Keeping Track of the National Transuranic Program Complex Defense Transuranic Waste

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ABSTRACT

The long-term performance of the Waste Isolation Pilot Plant (WIPP) disposal system in southeastern New Mexico is assessed periodically using transuranic (TRU) waste physical and radiological properties and other information describing the waste. This TRU waste estimate is based on the best knowledge of the TRU waste across the DOE complex at the time repository performance is assessed. TRU waste inventory was collected from each of the Department of Energy (DOE) sites that generated TRU waste for the Compliance Certification Application (CCA) and subsequently for the Compliance Recertification Application (CRA) in order to support the assessments that ultimately led to certification and re-certification of the WIPP. In each case, information was collected, stored and maintained in the Transuranic Waste Baseline Inventory Database (TWBID) that was used to generate tables describing the volumetric, physical, and radiological properties of the TRU waste. The tables and other descriptions of the waste were reported in baseline reports for the certification and the re-certification. Information maintained in the TWBID database has now been transferred to a new qualified database that utilizes a more efficient operating configuration. This database known as the Comprehensive Inventory Database (CID) will be the information repository for TRU waste destined to WIPP, and the source for information submitted for annual Transuranic Waste Inventory Update Reports to be used in future repository performance assessments (PAs) and recertifications. The information that has been collected will support a wider range of data needs including waste management, transportation and strategic planning.

INTRODUCTION

The WIPP opened on March 26, 1999, becoming the nation's first deep geologic repository for the permanent disposal of defense-generated transuranic (TRU) waste. WIPP was opened after the Carlsbad Field Office of the Department of Energy (CBFO) prepared and submitted the Compliance Certification Application (CCA) [1] to the Environmental Protection Agency (EPA). The CCA was based on transuranic (TRU) waste descriptions reported in various versions of the Transuranic Waste Baseline Inventory Report (TWBIR). Five years after the first receipt of TRU waste, the Compliance Recertification Application (CRA) was submitted that was based on an inventory provided as an Attachment to Appendix DATA of the application. A post CRA submittal to EPA, the Performance Assessment Baseline Calculation (PABC) was also based on this information. The Transuranic Waste Baseline Inventory Database (TWBID) was used to store and process data for both the CCA and the CRA. Future TRU waste descriptions will be generated by a new database known as the Comprehensive Inventory Database (CID) that includes waste management, transportation, and strategic planning information important to managing the repository.

HISTORY OF TWBIR AND TWBID REVISION 2

DOE complex-wide TRU waste inventory information has been collected, analyzed, and published in several reports. Revision 0 of the Waste Isolation Pilot Plant (WIPP) Transuranic Waste Baseline Inventory Report (WTWBIR) published in June 1994 [2] 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 were considered preliminary until the DOE TRU waste generator sites completed quality checks of the data. Data changes resulting from the site reviews were contained in Revision 1 of the WTWBIR [3].

Two additional baseline reports, Transuranic Waste Baseline Inventory Report (TWBIR) Revisions 2 [4] and 3 [5] were published in 1995 and 1996 to include WIPP and non-WIPP wastes and other characteristic information. The Transuranic Waste Baseline Inventory Report, Revision 2 [4] expanded the original purpose of Revisions 0 and 1 to include requirements from the WIPP Land Withdrawal Act (LWA)[6]. The TWBIR Revision 2 [4] contained waste profiles for all waste streams reported by the generator sites at that time, including some TRU waste streams that were unacceptable for disposal at the time in WIPP. The waste stream profiles resided in two appendices in TWBIR Revision 2: Appendix O reported the "Non-WIPP" waste streams and Appendix P reported the "WIPP" waste streams. The "Non-WIPP" waste streams included non-defense, commercial, polychlorinated biphenyl (PCB)-contaminated, and buried (predominately pre-1970) TRU wastes that were not planned to be emplaced into WIPP at the time. The TWBIR, Revision 3 [5] was based on TWBIR Revision 2 data, supplemented by data in several memoranda issued during early calendar year (CY) 1996. These supplemental data included: radionuclides, data estimates for complexing agents, oxyanions, and cement content in solidified waste**.** Data from Revision 2 and Revision 3 collectively provided the inventory used to perform the necessary calculations for the PA for the initial certification of the WIPP, the CCA.

A database was developed to collect and report this TRU waste inventory. The original database developed for tracking TRU waste generated across the DOE complex was the TWBID. This database consisted of two separate Microsoft™ Access version 2.0 databases. The first database contained original data submitted from the DOE TRU waste generator sites, and the second database generated reports. The TRU waste inventory was tracked by unique waste stream identifiers for each site. This first version of TWBID was not rigorously qualified under the software requirements of the quality assurance (QA) program but quality was built into the data by data checks that were performed to the extent possible. These TRU waste inventory data were summed for each site and reported as the physical and radiological characteristics of the TRU waste expected to be emplaced in WIPP in the future. These reports were ultimately used in the CCA PA that supported the 1996 CCA that led to WIPP certification in May 1998.

The site was subsequently opened for operations with the first receipt of TRU waste on March 26, 1999.

TRANSURANIC WASTE INVENTORY AND TWBID REVISION 2.1

Five years after the receipt of waste at WIPP, in accordance with the WIPP Land Withdrawal Act [6], a Compliance Recertification Application (CRA) was prepared and submitted to the EPA for the first recertification of the WIPP on March 26, 2004. At that time, the TRU waste inventory estimate was approximately 7 years old and knowledge about TRU waste throughout the complex had improved from years of characterization activities, improved estimation processes and emplacement in WIPP. Therefore, updated information was collected and reported using a defined process initiated by requests for modification of waste profile information that was included in the Transuranic Waste Baseline Inventory Report (TWBIR) Revision 2 [4]. This process included TRU waste generator site visits to facilitate data collection and assist with questions and issues.

The *Transuranic Waste Inventory Update Report, 2003, For the 2004 WIPP Compliance Re-Certification Application* generated from the data collected in this update was included in the CRA submitted to EPA in March 2004 as Attachment F to Appendix DATA [7]. This attachment documented the total inventory of DOE TRU waste as defined by the DOE TRU waste sites in 2002. The update included three annexes categorizing the waste streams obtained in the update into: Non-WIPP waste streams (Annex I), WIPP waste streams (Annex J), and "emplaced waste" (Annex K). Annex I included waste streams that did not have waste materials and radionuclides determined or required treatment or repackaging prior to shipment to WIPP among other considerations. These waste streams are considered to be potential waste streams for disposal in the future. Waste from these waste streams must pass waste acceptance criteria before shipment to WIPP. Similarly, waste streams reported in Annex J must also pass these requirements prior to shipment to WIPP. In addition to these annexes, Attachment F of Appendix DATA provided the summary data and the supplemental information required for the PA in support of the 2004 CRA PA.

The TRU waste inventory data were entered and maintained under the QA requirements of the WIPP Quality Assurance Program Document (QAPD) [8] in an upgraded Microsoft™ Access 2000 database known as the TWBID Revision 2.1 [9]. The TWBID Revision 2.1 consists of two main interface database files that are linked to a third common data file. The first interface file contained the interface forms that data entry personnel used to browse, add, modify, or delete waste streams and related information. Users were required to log into this interface in order to gain access to modify the data and maintain database configuration control. A central file, that contained username, password, and permission information, managed authentication. The second interface file was similar to the report generating database in the original TWBID and was used to generate the tables and reports used for the CRA submittal. The third file contained the raw data used by the other database files. This data file was "linked" to the other two by using the table-linking feature intrinsic to Microsoft™ Access 2000. The data that was collected and entered in the TWBID Revision 2.1 was subjected to intense reviews by Los Alamos National Laboratory – Carlsbad Operations (LANL-CO), Sandia National Laboratories (SNL), the WIPP Management and Operations (M&O) Contractor, the EPA and ultimately the public. The database and data were then qualified under a mature QA program at SNL. The qualified database ultimately facilitated generation of the update report that was submitted in the CRA.

THE PABC INVENTORY AND TWBIR 2004

After the CRA was submitted and during the time of EPA's determination of application completion, changes were noted in the PA software and to TRU waste inventory information that led the EPA to request a second PA known as the PABC. For the PABC, the Attachment F Appendix DATA was updated with corrections from Hanford and inclusion of buried waste from Idaho National Environmental Engineering Laboratory (INEEL, now known as the Idaho National Laboratory (INL)). The volumes, radionuclide information, and waste material parameters were also recalculated and supplied for the PABC. In addition, new analyses were performed for complexing agents (acetate, citrate, oxalate, ethylenediaminetetraacetic acid [EDTA]), oxyanions (nitrate, sulfate, and phosphate), and cement. This information was included in a revision to the CRA *Transuranic Waste Inventory Update Report* [7] known as *the Transuranic Waste Baseline Inventory Report 2004*[10].

FUTURE UPDATE PROCESS

The process used to collect, maintain and report TRU waste information was originally formalized for use in the CRA. The procedures that were developed have been modified based on input received through the CRA and have been transitioned between QA programs at SNL to LANL-CO. The process that will be used for future CRAs is based on collection of hard copy records that are tracked in the CID. The information collected includes that information needed to support future PAs, as well as, information important to WIPP management and planning. This information will be collected annually and is

maintained in the QAPD-qualified CID. The process begins with data collection and verification of hard copy records and ends with site validation of the data that has been entered in the CID.

Data Collection, Verification and Validation

TRU waste inventory information is now being updated on a yearly basis to keep information current. The data are first collected from the sites. The data collected include databases, spreadsheets, notes from discussions with waste management personnel, email correspondence, and site literature. After this information has been collected, it is organized in site specific notebooks and maintained as working records until the information in them is entered into the CID. The data that are entered in the CID are verified by an independent reviewer and this review is documented in the CID. Once the information has been verified in the CID, reports are generated for each site to validate the information in the database. These reports are reviewed by the sites and corrected or validated by DOE site representative signature depending on the results of the site review that the data in the reports are accurate.

Analysis Methods

In addition to collecting and processing data from the TRU waste sites and securing the site data in a qualified database for future use, analyses are performed on the data to support future PAs and other regulatory and programmatic decisions. Examples of some of the analyses that have been performed using data from TWBID to support PA include reports on chemical components in TRU Waste specifically related to oxyanions and complexing agents, emplacement materials, and cements. Other analyses that have supported regulatory efforts include background information for National Environmental Policy Act (NEPA) analyses, information on historic waste stream tracking needed for the New Mexico Environmental Department.

THE COMPREHENSIVE INVENTORY DATABASE

CID Development

The TWBID Revision 2.1 database has now been replaced with the Comprehensive Inventory Database (CID) as the repository for current TRU waste information. This data base includes information important to waste management in addition to the information needed to support recertification. A comparison of the fields used to maintain information for TWBID and for the CID is shown in Table I. Since the CID will provide information for the next WIPP Recertification in 2009, this database has been qualified in accordance with software QA requirements of the QAPD in similar fashion to the TWBID Revision 2.1 and includes improvements that are based on lessons learned during the 2006 WIPP recertification.

Table I. - Comparison of Fields in TWBID Important to WIPP

Fields in the TWBID	**Fields included in the CID**
Site, Handling and Waste Stream Identification	Site, Handling and Waste Stream Identification
Container types of Final Form and shipped/emplaced waste	Container types of Final Form, Current form stored at the Generator site and shipped/emplaced waste
Volumes of stored, projected and emplaced	Volumes of stored, projected and emplaced

Fields in the TWBID	**Fields included in the CID**
waste	waste
Radionuclide activity concentrations	Radionuclide activity concentrations
Waste material parameter densities	Waste material parameter densities
Estimates of the masses of chelating agents and oxyanions	Estimates of chemical constituents including chelating agents, oxyanions, beryllium, asbestos, graphite, magnesium and magnesium oxide, and PCBs.
Estimates of cement in solidified waste	Estimates of cement in solidified waste
Estimates of the types and amounts of materials that will be used to emplace waste in WIPP	Estimates of the types and amounts of materials that will be used to emplace waste in WIPP
Not included.	Hazardous Waste constituents, numbers and concentrations
Not included.	Historical Shipping Information
Not included.	Source Document Referencing
Not included.	Treatment and Repackaging Information
Not included.	TRUCON Codes
Not included.	Tracking to the TWBIR Revision 2

As part of the development of the CID, meetings were held with LANL-CO inventory project management and customers from CBFO to discuss data needs. These data needs covered strategic planning, transportation, disposal and general waste management. These data needs were included with those required to support future WIPP PAs in the requirement documentation for the CID.

The CID was then designed according to the requirements documented in the Requirements Document (RD). Verification and validation (V&V) activities were established in the Verification and Validation Plan (VVP). The design elements were documented in the Design & Implementation Document (DID). After the development, validation testing ensured that quality was built into the software. This was accomplished through the testing techniques and tools described in Table II. During V&V all tests needed to uncover possible defects in the software were addressed and changes were made to correct them.

Table II. Tools and Methods used for Validation Testing

Tools Used for Validation	**Methods used for Validation Testing**
CID software release candidate	Demonstration
Microsoft Excel (used for independently validating calculations)	Analysis
3 computers (2 clients for independent review of data entered under two different accounts and 1 server)	Execution
1 independent designated Code Tester	Inspection

Planning, design, development and testing were tracked in documents that contained referenceable traceability back to the requirements first requested by WIPP data customers. Verification activities were performed at each phase of development, to ensure that each phase adequately addressed the topics from the previous phase, and traced back to CID requirements. Validation activities involved execution of specific test cases to sufficiently prove that each requirement had been adequately implemented in the CID.

Once the CID passed testing criteria it was installed on work stations belonging to database users. Four user types were set up with differing privileges depending on responsibilities as shown in Table III. Access control and security was set up for accounts with these assigned privileges by password. Assignment of accounts and therefore privileges was managed by the CID administrator.

Table III. User Group Privileges

Group	Browse Data	Query/ Report on Data	Add/ Modify/ Delete Data	Review Data	Maintain Lookup Lists	Archive Data
Administrative	X	X	X	X	X	X
Power User	X	X	X	X	X	
Reviewer	X	X	X	X		
Data Entry	X	X	X			

CID Configuration

The CID was developed using Microsoft® Access Data Project® (ADP) technology. This technology allowed multiple users to run "front-end" clients while simultaneously accessing a common data store, a database running on a Microsoft SQL Server® 2000 platform. ADP differs from the traditional distributed Microsoft Access Database (MDB) configuration in that it is a specific file type that stores user objects such as forms, reports, macros, and Visual Basic for Applications (VBA) code modules, while all the other objects – tables, stored, procedures, user-defined functions, and views - are stored on the database server. The ADP technology allows a bulk of the processing to shift to the Server side of the network rather than burden the client. This configuration results in reduced network traffic and increased performance.

CID Qualified Reports

Several reports have been qualified for generation by the CID. Reports that support PA include scaling calculations, radionuclide decay calculations, summations of scaled radionuclides and waste material parameters for sites and the full repository. Other reports that have been qualified are those that support management decisions, planning and status updating. These include reports on volumes shipped by sites, waste containers and volumes that are readily shippable, and other reports identifying TRU waste status.

SUMMARY

The TRU waste inventory was collected for the first time a few years before the completion of the CCA. At that time, a database called the TWBID was developed but not qualified under the WIPP QA program. This database was transferred to LANL-CO a few months before data was needed to support the WIPP PA for the CRA in 2004. This TWBID was migrated to a more current operating system and Access version control for the CRA. In addition, the data structure of the TWBID was slightly modified to incorporate data important to PA. The updated inventory data were scrutinized by LANL-CO, SNL, the WIPP M&O contractor, EPA, and the public. Also, the TWBID database was qualified under QAPD software requirements. Inventory data from this database has now been transferred to the CID, which utilizes a more robust and efficient operating configuration and includes information collected from a process that incorporates lessons from previous inventory collection efforts. The information maintained by the CID includes data important to management and strategic planning for WIPP, as well as those important to PAs and recertifications.

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