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Sandia National Laboratories
Waste Isolation Pilot Plant

TRU Waste Inventory for the 2004 Compliance Recertification Application Performance Assessment Baseline Calculation

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ACRONYMS

AMWTP	Advanced Mixed Waste Treatment Plant
ANL-E	Argonne National Laboratory – East
ANL-W	Argonne National Laboratory – West
AP	Analysis Plan
BAPL	Bettis Atomic Power Laboratory
BBI-TWINS	Best Basis Inventory from the Tank Waste Inventory System
BCL	Battelle Columbus Laboratories
CCA	Compliance Certification Application
CFR	Code of Federal Regulations
CH	Contact Handled
COBRA	Computerized Burial Record Archive
CPR	Cellulose, plastic, and rubber
CRA	Compliance Recertification Application
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
EDTA	Ethylenediaminetetraacetic acid
EPA	U.S. Environmental Protection Agency
ETEC	Energy Technology Engineering Center
FGE	Fissile Gram Equivalents
GE-VNC	General Electric Vallecitos Nuclear Center
Hanford-RL	Hanford Richland Operations Office
Hanford-RP	Hanford Office of River Protection
INEEL	Idaho National Engineering and Environmental Laboratory
KAPL	Knolls Atomic Power Laboratory
KAPL-NFS	Knolls Atomic Power Laboratory-NFS
LANL	Los Alamos National Laboratory
LANL-CO	Los Alamos National Laboratory - Carlsbad Operations
LBNL	Lawrence Berkeley National Laboratory
LLNL	Lawrence Livermore National Laboratory
MURR	Missouri University Research Reactor
NTS	Nevada Test Site
NWMP	Nuclear Waste Management Program
ORNL	Oak Ridge National Laboratory
PA	Performance Assessment
PABC	Performance Assessment Baseline Calculation
PAPDB	Performance Assessment Parameter Database
PAVT	Performance Assessment Verification Test
PGDP	Paducah Gaseous Diffusion Plant

POC	Pipe Overpack Component
QA	Quality Assurance
RC	Records Center
RFETS	Rocky Flats Environmental Technology Site
RH	Remote Handled
SNL	Sandia National Laboratories
SPRU	Separations Process Research Unit
SQS	Small Quantity Site
SRS	Savannah River Site
SWB	Standard Waste Box
SWIFT	Solid Waste Integrated Forecast Tool
SWITS	Solid Waste Information and Tracking System
TDOP	Ten Drum Overpack
TRU	Transuranic Waste
TRUDB	TRU database
TWBID	Transuranic Waste Baseline Inventory Database
TWBIR	Transuranic Waste Baseline Inventory Report
TWC	TRU Waste Characterization
USAMC	U.S. Army Material Command
WEMS	Waste and Environmental Management System
WIPP	Waste Isolation Pilot Plant
WITS	Waste Information Tracking System
WTS	Washington TRU Solutions LLC
WTWBIR	WIPP Transuranic Waste Baseline Inventory Report
WV	West Valley Demonstration Project
WWIS	WIPP Waste Information System

1. INTRODUCTION

This report documents the transuranic (TRU) waste inventory used for the 2004 Compliance Recertification Application Performance Assessment Baseline Calculation (CRA-2004 PABC) The document was prepared under AP-119, *Analysis Plan For Deriving Radionuclide Inventory Information for Performance Assessment Calculations: Post CRA Performance Assessment Baseline Calculation* (Leigh, 2005c).

1.1 BACKGROUND

The Waste Isolation Pilot Plant (WIPP) is located in southeastern New Mexico and has been developed by the U.S. Department of Energy (DOE) for the geologic (deep underground) disposal of transuranic (TRU) waste (U. S. DOE, 1980; U. S. DOE, 1990; U. S. DOE, 1993). In 1992, the WIPP Land Withdrawal Act (LWA) designated the U.S. Environmental Protection Agency (EPA) as WIPP's official certifier and ordered the EPA to promulgate certification criteria (U. S. Congress, 1992). DOE first demonstrated and documented compliance with the EPA's long-term disposal standards found in Title 40 of the Code of Federal Regulations (CFR), Part 191 (U. S. EPA, 1993) in their Compliance Certification Application (CCA) (U. S. DOE, 1996a). EPA reviewed the CCA against their Certification Criteria, found in Title 40 CFR Part 194 (U. S. EPA, 1996), and certified that the WIPP would comply with the long-term disposal standards (U. S. EPA, 1998). In their demonstration of compliance, the DOE had their scientific advisor, Sandia National Laboratories (SNL), develop a computational modeling system to predict the future performance of the repository for 10,000 years after closure. SNL has developed a system, called WIPP Performance Assessment (PA), which examines failure scenarios, quantifies their likelihoods, calculates potential releases to the surface or the site boundary, and evaluates the potential consequences, including uncertainties. The regulation also requires that these models be maintained and periodically updated with new information. These updated models and related information are then used to demonstrate continued compliance with the EPA's long-term radioactive disposal standards. This cyclic regulatory process is called recertification and occurs at five-year intervals.

The WIPP PA requires many input parameters to represent the complex coupled processes that are expected to occur throughout the 10,000-year regulatory time period. Not surprisingly, information about the waste that will be placed in the repository is very important to the PA. This waste information is called the TRU waste inventory. The TRU waste inventory includes information about materials in the waste (wood, metal, soil etc), materials used to package waste (steel drums, plastic liners, rubber gaskets, etc.), materials used to emplace waste, radionuclides in the waste, and chemicals in the waste. Traditionally, information describing the TRU waste inventory is as comprehensive as possible, containing virtually everything known about the waste since the point of generation to final disposal, in keeping with DOE's cradle-to-grave management philosophy. However, the information that is needed as input to WIPP PA is limited to the following: volumes, waste, packaging, and emplacement materials (in particular, iron, cellulose, plastic, rubber, and cement), radionuclide activities, complexing agents and oxyanions (sulfate, nitrate, and phosphate). Consequently, a process that sorts, extracts, and compiles the waste information necessary for PA is necessary.

Because the waste information plays a key role in the performance predictions made by PA, the EPA's Certification Criteria (40 CFR Part 194) places specific requirements on how the waste information is derived from characterization activities, how the waste is described in the certification (or recertification) application, and how the information is used in performance calculations. Additionally, the EPA is interested in how waste inventory estimates change and, as more TRU waste streams are created and/or identified and increasing amounts of waste are disposed at the WIPP, the accuracy of these estimates. Since it is the nature of waste inventory to change, the recertification process provides an opportunity to revise the waste information with the most up-to-date information as practicable. Therefore, this document describes the relevant changes in waste information as represented in the DOE's Compliance Certification Application (CCA) (U. S. DOE, 1996a), the Compliance Recertification Application (CRA-2004) (U. S. DOE, 2004), and the most recent Performance Assessment Baseline Calculation (CRA-2004 PABC) (Leigh et al., 2005).

1.2 COMPLIANCE CERTIFICATION APPLICATION

Revision 0 of the *Waste Isolation Pilot Plant (WIPP) Transuranic Waste Baseline Inventory Report* (WTWBIR) published in June 1994 (U. S. DOE, 1994), was the first attempt ever made by the DOE complex to report all of its TRU waste at the waste stream level. The waste data reported in Revision 0 was considered preliminary until the DOE TRU waste generator/storage sites completed quality checks of the data. Data changes resulting from the site reviews were contained in Revision 1 of the WTWBIR (U. S. DOE, 1995b). Subsequently two additional baseline reports *Transuranic Waste Baseline Inventory Report* (TWBIR) Revisions 2 and 3 (U. S. DOE, 1995a; U. S. DOE, 1996b) were published in 1995 and 1996 to include WIPP and non-WIPP wastes and other additional characteristic information.

As stated previously, the DOE demonstrated and documented compliance with the EPA's long-term disposal standards in the CCA, which included the results of the WIPP PA. Appendix BIR of the CCA (U. S. DOE, 1996a) was the inventory basis for the CCA WIPP PA. In addition to demonstrating that the WIPP will meet the containment requirements, the CCA was also required to meet the certification criteria found in 40 CFR Part 194. Title 40 CFR Part 194.24(a) requires DOE to describe the chemical, radiological and physical composition of all existing and to-be-generated waste, including a list of waste components and their approximate quantities in the waste. Therefore in the CCA, the DOE provided the required information on existing waste (35% of the total WIPP inventory) by combining similar waste streams into waste stream profiles. The waste stream profiles contain information on the waste material parameters, or components that could affect repository performance. For to-be-generated waste (65% of the total WIPP inventory), DOE extrapolated information from the existing waste streams to determine the future amount of waste.

During the review of the CCA, EPA required an additional Performance Assessment Verification Test (PAVT), which revised selected CCA inputs to the PA (Sandia National Laboratories, 1997). The PAVT analysis ran the full suite of WIPP PA codes and confirmed the conclusions of the CCA analysis that the repository design met the regulations. TWBIR Revision 3 was the inventory basis for the PAVT PA.

Following the receipt of the PAVT analysis, EPA ruled in May 1998 that WIPP had met the regulations for permanent disposal of transuranic waste. With regard to the waste information presented in the CCA, the EPA stated in their final certification ruling that, "...The EPA reviewed this information and determined that DOE's waste stream profiles contained the appropriate specific information on the components and their approximate quantities in the waste."(U. S. EPA, 1998). The first shipment of radioactive waste from the nation's nuclear weapons complex arrived at the WIPP site in late March 1999, starting the five-year clock for the site's required recertification.

1.3 2004 COMPLIANCE RECERTIFICATION APPLICATION

The first compliance recertification application, CRA-2004, was submitted to the EPA by the DOE in March 2004 (U. S. DOE, 2004). DOE prepared an inventory for CRA-2004 which is contained in the transuranic waste baseline inventory database (TWBID Revision 2.1 Version 3.12 Data Version 4.09) and was published in Appendix DATA Attachment F and it's annexes (U. S. DOE, 2004).

During its review of CRA-2004, the EPA raised several questions regarding its completeness and technical adequacy (Cotsworth, 2004b; Cotsworth, 2004c; Cotsworth, 2004a; Cotsworth, 2004d; Gitlin, 2005) The DOE responded to EPA questions in writing (Detwiler, 2004a; Detwiler, 2004b; Detwiler, 2004c; Detwiler, 2004d; Detwiler, 2004e; Detwiler, 2004f; Piper, 2004; Patterson, 2005; Triay, 2005) and by engaging in technical meetings with EPA staff. The following is a summary of the EPA inventory related questions and the DOE responses.

1.3.1 Software Used to Prepare Inventory Estimates

In Comment G-3, the EPA requested that the DOE provide them with a copy of the TWBID Revision 2.1 database which contains inventory information in support of CRA-2004 (Cotsworth, 2004a). The DOE responded by providing the database as requested (Detwiler, 2004d).

In Comment C-42-2, the EPA noted that the DOE needed to provide an electronic version of the TWBID Revision 2.1 and ORIGEN Version 2.2 (Cotsworth, 2004a). The EPA also noted that the DOE needed to describe any changes made to the ORIGEN code and provide all of the code quality assurance (QA) documents. The EPA wanted to verify decay results for randomly selected data. In response, the DOE sent the code QA documents and the ORIGEN code Version 2.2 (Detwiler, 2004d)

In Comment C-31-1, the EPA requested a description of the code input data for the ORIGEN Version 2.2 decay model (Cotsworth, 2004c). In response, the DOE provided the information requested (Detwiler, 2004a).

1.3.2 Inventory Inconsistencies

In Comment C-24-1 and Comment C-24-6, the EPA noted that the preface to Appendix DATA, Attachment F (U. S. DOE, 2004) indicates that there were inconsistencies in the waste stream profiles without indicating the nature of the inconsistencies. In response, the DOE provided a summary of the inconsistencies for Idaho National Engineering and Environmental Laboratory

(INEEL), Oak Ridge National Laboratory (ORNL), Los Alamos National Laboratory (LANL), Savannah River Site (SRS) and the Small Quantity Sites (SQS) waste streams relating to their waste volumes, waste material parameters and radionuclide inventories that were important to PA (Detwiler, 2004e). DOE provided reports addressing these inconsistencies (Leigh, 2003a; Leigh and Crawford, 2004; Lott, 2004c; Warren, 2004).

1.3.3 Emplacement Materials

In Comment G-2, the EPA noted that the DOE did not include emplacement materials in the PA calculations for CRA-2004. The EPA indicated that the DOE must provide the volumes and weights of all materials that are placed in the disposal system and account for their effects or justify why these additional materials are not expected to affect the behavior of the disposal system (Cotsworth, 2004b). In response, DOE prepared estimates of the masses of cellulose, plastic and rubber (CPR) added to the repository because of emplacement materials (Detwiler, 2004d) and showed that there would only be a 12% increase in CPR if emplacement materials are included in the PA. Further, the DOE provided information showing that 250% more CPR than that used in the CRA-2004 PA did not impact the WIPP PA results (Dunagan et al., 2005). The DOE concluded that a 12% increase in CPR had no effect on the conclusion of the CRA-2004 PA (Detwiler, 2004d). However, EPA stated in their March 4, 2005 PABC letter, that all emplacement materials should be included in the PABC inventory. DOE included the emplacement materials in the inventory used in the PABC.

1.3.4 Compacted Waste

In Comment C-15-1, the EPA noted in their review of the Advanced Mixed Waste Treatment Project (AMWTP), they were told that only INEEL would compact waste but were later informed that other sites may also compact waste. They requested the DOE provide EPA with information on which sites will compact waste in the next five years and verify that this waste is appropriately included in the CRA-2004 PA. In response, the DOE identified two waste streams in Appendix DATA Attachment F from the Rocky Flats Environmental Technology Site (RFETS) that contained compacted waste. DOE stated that ORNL may have a portion of its debris waste compacted; however the DOE noted that ORNL does not plan to compact future waste. The DOE stated that they are unaware of any other site planning to compact waste (Detwiler, 2004a).

1.3.5 Waste-Steam Level Data for Chemical Components

In Comment C-24-5, the EPA noted that Appendix DATA Attachment F (U.S. DOE 2004) contains a summary of complexing agents, nitrates, phosphates and cements however it did not include a summary of the waste stream quantities or justification as to why the occurrence of complexing agents, etc. was limited to solidified waste forms (Cotsworth, 2004c). In response, the DOE presented the information in tables contained in the response and referenced documents by Crawford (2004a), Leigh and Sparks-Roybal (2003), and Crawford and Leigh (2003) that give specific waste stream information for complexing agents, nitrates, phosphates and cement (Piper, 2004).

1.3.6 Hanford Tank and K-Basin Wastes

In a December 17, 2004 letter, the EPA questioned the inclusion of several Hanford tank wastes in the CRA-2004 inventory because it has been managed by DOE as high-level waste. The EPA requested that DOE provide additional information regarding the tank waste, specifically two remote handled (RH) TRU and two contact handled (CH) TRU waste streams. The EPA also requested the same information on two additional waste streams generated from remediation of the Hanford K-Basins. In response, the DOE sent a March 18, 2005 letter (Patterson, 2005) providing information on how these wastes were generated and managed, what the characteristics of these wastes are, and the waste volumes. The DOE concluded that these wastes are transuranic and when treated and packaged, would meet all legal and regulatory eligibility requirements for disposal at WIPP.

1.3.7 Corrections Specific to the CRA-2004 PABC

The EPA also requested that DOE perform another recertification PA with specific changes requested in a March 04, 2005 letter (Cotsworth, 2005). In this letter, regarding the inventory, the EPA asked that the DOE correct a LANL waste stream classified as CH-TRU when it should be RH-TRU (see Section 3.3 below), include effects of other sites compressing waste (see Section 1.3.4), include packaging materials in the inventory (see Section 1.3.3), and revise the WIPP PA inventory to account for ten-drum overpacks (TDOPs) stacked with one 7-pack on top instead of the TDOP being equivalent to a three high stack. Hansen and Snider (2004) demonstrated the lack of sensitivity of the mean cuttings and cavings releases to the special arrangement of waste. Therefore, the assumption of waste stacking on TDOPs is not directly modeled in PA, however such a case is effectively represented by the current model. That is, the conceptual model for cuttings and cavings releases assumes that each intrusion encounters a stack of waste with an original height of 3.96 m. "In essence, the model for cuttings and cavings releases assumes that waste is stacked on TDOPs (Hansen and Snider, 2004)."

1.4 OBJECTIVES FOR THE CRA-2004 PABC INVENTORY ANALYSIS

Inventory estimates are inherently uncertain. These estimates are a compilation of both existing and projected waste volumes that are scaled to the repository volume limit. For the CCA, no waste had been emplaced in WIPP, and the entire repository scaled volume was highly uncertain. As time progresses, uncertainty is reduced since the ratio of the emplaced and existing waste volume to the projected waste volume increases. By default, each recertification waste estimate will contain better inventory estimates than the previous. Inventory estimates provided in the CCA [Appendix BIR of (U. S. DOE, 1996a)], the PAVT (TWBIR Revision 3), and CRA-2004 [Appendix DATA Attachment F of (U. S. DOE, 2004)] represent the best information available to DOE about its TRU waste in 1995, 1996, and 2002, respectively. It has always been anticipated that WIPP waste inventory estimates would change as the DOE characterizes the contents of waste containers prior to shipment to WIPP and as new TRU wastes are generated.

While both the EPA and the DOE understand that inventory estimates are inherently uncertain, the inventory upon which the WIPP PA is based has to be representative of what will ultimately be emplaced in the repository in order to instill confidence in the PA results. Thus, the primary objective of this analysis is to demonstrate that the CRA-2004 PABC is based on a TRU waste inventory that adequately represents the inventory of materials expected for disposal over the lifetime of WIPP. This report addresses the following:

1. The methods used to prepare the CRA-2004 TRU waste inventory;

2. The updates that were made to the CRA-2004 inventory to obtain the CRA-2004 PABC inventory; and

3. The CRA-2004 PABC inventory (emplaced, stored, and projected waste) in terms of volumes, non-radioactive components and radioactive components.

2. PREPARATION OF THE CRA-2004 TRU WASTE INVENTORY

Recognizing that volumes and characteristics (both physical and radiological) of waste that a TRU waste generator site may report as coming to WIPP depend on factors that vary over time, the DOE decided that the TRU waste inventory used for the CCA had to be updated for CRA-2004. The TRU waste sites are affected by:

- regulations on the federal and state level,
- waste program management decisions at the site, at the WIPP and on the national level,
- site funding for waste management on site,
- availability and confidence in supplemental characterization information or process knowledge, and
- the forecast for upcoming site programs.

These are just a few of the factors that affect a site's estimate of its waste stream volumes and characteristics.

The TRU waste inventory obtained for the CRA-2004 was based on the best estimate that the TRU waste generator sites could provide as of September 30, 2002. The cut-off date of September 30, 2002 was chosen to facilitate the timely preparation of CRA-2004. Between the time of the CCA and September 30, 2002, some of the sites had developed plans for managing waste more cost effectively through waste compression. Some sites had obtained additional characterization information that helped to better define the characteristics of their TRU waste. Other sites had discovered TRU waste that was not reported for the CCA. Finally, some sites embarking on decontamination and decommissioning (D&D) work found that their D&D waste volumes were actually larger than originally expected (as reported in the CCA).

Figure 1 is a flow diagram of the DOE process used to prepare the TRU waste inventory for CRA-2004. Steps 1 through 5 represent the data collection, compilation and verification process. Steps 6 through 10 represent the synthesis of data for use in PA.

2.1 DATA COLLECTION, COMPILATION AND VERIFICATION

The method used by Los Alamos National Laboratory – Carlsbad Operations (LANL-CO) to collect data from the DOE TRU waste sites and enter the data into a qualified database is captured in SNL Nuclear Waste Management Program (NWMP) Procedure, SP 9-6, *Baseline Inventory Report (BIR) Change Report Data Collection and Entry* (Sparks-Roybal, 2003). The process described in this procedure was initiated by a data call by the DOE. The data call specifically requested that the sites provide information that had changed since the CCA submittal in 1995. In order to appropriately capture these changes, each TRU waste site was sent a copy of the data they submitted for the CCA in the form of waste profiles from the TWBIR Revision 2 (U. S. DOE, 1995a). The sites were then instructed in the associated data call to mark all changes on the profiles provided and return the marked up profiles. The first data call was followed by a second data call specifically requesting data that was needed by SNL

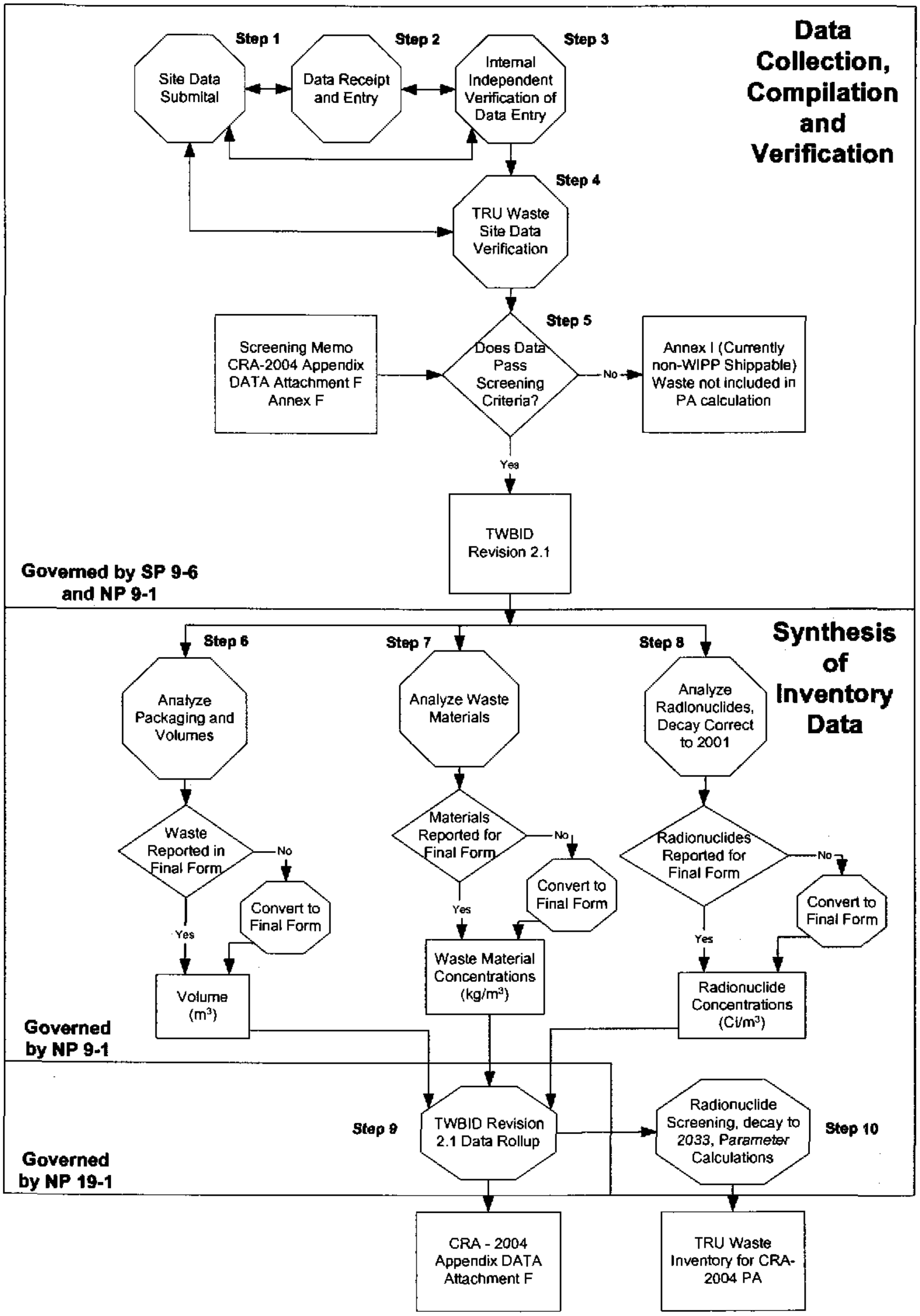

Figure 1. Process for Preparing the CRA-2004 TRU Waste Inventory

to perform calculations for PA (Giambalvo, 2002). During the time these data calls were issued, LANL-CO personnel visited the TRU waste sites to facilitate data collection and worked with the sites to assist with questions and issues as they came up.

Steps 1 through 5 in Figure 1 represent the data collection, compilation and verification process for CRA-2004. Step 1 is the submittal of data by the TRU waste sites. Step 2 is a review of the data submittal, clarifying discussions with the TRU waste sites if needed, and entry into a qualified database. If there were questions regarding the data, discussions continued with the site until all questions were resolved. If the data submitted by the TRU waste site required manipulation (for example unit conversions) or further analysis to accommodate PA, routine calculations and analyses were performed under SNL NWMP Procedure, NP 9-1, *Analyses* (Sandia National Laboratories, 2001).

Step 3 in Figure 1 is the internal verification process outlined in SP 9-6. Upon completion of data entry and internal verification of the data entry, the data were provided to each site with a signature sheet (Step 4 in Figure 1). The DOE site representative responsible for TRU waste management verified that the site's data were correctly entered into the database. Step 5 determines if the waste as reported by the site qualifies for shipment to WIPP. Waste streams that did not qualify for shipment to WIPP, while still contained in the database, were not included in PA calculations. These waste streams were reported in Appendix DATA Attachment F Annex I of U.S. DOE (2004).

All site information and associated correspondence used to clarify questions and provide objective evidence that the site reviewed and approved the data were entered into the SNL WIPP Records Center (RC) in accordance with SNL NWMP Procedure, NP 17-1, *Records* (Sandia National Laboratories, 2003). Table 1 provides the SNL WIPP RC package numbers that document Steps 1 through 5 in Figure 1. In addition to the site-specific records for data collection, compilation, and verification for CRA-2004, these records packages contain updates from the sites received and used for the CRA-2004 PABC.

At the completion of Steps 1 through 5 in Figure 1, the database, called the TWBID Revision 2.1, contained the data that the TRU waste sites provided and verified as being correct. This data was qualified for use in PA under SP 9-6. At this point a new data version was established. The CRA-2004 TRU waste inventory was based on Data Version 4.09. The CRA-2004 PABC TRU was inventory is based on Data Version 4.16. The progression from Data Version 0.00 to Data Version 4.16 is documented in Appendix A of this report.

Table 1. SNL WIPP RC Packages Related to Data Collection and Processing for the CRA-2004 and CRA-2004 PABC TRU Waste Inventory

TRU Waste Site	SNL WIPP RC Package Number
Ames	525948
ARCO Medical Products Company	526059
Mound	525953 and 525958
Pantex	525937
Teledyne Brown	525934
Missouri University Research Reactor	526555
Argonne National Laboratory – East	526109
Argonne National Laboratory – West	526407 and 528082
Battelle Columbus Laboratories (BCL)	526424
Bettis Atomic Power Laboratory (BAPL)	526164 and 526176
Babcock & Wilcox	526051
Energy Technology Engineering Center	526444 and 528054
Framatome	525983
INEEL	526765 (CH-TRU), 526179 (RH-TRU) and 528085
Knolls Atomic Power Laboratory (KAPL)	526087 and 526104
Knolls Atomic Power Laboratory-NFS	525960 and 526104
LANL	526504 and 528065
Lawrence Berkeley National Laboratory	526523
Lawrence Livermore National Laboratory	526536
U.S. Army Material Command	525940
Nevada Test Site (Jasper)	526576
Nevada Test Site	526565
ORNL	526589 and 528046
Paducah Gaseous Diffusion Plant (PGDP)	526074
RFETS	526779 and 528074
Hanford RL	526736
Hanford RP	526473
Sandia National Laboratories/NM	526606 and 526799
Separations Process Research Unit	526063
SRS	526676
General Electric Vallecitos Nuclear Center	526463
West Valley Demonstration Project	526695
WIPP[(a)]	528118

(a) This package contains information from the WIPP Waste Information System for waste emplaced as of September 30, 2002.

2.2 SYNTHESIS OF DATA FOR USE IN PA

In addition to collecting and processing data from the TRU waste generator sites and securing the site data in a qualified database for future use, preparation of the TRU waste inventory for CRA-2004 required a synthesis of the data to support PA (Steps 6 through 10 in Figure 1). For example, all concentration values (waste material concentrations, radionuclide concentrations etc.) must be calculated using final form volumes. If a site provided data based on any other volume, the information was corrected so that it was based on the final form volume. Another example is that radionuclide activities were decay-corrected to a common base year (the end of calendar year 2001 in this case).

Step 6 in Figure 1 is the analysis of waste stream volumes to obtain final form volumes. Step 7 is the analysis of waste material and packaging material concentrations based on final form volumes, and Step 8 is the decay of radionuclide activities and analysis of radionuclide activity concentrations based on final form volumes. All Step 6, 7 and 8 analyses were performed under NP 9-1. In addition, all Step 6, 7, and 8 analyses were entered into the SNL WIPP RC in accordance with NP 17-1. Three SNL WIPP RC packages, 525272, 525800, and 528035, house this body of work for CRA-2004.

In Step 9 of Figure 1, volume data from waste streams are rolled up into stored, projected and anticipated categories, projected volume data is scaled to obtain disposal volumes, waste material parameters are rolled up to provide average waste material densities in the repository, and radionuclide activities are rolled up to provide total radionuclide activities in the repository. These tasks are performed by the TWBID Revision 2.1 database. During the preparation of CRA-2004, the TWBID Revision 2.1 table structures, standard queries, and reports that support Step 9 in Figure 1 were qualified as software under SNL WIPP Procedure, NP 19-1, *Software Requirements* (Sandia National Laboratories, 2004). TWBID Revision 2.1 Version 3.12 was used for CRA-2004. TWBID Revision 2.1 Version 3.13 was used for the CRA-2004 PABC. The migration from software Version 3.12 to software Version 3.13 is documented in Van Soest (2004).

In Step 10 of Figure 1, the information that was reported in Appendix DATA Attachment F of U.S. DOE (2004) was used to populate the WIPP Performance Assessment Parameter Database (PAPDB) with parameter values needed for the CRA-2004 PA.

2.3 WASTE TRACKING AT THE TRU WASTE SITES

In responding to the CRA-2004 data calls, most sites used their own waste tracking systems to develop the data needed. At the large quantity sites:

- Hanford Richland Operations Office (Hanford RL)
- Hanford Office of River Protection (Hanford RP),
- INEEL,
- LANL,
- ORNL,
- Rocky Flats Environmental Technology Site (RFETS), and
- SRS,

site-specific databases were used for this purpose. A summary of those databases is given in Table 2. The information contained in each of these databases provides historical information about the radiological content and container specific materials packaged in each of the waste streams reported in the waste profiles for CRA-2004. In most cases, the radiological content of the waste has been tracked on mass balance sheets or engineering flow sheets that originated at the TRU waste generating facility. Information about the physical form of the TRU waste is also tracked at the sites with the exception of ORNL. At ORNL, the information about the physical form of the waste has not been tracked. An estimate was made for the CCA and the same estimate was used for CRA-2004. As the TRU waste at the sites is characterized, the information that is tracked for the TRU containers is updated.

Table 2. Site-Specific Databases Used to Prepare TRU Waste Inventory Information for CRA-2004

TRU Waste Site	Database	Application
Hanford RL	SWITS[(a)]	Used to obtain volumes, radionuclide activities and waste material masses for stored inventory
	SWIFT[(b)]	Used to obtain volumes, radionuclide activities and waste material masses for projected waste
Hanford RP	BBI-TWINS[(c)]	Used to obtain volumes, radionuclide activities and waste material masses for both stored and projected waste
INEEL	Ravio[(d)]	Used to obtain volumes, radionuclide activities and waste material masses for both stored and projected waste for the Advanced Mixed Waste Treatment Project.
	WILD(e)	Used to obtain volumes and radionuclide activities for Pre-1970 TRU waste for the Idaho Cleanup Project.
LANL	TRU DB[(f)]	Used to obtain volumes, containers, radionuclide activities and waste material masses for both stored and projected waste
ORNL	WITS[(g)]	Used to obtain waste container counts and radionuclide activities for both stored and projected waste
RFETS	WEMS[(h)]	Used to obtain volumes, containers, radionuclide activities and waste material masses for stored and projected waste
SRS	COBRA[(i)]	Used to obtain waste container counts, radionuclide activities, and physical characteristics of TRU waste generated from 1961 to 1998
	TWC[(j)]	Used for waste generated from 1998 to the present.

[(a)]Solid Waste Information and Tracking System [(b)]Solid Waste Integrated Forecast Tool; [(c)]Best Basis Inventory from the Tank Waste Inventory System; [(d)] Derived from the *Waste Description Information for Transuranically Contaminated Wastes Stored at the Idaho National Engineering Laboratory;* [(e)]Waste Inventory Location Database; [(f)] TRU database; [(g)] Waste Information Tracking System; [(h)]Waste and Environmental Management System; [(i)]Computerized Burial Record Archive; [(j)]TRU Waste Characterization

3. UPDATES FROM CRA-2004 TO CRA-2004 PABC

In preparing CRA-2004, DOE initiated a "data call" to obtain waste inventory information from its TRU waste sites. Each TRU waste site was sent a copy of the data they submitted for the CCA in the form of waste profile forms from TWBIR Revision 2.

The sites were asked to report information on their TRU waste with a cut-off date of September 30, 2002. The results of the "data call" were compiled in the TWBID Revision 2.1 Version 3.12 Data Version 4.09. Data on emplaced waste as of September 30, 2002 as reported in the WIPP Waste Information System (WWIS) were also entered into TWBID Revision 2.1 Version 3.12 Data Version 4.09.

Data from the TWBID Revision 2.1 Version 3.12 Data Version 4.09 were reported in detail in Appendix DATA, Attachment F of U.S. DOE (2004). The emplaced waste data as of September 30, 2002 were provided in Appendix DATA, Attachments D, E, and H of U.S DOE (2004).

During the final preparation of CRA-2004, SNL management (2003) requested a review of the waste stream profiles that form the basis of the inventory estimates for CRA-2004. The review was performed by Washington TRU Solutions LLC (WTS) (Warren, 2004). WTS found a number of inconsistencies on the waste profile forms (WPFs) and possible errors in the reporting of TRU waste inventories for CRA-2004. In response to the WTS review, LANL-CO and SNL investigated the noted inconsistencies and possible errors. The results of the LANL-CO and SNL investigations were summarized in Leigh and Crawford (2004).

Leigh and Crawford (2004) summarizes the findings of the LANL-CO and SNL investigation into the reviewer's comments (Warren, 2004) that potentially have an impact on PA. Waste stream volumes, concentrations of waste and packaging materials, and radionuclide concentrations were re-examined by LANL-CO and SNL as a result of the reviewer's comments. This re-examination resulted in no changes to the waste stream volumes in the CRA-2004 inventory. It resulted in a few minor changes in the waste material densities and packaging material densities, including CPR densities for 38 LANL waste streams, 27 INEEL waste streams, and 20 SRS waste streams. The re-examination performed by LANL-CO and SNL also resulted in a few minor changes in radionuclide activities for 12 LANL waste streams, 39 INEEL waste streams, and 19 SRS waste streams. The most significant result of the re-examination performed by LANL-CO and SNL was an update to the LANL waste stream LA-TA-55-48 as described in Section 3.3 below.

Coincident with this internal review of the CRA-2004 inventory, the EPA was conducting a completeness review of CRA-2004 as described in Section 1. EPA made comments about the CRA-2004 TRU waste inventory as outlined in Section 1.3. The EPA also conducted site visits at Hanford (RL and RP), SRS and ORNL as part of their completeness review of CRA-2004. In September 2004, Hanford RL and Hanford RP hosted a visit by the EPA. The EPA and site personnel discussed the process that Hanford RL and Hanford RP used to respond to the CRA-2004 data call; in particular, site personnel explained that some of the Hanford RL waste streams were "double-counted" in CRA-2004 (see Section 3.1). Site personnel from Hanford RP discussed the source processes for waste at their site (namely the waste in underground storage tanks) and the way they plan to process this waste.

In November 2004, the EPA visited ORNL. ORNL personnel discussed the process they used to respond to the CRA-2004 data call and hosted a tour of the site. During this tour, ORNL site personnel indicated that some of their waste would be "compressed" prior to shipment to WIPP; however, they did not report the waste as "compressed" waste in the CRA-2004 data call.

In April 2005, EPA visited SRS. The EPA was given an overview and history of the site. A description of the TRU waste management process at SRS was presented and the process used to respond to the CRA-2004 data call was discussed. At this meeting, SRS noted that approximately 50% of the drums of legacy TRU waste had already been shipped to WIPP and that many if not most of these drums have been shipped in TDOPs. The site also noted that most of their volume is stored in boxes which have to be repackaged before they can be shipped to WIPP.

The EPA site visits and reviews along with the internal reviews of the CRA-2004 TRU waste inventory highlighted the need for a number of updates to the TRU waste inventory for the CRA-2004 PABC. These updates were made to ensure that the TRU waste inventory for CRA-2004 PABC adequately represents the inventory of materials expected for disposal over the lifetime of WIPP. The following is a summary of the changes made to the CRA-2004 TRU waste inventory for the CRA-2004 PABC for waste streams from each of the major TRU waste sites.

3.1 HANFORD WASTE STREAMS

One of the differences between the CRA-2004 inventory and the CRA-2004 PABC inventory is in the Hanford-RL waste streams. Hanford-RL realized after their data submittal for CRA-2004 that they had "double-counted" in a number of cases their TRU waste streams (Crawford, 2003a).

The revision made by Hanford-RL for their waste resulted in the deletion of 12 waste streams that were inadvertently included in the data submittal for CRA-2004. RH waste streams deleted from the CRA-2004 inventory in preparation of the CRA-2004 PABC inventory are: RL-W424, RL-W425, RL-W426, RL-427, RL-W429, RL-W430, RL-W431, RL-W432 and RL-W434. The deletion of these RH-TRU waste streams resulted in a RH-TRU waste volume decrease reported by Hanford-RL of 8350.0 m^3 (Lott, 2004a). CH-TRU waste streams deleted from the CRA-2004 inventory in preparation of the CRA-2004 PABC inventory are: RL-W437, RL-W439 and RL-W443. The deletion of these CH-TRU waste streams resulted in a CH-TRU waste volume decrease reported by Hanford-RL of 7363.6 m^3 (Lott, 2004a).

Another change worth mentioning is for the K-basin sludges, waste streams RL-W445 and RL-W446, at Hanford-RL. The radionuclide activities for these waste streams were updated by the site because of a discrepancy between ^{90}Sr and ^{137m}Ba with regard to ^{137}Cs activity concentration. The result was that activity concentrations for ^{90}Y and ^{137m}Ba for both waste streams were lowered approximately 50% from the values reported in the CRA-2004 (Crawford, 2004c).

3.2 INEEL WASTE STREAMS

Another difference between the CRA-2004 inventory and the CRA-2004 PABC inventory is in the INEEL waste streams. The most significant change in the INEEL waste streams for the CRA-2004 PABC was the addition of the pre-1970 buried waste into the TRU waste inventory that is possibly coming to WIPP. The pre-1970 buried waste at INEEL was reported as part of the TRU waste inventory in CRA-2004 (waste stream IN-Z001 in Annex I of Appendix DATA Attachment F of U.S. DOE 2004); however, it was designated as non-WIPP TRU waste, and it was believed at that time that this waste would not be designated for disposal at WIPP. After the data call for CRA-2004, in April of 2003, Judge Lodge, a Federal District Court Judge, required all TRU waste to be removed from the site (Wasden, 2003). As a result of this court ruling, it was decided that the pre-1970 buried waste at INEEL would be excavated, packaged, and shipped to WIPP. DOE decided to include the pre-1970 buried waste in the CRA-2004 PABC because the resulting TRU waste inventory for CRA-2004 PABC would be a better representation of the inventory of materials expected for disposal over the lifetime of WIPP.

The quantity of pre-1970 buried waste was estimated as 55,800 m^3 in the CRA-2004, however after a more detailed evaluation of the waste retrieval areas the volume was reduced to a total of 17,998 m^3 (WIPP and non-WIPP waste) (Lott, 2004b). INEEL reported the expected waste volumes and characteristics for the pre-1970 buried waste for the CRA-2004 PABC as five waste streams, IN-ICP-002, IN-ICP-003, IN-ICP-004, IN-ICP-005, and IN-Z001. INEEL designated four of the waste streams, IN-ICP-002, IN-ICP-003, IN-ICP-004, and IN-ICP-005 as projected waste. The total volume reported for these four waste streams was 17,352.6 m^3 (Lott, 2004b). INEEL reported a volume of 645 m^3 remaining in IN-Z001 containing the "undefined sludge" component of the pre-1970 waste buried at INEEL (Clements, 2004).

The other change worth mentioning for the INEEL waste streams is related to IN-BN-510. IN-BN-510 is the supercompacted waste stream coming from INEEL to WIPP. IN-BN-510 contains weapons grade and heat source plutonium. At the time of their data submittal for CRA-2004, INEEL provided information about the weapons grade and heat source plutonium in the waste and about the conversion of weapons grade and heat source plutonium to isotopes that are tracked in PA (Wells, 2003). Two mistakes were found upon review of this information. First, the site made an error in the conversion of grams to curies for their weapons grade and heat source plutonium. Second, the conversion of weapons grade and heat source plutonium to individual isotopes performed for CRA-2004 (Brown, 2003) required correction.

For the CRA-2004 PABC, INEEL re-submitted isotope information for IN-BN-510 (Torres, 2004). In addition, the conversion of reported quantities of weapons grade and heat source plutonium in IN-BN-510 to the plutonium isotopes modeled in PA was corrected (Trone, 2004). The resulting changes in activity concentrations for key isotopes are shown in Table 3.

Table 3. Difference in Activity Concentrations for IN-BN-510 between CRA-2004 and CRA-2004 PABC

	Activity Concentration in IN-BN-510 (Ci/m^3)	
Radionuclide	**CRA-2004(a)**	**CRA-2004 PABC(b)**
^{241}Am	3.82E-01	3.70E-01
^{243}Am	3.22E-07	3.05E-07
^{237}Np	9.66E-06	9.09E-06
^{236}Pu	7.40E-08	2.91E-06
^{238}Pu	2.81E+00	3.04E+00
^{239}Pu	2.00E+00	1.48E+00
^{240}Pu	1.70E-01	3.63E-01
^{241}Pu	7.38E-03	8.36E+00
^{242}Pu	5.66E-04	2.89E-05
^{232}Th	3.30E-04	1.23E-04
^{233}U	4.44E-02	4.18E-02
^{235}U	3.95E-06	4.20E-06
^{238}U	1.14E-06	1.08E-06

(a) U.S. DOE (2004) (b) Trone (2004)

Finally, radionuclide concentrations for non-debris AMWTP waste were recalculated (Trone and Leigh, 2004) because INEEL made changes to the number and type of final form containers for their non-debris waste (Leigh, 2003b).

3.3 LOS ALAMOS NATIONAL LABORATORY WASTE STREAMS

Probably the most significant difference between the CRA-2004 inventory and the CRA-2004 PABC inventory for PA is in the LANL waste stream LA-TA-55-48. In the inventory for CRA-2004, LA-TA-55-48 was reported as 2.11 m^3 in storage and 13.7 m^3 projected for a total disposal inventory of 31 m^3 (the scaling factor for CH-TRU waste in the CRA-2004 was 2.11). However, given the radionuclide concentrations reported for this volume of waste, the fissile gram equivalents (FGE) per container were approximately ten times that allowed for shipment to WIPP. During the inventory update for the CRA-2004 PABC, this abnormality was noted. As a result, the LANL site was contacted and asked to re-examine their reporting of this waste stream. LANL reviewed the data and observed that the ^{239}Pu reported for LA-TA-55-48 in the CRA-2004 would correspond to an unusually high density of ^{239}Pu (9000 grams $^{239}Pu/m^3$), which was not representative of the waste stream (Crawford, 2005c). LANL provided new data for LA-TA-55-48 for the CRA-2004 PABC. The stored volume was changed to 2.72 m^3 while the projected volume remained as 13.7 m^3 for a disposal volume of 23 m^3 (the scaling factor for CRA-2004 PABC is 1.48). The new data for LA-TA-55-48 also had reduced radionuclide concentrations so that the FGE for LA-TA-55-48 reported by the LANL site for CRA-2004 PABC are within the FGE limits for waste that is shippable to WIPP (Crawford, 2004b).

3.4 ROCKY FLATS WASTE STREAMS

There were no changes made to the CRA-2004 TRU waste inventory for RFETS in support of the CRA-2004 PABC that have any impact on the PA. A question was raised by the EPA in their completeness review of CRA-2004 in Comment C-15-1 (Cotsworth, 2004c) regarding the use of compaction techniques at sites other than INEEL for waste that is coming to WIPP. Subsequent to the EPA's stated concern, EPA approved of the disposal of 21 drums of waste from RFETS (found in RFETS waste streams RF-MT2116 and RF-TT2216) that had been identified in the CRA-2004 inventory as "supercompacted." EPA approval for disposal of these drums was based on analysis of the effects on WIPP PA (absolutely minimal since there were only 21 drums) and on compliance with EPA waste characterization procedures. The only change that was made for the CRA-2004 PABC inventory in relation to the stated concern was a change in the designation for these drums as "compressed" rather than "supercompacted" (Lott, 2005). The "compressed" terminology is a better reflection of the actual process used to prepare these drums for shipment to WIPP.

3.5 SAVANNAH RIVER WASTE STREAMS

There were no changes of any significance made to the CRA-2004 TRU waste inventory for SRS in support of the CRA-2004 PABC. However, as noted below in Section 4.1.3, changes to waste streams at the other sites do have an impact on the disposal volumes (volumes scaled to the repository capacity) for SRS waste streams.

3.6 OAK RIDGE WASTE STREAMS

There were no changes of any significance made to the CRA-2004 TRU waste inventory for ORNL in support of the CRA-2004 PABC. However, as noted below in Section 4.1.3, changes to waste streams at the other sites do have an impact on the disposal volumes (volumes scaled to the repository capacity) for ORNL waste streams.

4. THE CRA-2004 PABC TRU WASTE INVENTORY

4.1 WASTE STREAM VOLUMES

The emplaced, stored, and projected volumes used in support of CRA-2004 and CRA-2004 PABC are shown for CH-TRU and RH-TRU waste in Table 4, Table 5, and Table 6, respectively. The emplaced volumes are those reported in the WWIS. The stored and projected volumes are those reported by the TRU waste sites as of September 30, 2002 except as noted in Section 3 of this report. Table 7 gives the disposal volumes which are the scaled volumes needed for PA.

4.1.1 Emplaced Volumes

At the time of the data call for CRA-2004 (September 30, 2002), approximately five percent of the CH-TRU waste DOE plans to dispose in the WIPP had been emplaced in the repository. WIPP had received 1,255 shipments totaling 7,716 m^3 of CH-TRU waste, primarily from INEEL, LANL, and RFETS. SRS and Hanford-RL had also made shipments (U. S. DOE, 2004).

As of August 1, 2005, approximately eighteen percent of the CH-TRU waste DOE plans to dispose in the WIPP had been emplaced in the repository (Leigh, 2005a). WIPP had received 30,719 m^3 of CH-TRU waste and had received all of the CH-TRU waste from RFETS. Table 4 shows the breakdown of emplaced waste volumes for each site as of September 30, 2002 and August 1, 2005.

While information about waste emplaced in the WIPP is readily available in the WWIS, corresponding information from the DOE sites about how each shipment affects stored and projected volumes is not readily available and can only be obtained by means of a complete "data call." A complete data call to determine how stored and projected TRU waste volumes changed in light of the emplaced volumes as of August 1, 2005 was not possible for CRA-2004 PABC. As a result, because the corresponding stored and projected TRU waste inventory data was available as of September 30, 2002 based on the data call for CRA-2004, the inventory for CRA-2004 PABC uses the emplaced waste stream data as of September 30, 2002 and the stored and projected data reported by the TRU waste sites as of September 30, 2002 except as noted in Section 3 of this report. Therefore, CRA-2004 and CRA-2004 PABC use the same emplaced inventory data.

4.1.2 Stored Volumes

4.1.2.1 CH-TRU Waste

The stored CH-TRU waste inventory reported by the TRU waste sites in support of CRA-2004 was larger than the same inventory reported in support of the CCA. SRS, RFETS, Hanford, and INEEL all reported increased stored CH-TRU volumes based on new information about their waste and increased accessibility to the waste. The Hanford-RP waste was not included in the Hanford estimate used in the CCA, although the TWBIR Revision 2 indicated that it might be included in the WIPP inventory at some time in the future. Several SQSs (BCL, BAPL, KAPL, and PGDP) identified small inventories of CH-TRU stored waste between the time of the CCA and CRA-2004.

Table 4. Emplaced Volumes as of September 30, 2002 and August 1, 2005

TRU Waste Site	Emplaced CH-TRU Volume As of September 30, 2002 (m^3)(a)	Emplaced CH-TRU Volume As of August 1, 2005 (m^3)(b)
Hanford-RL	9.8×10^1	1.5×10^3
Hanford-RP	0.0×10^0	0.0×10^0
INEEL	2.9×10^3	5.8×10^3
LANL	2.7×10^2	7.0×10^2
ORNL	0.0×10^0	0.0×10^0
RFETS	4.3×10^3	1.5×10^4
SRS	2.0×10^2	7.1×10^3
SQS	0.0×10^0	5.9×10^2
Totals	7.7×10^3	3.1×10^4

(a) U.S. DOE (2004); (b) Leigh (2005a)

Table 5. Stored and Projected CH-TRU Waste Inventory in Support of CRA-2004 PABC, CRA-2004 PA and CCA(a)

TRU Waste Site	Stored CH-TRU Inventory (m^3)	Projected CH-TRU Inventory (m^3)	Stored CH-TRU Inventory (m^3)	Projected CH-TRU Inventory (m^3)	Stored CH-TRU Inventory (m^3)	Projected CH-TRU Inventory (m^3)
	CRA-2004 PABC(b)		CRA-2004(c)		CCA(d)	
Hanford-RL	1.3×10^4	5.5×10^3	1.3×10^4	1.3×10^4	1.2×10^4	3.3×10^4
Hanford-RP	3.9×10^3	0.0×10^0	3.9×10^3	0.0×10^0	---	---
INEEL	6.1×10^4	1.8×10^4	6.1×10^4	1.2×10^2	2.9×10^4	0×10^0
LANL	1.2×10^4	3.3×10^3	1.2×10^4	3.3×10^3	1.1×10^4	7.4×10^3
ORNL	0.0×10^0	4.5×10^2	0.0×10^0	4.5×10^2	1.3×10^3	2.6×10^2
RFETS	5.4×10^3	2.8×10^3	5.4×10^3	2.7×10^3	7.1×10^2	4.4×10^3
SRS	1.3×10^4	2.4×10^3	1.3×10^4	2.4×10^3	2.9×10^3	6.8×10^3
SQS	1.2×10^3	2.9×10^3	1.2×10^3	2.8×10^3	1.1×10^3	1.7×10^3
Totals	1.1×10^5	3.5×10^4	1.1×10^5	2.5×10^4	5.8×10^4	5.4×10^4

(a) Not scaled to the disposal volume; (b)McInroy (2005); (c) U.S. DOE (2004) (d) U.S. DOE (1996a)

Table 6. Stored and Projected RH-TRU Waste Inventory in Support of CRA-2004 PABC, CRA-2004 PA and CCA[(a)]

TRU Waste Site	Stored RH-TRU Inventory (m^3)	Projected RH-TRU Inventory (m^3)	Stored RH-TRU Inventory (m^3)	Projected RH-TRU Inventory (m^3)	Stored RH-TRU Inventory (m^3)	Projected RH-TRU Inventory (m^3)
	CRA-2004 PABC[(b)]		CRA-2004 PA[(c)]		CCA[(d)]	
Hanford-RL	3.8×10^2	1.1×10^3	3.8×10^2	9.4×10^3	2.0×10^2	2.2×10^4
Hanford-RP	4.5×10^3	0.0×10^0	4.5×10^3	0.0×10^0	---	---
INEEL	2.2×10^2	0.0×10^0	2.2×10^2	0.0×10^0	2.2×10^2	0.0×10^0
LANL	1.3×10^2	0.0×10^0	1.2×10^2	0.0×10^0	9.4×10^1	9.9×10^1
ORNL	0.0×10^0	6.6×10^2	0.0×10^0	6.6×10^2	2.5×10^3	4.5×10^2
RFETS	0.0×10^0	0.0×10^0	0.0×10^0	0.0×10^0	0.0×10^0	0.0×10^0
SRS	0.0×10^0	2.3×10^1	0.0×10^0	2.3×10^1	0.0×10^0	0.0×10^0
SQS	9.5×10^1	3.1×10^2	9.5×10^1	3.3×10^2	6.0×10^2	1.3×10^3
Totals	5.3×10^3	2.1×10^3	5.3×10^3	1.0×10^4	3.6×10^3	2.3×10^4

(a) Not scaled to the disposal volume; (b) McInroy (2005); (c) U.S. DOE (2004) (d) U.S. DOE (1996a)

In support of the CRA-2004, the TRU waste sites reported a total CH-TRU waste stored inventory of 1.1×10^5 m^3. This was DOE's estimate of the stored CH-TRU inventory destined for WIPP when CRA-2004 was submitted. It is still DOE's estimate of the stored CH-TRU waste inventory destined for WIPP. The stored inventory values for CH-TRU waste did not change significantly as a result of the inventory update for the CRA-2004 PABC (see Table 5).

4.1.2.2 RH-TRU Waste

The stored RH-TRU waste inventory reported by the TRU waste sites in support of CRA-2004 represented an increase in the stored RH-TRU waste inventory reported in the CCA. Hanford-RP and Hanford-RL both reported more stored RH-TRU waste based on new information. Hanford-RL increased their RH-TRU waste volume and the Hanford-RP waste was added. ANL-E, BAPL, and SNL added small amounts of stored RH-TRU waste to their inventories. ORNL moved all of their RH-TRU waste into the projected waste category because they plan to process the waste using segregation, size reduction, and evaporative drying. As its entire RH-TRU waste inventory will be processed, the ORNL RH-TRU waste is reported only as a projected inventory.

In support of the CRA-2004, the TRU waste sites reported a total RH-TRU waste stored inventory of 5.3×10^3 m^3. The stored inventory values for RH-TRU waste did not change significantly as a result of the inventory update for the CRA-2004 PABC (see Table 6).

4.1.3 Projected Volumes

4.1.3.1 CH-TRU Waste

The TRU waste sites reported smaller quantities of CH-TRU waste in the projected category for CRA-2004 than they did for the CCA. This shift from reporting waste as stored rather than projected reflected progress at the TRU waste sites towards cleanup and closure between the time of the CCA and CRA-2004.

In their reporting for CRA-2004, the TRU waste sites estimated that in addition to the stored waste at the sites, approximately 2.5×10^4 m^3 of CH-TRU waste would be generated for disposal in WIPP. This was DOE's estimate of the projected inventory destined for WIPP when CRA-2004 was submitted.

This estimate has been updated for the CRA-2004 PABC. For the CRA-2004 PABC, the DOE estimates that in addition to the stored waste at the sites, approximately 3.5×10^4 m^3 of CH-TRU waste will be generated for disposal in WIPP (see Table 5). The CRA-2004 PABC estimate represents an increase of 10,000 m^3 in the projected category over the CRA-2004 estimate. The increase in projected CH-TRU waste is a result of adding the pre-1970 buried waste from INEEL as discussed in Section 3.2. This is offset by a decrease in the projected CH-TRU waste volume from Hanford-RL due to corrections made to their waste streams (see Section 3.1).

4.1.3.2 RH-TRU Waste

The projected RH-TRU waste inventory estimates for CRA-2004 were less than what they were in the CCA inventory estimate. The greatest decrease in projected RH-TRU waste inventory was reported by Hanford-RL. In their reporting for CRA-2004, the TRU waste sites estimated that in addition to the stored waste at the sites, approximately 1.0×10^4 m^3 of RH-TRU waste would be generated for disposal in WIPP. This was DOE's estimate of the projected inventory destined for WIPP when CRA-2004 was submitted.

This estimate has been updated for the CRA-2004 PABC. For the CRA-2004 PABC, the DOE estimates that in addition to the stored waste at the sites, approximately 2.1×10^3 m^3 of RH-TRU waste would be generated for disposal in WIPP (see Table 6). The CRA-2004 PABC estimate represents a decrease of 7,900 m^3 in the projected RH-TRU waste category when compared to the CRA-2004 estimate. The decrease in projected RH-TRU waste is a result of corrections made to the Hanford-RL waste streams (Section 3.1).

4.1.4 Total Disposal Volumes

Overall, the anticipated CH-TRU waste inventory (stored plus projected) remaining for disposal at WIPP increased in CRA-2004 when compared to the CCA. The anticipated CH-TRU inventory (stored plus projected) remaining for disposal at WIPP increased in the CRA-2004 PABC inventory when compared to CRA-2004 because of the addition of the pre-1970 buried waste from INEEL. None the less, in the CRA-2004 PABC inventory, the total inventory (anticipated inventory plus emplaced inventory as of September 30, 2002) is less than the limit of

168, 485 m^3. Therefore, for PA calculations, the CH-TRU waste projected inventory is scaled to produce a disposal inventory equal to the repository limit.

For CH waste the scaling factor is calculated using Equation 1.

$$SF_{CH} = (168{,}485\ m^3 - V_s - V_e)/\ V_p \qquad (1)$$

Where

SF_{CH} is the scaling factor for the CH waste volume
V_s is the total stored volume
V_e is the total emplaced volume as reported in the WWIS
V_p is the total projected volume

The anticipated volume of RH-TRU reported for the CRA-2004 was greater than the repository limit for RH-TRU. The same is true for the CRA-2004 PABC, although to a lesser extent. Therefore, for PA calculations, the RH-TRU projected inventory is scaled down so the total disposal volume of RH TRU waste equals the repository limit of 7,079 m^3.

For RH waste the scaling factor is calculated using Equation 2.

$$SF_{RH} = (7{,}079\ m^3 - V_s - V_e)/\ V_p \qquad (2)$$

Where

SF_{RH} is the scaling factor for the RH waste volume
V_s is the total stored volume
V_e is the total emplaced volume as reported in the WWIS
V_p is the total projected volume

The disposal volumes are calculated using the scaling factors as shown in Equations 3 and 4.

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

Where

SF_{CH} is the scaling factor for the CH-TRU waste
$v_{CH\text{-}Disposal}$ is the disposal volume (m^3)

v_p is the projected inventory volume (m^3)
v_s is the stored inventory volume (m^3)
v_e is the emplaced inventory volume (m^3)

$$v_{RH\text{-}Disposal} = SF_{RH} (v_p) + v_s + v_e \tag{4}$$

Where

SF_{RH} is the scaling factor for the RH-TRU waste
$V_{RH\text{-}Disposal}$ is the disposal volume (m^3)
v_p is the projected inventory volume (m^3)
v_s is the stored inventory volume (m^3)
v_e is the emplaced inventory volume (m^3)

The scaling factor used in the CRA-2004 for CH-TRU waste was 2.11. The scaling factor for RH-TRU waste was 0.172. The scaling factor used in the CRA-2004 PABC for CH-TRU waste is 1.48 and the scaling factor for RH-TRU waste for the CRA-2004 PABC is 0.861. The resulting disposal volumes for PA for CRA-2004 and the CRA-2004 PABC are shown in Table 7.

4.2 CONTAINER TYPES

The number of containers and types of containers in the CRA-2004 inventory and the CRA-2004 PABC inventory are shown in Table 8. Container types are not modeled specifically in PA. It is recognized that 5x5x8 boxes are not approved disposal containers and RH waste in 55-gallon drums would have to be reconfigured in a RH canister for disposal at WIPP. However, information about the number and type of containers is needed so that estimates of CPR from emplacement materials can be made. The CCA discussed the use of 85-gallon drums, 55-gallon drums, and standard waste boxes (SWBs) for disposal of TRU waste in WIPP. All of the sites that are shipping or will be shipping waste to WIPP are using 55-gallon drums and SWBs. Most of the 85-gallon drums are from RFETS. The CRA-2004 inventory contained three additional container types: TDOPs, 5x5x8 boxes, and 100-gallon drums. INEEL is using 100-gallon drums for disposal of supercompacted waste from the AMWTP. SRS plans to use 5x5x8 boxes for disposal. INEEL and SRS are using TDOPs for disposal.

There are only minor differences in the numbers of 55-gallon drums, SWBs, 5x5x8 boxes, and RH-canisters between the CRA-2004 inventory and the CRA-2004 PABC inventory. The number of 100-gallon drums, TDOPs and 85-gallon drums did not change for the CRA-2004 PABC inventory. These containers are from waste streams that did not change between CRA-2004 and CRA-2004 PABC.

Table 7. CH-TRU and RH-TRU Waste Disposal Inventory in Support of CRA-2004 PABC, CRA-2004 and CCA PA

TRU Waste Site	Disposal CH-TRU Inventory[a] (m^3)	Disposal RH-TRU Inventory[b] (m^3)	Disposal CH-TRU Inventory[c] (m^3)	Disposal RH-TRU Inventory[d] (m^3)	Disposal CH-TRU Inventory[e] (m^3)	Disposal RH-TRU Inventory[f] (m^3)
	CRA-2004 PABC		CRA-2004 PA		CCA	
Hanford-RL	2.1×10^4	1.3×10^3	4.1×10^4	2.0×10^3	8.0×10^4	2.2×10^4
Hanford-RP	3.9×10^3	4.5×10^3	3.9×10^3	4.5×10^3	---	---
INEEL	9.1×10^4	2.2×10^2	6.4×10^4	2.2×10^2	2.9×10^4	2.2×10^2
LANL	1.7×10^4	1.3×10^2	1.9×10^4	1.2×10^2	2.6×10^4	1.9×10^2
ORNL	6.7×10^2	5.7×10^2	9.5×10^2	1.1×10^2	1.8×10^3	3.0×10^3
RFETS	1.4×10^4	0.0×10^0	1.5×10^4	0.0×10^0	9.7×10^3	0.0×10^0
SRS	1.7×10^4	2.0×10^1	1.8×10^4	4.0×10^0	1.7×10^4	0.0×10^0
SQS	5.0×10^3	3.7×10^2	7.1×10^3	1.5×10^2	4.6×10^3	1.9×10^3
Totals	1.7×10^5	7.1×10^3	1.7×10^5	7.1×10^3	1.7×10^5	2.7×10^4

[a]This is the CRA-2004 PABC TRU waste site inventory scaled as follows: emplaced + stored + 1.48 (projected); [b]This is the CRA-2004 PABC TRU waste site inventory scaled as follows: emplaced + stored + 0.861 (projected); [c]This is the CRA-2004 TRU waste site inventory scaled as follows: emplaced + stored + 2.11 (projected); [d]This is the CRA-2004 TRU waste site inventory scaled as follows: emplaced + stored + 0.172 (projected) [e] This is the CCA TRU waste site inventory scaled as follows: stored + 2.05(projected); [f] This is the CCA TRU waste site inventory unscaled (stored + projected).

Table 8. Number of Containers to be Emplaced in WIPP from the CRA-2004 PABC, CRA-2004 and CCA TRU Waste Inventories

Container Type	Final Form Total Scaled Volume	Number of Containers	Final Form Total Scaled Volume	Number of Containers	Final Form Total Scaled Volume	Number of Containers
	From CRA-2004 PABC Inventory[a]		From CRA-2004 PA Inventory[b]		From CCA Inventory[c]	
55 Gallon Drums	71,634.05	343,654	66,578.32	319,400	---	---
100 Gallon Drums	19,874.76	52,440	19,874.76	52,440	---	---
SWBs	32,258.87	17,031	37,178.79	19,628	---	---
TDOPs	34,191.02	7,138	34,191.02	7,138	---	---
5x5x8	10,293.20	1,818	10,444.63	1,845	---	---
RH Canisters	7,053.99	7,965	7,069.54	7,983	---	---
85 Gallon Drum	200.72	624	200.72	624	---	---
RH in 55 Gallon Drums	4.58	22	0	0	---	---
RH 5x5x8	19.49	3	0	0	---	---
TOTAL	175,530.68	430,695	175,537.78	409,060	---	---

[a]Burns (2005a); [b]Smith and Leigh (2004); [c] Data Unavailable

4.3 MATERIAL DENSITIES

4.3.1 Waste Materials

Analysis of the CRA-2004 inventory estimate and the CCA inventory estimate for CH-TRU waste shows that waste materials expected for shipment to WIPP changed slightly between the time of the CCA and CRA-2004. The relative occurrence (expressed as the $kg/m^3$of a given material in the waste) of iron (Fe), aluminum (Al), and other metal alloys was smaller in the CRA-2004 inventory estimate than it was in the CCA inventory estimate. In addition, the relative occurrence of solidified organics, cement, soils, and vitrified material was smaller in the CRA-2004 inventory estimate than it was in the CCA inventory estimate. In contrast, the relative occurrence of CPR materials and other inorganic materials was larger in the CRA-2004 inventory estimate than it was in the CCA inventory estimate. The CRA-2004 inventory estimate reflected a shift from an expected waste form consisting of 40 percent metals, 15 percent CPR materials and 45 percent other materials reported in the CCA to a waste form that consists of 34 percent metals, 25 percent CPR materials and 41 percent other materials. The CRA-2004 inventory estimate reflected a higher occurrence of CPR materials primarily because of a process change at INEEL. At the time of the CCA, INEEL expected to thermally treat a significant quantity of waste that contained higher than average quantities of CPR materials. Through the process of thermal treatment, the CPR materials in the waste would be destroyed. At the time of the CRA-2004 submittal, INEEL planned to supercompact the waste that they had originally planned to thermally treat. Supercompaction does not destroy CPR materials in the waste. As a consequence, the waste expected to come to WIPP from INEEL at the time of the CRA-2004 submittal had increased CPR materials relative to those reported for the CCA.

Table 9 shows how the CH-TRU waste material inventory was updated for CRA-2004 PABC. The most noticeable difference is the increase in expected quantities of soil. The overall concentration of soil in CH-TRU waste in the CRA-2004 PABC inventory is 110 kg/m^3. It was only 19 kg/m^3 in the CRA-2004 inventory. Thus the CRA-2004 PABC inventory estimate reflects a shift from an expected waste form consisting of 34 percent metals, 25 percent CPR materials and 41 percent other materials reported in CRA-2004 to a waste form that consists of 26 percent metals, 19 percent CPR materials and 55 percent other materials.

Table 9. WIPP CH-TRU Waste Material Disposal Inventory in Support of CRA-2004 PABC, CRA-2004 and CCA PA

Waste Materials	**Average Density Based on CRA-2004 PABC Inventory[a] (kg/m³)**	**Average Density Reported in the CRA-2004[b] (kg/m³)**	**Average Density Reported in the CCA[c] (kg/m³)**
Waste Materials			
Fe-Base Metal/Alloys	1.1×10^{2}	1.1×10^{2}	1.7×10^{2}
Al-Base Metal/Alloys	1.4×10^{1}	1.4×10^{1}	1.8×10^{1}
Other Metal/Alloys	3.2×10^{1}	3.0×10^{1}	6.7×10^{1}
Other Inorganic Materials	4.0×10^{1}	4.2×10^{1}	3.1×10^{1}
Vitrified Materials	5.8×10^{0}	6.2×10^{0}	5.5×10^{1}
Cellulosic Material	6.0×10^{1}	5.8×10^{1}	5.4×10^{1}
Rubber	1.3×10^{1}	1.4×10^{1}	1.0×10^{1}
Plastic	4.3×10^{1}	4.2×10^{1}	3.4×10^{1}
Solidified Inorganic Materials	1.1×10^{2}	7.7×10^{1}	5.4×10^{1}
Solidified Organic Materials	3.3×10^{1}	1.6×10^{1}	5.6×10^{0}
Cement (Solidified)	3.9×10^{1}	2.9×10^{1}	5.0×10^{1}
Soil	$1.t \times 10^{2}$	1.9×10^{1}	4.4×10^{1}

(a)Crawford (2005b); (b)U.S. DOE (2004) (c) U.S. DOE (1996a)

Table 10. WIPP RH-TRU Waste Material Disposal Inventory in Support of CRA-2004 PABC, CRA-2004 and CCA PA

Waste Materials	Average Density Based on CRA-2004 PABC Inventory(a) (kg/m³)	Average Density Reported in the CRA-2004(b) (kg/m³)	Average Density Reported in the CCA(c) (kg/m³)
Waste Materials			
Fe-Base Metal/Alloys	5.9×10^{1}	1.1×10^{2}	1.0×10^{1}
Al-Base Metal/Alloys	5.0×10^{0}	2.5×10^{0}	7.1×10^{0}
Other Metal/Alloys	5.7×10^{1}	3.2×10^{1}	2.5×10^{2}
Other Inorganic Materials	1.6×10^{1}	3.5×10^{1}	6.4×10^{1}
Vitrified Materials	1.2×10^{-1}	5.7×10^{-2}	4.7×10^{0}
Cellulosic Material	9.3×10^{0}	4.5×10^{0}	1.7×10^{1}
Rubber	6.7×10^{0}	3.1×10^{0}	3.3×10^{0}
Plastic	8.0×10^{0}	4.9×10^{0}	1.5×10^{1}
Solidified Inorganic Materials	6.2×10^{1}	3.9×10^{1}	2.2×10^{1}
Solidified Organic Materials	8.3×10^{-1}	4.0×10^{0}	9.3×10^{-1}
Cement (Solidified)	1.9×10^{0}	8.7×10^{-1}	1.0×10^{0}
Soil	5.0×10^{1}	2.6×10^{1}	---

(a)Crawford (2005b); (b)U.S. DOE (2004) (c) U.S. DOE (1996a)

Table 10 shows how the RH-TRU waste material inventory was updated for CRA-2004 PABC. The CRA-2004 PABC inventory estimate reflects a shift from an expected waste form consisting of 55 percent metals, 5 percent CPR materials and 40 percent other materials reported in CRA-2004 to a waste form that consists of 44 percent metals, 9 percent CPR materials and 47 percent other materials.

4.3.2 Packaging Materials

The container packaging materials for CH-TRU waste include the container material and packaging materials inside the container. Container packaging materials are primarily steel, plastic, and lead, from liners, shielding and dunnage. The CRA-2004 inventory estimate reflected a higher occurrence of steel, a lower occurrence of plastic, and a higher occurrence of lead in the packages coming to WIPP when compared to the CCA inventory estimate. Additional steel in packages in the CRA-2004 inventory estimate resulted from the planned increased use of overpacks (Type A, pipe overpacks, TDOPs, 100-gallon drum overpacks, etc.). The increased use of overpack containers in the CRA-2004 inventory estimate also led to a reduction in the use of plastic liners in packages coming to WIPP. Thus, the density of plastic packaging material was smaller in the CRA-2004 inventory estimate than it was in the CCA inventory estimate.

Table 11 and Table 12 show how the CH-TRU and RH-TRU container packaging material inventory was updated for the CRA-2004 PABC. Differences between the CRA-2004 values and the CRA-2004 PABC values are attributable to inventory corrections made in response to the review provided by WTS (Warren, 2004) and are not limited to any particular waste stream.

Table 11. WIPP CH-TRU Container Packaging Material Disposal Inventory in Support of CRA-2004 PABC, CRA-2004 and CCA PA

Waste Materials	Average Density Based on CRA-2004 PABC Inventory[(a)] (kg/m^3)	Average Density Reported in the CRA-2004[(b)] (kg/m^3)	Average Density Reported in the CCA[(c)] (kg/m^3)
Container Packaging Materials			
Steel	1.7×10^2	1.7×10^2	1.4×10^2
Plastic and Liners	1.7×10^1	1.6×10^1	2.6×10^1
Lead	1.3×10^{-2}	1.4×10^{-2}	0.0×10^0

(a)Crawford (2005b); (b)U.S. DOE (2004) (c) U.S. DOE (1996a)

Table 12. WIPP RH-TRU Container Packaging Material Disposal Inventory in Support of CRA-2004 PABC, CRA-2004 and CCA PA

Waste Materials	Average Density Based on CRA-2004 PABC Inventory[(a)] (kg/m^3)	Average Density Reported in the CRA-2004 (kg/m^3) [(b)]	Average Density Reported in the CCA (kg/m^3) [(c)]
Container Packaging Materials			
Steel	5.4×10^2	4.8×10^2	4.5×10^2
Plastic and Liners	3.1×10^0	1.4×10^0	3.1×10^0
Lead	4.2×10^2	4.4×10^2	4.7×10^2

(a)Crawford (2005b); (b)U.S. DOE (2004); (c) U.S. DOE (1996a)

4.3.3 Emplacement Materials

Emplacement materials are materials external to the container used to aid emplacement operations. Emplacement materials include, but are not limited to, plastic that is wrapped around 7-packs of drums, plastic and cardboard slipsheets placed between waste packages stacked on top of one another in the repository, and the plastic supersacks used to emplace MgO. The PA for CRA-2004 inventory did not include CPR added to the repository as part of the emplacement process. Estimates of the masses of CPR added to the repository because of emplacement materials based on the CRA-2004 PABC inventory (Burns, 2005b) are shown in Table 13. Using the CRA-2004 PABC inventory, an estimate of 2.07×10^5 kg of cellulose and 1.48×10^6 kg plastic (Burns, 2005b) would be added to the repository as part of the emplacement process.

Table 13. WIPP Emplacement Material Disposal Inventory in Support of CRA-2004 PABC

Based on CRA-2004 Inventory PABC (kg)		
Total Cellulose (kg)	Total Rubber (kg)	Total Plastic (kg)
2.07×10^5	0	1.48×10^6

Burns (2005b)

4.4 RADIONUCLIDE ACTIVITIES

TRU waste sites derive estimates of radionuclide activities based on acceptable knowledge including any quantitative results that may be available. In the data call for the CCA and CRA-2004, TRU waste sites reported estimated values for radionuclide activities on a waste stream basis including both the stored and projected components (U. S. DOE, 1996a; U. S. DOE, 2004). The actual activity of disposed waste is determined quantitatively prior to shipment. An additional data call was not performed for CRA-2004 PABC; however, some radionuclide activities changed in the CRA-2004 PABC inventory as discussed in Section 3 of this report.

In addition, some radionuclide activities changed in the CRA-2004 PABC inventory as a secondary effect of the volume changes. The disposal radionuclide inventory for PA is a calculated value based on the radionuclide activities reported for emplaced, stored, and projected waste. The radionuclide activities in the projected component of the waste are scaled using the scaling factor and added to the radionuclide activities for stored and emplaced components of the waste. For CH-TRU waste, the total Ci for each radionuclide is divided by the CH-TRU disposal volume to obtain a Ci per cubic meter concentration for each radionuclide on a repository level. For RH-TRU waste, the total decayed Ci for each radionuclide is divided by the RH-TRU disposal volume to obtain a radionuclide concentration in Ci per cubic meter.

The WIPP disposal radionuclide inventories used in the CCA, CRA-2004 and CRA-2004 PABC are shown in Table 14. Activities at closure (2033) are used in PA. Radioactive decay and build-up calculations were performed using the commercially available code ORIGEN2 (Croff, 1980). The levels of radioactivity reported include contributions from both parent and daughter decay products. The table shows individual radionuclide activity in Ci at closure and in EPA Units at closure and after 10,000 years.

Based on the total Ci shown in Table 14 and to the extent to which each radionuclide is regulated by Section 191.13, approximately 98.3 percent of the regulated CH-TRU activity at repository closure is contributed by ^{238}Pu, ^{239}Pu, ^{240}Pu, and ^{241}Am. Approximately 99.5 percent of the regulated RH-TRU activity at repository closure is contributed by ^{137}Cs, ^{90}Sr, ^{239}Pu, ^{240}Pu, ^{241}Am, and ^{238}Pu. The same radionuclides were identified in the CCA and CRA-2004 as the largest contributors to the regulated CH-TRU waste and RH-TRU waste activity at repository closure.

Overall, activity at 2033 for all TRU radionuclides has decreased from 3.44×10^6 Ci reported in the CCA to 2.48×10^6 Ci in the CRA-2004 inventory estimate to 2.32×10^6 Ci in the CRA-2004 PABC inventory estimate.

In addition to the inventory in Table 14, DOE has determined the average radionuclide inventory for each of the 767 (690 CH-TRU waste streams and 77 RH-TRU waste streams) CH-TRU and RH-TRU waste streams (Fox, 2005). In the conceptual model for PA, the distribution of 690 CH-TRU waste streams and one RH-TRU waste stream (representing all 77 of the RH-TRU waste) are randomly sampled in the PA to determine releases due to inadvertent human intrusion.

Table 14. *Radionuclide Activities In the CRA-2004 PABC, CRA-2004, and CCA TRU Waste Inventories*

Radionuclide	CRA-2004 PABC Inventory Values(a)			Values Reported in CRA-2004(b)			Values Reported in CCA		
	Inventory at Closure (Ci)(f)	EPA Units		Inventory at Closure (Ci)	EPA Units		Inventory at Closure (Ci)	EPA Units	
		At Closure	At 10,000 years		At Closure	At 10,000 years		At Closure(c)	At 10,000 years(d)
^{238}Pu	1.13×10^{6}	4.86×10^{3}	2.91×10^{-23}	1.25×10^{6}	5.04×10^{3}	2.61×10^{-23}	1.94×10^{6}	5.64×10^{3}	1.32×10^{-22}
^{239}Pu	5.82×10^{5}	2.51×10^{3}	1.88×10^{3}	6.65×10^{5}	2.68×10^{3}	2.01×10^{3}	7.95×10^{5}	2.31×10^{3}	1.73×10^{3}
^{241}Am	5.17×10^{5}	2.23×10^{3}	2.87×10^{-4}	4.58×10^{5}	1.84×10^{3}	2.48×10^{-4}	4.88×10^{5}	1.42×10^{3}	1.78×10^{-4}
^{240}Pu	9.54×10^{4}	4.11×10^{2}	1.42×10^{2}	1.08×10^{5}	4.36×10^{2}	1.51×10^{2}	2.14×10^{5}	6.22×10^{2}	2.16×10^{2}
^{137}Cs	2.07×10^{5}	8.92×10^{1}	0.00×10^{0}	1.79×10^{5}	7.19×10^{1}	0.00×10^{0}	9.31×10^{4}	2.71×10^{1}	0.00×10^{0}
^{90}Sr	1.76×10^{5}	7.61×10^{1}	0.00×10^{0}	1.42×10^{5}	5.71×10^{1}	0.00×10^{0}	8.73×10^{4}	2.54×10^{1}	0.00×10^{0}
^{233}U	1.23×10^{3}	5.29×10^{0}	5.08×10^{0}	1.27×10^{3}	5.12×10^{0}	4.91×10^{0}	1.95×10^{3}	5.67×10^{0}	5.44×10^{0}
^{229}Th	5.21×10^{0}	2.25×10^{-2}	3.15×10^{0}	5.39×10^{0}	2.17×10^{-2}	3.04×10^{0}	9.97×10^{0}	2.90×10^{-2}	3.40×10^{0}
^{234}U	3.44×10^{2}	1.48×10^{0}	3.17×10^{0}	3.19×10^{2}	1.28×10^{0}	3.03×10^{0}	7.51×10^{2}	2.18×10^{0}	4.10×10^{0}
^{230}Th	1.80×10^{-1}	7.76×10^{-3}	2.76×10^{0}	1.76×10^{-1}	7.07×10^{-3}	2.64×10^{0}	3.06×10^{-1}	8.90×10^{-3}	3.55×10^{0}
^{238}U	2.17×10^{2}	9.35×10^{-1}	9.35×10^{-1}	1.54×10^{2}	6.21×10^{-1}	6.21×10^{-1}	5.01×10^{1}	1.46×10^{-1}	1.46×10^{-1}
^{237}Np	1.22×10^{1}	5.25×10^{-2}	5.14×10^{-1}	1.01×10^{1}	4.06×10^{-2}	4.27×10^{-1}	6.49×10^{1}	1.89×10^{-1}	4.83×10^{-1}
^{232}Th	3.42×10^{0}	1.47×10^{-1}	1.47×10^{-1}	6.83×10^{0}	2.75×10^{-1}	2.75×10^{-1}	1.01×10^{0}	2.94×10^{-2}	2.94×10^{-2}
^{226}Ra	4.56×10^{0}	1.97×10^{-2}	2.16×10^{-1}	6.28×10^{0}	2.53×10^{-2}	2.07×10^{-1}	1.14×10^{1}	3.31×10^{-2}	2.77×10^{-1}
^{210}Pb	3.59×10^{0}	1.55×10^{-2}	2.16×10^{-1}	4.94×10^{0}	1.99×10^{-2}	2.07×10^{-1}	8.75×10^{0}	2.54×10^{-2}	2.77×10^{-1}
^{242}Pu	1.27×10^{1}	5.46×10^{-2}	5.38×10^{-2}	2.71×10^{1}	1.09×10^{-1}	1.07×10^{-1}	1.17×10^{3}	3.40×10^{0}	3.34×10^{0}
^{243}Am	7.87×10^{1}	3.39×10^{-1}	2.57×10^{-1}	2.17×10^{1}	8.75×10^{-2}	5.74×10^{-2}	3.25×10^{1}	9.45×10^{-2}	3.69×10^{-2}
^{236}U	2.87×10^{0}	1.24×10^{-2}	8.75×10^{-2}	1.65×10^{0}	6.66×10^{-3}	8.62×10^{-2}	6.72×10^{-1}	1.95×10^{-3}	1.16×10^{-1}
^{235}U	5.01×10^{0}	2.16×10^{-2}	4.31×10^{-2}	2.28×10^{0}	9.18×10^{-3}	3.21×10^{-2}	1.75×10^{1}	5.09×10^{-2}	7.06×10^{-2}
^{14}C	2.41×10^{0}	1.04×10^{-2}	3.10×10^{-3}	3.25×10^{0}	1.31×10^{-2}	3.90×10^{-3}	1.28×10^{1}	3.72×10^{-2}	1.11×10^{-2}
^{232}U	1.02×10^{1}	4.40×10^{-2}	0.00×10^{0}	3.06×10^{0}	1.23×10^{-2}	0.00×10^{0}	1.79×10^{1}	5.20×10^{-2}	0.00×10^{0}
^{227}Ac	6.86×10^{-1}	2.96×10^{-3}	9.37×10^{-3}	9.57×10^{-1}	3.85×10^{-3}	8.06×10^{-3}	5.05×10^{-1}	1.47×10^{-3}	1.28×10^{-2}
^{231}Pa	8.69×10^{-1}	3.75×10^{-3}	9.36×10^{-3}	1.21×10^{0}	4.88×10^{-3}	8.06×10^{-3}	4.67×10^{-1}	1.36×10^{-3}	1.28×10^{-2}
^{243}Cm	4.14×10^{-1}	1.79×10^{-3}	0.00×10^{0}	4.07×10^{-1}	1.64×10^{-3}	0.00×10^{0}	2.07×10^{1}	6.02×10^{-2}	0.00×10^{0}
^{248}Cm	7.43×10^{-2}	3.20×10^{-4}	3.14×10^{-4}	9.32×10^{-2}	3.75×10^{-4}	3.68×10^{-4}	3.72×10^{-2}	1.08×10^{-4}	1.06×10^{-4}
^{245}Cm	1.71×10^{-02}	7.38×10^{-5}	3.74×10^{-5}	1.92×10^{-2}	7.72×10^{-5}	3.97×10^{-5}	1.15×10^{-2}	3.40×10^{-5}	$1.85 \times 10-^{5}$
^{244}Pu	5.53×10^{-3}	2.38×10^{-5}	2.39×10^{-5}	1.10×10^{-3}	4.44×10^{-6}	4.47×10^{-6}	1.51×10^{-6}	4.34×10^{-9}	1.26×10^{-8}
^{244}Cm	2.13×10^{3}	(e)	(e)	2.51×10^{3}	(e)	(e)	7.44×10^{3}	(e)	(e)
^{241}Pu	4.48×10^{5}	(e)	(e)	5.38×10^{5}	(e)	(e)	3.94×10^{5}	(e)	(e)

(a)Leigh and Fox (2005) for values at 2033, and 12,033;(b) U.S. DOE (2004);(c)U.S.DOE (1996a) Appendix WCA, Attachment WCA.8.1;(d)Sanchez (1997);(e) ^{241}Pu and ^{244}Cm are not listed by Part 191 of the Code of Federal Regulations but are included because their daughters, ^{241}Am and ^{240}Pu, respectively, are significant to performance;(f)At closure is decayed through 2033.

4.5 CHEMICAL COMPONENTS IN TRANSURANIC WASTE

As part of the data call for CRA-2004, the TRU waste sites were asked to provide information about the chemical components of the waste. The sites were asked about complexing agents (acetate, citrate, oxylate, sodium ethylenediaminetetraacetic acid (EDTA), oxyanions (nitrate, sulfate, and phosphate), cement, and pyrochemical salts. The masses of cement and pyrochemical salts are not used in PA calculations and therefore are not discussed below. The interested reader can consult Appendix B-7 of the TWBIR Revision 3 (U. S. DOE, 1996a), Leigh and Lott (2003), and Howard (2005) for information about estimates of the mass of cement expected for disposal in WIPP; Crawford (2003b) contains information about pyrochemical salts in TRU waste. The following is a summary of the information available about complexing agents and oxyanions in TRU waste coming to WIPP.

4.5.1 Complexing Agents

Information about potential complexing agents disposed in WIPP is important because complexing agents impact actinide solubility. Information about complexing agents was reported in the TWBIR Revision 3. 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 the thermal treatment assumption. Since the DOE strategy currently and at the time CRA-2004 was submitted does not include thermal treatment, the data reported without the thermal treatment assumption in Appendix B-4 of the TWBIR Revision 3 was deemed relevant for use in CRA-2004.

In the data call for CRA-2004, none of the TRU waste sites updated the complexing agent information in Appendix B-4 of TWBIR Revision 3. Therefore, the TWBIR Revision 3 Appendix B-4 data was carried forward into CRA-2004 without change. Two sites, RFETS and Hanford RP, reported the existence of complexing agents in waste streams that were first reported in CRA-2004. RFETS reported that sodium EDTA might be present at trace levels (< 1 wt%) in their new waste streams. This resulted in a slight increase in the total potential mass of sodium EDTA in the repository when the CRA-2004 inventory is compared to the CCA inventory. Hanford-RP identified the presence of sodium acetate and sodium oxalate in their new waste streams. This resulted in a significant increase in sodium acetate and sodium oxalate when the CRA-2004 inventory is compared to the CCA inventory. Total masses as well as site-specific breakdowns of acetic acid, sodium acetate, citric acid, sodium citrate, oxalic acid, sodium oxalate, and sodium EDTA estimated for the WIPP repository are presented in Table 15.

None of the updates made to the CRA-2004 inventory to obtain the CRA-2004 PABC inventory affected complexing agent masses. Therefore, total masses and site breakdowns for complexing agents in the CRA-2004 PABC inventory and the CRA-2004 inventory are identical. However, in Comment C-24-5, the EPA requested waste-stream-level breakdowns for complexing agents. An analysis was performed by Crawford (2004a) to delineate this waste stream information. The resulting waste-stream-level breakdown for complexing agents is shown in Table 16.

4.5.2 Oxyanions

Information about oxyanions (in particular nitrate, sulfate, and phosphate) disposed in WIPP is important because oxyanions impact microbial gas generation. This information was reported in the TWBIR Revision 3 Appendix B-6 in a number of formats. The oxyanion mass densities for individual waste streams reported in Appendix B-6 of the TWBIR Revision 3 were deemed relevant for use in CRA-2004.

In the data call for CRA-2004, none of the TRU waste sites updated the oxyanion mass densities in Appendix B-6 of TWBIR Revision 3. Therefore, the TWBIR Revision 3 oxyanion mass densities from Appendix B-6 were carried forward into CRA-2004. For the waste streams where oxyanion mass densities were reported in Appendix B-6 of TWBIR Revision 3, nitrate, sulfate, and phosphate masses were calculated using scaled waste stream volumes from CRA-2004 (Leigh and Sparks-Roybal, 2003). In addition, Hanford-RP and LANL reported some new waste streams and gave estimates of the nitrate, sulfate and phosphate masses in those waste streams (Leigh and Sparks-Roybal, 2003). RFETS provided revised nitrate, sulfate, and phosphate masses for one of their waste streams (Leigh and Sparks-Roybal, 2003). The sum of all of this information provided total oxyanion masses for CRA-2004.

None of the updates made to the CRA-2004 inventory to obtain the CRA-2004 PABC inventory directly affected oxyanion masses. However, since scaled waste stream volumes were used to determine masses of nitrate, sulfate, and phosphate for the waste streams where oxyanion mass densities were reported in Appendix B-6 of TWBIR Revision 3, the analysis of Leigh and Sparks-Roybal (2003) had to be repeated for the CRA-2004 PABC using the scaled masses for CRA-2004 PABC (Crawford, 2005a). Total oxyanion masses as well as site-specific breakdowns are presented in Table 17. The corresponding waste-stream-level breakdown for oxyanions is shown in Table 18.

The CRA-2004 PABC estimate of nitrate mass in the WIPP repository (2.67×10^6 kg) is larger than the estimate made for the CCA (U. S. DOE, 1996a) which was 1.62×10^6 kg, and is slightly higher than the estimate made for CRA-2004 (U. S. DOE, 2004) which was 2.51×10^6 kg. 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 CRA-2004 PABC estimate of sulfate mass in the WIPP repository (4.43×10^5 kg) is less than the estimate made for the CCA (U. S. DOE, 1996a) which was 6.33×10^5 kg but is slightly higher than the estimate made for CRA-2004 (U. S. DOE, 2004) (which was 4.21×10^5 kg).

Table 15. Mass of Potential Complexing Agents in the WIPP Disposal Inventory for CCA, CRA-2004 and CRA-2004 PABC

	Acetic Acid (kg)	Sodium Acetate (kg)	Citric Acid (kg)	Sodium Citrate (kg)	Oxalic Acid (kg)	Sodium Oxalate (kg)	Sodium EDTA (kg)
CCA Estimate [a]							
RFETS	132	1,110	90	400	90	---	23
LANL	10	---	1,100.5	---	13,706	---	---
Hanford RP	---	---	---	---	---	---	---
Total	142	1,110	1,190.5	400	13,796	---	23
CRA-2004 Estimate[b]							
RFETS	132	1,110	90	400	90	---	25.6
LANL	10	---	1,100.5	---	13,706	---	---
Hanford RP	---	7,400	---	---	---	33,940	---
Total	142	8,510	1,190.5	400	13,796	33,940	25.6
CRA-2004 PABC Estimate[c]							
RFETS	132	1,110	90	400	90	---	25.6
LANL	10	---	1,100.5	---	13,706	---	---
Hanford RP	---	7,400	---	---	---	33,940	---
Total	142	8,510	1,190.5	400	13,796	33,940	25.6

[a]U.S. DOE (1996a); [b]U.S. DOE (2004); [c] Leigh (2005b)

Table 16. Waste Stream Breakdown of Complexing Agents in the CRA-2004 PABC Inventory [(a)]

Waste Stream Identifier	Acetic Acid (kg)	Sodium Acetate (kg)	Citric Acid (kg)	Sodium Citrate (kg)	Oxalic Acid (kg)	Sodium Oxalate (kg)	EDTA (kg)
IN-W218.909	130	1,100	86	384	86	0	22
RF-MT0007	0	0	0	0	0	0	0
RF-MT0541	0	0	0	0	0	0	3
RF-MT0803	0	1	0	0	0	0	0
RF-MT0807	5	43	4	16	4	0	1
RP-W013	0	0	0	0	0	26,000 [(b)]	0
RP-W016	0	7,400 [(b)]	0	0	0	6,490 [(b)]	0
RP-W754	0	0	0	0	0	1,450 [(b)]	0
LA-TA-50-17	0	0	37	0	454	0	0
LA-TA-50-10	0	0	0	0	2	0	0
LA-TA-50-19	2	0	200	0	2,480	0	0
LA-TA-55-38	1	0	143	0	1,780	0	0
LA-TA-55-41	0	0	7	0	92	0	0
LA-TA-55-19	5	0	546	0	6,810	0	0
LA-TA-55-20	1	0	106	0	1,320	0	0
LA-TA-55-43	0	0	11	0	136	0	0
LA-TA-55-44	0	0	39	0	484	0	0
LA-TA-55-62	0	0	12	0	154	0	0

[(a)]Crawford (2004a) (b) Crawford and Leigh (2003)

Table 17. Mass of Oxyanions in the WIPP Disposal Inventory for CCA, CRA-2004 and CRA-2004 PABC

	Nitrate (kg)	Sulfate (kg)	Phosphate (kg)
CCA Estimate (a)			
RFETS	1.27×10^4	4.44×10^4	---
INEEL	3.09×10^5	5.48×10^3	---
LANL	1.30×10^6	5.82×10^5	---
LLNL	---	8.51×10^2	---
Total	1.62×10^6	6.33×10^5	---
CRA-2004 Estimate(b)			
RFETS	9.28×10^3	5.56×10^4	8.51×10^1
INEEL	7.82×10^5	1.03×10^4	---
LANL	5.56×10^5	3.18×10^5	---
Hanford RP	1.14×10^6	3.54×10^4	1.05×10^5
LLNL	---	1.22×10^3	---
Total	2.51×10^6	4.21×10^5	1.05×10^5
CRA-2004 PABC Estimate(c)			
RFETS	9.28×10^3	5.53×10^4	8.51×10^1
INEEL	7.82×10^5	1.03×10^4	---
LANL	7.35×10^5	3.41×10^5	---
Hanford RP	1.14×10^6	3.54×10^4	1.05×10^5
LLNL	---	1.03×10^3	---
Total	2.67×10^6	4.43×10^5	1.05×10^5

(a)U.S. DOE (1996a); (b)Leigh and Sparks-Roybal (2003); (c)Crawford (2005a)

Table 18. Waste Stream Breakdown of Oxyanions in the CRA-2004 PABC Inventory [(a)]

Waste Stream Identifier	Nitrate (kg)	Sulfate (kg)	Phosphate (kg)
IN-W164.153	---	5.41E+02	---
IN-W216.98	5.11E+05	7.04E+03	---
IN-W218.909	8.37E+04	2.09E+02	---
IN-W220.114	3.80E+04	5.23E+02	---
IN-W228.101	1.47E+05	2.03E+03	---
IN-W315.601	1.83E+03	---	---
LA-TA-03-28	5.68E+02	9.04E+01	---
LA-TA-03-30	3.72E+01	3.46E+01	---
LA-TA-21-13	1.85E+03	2.94E+02	---
LA-TA-21-15	1.16E+02	2.23E+01	---
LA-TA-21-16	6.27E+03	5.83E+03	---
LA-TA-21-43	2.89E+05	4.60E+04	---
LA-TA-48-01	2.51E+01	4.86E+00	---
LA-TA-50-15	6.03E+03	1.17E+03	---
LA-TA-50-17	1.26E+04	2.01E+03	---
LA-TA-50-18	7.64E+03	1.22E+03	---
LA-TA-55-19	5.80E+04	5.40E+04	---
LA-TA-55-30	1.04E+05	9.57E+04	---
LA-TA-55-32	2.45E+02	2.25E+02	---
LA-TA-55-33	2.67E+02	5.16E+01	---
LA-TA-55-34	2.39E+05	---	---
LA-TA-55-38	---	1.25E+05	---
LA-TA-55-41	3.09E+03	2.88E+03	---
LA-TA-55-44	1.22E+03	1.14E+03	---
LA-TA-55-49	9.04E+02	8.32E+02	---
LA-TA-55-53	4.79E+03	4.46E+03	---
LL-W019	---	1.03E+03	---
RF-MT0001	2.74E+02	3.80E+00	---
RF-MT0007	---	9.04E-02	---
RF-MT0541	8.51E+01	8.51E+01	8.51E+01
RF-MT0800	3.22E+03	4.43E+01	---
RF-MT0801	---	5.52E+04	---
RF-MT0803	1.51E+02	2.07E+00	---
RF-MT0807	5.55E+03	1.39E+01	---
RP-W013	4.40E+05	1.43E+04	1.80E+04
RP-W016	5.05E+05	1.35E+04	1.29E+04
RP-W754	7.31E+04	7.47E+02	1.12E+04
RP-W755	1.22E+05	6.86E+03	6.33E+04

(a)Crawford (2005a)

The CRA-2004 PABC estimate of phosphate mass in the WIPP repository (1.05×10^5 kg) is significant when compared to the CCA (U. S. DOE, 1996a) value which was zero, and is the same as the estimate for the CRA-2004 (U. S. DOE, 2004). There were no reportable quantities of phosphate in the waste streams identified for disposal in WIPP at the time of the CCA (U. S. DOE, 1996a). In contrast, the CRA-2004 and CRA-2004 PABC inventories contain the tank waste from Hanford RP which was identified in the CCA as waste that could potentially come to

WIPP but was not included in the CCA inventory estimate. The tank waste from Hanford RP is the primary source of phosphate in the CRA-2004 and CRA-2004 PABC inventories.

5. SUMMARY

Inventory estimates are inherently uncertain. These estimates are a compilation of both existing and projected waste volumes that are scaled to the repository volume limit. For the CCA, no waste had been emplaced in WIPP, and the entire repository scaled volume was highly uncertain. As time progresses, uncertainty is reduced since the ratio of the emplaced and existing waste volume to the projected waste volume increases. By default, each recertification waste estimate will contain better inventory estimates than the previous. It has always been anticipated that WIPP waste inventory estimates would change as the DOE characterizes the contents of waste containers prior to shipment to WIPP and as new TRU wastes are generated.

The primary objective of this analysis is to demonstrate that the CRA-2004 PABC is based on a TRU waste inventory that adequately represents the inventory of materials expected for disposal over the lifetime of WIPP. This report addresses the methods used to prepare the CRA-2004 TRU waste inventory (Section 2). It also addresses the updates that were made to the CRA-2004 inventory to obtain the CRA-2004 PABC inventory. Finally, this report documents the CRA-2004 PABC inventory (emplaced, stored, and projected waste) in terms of volumes, non-radioactive components and radioactive components that were used in PA.

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7. APPENDIX A

TWBID Rev. 2.1 Data Rev	CHANGES MADE FOR DATA REVISION	Date range
D.0.00	Updated CCA TWBID with site submittal data.	11/13/2002 to 3/18/2003
D.0.01	Corrected as Generated data for RL RH canisters; Entered Generation/Assay Year to 2002 for LLNL; Corrected Hanford RL drums counts per site submittal Hbir87a1.mdb table wcV and added final form internal volume for RL waste stream; made site changes in response to Final Data Verification for ANL-W, INEEL, NTS, KAPL, ORNL, WV, and SRS.	3/19/2003 to 3/20/2003
D.0.02	Changes were made as requested by this site in response to the Final Data Verification Request for ANL-W.	3/21/2003 to 3/21/2003
D.0.03	Changes were made as requested by this site in response to the Final Data Verification Request for ANL-W; Corrected INEEL waste material parameter input to conform to the droplist of WMP options in the database.	3/21/2003 to 3/21/2003
D.1.00	Final Form containers were rounded to next integral number for As-generated and Final Form waste for ANL-W, Bettis, ETEC, INEEL, Hanford-RL, Hanford-RP, KAPL, KAPL-NFS, SNL, SPRU, GE-VNC, ORNL, SRS and WV; Four LANL and one Hanford -RL waste stream were assigned to nonWIPP shippable waste streams because the FWF for the waste streams was "unknown"; SRS waste stream changes for period of generation for one waste stream, and TRUCON codes for 4 waste streams per telecon with Joe D'Amelio; Final Waste Forms were assigned to waste streams based on Waste Matrix Code submittals for RFETS, and Emplaced waste; EPA codes added to site data at ETEC, and SRS; The inventory date for Bettis was corrected to 9/30/02; Corrected the final form waste volume to 6 drums for ETEC based on what had been shipped to Hanford (ETEC has now been de-inventoried); Removed a blank container type form for Bettis as it was inadvertently added during data entry	3/21/2003 to 3/25/2003
D.1.01	Changed Waste Matrix Code for 1 waste stream at RFETS per site request; Updated WV information per new submittal from the site faxed to S. Lott on 3/25/2003; Entered changes for BCL based on Jim Eide's email dated 3/25/2003 to 10 waste streams; After inspection of records marked record complete box for one LANL and 3 Hanford -RL waste streams;	3/25/2003 to 3/26/2003
D.2.00	Changed Generation date, TRUCON Code, Inventory date, based on March 26 verification requests from BCL for 12 waste streams; Updated WV information for one waste stream; Deleted the Upper Limit of 80 and 200 kg/cubic meter from Packaging Material, Plastic and Packaging Material, Steel, respectively per telephone conversation with Dave Delwiche and Paul deKanel on March 26, 2003 for two KAPL waste streams; Changed the current stored volume to 26 drums per telecon with Adrian Collins on March 26, 2003 and adjusted the waste stream volume for one ANL-W waste stream and deleted comment from one ANL-W waste stream; Changed U-238 concentration to 2.51E-07 per site email; Evaluated blank and duplicate container entries and adjusted container counts for INEEL and Hanford-RL; copied Final form information into As generated for LANL, RFETS, and ANL-W; As generated waste was updated to include projected waste for 41 INEEL and 1 SRS waste stream and was copied in its entirety for 3 LANL waste streams; Estimated Generation year information was removed for 41 INEEL waste streams and 1 SRS waste stream where no projected waste was reported; Entered final verification changes for LANL per email dated 3/26/03 from Pam Rogers that included: corrections to volumes on 7 waste streams; Made change to Waste Matrix Codes for 7 ORNL waste streams per telecon dated March 27, 2003; corrected number of containers needed for 90 cu foot container from 6 to 5 after mistake was found in the routine calculation; removed blank container type forms for 5 LANL, 3 LLNL, 1 Hanford-RP, 1 SRS, 3 WV, 1 ANL-E, waste stream; Corrected As-generated stored volume to projected for two waste streams; Changed the current stored volume from 0.0 cubic meters to 0.34 cubic meters (2 drums) per telecon with Adrian Collins on March 27, 2003; Entered new information for IN-SBW-01B from site submittal; RFETS waste in final form was changed after data review in preparation for PA to accommodate additional As generated waste volume for 3 waste streams; Removed IN-SWB based on calculation from Casey and Lott dated March 7, 2003 from WIPP Shippable Inventory; Adjusted final waste form to accommodate reported As generated and overpacked waste for SWBs and TDOPs to account for waste only in approximately 63 waste streams at INEEL; containers for 42 INEEL waste streams were rounded to next integral number; Deleted 11 Hanford RL waste streams based on email from the site dated 3/27/03; Adjusted Final Form volume at Bettis for T001 waste stream to accommodate As-generated waste volume; Changed the radionuclide concentration for Ni-63 from 2.01 E-06 to 2.01E-04 per telephone conversation with Paul deKanel of KAPL for KA-W016 waste stream	3/26/2003 to 3/27/2003

TWBID Rev. 2.1 Data Rev	CHANGES MADE FOR DATA REVISION	Date range
D.3.00	Entered Changes for INEEL RH Waste streams to include 30-gallon drums and the final form container to the RH canister to overpack 30-gallon drums for 1 waste stream, 55-gallon drums not RH canisters for 2 waste stream, to RH canisters for 2 waste streams, and to overpacked 55-gallon drums in RH canisters for 2 waste streams and removed the D002 code for the SBW per email from Raj Bhatt on March 27, 2003; Average Waste material parameters were calculate based on documented methodology and entered for WMPs for 3 ANL-W, 13 BCL, 4 INEEL, 2 KAPL, 1 LLNL, 1 NTS, 7 ORNL, and 3 Hanford-RL waste stream; Zeros were replaced with null values for 2 ANL-E, 7 ANL-W, 8 BCL, 2 Bettis, 5 ETEC, 55 INEEL, 2 KAPL, 28 LANL, 1 LBNL, 9 LLNL, 1 USAMC, 1 MURR, 2 RFETS, 56 Hanford-RL, 4 SNL, 18 SRS, 2 Emplaced, and 4 WV waste streams; Added waste material parameters for 85 gallon drum in one ANLE waste stream; Added waste material parameters by container types for 1, BCL, 1 INEEL, 19 LANL, 5 LLNL, 1 NTS, 39 RFETS, 3 Hanford-RL, and 15 SRS waste stream; Entered changes to volume of stored waste after site verification per Jim Frego per telecon March 28, 2003; Added waste volumes for 3 waste streams by including S9000 "unknown" WMC waste into three waste streams IN-W308.816, IN-W306.817, and IN-W308.816); corrected WMC for KAPL per telecon with Paul DeKanel; Corrected WMP for 55 gallon Pipe Overpack Component (POC) packing material plastic and steel per Data Corrections methodology at RFETS; Assigned waste material parameters to AW-W046 and AW-W047 waste streams per waste material parameters correction methodology and added packaging material parameters to two waste streams; Assigned waste material parameters to LANL, Hanford-RL, and RFETS waste streams based on WMP correction methodology; corrected internal volume for 55-gallon drum for 1 INEEL waste stream; Final Form internal volume and number of stored container were corrected for 3 PGDP waste streams to include overpacked 55-gallon drums; Waste streams with no final waste form, waste matrix code, or waste material parameters were moved to the Non-WIPP shippable inventory as unknowns; changed Final Waste Form on three waste stream at LANL to match WMC and waste description; Added waste material parameters to LA-OS-00-01 waste stream in non-WIPP shippable inventory; Marked 7 RFETS waste streams with volumes to be determined as the site is not able to provide a volume at this time; moved 7 INEEL waste streams to Non-WIPP shippable inventory based on matrix code being "unknown"; assigned new Waste Matrix Codes to 9 Hanford-RL waste streams; Added container data from site submittal to 2 RL waste streams; Corrected date of generation information for 1 Hanford-RL waste stream because the waste was stored; Added waste material parameters for container from table 1-3 TWBIR Rev 3 for 10 Hanford RL waste streams; Assigned waste material parameters for 1 Bettis, 5 ETEC, 1 Framatome, 26 INEEL, 1 KAPL-NFS, 2 LLNL, 6 RFETS, 8 Hanford-RL, 1Hanford-RP, 1 USAMC, and 21 LANL waste streams based on waste material paramter correction methodology; Changed ANL-E waste stream from AE-T003 to AE-T001 based on site request from Jim Frego 3/28/2005; Removed D002 EPA code from IN-TRA-150 and IN-SBW-01B and corrected volume for IN-SBW-01A waste stream to 0.8 m3 per email from Bhatt on 3/28/2003; Assigned waste material parameters for T003-773A-HET waste stream at SRS; Added plastic packaging for TDOPs to 4 INEEL waste streams; Made Bettis inventory match the known volume identified for the site based on expected drums to be shipped; assigned 9 RFETS waste streams to Non-WIPP shippable inventory based on unknown matrix; uploaded Hanford RL packaging material parameters;	3/27/2003 to 4/1/2003
D.3.02	Assigned waste material parameters to 6 RFETS, 1 Hanford-RL, 13 LANL waste stream	4/1/2003 to 4/2/2003
D.3.03	Added Radionuclide inventory for 2 LANL waste streams per the radionuclide methodology; Added generation/assay year to 1 USAMC, 1PGDP, 3Hanford-RL and 2 LANL waste streams based on radionuclide methodology; Changed container type after review for 1 RFETS waste stream; Added waste material parameters based on waste material parameter methodology for 2 INEEL waste streams and 1 LANL waste stream; deleted double entry for waste material parameters and completed list of waste material parameters for 2 LANL waste streams.	4/2/2003 to 4/2/2003
D.3.04	Added Radionuclide inventory for 3 ANL-W, 5 INEEL, 3 LANL , 40 RFETS and 29 Hanford-RL waste streams per the radionuclide methodology; Added waste material paramters for waste container added for one waste stream at LANL;	4/2/2003 to 4/2/2003
D.4.00	Changed Rad Generation Year for 3 RL waste streams based on waste stream information in the IDB	4/9/2003 to 4/9/2003
D.4.01	Changed Rad Generation/Assay Year to 2002 from 2001 for Hanford-RL as Hanford decayed their waste streams to the end of 2001 but included the decay date in their electronic data submittal as 2001.	4/9/2003 to 4/9/2003
D.4.02	Changed Rad Generation/Assay Year to 2002 from 2001 for Hanford-RP as Hanford decayed their waste streams to the end of 2001 but included the decay date in their electronic data submittal as 2001.	4/10/2003 to 4/10/2003

TWBID Rev. 2.1 Data Rev	CHANGES MADE FOR DATA REVISION	Date range
D.4.03	Moved 5x5x8 box quantities to stored in final form for 13 SRS waste streams per telephone conversation with J. D'Amelio on 4/14/03. Corrected final form container to .208 for LA-OS-00-01 waste stream per Lee Leonard at LANL.	4/14/2003 to 4/14/2003
D.4.04	Added Waste Stream RL-W756 based on submittal from K. Hladek email 4/15/03; Pu-52 and Pu-83 were broken into contributive radionuclides and entered into database for IN-BN510;	4/16/2003 to 5/1/2003
D.4.05	Changed U-238 and Sm-151 values in RP-W013 waste stream per Hanford (John Kristofzski) to 4.3E-4 and 0 respectively	5/1/2003 to 5/1/2003
D.4.06	Added EPA codes to 7 RFETS waste streams per Geoff Asmus's email dated 4/17/03; Deleted EPA codes in 24 RFETS waste streams based on Roger Ballenger email dated 5/6/2003.	5/1/2003 to 5/6/2003
D.4.07	Added more detail to IN-Z001 waste stream at INEEL and identified the uncontained part of the waste stream in IN-Z001A as as-generated; Added waste matrix code to IN-Z001A.	5/21/2003 to 6/17/2003
D.4.08	Waste volumes, waste material paramter values, and radionuclide values were changed for 3 ETEC, 2 KAPL, 8 ANLW, 3 LLNL, 12 BCL, 78 Hanford-RL, 2 Hanford-RP, 1 hanford-RP, 1 PGDP, 52 INEEL, 1 ANL-E, 33 LANL waste streams as a result of inventory correction activity in Routine Calculation Report ERMS# 530658, 530648, 530639, 530662, 530634, 530693, 530675, 530666, 530670, 530679, 530688, 530643, 530717; Corrected packaging materials for 1 ANLW waste stream; Framatome did not have a defense determination at 9/30/2002 the determination was changed to Non-Defense; Changed WV defense determination to commercial as indicated in TWBIR, Rev. 2; Comments in Final Form were changed for 2 Hanford-RP waste streams per email from John Kristofszki; Removed empty 55-gallon final form container form for 1 BCL waste stream;	8/13/2003 to 8/14/2003
D.4.09	Radionuclides were changed for 8 LANL waste streams as a result of inventory correction activity Routine Calculation Report ERMS# 530717; checked box to delineate Framatome as non-WIPP shippable; Corrected Hanford waste stream error reporting RH for 76 CH waste stream documented in ERMS#530693;	9/3/2003 to 7/22/2004
D4.10	Deleted duplicate record for final form container type RH per corrections dated 7/23/2004 (AP-113); added final form containers for IN-ICP waste streams per ERMS# 535463 and 534774; Changed waste type from TRU to MTRU based on presence of EPA codes for 12 INEEL waste streams; Changed generator site from Oak Ridge Associated University to ORNL for 9 ORNL waste streams (ERMS #534062); Final Waste Form for 6 LANL waste streams was changed per email dated 10/2/2003; Added Co-60 to AW-T031.1322 per ERMS 534497; Added plastic packaging material to waste material parameters for 3 LLNL waste streams per ERMS 534501; Added waste stream description for AMLLW for 2 INEEL waste streams per ERMS 534774; removed "(n)" from U-235 in waste stream AE-002 ERMS 535443; Added IN-W341.954 to Non-WIPP shippable inventory per ERMS 535779; Copied waste profile comments to management comments so the information would be printed in the next version of the waste profiles generated from TWBID Rev 2.1, version 3.13 (involved 48 INEEL, 45 Hanford-RL, 17 SRS, 1 WV, 1 ANL-E, 1 BCL, 1 Bettis, 1 LLNL, 3 NTS, 2 PGDP, 4 Hanford-RP, 1 SNL, 1 SPRU, 5 WV and 1 KAPL waste stream); copied information on how waste stream was derived for data version 4.09 into Management comments for final printing for 2 LANL waste streams; Updated radionuclides per recommendation report for 7 ANLW waste streams ERMS 534497; Removed politically sensitive text from comments for one BCL RH waste stream (ERMS 534062); Entered recalculated radionuclides for 35 INEEL waste streams (ERMS 535463 and 536471); Entered recalculated radionuclides for IN-BN-510 based on ERMS # 536476; Entered radionuclides for 4 LANL waste streams per ERMS 534768; Added clarifying comment about CPR differences in 1 INEEL waste stream per ERMS 535727; Deleted APP8 entries in hazardous waste codes for 8 waste streams at INEEL per AP-113; Fixed Am-241 and Pu-238 for two INEEL waste streams per ERMS# 535463 and 536471; Changed CH to RH Handling for LANL waste stream LA-TA-55-48 based on reported rad content and expanded waste stream based on volume expected to be shipped if radionuclide content is correct; Changed management comment for 17 SRS waste streams per ERMS 534062; Deleted comment in 2 Hanford-RP waste streams based on SP-9-6-3 form dated 8/26/2004 from Hanford; corrected waste material paramter discrepancy for LA-TA-55-48 per ERMS 536568 and added final form comment to explain origin of the number of stored and projected containers for the waste stream; Added management comments from other comment fields for final printing for 1 RFETS, 1 RL, 1 SRS, and corrected one INEEL comment for final printing; Changed the waste material parameters reported for 40 LANL waste streams per ERMS 536601; Changed defense determination for WV from commercial to pending defense determination; Changed defense determination for B&W Lynchburg per DOE HQ direction; Removed duplicate U-235 entry from AE-T001; Removed duplicate Pu-238 entry in LA-OS-00-01; Changed radionuclides for 4 LANL	8/31/2004 to 9/3/2004

TWBID Rev. 2.1 Data Rev	CHANGES MADE FOR DATA REVISION	Date range
	waste streams to the radionuclides reported for TWBIR Rev 3 per ERMS 536606.	
D.4.11	Deleted 14 waste streams per ERMS# 537695 as Hanford Over-reported waste streams by not requesting deletion of waste streams that existed in TWBIR Rev. 2 but are not included in the update for 2003; Changed Hanford K-basin radionuclide activity concentration for Ba-137m and Y-90 per email from Mike Cooney for waste streams RL-W445 and RL-W446; Added waste streams IN-ICP-002 through -005 as a result of inclusion of IN-Z001; Changed radionuclides on LA-TA-55-48 based on email from Stan Kosiewicz at LANL; deleted duplicate plastic waste material parameters from IN-ICP-005; Added waste material parameters for IN-Z001; Corrected radionuclides per ERMS 536471 for 39 INEEL waste streams; Changed source and stored containers to projected for IN-Z001 and associated ICP waste streams per Tom Clements 11/5/2004;	11/2/2004 to 11/5/2004
D.4.12	Updated radionuclides based on second email from Stan K. at LANL dated 11/10 and SP-9-6-3 form dated 11/12/04; Added assay year to IN-ICP-002 through IN-ICP-005 per SP-9-6-3 form dated 11/12/2004; Corrected containers in ICP-003 waste streams for rounding;	11/12/2004 to 11/12/2004
D.4.13	Changed assay year to 1970 per INEEL May 2003 submittal from the waste stream description of IN-Z001 for IN-ICP-002 through IN-ICP-005 and IN-Z001;	11/19/2004 to 11/19/2004
D.4.14	Changed final waste forms for IN-ICP-002, 003, 005 per email sent 11/5/2004; changed the as generated volume for IN-ICP-005 per note from J. Perry dated 11/04/04.	11/29/2004 to 1130/2004
D.4.15	Radionuclide concentration for Pu-242 was changed for IN-BN-510 to correct an error as described in ERMS#538210;	12/20/2004 to 12/20/2004
D.4.16	Changed the Waste Stream Name from "Supercompacted Combustible/TRM" to "Compressed Combustible/TRM" and added appropriate waste description and management comments. This was a request from EPA to update this waste profile prior to shipment of waste from RFETS pertains to RF-MT2116 and RF-TT2216.	3/18/2005 to 3/18/2005

Trone, Janis R

From: Leigh, Christi D
Sent: Tuesday, September 20, 2005 11:56 AM
To: Trone, Janis R; Chavez, Mario Joseph
Subject: RE: Signature Authority

JT 9/20/05

Janis Trone is granted signature authority for me during my absence on two documents and their related forms:

2004 Compliance Recertification Application Performance Assessment Baseline Calculation

TRU Waste Inventory for the 2004 Compliance Recertification Application Performance Assessment Baseline Calculation

Christi Leigh, PhD
Sandia National Laboratories
Carlsbad, NM