Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant

Appendix BIR

United States Department of Energy
Waste Isolation Pilot Plant

Carlsbad Area Office
Carlsbad, New Mexico

Transuranic Waste Baseline Inventory Report

DOE/CAO-95-1121

Transuranic Waste Baseline Inventory Report (Revision 2)

December 1995

Prepared by Carlsbad Area Office Technical Assistance Contractor
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Volume 1

PREFACE

TRANSURANIC WASTE BASELINE INVENTORY REPORT
REVISION 2, CAO/DOE-95-1121

Change History

Page 3-31 - 3/11/96

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AE	Argonne National Laboratory-East site identifier
AL	Ames Laboratory site identifier
AM	ARCO Medical Products Company site identifier
ANL-E	Argonne National Laboratory-East
AW	ANL-W site identifier
ANL-W	Argonne National Laboratory-West
BC	Battelle Columbus Laboratory site identifier
BEMR	Baseline Environmental Management Report
BT	Bettis Atomic Power Laboratory site identifier
C&C Agreement	Agreement for Consultation and Cooperation between the Department of Energy and the State of New Mexico on the Waste Isolation Pilot Plant
CFR	Code of Federal Regulations
CH	contact handled
CY	calendar year
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
ET	Energy Technology Engineering Center site identifier
ETEC	Energy Technology Engineering Center
FFCAct	Federal Facility Compliance Act
FGE	Fissile Gram Equivalent
HDPE	high-density polyethylene
HQ	(DOE) Headquarters
ID	identification
IDB	Integrated Data Base
IDC	item description code
IN	Idaho National Engineering Laboratory site identifier
INEL	Idaho National Engineering Laboratory
IMWIR	Interim Mixed Waste Inventory Report
IT	Inhalation Toxicology Research Institute site identifier
ITRI	Inhalation Toxicology Research Institute
KA	Knolls Atomic Power Laboratory-Schenectady site identifier
KAPL	Knolls Atomic Power Laboratory - Schenectady
kg	kilograms
LA	Los Alamos National Laboratory site identifier
LANL	Los Alamos National Laboratory
LB	Lawrence Berkeley Laboratory site identifier
LBL	Lawrence Berkeley Laboratory
LL	Lawrence Livermore National Laboratory site identifier
LLNL	Lawrence Livermore National Laboratory
LWA	Land Withdrawal Act
MC	U.S. Army Material Command
MD	Mound Plant site identifier
MITI95	Material Inventory and Tracking Information Database 1995
m^3	cubic meters

mrem	millirem
MU	University of Missouri Research Reactor site identifier
MTRU	mixed transuranic
MWIR	Mixed Waste Inventory Report
NMVP	No-Migration Variance Petition
NRC	Nuclear Regulatory Commission
NT	Nevada Test Site site identifier
NTS	Nevada Test Site
OR	Oak Ridge National Laboratory site identifier
ORIGEN-2	Oak Ridge Isotope Generation and Depletion Code
ORNL	Oak Ridge National Laboratory
PA	performance assessment (in text only)
PA	Paducah Gaseous Diffusion Plant site identifier (in waste profiles only)
PCB	polychlorinated biphenyls
PGDP	Paducah Gaseous Diffusion Plant
PX	Pantex site identifier
RCRA	Resource Conservation and Recovery Act
RF	Rocky Flats Environmental Technology Site site identifier
RFETS	Rocky Flats Environmental Technology Site
RH	remote handled
RL	Hanford (Richland) site identifier
SA	Sandia National Laboratories/New Mexico site identifier
SARP	Safety Analysis Report for Packaging
SEIS	Supplemental Environmental Impact Statement
SNL/NM	Sandia National Laboratories/New Mexico
SR	Savannah River Site site identifier
SRS	Savannah River Site
SWB	Standard Waste Box
TB	Teledyne Brown Engineering
TDOP	Ten Drum Overpack
TRU	transuranic
TRUCON	Transuranic Package Transporter-II Content Codes
TRUPACT-II	Transuranic Package Transporter-II
TSCA	Toxic Substances Control Act
TWBID	Transuranic Waste Baseline Inventory Database
TWBIR	Transuranic Waste Baseline Inventory Report
WAC	waste acceptance criteria
WIPP	Waste Isolation Pilot Plant
WMC	waste matrix code
WMP	waste material parameter
WS	waste stream
WTWBIR	Waste Isolation Pilot Plant Transuranic Waste Baseline Inventory Report
WV	West Valley Demonstration Project site identifier
WVDP	West Valley Demonstration Project

PREFACE

The information in this report summarizes the U.S. Department of Energy's (DOE) transuranic (TRU) waste inventory, projections, and characteristics. Revision 0 of the *Waste Isolation Pilot Plant (WIPP) Transuranic Waste Baseline Inventory Report* (WTWBIR) published in June 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 quality checks of the data were completed by the DOE TRU waste generator/storage sites. Data changes resulting from the site reviews were contained in Revision 1 of the WTWBIR.

This document, Revision 2 of the *Transuranic Waste Baseline Inventory Report* (TWBIR) reports **all** DOE TRU waste, WIPP and non-WIPP TRU wastes, that have been identified by DOE TRU waste generator/storage sites. The primary differences between Revision 1 and Revision 2 are as follows:

- The name of the document has changed from WTWBIR to TWBIR to reflect the inclusion of all DOE TRU waste.
- Revision 1 was primarily developed to support Sandia National Laboratories, New Mexico (SNL/NM) performance assessment (PA) of the WIPP. Revision 2 TWBIR questionnaire continues to support the SNL/NM PA analyses and also supports additional WIPP program (e.g., WIPP Land Withdrawal Act requirements, WIPP transportation studies, the RCRA Part B Permit Application, WIPP No-Migration Variance Petition for Operations Period, and the Supplemental Environmental Impact Statement for Disposal Phase).
- Revision 2 incorporates a change in the plutonium residue processing assumptions at the Rocky Flats Environmental Technology Site (RFETS). In Revision 1, the RFETS TRU waste and radionuclide inventory projections reflected the plan to process the plutonium residues for actinide separation. In Revision 2, at the WIPP level, the RFETS TRU waste and radionuclide inventory projections reflect the plan to repackage/process the plutonium residues to meet WIPP Waste Acceptance Criteria, and safe storage requirements. This results in an increase to the WIPP waste inventory of approximately 1,320 cubic meters and an increase to the WIPP radionuclide inventory of approximately 1.35 million curies in the RFETS submittal.
- Revision 1 reported Hanford Site's submittal as approximately 46,000 cubic meters projected RH-TRU, of which 43,000 cubic meters were called "suspect" RH-TRU due to insufficient information from the Hanford Site. Reevaluation of the 46,000 m^3 of projected RH-TRU by Hanford personnel has resulted in a decrease of reported projected RH-TRU to approximately 21,500 m^3 for Revision 2 of the TWBIR. Additional evaluations of the reported Hanford Site RH-TRU waste volumes is ongoing and the results will be reported in future revisions of the TWBIR.
- Revision 2 defines waste streams to a more detailed level than Revision 1 of the WTWBIR. Savannah River Site (SRS), Idaho National Engineering Laboratory (INEL), Hanford Site, and RFETS divided their waste streams to the Local Identification level which will provide the detail desired to support the additional programs requesting DOE TRU waste inventory information. This resulted in an increase in the number of waste streams from 360 to approximately 970.

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

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

The purpose of Revisions 0 and 1 of this report was to provide data to be included in the SNL/NM performance assessment (PA) processes. This revision of the document is also intended to support the WIPP Land Withdrawal Act requirement for providing the total DOE TRU waste inventory. Therefore, this document includes a chapter and an appendix that discusses the total DOE TRU waste inventory including non-defense, commercial, PCB contaminated, and buried (pre-1970) TRU wastes.

The WIPP baseline inventory is estimated using waste streams identified by the DOE TRU waste generator/storage sites. Each waste stream is defined in a waste stream profile and has been assigned to a Final Waste Form by the DOE TRU waste generator/storage sites. The sites provided and/or authorized all information in the Waste Stream Profiles. Waste stream profiles that have similar physical and chemical properties can be combined into the same Final Waste Form and is documented in a site-specific waste profile for each TRU waste generator/storage site.

Based on the methodology presented in this TWBIR, a maximum of 11 site-specific waste profiles have been identified for contact-handled (CH) TRU waste and a maximum of 11 have been identified for remote-handled (RH) TRU waste for each site. Each of these site-specific waste profiles have unique Final Waste Form criteria, and they are developed, if appropriate, for each of the TRU waste generator/storage sites. A particular site-specific waste profile, with a specific Final Waste Form, can be combined with other site-specific waste profiles having identical Final Waste Forms from the TRU waste generator/storage sites to derive a WIPP waste profile.

The WIPP anticipated (stored and projected) inventory of TRU waste is defined as the sum of retrievably stored waste plus currently projected TRU waste volumes. The anticipated inventory for CH-TRU waste is not sufficient to fill the maximum CH-TRU disposal inventory for WIPP (calculated to be 5,950,000 cubic feet or approximately 168,500 cubic meters). Scaling has been developed as a means for Sandia National Laboratories/New Mexico (SNL/NM) to model the impacts of a full repository. Scaling has not been applied to the RH-TRU inventory since the sites have reported sufficient RH-TRU waste to fill the RH-TRU disposal inventory (250,000 cubic feet or approximately 7,080 cubic meters). Additionally, it is anticipated that the data on wastes to be generated in the future from environmental restoration (ER) and decontamination and decommissioning (D&D) activities at the sites will be available in the Baseline Environmental Management Report that is currently under preparation by the DOE. Because of the difficulty in estimating detailed characteristics of these future ER and D&D wastes on a waste stream basis (as is required by the TWBIR), it was possible for only three sites (Battelle Columbus Laboratories, Bettis Atomic Power Laboratories, and Hanford) to report ER and D&D projections for this document.

The TWBIR also estimates the WIPP disposal inventory in terms of 12 waste material parameters and additional packaging materials that have been identified by Sandia National Laboratories/New Mexico, as necessary for PA. The 12 waste material parameters and additional packaging materials are waste constituents of TRU waste and are input parameters for one or more PA models or are required to adequately describe the waste form. These parameters may change as a result of PA efforts.

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

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

Packaging Materials
- Steel
- Plastic
- Lead

The waste material parameters in the waste stream, site-specific and WIPP waste profiles are expressed on a weight/volume (kilograms per cubic meter) basis. However, the occurrence of more than one waste material parameter at the maximum value within a waste stream is highly unlikely. If required by PA calculations, the sampling statistics must be controlled so that several waste material parameters do not get sampled all at their maximum value (weight/volume), thereby exceeding the average weight/volume. This revision of the TWBIR provides diskettes that contain the TRU Waste Baseline Inventory Database (TWBID) in Microsoft Access in either a run-time only version (not requiring purchase of Access) or a full version (requiring Access).

There are two types of distributions of the TWBIR, Revision 2 document. One will be presented in three volumes: Volume 1 contains the TWBID diskettes, the Preface; Executive Summary through Chapter 8; Volumes II and III contain Appendices A through P. This document presentation will be distributed to regulatory agencies, DOE and other top-level interfaces. A second distribution will be presented in one volume with the elimination of Volumes 2 and 3. For this second type of distribution the volume will contain the TWBID diskettes; the Preface; Executive Summary through Chapter 8; and Appendices A through N. Information for Appendices O and P can be found on the diskettes. This document presentation will be distributed to all other users of the TWBIR.

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

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

Table ES-1

WIPP CH-TRU Waste Material Parameter Disposal Inventory

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

Table ES-2

WIPP RH-TRU Waste Material Parameter Disposal Inventory

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

Table ES-3

WIPP CH-TRU Waste Anticipated Inventory By Site

(Cubic Meters)

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

Table ES-4

WIPP RH-TRU Waste Anticipated Inventory By Site

(Cubic Meters)

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

Table ES-5. WIPP Contact-Handled Mixed and Non-Mixed Disposal Inventory by Site (Final Waste Form)

Storage/Generator Site	Stored Volumes (m3)		Projected Volumes (m3)	
	Mixed	Non-Mixed	Mixed	Non-Mixed
Ames Laboratory - Iowa State Univ.	0.0E+00	0.0E+00	4.2E-01	0.0E+00
Argonne National Laboratory - East	6.5E+00	5.0E+00	1.3E+00	1.3E+02
Argonne National Laboratory - West	4.3E+00	2.3E+00	2.0E+00	7.4E+02
Bettis Atomic Power Laboratory	0.0E+00	0.0E+00	0.0E+00	1.2E+02
Energy Technology Engineering Center	0.0E+00	1.7E+00	0.0E+00	0.0E+00
Hanford (Richland) Site	2.0E+02	1.2E+04	1.3E+04	2.0E+04
Idaho National Engineering Laboratory	2.3E+04	5.3E+03	0.0E+00	0.0E+00
Lawrence Livermore National Laboratory	8.3E+00	2.2E+02	5.0E+01	6.6E+02
Los Alamos National Laboratory	7.7E+03	3.3E+03	3.8E+03	3.6E+03
Mound Plant	3.5E+00	2.7E+02	0.0E+00	0.0E+00
Nevada Test Site	6.1E+02	5.7E+00	9.0E+00	0.0E+00
Oak Ridge National Laboratory	7.0E+02	6.1E+02	2.6E+02	0.0E+00
Paducah Gaseous Diffusion Plant	0.0E+00	0.0E+00	1.9E+00	0.0E+00
Pantex Plant	0.0E+00	6.2E-01	0.0E+00	0.0E+00
Rocky Flats Environmental Technology Site	4.4E+02	2.7E+02	3.3E+03	1.1E+03
Sandia National Laboratory - Albuquerque	0.0E+00	6.7E+00	0.0E+00	7.5E+00
Savannah River Site	1.5E+03	1.4E+03	2.9E+03	3.9E+03
Teledyne Brown Engineering	0.0E+00	2.1E-01	0.0E+00	0.0E+00
U.S. Army Material Command	0.0E+00	2.5E+00	0.0E+00	0.0E+00
University of Missouri Research Reactor	2.1E-01	0.0E+00	8.3E-01	0.0E+00
Totals	3.4E+04	2.4E+04	2.4E+04	3.0E+04

Table ES-6. WIPP Remote-Handled Mixed and Non-Mixed Disposal Inventory by Site (Final Waste Form)

Storage/Generator Site	Stored Volumes (m3)		Projected Volumes (m3)	
	Mixed	Non-Mixed	Mixed	Non-Mixed
Argonne National Laboratory - West	1.8E+00	1.8E+01	3.5E+01	1.2E+03
Battelle Columbus Laboratories	0.0E+00	5.8E+02	0.0E+00	0.0E+00
Bettis Atomic Power Laboratory	0.0E+00	0.0E+00	0.0E+00	6.7E+00
Energy Technology Engineering Center	8.9E-01	0.0E+00	0.0E+00	0.0E+00
Hanford (Richland) Site	2.7E+00	2.0E+02	1.5E+04	6.3E+03
Idaho National Engineering Laboratory	1.9E+02	2.6E+01	0.0E+00	0.0E+00
Los Alamos National Laboratory	1.7E+01	7.7E+01	3.4E+01	6.5E+01
Oak Ridge National Laboratory	2.4E+03	8.5E+01	4.5E+02	0.0E+00
Totals	2.6E+03	9.9E+02	1.6E+04	7.6E+03

Table ES-7. Summary Radionuclide Inventory[1]

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)
Am241	2.60E+00	8.42E-01
Ba137m	4.53E-02	2.89E+01
Cm244	4.72E-02	4.45E-02
Co58	1.81E-18	1.47E+00
Cs137	4.78E-02	3.05E+01
Pu238	2.26E+01	2.05E-01
Pu239	4.64E+00	1.45E+00
Pu240	1.23E+00	7.16E-01
Pu241	1.55E+01	2.00E+01
Sr90	4.07E-02	2.95E+01
Y90	4.07E-02	2.95E+01

[1]Summary shows the ten radionuclides with the highest concentration in curies per cubic meter of the waste.

CHAPTER 1

1. INTRODUCTION

1.1 BACKGROUND

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

The Waste Isolation Pilot Plant (WIPP) is a TRU waste management facility operated by the U.S. Department of Energy (DOE). The WIPP is currently identified as the permanent disposal site for TRU wastes generated at various DOE sites after 1970 from defense activities of the United States including weapons production and research and development.

The DOE is committed to demonstrating compliance with all applicable regulations prior to permanent disposal of TRU defense wastes in the WIPP repository. These regulations are the environmental standards for management and disposal of TRU defense wastes as mandated in 40 CFR Part 191 (EPA, 1993) and Part 194 (EPA, 1995), and the RCRA regulations. Compliance demonstration through Sandia National Laboratory/New Mexico (SNL/NM) performance assessment (PA) calculations will be based on the inventory of existing and currently projected waste streams compiled in this document, as reported by the DOE TRU waste generator/storage sites. The WIPP is scheduled to receive and dispose of TRU defense wastes from 8 major and additional minor DOE TRU waste generator/storage sites (see Figure 1-1). In addition to the sites identified in Figure 1-1, there are several small quantity sites that may have DOE TRU wastes in storage and/or projected. These sites are listed below:

- Babcock & Wilcox – Parks Township; Vandergrift, PA
- GE Vallecitas Nuclear Center; Pleasanton, CA
- Massachusetts Institute of Technology; Boston, MA
- National Institute of Standards and Technology; Gaithersburg, MD
- Site A/Plot M; Argonne, IL
- Special Process Research Unit; Schenectady, NY

The TWBIR team contacted these sites and requested data on their TRU waste inventories. These sites were not able to respond to the TWBIR Revision 2 data call with sufficient information to be included in this revision of the TWBIR, but could be included in future revisions as more detailed data are submitted.

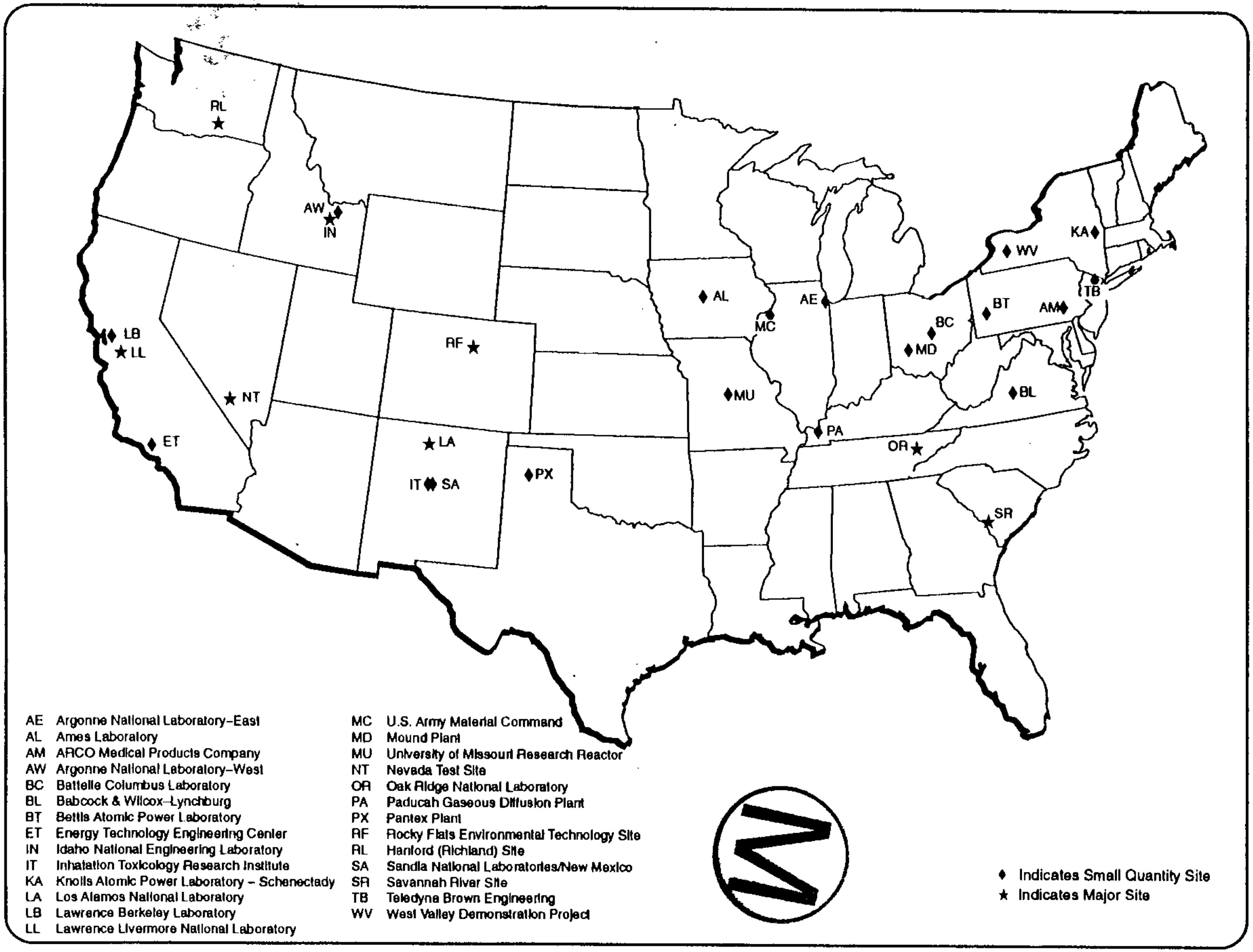

Figure 1-1. U.S. Department of Energy Transuranic Waste Generator/Storage Sites.

Inhalation Toxicology Research Institute reports their waste stream profiles with Sandia National Laboratories/New Mexico submittals in Appendix P. Two Small Quantity Site, Babcock & Wilcox-Lynchburg and General Electric Vallecitas Nuclear Center, provided TRU waste volumes only. There is insufficient information provided to generate waste stream profiles for these wastes, so they are incorporated as "Possible Future Waste" for WIPP and are listed in Section 5.4.

1.2 PURPOSE

The purpose of the *Transuranic Waste Baseline Inventory Report* (TWBIR) is to document the total inventory of DOE TRU waste as defined by the DOE TRU waste generator/storage sites. This includes both the TRU waste that is planned to be disposed at the WIPP site and the TRU waste that will not be sent to WIPP. The WIPP portion of the TRU waste inventory will be used in the SNL/NM PA calculations and sensitivity analyses that will support the development of compliance applications to the appropriate regulatory agencies regarding the operations and post-closure timeframes of the WIPP repository. The total DOE TRU waste inventory will be used in the development of the DOE plan to define the disposal options for all WIPP and non-WIPP transuranic waste as required by the Land Withdrawal Act (LWA) (Public Law, 1992b).

To accomplish this purpose, the TWBIR has been developed from the best available information and acceptable knowledge provided by the DOE TRU waste generator/storage sites. In support of PA, the TWBIR describes a process for grouping individual waste streams with similar physical and chemical properties into waste profiles, based on their waste matrix code (WMC) (DOE, 1995b) assigned by the DOE TRU waste generator/storage sites. Waste profiles with similar WMCs, are then combined across the DOE TRU waste system to provide estimated total volumes and total waste material parameters (WMPs). The methodology for this grouping and combining is discussed in detail in Chapter 2, Waste Profile Methodology. The individual waste streams also are evaluated to estimate the occurrence and quantities of non-radioactive waste material parameters as defined in Appendix B and listed in Table 1-1 (e.g., cellulosics, plastics, iron-base metal/alloys, etc.) that have been identified by SNL/NM as being potentially important to the performance of the WIPP repository. The methodology, assumptions, and totals of these waste material parameters are described in Chapter 3, WIPP Disposal Inventory.

The information/data presented in this report is derived from the Transuranic Waste Baseline Inventory Database (TWBID). The TWBID supports most programs at WIPP that require waste information and/or volumes. Examples of some of the programs that are supported by the TWBID are: Performance Assessment (PA), RCRA Part B Permit Application (DOE, 1995f), WIPP No-Migration Variance Petition for Operations Period (DOE, 1995c), and the Supplemental Environmental Impact Statement (SEIS)-II for Disposal Phase (in development phase). In addition, the TWBID can support other projects and applications requiring waste information in formats different than that presented in the TWBIR. The TWBID structure and a data dictionary are included in Chapter 6 and Appendix L of this report.

1.3 WASTE INVENTORY TERMINOLOGY

The derivation of a disposal inventory from individual waste streams is a formidable and complex process. To document each step of this process, a system of waste inventory terminology needs to be defined so the reader may easily follow the process. The following sections provide

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

Waste Material Parameter	Input Variable in Current PA Models		Input Variable in PA Models Under Development	Input Variable in Possible Future PA Models
	Gas Generation	Mechanical Characteristics		
Iron-Base Metal/Alloys	YES	YES	YES	YES
Aluminum-Base Metal/Alloys[1]		YES	YES	
Other Metal/Alloys		YES		POSSIBLE
Other Inorganic Materials		YES		POSSIBLE
Vitrified[2]		YES	POSSIBLE	POSSIBLE
Cellulosics	YES	YES	YES	YES
Rubber	YES[3]	YES	YES	YES
Plastics	YES[3]	YES	YES	YES
Solidified Inorganic Material		YES	YES	YES
Solidified Organic Material		YES	YES	YES
Cement (solidified)[4,5]	YES		YES	POSSIBLE
Soils[6]		YES	POSSIBLE	POSSIBLE

[1] Future model for PA does not include aluminum.
[2] New waste material parameter corresponding to treatment, identified by some sites, to be used in the future.
[3] Only one-half of materials assumed to generate gas.
[4] Percentage of material to generate gas is unknown at the present time.
[5] Information on this waste material parameter is needed for non-PA scoping calculations for assessment of its importance.
[6] May impact colloids.

definitions of terminology used throughout the TWBIR. These definitions are also summarized in Chapter 7, Glossary. A list of acronyms and abbreviations used are provided in the front of the document.

1.3.1 Inventory Terminology

Stored Inventory – The part of the TRU inventory currently in retrievable storage at the time of the last data call for inventory information is known as "stored inventory." For Revision 2, stored waste includes that waste in storage as of December 31, 1994, unless a different inventory date is indicated in the waste stream profiles (Appendices O and P). Retrievably stored waste includes waste stored since approximately 1970 in buildings or in berms with earthen cover and does not include any waste that was buried prior to 1970 (DOE, 1990a).

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

Projected Inventory – The part of the TRU inventory that has not been generated but is currently estimated to be generated at some time in the future by the TRU waste generator/storage sites is known as "projected inventory." Because of the current uncertainty associated with environmental restoration (ER) and decontamination and decommissioning (D&D) waste inventory projections, the ER and D&D wastes are not included in the projected inventory, except for a few waste streams at some sites. For Revision 2, a projected inventory includes waste scheduled for generation from calendar year (CY) 1995 to 2022. "Newly generated waste" is sometimes used as a synonym for the projected inventory.

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

Stored Inventory + Projected Inventory = Anticipated Inventory

Scaling – The process for adjusting, if needed, the projected inventory to the design limit (disposal inventory) of the WIPP repository is called "scaling." Chapter 3, describes the scaling process used for developing the TWBIR.

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

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

1.3.2 Waste Matrix Code Terminology

Waste Matrix Code (WMC) - The WMCs were developed by DOE, in response to the Federal Facilities Compliance Act (FFCAct) (Public Law 1992a), as a methodology to aid in categorizing mixed waste streams in the DOE system into a series of five-digit alphanumeric codes (e.g., S5400; Heterogeneous Debris) that represent different physical/chemical matrices (DOE, 1995b). The WMC is assigned by the TRU waste generator/storage sites for all mixed waste streams and some non-mixed waste streams. The TWBIR has adopted this system to remain consistent with common terminology used by the DOE waste generator/storage sites.

Final Waste Form – Final Waste Form of a waste stream consists of a series of WMCs that are grouped together, which for PA purposes have similar physical and chemical properties. The Final Waste Form applies to both stored and future generation waste. An example of combining three waste streams which either contain particulates or are cemented particulate waste is presented below:

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

Because of the restriction on particulate wastes in the *TRU Waste Acceptance Criteria (WAC) for the Waste Isolation Pilot Plant*, Revision 4 (DOE, 1991), particulate waste will usually be immobilized prior to shipment to WIPP. Therefore, all three of these WMCs would be the same basic waste form when emplaced in WIPP and have similar physical and chemical properties. The Final Waste Form for this example is solidified inorganics. Table 1-2 presents all anticipated WMCs for TRU waste and indicates the Final Waste Form typically assigned to each WMC for the TWBIR. There are 11 Final Waste Forms used in this TWBIR. The last two rows in Table 1-2, excluded waste streams and unknown, group WMCs that will not be accepted at WIPP unless additional characterization and/or processing occurs to meet the WIPP WAC (DOE, 1991). Wastes that are categorized as "Excluded" or "Unknown" are listed in Section 5.4, Possible Future Waste. Some sites did not assign WMCs to non-mixed TRU streams; but they did assign Final Waste Forms based on the physical and chemical properties of the waste stream.

1.3.3 Waste Profile Terminology

Waste Stream Profile – This is a description of a CH-TRU or RH-TRU waste stream. Sites were requested to define a waste stream as presented in Figure 1-2 and to describe their waste streams at the lowest practical level of Figure 1-2. The waste stream profile is presented in tabular format and is intended to provide a summary of important information about a particular waste stream. Examples of information included in a waste stream profile are:

- Waste Stream description.
- Waste Stream source description.
- Currently used identification codes, including the DOE TRU waste site matrix description;
- Final waste form assigned by the TRU waste generator/storage sites;
- As-generated waste form volumes and Final Waste Form volumes:
- Estimated minimum, average, and maximum weights of waste material parameters per cubic meter of final waste form volume (e.g., iron-base metal/alloys, aluminum-base metal/ alloys, cellulosics, etc.);
- Indication as to whether the waste is CH-TRU or RH-TRU;
- Indication as to whether the waste is mixed or non-mixed;

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

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

TABLE 1-2. FINAL WASTE FORM NAMES (CONTINUED)

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

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

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

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

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

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

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

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

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

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

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

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

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

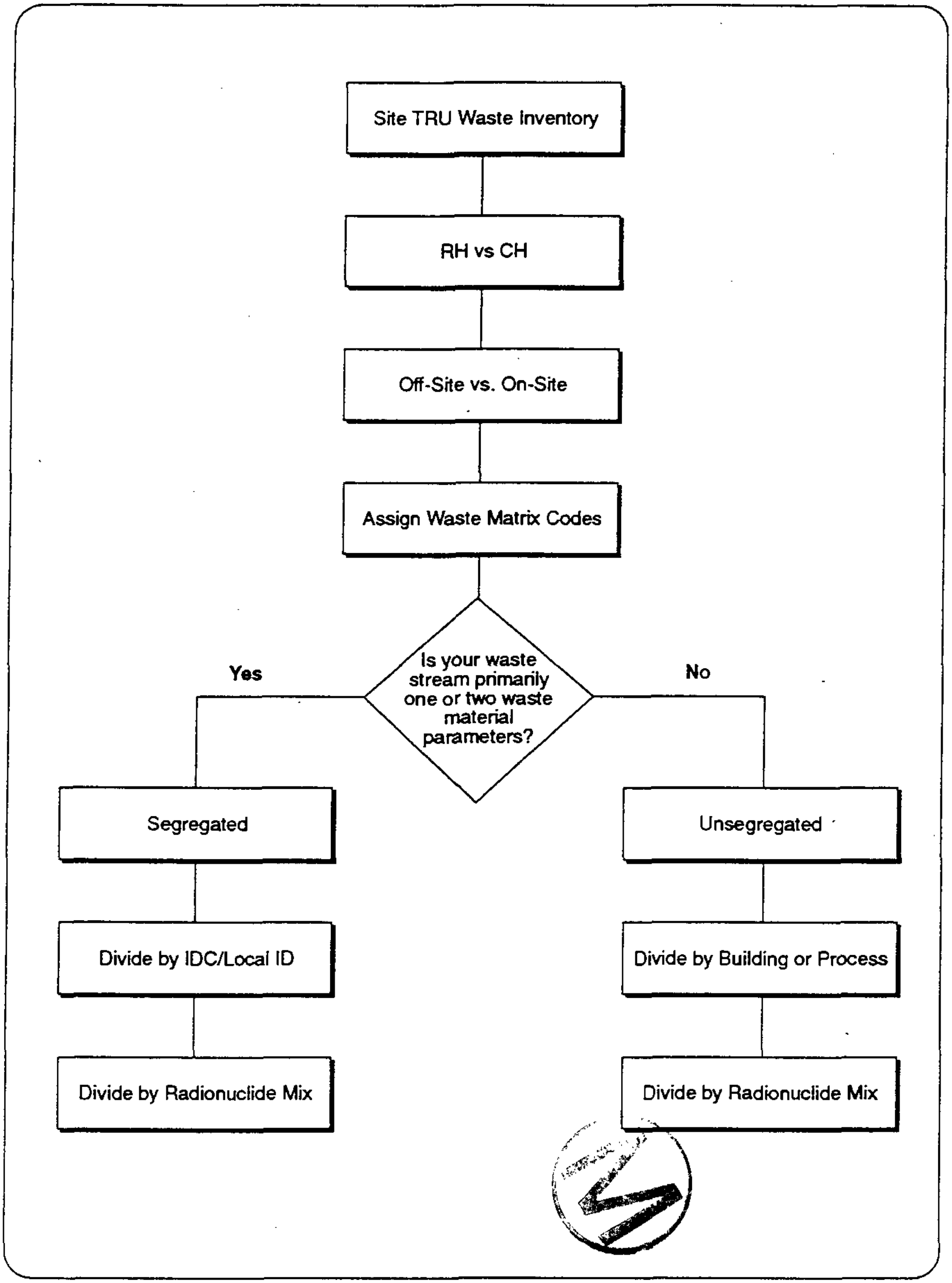

Figure 1-2. Definition of a Waste Stream

- As-generated Hazardous waste codes (EPA codes) as assigned by the DOE TRU waste generator/storage sites for the RCRA regulated portion of the waste stream. Some waste streams (waste stream profiles) contain hazardous waste codes that would not be currently acceptable for disposal in WIPP (e.g., D001, D002, and D003) under the most recent WIPP Part B Permit Application (DOE, 1995f). These hazardous waste codes are applied to the waste in its current physical form. These waste streams will have to be treated for any unacceptable hazardous constituents prior to transport to WIPP for disposal.
- Final Waste Form radionuclide inventory: activity in curies per cubic meter.
- Comments provided by the TRU waste generator/storage sites to further explain the data provided.
- TRUPACT-II Content (TRUCON) Codes (DOE, 1994c) and No Migration Variance Petition (NMVP) (DOE, 1990b) identifiers, where provided by the site.

Figure 1-3 provides an example of a blank waste stream profile form. The methodology for developing waste stream profiles is described in Chapter 2 and the TRU waste stream profiles are provided in Appendices O, P, and in the TWBID database files.

Site-Specific Waste Profile – This represents a Final Waste Form at a particular DOE TRU waste generator/storage site. That is, one or more waste stream profiles at a particular DOE TRU waste site, that have been placed in the same Final Waste Form, are summarized in the site-specific waste profile. Examples of information included in a site-specific waste profile are:

- DOE TRU waste generator/storage site identification;
- The Final Waste Form that the profile represents;
- Listing of the waste streams (represented by waste stream profiles provided by the TRU waste generator/storage sites) that are included in the site-specific waste profile, including the waste stream identification;
- Final Waste Form volumes (both stored and currently projected); and
- Summary of minimum, volume weighted average, and maximum weights of waste material parameters per cubic meter of final waste form volume on a site basis (e.g., iron-base metal/alloys, aluminum-base metal/alloys, cellulosics, etc.).

Figure 1-4 provides an example of a blank site-specific waste profile form. The methodology for developing site-specific waste profiles is described in Chapter 2 and printouts of WIPP TRU site-specific waste profiles are provided in Appendix A.

Waste Sub-stream – A waste sub-stream is one that results from a waste stream being divided into two or more fractions (for the purposes of reporting) in order to provide an additional level of detail about a site's current plans for repackaging or treating the waste.

WIPP Waste Profile – The WIPP waste profile represents a summary of TRU wastes at all DOE TRU waste generator/storage sites that have an identical Final Waste Form. Examples of information included in a WIPP waste profile are:

- The Final Waste Form that the profile represents;

TWBIR ID:

TRU WASTE BASELINE INVENTORY WASTE PROFILE

HQ ID:		Handling:		NMVP #:		Stream Name:		Inventory Date:	
Local ID:		Type:		Generator Site:		Final Waste Form:	Waste Matrix Code:	TRUCON Code:	

AS-GENERATED EPA CODES

WASTE MATERIAL PARAMETERS (kg/m3)

	Avg	Min	Max
Iron-base Metal/Alloys:	0.0	0.0	0.0
Aluminum-base Metal/Alloys:	0.0	0.0	0.0
Other Metals:	0.0	0.0	0.0
Other Inorganic Material:	0.0	0.0	0.0
Vitrified:	0.0	0.0	0.0
Cellulosics:	0.0	0.0	0.0
Rubber:	0.0	0.0	0.0
Plastics:	0.0	0.0	0.0
Solidified Inorganic Material:	0.0	0.0	0.0
Solidified Organic Material:	0.0	0.0	0.0
Cement (solidified):	0.0	0.0	0.0
Soils:	0.0	0.0	0.0
Packaging Material Steel:	0.0		
Packaging Material Plastic:	0.0		

FINAL WASTE FORM DESCRIPTORS

Defense:

Residues:

Asbestos:

PCBs:

Source:

SITE IDCs

FINAL FORM RADIONUCLIDES

Isotope **Activity** (Ci/m3)

WASTE VOLUME DETAIL (cu. meters)

As-Generated Waste Form Volumes

Container	Stored	96-97	98-02	03-12	13-22	Totals

Final Waste Form Volumes

Container	Stored	96-97	98-02	03-12	13-22	Totals

As-Generated Form: Stored: Projected: Total:

Final Waste Form: Stored: Projected: Total:

WASTE STREAM DESCRIPTION

WASTE STREAM SOURCE DESCRIPTION

CURRENT CONTAINER COMMENTS

December 1995

Figure 1-3. Blank Waste Stream Profile Form

TWBIR ID:

TRU WASTE BASELINE INVENTORY WASTE PROFILE

COMMENTS	
EPA COMMENTS	
MANAGEMENT COMMENTS	
ACCEPTANCE COMMENTS	

Figure 1-3. Blank Waste Stream Profile Form (continued)

Site-Specific Contact Handled Waste Profiles

Site Name:

Final Waste Form:

Waste Stream ID	Retrievably Stored (m3)	Projected (m3)	Total (m3)

Total Volume:

Material Parameters (kg/m3)	Maximum	Average	Minimum
Iron Base Metals			
Aluminum Base Metals			
Other Metals			
Other Inorganic Material			
Vitrified			
Cellulosics			
Rubber			
Plastics			
Solidified Inorganic Materi			
Solidified Organic Materia			
Cement (Solidified)			
Soils			

Figure 1-4. Blank Site-Specific Waste Profile Form

- Listing of the DOE TRU waste sites (represented by the same Final Waste Form) that are included in the WIPP waste profile, including the name of the DOE TRU waste site;
- Final Waste Form volumes of stored and currently projected waste for each site and
- Summary of minimum, volume weighted average, and maximum weights of waste material parameters per cubic meter of final waste form volume on a WIPP basis (e.g., iron-base metal/alloys, aluminum-base metal/alloys, cellulosics, etc.).

Figure 1-5 provides an example of a blank WIPP waste profile form. The methodology and assumptions for developing WIPP waste profiles and printouts of the WIPP profiles are described in Chapters 2 and 3.

1.3.4 Database Terminology

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

Transuranic Waste Baseline Inventory Database (TWBID) – The TWBID is the database specifically developed to support the TWBIR and any other applications that might need TRU waste information on a waste–stream basis or for higher–level roll-ups.

1.3.5 Other Terminology

Waste Material Parameter – This is one or more nonradioactive waste constituents that occur in a TRU waste stream that is an input parameter into one or more current PA models or PA models under development, a potential future model, or is required to adequately describe the waste form (see Appendix B). The 12 waste material parameters have been grouped by their chemical/physical properties. These waste material parameters and additional packaging materials that are reported in densities (kg/m^3) and included in the TWBIR are:

WASTE MATERIAL PARAMETERS

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

PACKAGING MATERIALS

- Steel
- Plastic
- Lead

Definitions for these waste material parameters can be found in Chapter 2.

WIPP Contact Handled Waste Profiles

Final Waste Form:

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Total Volume			

	Material Parameters (Kg/m3)		
	Maximum	Average	Minimum
Iron Base Metals			
Aluminum Base Metals			
Other Metals			
Other Inorganic Material			
Vitrified			
Cellulosics			
Rubber			
Plastics			
Solidified Inorganic Materi			
Solidified Organic Materia			
Cement (Solidified)			
Soils			

Figure 1-5. Blank WIPP Waste Profile Form

1.4 OBJECTIVES

The objectives of the TWBIR are:

1. **Establish a consistent DOE complex-wide methodology for grouping TRU wastes of similar physical and chemical composition.** A consistent methodology, in support of PA, for grouping TRU wastes of similar physical and chemical properties into "waste profiles" will provide a common frame of reference for discussion of TRU waste issues with regulatory organizations.

2. **Define the inventory of TRU wastes destined for WIPP.** The anticipated inventory of CH-TRU and RH-TRU wastes is defined as the sum of the existing volumes of stored and currently projected waste streams at each of the TRU waste generator/storage sites. The WIPP disposal inventory is defined in Section 1.3.1.

   Scaling of the currently projected CH-TRU waste inventory is necessary to attain the WIPP capacity. There is a high level of uncertainty in and a current lack of consistent data on waste projected to be produced by D&D and ER activities. DOE is developing the ER and D&D inventories through the 1995 *Baseline Environmental Management Report* (BEMR) data call (in development). The data for this report were not available in time to be incorporated in this revision of the TWBIR. Therefore, the projected inventory has been scaled to the WIPP capacity (disposal inventory).

3. **Calculate the disposal inventory in terms of waste material parameters.** Several waste material parameters (e.g., iron-base metal/alloys, rubber, plastics, etc.) have been identified by SNL/NM as being potentially significant in relation to the performance of the WIPP repository (see Table 1-1). Calculating the WIPP disposal inventory in terms of these parameters provides input for the PA calculations and sensitivity analyses needed to determine compliance with federal standards.

4. **Define the total DOE TRU waste inventory.** The Land Withdrawal Act requires that DOE develop recommendations and schedules for the disposal of all DOE TRU waste (Public Law, 1992b). The inventory presented in this document will be used in the development of the plan to respond to the LWA requirement.

1.5 TRU SYSTEM-WIDE DATA ASSUMPTIONS

As stated earlier, the TWBIR was developed using the best available information from the TRU waste generator/storage sites. Some sites used different assumptions and methodologies for reporting their waste stream data. Because of these differences, the TWBIR team had to make assumptions and take specific steps to ensure consistency among the sites' reported data. This section addresses the system-wide assumptions and actions taken by the TWBIR team in reporting the waste stream data. All adjustments made to the TRU waste generator/storage sites' data by the TWBIR team were approved by the sites. For a description of site-specific assumptions, see discussion in front of each site's waste stream profiles in Appendices O and P.

1.5.1 Waste Material Parameter Assumptions

The waste material parameter information reported by the sites must be summed and averaged to obtain data at the site-specific and WIPP waste profile levels. For some waste streams, however, not all of the waste parameter data were available from the sites. In order to calculate material parameters from the waste stream data provided by the sites, the following assumptions were made by the TWBIR team:

- If no minimum was provided, but a maximum was provided, the minimum was assumed to be zero.
- If a maximum and minimum were provided, but no average, the average was assumed to be one half the sum of the maximum and minimum.
- If an average was provided but no minimum or maximum, the average was assigned to the minimum and maximum.
- If only a minimum was provided, the minimum was assigned to both the maximum and the average.

For those waste streams where the site did not provide any waste material parameter information, but which could be assigned to a final waste form, an average set of parameters was calculated and used. This average set of parameters was calculated by volume averaging the parameters provided for other waste streams with the same final waste form.

Waste material parameter data contained in the body of this report are based on these assumptions, whereas, individual waste stream profiles included in Appendices O and P or in the database which accompanies this report contain the original, unchanged data as reported by the TRU waste generator/storage sites.

1.5.2 General Inventory Volume Assumptions

Other assumptions had to be made by the TWBIR team to ensure consistency in inventory volumes:

- Some sites did not provide final waste form volumes for waste streams that would be shipped to WIPP. Final waste form volumes are used in determining the overall inventories. In those instances, the TWBIR team assumed that the reported, as-generated volume would be the same as the final waste form volume.
- Many sites reported the final waste form containers (volumes) in the year that the waste will be treated or repackaged and not in the year the waste is initially generated. Because it is not the intent of the TWBIR to be a WIPP load management document, the TWBIR team put those treated/repackaged waste volumes in the year of initial generation, rather than show the work-off plans for the sites.

1.5.3 Changes to Rocky Flats Environmental Technology Site Volume and Curies Due to Change in Processing Option for Plutonium Residues

The Rocky Flats Environmental Technology Site (RFETS) changed their processing option for plutonium residues after the Revision 2 TWBIR data were submitted. The waste stream data provided in the TWBIR Revision 2 data update are based on processing of plutonium residues to recover plutonium. The current processing option is to repackage the plutonium residues to meet WIPP WAC (DOE, 1991) and ship as TRU waste to WIPP for disposal. There was not enough time left in Revision 2 TWBIR update for RFETS to completely restructure their waste stream profiles to the new processing option in time to achieve the TWBIR Revision 2 schedule. Therefore, in order to more accurately represent the new treatment option (repackaging; ship as waste to WIPP) for plutonium residues, the following supplementary information was requested from RFETS (see Appendix J):

- Changes in total volume of waste by "Final Waste Form" due to the change in processing options
- Report the additional amount of radionuclides that would occur in the RFETS inventories as a result of not processing the plutonium residues to recover plutonium.

The methodology used to incorporate this supplemental information from RFETS, due to the new processing option, into the anticipated inventory (volumes) and the disposal radionuclide inventory (curies) is outlined below.

- The RFETS waste stream profiles are reported (Appendix P or the database that accompanies this report) as submitted with the older processing option, recovery of plutonium.
- In the RFETS site transuranic waste volume (Chapter 4), after all the individual waste stream profiles have been summed for a particular final waste form, the summed volumes are adjusted per the RFETS memo (Appendix J) and this adjustment is indicated in a footnote to the WIPP waste profiles.
- The "adjusted" final waste form volumes for RFETS are then in the summation of all TRU waste site volumes by final waste form to calculate the volumes for the WIPP waste profiles.
- The waste material parameter distributions for the new "ship as waste" option is assumed to be the same as that calculated in the "process to recover plutonium" option.
- Finally, the increased curies reported by RFETS due to the changes in processing options are added to the RFETS radionuclide inventory (Appendix D) and the WIPP radionuclide inventory (Table 3-4). The increased plutonium residue curies are not decayed to end of CY 1994 because RFETS did not have enough time to provide the residue radionuclide inventory for each year.

1.5.4 Packaging Material Assumptions

The TRU waste container data were not always reported consistently. While most did, some of the sites did not provide data for final waste form in WIPP approved containers as defined in WIPP WAC, Revision 3 (DOE, 1989). Some reported their waste in as-generated containers while others did not provide container information. Adjustments had to be made to the data to:

- Achieve consistency at the waste stream level in the presentation of data in the waste stream profiles (Appendices O and P or in the database which accompanies this report).
- Produce the upper-level waste packaging roll-ups needed by PA as inputs to the modeling activities.

1.5.5 Waste Profile Assumptions

The DOE TRU waste generator/storage sites assigned the TRUCON and NMVP codes based on the best available information. Many of the waste streams reported in Appendices O and P (or the database that accompanies this report) do not have TRUCON codes. The generator/storage sites will be required to generate the characterization paperwork necessary for DOE to include these waste streams in TRUCON. The cross-correlation table presented in Appendix E identifies each waste stream, TRUCON code, and NMVP code (if available).

Each waste stream profile was reviewed for consistency in reporting packaging configurations. In cases where incomplete information was submitted, clarifications were requested from the TRU waste generator/storage sites. In those cases where clarifications were not received from these sites, the following assumptions were made, concerning the waste stream profiles:

- If a particular waste container (e.g., 55-gallon drum) was reported by the sites (but no further information was provided), "standard" values of the waste container properties (see Table 1-3) were added to the waste profile forms. An example of this process is listed below for a reported 55-gallon drum without any additional information:

  - Type of material used to fabricate the waste container (steel)

  - The internal volume of the container (0.208 m^3)

  - Inclusion of a "standard" density for the container (131 kg/ m^3).

- If sites reported a "plastic" or "rigid" liner without any further definition of the liner then the values in Table 1-3 were used in the waste stream profiles:

  - A 90-mil high density polyethylene (HDPE) liner was assumed

  - The density for that type of liner was assumed (37 kg/m^3).

For RH-TRU waste, the following assumptions were made:

- If the waste was reported in drums, the drums were assumed to be overpacked in RH canisters at a maximum of three drums per canister.
- If the waste was not reported to be in drums, the waste was assumed to be direct loaded into RH canisters. The standard internal volume for RH canisters and the reported waste stream volume were used to determine the number of RH canisters.
- The lead in the RH canister (464 kg/m^3) is assumed in the packaging roll-ups even if it was not stated on each RH waste stream profile by the TRU waste generator/storage site.

Sites were requested to provide inventories and projections in number of containers. To be consistent with other DOE inventory reports (i.e., proposed Site Treatment Plans, IDB), the TWBIR team converted the number of containers to cubic meters using the internal container volume provided by the sites.

Table 1-3. Packaging Material Assumptions*

Container Configuration	Steel (kg/m^3)	Plastic (kg/m^3)	Lead (kg/m^3)	Volume (m^3)
55-gallon drum	131	37	N/A	0.208
SWB (direct load)	154	1.2	N/A	1.89
SWB (overpack) (4 55-gallon drums)	211	16	N/A	1.89
RH-TRU Canister (direct load)	434	0	464	0.89
RH-TRU Canister (overpack of 3 55-gallon drums)	526	26	464	0.89

*See calculations in Appendix M.

1.5.6 Radionuclide Information Assumptions

Some TRU waste sites reported incomplete radionuclide information (e.g., some show mixed fission products but no transuranic isotopes) for some waste streams. It is assumed that these waste streams will be demonstrated to be TRU upon completion of the radionuclide characterization.

Some sites did not report the radionuclide inventories for some waste streams in the units required by the TWBIR (curies per cubic meter). If the sites could provide the conversion factors, the TWBIR team converted the units to curies per cubic meter. If the conversion factors could not be provided, the radionuclides for these waste stream profiles were not reported in Appendices O and P or in the database that accompanies this report.

As indicated in Section 1.5.3, RFETS requested to change their TWBIR Revision 2 data package after submission. The data package modification was to incorporate a change in processing options for plutonium residues from recovery of plutonium to repackage and ship as waste to WIPP for disposal. The additional increment of curies due to the change in processing options has been included in the RFETS radionuclide submittal for Revision 2, which is reflected in the disposal radionuclide inventory presented later in Chapter 3, Table 3-4 and Appendix D.

The reported radionuclide information provided by the TRU waste generator/storage sites on a waste stream basis for most waste stream profiles is reported in Appendices O and P or in the database that accompanies this document. These data are provided for informational purposes only. The waste stream specific radionuclide data are not used in the calculation of the radionuclide inventory in Chapter 3.

1.6 SOURCE OF TRU WASTE INFORMATION

The TRU waste disposal inventory is derived from existing information on waste, which has been provided by the DOE TRU waste generator/storage sites and is primarily based on acceptable knowledge (see Glossary in Chapter 7). In addition to the general acceptable knowledge of a waste stream for non-radionuclide parameters, the radionuclide inventories are derived from non-destructive assay, with some chemical analyses (to detect isotopes that do not lend themselves to non-destructive analyses or to evaluate waste streams that cannot be effectively analyzed through non-destructive methods), and on-site accountability and tracking records of special nuclear materials including any changes of isotopic ratios during processing.

Transuranic waste information primarily exists in two forms within the DOE TRU waste system:

- On-site documentation developed by the TRU waste generator/storage sites during the history of their operations.
- Summary reports, usually prepared to support WIPP documentation requirements. These summary reports have either been generated by the DOE area office in charge of WIPP or at the DOE-Headquarters (HQ) level. The information contained in these reports is derived from the TRU waste generator/storage sites.

Each of these two forms of waste information is described below.

1.6.1 Site-Specific Waste Information

The TRU waste generator/storage sites use a variety of on-site documents and records in order to derive the information listed for each individual waste stream in Appendices O and P or the database that accompanies this report. The documents/records can include many different sources, some of which might be the following: procurement records, waste stream process manuals, operating procedures, on-site safety documentation, process diagrams, waste production records, storage records, on-site waste database management systems, interviews with existing and former workers, transportation records, waste container tracking records, on-site documentation prepared for local, state, or regional regulators. This list is not meant to be inclusive or representative of all records used at every site, but is intended to be used for example purposes only. The number and types of documents can vary greatly from site-to-site so it is impractical to list them as references in this document.

The TWBIR team provided each DOE TRU waste site with a data package defining each TRU waste stream at their site that was reported in the WTWBIR, Revision 1 from their previous data submittals. The TRU waste generator/storage sites reviewed, changed, and authorized the characterization as valid for use in developing the TRU inventory for the TWBIR, Revision 2.

1.6.2 Existing Summary Documents on TRU Waste Information

In support of various programs, the DOE has published a series of documents over the years that contain varying amounts of waste information. Listed below are those documents that have formed the foundation of summary TRU waste information prior to the publication of the TWBIR.

Mixed Waste Inventory Report

The FFCAct required that the DOE, within 180 days of enactment of the FFCAct, submit to the EPA Administrator and the governor of each state in which the DOE stores or generates mixed wastes a report that contains:

- National inventory of all mixed wastes, regardless of the time they were generated, on a state-by-state basis and
- National inventory of mixed waste treatment capacities and technologies.

The FFCAct also stipulated specific reporting requirements for each of these inventories. The DOE submitted the six-volume set entitled: *U.S. Department of Energy Interim Mixed Waste Inventory Report: Waste Streams, Treatment Capacities and Technologies* (IMWIR), DOE/NBM-1100, dated April 1993 (DOE, 1993b), to fulfill these requirements. Since issuance of the "interim" report, DOE has requested additional information from the DOE TRU waste generator/storage sites and published two updated reports entitled:

- *Release of Phase I Mixed Waste Inventory Report Data*, dated April 1, 1994 (Phase I MWIR) (DOE, 1994b), which includes a data diskette (Version .97B) and the draft *Mixed Waste Inventory Report Data Base System User's Guide*.
- *Distribute* [Distribution] *of the Phase II Mixed Waste Inventory Report Data*, dated May 17, 1994 (Phase II MWIR) (DOE, 1994a), which includes a data diskette (Version 1.00) and the draft *User's Guide for National Data Base System for the Final Mixed Waste Inventory Report* (May 1994).
- *1995 National Mixed Waste Inventory Report Data System* which is the updated *1995 Mixed Waste Inventory Report* (DOE 1995g).

The Phase II MWIR was the basis of the mixed waste streams that were included in Revision 0 of the WTWBIR. The *1995 National Mixed Waste Inventory Report Data System*, Revision 11 of the IDB, and Revision 2 of the TWBIR were based on a joint request for data. Because the waste streams reported in the MWIR are the same as the mixed waste streams reported in the TWBIR, it was decided to expand the data call to accommodate both systems.

Integrated Data Base

The IDB (DOE, 1995d) is published by Oak Ridge National Laboratory (ORNL) for the DOE. The ORNL assembles radioactive waste inventories provided by DOE TRU waste generator/storage sites. This database does not report by waste stream, but rather, by the total inventory at each DOE site. The IDB also contains the radionuclide isotopic distribution for the waste stored at each site. In the past there were apparent inconsistencies between the WIPP TRU Waste Baseline Inventory Report and the IDB inventories due to the time differences and assumptions associated with the two data calls and due to the differences in reporting formats (e.g., "as-generated" versus "final form" volumes). In an effort to eliminate such inconsistencies, the TRU waste section of Revision 11 of the IDB (DOE, 1995d) was developed based on the Revision 1 WTWBIR data call and is presented in Appendix G of this document.

Other Sources of TRU Waste Information

There are additional summary documents that have been produced which contain extensive information about TRU waste. The amount and form of the documentation varies between documents due to the initial purpose for including waste information. These include:

- TRUCON (DOE, 1994c) - This document was developed to provide waste information to the Nuclear Regulatory Commission (NRC) in support of the TRUPACT-II certification application. The TRUCON concentrated on those waste parameters that were important for safe transportation of TRU waste (e.g., thermal heat loading, criticality, free liquids, etc.)
- NMVP (DOE, 1990b) - The No-Migration Variance Petition (NMVP) was developed by DOE to obtain a variance from the land disposal restrictions for mixed waste during the WIPP test phase as allowed under 40 CFR 268.6 (EPA, 1986). The NMVP waste information

concentrated on defining the volumes of various known TRU and MTRU waste streams in the DOE system at that time, and identifying the hazardous constituents expected to be found in the MTRU waste streams. Text was provided in the NMVP on each known waste stream at that time which summarized the acceptable knowledge and sampling and analysis information available (many TWBIR waste streams were not defined at the time the NMVP was developed). A NMVP for the operations/disposal phase will be submitted in 1996 to the EPA. The most current version of the TWBID will be the basis of the waste inventories in the operations/disposal phase NMVP.

- WIPP RCRA Part B Permit Application (DOE, 1995f) – This document has been submitted to the State of New Mexico to obtain a RCRA Part B Permit for WIPP.

TRU waste streams that are included in the TRUCON and the NMVP are cross correlated, if possible, to TWBIR waste streams in Appendix E. The designation of each waste stream in the TRUCON and NMVP, if applicable, can be found on the waste stream profile (Figure 1-3). The TWBIR should be considered the most current source of waste stream information when there is a discrepancy in information between the TWBIR and the TRUCON or NMVP documents.

1.7 METHODOLOGY FOR DEVELOPMENT OF DISPOSAL INVENTORY

Development of the WIPP TRU waste disposal inventory is accomplished by a series of steps starting with the individual waste streams submitted by the TRU waste generator/storage sites that are identified in Appendices O and P or the database that accompanies this report. These waste stream profiles are grouped together, based on similar physical and chemical properties, into common "WIPP waste profiles," which should facilitate discussions concerning the disposal waste inventory with regulatory agencies and stakeholders. The waste profiles also contain information on waste material parameters that could affect the performance of the WIPP repository and that may be direct inputs to the PA models. A more detailed explanation of the waste profile methodology is found in Chapter 2.

Because the volume of the anticipated inventory (as defined in Section 1.3.1) is not sufficient to fill the maximum calculated CH-TRU capacity of WIPP, scaling of the projected CH-TRU inventory is necessary to attain the following WIPP disposal inventory:

- Maximum calculated CH-TRU inventory = 5.95 million cubic feet (approximately 168,500 cubic meters) (see Section 1.3.1)

The anticipated inventory (as defined in Section 1.3.1) consists of up to 11 overall CH-TRU WIPP Final Waste Forms based on the physical and chemical properties of the waste streams. The CH-TRU scaling factor is computed as follows:

- For CH waste:

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

If the sum of the anticipated RH-TRU and CH-TRU inventories are less than the maximum allowable WIPP capacity, the projected inventory in future revisions of the TWBIR will include volumes of waste anticipated from D&D and ER activities as these estimates are made available.

The WIPP disposal inventory is the inventory to be used in PA calculations. To calculate the disposal inventory by Final Waste Form for CH-TRU waste, the projected inventory is multiplied by the scaling factor, added to the stored inventory for each Final Waste Form and summed together. See Section 3.2 for further details.

The RH-TRU anticipated inventory is greater than the WIPP C&C Agreement limit (DOE and State of New Mexico, 1981) of approximately 7,080 cubic meters. DOE will abide by the WIPP C&C Agreement for RH-TRU waste volumes and the Land Withdrawal Act which limits the curies of RH-TRU waste allowed in WIPP to 5.1 million curies (Public Law, 1992b). As stated earlier, one purpose of the TWBIR is to report the DOE TRU inventory in such a way that it will facilitate performance assessment by SNL/NM and support development of compliance applications to the appropriate regulatory agencies. **This is not a WIPP load management document. For these reasons, the RH-TRU inventory has not been scaled back in this document to the regulatory limit.** The RH-TRU inventory for WIPP will be averaged across all RH-TRU waste sites and reported as kg/m^3 for the waste material parameters and curies/m^3 for radionuclides.

1.8 BASELINE INVENTORY UPDATES

The TWBIR represents the best available TRU waste inventory information in support of the WIPP Project. It is anticipated that the TWBIR will be updated periodically. This update cycle will be modified based on the availability of additional waste information and/or the data needs of the WIPP Project as determined by the DOE.

1.9 DOCUMENT ORGANIZATION

The TWBIR is organized into chapters of text, figures, tables and supporting appendices. It flows from specific, detailed TRU waste information (provided by the TRU waste generator/storage sites) to the top level development and description of waste profiles and waste material parameters. The contents of remaining chapters in this document are summarized below:

- Chapter 2 discusses the waste profile methodology .
- Chapter 3 presents the WIPP disposal inventory: volumes, waste material parameters, and radionuclide inventory.
- Chapter 4 provides the stored and currently projected WIPP CH-TRU and RH-TRU inventories by site.
- Chapter 5 provides waste streams that are currently unacceptable for disposal in WIPP.
- Chapter 6 contains a description of the TWBID.
- Chapter 7 contains a glossary of important terms used in this document.
- Chapter 8 lists references cited in the TWBIR.
- Appendix A provides the WIPP site-specific waste profiles.
- Appendix B provides the SNL/NM memorandum describing the WIPP inventory data needed for PA modeling.
- Appendix C provides the TWBIR Revision 2 questionnaire.

- Appendix D provides the site-specific stored radionuclide inventories decayed to December 1995.
- Appendix E provides the cross-correlation table for the TWBIR Revision 2, TRUCON, and the NMVP.
- Appendix F provides the MWIR code designations and descriptions.
- Appendix G provides the TRU waste section of the 1995 Integrated Data Base, *Revision 11*.
- Appendix H provides a cross-reference table for the WTWBIR Revision 1 waste streams and the TWBIR Revision 2 waste streams.
- Appendix I provides a table of the phosphates, sulfates, and nitrates reported by the DOE generator/storage sites.
- Appendix J provides the Rocky Flats Environmental Technology Site memorandum that describes the volume and curie changes due to the change in processing assumptions for plutonium residues.
- Appendix K provides summary information of the mixed and non-mixed WIPP waste by site.
- Appendix L provides the TWBID Revision 2 Data Dictionary.
- Appendix M provides Waste Packaging Material Derivation Calculations.
- *Appendix* N *provides the guidelines for review of generator/storage site waste stream* profiles.
- Appendix O provides the non-WIPP waste stream profiles.
- Appendix P provides the WIPP waste stream profiles.

There will be two distributions of the TWBIR, Revision 2 document. One will be presented in three volumes: Volume 1 contains the TWBID diskettes; the Preface; Executive Summary through Chapter 8; Volumes 2 and 3 contain Appendices A through P. This document presentation will be distributed to regulatory agencies, DOE and other top-level interfaces. A second distribution will be presented in one volume. For this second type of distribution, the volume will contain the TWBID diskettes; the Preface; Eecutive Summary through Chapter 8; and Appendices A through N. Information for Appendices O and P can be found on the diskettes. This document presentation will be distributed to all other users of the TWBIR.

CHAPTER 2

2. WASTE PROFILE METHODOLOGY

2.1 INTRODUCTION

The lowest tier of information in the TWBIR is the waste stream profile, which documents specific information for each separate TRU waste stream identified by each DOE TRU waste generator/storage site. In this chapter the waste stream profile will be discussed along with the methodology for grouping waste streams into site-specific profiles and WIPP waste profiles.

2.1.1 Waste Stream Profile Description

Each DOE TRU waste generator/storage site was provided data packages that contained the characterization information provided by the TRU waste sites for Revision 1 of the WTWBIR. Each DOE site was asked to review the data packages and update the information as necessary (see Appendix C for the TWBIR Revision 2 Questionnaire). Some sites divided their WTWBIR, Revision 1 waste streams into two or more sub-streams to provide greater characterization detail. A cross reference table for WTWBIR, Revision 1 waste streams and TWBIR, Revision 2 waste streams is provided in Appendix H. Additionally, the sites were required to generate data packages for any waste streams that were not defined in the WTWBIR, Revision 1 (e.g., new waste streams or excluded waste streams). This data submittal from the DOE generator/storage sites provided approximately 970 individual TRU waste streams that were used in developing the waste stream profiles (see Appendices O and P or the database that accompanies this report). Figure 2-1 provides an example TRU waste stream profile for an INEL waste stream.

In addition to presenting the density of waste material parameters (if reported by the TRU waste generator/storage sites) in each DOE waste stream, the waste stream profile also provides a cross-reference (top of the waste stream profile form) to the different waste stream nomenclature used in previously generated DOE documents (i.e., TRUCON, NMVP). Appendix E provides a cross correlation table for a TWBIR waste stream with the NMVP and the TRUCON. The fields utilized on the waste stream profile, the sources of the information, and a short explanation of the data located in a particular field are described in Table 2-1. All data (except the MWIR ID which may be provided by the MWIR team) in all waste profiles are provided by the TRU waste generator/storage sites. A complete set of the waste stream profiles is provided in Appendices O and P or in the database that accompanies this report. The waste stream profiles do not incorporate all the data collected in the TWBIR data call questionnaire. Other information, such as that presented in Appendix K, can be obtained by querying the TWBID.

DOE has directed the TRU waste generator/storage sites to append their hazardous waste codes (EPA codes) to further define the waste in order to develop an appropriate treatment technology. These appended codes are recorded in the TWBIR, if they were provided by the generator/storage sites, to maintain consistency with other characterization documents and to provide the maximum characterization information available. These code designations and descriptions are presented in Appendix F. For example, D003 is defined by EPA as a hazardous waste that exhibits "reactive" characteristics. DOE further subdivided this code as D003A (reactive cyanide), D003B (reactive sulfides), D003C (explosives), D003D (water reactives), and D003E (other reactives).

Figure 2-1. Example of Waste Stream Profile from Idaho National Engineering Laboratory

TRU WASTE BASELINE INVENTORY WASTE PROFILE

HQ ID:	IN-W169	Handling:	CH	NMVP #:	116	Stream Name:	DRY PAPER AND RAGS:CH-Cert-repack	Inventory Date:	
Local ID:	ID-RFO-330T	Type:	MTRU	Generator Site:	RF	Final Waste Form:	Heterogeneous	Waste Matrix Code:	S5300

AS-GENERATED EPA CODES

APP8, F005, F003, F002, F001, D029, D022, D008

WASTE MATERIAL PARAMETERS (kg/m3)

	Avg	Min	Max
Iron-base Metal/Alloys:	0.0	0.0	0.0
Aluminum-base Metal/Alloys:	0.0	0.0	0.0
Other Metals/Alloys:	36.8	0.0	233.0
Other Inorganic Material:	27.2	0.0	196.0
Vitrified:	0.0	0.0	0.0
Cellulosics:	135.0	6.6	617.0
Rubber:	57.2	0.0	330.0
Plastics:	188.0	14.8	887.0
Solidified Inorganic Material:	0.0	0.0	0.0
Solidified Organic Material:	0.0	0.0	0.0
Cement (solidified):	0.0	0.0	0.0
Soils:	0.0	0.0	0.0
Packaging Material Steel:	131.0		
Packaging Material Plastic:	37.0		
Packaging Material Lead:	0.0		
Packaging Material Steel Plug:	0.0		

FINAL WASTE FORM DESCRIPTORS

Category:	Defense TRU Waste
Residues:	No
Asbestos:	Unknown
PCBs:	No
Source:	Facility/Equipment Operation and Maintenance Waste

TRUCON CODE

116, 216

FINAL FORM RADIONUCLIDES

Isotope	(Ci/m3)
U-238	8.48E-11
U-235	2.60E-06
Pu-242	9.75E-06
Pu-241	3.61E+00
Pu-240	1.36E-01
Pu-239	5.98E-01
Pu-238	2.11E-02
Am-241	3.78E-01

WASTE VOLUME DETAIL (cu. meters)

As-Generated Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
Box	4266.8	0.0	0.0	0.0	0.0	4266.8
Totals	4266.8	0.0	0.0	0.0	0.0	4266.8

Final Waste Form Volumes

Container	Stored	Pre-97	98-02	03-12	13-22	Totals
55 Gallon Drum	4267.1	0.0	0.0	0.0	0.0	4267.1
Totals	4267.1	0.0	0.0	0.0	0.0	4267.1

As-Generated Form: Stored: 4266.8 Projected: 0.0 Total: 4266.8

Final Waste Form: Stored: 4267.1 Projected: 0.0 Total: 4267.1

WASTE STREAM DESCRIPTION

This waste stream is the largest combustible waste stream. The waste stream is from Rocky Flats Plant and primarily consists of line- and nonline-generated dry combustible materials such as paper, rags, plastics, surgical gloves, cloth overalls and booties, cardboard, wood, wood filter frames, PE bottles, and laundry lint. Some combustibles may be damp or moist. Limited amounts of noncombustibles such as glass, concrete, cement, leaded glovebox gloves, batteries, and metal scrap may also be present.

There is a lack of information about the waste shipped prior to 1975. The average waste organic material content may range from 8 lb/ft3 for boxes to over 14 lb/ft3 for drums. Although limited fines are expected from floor sweepings, powder, etc., levels of fines should be within WIPP-WAC limits. The waste is packaged with no free liquids, sludges, explosives, compressed gases, pyrophoric or corrosive materials.

Depending on when and where the waste was generated at Rocky Flats, the waste packaging may vary. For wastes generated prior to 1975, packaging information is incomplete. Line-generated waste may be double contained in plastic or placed in PE bottles and then double bagged. Nonline-generated wastes were single-bagged or placed directly into the waste container. Oil-Dri may have been added to some drums.

After 1974, some waste was drummed, and some waste was placed in 4 ft x 4 ft x 7 ft boxes. Some combustibles are single, double or quadruple bagged or wrapped PVC and PE bags or plastic. Combustibles such as clothing and dryer lint are placed directly into 55-gallon drums. Some wastes are placed in 1-gallon PE bottles. Some drummed waste was repacked into boxes to reduce volume. During repacking, any noncombustibles were removed. Some boxes may contain moist combustible waste and up to 100 lb of Oil-Dri.

Drums containing wastes from the Americium Recovery Line are lead-lined. Drums shipped prior to 1977 contain compacted wastes.

WASTE STREAM SOURCE

This record represents the {CH-Cert-repack} portion (73.89%) of the MWIR waste stream, {DRY PAPER AND RAGS} after processing. The proposed processing sequence is {SWEPP:segpk IWPF:segpk segpk TRANS:trans WIPP:disp}. This waste will be segregated during future characterization and processing activities. It currently exists only as the unsegregated mixed waste stream, IN-W169, reported in the DOE National Core Mixed and TRU Waste Data Requirements. The storage data is reported in Section 4 and the generation data is reported in Section 5.

This record is subject to redefinition based on changes in the availability/utilization of INEL's treatment resources. It is not recognized as an INEL waste stream. It represents a proposed approach to the processing of the unsegregated mixed waste stream.

CURRENT CONTAINER COMMENTS N/A

EPA COMMENTS

The EPA list in 3.4.3 is based on generator supplied process knowledge and/or headspace gas sampling. No TCLP or Total Analysis has been done.

MANAGEMENT COMMENTS

Total inventory figures as to number of containers and volume of waste, is considered to be fairly accurate. All waste is presently stored on indoor or earthen covered pads. Retrieval from the earthen covered pads will begin in the next 1 - 2 years.

ACCEPTANCE COMMENTS N/A

FINAL FORM COMMENTS

All containers of this WTWBIR waste stream are included in the amount listed above. See 8.2.15.1.13 for the years.

Figure 2-1. Example of Waste Stream Profile from Idaho National Engineering Laboratory

TABLE 2-1. SOURCES OF INFORMATION USED IN WASTE STREAM PROFILES

Information Field	Explanation
TWBIR ID	The TWBIR ID number assigned by the TRU waste generator/storage site
HQ ID	The unique identifier assigned by the Headquarters Waste Inventory team (MWIR)
Local ID	On-site ID used at the TRU waste generator/storage site
Handling	CH – Contact-Handled TRU waste RH – Remote-Handled TRU waste
[Waste] Type	MTRU – mixed TRU waste TRU – nonmixed TRU waste
NMVP #	If applicable, what a waste stream is called in the No Migration Variance Petition (DOE, 1990b)
Generator Site	TRU waste site that originally generated the waste
Stream Name	Name used to identify waste stream by the TRU waste generator/storage site
Final Waste Form	Grouping of wastes into 11 WIPP profiles (see Table 1-2)
Waste Matrix Code	Physical/chemical waste matrix code assigned by the TRU waste generator/storage site (DOE, 1995b)
Inventory Date	Date of the waste volume inventory
TRUCON Code	If applicable, what a waste stream is called in the TRUCON (DOE, 1994c)
As-Generated EPA Codes	Identifies the applicable EPA codes for the waste at the time of generation
Waste Material Parameters	The average (nominal), minimum, and maximum densities of the non-radionuclide waste materials in the waste stream (kg/m^3)
Final Waste Form Descriptors	Identifies if the waste stream is defense, non-defense, or commercial; if it contains residues, asbestos, PCBs, identifies the source for the waste stream
Final Form Radionuclides	Radionuclide inventory of the Final Waste Form of the waste stream. Provides estimate of "typical" radionuclide concentration expected in waste stream on a curies/m^3 basis.
Waste Volume Detail	The as-generated waste form volumes and the final waste form volumes (in cubic meters)
Waste Stream Description	Description of the physical/chemical nature of the waste from Section 3.1 of the TWBIR, Revision 2 Questionnaire (see Appendix C).
Waste Stream Source Description	Description of the waste stream generating process from Section 8.2.9.1 of the TWBIR, Revision 2 Questionnaire (see Appendix C)
Management Comments	Additional information (if provided by the sites) that may be pertinent to the status of current or planned management of the waste stream.
Acceptance Comments	Additional information (if provided by the site) that may be pertinent to the acceptance of the data reported for the waste stream.
Current Container Comments	Additional information (if provided by the site) that may be pertinent to describing the as-generated waste.
EPA Comments	Additional information (if provided by the site) that may be pertinent to the hazardous waste characterization of the waste stream.

2.1.2 Waste Material Parameter Description

This section defines the waste material parameters to be evaluated in PA calculations. Waste material parameter information is provided on the waste stream profile by the TRU waste generator/storage sites. In those cases where waste material parameter information could not be provided by the TRU waste generator/storage sites for waste streams with volumes in the final waste form. An alternative methodology was adopted as described in Section 2.1.3. If a waste stream is to be packaged in Final Waste Form into more than one type of container (e.g., drums and SWBs) and the waste material parameters are different for each container, then the Waste Stream Profile for the waste stream in Appendix O or P will provide a weighted average for all containers for the waste material parameters. The database that accompanies the report will provide the waste material parameters for each container. This waste material parameter information is used to estimate the anticipated WIPP inventory, which is then scaled, if necessary, to obtain the WIPP disposal inventory. This WIPP inventory is presented as a weighted average with a maximum and minimum expected weight/volume for each waste material parameter. The packaging materials are also reported as weight/volume, but there is no range because standard packaging densities in Table 1-3 are used for roll-ups.

The waste material parameter information, which is provided by the TRU waste generator/storage sites, consists of 12 waste material parameters and additional packaging materials that are inputs into the PA models. These are presented below.

- Iron-base metal/alloys – This designation is meant to include iron and steel alloys in the waste and does not include the waste container materials. This also includes an iron-base metallic phase associated with any vitrification process, if applicable.
- Aluminum-base metal/alloys – Aluminum or aluminum-base alloys in the waste materials.
- Other Metal/Alloys – All other metals found in the waste materials (e.g., copper, lead, zirconium, tantalum, etc.). The lead portion of lead rubber gloves/aprons is also included in this category.
- Other Inorganic Materials – Includes inorganic non-metal waste materials such as concrete, glass, firebrick, ceramics, graphite, sand, and inorganic sorbents.
- Vitrified – This refers to waste that has been melted or fused at high temperatures with glass forming additives such as soil or silica in appropriate proportions to result in a homogeneous glass-like matrix. (Note that any unoxidized metallic phases, if present, are included in the "Iron-base metal/alloys" WMP.)
- Cellulosics – Includes those materials generally derived from high polymer plant carbohydrates. Examples are paper, cardboard, kimwipes, wood, cellophane, cloth, etc.
- Rubber – Includes natural or manmade elastic latex materials. Examples are Hypalon®, neoprene, surgeons' gloves, leaded-rubber gloves (rubber part only), etc.
- Plastics – Includes generally manmade materials, often derived from petroleum feedstock. Examples are polyethylene, polyvinylchloride, Lucite®, Teflon, etc.

- Solidified Inorganic Material – Includes any homogenous materials consisting of sludge or aqueous-base liquids that are solidified with cement, Envirostone®, or other solidification agents. Examples are wastewater treatment sludge, cemented aqueous liquids, and inorganic particulates, etc. If a TRU waste site has not reported cement used as part of the solidification process in the "cement (solidified)" WMP, the density of the cement is included in this field.
- Solidified Organic Material – Includes cemented organic resins, solidified organic liquids, and sludges.
- Cement (solidified) – Includes the cement used in solidifying liquids, particulates, and sludges. If for a solidified final waste form this field is left blank, it means that either cement is not the solidifying agent or that the cement is included in the "solidified inorganic material" WMP.
- Soils – Generally consists of naturally occurring soils that have been contaminated with inorganic radioactive waste materials.

Packaging Materials

The TRU waste generator/storage sites have been asked in each waste stream profile to define the final waste form and volumes in containers that are currently approved for shipment. Listed below are the currently approved CH-TRU packaging configurations for TRUPACT-II (NRC, 1995) and anticipated approved RH-TRU packaging configurations (VECTRA Technologies, Inc., 1994):

- TRUPACT-II
  - 55-gallon drum
  - Standard Waste Box (SWB)
  - 55-gallon drums (maximum of 4) overpacked in SWB.
  - Ten drum overpack (TDOP)
- RH-TRU cask (anticipated acceptable packaging configurations for the RH-TRU cask)
  - RH-TRU canister
  - maximum of three 55-gallon or 30-gallon drums overpacked in a RH-TRU canister.

For the rollups in the site-specific and WIPP profiles, the standard values provided in Table 1-3 were used for the packaging materials.

In cases where the sites defined a type of waste container, but not the weight/volume of the packaging, assumptions were made about the weight of the containers in order to include these estimates as part of the overall inventory destined for WIPP. If overpacking a waste container was necessary for transport in a shipping cask, overpacking was assumed. The densities assumed are included as part of the "TRU system-wide data assumptions" included in Section 1.5.4 and Table 1-3.

- Steel – The weight of the steel part of the packaging from container information provided by the TRU waste generator/storage sites. Any necessary overpacking is included in the weight.
- Plastics – The weight of any plastic packaging submitted by the TRU sites. When weight of a rigid liner is not given a 90-mil HDPE liner is assumed.
- Lead – The weight of the lead shielding in a RH-TRU canister is assumed if not provided by the TRU waste generator/storage sites. The weight is included in the "Packaging Material Assumptions" in Section 1.5.

2.1.3 Assignment of the Final Waste Form

The DOE TRU waste generator/storage sites have assigned an overall Final Waste Form to each waste stream based on the physical and chemical form of the waste. The WIPP Project has developed the WIPP WAC (DOE, 1991) for any waste packages to be shipped to WIPP to ensure the safe handling, transport, and emplacement of the waste packages in the WIPP. In general, the final waste forms that meet the Department of Transportation (DOT) regulations and are acceptable for emplacement in WIPP are listed in Table 1-2. The WMC and Final Waste Form are located on each waste stream profile. The assignment of the WMC is based on *DOE Waste Treatability Group Guidance* (DOE, 1995b).

For the purpose of this document, TRU waste generator/storage sites were requested to provide Final Waste Forms for the waste after the sites process, treat, or repackage the waste. The Final Waste Form is indicated on the waste stream profile. For most waste stream profiles, the TRU waste generator/storage sites have provided estimates of the waste material parameters (e.g., an INEL waste stream profile is used for illustrative purposes in Figure 2-1). However, in some cases the TRU waste generator/storage sites were unable to provide waste material parameter values for some waste streams. This resulted in the following possible changes to the overall methodology presented in this chapter:

- In some cases the TRU waste generator/storage sites could categorize the waste stream profile into one of the 11 WIPP Final Waste Forms (Table 1-2) but could not give any waste material parameter information. In these cases, the TWBIR derived the parameters as follows:
  - If the waste stream was reported with waste material parameters in the WTWBIR, Revision 1, the TWBIR team used the Revision 1 parameters.
  - If the waste stream was not reported with waste material parameters in the WTWBIR, Revision 1, the TWBIR team assumed that the waste stream has the same range and average waste material parameters as that of the particular WIPP Final Waste Form

profile. For example, if a salt waste stream did not contain any waste material parameter information, but has been identified by a TRU waste generator/storage site as being a salt final waste form, then the volume of that waste stream was added to the total volume of all other salt waste streams in the WIPP Waste Profile for salt waste.

- In a few cases, TRU waste generator/storage sites were unable to categorize a TRU waste stream into one of the WIPP Final Waste Forms (Table 1-2). In these cases the waste stream profile is placed in the "unknown" category. The "unknown" waste streams are not documented as part of the WIPP inventory, but are listed in the "Possible Future Waste" in Section 5.4. "Unknown" wastes will have to be characterized and may require treatment prior to emplacement in WIPP.

2.2 REVIEW OF WASTE STREAM PROFILES

The TWBIR technical staff conducted a thorough review of each waste stream profile submitted by the generator/storage sites. Appendix N provides the reviewer guidelines for waste stream profile evaluations. If there are questions about the waste stream profiles, the TWBIR team contacts the TRU waste generator/storage site to resolve the issues. In some instances, a member of the team visited the site to support resolution of major discrepancies. Concurrence by TRU waste generator/storage site representative on data changes to waste stream profiles are required prior to publication. Figure 2-2 provides a flow diagram of the waste stream profile review process. New/updated data that are entered in the TWBID are quality checked (QC) to ensure the accuracy of the database.

2.3 SITE-SPECIFIC WASTE PROFILE METHODOLOGY

Waste streams at each TRU waste generator/storage site with similar WMCs can be grouped together into Final Waste Forms (Table 1-2) for a site-specific waste profile. In other words, a site-specific waste profile presents a roll-up of the data for all waste streams at a given site that have the same final waste form. The methodology for grouping waste streams within generator/storage site is shown in Figure 2-3. The grouping of individual waste stream profiles into a site-specific waste profile is based on the similar physical and chemical properties of the waste streams and how that information is used in the PA models (see Appendix B). In the example in Figure 2-3, due to their similar properties for PA modeling, concrete waste, glass waste, firebrick waste, and ceramic waste mainly influence the estimation of porosity and permeability in the PA calculations. Therefore, the three waste streams within DOE TRU Waste Site #1 and the two at DOE TRU Waste Site #2 can be grouped together at each site based on similar physical and chemical properties and placed into the site-specific waste profile "inorganic non-metal" waste, with the Final Waste Form defined in Table 1-2.

A site-specific waste profile is developed at each of the TRU waste generator/storage sites for each of the Final Waste Forms that have individual waste streams at the site. These site-specific waste profiles provide a roll-up of the waste material parameter and volume information found in the waste stream profiles for each site. Since there are 11 Final Waste Forms, there is a maximum of 11 possible CH-TRU and 11 possible RH-TRU site-specific waste profiles at any generator/storage site; however, most sites have fewer profiles due to differences in waste segregation practices. An example site-specific waste profile is provided in Figure 2-4. All the site-specific waste profiles for TRU waste are provided in Appendix A.

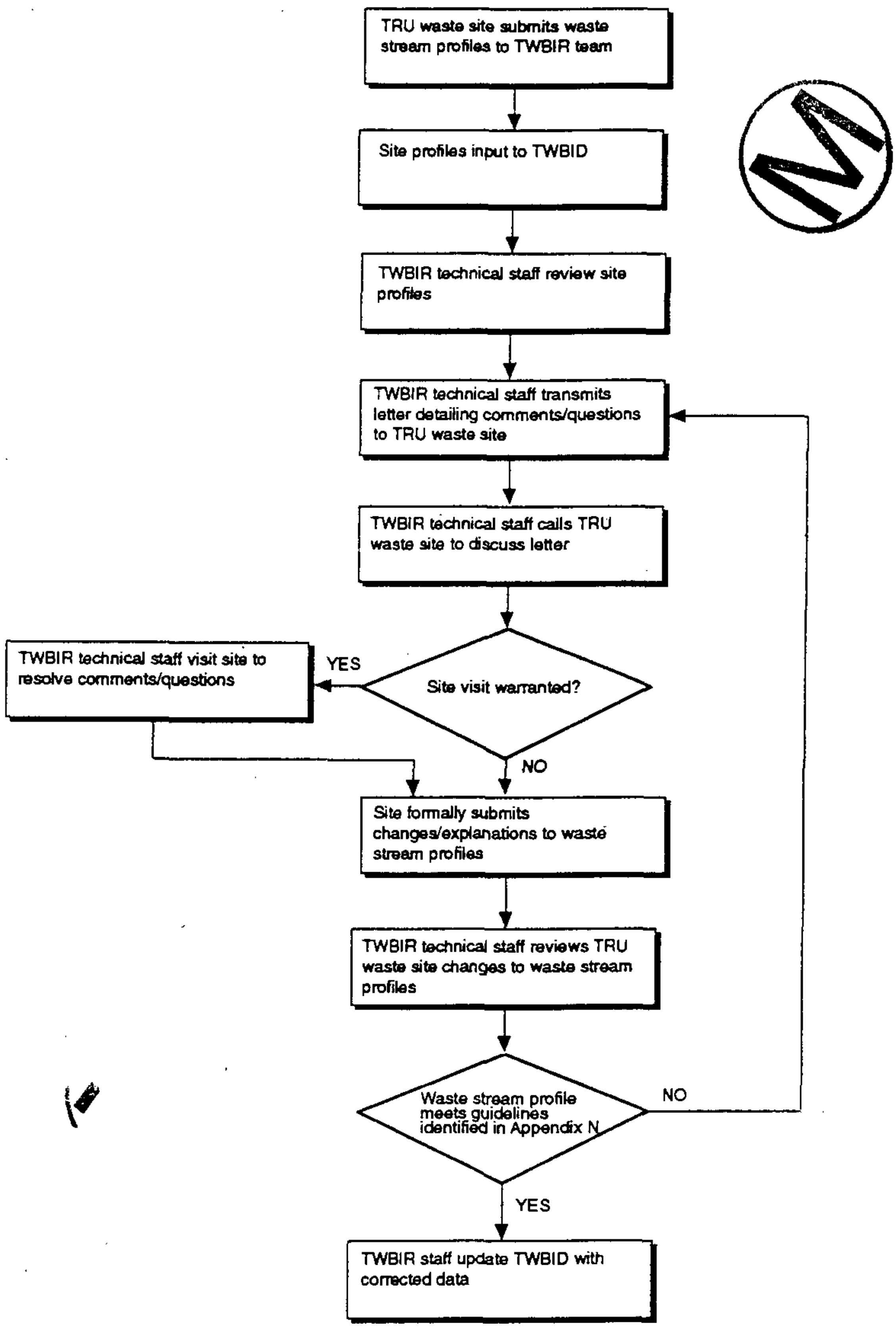

Figure 2-2. Schematic of Review Methodology of Waste Stream Profiles

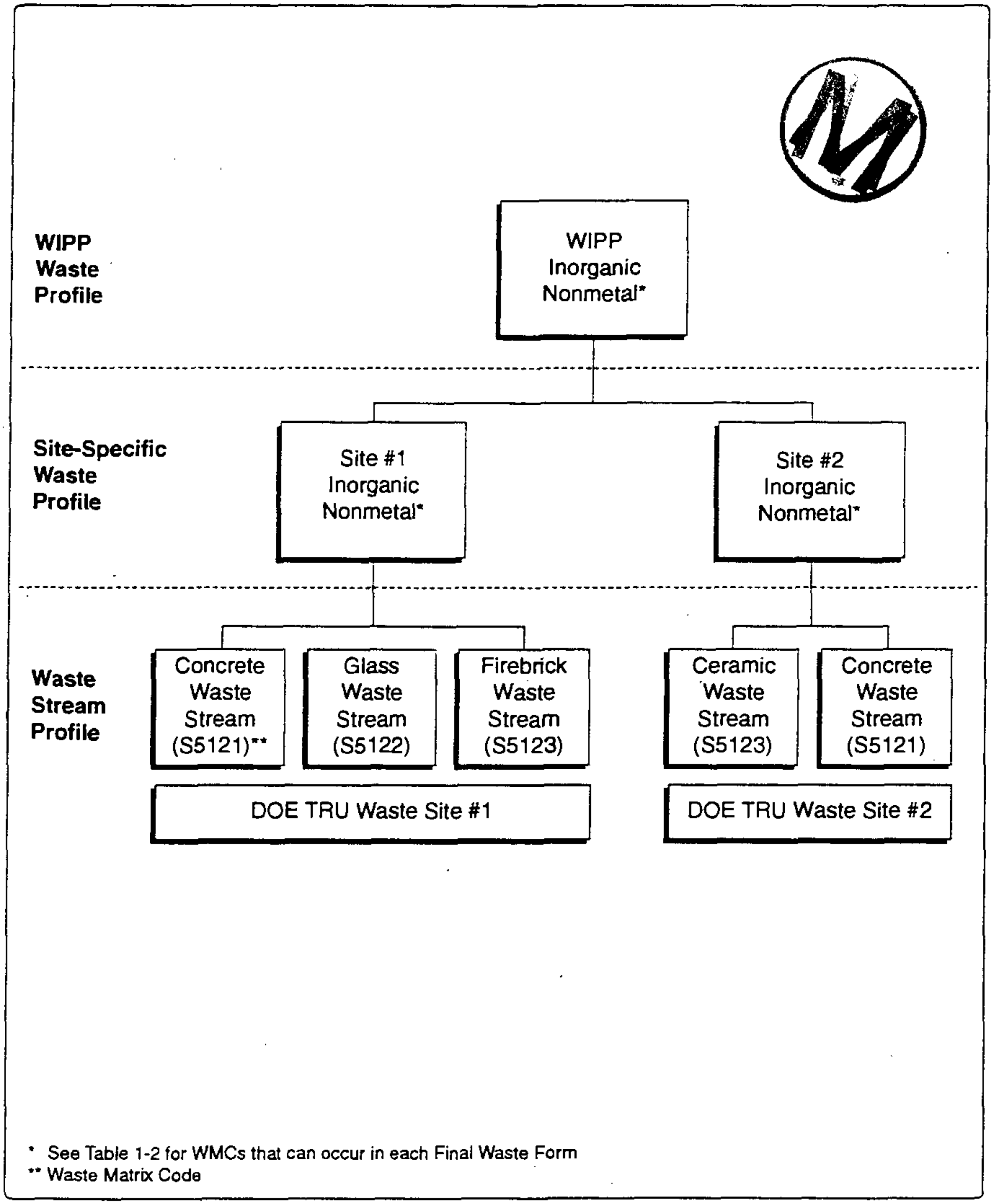

Figure 2-3. Schematic of Waste Stream Profile Methodology.

Site-Specific Contact Handled Waste Profiles

Site Name: Idaho National Engineering Laboratory

Final Waste Form: Combustible

Waste Stream ID	Retrievably Stored (m3)	Projected (m3)	Total (m3)
IN-W186.187	2695.2643	0.0000	2695.2643
IN-W198.202	119.6000	0.0000	119.6000
IN-W198.804	32.8230	0.0000	32.8230
IN-W199.1039	0.8885	0.0000	0.8885
IN-W202.1092	0.8885	0.0000	0.8885
IN-W202.224	109.6160	0.0000	109.6160
IN-W205.1086	0.8320	0.0000	0.8320
IN-W205.220	0.6805	0.0000	0.6805
IN-W250.259	14.0670	0.0000	14.0670
IN-W250.941	50.9600	0.0000	50.9600
IN-W252.283	117.7280	0.0000	117.7280
IN-W252.811	32.8230	0.0000	32.8230
IN-W254.289	2.3445	0.0000	2.3445
IN-W254.290	7.2800	0.0000	7.2800
IN-W256.1062	20.5920	0.0000	20.5920
IN-W256.295	5.9935	0.0000	5.9935
IN-W269.510	5.9935	0.0000	5.9935
IN-W269.535	20.8000	0.0000	20.8000
IN-W305.1068	37.4400	0.0000	37.4400
IN-W305.828	10.6825	0.0000	10.6825
IN-W327.1085	3.5360	0.0000	3.5360
IN-W327.735	1.3045	0.0000	1.3045
IN-W330.677	6.0320	0.0000	6.0320

Figure 2-4. Example of Site-Specific Waste Profile

Site-Specific Contact Handled Waste Profiles

Site Name: Idaho National Engineering Laboratory

Final Waste Form: Combustible

IN-W330.678	1.9285	0.0000	1.9285
IN-W336.660	4.1600	0.0000	4.1600
IN-W336.820	0.6805	0.0000	0.6805
Total Volume:	**3304.94**	**0.00**	**3304.94**

Waste Material Parameters (kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	167.8	2.2	0.0
Aluminum Base Metal/Alloys	0.3	0.0	0.0
Other Metal/Alloys	474.5	7.8	0.0
Other Inorganic Materials	119.0	6.1	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	961.5	479.6	0.0
Rubber	629.0	75.3	0.0
Plastics	706.7	145.9	0.0
Solidified Inorganic Material	0.0	0.0	0.0
Solidified Organic Material	0.0	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	0.0	0.0	0.0

M

Figure 2-4. Example of Site-Specific Waste Profile (continued)

The TWBIR technical staff performs QC on the site-level rollups to be sure that the database rollups are correct, and reviews the summary data to ascertain if the data are "reasonable" based on the experience of the technical staff. If the data appear unreasonable, the TWBIR participant will question the site to be sure that the data have been properly reported. If a change is required, formal documentation from the site is received.

2.4 WIPP WASTE PROFILE METHODOLOGY

The WIPP waste profiles are the highest tier of information in the TWBIR. Site-specific waste profiles with the same Final Waste Form are combined across the TRU waste generator/storage sites into what is defined as an overall WIPP waste profile. To illustrate the methodology for grouping similar site-specific waste profiles into WIPP waste profiles, the CH-TRU WIPP waste profile for "inorganic non-metal" waste (exemplified in Figure 2-3) is provided in Figure 3-5. The TWBIR technical staff evaluates the WIPP-level rollups in a similar manner as described for the site-level rollups.

As described in Sections 2.1 and 2.2, each waste stream from each TRU waste generator/storage site is defined in a waste stream profile, then grouped by site Final Waste Forms into site-specific waste profiles. These site-specific waste profiles are then rolled-up into WIPP waste profiles by combining identical Final Waste Forms from all the TRU waste generator/storage sites. For example, all site-specific waste profiles for "inorganic non-metal" waste are grouped together to generate the WIPP waste profile, "inorganic non-metal" waste. As with the site-specific waste profiles, there can be a maximum of 11 possible WIPP waste profiles for CH-TRU and 11 possible WIPP waste profiles for RH-TRU waste.

CHAPTER 3

3. WIPP DISPOSAL INVENTORY

3.1 INTRODUCTION

The highest tier of information in the TWBIR is the WIPP waste profiles, waste material parameter densities, disposal radionuclide inventory, and the WIPP disposal inventory volumes. This chapter will present these upper level WIPP data sets and the methodology used in deriving the data sets.

3.2 WIPP DISPOSAL INVENTORY VOLUMES FOR EACH FINAL WASTE FORM

As discussed in Section 1.3, the disposal inventory is defined by the LWA (Public Law, 1992b) and the WIPP C&C Agreement (DOE and the State of New Mexico, 1981) as: the maximum allowable WIPP capacity is approximately 175,600 cubic meters, of which RH-TRU disposal inventory is limited to approximately 7,080 cubic meters resulting in a calculated CH-TRU disposal inventory limit of approximately 168,500 cubic meters.

Using volumes for all the defense TRU waste streams (including the mixed and non-mixed TRU waste volumes) in the TWBID, a disposal inventory of TRU waste has been developed using the methodology described in this and the preceding sections. This inventory is presented in Table 3-1 (by Final Waste Forms) and depicts both the anticipated and disposal inventory volumes.

As defined in Section 1.3.1, the anticipated CH-TRU inventory volumes are the sum of the "stored" and "projected" volumes. The procedure to scale to the disposal inventory is summarized below. Scaling of the disposal inventory is for PA purposes to allow PA to model a capacity waste load based on currently anticipated profiles.

- Applying the formula given in Chapter 1:

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

- Multiply the CH-TRU waste projected inventory volumes by the scaling factor for all the Final Waste Forms, and add the stored volumes (which results in the numbers in the "Disposal Inventory" column of Table 3-1).

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

The RH-TRU WIPP inventory has not been scaled. The RH-TRU anticipated inventory is greater than the amount of RH-TRU waste allowed in the WIPP by the C&C Agreement (DOE and the State of New Mexico, 1981). DOE is committed to abide by all agreements and laws regarding RH-TRU limitations. DOE and SNL/NM will evaluate this inventory to determine the disposal

Table 3-1

TRANSURANIC WASTE DISPOSAL INVENTORY FOR WIPP

Contact Handled Waste (Cubic Meters)

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

options for all DOE RH-TRU waste. This inventory has not been scaled down to the limit imposed by the C&C Agreement so that all available data are presented to DOE and SNL/NM to conduct modeling and other evaluations to determine the disposition of this waste.

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

The roll-ups of waste material parameters by Final Waste Forms, or by site, are developed from the volumes from the TWBID. The roll-ups by Final Waste Forms or by site require combining data from several TWBID waste streams. A weighted average value for the waste material parameters is calculated from the average densities provided by the TRU waste generator/storage sites modified by the TWBID volume fractions and summed as follows:

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

where i is an index representing individual waste streams of the same Final Waste Form

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

In some cases, the TRU waste generator/storage sites did not have data for minimum and maximum densities, even though average densities were provided. In these cases; for roll-up purposes only, the assumptions identified in Section 1.5.1 were implemented. This ensures that the calculated and rolled-up maximum densities are equal to or greater than the average densities. However, the maximum density may not be a true maximum but rather the maximum average density (see Chapter 6 for further TWBID information).

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

3.4 UTILIZATION OF WASTE MATERIAL PARAMETER DATA IN APPLICATIONS

The waste material parameter data presented in Tables 3-2 and 3-3 must be used with certain limitations. If the "average" weight/volume (density) composition of CH-TRU and RH-TRU wastes in terms of the waste material parameters is needed then the middle column of Tables 3-2 and 3-3 labelled "Average" should be used in the calculations. If the task requires a distribution of values then the "Maximum" and "Minimum" columns should be used in conjunction with the "Average" column with the following limitations:

Table 3-2

WIPP CH-TRU Waste Material Parameter Disposal Inventory

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

Table 3-3

WIPP RH-TRU Waste Material Parameter Disposal Inventory

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

Container Materials - Kg/m3

Steel	446
Plastic/Liners	3.1
Lead	465
Steel Plug	2145

- The sum of all the waste material parameters in the "average" column represents the "average" weight of a cubic meter of CH–TRU or RH–TRU expected at WIPP. For instance, the "average" cubic meter of CH–TRU waste expected at WIPP is (see Table 3-2):

  592.6 kg/m^3 CH–TRU waste + 165 kg/m^3 of packaging = 757.6 kg/m^3

- The weight of packaging is not expected to vary, so if any "sampling" of distributions of densities is required, the sampling should only be on the waste part of the above equation.
- If sampling of the waste material parameters is needed, caution should be taken in not over- or under-estimating the waste material parameters during analyses. The minimum and maximum values are the absolute extremes and never should a site have an entire waste stream which resulted with values at either extreme. Within a waste stream there may be only one container (as small as 0.002 m^3) that is packaged at either extreme. Additionally, these extremes could result from a projected waste volume which contains more uncertainty than stored waste.

The same sampling methodology, if needed, should be used for the RH–TRU waste as reported in Table 3-3.

TO OBTAIN THE TOTAL WASTE MATERIAL PARAMETER WEIGHTS FOR THE DISPOSAL INVENTORY, USERS OF THE DATA SHOULD MULTIPLY THE AVERAGE DENSITIES OF THE WASTE MATERIAL PARAMETERS FOR CH–TRU (TABLE 3-2) AND RH–TRU (TABLE 3-3) BY THEIR RESPECTIVE DISPOSAL INVENTORY VOLUMES AS DEFINED IN SECTION 1.3.1.

For example:

The expected (average) CH–TRU inventory of cellulosics for WIPP is (Table 3-2):

54 kg/m^3 x 168,500 m^3 (design basis) = 9,099,500 kg cellulosics

For steel in CH–TRU waste:

170 kg/m^3(waste) + 139 kg/m^3(container) = 309 kg/m^3

309 kg/m^3 x 168,500 m^3 = 52,066,500 kg steel

3.5 WIPP WASTE PROFILES

Figures 3-1 through 3-18 present the WIPP profiles by Final Waste Form. These profiles provide the WIPP level volumes and summary waste material parameter densities of each Final Waste Form.

WIPP Contact Handled Waste Profiles

Final Waste Form: Combustible

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Mound Plant	7.07	0.00	7.07
Hanford (Richland) Site	455.73	1247.26	1702.99
Rocky Flats Environmental Technology Site	185.54	861.08	1046.62
Los Alamos National Laboratory	1821.45	2376.19	4197.64
Idaho National Engineering Laboratory	3304.94	0.00	3304.94
Argonne National Laboratory - West	0.00	101.64	101.64
Total Volume	**5774.73**	**4586.18**	**10360.91**

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	265.2	109.0	0.0
Aluminum Base Metal/Alloys	4.9	0.2	0.0
Other Metal/Alloys	474.5	10.4	0.0
Other Inorganic Materials	370.2	8.7	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	961.5	192.5	0.0
Rubber	629.0	30.0	0.0
Plastics	706.7	59.5	0.0
Solidified Inorganic Material	0.0	0.0	0.0
Solidified Organic Material	7.0	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	7.5	0.0	0.0

Figure 3 - 1
WIPP CH-TRU Waste Profile for Final Waste Form Combustible

WIPP Contact Handled Waste Profiles

Final Waste Form: Filter

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Rocky Flats Environmental Technology Site	72.09	477.51	549.60
Mound Plant	0.83	0.00	0.83
Lawrence Livermore National Laboratory	15.54	32.28	47.82
Idaho National Engineering Laboratory	131.05	0.00	131.05
Total Volume	**219.51**	**509.79**	**729.30**

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	150.0	5.3	0.0
Aluminum Base Metal/Alloys	191.6	12.5	0.0
Other Metal/Alloys	20.0	0.8	0.0
Other Inorganic Materials	293.3	15.0	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	429.5	56.3	0.0
Rubber	20.0	3.3	0.0
Plastics	100.0	4.6	0.0
Solidified Inorganic Material	0.0	0.0	0.0
Solidified Organic Material	0.0	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	0.0	0.0	0.0

Figure 3 - 2
WIPP CH-TRU Waste Profile for Final Waste Form Filter

WIPP Contact Handled Waste Profiles

Final Waste Form: Graphite

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Rocky Flats Environmental Technology Site	13.73	47.57	61.30
Idaho National Engineering Laboratory	498.19	0.00	498.19
Total Volume	**511.91**	**47.57**	**559.48**

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	764.4	1.4	0.0
Aluminum Base Metal/Alloys	38.2	0.0	0.0
Other Metal/Alloys	46.6	0.0	0.0
Other Inorganic Materials	812.5	299.9	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	9.8	4.8	0.0
Rubber	0.0	0.0	0.0
Plastics	51.4	5.6	0.0
Solidified Inorganic Material	0.0	0.0	0.0
Solidified Organic Material	0.0	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	0.0	0.0	0.0

Figure 3 - 3
WIPP CH-TRU Waste Profile for Final Waste Form Graphite

WIPP Contact Handled Waste Profiles

Final Waste Form: Heterogeneous

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
University of Missouri Research Reactor	0.21	0.83	1.04
Los Alamos National Laboratory	16.02	29.12	45.14
Hanford (Richland) Site	11190.75	6271.29	17462.04
Lawrence Livermore National Laboratory	198.85	663.78	862.63
Energy Technology Engineering Center	1.68	0.00	1.68
Idaho National Engineering Laboratory	10608.50	0.00	10608.50
Nevada Test Site	613.26	8.98	622.24
Mound Plant	0.62	0.00	0.62
Bettis Atomic Power Laboratory	0.00	123.27	123.27
U.S. Army Material Command	2.50	0.00	2.50
Savannah River Site	2611.61	5475.85	8087.46
Sandia National Laboratory - Albuquerque	6.66	7.49	14.14
Argonne National Laboratory - West	6.54	345.35	351.89
Oak Ridge National Laboratory	1304.16	256.26	1560.42
Rocky Flats Environmental Technology Site	3.86	0.00	3.86
Pantex Plant	0.62	0.00	0.62
Total Volume	**26565.83**	**13182.22**	**39748.05**

Figure 3 - 4
WIPP CH-TRU Waste Profile for Final Waste Form Heterogeneous

WIPP Contact Handled Waste Profiles

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	1716.4	247.3	0.0
Aluminum Base Metal/Alloys	800.0	46.0	0.0
Other Metal/Alloys	800.0	5.7	0.0
Other Inorganic Materials	1442.3	26.2	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	961.5	86.1	0.0
Rubber	330.0	19.4	0.0
Plastics	887.0	71.5	0.0
Solidified Inorganic Material	300.0	3.8	0.0
Solidified Organic Material	331.6	0.4	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	628.4	2.9	0.0

Figure 3-4 (continued)
WIPP CH-TRU Waste Profile for Final Waste Form Heterogeneous

WIPP Contact Handled Waste Profiles

Final Waste Form: Inorganic Non-Metal

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Hanford (Richland) Site	34.74	69.06	103.79
Paducah Gaseous Diffusion Plant	0.00	1.89	1.89
Teledyne Brown Engineering	0.21	0.00	0.21
Idaho National Engineering Laboratory	3028.24	0.00	3028.24
Rocky Flats Environmental Technology Site	58.29	866.74	925.03
Total Volume	**3121.47**	**937.68**	**4059.16**

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	63.6	2.8	0.0
Aluminum Base Metal/Alloys	3.9	0.0	0.0
Other Metal/Alloys	76.6	0.2	0.0
Other Inorganic Materials	1250.0	99.6	0.0
Vitrified	2500.0	1414.6	0.0
Cellulosics	850.0	15.9	0.0
Rubber	47.6	0.4	0.0
Plastics	166.9	6.7	0.0
Solidified Inorganic Material	327.0	1.4	0.0
Solidified Organic Material	0.9	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	865.8	0.0	0.0

Figure 3 - 5
WIPP CH-TRU Waste Profile for Final Waste Form Inorganic Non-Metal

WIPP Contact Handled Waste Profiles

Final Waste Form: Lead/Cadmium Metal Waste

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Argonne National Laboratory - East	1.07	1.29	2.36
Rocky Flats Environmental Technology Site	3.95	298.27	302.22
Los Alamos National Laboratory	1.89	0.00	1.89
Hanford (Richland) Site	14.17	34.53	48.69
Idaho National Engineering Laboratory	14.37	0.00	14.37
Total Volume	35.45	334.09	369.53

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	488.7	133.8	0.0
Aluminum Base Metal/Alloys	61.6	16.6	0.0
Other Metal/Alloys	1438.1	52.2	0.0
Other Inorganic Materials	40.9	11.7	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	87.9	4.0	0.0
Rubber	125.5	15.5	0.0
Plastics	91.7	22.3	0.0
Solidified Inorganic Material	0.0	0.0	0.0
Solidified Organic Material	0.9	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	0.0	0.0	0.0

Figure 3 - 6
WIPP CH-TRU Waste Profile for Final Waste Form Lead/Cadmium Metal Waste

WIPP Contact Handled Waste Profiles

Final Waste Form: Salt Waste

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Rocky Flats Environmental Technology Site	0.00	325.92	325.92
Idaho National Engineering Laboratory	20.52	0.00	20.52
Lawrence Livermore National Laboratory	0.62	3.02	3.64
Total Volume	**21.14**	**328.93**	**350.07**

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	540.0	181.4	0.0
Aluminum Base Metal/Alloys	80.0	0.1	0.0
Other Metal/Alloys	212.0	2.3	0.0
Other Inorganic Materials	625.0	170.1	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	211.7	164.2	0.0
Rubber	20.0	0.0	0.0
Plastics	100.0	0.6	0.0
Solidified Inorganic Material	10.0	0.0	0.0
Solidified Organic Material	10.0	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	0.0	0.0	0.0

Figure 3 - 7
WIPP CH-TRU Waste Profile for Final Waste Form Salt Waste

WIPP Contact Handled Waste Profiles

Final Waste Form: Soils

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Mound Plant	177.18	0.00	177.18
Los Alamos National Laboratory	110.57	29.12	139.69
Hanford (Richland) Site	119.48	5961.70	6081.17
Total Volume	407.23	5990.82	6398.04

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	29.1	1.7	0.0
Aluminum Base Metal/Alloys	0.0	0.0	0.0
Other Metal/Alloys	0.0	0.0	0.0
Other Inorganic Materials	17.4	1.0	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	68.7	3.7	0.0
Rubber	56.4	1.7	0.0
Plastics	131.0	3.2	0.0
Solidified Inorganic Material	0.0	0.0	0.0
Solidified Organic Material	138.2	0.1	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	1600.0	756.9	0.0

Figure 3 - 8
WIPP CH-TRU Waste Profile for Final Waste Form Soils

WIPP Contact Handled Waste Profiles

Final Waste Form: Solidified Inorganics

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Hanford (Richland) Site	12.94	7.07	20.02
Argonne National Laboratory - East	5.20	0.00	5.20
Nevada Test Site	5.67	0.00	5.67
Savannah River Site	200.19	1169.61	1369.80
Rocky Flats Environmental Technology Site	165.36	1257.64	1423.01
Idaho National Engineering Laboratory	4344.44	0.00	4344.44
Mound Plant	6.03	0.00	6.03
Los Alamos National Laboratory	4888.20	2033.82	6922.02
Ames Laboratory - Iowa State Univ.	0.00	0.42	0.42
Lawrence Livermore National Laboratory	14.35	5.82	20.18
Total Volume	**9642.39**	**4474.39**	**14116.78**

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	2375.0	181.4	0.0
Aluminum Base Metal/Alloys	50.0	0.0	0.0
Other Metal/Alloys	544.0	0.8	0.0
Other Inorganic Materials	985.1	80.7	0.0
Vitrified	2473.0	32.4	0.0
Cellulosics	100.0	0.4	0.0
Rubber	32.9	0.0	0.0
Plastics	100.0	2.2	0.0
Solidified Inorganic Material	2180.0	415.6	0.0
Solidified Organic Material	365.0	0.1	0.0
Cement (Solidified)	1166.0	388.1	0.0
Soils	671.5	0.6	0.0

Figure 3 - 9
WIPP CH-TRU Waste Profile for Final Waste Form Solidified Inorganics

WIPP Contact Handled Waste Profiles

Final Waste Form: Solidified Organics

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Rocky Flats Environmental Technology Site	109.82	31.11	140.93
Hanford (Richland) Site	7.36	9.36	16.72
Los Alamos National Laboratory	1.46	29.12	30.58
Idaho National Engineering Laboratory	789.67	0.00	789.67
Argonne National Laboratory - East	0.21	0.00	0.21
Lawrence Livermore National Laboratory	1.04	5.82	6.86
Total Volume	909.56	75.41	984.97

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	100.0	0.3	0.0
Aluminum Base Metal/Alloys	50.0	0.0	0.0
Other Metal/Alloys	20.0	0.0	0.0
Other Inorganic Materials	673.1	115.4	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	100.0	0.3	0.0
Rubber	20.0	0.0	0.0
Plastics	126.5	6.7	0.0
Solidified Inorganic Material	1014.0	20.6	0.0
Solidified Organic Material	1375.6	612.2	0.0
Cement (Solidified)	1166.0	129.8	0.0
Soils	137.2	0.2	0.0

Figure 3 - 10
WIPP CH-TRU Waste Profile for Final Waste Form Solidified Organics

WIPP Contact Handled Waste Profiles

Final Waste Form: Uncategorized Metal

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Savannah River Site	70.35	120.54	190.89
Argonne National Laboratory - East	4.99	128.54	133.54
Mound Plant	82.48	0.00	82.48
Argonne National Laboratory - West	0.00	293.76	293.76
Idaho National Engineering Laboratory	5866.82	0.00	5866.82
Hanford (Richland) Site	444.86	19635.15	20080.01
Los Alamos National Laboratory	4214.43	2853.76	7068.19
Rocky Flats Environmental Technology Site	93.31	236.12	329.43
Total Volume	10777.24	23267.87	34045.12

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	2595.2	153.5	0.0
Aluminum Base Metal/Alloys	73.7	3.5	0.0
Other Metal/Alloys	1586.5	210.3	0.0
Other Inorganic Materials	812.5	14.1	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	184.8	12.2	0.0
Rubber	113.7	0.7	0.0
Plastics	149.0	7.9	0.0
Solidified Inorganic Material	0.0	0.0	0.0
Solidified Organic Material	0.1	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	3.5	0.0	0.0

Figure 3 - 11
WIPP CH-TRU Waste Profile for Final Waste Form Uncategorized Metal

WIPP Remote Handled Waste Profiles

Final Waste Form: Combustible

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Idaho National Engineering Laboratory	21.36	0.00	21.36
Los Alamos National Laboratory	15.13	48.95	64.08
Total Volume	36.49	48.95	85.44

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	265.2	193.3	0.0
Aluminum Base Metal/Alloys	0.4	0.3	0.0
Other Metal/Alloys	330.9	16.6	0.0
Other Inorganic Materials	50.3	8.6	3.3
Vitrified	0.0	0.0	0.0
Cellulosics	98.3	49.0	0.0
Rubber	438.7	64.4	0.0
Plastics	71.1	7.0	0.0
Solidified Inorganic Material	0.0	0.0	0.0
Solidified Organic Material	0.0	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	0.0	0.0	0.0

Figure 3 - 12
WIPP RH-TRU Waste Profile for Final Waste Form Combustible

WIPP Remote Handled Waste Profiles

Final Waste Form: Heterogeneous

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Oak Ridge National Laboratory	1432.01	240.30	1672.31
Los Alamos National Laboratory	11.57	0.00	11.57
Battelle Columbus Laboratories	580.50	0.00	580.50
Bettis Atomic Power Laboratory	0.00	6.67	6.67
Idaho National Engineering Laboratory	49.84	0.00	49.84
Hanford (Richland) Site	199.36	4066.41	4265.77
Argonne National Laboratory - West	0.00	1208.62	1208.62
Total Volume	**2273.28**	**5522.00**	**7795.29**

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	1716.4	175.5	0.0
Aluminum Base Metal/Alloys	167.8	23.7	0.0
Other Metal/Alloys	500.0	14.1	0.0
Other Inorganic Materials	2000.0	185.7	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	572.8	57.4	0.0
Rubber	231.4	10.4	0.0
Plastics	621.9	49.1	0.0
Solidified Inorganic Material	83.0	9.0	0.0
Solidified Organic Material	31.0	2.9	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	24.4	3.5	0.0

Figure 3 - 13
WIPP RH-TRU Waste Profile for Final Waste Form Heterogeneous

WIPP Remote Handled Waste Profiles

Final Waste Form: Inorganic Non-Metal

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Argonne National Laboratory - West	0.00	21.36	21.36
Idaho National Engineering Laboratory	46.28	0.00	46.28
Total Volume	46.28	21.36	67.64

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	4.3	0.9	0.0
Aluminum Base Metal/Alloys	0.0	0.0	0.0
Other Metal/Alloys	9.1	0.1	0.0
Other Inorganic Materials	592.8	55.7	0.0
Vitrified	2500.0	1852.5	0.0
Cellulosics	40.8	6.1	0.0
Rubber	6.1	0.2	0.0
Plastics	48.8	3.8	0.0
Solidified Inorganic Material	2.9	0.4	0.0
Solidified Organic Material	0.0	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	0.4	0.0	0.0

Figure 3 - 14
WIPP RH-TRU Waste Profile for Final Waste Form Inorganic Non-Metal

WIPP Remote Handled Waste Profiles

Final Waste Form: Lead/Cadmium Metal Waste

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Argonne National Laboratory - West	0.00	6.23	6.23
Energy Technology Engineering Center	0.89	0.00	0.89
Hanford (Richland) Site	2.67	60.52	63.19
Idaho National Engineering Laboratory	3.56	0.00	3.56
Total Volume	7.12	66.75	73.87

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	345.0	24.2	4.7
Aluminum Base Metal/Alloys	43.1	2.1	0.0
Other Metal/Alloys	585.3	512.7	104.7
Other Inorganic Materials	29.2	1.4	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	7.1	0.5	0.0
Rubber	17.4	1.9	0.0
Plastics	49.6	2.8	0.0
Solidified Inorganic Material	0.0	0.0	0.0
Solidified Organic Material	202.7	5.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	0.0	0.0	0.0

Figure 3 - 15
WIPP RH-TRU Waste Profile for Final Waste Form Lead/Cadmium Metal Waste

WIPP Remote Handled Waste Profiles

Final Waste Form: Solidified Inorganics

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Oak Ridge National Laboratory	1036.85	206.48	1243.33
Idaho National Engineering Laboratory	65.27	0.00	65.27
Argonne National Laboratory - West	1.78	28.48	30.26
Total Volume	**1103.90**	**234.96**	**1338.86**

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	199.9	3.8	0.0
Aluminum Base Metal/Alloys	0.1	0.0	0.0
Other Metal/Alloys	2.3	0.1	0.0
Other Inorganic Materials	109.6	2.7	0.0
Vitrified	40.5	0.7	0.0
Cellulosics	0.8	0.0	0.0
Rubber	0.0	0.0	0.0
Plastics	6.8	0.3	0.0
Solidified Inorganic Material	609.6	390.5	33.9
Solidified Organic Material	0.5	0.0	0.0
Cement (Solidified)	584.4	385.6	22.6
Soils	0.6	0.0	0.0

Figure 3 - 16
WIPP RH-TRU Waste Profile for Final Waste Form Solidified Inorganics

WIPP Remote Handled Waste Profiles

Final Waste Form: Solidified Organics

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Idaho National Engineering Laboratory	3.56	0.00	3.56
Total Volume	**3.56**	**0.00**	**3.56**

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	0.9	0.3	0.1
Aluminum Base Metal/Alloys	0.4	0.0	0.0
Other Metal/Alloys	0.1	0.0	0.0
Other Inorganic Materials	220.4	115.4	37.8
Vitrified	0.0	0.0	0.0
Cellulosics	1.0	0.3	0.2
Rubber	0.2	0.0	0.0
Plastics	14.1	6.7	1.1
Solidified Inorganic Material	36.0	20.6	17.0
Solidified Organic Material	808.1	612.2	391.2
Cement (Solidified)	195.7	129.8	75.9
Soils	0.2	0.2	0.2

Figure 3 - 17
WIPP RH-TRU Waste Profile for Final Waste Form Solidified Organics

WIPP Remote Handled Waste Profiles

Final Waste Form: Uncategorized Metal

Site	Retrievably Stored (m3)	Projected (m3)	Total (m3)
Argonne National Laboratory - West	17.51	0.00	17.51
Idaho National Engineering Laboratory	30.85	0.00	30.85
Los Alamos National Laboratory	67.64	49.84	117.48
Hanford (Richland) Site	0.00	17400.39	17400.39
Total Volume	**116.00**	**17450.23**	**17566.23**

Waste Material Parameters (Kg/m3)	Maximum	Average	Minimum
Iron Base Metal/Alloys	1146.1	75.3	0.0
Aluminum Base Metal/Alloys	33.5	0.4	0.0
Other Metal/Alloys	913.5	375.5	0.0
Other Inorganic Materials	52.0	15.4	0.0
Vitrified	0.0	0.0	0.0
Cellulosics	129.6	0.8	0.0
Rubber	11.5	0.0	0.0
Plastics	104.5	0.5	0.0
Solidified Inorganic Material	0.0	0.0	0.0
Solidified Organic Material	0.0	0.0	0.0
Cement (Solidified)	0.0	0.0	0.0
Soils	0.0	0.0	0.0

Figure 3 - 18
WIPP RH-TRU Waste Profile for Final Waste Form Uncategorized Metal

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3.6 WIPP DISPOSAL RADIONUCLIDE INVENTORY

The waste-stream level radionuclide data reported in Appendices O and P (and/or on the accompanying TWBID diskettes) are insufficient to derive a WIPP radionuclide inventory because not all sites provided radionuclide data for each individual waste stream. Therefore, the site-level radionuclide inventories collected in the joint IDB and Revision 2 TWBIR data call were used. Table 3-4 provides the radionuclide inventory reported in curies per cubic meter and total curies. The generator/storage sites report the total curies for each isotope for <u>stored waste only</u>. All numbers (except the RFETS plutonium residues as explained in Section 1.5.3) have been decayed to December 1995, using the Oak Ridge Isotope Generation and Depletion Code (ORIGEN 2) (Croff, 1980 and Croff, 1983). The TWBIR team calculated the WIPP radionuclide inventory as follows:

CH-TRU

- All sites (except RFETS)

$$\frac{\text{Total Stored Decayed Curies (IDB)}}{\text{Total Stored Volume (TWBIR)}} = \text{Stored Ci/m}^3$$

- For RFETS

$$\frac{\text{Total Stored Decayed Curies (IDB)}}{\underset{\text{(TWBIR)}}{\text{Total Stored Volume}} - \underset{\text{(TWBIR, Appendix J)}}{\text{RFETS Actinide Separation Residue Volume}}} = \text{Stored Ci/m}^3$$

Because RFETS did not report plutonium residue curies in the IDB submittals, the RFETS plutonium residue volumes had to be subtracted from the TWBIR stored volumes to make the TWBIR consistent with the IDB.

To calculate the radionuclide inventory for all sites (except RFETS) the following formula was used:

$$\begin{array}{c}\text{Stored Decayed Curies (IDB) +} \\ \text{[(Scaled Projected Volumes) (Stored Ci/m}^3\text{)]} \\ \text{(TWBIR)}\end{array} = \begin{array}{c}\text{Total Decayed CH-TRU WIPP Curies} \\ \text{for all sites except RFETS}\end{array}$$

For the RFETS, the following formula was used:

$$\begin{array}{c}\text{Stored Decayed}\\ \text{Curies (IDB)}\end{array} + \begin{array}{c}\text{RFETS (ship as waste)}\\ \text{Undecayed Curies}\\ \text{(TWBIR, Appendix J)}\end{array} + \left[\left(\begin{array}{c}\text{Scaled Projected}\\ \text{Volumes (TWBIR)}\end{array}\right)\left(\begin{array}{c}\text{Stored}\\ \text{Ci/m}^3\end{array}\right)\right] = \begin{array}{c}\text{Total Decayed}\\ \text{CH-TRU WIPP}\\ \text{Curies for RFETS}\end{array}$$

To calculate the WIPP CH-TRU radionuclide inventory in Ci/m^3):

$$\frac{\text{Total Decayed CH-TRU WIPP Curies for all sites}}{\text{CH-TRU Disposal Inventory}} = \text{CH-TRU radionuclide inventory (Ci/m}^3\text{)}$$

RH-TRU

$$\frac{\text{Total Stored Decayed Curies (IDB)}}{\text{Total Stored Volume (TWBIR)}} = \text{Stored Ci/m}^3$$

$$\begin{array}{c}\text{Stored Decayed Curies (IDB) +}\\ \text{[(Total Projected Volumes) (Stored Ci/m}^3\text{)]}\\ \text{(TWBIR)}\end{array} = \text{Total Decayed RH-TRU WIPP Curies}$$

To calculate the WIPP RH-TRU radionuclide inventory in Ci/m^3:

$$\frac{\text{Total Decayed RH-TRU WIPP Curies}}{\text{Total RH-TRU (stored \& projected) Inventory}} = \text{RH-TRU radionuclide inventory (Ci/m}^3\text{)}$$

Reporting the radionuclide inventory and curies per cubic meter (see Table 3-4) will allow the users of the data the opportunity to scale the radionuclide inventory to various volumes for sensitivity studies. Reporting in terms of curies per cubic meter also eliminates the requirement to scale down the RH-TRU inventory to the WIPP disposal RH-TRU inventory. Assuming that the radionuclide distribution for the WIPP inventory will be the same as that reported for the stored inventory, the total CH-TRU and RH-TRU radionuclide inventory is estimated in Table 3-4 by multiplying the respective disposal inventories as defined in Section 1.3.1 (168,500 cubic meters for CH-TRU and 7,080 cubic meters for RH-TRU).

Appendix D presents the radionuclide inventory in decayed curies for each TRU waste site for the stored waste inventories provided by the TRU waste generator/storage sites. Again, these numbers were decayed to December, 1995 using ORIGEN 2. The RFETS plutonium residue curies, which are included in the numbers in Table 3-4, are undecayed values (see Appendix J) and were added to their decayed site radionuclide inventory submittal to calculate the total RFETS radionuclide inventory. The results are reported as the RFETS radionuclide inventory in Appendix D.

Since Oak Ridge National Laboratory (ORNL) reported a very conservative inventory for U-235 in RH-TRU waste, the anticipated transportation requirements of the RH-TRU canister have been imposed on the RH-TRU inventory in order to estimate the curies per cubic meter of U-235 in the WIPP radionuclide inventory for RH-TRU waste.

The basis for the new estimate for U-235 is the anticipated initial transportation limit of a maximum of 325 grams of Pu-239 fissile gram equivalent (FGE) for an RH canister (DOE, 1991). Based on the curies per cubic meter calculated for Pu-239 (1.45 Ci/m^3) and U-233 (4.50E-03 Ci/m^3) in Table 3-4 for RH-TRU waste, it was estimated that these two radionuclides would contribute a total of approximately 21.8 grams of Pu-239 FGE per RH canister. If the transportation limit of 325 Pu-239 FGE is imposed, the maximum amount of U-235 that can be transported would equal not more than 303.8 Pu-239 FGE. Assuming a 1:1 equivalence for U-235 in terms of Pu-239 FGE (Nuclear Packaging, 1991) and 2.19 curies per gram of U-235, the curies per cubic meter of U-235 is estimated as,

$$= \frac{303.8 \text{ g of U-235}}{\text{RH Canister}} \times \frac{1 \text{ RH Canister}}{0.89 \text{ m}^3} \times \frac{2.19\text{E-06 Curies of U-235}}{1 \text{ g of U-235}}$$

$$= 7.47\text{E-04 Ci/m}^3$$

To avoid discrepancies in reporting the radionuclide inventory between the IDB and the Baseline Inventory Report, the TRU waste section of Revision 11 of the IDB is based on Revision 1 of the WTWBIR. Appendix G of this report presents the site-level radionuclide inventory as reported in Revision 11 of the IDB (DOE, 1995d).

Table 3-4. Disposal Radionuclide Inventory[1]

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Ac225	1.71E-05	4.89E-06	2.88E+00	3.46E-02
Ac227	3.61E-06	2.05E-07	6.08E-01	1.45E-03
Ac228	4.43E-06	1.10E-05	7.46E-01	7.76E-02
Ag109M	9.32E-05	NR	1.57E+01	NR
Ag110	4.20E-14	2.46E-13	7.07E-09	1.74E-09
Ag110M	7.48E-12	1.85E-11	1.26E-06	1.31E-07
Am241	2.60E+00	8.42E-01	4.39E+05	5.96E+03
Am243	1.93E-04	3.23E-08	3.25E+01	2.28E-04
Am245	7.89E-15	4.06E-20	1.33E-09	2.87E-16
At217	1.71E-05	4.89E-06	2.88E+00	3.46E-02
Ba137m	4.53E-02	2.89E+01	7.63E+03	2.04E+05
Bi210	1.52E-05	1.00E-09	2.55E+00	7.08E-06
Bi211	3.61E-06	2.05E-07	6.09E-01	1.45E-03
Bi212	1.61E-04	8.53E-05	2.71E+01	6.04E-01
Bi213	1.71E-05	4.89E-06	2.88E+00	3.46E-02
Bi214	6.91E-05	4.97E-09	1.16E+01	3.52E-05
Bk249	5.44E-10	2.80E-15	9.16E-05	1.98E-11
Bk250	2.59E-16	NR	4.37E-11	NR
C14	6.43E-05	2.89E-04	1.08E+01	2.05E+00
Cd109	9.31E-05	NR	1.57E+01	NR
Cd113m	1.09E-11	7.71E-11	1.84E-06	5.46E-07

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

Table 3-4. Disposal Radionuclide Inventory (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Ce144	3.71E-07	7.25E-04	6.26E-02	5.14E+00
Cf249	3.81E-07	6.31E-07	6.42E-02	4.47E-03
Cf250	1.96E-06	NR	3.30E-01	NR
Cf251	2.24E-08	NR	3.78E-03	NR
Cf252	1.41E-03	1.82E-04	2.37E+02	1.29E+00
Cm242	1.92E-08	NR	3.23E-03	NR
Cm243	1.63E-05	6.98E-03	2.75E+00	4.95E+01
Cm244	4.72E-02	4.45E-02	7.96E+03	3.15E+02
Cm245	6.64E-04	2.07E-10	1.12E+02	1.46E-06
Cm246	6.06E-07	NR	1.02E-01	NR
Cm247	1.91E-14	NR	3.21E-09	NR
Cm248	5.29E-07	2.89E-08	8.91E-02	2.05E-04
Co58	1.81E-18	1.75E-15	3.05E-13	1.24E-11
Co60	3.83E-04	1.47E+00	6.46E+01	1.04E+04
Cr51	NR	4.29E-10	NR	3.04E-06
Cs134	7.97E-08	2.60E-03	1.34E-02	1.84E+01
Cs135	2.98E-09	1.66E-08	5.02E-04	1.17E-04
Cs137	4.78E-02	3.05E+01	8.06E+03	2.16E+05
Es254	2.51E-16	NR	4.24E-11	NR
Eu150	2.08E-10	NR	3.51E-05	NR
Eu152	7.46E-06	1.73E-01	1.26E+00	1.22E+03
Eu154	6.81E-06	8.36E-02	1.15E+00	5.92E+02

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

Corrected 3/11/96

Table 3-4. Disposal Radionuclide Inventory (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Eu155	1.86E-03	1.67E-02	3.14E+02	1.18E+02
Fe55	1.13E-10	2.38E-05	1.91E-05	1.68E-01
Fe59	1.57E-12	NR	2.64E-07	NR
Fr221	1.71E-05	4.89E-06	2.88E+00	3.46E-02
Fr223	4.98E-08	2.83E-09	8.39E-03	2.01E-05
H3	5.15E-06	9.33E-06	8.68E-01	6.60E-02
I129	4.11E-12	NR	6.93E-07	NR
Kr85	1.20E-06	2.37E-04	2.02E-01	1.68E+00
Mn54	5.06E-09	3.31E-06	8.52E-04	2.34E-02
Nb95	1.51E-14	1.48E-07	2.54E-09	1.05E-03
Nb95m	5.04E-17	1.16E-10	8.50E-12	8.19E-07
Ni59	4.39E-08	NR	7.40E-03	NR
Ni63	5.35E-06	1.40E-04	9.02E-01	9.89E-01
Np237	3.26E-04	6.85E-06	5.49E+01	4.85E-02
Np239	2.20E-04	3.23E-08	3.71E+01	2.28E-04
Np240M	8.91E-12	3.12E-15	1.50E-06	2.21E-11
Pa231	2.67E-06	1.24E-06	4.51E-01	8.79E-03
Pa233	3.26E-04	6.85E-06	5.49E+01	4.85E-02
Pa234	3.05E-07	2.64E-07	5.14E-02	1.87E-03
Pa234m	2.35E-04	2.03E-04	3.96E+01	1.44E+00
Pb209	1.71E-05	4.89E-06	2.88E+00	3.46E-02

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

Table 3-4. Disposal Radionuclide Inventory (continued)

Nuclide	CH-TRU Waste (Ci/m³)	RH-TRU Waste (Ci/m³)	CH-TRU Waste (Total Curies²)	RH-TRU Waste (Total Curies²)
Pb210	1.52E-05	1.00E-09	2.55E+00	7.08E-06
Pb211	3.61E-06	2.05E-07	6.09E-01	1.45E-03
Pb212	1.61E-04	8.53E-05	2.71E+01	6.04E-01
Pb214	6.91E-05	4.97E-09	1.16E+01	3.52E-05
Pd107	4.40E-10	2.45E-09	7.41E-05	1.73E-05
Pm147	4.68E-05	1.52E-03	7.88E+00	1.07E+01
Po210	1.52E-05	1.00E-09	2.55E+00	7.08E-06
Po211	1.01E-08	5.75E-10	1.71E-03	4.07E-06
Po212	1.03E-04	5.47E-05	1.73E+01	3.87E-01
Po213	1.67E-05	4.78E-06	2.82E+00	3.39E-02
Po214	6.91E-05	4.97E-09	1.16E+01	3.52E-05
Po215	3.61E-06	2.05E-07	6.09E-01	1.45E-03
Po216	1.61E-04	8.63E-05	2.71E+01	6.11E-01
Po218	6.91E-05	4.97E-09	1.16E+01	3.52E-05
Pr144	3.67E-07	8.68E-04	6.18E-02	6.14E+00
Pu236	6.16E-08	NR	1.04E-02	NR
Pu238	2.26E+01	2.05E-01	3.80E+06	1.45E+03
Pu239	4.64E+00	1.45E+00	7.82E+05	1.03E+04
Pu240	1.23E+00	7.16E-01	2.08E+05	5.07E+03
Pu241	1.55E+01	2.00E+01	2.61E+06	1.42E+05
Pu242	6.93E-03	2.11E-05	1.17E+03	1.50E-01

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

Table 3-4. Disposal Radionuclide Inventory (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Pu243	1.91E-14	NR	3.21E-09	NR
Pu244	8.92E-12	3.12E-15	1.50E-06	2.21E-11
Ra223	1.39E-05	2.05E-07	2.34E+00	1.45E-03
Ra224	1.61E-04	8.53E-05	2.71E+01	6.04E-01
Ra225	1.71E-05	4.89E-06	2.88E+00	3.46E-02
Ra226	6.95E-05	4.97E-09	1.17E+01	3.52E-05
Ra228	4.43E-06	1.10E-05	7.46E-01	7.76E-02
Rh106	1.72E-07	1.54E-03	2.90E-02	1.09E+01
Rn219	3.61E-06	2.05E-07	6.09E-01	1.45E-03
Rn220	1.61E-04	8.53E-05	2.71E+01	6.04E-01
Rn222	6.91E-05	4.97E-09	1.16E+01	3.52E-05
Ru106	1.72E-07	1.54E-03	2.90E-02	1.09E+01
Sb125	7.17E-07	2.67E-04	1.21E-01	1.89E+00
Sb126	8.02E-10	4.46E-09	1.35E-04	3.16E-05
Sb126m	5.73E-09	3.18E-08	9.65E-04	2.25E-04
Se79	2.58E-09	1.44E-08	4.35E-04	1.02E-04
Sm151	8.76E-06	5.06E-05	1.48E+00	3.58E-01
Sn119m	2.46E-11	1.35E-10	4.14E-06	9.59E-07
Sn121M	1.58E-07	9.46E-07	2.66E-02	6.70E-03
Sn126	5.80E-09	3.18E-08	9.77E-04	2.25E-04
Sr89	NR	2.65E-08	NR	1.88E-04

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

Table 3-4. Disposal Radionuclide Inventory (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
Sr90	4.07E-02	2.95E+01	6.85E+03	2.09E+05
Ta182	NR	5.95E-12	NR	4.21E-08
Tc99	1.49E-04	8.26E-07	2.52E+01	5.85E-03
Te125m	1.75E-07	6.57E-05	2.95E-02	4.65E-01
Te127	7.72E-13	2.42E-13	1.30E-07	1.72E-09
Te127m	7.88E-13	2.47E-13	1.33E-07	1.75E-09
Th227	3.56E-06	2.03E-07	6.01E-01	1.43E-03
Th228	1.61E-04	8.53E-05	2.71E+01	6.04E-01
Th229	1.71E-05	4.89E-06	2.88E+00	3.46E-02
Th230	5.36E-07	1.04E-06	9.03E-02	7.34E-03
Th231	7.60E-05	9.38E-03	1.28E+01	6.64E+01
Th232	5.41E-06	1.31E-05	9.11E-01	9.24E-02
Th234	2.35E-04	2.03E-04	3.96E+01	1.44E+00
Tl207	3.60E-06	2.05E-07	6.07E-01	1.45E-03
Tl208	5.77E-05	3.07E-05	9.73E+00	2.17E-01
Tl209	3.69E-07	1.06E-07	6.22E-02	7.48E-04
U232	1.56E-04	8.31E-05	2.63E+01	5.88E-01
U233	1.18E-02	4.50E-03	2.00E+03	3.18E+01
U234	3.28E-03	5.55E-03	5.53E+02	3.93E+01
U235	7.60E-05	7.34E-04	1.28E+01	5.20E+00
U236	1.89E-06	3.70E-07	3.19E-01	2.62E-03

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

Table 3-4. Disposal Radionuclide Inventory (continued)

Nuclide	CH-TRU Waste (Ci/m^3)	RH-TRU Waste (Ci/m^3)	CH-TRU Waste (Total Curies[2])	RH-TRU Waste (Total Curies[2])
U237	2.31E-04	4.91E-04	3.89E+01	3.48E+00
U238	2.35E-04	2.03E-04	3.96E+01	1.44E+00
U240	8.91E-12	3.12E-15	1.50E-06	2.21E-11
Y90	4.07E-02	2.95E+01	6.85E+03	2.09E+05
Zn65	4.13E-14	NR	6.96E-09	NR
Zr93	NR	2.89E-07	NR	2.04E-03
Zr95	NR	1.56E-08	NR	1.10E-04
TOTALS	**4.68E+01**	**1.43E+02**	**7.88E+06**	**1.02E+06**

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

CHAPTER 4

4. STORED AND PROJECTED WIPP CH-TRU AND RH-TRU INVENTORIES BY SITE

As described in Chapter 2, each WIPP waste stream from each waste generator/storage site is characterized in a waste stream profile (Appendix P or the accompanying TWBID). These waste stream profiles are rolled-up by Final Waste Forms for each generator/storage site. Summary tables of contact-handled and remote-handled WIPP (only) waste volumes by site are provided in Tables 4-1 and 4-2. Summary profiles of WIPP waste volumes by Final Waste Form for each site are provided in Tables 4-3 through 4-23. Additional information is presented in Appendix K.

Table 4 - 1

WIPP CH-TRU Waste Anticipated Inventory By Site

(Cubic Meters)

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

Table 4 - 2

WIPP RH-TRU Waste Anticipated Inventory By Site

(Cubic Meters)

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

Table 4 - 3

Ames Laboratory - Iowa State Univ. Final Waste Form Volumes

	(Cubic Meters)		
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Solidified Inorganics	0.00	0.42	0.42
Total CH Volumes	**0.00**	**0.42**	**0.42**

Table 4 - 4

Argonne National Laboratory - East Final Waste Form Volumes

	(Cubic Meters)		
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Lead/Cadmium Metal Waste	1.07	1.29	2.36
Solidified Inorganics	5.20	0.00	5.20
Solidified Organics	0.21	0.00	0.21
Uncategorized Metal	4.99	128.54	133.54
Total CH Volumes	**11.47**	**129.83**	**141.30**

Table 4 - 5

Argonne National Laboratory - West Final Waste Form Volumes

(Cubic Meters)

Final Waste Form	Retrievably Stored	Projected	Total
Contact Handled Waste			
Combustible	0.00	101.64	101.64
Heterogeneous	6.54	345.35	351.89
Uncategorized Metal	0.00	293.76	293.76
Total CH Volumes	**6.54**	**740.76**	**747.30**
Remote Handled Waste			
Heterogeneous	0.00	1208.62	1208.62
Inorganic Non-Metal	0.00	21.36	21.36
Lead/Cadmium Metal Waste	0.00	6.23	6.23
Solidified Inorganics	1.78	28.48	30.26
Uncategorized Metal	17.51	0.00	17.51
Total RH Volumes	**19.29**	**1264.69**	**1283.98**

Table 4 - 6

Battelle Columbus Laboratories Final Waste Form Volumes

	(Cubic Meters)		
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Total CH Volumes			
Remote Handled Waste			
Heterogeneous	580.50	0.00	580.50
Total RH Volumes	**580.50**	**0.00**	**580.50**

Table 4 - 7

Bettis Atomic Power Laboratory Final Waste Form Volumes

(Cubic Meters)

Final Waste Form	Retrievably Stored	Projected	Total
Contact Handled Waste			
Heterogeneous	0.00	123.27	123.27
Total CH Volumes	**0.00**	**123.27**	**123.27**
Remote Handled Waste			
Heterogeneous	0.00	6.67	6.67
Total RH Volumes	**0.00**	**6.67**	**6.67**

Table 4 - 8

Energy Technology Engineering Center Final Waste Form Volumes

	(Cubic Meters)		
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Heterogeneous	1.68	0.00	1.68
Total CH Volumes	**1.68**	**0.00**	**1.68**
Remote Handled Waste			
Lead/Cadmium Metal Waste	0.89	0.00	0.89
Total RH Volumes	**0.89**	**0.00**	**0.89**

Table 4 - 9

Hanford (Richland) Site Final Waste Form Volumes

(Cubic Meters)

Final Waste Form	Retrievably Stored	Projected	Total
Contact Handled Waste			
Combustible	455.73	1247.26	1702.99
Heterogeneous	11190.75	6271.29	17462.04
Inorganic Non-Metal	34.74	69.06	103.79
Lead/Cadmium Metal Waste	14.17	34.53	48.69
Soils	119.48	5961.70	6081.17
Solidified Inorganics	12.94	7.07	20.02
Solidified Organics	7.36	9.36	16.72
Uncategorized Metal	444.86	19635.15	20080.01
Total CH Volumes	**12280.03**	**33235.41**	**45515.44**
Remote Handled Waste			
Heterogeneous	199.36	4066.41	4265.77
Lead/Cadmium Metal Waste	2.67	60.52	63.19
Uncategorized Metal	0.00	17400.39	17400.39
Total RH Volumes	**202.03**	**21527.32**	**21729.35**

Table 4 - 10

Idaho National Engineering Laboratory Final Waste Form Volumes

(Cubic Meters)

Final Waste Form	Retrievably Stored	Projected	Total
Contact Handled Waste			
Combustible	3304.94	0.00	3304.94
Filter	131.05	0.00	131.05
Graphite	498.19	0.00	498.19
Heterogeneous	10608.50	0.00	10608.50
Inorganic Non-Metal	3028.24	0.00	3028.24
Lead/Cadmium Metal Waste	14.37	0.00	14.37
Salt Waste	20.52	0.00	20.52
Solidified Inorganics	4344.44	0.00	4344.44
Solidified Organics	789.67	0.00	789.67
Uncategorized Metal	5866.82	0.00	5866.82
Total CH Volumes	**28606.72**	**0.00**	**28606.72**
Remote Handled Waste			
Combustible	21.36	0.00	21.36
Heterogeneous	49.84	0.00	49.84
Inorganic Non-Metal	46.28	0.00	46.28
Lead/Cadmium Metal Waste	3.56	0.00	3.56
Solidified Inorganics	65.27	0.00	65.27
Solidified Organics	3.56	0.00	3.56
Uncategorized Metal	30.85	0.00	30.85
Total RH Volumes	**220.72**	**0.00**	**220.72**

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Table 4 - 11

Lawrence Livermore National Laboratory Final Waste Form Volumes

	(Cubic Meters)		
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Filter	15.54	32.28	47.82
Heterogeneous	198.85	663.78	862.63
Salt Waste	0.62	3.02	3.64
Solidified Inorganics	14.35	5.82	20.18
Solidified Organics	1.04	5.82	6.86
Total CH Volumes	**230.40**	**710.73**	**941.13**

Table 4 - 12

Los Alamos National Laboratory Final Waste Form Volumes

(Cubic Meters)

Final Waste Form	Retrievably Stored	Projected	Total
Contact Handled Waste			
Combustible	1821.45	2376.19	4197.64
Heterogeneous	16.02	29.12	45.14
Lead/Cadmium Metal Waste	1.89	0.00	1.89
Soils	110.57	29.12	139.69
Solidified Inorganics	4888.20	2033.82	6922.02
Solidified Organics	1.46	29.12	30.58
Uncategorized Metal	4214.43	2853.76	7068.19
Total CH Volumes	**11054.01**	**7351.14**	**18405.15**
Remote Handled Waste			
Combustible	15.13	48.95	64.08
Heterogeneous	11.57	0.00	11.57
Uncategorized Metal	67.64	49.84	117.48
Total RH Volumes	**94.34**	**98.79**	**193.13**

Table 4 - 13

Mound Plant Final Waste Form Volumes

	(Cubic Meters)		
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Combustible	7.07	0.00	7.07
Filter	0.83	0.00	0.83
Heterogeneous	0.62	0.00	0.62
Soils	177.18	0.00	177.18
Solidified Inorganics	6.03	0.00	6.03
Uncategorized Metal	82.48	0.00	82.48
Total CH Volumes	**274.22**	**0.00**	**274.22**

Table 4 - 14

Nevada Test Site Final Waste Form Volumes

Final Waste Form	Retrievably Stored	Projected	Total
	(Cubic Meters)		
Contact Handled Waste			
Heterogeneous	613.26	8.98	622.24
Solidified Inorganics	5.67	0.00	5.67
Total CH Volumes	**618.93**	**8.98**	**627.91**

Table 4 - 15

Oak Ridge National Laboratory Final Waste Form Volumes

(Cubic Meters)			
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Heterogeneous	1304.16	256.26	1560.42
Total CH Volumes	**1304.16**	**256.26**	**1560.42**
Remote Handled Waste			
Heterogeneous	1432.01	240.30	1672.31
Solidified Inorganics	1036.85	206.48	1243.33
Total RH Volumes	**2468.86**	**446.78**	**2915.64**

Table 4 - 16

Paducah Gaseous Diffusion Plant Final Waste Form Volumes

	(Cubic Meters)		
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Inorganic Non-Metal	0.00	1.89	1.89
Total CH Volumes	**0.00**	**1.89**	**1.89**

Table 4 - 17

Pantex Plant Final Waste Form Volumes

(Cubic Meters)

Final Waste Form	Retrievably Stored	Projected	Total
Contact Handled Waste			
Heterogeneous	0.62	0.00	0.62
Total CH Volumes	**0.62**	**0.00**	**0.62**

Table 4 - 18

Rocky Flats Environmental Technology Site Final Waste Form Volumes

(Cubic Meters)

Final Waste Form	Retrievably Stored	Projected	Total
Contact Handled Waste			
Combustible	185.54	861.08	1046.62
Filter	72.09	477.51	549.60
Graphite	13.73	47.57	61.30
Heterogeneous	3.86	0.00	3.86
Inorganic Non-Metal	58.29	866.74	925.03
Lead/Cadmium Metal Waste	3.95	298.27	302.22
Salt Waste	0.00	325.92	325.92
Solidified Inorganics	165.36	1257.64	1423.01
Solidified Organics	109.82	31.11	140.93
Uncategorized Metal	93.31	236.12	329.43
Total CH Volumes	**705.96**	**4401.95**	**5107.91**

Table 4 - 19

Sandia National Laboratory - Albuquerque Final Waste Form Volumes

(Cubic Meters)			
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Heterogeneous	6.66	7.49	14.14
Total CH Volumes	**6.66**	**7.49**	**14.14**

Table 4 - 20

Savannah River Site Final Waste Form Volumes

(Cubic Meters)

Final Waste Form	Retrievably Stored	Projected	Total
Contact Handled Waste			
Heterogeneous	2611.61	5475.85	8087.46
Solidified Inorganics	200.19	1169.61	1369.80
Uncategorized Metal	70.35	120.54	190.89
Total CH Volumes	**2882.14**	**6766.01**	**9648.15**

Table 4 - 21

Teledyne Brown Engineering Final Waste Form Volumes

	(Cubic Meters)		
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Inorganic Non-Metal	0.21	0.00	0.21
Total CH Volumes	**0.21**	**0.00**	**0.21**

Table 4 - 22

U.S. Army Material Command Final Waste Form Volumes

	(Cubic Meters)		
Final Waste Form	**Retrievably Stored**	**Projected**	**Total**
Contact Handled Waste			
Heterogeneous	2.50	0.00	2.50
Total CH Volumes	**2.50**	**0.00**	**2.50**

Table 4 - 23

University of Missouri Research Reactor Final Waste Form Volumes

(Cubic Meters)

Final Waste Form	Retrievably Stored	Projected	Total
Contact Handled Waste			
Heterogeneous	0.21	0.83	1.04
Total CH Volumes	**0.21**	**0.83**	**1.04**

CHAPTER 5

5. DEPARTMENT OF ENERGY TRANSURANIC WASTE INVENTORY

5.1 INTRODUCTION

The *Waste Isolation Pilot Plant Land Withdrawal Act* states that "The Secretary may commence emplacement of transuranic waste underground for disposal at WIPP only upon completion of ... the submittal to the Congress by the Secretary of comprehensive recommendations for the disposal of all transuranic waste under the control of the Secretary, including a timetable for the disposal of such waste..." (Public Law, 1992b). This section identifies waste streams not included in the WIPP inventory. The combined waste streams from Appendices O and P define all known TRU waste reported by the TRU waste generator/storage sites. Non-WIPP waste streams in Appendix O are summarized in Section 5.2.

There are some materials that have not been declared TRU waste by the DOE TRU waste generator/storage sites at this time that may become TRU waste in the future. These possible future wastes are also discussed in this chapter.

5.2 WASTE STREAMS EXCLUDED FROM WIPP

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

- **Commercial and Non-Defense Waste** – The *National Security Programs* (Public Law, 1979), which authorized the construction of the WIPP, states that WIPP is to be a defense activity. Therefore those wastes that are identified as non-defense or commercial are not allowed to be disposed in WIPP. The non-defense or commercial waste streams are identified in Table 5-1.

- **Pre-1970 Buried Waste** – Several sites (i.e., Los Alamos National Laboratory, Savannah River Site, Sandia National Laboratories, Hanford Site, Idaho National Engineering Laboratory, Oak Ridge National Laboratory, and West Valley) have TRU waste that were buried prior to 1970. The final disposition of the buried TRU wastes at DOE sites is still undecided. The waste streams presented in Table 5-2 provide the volume of pre-1970 buried waste that has been reported to date.

- **Classified Waste** – Sites that have classified waste will be required to declassify the waste prior to shipment to WIPP. Several generator/storage sites have identified classified waste in storage. These sites have planned declassification of these waste streams. If declassification is anticipated, the Final Waste Form is a part of the WIPP disposal inventory. If declassification is not anticipated, the Final Waste Form is excluded from WIPP. There was no classified waste in Final Waste Form reported in the Revision 2 TWBIR data call.

- **Polychlorinated Biphenyls (PCBs)** – This category of Toxic Substances Control Act (TSCA) waste is not permitted in WIPP if the PCB concentrations exceed 50 ppm (DOE, 1995f). The TRU waste generator/storage sites have identified several waste streams that are regulated under TSCA (i.e., containing PCBs). Because the concentrations

Table 5-1

Non Defense and Commercial Waste (Final Waste Form)

(Cubic Meters)

Commercial TRU Waste

Waste Stream ID	Waste Stream Name	Stored Volumes	Projected Volumes	Total Volumes
AM-W001	Nuclear Pacemakers	0.0E+00	4.2E-01	4.2E-01
WV-M005	TRU Filters	4.9E+01	4.6E+01	9.5E+01
WV-M007	TRU General Waste	1.0E+01	0.0E+00	1.0E+01
WV-M008	TRU Concrete	2.1E-01	0.0E+00	2.1E-01
WV-M010	TRU Spent Absorbents	4.2E-01	0.0E+00	4.2E-01
WV-M012	Glove Boxes	2.1E-01	0.0E+00	2.1E-01
WV-M013	Sweeping Compound	1.5E+00	0.0E+00	1.5E+00
WV-M015	Chemical Process Cell General Waste	1.8E+01	0.0E+00	1.8E+01
WV-T001	Fissile Material - Solids	3.7E+00	0.0E+00	3.7E+00
WV-T002	Fissile Material - Alpha Lab Liquids	6.2E-01	0.0E+00	6.2E-01
WV-T003	Fissile Material-UNH Solution	2.1E-01	0.0E+00	2.1E-01
WV-T004	Fissile Material - Other	4.2E-01	0.0E+00	4.2E-01
WV-T006	TRU General Waste	1.3E+01	8.8E+01	1.0E+02
WV-T009	TRU General Laboratory Waste	2.1E+00	2.9E+01	3.1E+01
WV-T011	TRU Glove Boxes	2.1E-01	0.0E+00	2.1E-01
WV-T014	Chemical Process Cell Vessels	9.0E+01	0.0E+00	9.0E+01
WV-T016	Chemical Process Cell Miscellaneous Equipment	1.5E+02	0.0E+00	1.5E+02
WV-T017	Spent Filter Media	3.8E+00	0.0E+00	3.8E+00
WV-W024	TRU Lead	2.1E+00	0.0E+00	2.1E+00
WV-W041	TRU Paint (Dry) with Metals	4.2E-01	0.0E+00	4.2E-01
	Totals	3.4E+02	1.6E+02	5.1E+02

Non-Defense TRU Waste

Waste Stream ID	Waste Stream Name	Stored Volumes	Projected Volumes	Total Volumes
KA-T001	Transuranic Debris	2.5E+00	5.1E+01	5.4E+01
KA-W016	Transuranic Debris	0.0E+00	6.9E+00	6.9E+00
LB-T001	LBL - Waste	6.2E-01	1.0E+00	1.7E+00
OR-W051	CH-TRU Heterogeneous Debris (nondefense)	1.0E+00	0.0E+00	1.0E+00
OR-W052	CH-TRU Uncategorized (nondefense, nonmixed)	4.4E+00	0.0E+00	4.4E+00
	Totals	8.5E+00	5.9E+01	6.8E+01

Table 5-2. Pre-1970 Buried Waste

Site	Waste Stream ID	Current Volume (m^3)	Total Curies (estimates)
LANL	LA-Z001	14,000	9,230[1]
ORNL	OR-Z001	176	20[1]
Hanford	RL-Z001	63,629	93,800[1]
SNL/NM	SA-Z001	1.33	Not available
SRS	SR-Z001	4,874	30,500[1]
INEL	IN-Z001	57,000	248,830[2]
WVDP	WV-Z001	1,353	652,000[2,3]

[1] Decayed to December 1993
[2] Not decayed
[3] TRU radionuclides only

of the PCBs frequently is unknown, it is assumed that any waste identified as PCB contaminated cannot be accepted at WIPP under the WIPP permit applications without being treated. These waste streams are summarized in Table 5-3 and are not included in the WIPP disposal inventory.

5.3 ANTICIPATED DOE TRU WASTE INVENTORY

The anticipated DOE TRU waste inventory that has been identified to date is provided in Tables 5-4 and 5-5. Tables 5-4 and 5-5 include the WIPP transuranic waste disposal inventory provided in Tables 4-1 and 4-2 with the addition of the excluded wastes discussed in Section 5.2. Table 5-2 provides the total pre-1970 buried waste inventory by site. This information is not included in Tables 5-4 or 5-5 because the handling (CH-TRU or RH-TRU) is unknown.

5.4 POSSIBLE FUTURE WIPP WASTE

There are several categories of material that have not been declared TRU waste at this time that may be placed in the TRU waste category in the future:

- One of these is plutonium residues at sites other than RFETS. RFETS has declared their (<50% Pu) plutonium residues TRU waste and the volumes and radionuclide inventories are included in the WIPP-level profiles. The *Defense Nuclear Facilities Safety Board Recommendation 94-1 Implementation Plan* (DOE, 1995a) provides estimates of residues and mixed oxides (<50% assay) at other DOE TRU waste sites as presented in Table 5-6. The units for Table 5-6 is kilogram which departs from units used elsewhere in this document. These are the units used in the *94-1 Implementation Plan.* Although the RFETS residues are included in the Defense Nuclear Facilities Safety Board document, they are not listed in Table 5-6 because they are already included in the WIPP disposal inventory.

Table 5-3

Polychlorinated Biphenyl (PCB) TRU Waste (Final Waste Form)

		(Cubic Meters)		
WASTE Stream ID	**Waste Stream Name**	**Stored Volumes**	**Projected Volumes**	**Total Volumes**
RF-MT0831	PCB Solids-Compatibles/TRM			
RL-W327	2345Z Uncat met debris CH RC/TS MTRU w/ met(Hg)	6.6E+01	1.1E+02	1.8E+02
RL-W328	2345Z Pb/Cd debris CH RC/TS MTRU w/ met(Hg)	3.8E+00	0.0E+00	3.8E+00
RL-W329	2345Z Solidif org CH RC/TS MTRU w/ ign	2.1E+00	8.3E+00	1.0E+01
RL-W333	2345Z Solidif org debris CH TSCA MTRU	1.2E+00	2.5E+00	3.7E+00
RL-W334	2345Z Uncat mt debris CH TSCA MTRU	2.1E-01	0.0E+00	2.1E-01
	Totals	7.3E+01	1.2E+02	1.9E+02

No volumes are shown for the waste stream from Rocky Flats because the Final Waste Form for this stream has not been determined by the site.

Table 5-4
Total Contact-Handled Transuranic Waste Inventory By Site

Contact Handled TRU Waste Site	(Cubic Meters)		
Generator/Storage Site	**Stored Volumes**	**Projected Volumes**	**Anticipated Volumes**
Ames Laboratory - Iowa State Univ.	0.0E+00	4.2E-01	4.2E-01
ARCO Medical Products Co.	0.0E+00	4.2E-01	4.2E-01
Argonne National Laboratory - East	2.5E+01	1.3E+02	1.5E+02
Argonne National Laboratory - West	6.5E+00	7.4E+02	7.5E+02
Bettis Atomic Power Laboratory	0.0E+00	1.2E+02	1.2E+02
Energy Technology Engineering Center	1.7E+00	0.0E+00	1.7E+00
Hanford (Richland) Site	1.2E+04	3.3E+04	4.6E+04
Idaho National Engineering Laboratory	2.9E+04	0.0E+00	2.9E+04
Lawrence Berkeley Laboratory	6.2E-01	1.0E+00	1.7E+00
Lawrence Livermore National Laboratory	2.3E+02	7.1E+02	9.4E+02
Los Alamos National Laboratory	1.1E+04	7.4E+03	1.8E+04
Mound Plant	3.2E+02	0.0E+00	3.2E+02
Nevada Test Site	6.2E+02	9.0E+00	6.3E+02
Oak Ridge National Laboratory	1.3E+03	2.6E+02	1.6E+03
Paducah Gaseous Diffusion Plant	0.0E+00	5.7E+00	5.7E+00
Pantex Plant	6.2E-01	0.0E+00	6.2E-01
Rocky Flats Environmental Technology Site	7.1E+02	4.4E+03	5.1E+03
Sandia National Laboratory - Albuquerque	6.7E+00	7.5E+00	1.4E+01
Savannah River Site	2.9E+03	6.8E+03	9.6E+03
Teledyne Brown Engineering	2.1E-01	0.0E+00	2.1E-01
U.S. Army Material Command	2.5E+00	0.0E+00	2.5E+00
University of Missouri Research Reactor	2.1E-01	8.3E-01	1.0E+00
West Valley Demonstration Project	3.9E+01	1.2E+02	1.6E+02
Totals	5.8E+04	5.4E+04	1.1E+05

Table 5-5

Total Remote-Handled Transuranic Waste Inventory By Site

Remote Handled TRU Waste Site	(Cubic Meters)		
Generator/Storage Site	**Stored Volumes**	**Projected Volumes**	**Anticipated Volumes**
Argonne National Laboratory - West	1.9E+01	1.3E+03	1.3E+03
Battelle Columbus Laboratories	5.8E+02	0.0E+00	5.8E+02
Bettis Atomic Power Laboratory	0.0E+00	6.7E+00	6.7E+00
Energy Technology Engineering Center	6.3E+00	8.3E-01	7.1E+00
Hanford (Richland) Site	2.0E+02	2.2E+04	2.2E+04
Idaho National Engineering Laboratory	2.2E+02	0.0E+00	2.2E+02
Knolls Atomic Power Laboratory - Schenectady	2.5E+00	5.8E+01	6.1E+01
Los Alamos National Laboratory	9.4E+01	9.9E+01	1.9E+02
Oak Ridge National Laboratory	2.5E+03	4.5E+02	2.9E+03
West Valley Demonstration Project	3.0E+02	4.6E+01	3.5E+02
Totals	3.9E+03	2.3E+04	2.7E+04

Table 5-6. Possible Future Waste - Residues

Site	Radionuclide Inventory (kgs)	Number of Items
Argonne National Laboratory-East	<1	12
Hanford (Richland) Site	1,500	5000
Lawrence Berkley Laboratory	<1	250
Lawrence Livermore National Laboratory	35	182
Los Alamos National Laboratory	1,400	6,300
Mound	3	39
Oak Ridge National Laboratories	0.1	12
Savannah River Site	Classified	1,306

- Another category of possible future TRU waste is from Hanford site. The tank wastes at Hanford can be classified as high-level wastes (HLW), transuranic (TRU) wastes, or low-level (LLW). For purposes of receipt, storage, and management, all tank wastes are managed as HLW. As the tank wastes are characterized and retrieved, those wastes classified as TRU wastes will be maintained as a separate waste stream for purposes of treatment and immobilization at Hanford and potential disposal at the Waste Isolation Pilot Project (WIPP). A very preliminary estimate of the volume of immobilized TRU tank waste from Hanford that would be potentially disposed in WIPP as the tank wastes are characterized and retrieved (if these wastes are able to be segregated), is approximately 1300 m^3.
- Waste streams that have been declared "unknown" make up another category of possible future WIPP waste and are summarized in Table 5-7. These wastes have not been characterized adequately to determine the Final Waste Form and/or other significant parameters. If these wastes are characterized they will be included in the WIPP inventory.
- Babcock and Wilcox in Lynchburg, VA, currently has in storage approximately 18.1 m^3 of TRU waste in on-site storage silos that are classified as possible future TRU waste. Virtually all of the material is a result of the Light Water Reactor Extended Burnup Program. The program was responsible for sending test elements of normal commercial reactor fuel to various hot cells, including the one at Lynchburg, for examination. The waste consists mostly of cellulosics, rubber, and lead lined gloves. In addition, some TRU materials and spent fuel currently reside in TRU-waste contaminated hot cells; however, these materials have not been declared TRU waste.
- General Electric Vallecitas Nuclear Center currently has in storage approximately 5.33 m^3 of CH-TRU waste and 8 m^3 of RH-TRU wastes. They anticipate generating an additional 3.5 m^3 of CH-TRU and 5.33 m^3 of RH-TRU waste during D&D activities of the DOE programs. This waste was generated in support of the Nuclear Energy's boiling water reactor (BWR) activities conducted for DOE and the Atomic Energy Commission.
- RFETS particulate waste streams will be shipped and disposed in a 55-gallon drum containing a 6-inch or 12-inch steel pipe component. The 6-inch pipe will add 88 pounds of steel and 97 pounds of fiberboard per container. The 12-inch pipe will add 195 pounds of steel and 65 pounds of fiberboard per drum. It is anticipated that RFETS will have an estimate of the total number of drums in TWBIR, Rev. 3.

Table 5-7
Possible Future Waste for WIPP

		(Cubic Meters)		
Waste Stream ID	**Waste Stream Name**	**Stored Volumes**	**Projected Volumes**	**Total Volumes**
AE-T001	Solid heterogeneous inorganic/organic waste	1.3E+01	0.0E+00	1.3E+01
AW-N028	TRU WASTE USED PRE-FILTERS			
AW-W018	SODIUM - TRU			
AW-W019	SODIUM POTASSIUM -NaK- TRU			
ET-T001A	Hot Lab & PU Facility D&D	5.4E+00	8.3E-01	6.2E+00
MD-T004	Uncategorized unknowns	4.2E+00	0.0E+00	4.2E+00
MD-T004	Uncategorized unknowns	2.3E+01	0.0E+00	2.3E+01
MD-W018	PCB TRU WASTE	2.1E-01	0.0E+00	2.1E-01
MD-W018	PCB TRU WASTE	1.9E+01	0.0E+00	1.9E+01
OR-W049	CH-TRU Uncategorized (nonmixed)	1.8E+01	0.0E+00	1.8E+01
OR-W050	RH-TRU Uncategorized (nonmixed)	8.9E-01	0.0E+00	8.9E-01
OR-W052	CH-TRU Uncategorized (nondefense, nonmixed)	4.4E+00	0.0E+00	4.4E+00
PA-B015	Transuranic and Technetium Wastes - Liquid	0.0E+00	1.9E+00	1.9E+00
PA-W014	Transuranic Waste Liquid	0.0E+00	1.9E+00	1.9E+00
RL-W284	201C Unk form CH RCRA MTRU w/ met	4.2E-01	0.0E+00	4.2E-01
RL-W332	2345Z Unk form CH St MTRU	2.0E-01	0.0E+00	2.0E-01
RL-W357	KAPL Unk form CH/r TRU	2.1E-01	0.0E+00	2.1E-01
RL-W366	202A Unk form CH TRU	1.5E+00	8.3E-01	2.3E+00
RL-W382	2345Z Unk form CH TRU	1.9E+01	6.1E+01	8.0E+01
RL-W391	308 Comb unk form CH TRU	4.2E-01	0.0E+00	4.2E-01
	Totals	1.1E+02	6.7E+01	1.8E+02

No volumes are shown for the waste streams from Argonne-West because the Final Waste Form for these streams has not been determined by the site.

CHAPTER 6

6. TRANSURANIC WASTE BASELINE INVENTORY DATABASE

A Transuranic Waste Baseline Inventory Database (TWBID) has been developed to support the Transuranic Waste Baseline Inventory Report (TWBIR). This database was used to summarize the waste data and print out the various tables and reports used in the TWBIR. The database is operated in the Microsoft Access version 2.0 system.

6.1 DATABASE DESCRIPTION

The database actually consists of two databases with essentially the same primary data tables. The first database is TWBIR.MDB. This database contains the original data submitted by the sites or amended data as agreed upon by the sites through discussions with TWBIR personnel. This database is used to produce the forms in Appendices O and P. The second database is called REPORTS.MDB and is used to produce the tables and figures in the remainder of the report. Summary tables produced by REPORTS.MDB are the result of a series of calculations based on data from TWBIR.MDB utilizing assumptions outlined in Chapter 1, Appendix O and Appendix P. These calculations and the associated methodology are described in this section of the report. The basic data tables in each database are the same with the exception of one additional table called Container_Data in the Reports.MDB database.

Each record in the database represents one waste stream as defined by a unique Waste Stream ID (WIPP_ID) and a Survey ID (Survey_ID). The Survey ID is the record identifier for the Material Inventory and Tracking Information Database for 1995 (MITI95) data call. The MITI95 database is the source of information for the 1995 Mixed Waste Inventory Report (to be published in Winter 1995). The WIPP_ID is a unique TWBIR identifier for the records containing the TRU waste stream data reported in the MITI95 data call. There may be more than one WIPP_ID for each Survey_ID because some of the sites presented the WIPP waste streams at a finer level of detail. Under the WIPP_ID records there is another level of detail associated with containers as currently existing or as planned to be generated plus containers in final form as expected to arrive at the WIPP.

The reports and tables produced for the TWBIR are produced from different data sorts based on the WIPP_ID, Site_Name, Handling and Final_Waste_Form fields. The Site_Name specifies the site which reported and is typically storing the waste. The generator site may differ from the storage site. The Handling field defines whether the waste is categorized as CH-TRU or RH-TRU waste. The Final_Waste_Form defines a general grouping based on the physical and chemical properties in the waste stream.

The volumes are rolled-up from the stored and projected final waste form containers provided by the sites. The date on which the stored inventory is based may not be consistent among sites.

In Table 3-1, a column, titled "WIPP Disposal Volumes," was calculated to match the maximum calculated CH-TRU disposal inventory. This was done by increasing all the Final_Waste_Form projected volumes proportionately, except Unknown, so that the total CH-TRU volume would equal the maximum calculated WIPP capacity for CH-TRU. Additional waste volume was calculated for each waste stream proportionate to the projected volumes for each stream such that the sum of the scaled volumes for contact handled waste equaled 168,500 cubic meters. Enough waste is already identified to fill the WIPP to capacity for RH-TRU waste.

The other fields used to develop summaries for the tables in the reports are the waste material parameters. The TRU waste generator/storage sites were asked to estimate an average, minimum and maximum concentration of materials in each waste stream. For example, weights of metals such as brass, copper, tantalum and materials simply described as metals were included under the field OM_xxx (where xxx is min, max, or avg) which stands for "Other Metals" (see the data dictionary; Appendix L). Note that because some materials are described only as metals, aluminum and iron can be in the OM_xxx field as well as in the IB_xxx (iron-base) or AB_xxx (aluminum-base) fields.

Four categories of sludges and solidified materials are represented by fields. These are solidified inorganic material (SIM_xxx), solidified organic material (SOM_xxx), vitrified (VIT_xxx) and cement (solidified). The particular category into which a sludge or solidified material is placed is determined by the overall matrix of the resulting material after any solidification or stabilization steps. For example, a small amount of inorganic liquids/sludges solidified in an inorganic matrix would be placed in the solidified inorganic material category and a drum of organic base resin beads solidified in cement would be placed in the solidified organic material category.

The rest of the fields are reasonably self explanatory, but additional discussion on Cel_xxx, Rub_xxx, and Plas_xxx, may be helpful. Cel_xxx includes all cellulose-base materials and will typically include paper, cloth, wood, kimwipes and other materials derived from plant base materials. It is assumed that cloth is plant derived material such as cotton and not plastic based such as rayon or nylon. Rub_xxx consists of rubber based materials. Included in this category are Hypalon®, neoprene, and surgeons gloves. Plas_xxx represents plastics such as Lucite®, polyethylene, Tyvek®, teflon and polyvinyl chloride. Plastic bags are used extensively in packaging the waste and would be included in this category. The plastic drum or container liners were not included in this category and were requested separately.

The waste material parameter information is structured in the database so that the waste material parameters can be summed and averaged at the WIPP, site and Final Waste Form levels. Waste streams for which no waste material parameters are provided or for which average, minimum and maximum parameters are not all provided cannot be rationally averaged and summed. Therefore, in order to calculate averaged parameters from the waste stream data provided, certain data assumptions are necessary. These assumptions are summarized below. If the parameters for a particular waste material were incomplete, the following assumptions were used so that averages and sums could be provided:

- If no minimum was provided, but a maximum was provided, the minimum was assumed to be zero.
- If a maximum and minimum was provided, but no average, the average was assumed to be one half the sum of the maximum and minimum.
- If an average was provided but no minimum or maximum, the average was assigned to the minimum and maximum.
- If only a minimum was provided, the minimum was assigned to both the maximum and the average.

For those waste streams where the site did not provide any waste parameter information, but which could be assigned to a final waste form, an average set of parameters was calculated and used. This average set of parameters was calculated by volume averaging the parameters provided for other waste streams with the same final waste form.

The data that are printed on all the tables in the report are based on these calculations and assumptions and are derived from the REPORTS.MDB database. The individual stream data printed in Appendices O and P are the original data submitted by the TRU waste generator/storage sites or amended data as agreed to by the sites through discussions and questions with the TWBIR team and is contained in the TWBIR.MDB database.

The minimum density is chosen as the smallest minimum density of a particular material parameter in the TWBIR streams in a particular Final_Waste_Form. The maximum density is chosen in a similar manner except that the largest maximum density was chosen. Note that the maximum and minimum densities apply to individual containers and cannot be used to directly calculate a maximum and minimum density of particular material parameters for the entire WIPP inventory. Also note, that it is possible, that the maximum density may not be a true maximum but a maximum average density, if a site provided only averages and no maximums and these averages are higher than other sites' maximums.

The amount of and type of materials in the containers and liners was requested separately in the waste stream profiles. Many of the sites did not provide complete data for final waste form containers. In order to add up packaging materials for the waste as it would arrive at WIPP, standard container configurations were assumed for waste from all sites. This was done because many sites did not provide liner information and assuming standard liners will generally maximize the amount of liner material. The standard packaging configurations used are shown in Table 6-1. This data is used in generating the packaging material assumptions provided in Table 1-3.

The tables and reports for the TWBIR were produced using the various data organization features provided by the Microsoft Access Version 2.0 database system. These tables and reports consist primarily of various sorts based on waste streams, final waste forms, sites, etc. and summations of volumes and waste material parameter weights.

6.2 DATA DICTIONARY

Appendix L presents a data dictionary for the TWBIR and REPORTS databases. The tables in the databases are the same except for an additional table in REPORTS called Container_Data. Except for tables Page_1 and Container_Data, tables are the same as tables in the MITI95 data call with some minor changes and field additions. Certain temporary tables or tables used to hold intermediate data that were used to produce reports are not included in the dictionary.

6.3 DATABASE OPERATING INSTRUCTIONS

The Transuranic (TRU) Waste Baseline Inventory Report (TWBIR), Revision 2, database is a Microsoft Access 2.0 database. It requires the user to possess a copy of Access 2.0 and be running under the Windows 3.1 operating system. Access, unlike most other databases, provides a single structure that contains objects such as queries, reports, program segments, macros,

Table 6-1. Table of Materials for CH and RH Waste Containers (Weights in kg per container, Volume in m^3 per container)

CH Waste

Container Characteristic	Drum	SWB	SWB Overpack[1]
Steel Weight	27.3	290.9	400.1 (includes 4 drums)
Liner Type	Rigid Drum Liner	Bag	Rigid Drum Liners and Bag
Liner Material	90 mil HDPE	Plastic	90 mil HDPE and Plastic
Liner Weight	7.7	2.2	33
Volume (Capacity)	0.208	1.89	1.89
Payload Volume[2]	0.208	1.89	0.832 (4 drums)

RH Waste

Container Characteristics	RH Canister	RH Canister Overpack[3]
Steel Weight	386.4	468 (3 drums)
Lead Weight	412.7	412.7
Steel Plug Weight	1911.6	1911.6
Liner Type	None	Rigid Liner in Drums
Liner Material	N/A	90 mil HDPE
Liner Weight	N/A	23.1
Volume (Capacity)	0.89	0.89
Payload Volume[2]	0.89	0.624 (3 drums)

1 Four 55-gallon drums overpacked in an SWB
2 Payload volume is the actual volume of waste which can be placed in the container.
3 Three 55-gallon drums overpacked in an RH Canister

indexes, relations, and multiple data tables. This means there is only one file to work with, one with the suffix, .MDB. A second file normally accompanies the database file, one with the suffix .LDB and having the same name. It is not normally used except for certain file maintenance operations. For those users who do not have a copy of Access 2.0, a "run-time" only version also accompanies this report.

Two databases are provided as part of the compressed file on the TWBID distribution disk. The first database is TWBIR_1, which contains the original data by waste stream from all generator/storage sites. This is the database used to print out the individual stream data in Appendices O and P.

The second database is called REPORTS. This is the database used to produce the other tables and figures in the report. The databases are separate because the summaries for some TWBIR tables require some changes to the data to produce technically corrected numbers in appendices, tables and figures.

INSTALLATION: The two databases are compressed into a file on the distribution disk called TWBIR.EXE. Approximately 26 megabytes of hard disc space should be available to install the database. To install the TWBIR Revision 2 database, copy TWBIR.EXE to a convenient directory on your hard disk, go to the directory containing TWBIR.EXE, type TWBIR and press the enter key. The database should be expanded into the directory. The directory should now contain TWBIR.EXE, TWBIR1.MDB, TWBIR1.LDB, TWBIR.HLP, REPORTS.MDB, and REPORTS.LDB. TWBIR.HLP contains the data field descriptions. (See the latest installation instructions in the file README.TXT on the first disc.) This procedure can be performed either in DOS, a DOS prompt in Windows or from File Manager in Windows. Enter Windows and start Access, and open the TWBIR_1 or REPORTS database. See the Access User's Manual in case of difficulty.

TWBIR_1 INSTRUCTIONS: The TWBIR Revision 2 database has a built-in program (a macro called "autoexec") which takes control immediately upon opening the database file. It brings up a screen from which the user can view, edit, and locate various waste streams using the normal Access 2.0 tool bar features. In addition, a large printer icon button appears midway down the left side of the screen. This button affords the user the opportunity of printing the waste stream being viewed, waste streams for a specific site, or waste streams for all sites in the database. Scroll bars are provided to scroll between waste streams at the bottom left of the screen. For a given waste stream, the gray section contains waste container data for the various containers used to store this stream, and a scroll bar is provided in the bottom left to scroll among the types of containers for that waste stream. For a given type of container, the typical nuclides for that type of container are listed in a white area inset into the gray and a scroll bar provided.

Descriptions of the data fields can be viewed by opening the desired data table in Access's Table Mode, Design View. If the TWBIR_1.HLP file was copied into the directory occupied by the TWBIR database files, limited descriptions of the data fields in the TWBIR database are available when the cursor is placed in a data box and the F1 function key is pressed.

Reports Instructions:

The first step is to open the database REPORTS.MDB. An "autoexec" macro executes when the database opens. This macro presents a form, titled "Figure and Table Viewer", listing the reports available for viewing.

The reports and tables available for review are listed with a number on the left side. If all entries cannot be seen, the scrolling arrows on the right side of the form can be used to scroll the entries. On the bottom of the form is a series of buttons. Each form can be viewed (in report preview mode) by clicking on the command button with the same number as the number to the left of the list of figures and tables.

When the table appears on screen, the size of the window for viewing the table can be adjusted by clicking on the upper right corner up or down arrow in the report window. The report preview window also permits moving between pages of multi-page sets of figures and tables by using the arrows on the lower left corner.

The table or figure can be printed from the report preview window. The tables and figures were originally printed from and formatted for a Laserjet III printer. When printing the tables and figures, make sure the margins are set so that the entire table or figure is contained on one page, other wise blank pages may be printed.

6.4 TWBID QUALITY CONTROL

To ensure that proper controls and documentation were in place during development and population of the TWBID, several quality control activities were implemented by the TWBIR Team. Project quality control objectives were to:

- Define a method for receiving, tracking, reviewing, updating, and documenting data received from the waste generator/storage sites.
- Identify and document the contents of each project baseline.
- Establish and implement a process for releasing and maintaining the TWBID.
- Create a master library for TWBID software and documentation.
- Ensure that TWBID-generated reports and database copies are produced from released database revisions.

The activities performed to meet these objectives are described in the Transuranic Baseline Inventory Report Database Management Procedure (DOE, 1995e). The procedure identifies the responsible individuals and actions required for developing, populating, and maintaining the TWBID, and for managing the data used to produce the TWBIR and other summary documents if required in the future.

CHAPTER 7

7. GLOSSARY

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

40 CFR Part 268, Protection of Environment. EPA: Land Disposal Restrictions – Restricts the land disposal of all hazardous wastes and specifies strict treatment standards that must be met before these wastes can be land-disposed.

Acceptable Knowledge – Includes process knowledge and results from previous testing, sampling, and analysis associated with the waste. Acceptable knowledge includes information regarding the raw materials used in a process or operation, process description, products produced, and associated wastes. Acceptable knowledge documentation may include the site history and mission, site-specific processes or operations, administration building controls, and all previous and current activities that generate a specific waste.

Americium (Am) – A TRU radionuclide having an atomic number of 95, containing 95 electrons and 95 protons. Am-241 (half-life 432.7 y) results from the decay of Pu-241 (half-life 14.4 y). Waste initially rich in Pu-241 will therefore "grow" in Am-241 for several decades as the Pu decays. Am-241 exists in finite amounts in TRU waste at some DOE sites.

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

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

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

Californium (Cf) – A TRU element having an atomic number 98 (the number of protons in the nucleus). An alpha emitter (half-life 2.64 y), Cf-252 also spontaneously fissions, thus making it desirable as a neutron source. Cf-252 is created by neutron bombardment of Cm-244 targets. Oak Ridge National Laboratory (ORNL) is the only production agency for Cf. As a result, the ORNL inventory is the only TRU waste inventory showing finite quantities of this element.

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

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

Curie – A quantitative measure of radioactivity equal to 3.7 x 10^{10} disintegrations per second.

Curium (Cm) – A TRU element having an atomic number of 96 (the number of protons in the nucleus). An alpha emitter (half-life 18.1 y), Cm-244 is used for neutron bombardment of targets for the production of Cf-252 at ORNL. In spite of its half-life being less than 20 years, ORNL manages Cm-244 as if it were a TRU nuclide. Some TRU waste at both ORNL and Savannah River Site contains Cm-244.

Decontamination and Decommissioning (D&D) – The process through which DOE facilities which are no longer operational are cleared of contamination and removed from service. In particular, a reference to D&D waste is a reference to the waste materials that are generated during D&D activities.

Defense Waste – (1) Radioactive waste from any activity performed in whole or in part in support of DOE atomic energy defense activities; excludes waste under purview of the Nuclear Regulatory Commission or generated by the commercial nuclear power industry. (2) Nuclear waste derived mostly from the manufacture of nuclear weapons, weapons-related research programs, the operation of naval reactors, and the decontamination of nuclear weapons production facilities. (DOE, 1993a)

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

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

Disposal Inventory – The inventory volume defined for WIPP emplacement to be used for PA calculations is the "disposal inventory." The LWA defines the total amount of TRU waste allowed in the WIPP as 6,200,000 cubic feet (approximately 176,000 cubic meters) (Public Law, 1992b). The "Agreement for Consultation and Cooperation" (C&C Agreement) limits the RH-TRU inventory to 250,000 cubic feet (approximately 7,080 cubic meters) (DOE and State of New Mexico, 1981). Therefore by difference, the CH-TRU inventory is limited to 5,950,000 cubic feet (approximately 168,920 cubic meters).

Environmental Restoration (ER) – Those activities associated with the remediation of sites contaminated with hazardous and/or radioactive materials. In particular, a reference to remediation activities conducted under the auspices of the DOE Office of Environmental Management, Office of Environmental Restoration, EM-40.

Federal Facility Compliance Act (FFCAct) – Public law 102-386, 1992.

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

Gas Generation – Three gas generation processes are expected to be a factor associated with the degradation of TRU wastes in the WIPP repository. The generation of gases is expected to occur through chemical (i.e., corrosion), microbial, and radiolytic processes.

Generator/Storage Sites – See Waste Generator/Storage Sites.

Hazardous Waste – Those wastes that are designated hazardous by EPA (or state) regulations through the RCRA.

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

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

Mixed Waste Inventory Report (MWIR) – The latest release of information from the MWIR database that supports requirements under the FFCAct of 1992 (Public Law 102-386).

Newly Generated Wastes – See Projected Inventory.

No-Migration Variance Petition (NMVP) – Section 3004 of RCRA allows EPA to grant a variance from the land disposal restrictions when a determination can be made that, to a reasonable degree of certainty, there will be no migration of hazardous constituents from the disposal unit for as long as the waste remains hazardous. Specific requirements for making this demonstration are found in 40 CFR 268.6, and EPA has published a draft guidance document to assist petitioners in preparing a variance petition.

Non-Defense Waste – The balance of radioactive waste (including TRU) belonging to DOE that is not from support of DOE atomic energy defense activities.

Non-Mixed TRU Waste – Transuranic waste that does not contain hazardous constituents or exhibit hazardous characteristics, as identified in 40 CFR 261, Subparts C and D.

Performance Assessment (PA) – (1) A systematic analysis of the potential risks posed by waste management systems to the public and environment and a comparison of those risks to established performance objectives. (2) An analysis that (a) identifies the processes and events that might affect the disposal system, (b) examines the effects of these processes and events on the performance of the disposal system, and (c) estimates the cumulative releases of radionuclides, considering the associated uncertainties, caused by all significant processes and events. These estimates shall be incorporated into an overall probability distribution of cumulative release to the extent practicable. (3) A term used to denote all activities (qualitative and quantitative) carried out to (a) determine the long-term ability of a site/facility to effectively isolate the waste and ensure the long-term health and safety of the public and (b) provide the basis for demonstrating regulatory compliance. (SNL/NM, 1993)

Plutonium (Pu) – A radionuclide having an atomic number of 94. Pu isotopes exist in some TRU waste at all the major DOE storage facilities. The significant isotopes that may exist in measurable quantities at these facilities are Pu-238 through Pu-242. Each isotope is an alpha emitter; the respective half-lives in years are: 238=87.7, 239=24,000, 240=6,563, 241=14.4, 242=376,000. Because of its high activity, Pu-238 can contribute significantly to the thermal loading on some TRU waste. Pu-241 decays, primarily by beta emission, to Am-241.

Process Knowledge – A qualitative evaluation of the contents of a waste container through the study of existing records of production history of the waste.

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

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

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

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

Repository – As used in this report: designated location for the permanent disposal of post-1970 defense transuranic wastes; the Waste Isolation Pilot Plant.

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

Retrievable Storage – Designated storage location for transuranic wastes that is designed, operated, and maintained in such a manner that the wastes remain accessible for subsequent retrieval.

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

Site-Specific Waste Profile – Represents a summary of the characteristics of all waste streams at a particular DOE TRU waste generator/storage site that belong to the same Final Waste Form.

Stakeholders – Those persons and/or groups of people and organizations who are affected or perceive they are affected by the DOE waste management program. Stakeholders include DOE management, employees, and contractors (internal); and executive, legislative, and regulatory groups, public representatives, the general public, intervenor groups, special interest groups, contractors, suppliers, and universities (external).

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

Thorium (Th) – A radionuclide having an atomic number of 90. Although not TRU, Th-232 is an alpha emitter (half-life 14 billion years) and exists in finite amounts in some TRU waste at Hanford Site, Idaho National Engineering Laboratory, and Oak Ridge National Laboratory. [Note: Thorium is naturally occurring and contributes to background radiation at some sites (e.g., INEL)]

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

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

TRUCON – See TRUPACT-II Content Codes.

TRUPACT-II Content Codes (TRUCON) – The document containing a description of the waste stream, waste form, and package configuration for each waste content code authorized for shipment in TRUPACT-II containers.

Uranium (U) – A naturally radioactive element with the atomic number of 92 (number of protons in the nucleus) and an atomic weight of approximately 238. The two principal naturally occurring isotopes are the fissionable U-235 (0.7 percent of natural uranium) and the fertile U-238 (99.3 percent of natural uranium). (Note: An alpha emitter [half-life 159,000 y], U-233 also spontaneously fissions; it is present in finite quantities in some TRU waste inventories at INEL, LANL, and ORNL.)

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

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

Waste Generator/Storage Sites – The 10 largest DOE facilities and several smaller sites throughout the U.S. that generate and store TRU waste.

Waste Isolation Pilot Plant (WIPP) – (1) The project authorized under Section 213 of the DOE National Security and Military Applications of Nuclear Energy Authorization Act of 1980 (Public Law 96-164; 93 Stat. 1259, 1265) to demonstrate the safe, and environmentally sound, disposal of radioactive waste materials generated by atomic energy defense activities. (2) A research and development facility, located near Carlsbad, New Mexico, to be used for demonstrating a practical, long-term solution to a complex problem: the safe disposal in deep geologic repositories of TRU waste resulting from DOE activities.

Waste Material Parameter – A waste material that occurs in TRU waste that is an input parameter into one or more current PA models or PA model under development, a potential future model, or is required to adequately describe the waste form.

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

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

Waste Stream Name – A site-specific, unique descriptive identifier for a TRU waste stream.

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

Waste Stream Site ID – A site-specific alphanumeric identification code which provides a unique identifier for an individual TRU waste stream.

Waste Sub-stream – A waste sub-stream is one that results from a waste stream being divided into two or more fractions (for the purposes of reporting) in order to provide an additional level of detail about a site's current plans for repackaging or treating the waste.

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

CHAPTER 8

8. REFERENCES

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

DOE – See U.S. Department of Energy.

EPA – See U.S. Environmental Protection Agency.

NRC – See U.S. Nuclear Regulatory Commission

SNL/NM – See Sandia National Laboratory/NM

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