-03	2.0E-01	—	—	—	—
Am-243	3.2E-05	5.4E-04	6.7E-01	1.2E-02	—	—	5.3E-05
At-217	4.6E-07	1.2E-04	—	—	3.2E-14	2.2E-13	9.6E-10
Ba-137m	4.3E+01	1.2E+04	—	6.2E+03	9.2E+00	1.9E+02	7.2E+01
Bi-210	7.0E-11	4.3E-11	—	—	9.8E-16	9.2E-11	2.5E-09
Bi-211	2.9E-08	6.5E-08	—	—	1.8E-08	2.1E-08	4.8E-08
Bi-212	1.1E-15	5.6E-15	—	—	5.5E-18	9.8E-17	1.0E-05
Bi-213	4.6E-07	1.2E-04	—	—	3.2E-14	2.2E-13	9.6E-10
Bi-214	3.8E-10	7.2E-10	—	—	1.7E-14	1.8E-09	9.5E-09
C-14	—	—	—	1.6E-01	—	—	1.9E-03
Cd-113m	5.9E-01	—	—	—	—	—	—
Ce-141	—	4.3E-19	—	—	—	—	—
Ce-144	2.0E-09	7.3E+00	—	—	—	—	—
Cf-249	—	—	—	2.3E-10	—	—	4.0E-12
Cf-250	—	—	—	—	—	—	—
Cf-251	—	—	—	1.1E-11	—	—	5.0E-14
Cf-252	—	—	—	—	—	—	1.9E-15
Cm-242	1.5E-21	4.2E-03	—	—	—	—	—
Cm-243	—	1.4E-04	4.6E-01	1.3E-02	—	—	1.5E-05
Cm-244	1.9E-01	4.4E-03	6.8E+01	7.6E-01	—	—	1.5E-03
Cm-245	—	—	1.1E-02	8.1E-05	—	—	4.9E-07
Cm-246	—	—	1.6E-04	1.4E-05	—	—	6.4E-08
Cm-247	—	—	—	3.2E-11	—	—	1.5E-13
Cm-248	—	—	—	5.8E-11	—	—	3.0E-13
Co-60	2.2E-01	1.9E+01	5.0E+02	2.8E+02	—	—	—
Cs-134	8.8E-05	1.1E+02	2.7E-04	—	—	—	—
Cs-135	—	—	—	—	—	—	4.0E-04
Cs-137	4.5E+01	1.3E+04	2.3E+03	6.4E+03	9.8E+00	2.0E+02	7.7E+01
Eu-152	1.7E-04	—	1.4E-02	2.8E+02	—	—	—
Eu-154	8.2E-03	1.6E+02	3.8E-01	2.8E+02	—	—	—
Eu-155	1.0E-02	3.2E+02	—	—	—	—	—
Fe-55	1.5E-01	—	—	—	—	—	—
Fr-221	4.6E-07	1.2E-04	—	—	3.2E-14	2.2E-13	9.6E-10
Fr-223	4.0E-10	8.9E-10	—	—	2.4E-10	2.9E-10	6.6E-10
Gd-152	1.8E-17	—	—	—	—	—	—

*Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 31. RH-TRU Waste Curies on a Site-by-Site Basis*—Continued

Nuclide	LANL	ORNL	Hanford	Hanf-RP	SNL	SRS	Total
Ac-225	6.1E-15	2.1E-01	—	—	4.6E-12	—	2.1E-01
Ac-227	2.4E-08	2.3E-05	—	—	4.4E-09	—	2.3E-05
Ac-228	1.0E-16	8.3E-01	—	—	1.2E-18	—	8.3E-01
Ag-110	—	1.1E-10	—	—	—	—	1.1E-10
Ag-110m	—	8.5E-09	—	—	—	—	8.5E-09
Am-241	2.5E-02	3.2E+02	2.1E+03	1.1E+04	2.1E+01	—	1.4E+04
Am-242	—	—	—	—	—	—	5.0E-03
Am-242m	—	—	—	—	—	—	2.1E-01
Am-243	—	3.3E-01	—	—	—	4.1E-02	1.1E+00
At-217	6.1E-15	2.1E-01	—	—	4.6E-12	—	2.1E-01
Ba-137m	1.5E+01	1.5E+04	2.5E+05	1.2E+05	4.6E+02	5.8E+01	4.1E+05
Bi-210	9.1E-12	1.2E-06	—	—	1.8E-11	2.1E-13	1.2E-06
Bi-211	2.4E-08	2.2E-05	—	—	4.3E-09	—	2.3E-05
Bi-212	1.0E-16	1.6E+01	—	—	3.2E-19	—	1.6E+01
Bi-213	6.1E-15	2.1E-01	—	—	4.6E-12	—	2.1E-01
Bi-214	3.6E-11	7.9E-06	—	—	3.5E-10	3.5E-12	7.9E-06
C-14	—	4.8E-04	—	1.1E+00	—	—	1.2E+00
Cd-113m	—	—	—	—	—	—	5.9E-01
Ce-141	—	—	—	—	—	—	4.3E-19
Ce-144	—	6.2E-07	—	—	—	—	7.3E+00
Cf-249	—	4.9E-03	—	—	—	—	4.9E-03
Cf-250	—	8.7E-02	—	—	—	—	8.7E-02
Cf-251	—	9.3E-04	—	—	—	—	9.3E-04
Cf-252	—	1.0E-01	—	—	—	—	1.0E-01
Cm-242	—	8.9E-12	—	—	—	—	4.2E-03
Cm-243	—	3.1E-07	—	—	3.8E-02	—	5.1E-01
Cm-244	—	1.2E+03	—	—	4.2E-01	—	1.3E+03
Cm-245	—	6.9E-06	—	—	—	—	1.1E-02
Cm-246	—	3.9E+00	—	—	—	—	3.9E+00
Cm-247	—	7.1E-10	—	—	—	5.5E+01	5.5E+01
Cm-248	—	1.1E-02	—	—	—	—	1.1E-02
Co-60	—	1.7E+02	8.8E+02	—	3.3E-02	—	1.9E+03
Cs-134	—	4.5E-03	—	—	1.6E+01	—	1.2E+02
Cs-135	—	—	—	—	—	—	4.0E-04
Cs-137	1.6E+01	1.6E+04	2.8E+05	1.2E+05	4.9E+02	6.2E+01	4.4E+05
Eu-152	—	2.4E+03	—	—	—	—	2.7E+03
Eu-154	—	8.2E+02	—	—	1.3E+00	—	1.3E+03
Eu-155	7.9E-03	8.2E+01	—	—	—	—	4.1E+02
Fe-55	—	—	—	—	—	—	1.5E-01
Fr-221	6.1E-15	2.1E-01	—	—	4.6E-12	—	2.1E-01
Fr-223	3.3E-10	3.1E-07	—	—	6.0E-11	—	3.1E-07
Gd-152	—	1.1E-10	—	—	—	—	1.1E-10

*Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 31. RH-TRU Waste Curies on a Site-by-Site Basis*—Continued

Nuclide	AE	AW	Battelle	Bettis	ETEC	INEEL	KAPL
H-3	—	6.8E-04	—	—	—	—	—
I-129	—	—	—	2.1E-03	—	—	3.7E-05
Kr-85	4.1E-01	—	—	—	—	—	—
Mn-54	2.5E-09	2.1E+00	—	—	—	—	—
Na-22	—	3.4E-01	—	—	—	—	—
Nb-93m	9.2E-04	—	—	—	—	—	1.2E-04
Nb-95	—	2.4E-13	—	—	—	—	—
Nb-95m	—	8.1E-16	—	—	—	—	—
Ni-59	—	—	—	2.3E+01	—	—	1.8E-04
Ni-63	—	—	—	1.1E+03	—	—	1.9E-02
Np-237	1.7E-03	1.9E-03	1.2E-02	1.7E-02	2.7E-06	6.8E-05	8.5E-04
Np-238	—	2.5E-05	—	—	—	—	—
Np-239	3.1E-05	5.3E-04	—	—	—	—	5.2E-05
Np-240m	—	—	—	—	—	—	1.7E-12
Pa-231	8.9E-08	7.3E-07	—	—	1.5E-07	2.0E-07	9.7E-08
Pa-233	1.6E-03	1.9E-03	—	—	2.6E-06	6.8E-05	8.4E-04
Pa-234	7.8E-08	5.9E-07	—	—	2.9E-06	1.4E-15	4.1E-10
Pa-234m	6.0E-05	4.6E-04	—	—	2.2E-03	1.1E-12	3.1E-07
Pb-209	4.6E-07	1.2E-04	—	—	3.2E-14	2.2E-13	9.6E-10
Pb-210	7.0E-11	4.3E-11	—	—	9.9E-16	9.3E-11	2.5E-09
Pb-211	2.9E-08	6.5E-08	—	—	1.8E-08	2.1E-08	4.8E-08
Pb-212	1.1E-15	5.6E-15	—	—	5.4E-18	9.8E-17	1.0E-05
Pb-214	3.9E-10	7.2E-10	—	—	1.7E-14	1.8E-09	9.5E-09
Pd-107	—	—	—	—	—	—	1.7E-05
Pm-147	3.0E-02	3.7E+02	—	2.8E+02	—	—	5.9E-02
Po-210	7.0E-11	4.3E-11	—	—	9.9E-16	9.3E-11	2.0E-09
Po-211	8.8E-11	2.0E-10	—	—	5.4E-11	6.3E-11	1.5E-10
Po-212	6.8E-16	3.6E-15	—	—	3.5E-18	6.3E-17	6.6E-06
Po-213	4.5E-07	1.2E-04	—	—	3.1E-14	2.2E-13	9.4E-10
Po-214	3.9E-10	7.2E-10	—	—	1.7E-14	1.8E-09	9.5E-09
Po-215	2.9E-08	6.5E-08	—	—	1.8E-08	2.1E-08	4.8E-08
Po-216	1.1E-15	5.6E-15	—	—	5.4E-18	9.8E-17	1.0E-05
Po-218	3.8E-10	7.1E-10	—	—	1.6E-14	1.7E-09	9.3E-09
Pr-144	2.0E-09	7.2E+00	—	—	—	—	—
Pu-238	9.2E+00	1.2E+00	7.8E+01	2.8E+02	1.5E-02	2.7E+03	2.8E+00
Pu-239	1.8E+01	2.5E+01	1.0E+01	2.2E-01	1.1E+00	3.5E+01	7.6E-03
Pu-240	3.8E+00	2.3E+01	1.6E+01	4.5E-01	2.7E-01	3.3E+01	1.9E-03
Pu-241	3.0E+01	7.2E+02	1.3E+03	4.8E+01	2.2E+00	6.6E+01	2.7E-01
Pu-242	—	5.5E-04	4.8E-02	3.5E-03	—	1.0E-03	7.2E-06
Pu-243	—	—	—	—	—	—	1.5E-13
Pu-244	—	—	—	2.0E-10	—	—	1.7E-12
Ra-223	2.9E-08	6.5E-08	—	—	1.8E-08	2.1E-08	4.9E-08

*Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 31. RH-TRU Waste Curies on a Site-by-Site Basis*—Continued

Nuclide	LANL	ORNL	Hanford	Hanf-RP	SNL	SRS	Total
H-3	—	2.6E-01	—	—	—	—	**2.6E-01**
I-129	—	—	—	8.0E-02	—	—	**8.2E-02**
Kr-85	—	—	—	—	—	—	**4.1E-01**
Mn-54	—	—	—	—	—	—	**2.1E+00**
Na-22	—	—	—	—	—	—	**3.4E-01**
Nb-93m	—	—	—	—	—	—	**1.0E-03**
Nb-95	—	—	—	—	—	—	**2.4E-13**
Nb-95m	—	—	—	—	—	—	**8.1E-16**
Ni-59	—	—	—	—	—	—	**2.3E+01**
Ni-63	—	—	—	—	—	—	**1.1E+03**
Np-237	1.6E-07	1.8E-03	—	6.4E-01	9.0E-04	—	**6.7E-01**
Np-238	—	—	—	—	—	—	**2.5E-05**
Np-239	—	3.2E-01	—	—	—	4.1E-02	**3.7E-01**
Np-240m	—	6.5E-03	—	—	—	—	**6.5E-03**
Pa-231	6.6E-08	9.9E-05	—	—	5.8E-08	5.3E-19	**1.0E-04**
Pa-233	1.6E-07	1.8E-03	—	—	9.0E-04	—	**7.2E-03**
Pa-234	5.7E-10	1.6E-02	—	—	2.4E-07	—	**1.6E-02**
Pa-234m	4.4E-07	1.3E+01	—	—	1.8E-04	—	**1.3E+01**
Pb-209	6.1E-15	2.1E-01	—	—	4.6E-12	—	**2.1E-01**
Pb-210	9.2E-12	1.2E-06	—	—	1.8E-11	2.1E-13	**1.2E-06**
Pb-211	2.4E-08	2.2E-05	—	—	4.3E-09	—	**2.3E-05**
Pb-212	1.0E-16	1.6E+01	—	—	3.2E-19	—	**1.6E+01**
Pb-214	3.6E-11	7.9E-06	—	—	3.5E-10	3.5E-12	**7.9E-06**
Pd-107	—	—	—	—	—	—	**1.7E-05**
Pm-147	—	—	—	—	7.0E+00	2.2E+00	**6.6E+02**
Po-210	9.2E-12	1.2E-06	—	—	1.8E-11	2.1E-13	**1.2E-06**
Po-211	7.2E-11	6.8E-08	—	—	1.3E-11	—	**6.9E-08**
Po-212	6.6E-17	1.0E+01	—	—	2.1E-19	—	**1.0E+01**
Po-213	6.0E-15	2.1E-01	—	—	4.5E-12	—	**2.1E-01**
Po-214	3.6E-11	7.9E-06	—	—	3.5E-10	3.5E-12	**7.9E-06**
Po-215	2.4E-08	2.2E-05	—	—	4.3E-09	—	**2.3E-05**
Po-216	1.0E-16	1.6E+01	—	—	3.2E-19	—	**1.6E+01**
Po-218	3.5E-11	7.8E-06	—	—	3.5E-10	3.5E-12	**7.8E-06**
Pr-144	—	6.1E-07	—	—	—	—	**7.2E+00**
Pu-238	1.3E-02	2.5E+02	5.3E+02	1.0E+01	4.2E+00	3.6E+00	**3.9E+03**
Pu-239	2.5E+00	1.4E+02	8.6E+02	4.2E+03	2.8E+00	4.8E-06	**5.3E+03**
Pu-240	2.7E-02	3.4E+01	4.6E+02	1.0E+03	4.3E-01	—	**1.6E+03**
Pu-241	2.2E-01	1.5E+02	1.2E+05	1.8E+04	2.5E-02	—	**1.4E+05**
Pu-242	1.6E-05	7.1E-02	1.5E-01	2.2E-01	—	—	**4.9E-01**
Pu-243	—	7.0E-10	—	—	—	5.4E+01	**5.4E+01**
Pu-244	—	6.4E-03	—	—	—	—	**6.4E-03**
Ra-223	2.4E-08	2.3E-05	—	—	4.4E-09	—	**2.3E-05**

*Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 31. RH-TRU Waste Curies on a Site-by-Site Basis*—Continued

Nuclide	AE	AW	Battelle	Bettis	ETEC	INEEL	KAPL
Ra-224	1.1E-15	5.5E-15	—	—	5.4E-18	9.8E-17	1.0E-05
Ra-225	4.6E-07	1.2E-04	—	—	3.2E-14	2.2E-13	9.6E-10
Ra-226	3.9E-10	7.3E-10	—	—	1.7E-14	1.8E-09	9.6E-09
Ra-228	1.3E-15	1.4E-14	—	—	1.1E-17	2.8E-16	4.1E-11
Rh-106	3.6E-07	—	—	—	—	—	—
Rn-219	2.9E-08	6.5E-08	—	—	1.8E-08	2.1E-08	4.8E-08
Rn-220	1.1E-15	5.6E-15	—	—	5.4E-18	9.8E-17	1.0E-05
Rn-222	3.9E-10	7.2E-10	—	—	1.7E-14	1.8E-09	9.5E-09
Ru-106	3.6E-07	—	—	—	—	—	—
Sb-125	3.7E-03	5.0E+00	2.8E-03	—	—	—	—
Sb-126	1.2E-04	—	—	—	—	—	4.7E-05
Sb-126m	8.7E-04	—	—	—	—	—	3.4E-04
Se-79	—	—	—	4.0E-02	—	—	1.0E-04
Sm-147	9.3E-10	3.5E-08	—	—	—	—	4.4E-13
Sm-151	2.0E+00	3.5E+01	—	3.1E+01	—	—	1.2E+00
Sn-121m	—	—	—	—	—	—	3.0E-03
Sn-126	8.7E-04	—	—	—	—	—	3.4E-04
Sr-90	2.6E+01	1.3E+04	1.5E+03	6.4E+03	9.5E+00	—	7.3E+01
Tc-99	1.1E-02	—	4.4E-01	1.4E+00	—	—	2.1E-02
Te-125m	8.9E-04	1.2E+00	—	—	—	—	—
Th-227	2.8E-08	6.4E-08	—	—	1.7E-08	2.0E-08	4.7E-08
Th-228	1.1E-15	5.6E-15	—	—	5.5E-18	9.9E-17	1.1E-05
Th-229	4.7E-07	1.2E-04	—	—	3.2E-14	2.2E-13	9.6E-10
Th-230	9.8E-08	5.6E-07	—	—	1.4E-11	1.8E-06	1.4E-06
Th-231	1.5E-04	5.7E-03	—	—	8.9E-04	1.4E-03	7.1E-05
Th-232	2.1E-15	4.7E-14	—	1.7E-11	2.9E-17	1.2E-15	4.1E-11
Th-234	6.0E-05	4.6E-04	—	—	2.2E-03	1.1E-12	3.1E-07
Tl-207	2.9E-08	6.4E-08	—	—	1.8E-08	2.1E-08	4.8E-08
Tl-208	3.8E-16	2.0E-15	2.3E-03	—	2.0E-18	3.5E-17	3.7E-06
Tl-209	1.0E-08	2.6E-06	—	—	7.1E-16	4.9E-15	2.1E-11
U-232	—	—	7.4E-04	4.0E-03	—	—	3.4E-05
U-233	1.8E-04	2.1E-01	1.3E-06	—	7.6E-11	1.0E-09	3.9E-07
U-234	7.8E-04	1.0E-02	2.8E-02	6.0E-01	4.0E-07	5.5E-02	4.8E-03
U-235	1.6E-04	5.7E-03	4.1E-04	7.8E-03	9.0E-04	1.4E-03	7.2E-05
U-236	3.1E-06	1.6E-04	5.4E-03	8.9E-02	9.4E-08	6.8E-06	6.8E-04
U-237	7.3E-04	1.8E-02	—	—	5.4E-05	1.6E-03	6.6E-06
U-238	6.1E-05	4.6E-04	8.0E-03	3.6E-05	2.3E-03	1.1E-12	3.2E-07
U-240	—	—	—	—	—	—	1.7E-12
Y-90	2.5E+01	1.3E+04	—	6.4E+03	9.4E+00	—	7.3E+01
Y-91	—	4.7E-12	—	—	—	—	—
Zr-93	1.3E-03	—	—	3.4E-01	—	—	2.6E-03
Zr-95	—	1.1E-13	—	—	—	—	—
TOTAL	**2.1E+02**	**5.2E+04**	**5.8E+03**	**2.8E+04**	**4.2E+01**	**3.3E+03**	**3.0E+02**

*Data decayed through December 31, 2001. Date Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 31. RH-TRU Waste Curies on a Site-by-Site Basis*---Continued

Nuclide	LANL	ORNL	Hanford	Hanf-RP	SNL	SRS	Total
Ra-224	1.0E-16	1.6E+01	—	—	3.2E-19	—	**1.6E+01**
Ra-225	6.1E-15	2.1E-01	—	—	4.6E-12	—	**2.1E-01**
Ra-226	3.6E-11	8.0E-06	—	—	3.6E-10	3.6E-12	**8.0E-06**
Ra-228	1.2E-16	9.8E-01	—	—	1.4E-18	—	**9.8E-01**
Rh-106	1.3E-10	2.2E-03	—	—	—	—	**2.2E-03**
Rn-219	2.4E-08	2.2E-05	—	—	4.3E-09	—	**2.3E-05**
Rn-220	1.0E-16	1.6E+01	—	—	3.2E-19	—	**1.6E+01**
Rn-222	3.6E-11	7.9E-06	—	—	3.5E-10	3.5E-12	**7.9E-06**
Ru-106	1.3E-10	2.3E-03	—	—	—	—	**2.3E-03**
Sb-125	5.5E-04	1.3E-02	—	—	—	—	**5.0E+00**
Sb-126	—	—	—	—	—	—	**1.7E-04**
Sb-126m	—	—	—	—	—	—	**1.2E-03**
Se-79	—	—	—	—	—	—	**4.0E-02**
Sm-147	—	—	—	—	4.7E-10	4.0E-10	**3.7E-08**
Sm-151	—	—	3.0E+02	2.4E+02	—	—	**6.0E+02**
Sn-121m	—	—	—	—	—	—	**3.0E-03**
Sn-126	—	—	—	—	—	—	**1.2E-03**
Sr-90	1.5E+01	5.6E+04	1.8E+05	7.5E+04	4.9E+02	5.8E+01	**3.4E+05**
Tc-99	—	6.5E-09	6.6E-03	1.6E+02	—	—	**1.6E+02**
Te-125m	1.3E-04	3.1E-03	—	—	—	—	**1.2E+00**
Th-227	2.3E-08	2.2E-05	—	—	4.3E-09	—	**2.2E-05**
Th-228	1.1E-16	1.6E+01	—	—	3.3E-19	—	**1.6E+01**
Th-229	6.1E-15	2.1E-01	—	—	4.6E-12	—	**2.1E-01**
Th-230	5.5E-09	2.2E-03	—	—	3.3E-07	3.1E-09	**2.2E-03**
Th-231	9.9E-05	2.7E-01	—	—	5.4E-04	1.2E-14	**2.8E-01**
Th-232	1.5E-16	1.0E+00	4.3E-02	—	7.8E-18	—	**1.1E+00**
Th-234	4.4E-07	1.3E+01	—	—	1.8E-04	—	**1.3E+01**
Tl-207	2.4E-08	2.2E-05	—	—	4.3E-09	—	**2.3E-05**
Tl-208	3.7E-17	5.6E+00	—	—	1.2E-19	—	**5.7E+00**
Tl-209	1.4E-16	4.7E-03	—	—	1.0E-13	—	**4.7E-03**
U-232	—	1.5E+01	—	—	—	—	**1.5E+01**
U-233	7.9E-12	1.4E+02	8.5E+00	2.3E+00	1.9E-08	—	**1.5E+02**
U-234	2.0E-05	1.4E+01	2.9E+00	1.5E+01	7.4E-03	8.4E-05	**3.2E+01**
U-235	1.0E-04	2.8E-01	2.8E-01	5.6E-01	5.5E-04	1.3E-14	**1.1E+00**
U-236	1.1E-07	4.9E-02	2.1E-04	1.2E+00	6.3E-08	—	**1.3E+00**
U-237	5.5E-06	3.7E-03	—	—	6.1E-07	—	**2.4E-02**
U-238	4.4E-07	1.3E+01	2.7E-02	1.3E+02	1.8E-04	—	**1.4E+02**
U-240	—	6.4E-03	—	—	—	—	**6.4E-03**
Y-90	1.5E+01	5.6E+04	1.8E+05	7.5E+04	4.8E+02	5.7E+01	**3.3E+05**
Y-91	—	—	—	—	—	—	**4.7E-12**
Zr-93	—	—	—	—	—	—	**3.4E-01**
Zr-95	—	—	—	—	—	—	**1.1E-13**
TOTAL	**6.4E+01**	**1.5E+05**	**1.0E+06**	**4.3E+05**	**2.0E+03**	**3.5E+02**	**1.7E+06**

*Data decayed through December 31, 2001. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

Table 32. WIPP Disposal Radionuclide Inventory for the CRA[1,2]

Nuclide	CH-TRU Waste Concentration (Ci/m^3)	RH-TRU Waste Concentration (Ci/m^3)	CH-TRU Waste (Total Curies)	RH-TRU Waste (Total Curies)
Ac-225	8.0E-06	2.6E-05	1.4E+00	1.8E-01
Ac-227	2.2E-06	2.8E-09	3.6E-01	2.0E-05
Ac-228	1.1E-05	1.0E-04	1.8E+00	7.2E-01
Ag-109m	7.5E-10	NR	1.3E-04	NR
Ag-110	1.9E-16	1.4E-14	3.1E-11	9.6E-11
Ag-110m	1.4E-14	1.0E-12	2.4E-09	7.3E-09
Am-241	2.8E+00	2.0E+00	4.8E+05	1.4E+04
Am-242	2.8E-07	6.0E-07	4.7E-02	4.3E-03
Am-242m	2.8E-07	2.9E-05	4.8E-02	2.1E-01
Am-243	4.6E-04	1.4E-04	7.8E+01	9.9E-01
Am-245	5.6E-16	NR	9.4E-11	NR
At-217	8.1E-06	2.6E-05	1.4E+00	1.9E-01
Ba-137m	4.1E-02	5.6E+01	6.9E+03	3.9E+05
Bi-210	1.1E-05	1.5E-10	1.9E+00	1.1E-06
Bi-211	2.1E-06	2.8E-09	3.6E-01	1.9E-05
Bi-212	1.7E-05	1.9E-03	2.8E+00	1.4E+01
Bi-213	8.0E-06	2.6E-05	1.4E+00	1.8E-01
Bi-214	2.7E-05	9.6E-10	4.6E+00	6.8E-06
Bk-249	3.8E-11	NR	6.5E-06	NR
Bk-250	1.5E-17	NR	2.6E-12	NR
C-14	7.2E-06	1.7E-04	1.2E+00	1.2E+00
Cd-109	7.6E-10	NR	1.3E-04	NR
Cd-113m	NR	7.4E-05	NR	5.2E-01
Ce-141	NR	5.9E-23	NR	4.2E-19
Ce-144	2.1E-09	9.1E-04	3.6E-04	6.4E+00
Cf-249	3.4E-07	5.9E-07	5.8E-02	4.2E-03
Cf-250	1.0E-06	1.1E-05	1.7E-01	7.5E-02
Cf-251	1.5E-09	1.1E-07	2.6E-04	8.0E-04
Cf-252	1.0E-06	1.3E-05	1.7E-01	8.9E-02
Cm-242	2.3E-07	5.1E-07	3.9E-02	3.6E-03
Cm-243	2.4E-06	7.1E-05	4.0E-01	5.1E-01
Cm-244	3.7E-02	1.5E-01	6.2E+03	1.1E+03
Cm-245	3.6E-08	1.6E-06	6.0E-03	1.1E-02

NR=Not reported by sites. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

[1] Data decayed through 2001.

[2] Total curies estimated by assuming a volume of 5,950,000 cubic feet for CH-TRU waste and 250,000 cubic feet for RH-TRU waste.

Table 32. WIPP Disposal Radionuclide Inventory for the CRA[1,2]— Continued

Nuclide	CH-TRU Waste Concentration (Ci/m^3)	RH-TRU Waste Concentration (Ci/m^3)	CH-TRU Waste (Total Curies)	RH-TRU Waste (Total Curies)
Cm-246	6.6E-06	4.8E-04	1.1E+00	3.4E+00
Cm-247	1.2E-15	6.7E-03	2.0E-10	4.7E+01
Cm-248	3.9E-07	1.3E-06	6.5E-02	9.2E-03
Cm-250	2.8E-16	NR	4.7E-11	NR
Co-60	5.8E-06	2.6E-01	9.8E-01	1.8E+03
Cs-134	1.2E-07	1.5E-02	2.0E-02	1.1E+02
Cs-135	NR	4.9E-08	NR	3.5E-04
Cs-137	4.4E-02	6.0E+01	7.4E+03	4.3E+05
Eu-152	1.1E-05	3.3E-01	1.9E+00	2.4E+03
Eu-154	9.4E-06	1.6E-01	1.6E+00	1.1E+03
Eu-155	2.9E-07	4.9E-02	4.9E-02	3.5E+02
Fe-55	NR	1.9E-05	NR	1.3E-01
Fr-221	8.0E-06	2.6E-05	1.4E+00	1.8E-01
Fr-223	2.9E-08	3.8E-11	4.9E-03	2.7E-07
Gd-152	2.5E-19	1.4E-14	4.3E-14	9.8E-11
H-3	1.3E-03	3.2E-05	2.2E+02	2.3E-01
I-129	3.0E-09	1.2E-05	5.1E-04	8.2E-02
Kr-85	2.7E-06	5.1E-05	4.6E-01	3.6E-01
Mn-54	NR	2.9E-04	NR	2.0E+00
Na-22	2.3E-12	4.6E-05	3.9E-07	3.3E-01
Nb-93m	NR	1.3E-07	NR	9.1E-04
Nb-95	NR	3.0E-17	NR	2.2E-13
Nb-95m	NR	1.0E-19	NR	7.2E-16
Ni-59	4.5E-07	3.3E-03	7.6E-02	2.3E+01
Ni-63	2.2E-05	1.6E-01	3.7E+00	1.1E+03
Np-237	3.7E-05	9.5E-05	6.2E+00	6.7E-01
Np-238	1.4E-09	3.0E-09	2.4E-04	2.2E-05
Np-239	4.6E-04	4.5E-05	7.7E+01	3.2E-01
Np-240m	7.4E-12	7.9E-07	1.3E-06	5.6E-03
Pa-231	5.1E-06	1.2E-08	8.7E-01	8.7E-05
Pa-233	3.7E-05	9.0E-07	6.2E+00	6.3E-03
Pa-234	4.7E-07	2.0E-06	8.0E-02	1.4E-02
Pa-234m	3.6E-04	1.5E-03	6.1E+01	1.1E+01

NR=Not reported by sites. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

[1] Data decayed through 2001.

[2] Total curies estimated by assuming a volume of 5,950,000 cubic feet for CH-TRU waste and 250,000 cubic feet for RH-TRU waste.

Table 32. WIPP Disposal Radionuclide Inventory for the CRA[1,2]— Continued

Nuclide	CH-TRU Waste Concentration (Ci/m^3)	RH-TRU Waste Concentration (Ci/m^3)	CH-TRU Waste (Total Curies)	RH-TRU Waste (Total Curies)
Pb-209	8.0E-06	2.6E-05	1.4E+00	1.8E-01
Pb-210	1.1E-05	1.5E-10	1.9E+00	1.1E-06
Pb-211	2.1E-06	2.8E-09	3.6E-01	2.0E-05
Pb-212	1.7E-05	1.9E-03	2.8E+00	1.4E+01
Pb-214	2.7E-05	9.6E-10	4.6E+00	6.8E-06
Pd-107	NR	2.0E-09	NR	1.5E-05
Pm-147	1.0E-05	8.6E-02	1.8E+00	6.1E+02
Po-210	1.1E-05	1.5E-10	1.9E+00	1.1E-06
Po-211	6.5E-09	8.4E-12	1.1E-03	5.9E-08
Po-212	1.1E-05	1.2E-03	1.8E+00	8.6E+00
Po-213	7.9E-06	2.6E-05	1.3E+00	1.8E-01
Po-214	2.7E-05	9.6E-10	4.6E+00	6.8E-06
Po-215	2.1E-06	2.8E-09	3.6E-01	2.0E-05
Po-216	1.7E-05	1.9E-03	2.8E+00	1.4E+01
Po-218	2.7E-05	9.5E-10	4.5E+00	6.7E-06
Pr-144	2.1E-09	8.9E-04	3.5E-04	6.3E+00
Pu-236	2.0E-08	NR	3.3E-03	NR
Pu-238	8.6E+00	5.4E-01	1.5E+06	3.8E+03
Pu-239	3.4E+00	7.4E-01	5.8E+05	5.2E+03
Pu-240	5.6E-01	2.2E-01	9.4E+04	1.6E+03
Pu-241	1.2E+01	1.8E+01	2.0E+06	1.3E+05
Pu-242	7.2E-05	6.8E-05	1.2E+01	4.8E-01
Pu-243	1.2E-15	6.6E-03	2.0E-10	4.7E+01
Pu-244	7.4E-12	7.8E-07	1.2E-06	5.5E-03
Ra-223	2.2E-06	2.8E-09	3.6E-01	2.0E-05
Ra-224	1.7E-05	1.9E-03	2.8E+00	1.4E+01
Ra-225	8.1E-06	2.6E-05	1.4E+00	1.9E-01
Ra-226	2.8E-05	9.8E-10	4.6E+00	6.9E-06
Ra-228	1.3E-05	1.2E-04	2.1E+00	8.5E-01
Rh-106	8.5E-10	2.7E-07	1.4E-04	1.9E-03
Rn-219	2.1E-06	2.8E-09	3.6E-01	1.9E-05
Rn-220	1.7E-05	1.9E-03	2.8E+00	1.4E+01

NR=Not reported by sites. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

[1] Data decayed through 2001.

[2] Total curies estimated by assuming a volume of 5,950,000 cubic feet for CH-TRU waste and 250,000 cubic feet for RH-TRU waste.

Table 32. WIPP Disposal Radionuclide Inventory for the CRA[1,2]— Continued

Nuclide	CH-TRU Waste Concentration (Ci/m^3)	RH-TRU Waste Concentration (Ci/m^3)	CH-TRU Waste (Total Curies)	RH-TRU Waste (Total Curies)
Rn-222	2.7E-05	9.7E-10	4.6E+00	6.8E-06
Ru-106	8.6E-10	2.7E-07	1.5E-04	1.9E-03
Sb-125	2.1E-08	6.9E-04	3.6E-03	4.9E+00
Sb-126	NR	2.1E-08	NR	1.5E-04
Sb-126m	NR	1.5E-07	NR	1.1E-03
Se-79	7.8E-10	5.6E-06	1.3E-04	4.0E-02
Sm-147	2.1E-15	4.5E-12	3.5E-10	3.2E-08
Sm-151	3.4E-04	8.4E-02	5.7E+01	6.0E+02
Sn-121m	NR	3.7E-07	NR	2.6E-03
Sn-126	NR	1.5E-07	NR	1.1E-03
Sr-90	3.3E-01	4.6E+01	5.6E+04	3.2E+05
Tc-99	8.7E-04	2.3E-02	1.5E+02	1.6E+02
Te-123	2.9E-10	NR	4.8E-05	NR
Te-123m	2.1E-24	NR	3.6E-19	NR
Te-125m	5.2E-09	1.7E-04	8.7E-04	1.2E+00
Th-227	2.1E-06	2.7E-09	3.5E-01	1.9E-05
Th-228	1.7E-05	1.9E-03	2.9E+00	1.4E+01
Th-229	8.1E-06	2.6E-05	1.4E+00	1.9E-01
Th-230	5.7E-07	2.7E-07	9.5E-02	1.9E-03
Th-231	1.7E-05	3.4E-05	2.9E+00	2.4E-01
Th-232	1.5E-05	1.3E-04	2.5E+00	9.2E-01
Th-234	3.6E-04	1.5E-03	6.1E+01	1.1E+01
Tl-207	2.1E-06	2.7E-09	3.6E-01	1.9E-05
Tl-208	6.0E-06	6.9E-04	1.0E+00	4.9E+00
Tl-209	1.8E-07	5.7E-07	3.0E-02	4.1E-03
U-232	7.4E-06	1.8E-03	1.3E+00	1.3E+01
U-233	6.5E-03	1.8E-02	1.1E+03	1.3E+02
U-234	1.2E-03	4.3E-03	2.0E+02	3.0E+01
U-235	2.3E-05	1.5E-04	3.9E+00	1.1E+00
U-236	8.7E-06	1.9E-04	1.5E+00	1.3E+00
U-237	1.2E-04	3.2E-06	2.1E+01	2.3E-02
U-238	4.7E-04	2.0E-02	7.9E+01	1.4E+02

NR=Not reported by sites. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

[1] Data decayed through 2001.

[2] Total curies estimated by assuming a volume of 5,950,000 cubic feet for CH-TRU waste and 250,000 cubic feet for RH-TRU waste.

Table 32. WIPP Disposal Radionuclide Inventory for the CRA[1,2]— Continued

Nuclide	CH-TRU Waste Concentration (Ci/m^3)	RH-TRU Waste Concentration (Ci/m^3)	CH-TRU Waste (Total Curies)	RH-TRU Waste (Total Curies)
U-240	7.3E-12	7.7E-07	1.2E-06	5.5E-03
Y-90	3.3E-01	4.5E+01	5.6E+04	3.2E+05
Y-91	NR	5.8E-16	NR	4.1E-12
Zn-65	9.8E-16	NR	1.7E-10	NR
Zr-93	6.7E-09	4.8E-05	1.1E-03	3.4E-01
Zr-95	NR	1.4E-17	NR	9.8E-14
TOTALS	**2.8E+01**	**2.3E+02**	**4.7E+06**	**1.6E+06**

NR=Not reported by sites. Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

[1] Data decayed through 2001.

[2] Total curies estimated by assuming a volume of 5,950,000 cubic feet for CH-TRU waste and 250,000 cubic feet for RH-TRU waste.

3.7 Non-Waste Isolation Pilot Plant and Future Potential Waste

This section identifies waste streams not included in the WIPP inventory used for the PABC (Leigh et al. 2005a; Leigh et al. 2005b). The waste permitted to come to WIPP is restricted by radionuclide activity limits, volume, and purpose of generation (i.e., waste generated only from defense activities). Non-WIPP waste streams are summarized in Section 3.8 and waste profiles and waste streams are presented in Appendix I.

Other restrictions to the waste result from how the waste has been managed at the TRU waste sites. Some materials that have not been declared TRU waste by the DOE TRU waste sites at this time may become TRU waste in the future. Some waste has been identified in the TRU inventory but the option for processing has not been determined at this time. These possible future waste streams may ultimately become eligible for shipment to WIPP and are discussed in Section 3.9.

3.8 Non-Defense TRU Waste and Waste Isolation Pilot Plant Future Potential Waste

The DOE has several categories of waste that are currently not acceptable for disposal in WIPP. These are summarized below:

- Non-Defense Waste—The National Security Program (Public Law 96-164, 1980, National Security and Military Applications of Nuclear Energy Authorization Act of 1980, 93 Stat. 1259), which authorized the construction of the WIPP, states that the WIPP is to be a defense waste repository. Therefore, wastes that are identified as non-defense can not be disposed in the WIPP. Some waste streams from sites for which a defense determination has not been made are identified in Table 33.

- Pre-1970 buried TRU Waste—Several sites (i.e., LANL, Savannah River Site (SRS), SNL, Hanford Site, INL, ORNL, and West Valley Demonstration Project) have TRU wastes that were buried prior to 1970. INL is currently preparing pre-1970 buried waste for shipment to WIPP. Only INL has included pre-1970 buried waste in the WIPP shippable inventory at this time.

- Classified Waste—Some classified TRU waste, such as TRU-contaminated classified materials (materials used in weapons production), is now acceptable for disposal at WIPP. These materials are classified for security and national defense purposes due to their physical shape or form and may include graphite, metal, tooling, and plastic materials. The same characterization and associated QA activities currently required under the WIPP program will be implemented for the characterization of classified waste using selected personnel.

- Polychlorinated Biphenyl (PCB) waste—The EPA Region 6 approved the disposal of non-liquid PCB-contaminated TRU waste (PCB/TRU waste) and PCB/TRU waste mixed with hazardous waste (PCB/TRU mixed waste) at the WIPP in May 2003. However, at the time the inventory estimate was prepared for the PABC (Leigh et al. 2005a; Leigh et al. 2005b), this approval had not been received. Therefore PCB/TRU waste > 50 ppm was not included in this updated inventory.

- RH-TRU waste that exceeds 23,000 Ci/m^3 (650 Ci/ft^3)—This limit is from the LWA (U.S. Congress 1996).

Table 33. Possible Future TRU Waste for WIPP

CH TRU Waste Streams				
Waste Stream ID	**Waste Stream Name**	**Stored Volumes (m^3)**	**Projected Volumes (m^3)**	**Anticipated Volumes (m^3)**
BL-001	Reactor Fuel Test Specimens	4.5E+01	0.0E+00	4.5E+01
FM-MOX-MT0	Framatome MOX Fuel Plant D&D Mixed TRU Waste	4.2E-01	0.0E+00	4.2E-01
FM-MOX-T01	Framatome MOX Fuel Plant D&D TRU Waste	6.9E+00	0.0E+00	6.9E+00
LA-OS-00-02	Isotopic sources waiting determination of eligibility for WIPP disposal	0.0E+00	1.6E+02	1.6E+02
LA-TA-00-01	Containers waiting assignment to waste streams	7.7E+01	0.0E+00	7.7E+01
LA-TA-00-02	Containers waiting assignment to waste streams	1.1E+02	0.0E+00	1.1E+02
LA-TA-00-03	Containers waiting assignment to waste streams	7.7E+00	0.0E+00	7.7E+00
LA-TA-00-04	Containers waiting assignment to waste streams	2.1E+02	0.0E+00	2.1E+02
LA-TA-00-05	Containers waiting assignment to waste streams	4.2E+02	0.0E+00	4.2E+02
LA-TA-00-06	Containers waiting assignment to waste streams	4.5E+01	0.0E+00	4.5E+01
LA-TA-00-07	Containers waiting assignment to waste streams	1.8E+01	0.0E+00	1.8E+01
LB-T001	LBL Waste	6.2E-01	1.0E+00	1.6E+00
PA-B015	Transuranic and Technetium Wastes - Liquid	2.5E+00	0.0E+00	2.5E+00
PA-W014	Transuranic Waste Liquid	4.2E-01	0.0E+00	4.2E-01
RF-MT0503	Un-named Waste Stream	1.7E+00	0.0E+00	1.7E+00
RF-MT0505	Un-named Waste Stream	2.1E-01	0.0E+00	2.1E-01
RF-MT0529	Un-named Waste Stream	2.1E-01	0.0E+00	2.1E-01
RF-MT0533	Un-named Waste Stream	3.1E+00	0.0E+00	3.1E+00
RF-MT0535	Un-named Waste Stream	6.3E-01	0.0E+00	6.3E-01
RF-TT0533	Un-named Waste Stream	8.3E-01	0.0E+00	8.3E-01
RL-W284	201C Unknown form CH RCRA MTRU w/ met	4.2E-01	0.0E+00	4.2E-01
RL-W332	2345Z Unknown form CH St MTRU	1.9E+00	0.0E+00	1.9E+00
RL-W357	KAPL Unknown form CH/r TRU	2.1E-01	0.0E+00	2.1E-01
RL-W366	202A Unknown form CH TRU	1.5E+00	8.3E-01	2.3E+00
RL-W382	2345Z Unknown form CH TRU	1.9E+01	6.1E+01	8.0E+01
RL-W391	308 Combustible unknown form CH TRU	4.2E-01	0.0E+00	4.2E-01
RL-W471	202A MTRU CH unknown forms S9000 Mixed RCRA w/ org, met, Hg	1.9E+00	0.0E+00	1.9E+00
RL-W472	202A MTRU CH unknown forms S9000 Mixed RCRA w/ met	2.1E-01	0.0E+00	2.1E-01
RL-W556	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ org, met, Hg	4.2E-01	0.0E+00	4.2E-01
RL-W557	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ org, ign	2.1E-01	0.0E+00	2.1E-01
RL-W558	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ org	2.1E-01	0.0E+00	2.1E-01

Table 33. Possible Future TRU Waste for WIPP – Continued

CH TRU Waste Streams				
Waste Stream ID	**Waste Stream Name**	**Stored Volumes (m^3)**	**Projected Volumes (m^3)**	**Anticipated Volumes (m^3)**
RL-W561	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ met, Hg, cor	2.1E-01	0.0E+00	2.1E-01
RL-W562	2345Z MTRU CH unknown forms S9000 Mixed RCRA w/ met, Hg	1.0E+00	0.0E+00	1.0E+00
RL-W609	324 MTRU CH unknown forms S9000 Mixed RCRA w/org, met, Hg	2.1E-01	0.0E+00	2.1E-01
RL-W650	325 TRU CH unknown forms S9000 Non-mixed	2.1E-01	0.0E+00	2.1E-01
RL-W651	325 MTRU CH unknown forms S9000 Mixed RCRA w/org, met	1.0E+00	0.0E+00	1.0E+00
RL-W652	325 MTRU CH unknown forms S9000 Mixed RCRA w/org	3.8E+00	0.0E+00	3.8E+00
RL-W722	MCGEE TRU CH unknown forms S9000 Non-mixed	2.1E-01	0.0E+00	2.1E-01
RL-W756	PFP Residues - Mixed Oxides Wastes in POCs: MTRU CH solidified inorganic S3150 Mixed	0.0E+00	2.9E+02	2.9E+02
SP-T001	Un-named Waste Stream	0.0E+00	5.0E+01	5.0E+01
SR-T001-WSB-1	Unknown	0.0E+00	4.3E+03	4.3E+03
SR-W026-MFFF-1	Unknown	0.0E+00	2.6E+03	2.6E+03
SR-W026-PDCF-1	Unknown	0.0E+00	1.8E+03	1.8E+03
SR-W026-WSB-2	Unknown	0.0E+00	6.7E+02	6.7E+02
SR-T001-WSB-3	Unknown	0.0E+00	1.4E+02	1.4E+02
VN-CHT001	Un-named Waste Stream	0.0E+00	2.0E+01	2.0E+01
WV-M007	TRU General Waste	1.1E+01	0.0E+00	1.1E+01
WV-T004	Fissile Material – Other	6.2E-01	0.0E+00	6.2E-01
WV-T020	PPC/XC2 PPE and DAW	0.0E+00	2.3E+02	2.3E+02
WV-M008	TRU Concrete	2.1E-01	0.0E+00	2.1E-01
WV-M010	TRU Spent Absorbents	8.3E-01	0.0E+00	8.3E-01
WV-M013	Sweeping Compound	1.9E+00	0.0E+00	1.9E+00
WV-T001	Fissile Material –Solids	3.7E+01	0.0E+00	3.7E+01
WV-T006	TRU General Waste	1.0E+01	1.0E+01	2.0E+01
WV-T009	TRU General Laboratory Waste	1.0E+01	2.1E+01	3.1E+01
WV-T011	TRU Glove Boxes	1.0E+01	0.0E+00	1.0E+01
WV-T017	Spent Filter Media	2.5E+00	0.0E+00	2.5E+00
WV-T021	RHWF Process	0.0E+00	8.1E+01	8.1E+01
WV-W024	TRU Lead	1.9E+01	0.0E+00	1.9E+01
TOTALS		**1.1E+03**	**1.1E+04**	**1.2E+04**

Table 33. Possible Future TRU Waste For WIPP -- Continued

RH TRU Waste Streams				
Waste Stream ID	**Waste Stream Name**	**Stored Volumes (m^3)**	**Projected Volumes (m^3)**	**Anticipated Volumes (m^3)**
IN-SBW-01A	SBW Treatment Option 1 - Calcine Process - Calcine	0.0E+00	1.1E+03	1.1E+03
IN-SBW-01B	SBW Treatment Option 1 - Calcine Process - Grouted Scrub	0.0E+00	3.0E+01	3.0E+01
IN-TRA-BE-01	TRA Beryllium Blocks	1.2E+01	1.3E+01	2.4E+01
RL-W475	202A TRU CH combustible S5319 Non-mixed	6.2E+00	0.0E+00	6.2E+00
RL-W477	202A TRU RH heterogeneous S5420 Non-mixed	1.8E+00	0.0E+00	1.8E+00
RL-W478	202A TRU RH heterogeneous S5440 Non-mixed	2.3E+01	0.0E+00	2.3E+01
RL-W479	202A TRU RH heterogeneous S5900 Non-mixed	9.0E-01	0.0E+00	9.0E-01
RL-W577	2345Z TRU RH unknown forms S9000 Non-mixed	2.7E+00	0.0E+00	2.7E+00
RL-W578	2345Z TRU RH unknown forms U9999 Non-mixed	5.3E+00	0.0E+00	5.3E+00
RL-W667	325 TRU RH unknown forms S9000 Non-mixed	8.9E-01	0.0E+00	8.9E-01
RL-W684	327 TRU RH heterogeneous S5420 Non-mixed	9.0E-01	0.0E+00	9.0E-01
VN-RHT001	Un-named Waste Stream	0.0E+00	1.2E+01	1.2E+01
WV-M005	TRU Filters	6.0E+01	4.6E+01	1.1E+02
WV-M015	Chemical Process Cell General Waste	6.0E+00	0.0E+00	6.0E+00
WV-T014	Chemical Process Cell Vessels	1.1E+01	0.0E+00	1.1E+01
WV-T016	Chemical Process Cell Miscellaneous Equipment	8.5E+00	0.0E+00	8.5E+00
WV-T018	Head End Cell Debris	5.4E+01	2.6E+01	8.0E+01
WV-T019	FRS Pool Filters	0.0E+00	2.1E+01	2.1E+01
TOTALS		**1.9E+02**	**1.2E+03**	**1.4E+03**

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16, LANL 2005.

3.9 Possible Future Waste Isolation Pilot Plant Waste

Categories of waste that eventually may become acceptable for disposal at WIPP include the following:

- Unknown - Potential future waste may come from waste streams currently declared “unknown.” (see Table 33). These wastes have not been characterized adequately to determine the final waste form and/or other significant parameters. If these wastes are characterized and meet the WIPP Waste Acceptance Criteria (WAC) (DOE 2004a), they will be included in the WIPP inventory in the future.

- Defense determination pending – Only one waste stream has been identified as requiring a defense determination. Babcock and Wilcox in Lynchburg, VA, currently has approximately 45 m^3 (1,590 ft^3) of TRU waste in on-site storage silos. Virtually all of the material was generated from the Light Water Reactor Extended Burn-Up Program. That program was responsible for sending test elements of reactor fuel to various hot cells, including the one at Lynchburg. The waste consists mostly of cellulosics, rubber, and lead-lined gloves.

- Newly identified TRU waste - Brookhaven National Laboratory (BNL) has identified an existing legacy 17,500-lb concrete vault stored at the Hazardous Waste Management Facility as TRU waste based on recalculation of ^{239}Pu curie content. The vault holds five plutonium foils (TRU waste) and other non-TRU waste constituents including Brookhaven Linear Isotope Production (BLIP) waste, and cesium and cobalt sources embedded in concrete. The vault must now be managed as TRU waste.

- The Beryllium Block waste stream at INL includes beryllium blocks and outer shim control cylinders from the Advanced Test Reactor. The radionuclide concentrations are too great to be considered in this update, but may be considered in the future.

3.10 Emplacement Materials

The inventory of CPR materials used by WIPP Waste Handling Operations (WHO) to facilitate waste emplacement was estimated to support the PABC (Leigh et al. 2005a; Leigh et al. 2005b). This information was not used for the CRA-2004 PA but has been calculated as a best estimate based on current knowledge of the packaging expected to be used by the sites for shipment (Burns 2005). The TRAMPAC (DOE 2004b) allows certain container types to be transported in the TRUPACT-II. These are 55-gallon drums, 85-gallon drums, 100-gallon drums, SWB, and TDOPs. One standard large box container type (5 ft x 5 ft x 8 ft box) was also added as a possible future transportation container to these calculations (Burns 2005).

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

The WIPP WHO uses several materials to facilitate the emplacement of TRU waste, and magnesium oxide (MgO) is used as an engineered barrier. The amount of MgO emplaced is based on a safety factor and is subject to change based on the amount of CPR in the repository. The CPR, however, has been estimated for each payload configuration expected to be emplaced in the repository (Burns 2005). Plastic and cellulosic materials are used to emplace CH-TRU waste. The MgO is placed on top of the containers and comes in a woven plastic bag called a “supersack.” RH-TRU waste will be emplaced in boreholes in the salt. Currently, there is no CPR materials used for RH-TRU waste emplacement.

The materials used to emplace CH-TRU waste are:

- Polyethylene (PE) slip-sheets for the seven-packs of 55-gallon drums and/or POCs, four-packs of 85-gallon drums, three-packs of 100-gallon drums, and the MgO supersacks (plastics);
- Fiberboard slip-sheet for the SWB and TDOP (cellulosic material);
- Woven polypropylene supersacks containing MgO (plastic material/MgO);
- Cardboard stabilizers for the supersacks (cellulosic material); and
- Stretch wrap for the seven-packs (plastic material).

There is no rubber materials used for CH- or RH-TRU waste emplacement. For CH-TRU waste, the total mass of each of the emplacement materials (plastic, cellulosic, and MgO) was calculated as of the inventory date. The WWIS was modified in March 2005 to begin tracking the emplaced quantities of MgO, as well as the added emplacement materials (e.g., slip sheets and shrink wrap). The relevant information is provided in Table 34.

Table 34. Estimates of Materials Used to Facilitate Emplacement of Waste in the WIPP

CPR Component	From Supersacks (kg)	From Emplacement Packs (kg)	Total Emplacement Materials (kg)
Cellulose	1.17×10^5	8.98×10^4	2.07×10^5
Plastic	3.85×10^5	1.10×10^6	1.48×10^6
Rubber	0	0	0

Data Source: Burns 2005

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EXECUTIVE SUMMARY

The U.S. Department of Energy's (DOE's) Waste Isolation Pilot Plant (WIPP) opened on March 26, 1999, becoming the nation's first deep geologic repository for the permanent disposal of defense-generated transuranic (TRU) waste. This waste is currently retrievably stored at 27 sites across the country (see Figure 1, Section 1.0). From the WIPP's opening through the inventory date (September 30, 2002), 1,255 shipments of TRU waste were safely characterized, transported, and disposed in the WIPP.

DOE complex-wide TRU waste inventory information has been collected, analyzed, and published in several reports. The *WIPP Transuranic Waste Baseline Inventory Report* (WTWBIR), Revision 0, published in June 1994 (DOE 1994), was the first attempt made by the DOE complex to report all of its TRU waste at the waste-stream level. The TRU waste data reported in Revision 0 were considered preliminary until the DOE TRU waste sites completed quality checks of the data. Data changes resulting from the quality checks were contained in the WTWBIR, Revision 1, (DOE 1995a). Transuranic Waste Baseline Inventory Report (TWBIR) Revisions 2 and 3 (DOE 1995b and DOE 1996a) were published in 1995 and 1996 to include WIPP and non-WIPP wastes and other additional waste stream characteristic information. Data from Revision 2 and 3 supplemental information provided the inventory that Sandia National Laboratories (SNL) used to perform the necessary calculations for the Performance Assessment (PA) for the initial certification of the WIPP [Compliance Certification Application (CCA)] (DOE 1996b). To effectively keep track of the changes in the TRU waste inventory, site inventory information will be monitored for changes.

The WIPP Land Withdrawal Act (LWA) (Public Law No. 102-579, 110 Stat.2422, [1992], as amended by 104-201 [1996]) required that the U.S. Environmental Protection Agency (EPA) certify the WIPP site every five years after the first receipt of TRU waste. The first recertification application (the Compliance Recertification Application, referred to hereafter as the CRA-2004) was submitted to the EPA on March 26, 2004. The CRA-2004 included the inventory data collected in 2003 to support the waste estimate that would fill the repository for the Performance Assessment (PA). Subsequently, this document is a revision of Attachment F found in Appendix DATA of the CRA-2004 (DOE 1996b) and the *Performance Assessment Baseline Calculation* (PABC) (Leigh et al. 2005a; Leigh et al. 2005b) and will be referred to as the Transuranic Waste Baseline Inventory Report – 2004 (TWBIR-2004) throughout this document. The TWBIR-2004 primarily focuses on inventory information needed for the PA for the CRA-2004 and PABC and has been revised to include changes to the Hanford and Idaho National Engineering and Environmental Laboratory (INEEL), now the Idaho National Laboratory (INL) data as described in more detail below. The information in this report summarizes the DOE's TRU waste inventory, projections, and characteristics; reports emplaced waste; and is an update to the previously published TRU waste inventory that was used for the CRA-2004 PA. This update is also known as the PABC inventory. The TWBIR-2004 includes estimates for : 1) waste volumes (stored, projected, and emplaced); 2) radionuclides; 3) the 12 waste material parameters; 4) complexing agents; 5) oxyanions; 6) cement; 7) pyrochemical salts; and 8) the materials used to emplace the waste in the WIPP.

The primary differences between previous inventory data submittals (TWBIR Revisions 2 and 3) and the TWBIR-2004 are:

- This report accounts for the INEEL Advanced Mixed Waste Treatment Facility process by which 55-gallon drums are compacted and placed into 100-gallon drums, and disregards those calculations related to the proposed waste incineration process that was described in the TWBIR

Revision 3 (DOE 1996a). The Advanced Mixed Waste Treatment Facility is planning to do supercompaction rather than incineration.

- In addition, INEEL inventory has been revised to include buried waste identified for WIPP shipment that was originally reported in waste stream IN-Z001. This waste has been reported under four waste stream designations: IN-ICP-002, IN-ICP-003, IN-ICP-004, and IN-ICP-005. IN-Z001 still identifies the unknown portion of the waste stream.

- This report includes approximately 8,400 m^3 (296,688 ft^3) of stored Hanford tank waste that was added to the inventory in December 2002.

- This report accounts for the site-requested deletion of several waste streams from Hanford Richland Operations inventory after the original CRA-2004 submittal.

- This report also addresses the waste that has been emplaced since the WIPP opened in 1999.

Finally, this report includes updates to site TRU Waste Baseline Inventory Waste Profiles (Waste Profiles) that were reported in TWBIR Revision 2 (DOE 1995b). The TRU waste sites provided updated Waste Profiles, which contain parameters that are important to the PA. The updated Waste Profiles for non-WIPP, WIPP, and emplaced waste streams are given in Appendices I, J, and K, respectively. The information contained in these profiles is considered the best estimate as of the inventory date, September 30, 2002, because more TRU waste characterization data are now available. The TRU Waste Baseline Inventory Waste Profile forms reflect the data as reported by the TRU waste sites. Some information that the sites have provided may have been changed to accommodate assumptions that are used in PA (for example, expansion of reported waste volumes for waste streams containing over-packed containers). In addition, the radionuclides have been decayed to a common time frame. References to the methodologies used for these adjustments are provided by Electronic Record Management System (ERMS) numbers in Appendix M of this document.

A comprehensive reference to the TWBIR-2004, entitled the *Transuranic Waste Inventory Update Report 2003*, *Computational Methodology* (LANL 2003), provides descriptions of the computations used to produce the inventory information that was used by SNL in the CRA-2004 and the PABC. Correction methodologies were used to analyze data provided by the sites, to correct inconsistencies, and to estimate waste material parameter densities and radionuclide activities where these data were not provided.

The following tables summarize the main aspects from the body of the text of the *Transuranic Waste Baseline Inventory Report-2004:*

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

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

Waste Material Parameters	Average Density (Kg/m3)
Iron-Base Metal/Alloys	1.1E+02
Aluminum-Base Metal/Alloys	1.4E+01
Other Metal/Alloys	3.2E+01
Other Inorganic Materials	4.0E+01
Cellulosics	6.0E+01
Rubber	1.3E+01
Plastics	4.3E+01
Solidified, Inorganic Matrix	1.1E+02
Cement (Solidified)	3.9E+01
Vitrified	5.8E+00
Solidified, Organic Matrix	3.3E+01
Soils	1.1E+02
Container Materials	
Steel	1.7E+02
Plastic	1.7E+01
Lead	1.3E-02

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16 (LANL 2005).

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

Waste Material Parameters	Average Density (Kg/m3)
Iron-Base Metal/Alloys	5.9E+01
Aluminum-Base Metal/Alloys	5.0E+00
Other Metal/Alloys	5.7E+01
Other Inorganic Materials	1.6E+01
Cellulosics	9.3E+00
Rubber	6.7E+00
Plastics	8.0E+00
Solidified, Inorganic Matrix	6.2E+01
Cement (Solidified)	1.9E+00
Vitrified	1.2E-01
Solidified, Organic Matrix	8.3E-01
Soils	5.0E+01
Container Materials	
Steel	5.4E+02
Plastic	3.1E+00
Lead	4.2E+02

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16 (LANL 2005).

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

Storage/Generator Site	Stored Volumes (Cubic Meters)	Projected Volumes (Cubic Meters)	Anticipated Volumes (Cubic Meters)
Argonne National Laboratory - East	1.1E+02	8.0E+01	1.9E+02
Argonne National Laboratory - West	6.0E+00	3.8E+01	4.4E+01
Battelle Columbus Laboratories	5.2E+00	0.0E+00	5.2E+00
Bettis Atomic Power Laboratory	1.9E+01	0.0E+00	1.9E+01
Energy Technology Engineering Center	2.3E+00	0.0E+00	2.3E+00
Hanford (Richland) Site	1.3E+04	5.5E+03	1.8E+04
Hanford (River Protection) Site	3.9E+03	0.0E+00	3.9E+03
Idaho National Engineering and Environmental Laboratory	6.1E+04	1.8E+04	7.8E+04
Knolls Atomic Power Laboratory - Nuclear Fuel Services	5.5E+01	1.7E+02	2.3E+02
Lawrence Livermore National Laboratory	3.5E+02	2.1E+03	2.4E+03
Los Alamos National Laboratory	1.2E+04	3.3E+03	1.5E+04
Nevada Test Site	6.2E+02	4.6E+02	1.1E+03
Oak Ridge National Laboratory	0.0E+00	4.5E+02	4.5E+02
Paducah Gaseous Diffusion Plant	5.7E+00	5.7E+00	1.1E+01
Rocky Flats Environmental Technology Site	5.4E+03	2.8E+03	8.1E+03
Sandia National Laboratories - Albuquerque	2.4E+01	0.0E+00	2.4E+01
Savannah River Site	1.3E+04	2.4E+03	1.5E+04
U.S. Army Material Command	2.5E+00	0.0E+00	2.5E+00
University of Missouri Research Reactor	1.5E+00	0.0E+00	1.5E+00
Totals	**1.1E+05**	**3.5E+04**	**1.4E+05**
Emplaced Volume			
Waste Isolation Pilot Plant	7.7E+03		7.7E+03
Grand Totals	**1.2E+05**	**3.5E+04**	**1.5E+05**

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16 (LANL 2005).

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

Storage/Generator Site	Stored Volumes (Cubic Meters)	Projected Volumes (Cubic Meters)	Anticipated Volumes (Cubic Meters)
Argonne National Laboratory - East	1.5E+01	1.0E+02	1.2E+02
Argonne National Laboratory - West	2.4E+01	6.9E+01	9.3E+01
Battelle Columbus Laboratories	4.4E+01	1.8E+00	4.6E+01
Bettis Atomic Power Laboratory	2.0E+00	0.0E+00	2.0E+00
Energy Technology Engineering Center	5.0E+00	0.0E+00	5.0E+00
Hanford (Richland) Site	3.8E+02	1.1E+03	1.5E+03
Hanford (River Protection) Site	4.5E+03	0.0E+00	4.5E+03
Idaho National Engineering and Environmental Laboratory	2.2E+02	0.0E+00	2.2E+02
Knolls Atomic Power Laboratory - Schenectady	0.0E+00	1.4E+02	1.4E+02
Los Alamos National Laboratory	1.3E+02	0.0E+00	1.3E+02
Oak Ridge National Laboratory	0.0E+00	6.6E+02	6.6E+02
Sandia National Laboratories - Albuquerque	4.6E+00	0.0E+00	4.6E+00
Savannah River Site	0.0E+00	2.3E+01	2.3E+01
Totals	**5.3E+03**	**2.1E+03**	**7.4E+03**

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16 (LANL 2005).

Table ES-5. WIPP Summary Radionuclide Inventory [1,2]

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)
Am-241	2.8E+00	2.0E+00
Ba-137m	4.1E-02	5.6E+01
Cm-244	3.7E-02	1.5E-01
Co-60	5.8E-06	2.6E-01
Cs-137	4.4E-02	6.0E+01
Eu-152	1.1E-05	3.3E-01
Pu-238	8.6E+00	5.4E-01
Pu-239	3.4E+00	7.4E-01
Pu-240	5.6E-01	2.2E-01
Pu-241	1.2E+01	1.8E+01
Sr-90	3.3E-01	4.6E+01
Y-90	3.3E-01	4.5E+01

Data Source: TWBID Revision 2.1, Version 3.13, Data Version D.4.16 (LANL 2005).

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

[2] Decayed through December 31, 2001.

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ACRONYMS AND ABBREVIATIONS

AE	**Argonne National Laboratory – East (site identifier)**
AK	**Acceptable Knowledge**
AMWTF(P)	**Advanced Mixed Waste Treatment Facility (Project)**
ANL-E	**Argonne National Laboratory East**
ANL-W	**Argonne National Laboratory West**
AL	**Ames Laboratory (site identifier)**
AM	**ARCO Medical Products Company (site identifier)**
AW	**Argonne National Laboratory - West (site identifier)**
BC	**Battelle Columbus Laboratory (site identifier)**
BAPL	**Bettis Atomic Power Laboratory**
BCL	**Battelle Columbus Laboratories**
BIR	**Baseline Inventory Report**
BL	**Babcock and Wilcox-Lynchburg (site identifier)**
BLIP	**Brookhaven Linear Isotope Production**
BNL	**Brookhaven National Laboratory**
BT	**Bettis Atomic Power Laboratory (site identifier)**
C&C Agreement	**Agreement for Consultation and Cooperation between the Department of Energy and the State of New Mexico on the Waste Isolation Pilot Plant**
CAO	**Carlsbad Area Office**
CBFO	**Carlsbad Field Office**
CCA	**Compliance Certification Application**
CCP	**Central Characterization Project**
CFR	**Code of Federal Regulations**
CH	**Contact-Handled**
CNS	**ChemNuclear Systems**
CPR	**Cellulosic, Plastic, and Rubber Materials**
CRA-2004	**Compliance Recertification Application**
CY	**Calendar Year**
D&D	**Decontamination and Decommissioning**
DOE	**U.S. Department of Energy**
DOE-ORO	**U.S. Department of Energy Oak Ridge Office**
DOR	**Direct Oxide Reduction**
EDTA	**ethylenediaminetetraacetic acid**
EPA	**U.S. Environmental Protection Agency**
ER	**Environmental restoration or electro-refining (salts)**
ERMS	**Electronic Records Management System**
ET	**Energy Technology Engineering Center (site identifier)**
ETEC	**Energy Technology Engineering Center**
FFCAct	**Federal Facilities Compliance Act**
FM	**Framatome (Richland) (site identifier)**
FRP	**Fiberglass-reinforced plywood**
HDPE	**High density polyethylene**
HEPA	**High Efficiency Particulate Air**
ICP	**Idaho Completion Project**
IDB	**Integrated Database**
IDC	**Item Description Code**

IN	**Idaho National Laboratory (site identifier)**
INL	**Idaho National Laboratory**
IT	**Inhalation Toxicology Research Institute (now known as Lovelace Respiratory Research Institute, LRRI) (site identifier)**
ITRI	**Inhalation Toxicology Research Institute (now known as Lovelace Respiratory Research Institute, LRRI)**
JASPER	**Joint Actinide Shock Physics Experimental Research**
KA	**Knolls Atomic Power Laboratory-Schenectady (site identifier)**
KAPL	**Knolls Atomic Power Laboratory**
KN	**Knolls Atomic Power Laboratory – Nuclear Fuels Service (site identifier)**
LA	**Los Alamos National Laboratory (site identifier)**
LANL	**Los Alamos National Laboratory**
LANL-CO	**Los Alamos National Laboratory – Carlsbad Operations**
LB	**Lawrence Berkeley National Laboratory (site identifier)**
LBNL	**Lawrence Berkeley National Laboratory**
LECO	**Trade name for manufacturer of crucibles, furnaces and analytical instrumentation**
LL	**Lawrence Livermore National Laboratory (site identifier)**
LLNL	**Lawrence Livermore National Laboratory**
LLW	**Low-level radioactive waste**
LRRI	**Lovelace Respiratory Research Institute**
LWA	**Land Withdrawal Act**
MC	**U.S. Army Material Command (site identifier)**
MgO	**Magnesium Oxide**
mrem	**Millirem**
MSE	**Molten Salt Extraction**
MT	**Mixed-TRU**
MU	**University of Missouri Research Reactor (site identifier)**
MURR	**University of Missouri Research Reactor**
NT	**Nevada Test Site (site identifier)**
NTS	**Nevada Test Site**
NWMP	**Nuclear Waste Management Program**
OP	**Overpack**
OR	**Oak Ridge National Laboratory (site identifier)**
ORIGEN2	**Oak Ridge Isotope Generation and Depletion Code**
ORNL	**Oak Ridge National Laboratory**
OSR	**Offsite Source Recovery**
ORP	**Office of River Protection**
PA	**Performance Assessment**
PA	**Paducah Gaseous Diffusion Plant (site identifier, in waste profiles only)**
PABC	**Performance Assessment Baseline Calculations**
PCB	**Polychlorinated Biphenyls**
PE	**Polyethylene**
PGDP	**Paducah Gaseous Diffusion Plant**
POC	**Pipe Overpack Component**
PX	**Pantex Plant (site identifier)**
QA	**Quality Assurance**
RCRA	**Resource Conservation and Recovery Act**

RF	**Rocky Flats Environmental Technology (site identifier)**
RFETS	**Rocky Flats Environmental Technology Site**
RH	**Remote-Handled**
RHWF	**Remote-handled Waste Facility**
RL	**Hanford (Richland Operations Office) (site identifier)**
RP	**Hanford (Office of River Protection) (site identifier)**
RTR	**Real-time radiography**
SA	**Sandia National Laboratories (site identifier)**
SLB	**Standard large boxes**
SNL	**Sandia National Laboratories**
SP	**Separations Process Research Unit (site identifier)**
SPRU	**Separations Process Research Unit**
SQAP	**Software Quality Assurance Plan**
SR	**Savannah River Site (site identifier)**
SRS	**Savannah River Site**
STTP	**Source Term Test Program**
SWB	**Standard Waste Box**
TB	**Teledyne-Brown**
TDOP	**Ten Drum Overpack**
TOC	**Total Organic Carbon**
TRAMPAC	**Transuranic Waste Authorized Methods for Payload Control**
TRU	**Transuranic**
TRUCON	**TRU Waste Content Codes**
TRUPACT II	**Transuranic Package Transporter – II**
TWBID	**Transuranic Waste Baseline Inventory Database, Rev. 2.1**
TWBIR	**Transuranic Waste Baseline Inventory Report**
USAMC	**U.S. Army Material Command**
VN	**General Electric Vallecitos Nuclear Center (site identifier)**
WAC	**Waste Acceptance Criteria**
WAP	**Waste Analysis Plan**
WHO	**Waste Handling Operations**
WIPP	**Waste Isolation Pilot Plant**
WM	**Waste Material**
WMC	**Waste Matrix Code**
WMP	**Waste Material Parameter**
WP	**WIPP repository (site identifier)**
WTWBIR	**WIPP Transuranic Waste Baseline Inventory Report**
WV	**West Valley Demonstration Project (site identifier)**
WVDP	**West Valley Demonstration Project**
WWIS	**WIPP Waste Information System**

ABBREVIATED TITLES

TWBIR Revision 2	**Transuranic Waste Baseline Inventory Report, Revision 2 (DOE 1995b)**
TWBID Revision 2.1	**Transuranic Waste Baseline Inventory Database (LANL 2005)**
TWBIR Revision 3	**Transuranic Waste Baseline Inventory Report, Revision 3 (DOE 1996a)**
TWBIR-2004 Revision 0	**Transuranic Waste Baseline Inventory Report - 2004, Revision 0 (this document)**
Computational Methodology	**Transuranic Waste Inventory Update Report – 2003 Computational methodology (LANL 2003b)**