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Sandia National Laboratories Waste Isolation Pilot Plant

Analysis Plan for Transuranic Waste Inventory Update Report , 2003

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TABLE OF CONTENTS

1 INTRODUCTION AND OBJECTIVES.....3

2 APPROACH.....4

3 SOFTWARE LIST.....7

4 TASKS7

5 SPECIAL CONSIDERATIONS10

6 APPLICABLE PROCEDURES11

7 REFERENCES11

LIST OF TABLES

1. Software List and Qualification Method for the Update to *TWBIR Revision 3* ...7

2. TWBIR Team Task and Deliverables9

LIST OF FIGURES

1. U.S. DOE transuranic waste sites.4

2. Flowchart showing major WIPP PA codes, code linkage, and flow path of information from TWBIR used in WIPP PA calculations.6

1 INTRODUCTION AND OBJECTIVES

This analysis plan describes the compliance decision technical activities to be performed by Los Alamos National Laboratory (LANL), with quality assurance (QA) oversight from Sandia National Laboratories (SNL), for the development of the *Transuranic Waste Inventory Update Report, 2003*. This technical work and the documentation produced will be performed under the controls provided by the SNL QA program developed for the SNL Nuclear Waste Management Program (NWMP). This meets the requirements for Waste Isolation Pilot Plant (WIPP) activities. This work will be done under a *Memorandum of Agreement, Revision 1* (December 6, 2002) between the participating parties, LANL and SNL (MOA, 2002). The product of this work activity will be a published report in a format consistent with that of the *Waste Isolation Pilot Plant Transuranic Waste Baseline Inventory Report, Revision 3* (U.S. DOE, 1996a) which was included in the Compliance Certification Application (CCA; U.S. DOE, 1996b) and is referred to throughout this document as *TWBIR Revision 3*. The update to *TWBIR Revision 3* will provide the information needed for the performance assessment (PA) calculations to be generated by SNL as part of the completion of the WIPP Compliance Recertification Application (CRA). As identified in this analysis plan, LANL will: (1) design a collection method for transuranic (TRU) waste stream information; (2) obtain responses from TRU waste generation sites; (3) compile the technical data into an electronic database; (4) perform data calculations (radioactive decay calculations, WIPP volume scaling calculations, etc.); (5) perform data checks (internal reviews and QA record documentation), and (6) compile data/results in a published report acceptable for use for WIPP PA calculations.

Acronyms and definitions for terms used in this plan may be found in the NWMP Glossary located at the SNL NWMP On-line Documents web site, located at the following address:
<http://www.nwmp.sandia.gov/onlinedocuments/>.

The WIPP is a U.S. Department of Energy (DOE) facility designed for safe disposal of TRU radioactive wastes generated from defense activities. The WIPP is located near Carlsbad, New Mexico, and is sited on land described in the WIPP Land Withdrawal Act (LWA) (U.S. Congress, 1992). The Environmental Protection Agency (EPA) regulates the disposal of TRU waste. To demonstrate compliance with EPA's long-term disposal regulations, the DOE uses conceptual and computational models to perform a system-level consequence analysis called performance assessment. In PA, conceptual models of the WIPP disposal system are used to simulate the complex interactions between the waste, natural environment, and the engineered system (see Rechar, 1995 for details).

Pertinent regulations (40 CFR 194.24) specify that the DOE shall provide information pertaining to the chemical, radiological, and physical composition of the waste planned to be emplaced in the repository. Currently, it is assumed that WIPP TRU wastes originated at 27 DOE generator sites (Figure 1). The WIPP Compliance Certification Application (U.S. DOE, 1996b) provided a PA that showed conformity with EPA standards, 40 CFR 191 (U.S. EPA, 1996), which addresses the management and disposal of transuranic radioactive waste in the WIPP facility (Howard et. al., 2000). SNL contribution is to conduct the bounding PA for a 10,000-year timeframe. Information used in the WIPP CCA PA was obtained from the *TWBIR, Revision 3* (U.S. DOE, 1996a), which was developed from the best available information provided by the DOE TRU waste sites.

In May 1998, the WIPP was certified by EPA to permanently dispose of TRU waste. In November 1999, the WIPP Resource Conservation and Recovery Act (RCRA) permit was granted by the New Mexico Environment Department and enabled the WIPP to dispose of TRU waste containing hazardous materials. The operating period of the WIPP prior to sealing and closure may be as long as 35 years. During this

operating period, the U.S. Department of Energy Carlsbad Field Office (CBFO) will implement a structured and iterative recertification process required by the LWA to ensure that the WIPP continues to comply with the commitments, terms, and conditions of WIPP’s certification.

This analysis plan defines the information and data that is necessary to provide an updated estimate of inventory components in PA for the CRA.



Figure 1. U.S. DOE transuranic waste sites (after U.S. DOE, 1996a).

2 APPROACH

The technical information obtained for the update to the *TWBIR Revision 3* will be used extensively in the WIPP PA calculations. The flowchart in Figure 2 identifies that the inventory information is vital for PA calculations for both direct human intrusion scenarios (main contributor to probabilistic futures) and to

indirect (subsurface) release scenarios (detailed discussions can be found in Rechar, 1995).

2.1 Waste Inventory Parameters for Performance Assessment

The information in both the *TWBIR, Revision 3* and the *Waste Isolation Pilot Plant Transuranic Waste Baseline Inventory Report, Revision 2* (referred to as *TWBIR Revision 2* throughout the rest of this document) were used to identify the components of the waste important to the PA performed for the CCA (requested parameters for the update to *TWBIR Revision 3* are listed in Giambalvo, 2002). The information in the *TWBIR Revision 3* were based on estimations of existing waste, as well as estimations of waste volumes to be generated by future activities. These components were scaled up to quantities that would fill the WIPP for PA modeling. Originally, the DOE identified eight waste components influencing six significant waste characteristics: ferrous metals, cellulose, radionuclide isotope identification, radioactivity of isotopes, TRU activity of waste, solid waste components, sulfates, and nitrates. Later, DOE argued that nitrates and sulfates could be excluded from further consideration (and therefore tracking) because they would not significantly affect the behavior of the disposal system as long as cellulose were limited. Thus, the EPA concurred that it is unnecessary to specify limits for nitrates, sulfates, and solid waste.

These same inventory components, parameters, and waste related information will be updated for the PA for the CRA.

2.2 Inventory Items that Affect Processes

Through a data call (SP 9-6, *Baseline Inventory Report (BIR) Change Report Data Collection and Entry*), TRU waste sites will be provided with *TWBIR Revision 2* and *TWBIR Revision 3* information on a waste stream basis. The sites will review this information for each waste stream and will provide updated information and changes to LANL. This information will include information on any new waste stream(s) or the aggregation of former waste streams into newly identified or expanded waste streams. LANL, working with the site, will compile this information into an updated inventory database (*Transuranic Waste Baseline Inventory Database, Revision 3*) and reported in the *Transuranic Waste Inventory Update Report, 2003*. Each TRU waste site will verify that the updated inventory information for the respective site is correct and will formally attest to its validity and accuracy.

2.3 Data and Information Preparation for Use in Performance Assessment

Updated inventory information that has been verified correct by the TRU waste sites will be entered, according to SP 9-6, into a Microsoft® Access database that will be qualified for use according to NP 19-1. For use in CRA PA, the inventory data will be formatted consistent with that used for *TWBIR Revision 2* and *TWBIR Revision 3* and the CCA PA. The updated inventory data must be scaled to the WIPP repository capacity (6.2 million cubic feet), the updated isotopic inventory will be decayed to the end of calendar year 2001 (if necessary), and any other normalization analyses will be performed, as required. These calculations will be performed using the available functions or macros developed through the use of Microsoft® Access or Microsoft® Excel. ORIGEN 2.2 will be employed for the isotopic decay analysis.

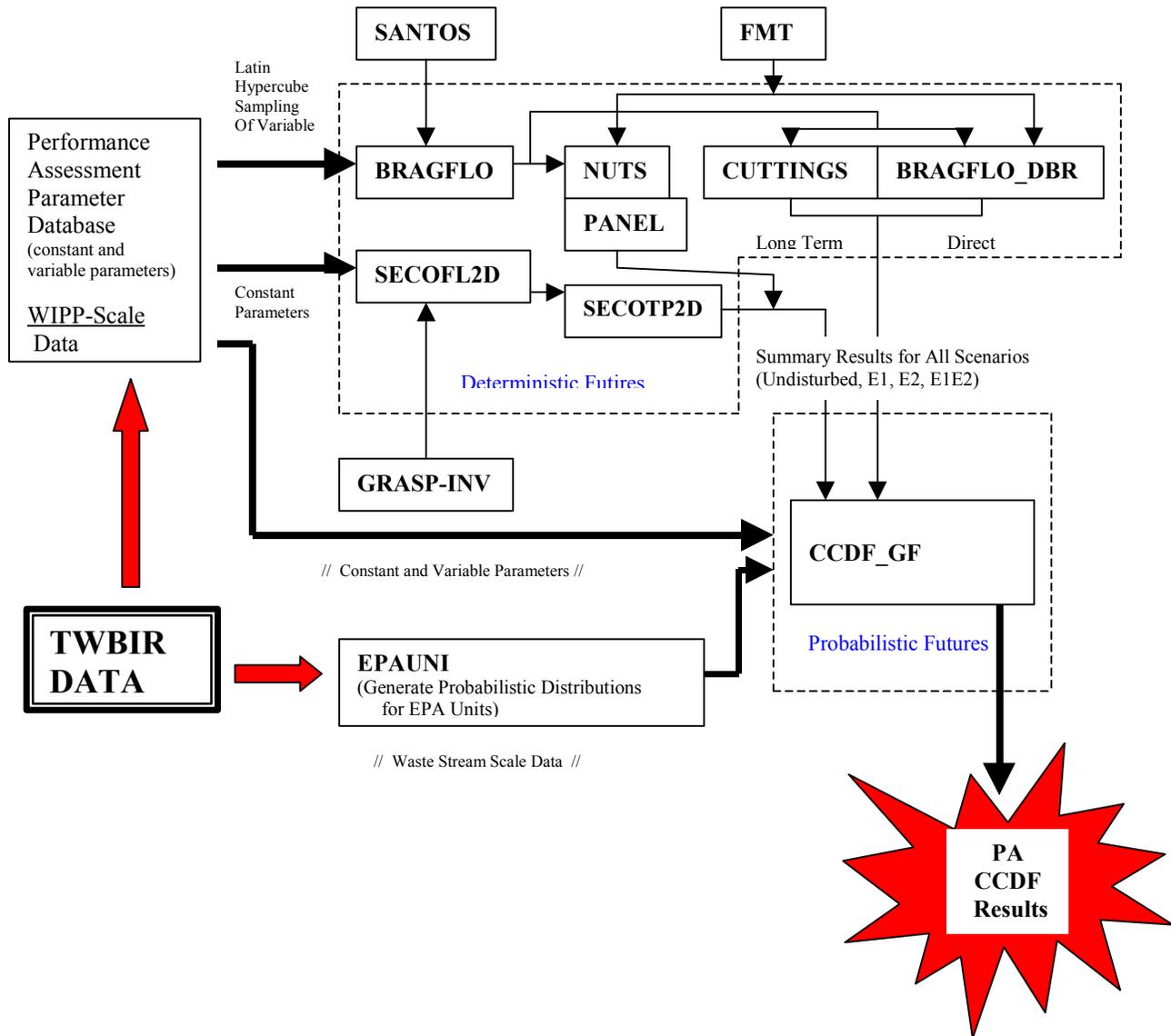


Figure 2. Flowchart showing major WIPP PA codes, code linkage, and flow path of information from inventory data used in WIPP PA calculations. Much of this flowchart is based on the PA mechanics as used in the 1996 WIPP CCA, minor changes may be used for the WIPP CRA PA calculations.

3 SOFTWARE LIST

All analysis software will be qualified either for routine use (NP 9-1) or production codes (NP 19-1) via SNL WIPP computer software QA procedures, examples of which are shown in Table 1.

Code	Description	QA Method
Radioactive decay analysis software (ORIGEN2.2)	Production code	NP 19-1
Microsoft® EXCEL and ACCESS	Routine use	NP 9-1 and 19-1, respectively

4 TASKS

The LANL manager and LANL technical task leader will handle the coordination and management of the *Transuranic Waste Inventory Update Report, 2003*. The task activities are listed in Table 2, and discussion of these tasks is provided in the remainder of this section. LANL, is solely responsible for providing an update report with the requested (Giambalvo, 2002) qualified inventory estimates.

4.1 Compilation of Existing Data on WIPP Transuranic Waste

LANL will collect and review existing information on the transuranic waste to be disposed within the WIPP. Data sources to be analyzed include: (1) the *TWBIR Revision 3*; (2) the Transuranic Waste Baseline Inventory Database, Revision 2 (the electronic database which supported the development of both the *TWBIR Revision 2* and the *TWBIR Revision 3* and contains technical/historical information important to the inventory update process; (3) WIPP Waste Information System (WWIS) for information on already emplaced contact-handled transuranic wastes placed within the WIPP; (4) “acceptable knowledge” (AK) information for the waste streams expected to be disposed within the WIPP. Compiled data will be submitted to records according to NP 17-1. The data collection and entry method (SP 9-6) and the supporting computational approach will be reviewed (NP 6-1) and documentation will be submitted to the SNL records.

4.1.1 Design Data Collection Method

The LANL team will design a data collection method (SP 9-6) for Large Quantity Sites (LQSs) and Small Quantity Sites (SQSs) that generate or store TRU waste. Collected information will include: (1) stored (or legacy) waste; (2) future projected waste. Data collection will include both radioactive and nonradioactive final waste form components. The requirements for the information and produced information are discussed in Giambalvo (2002).

4.1.2 Submit Final Data Collection Package

The LANL team will provide each site with all waste stream data for the respective site that was previously developed for *TWBIR Revision 3*. Sites will report any changes to that data previously reported as well as information on new or consolidated waste streams per SP 9-6. The *Transuranic Waste Inventory Update Report, 2003* team will visit LQS sites to facilitate the data collection requests.

4.1.3 Compilation of Electronic Data Responses

The LANL team will enter data into an integrated electronic database. The electronic database will be qualified under NP 19-1 and the LANL TWBIR team will: (1) verify the completeness of the received primary data; (2) verify that input data are within the appropriate range for their physical parameter; (3) identify significant changes to baseline waste streams; (4) document all computational processes in the

"calculations briefs" (i.e., computational procedures and support documentation). Documentation will be submitted to SNL Records Center.

Task #	Task Description	Responsible Individual(s)	Deliverable(s)	Start Date	Target Date
1	QA training for LANL team.	SNL QA Lead	Submit training records to SNL Records Center	8/9/02	8/19/02
2	Project Team Leaders, assisted by SNL, submit Analysis Plan to SNL Records Center.	SNL Tech. Lead, LANL Mngmt & Tech Leads	Submit AP to SNL Records Center.	8/9/02	8/19/02
3	LANL team review available information on WIPP final waste forms, review data requirements (Giambalvo 2002), and design data collection method.	LANL Tech. & QA Leads	Results to LANL Inventory Lead.	8/9/02	12/20/02
4	Design computational methodology for analyzing/synthesizing data.	LANL Tech. Lead	TWBIR memo to LANL project manager.	8/9/02	12/20/02
5	SNL review of computational methodology.	LANL Mngmt, Tech. & QA Leads	Letter to SNL with copy to CFBO	8/9/02	12/18/02
6	Site Visits to LQs, as necessary.	TWBIR team	Results to LANL Inventory Lead.	9/02/02	10/02/02
7	Site Visits to SQs, as necessary.	TWBIR team	Results to LANL Inventory Lead.	9/02/02	10/02/02
8	Compilation of responses and identification of data gaps.	LANL Mngmt. & Tech. Lead	Results to LANL Inventory Lead.	10/02/02	10/31/02
9	Anticipated (current and projected) database of inventory	LANL Mngmt., QA & Tech. Leads	Letter to CFBO and SNL, with preliminary, non-QA qualified copy of electronic database.	8/9/02	12/18/02
10	Submit verified data to TRU waste generation sites.	LANL Mngmt. & Tech. Leads	Results to LANL Inventory Lead and sites.	1/2/03	01/6/03
11	QA'd decay software (ORIGEN2.2).	TWBIR team	Memorandum to Records.	8/9/02	01/31/03
12	QA'd "scale-up" software.	TWBIR team	Memorandum to Records.	8/9/02	01/31/03
13	QA'd software for re-normalization of waste stream information, if necessary.	TWBIR team	Memorandum to Records.	8/9/02	01/31/03
14	Perform "common base-year 2001" decay calculations.	TWBIR team	Results to LANL Inventory Lead.	10/31/02	01/31/03
15	Perform "scale-up" calculations for the WIPP future waste components.	TWBIR team	Results to LANL Inventory Lead.	10/31/02	01/31/03
16	Perform re-normalization calculations for individual waste streams, if necessary.	TWBIR team	Results to LANL Inventory Lead.	10/31/02	01/31/03
17	Radionuclide inventory "scale-up"	LANL Rad. Tech. Lead	Tables 3.1, p. 3-3, and Table 1 in App. B and C <i>TWBIR Revision 3</i>	1/6/03	01/31/03
18	Complete non-radioactive roll-up	TWBIR team	Letter and data to CBFO	1/6/03	02/28/03
19	QA'd all computational sets, calculations briefs, database, etc.	LANL Mngmt. & Tech. Leads	Results to LANL Project Leader. Submit documentation to SNL Records Center.	1/6/03	4/14/03
20	Documentation of all data requested (Giambalvo 2002) in final report (consistent format as TWBIR Rev 3).	LANL Mngmt., QA & Tech. Leads	Technical data report to CFBO. Submit documentation to SNL Records Center.	12/02/02	4/14/03
21	Present documentation (paper report and electronic files) of all data requested (Giambalvo 2002) in final report (consistent format as <i>TWBIR Revision 3</i>).	LANL Mngmt., QA & Tech. Leads	Present <i>Transuranic Waste Inventory Update Report, 2003</i> with accompanying electronic waste stream information to SNL Records Center.	2/28/03	4/28/03

4.1.4 Decay Calculations

All radioactive inventory information of individual final waste streams will be decayed (i.e., radioactive decay via ORIGEN 2.2) to end of calendar year 2001. The LANL team will crosscheck WIPP-scale roll-

up data to values of (1) total curies inventory; (2) CH scaling factor obtained previously in *TWBIR Revision 3*. Significant changes (>10%) in the WIPP-scale roll-up values will be accounted for, explained, and documented. These differences will be investigated by SNL to determine the effect of the difference. If the LANL team needs to perform computational analyses, the numerical computations will be performed in accordance with the SP 9-6, "Baseline Inventory Report Change Report Data Collection and Entry".

4.1.5 Identify Stored and Future Volumes (for Scale-Up Calculations)

The LANL team will determine, from the data collection results, the volumes for stored and future WIPP waste streams. These volumes will be independently tallied to determine the "anticipated" waste volume and to "scale-up" the future waste component to meet the repository allowed total volume.

4.1.6 Re-Normalization Calculations of Waste Steam Radionuclides (if needed)

Radioactive inventory data for a specific waste generator site may need to be based upon pre-existing *TWBIR Revision 3* waste stream radionuclides. If this is the case, then each individual waste streams will need to be re-normalized to new site level (roll-up) data. The re-normalization will include the seven key significant radionuclides for CH- (contact-handled), TRU (i.e., the radionuclides that contribute to 99.9% of the source term EPA Units, these included the radionuclides: Am-241, Cm-244, Pu-238, Pu-239, Pu-240, Pu-241, and U-234 for the WIPP CCA and may be subject to change for the CRA) and the 10 key significant radionuclides for remote-handled (RH) TRU (i.e., for the WIPP CCA this included the CH-TRU list plus Cs-137, Sr-90, and U-233, see Sanchez et.al., 1997, for details). QA testing/benchmarking results of: (1) radioactivity decay calculations; (2) scale-up calculations, and 3) re-normalization software will documented and submitted to records.

4.2 Generate Transuranic Waste Inventory Update Report, 2003

- a. After data reviews and data analyses are completed according to NP 6-1, the LANL team will consolidate data requested in Giambalvo (2002) into a formal report consistent in format with *TWBIR Revision 3* (U.S. DOE, 1996a) and will submit the documentation to SNL records in accordance with NP 17-1.

5 SPECIAL CONSIDERATIONS

None.

6 APPLICABLE PROCEDURES

All analyses will be conducted in accordance with the quality assurance (QA) procedures listed below.

1. *Training*: Training of personnel will be performed in accordance with the requirements in NP 2-1, Qualification and Training.
2. *Computer Codes*: Computer codes used in the analyses will be qualified in accordance with NP 19-1, Software Requirements.
3. *Analysis and Documentation*: Documentation will meet the applicable requirements in NP 6-1, Document Review Process and NP- 9-1, Analyses.
4. *Reviews*: Reviews will be conducted and documented in accordance with NP 6-1, Document Review Process and NP 9-1, as appropriate.
5. *Records*: All required records will be submitted to the WIPP Records Center in accordance with NP 17-1, Records.
6. *Data Collection and Database Entry*: Data collection and database entry will be performed according to SP 9-6, Baseline Inventory Report (BIR) Change Report Data Collection and Entry.

Training to the above procedures for LANL team members will be completed prior to beginning work. Training will be conducted in accordance with the NWMP QA Training Program. Training records will be maintained in the NWMP Records Center, located in the SNL/Carlsbad office.

7 REFERENCES

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