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SANDIA NATIONAL LABORATORIES
WASTE ISOLATION PILOT PLANT

AP-163
Revision 0

Analysis Plan to Evaluate Waste Material Degradation Incorporating Recent Corrosion Experimental Data

Task 1.4.1.2

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1 *Introduction and Objectives*

The Waste Isolation Pilot Plant (WIPP), located in southeastern New Mexico, has been developed by the U.S. Department of Energy (DOE) for the geologic (deep underground) disposal of transuranic (TRU) waste. Containment of TRU waste at the WIPP is regulated by the U.S. Environmental Protection Agency (EPA) according to the regulations set forth in Title 40 of the Code of Federal Regulations (CFR), Part 191. The DOE demonstrates compliance with the containment requirements according to the Certification Criteria in Title 40 CFR Part 194 by means of performance assessment (PA) calculations. WIPP PA calculations estimate the probability and consequence of potential radionuclide releases from the repository to the accessible environment for a regulatory period of 10,000 years after facility closure. The models are maintained and updated with new information as part of a recertification process that occurs at five-year intervals following the receipt of the first waste shipment at the site in 1999. As part of the 2009 recertification, EPA requested a PA calculation (Cotsworth 2009), referred to as the 2009 Compliance Recertification Application Performance Assessment Baseline Calculation (PABC-2009) (Clayton et al. 2010). With the recertification of the WIPP in November of 2010 (U.S. EPA 2010), a new PA baseline was established by the PABC-2009.

A series of experiments has been conducted under Test Plan TP 06-02 (Wall and Enos 2006), in order to determine iron and lead corrosion rates under WIPP-relevant conditions. From these experiments, an updated iron corrosion rate will be produced (Roselle 2011). In PA, the iron corrosion rate directly affects the amount of waste material degradation, and the amount of waste material degradation influences the long-term properties of the repository. Direct releases are a function of the long-term waste material properties, so the change in iron corrosion rate may impact total releases. This analysis plan outlines the approach to determine the potential impact of this updated iron corrosion rate on the amount of waste material degradation. Therefore, this analysis is considered a compliance decision analysis per NP 9-1.

2 Approach

To determine the impact of the updated iron corrosion rate on the amount of waste material degradation, a focused set of calculations will be performed. One replicate of 100 vectors will be created using the computer code LHS. The random seed and parameter ordering from the PABC-2009 will be used for the AP-163 LHS calculations. This will result in identical sampled parameter values for parameters that are common to both the AP-163 and PABC-2009 calculations. The code LHS version 2.42 will be used for the AP-163 LHS calculations; the same code was used for the PABC-2009 LHS calculations.

The two-phase flow code BRAGFLO simulates brine and gas flow in and around the WIPP repository, incorporating the effects of gas pressure on disposal room closure, gas generation, brine consumption, and inter-bed fracturing. To assess the impacts resulting from the updated iron corrosion rate, BRAGFLO simulations will be performed. The AP-163 BRAGFLO calculations will use the same procedures that were used in the PABC-2009 BRAGFLO calculations (Nemer 2010). These calculations will consist of 1 replicate, 100 vectors per replicate, and 3 scenarios (see Table 1) per vector. Waste material degradation results obtained from the AP-163 BRAGFLO calculations will be compared to those calculated in the PABC-

2009. The same code used for PABC-2009 will be used for the AP-163 BRAGFLO calculations, specifically BRAGFLO version 6.0.

Table 1: WIPP PA BRAGFLO Scenarios

Scenario	# of Drilling Intrusions	Time of Intrusion (Years)	Castile Brine Pocket encountered
S1-BF	0 (Undisturbed)	NA	NA
S3-BF	1	1,000	Yes
S5-BF	1	1,000	No

3 Software List

The major WIPP PA codes to be used for this analysis are listed in Table 2. These codes will be executed on the WIPP PA Alpha Cluster, which is described in Table 3. Additionally we may utilize COTS (Commercial off-the-shelf) software such as Excel® or Python, running on workstations. The use of any COTS application will be verified per NP 9-1 Appendix C as appropriate.

Table 2: Codes to be used for the AP-163 analysis

Code	Version	Build Date	Executable
ALGEBRACDB	2.35	31-JAN-1996	ALGEBRACDB_PA96.EXE
BRAGFLO	6.0	12-FEB-2007	BRAGFLO_QB0600.EXE
GENMESH	6.08	31-JAN-1996	GM_PA96.EXE
ICSET	2.22	1-FEB-1996	ICSET_PA96.EXE
LHS	2.42	18-JAN-2005	LHS_QA0242.EXE
MATSET	9.20	4-JAN-2012	MATSET_QA0920.EXE
POSTBRAG	4.00A	28-MAR-2007	POSTBRAG_QA0400A.EXE
POSTLHS	4.07A	25-APR-2005	POSTLHS_QA0407A.EXE
PREBRAG	8.00	8-MAR-2007	PREBRAG_QA0800.EXE
PRELHS	2.40	4-JAN-2012	PRELHS_QA0240.EXE
SUMMARIZE	3.01	21-DEC-2005	SUMMARIZE_QB0301.EXE

Table 3: WIPP PA Alpha Cluster

Node	Hardware Type	CPU	Operating System
CCR	HP AlphaServer ES45	Alpha EV68	Open VMS 8.2
TDN	HP AlphaServer ES45	Alpha EV68	Open VMS 8.2
BTO	HP AlphaServer ES45	Alpha EV68	Open VMS 8.2
CSN	HP AlphaServer ES45	Alpha EV68	Open VMS 8.2
GNR	HP AlphaServer ES47	Alpha EV7	Open VMS 8.2
MC5	HP AlphaServer ES47	Alpha EV7	Open VMS 8.2
TRS	HP AlphaServer ES47	Alpha EV7	Open VMS 8.2
TBB	HP AlphaServer ES47	Alpha EV7	Open VMS 8.2

4 Tasks

The tasks, responsible personnel and estimated task schedule are summarized below in Table 4.

Table 4: Task list and estimated schedule for the AP-163 analysis.

Task	Description	Guiding Document	Approximate Completion Date	Responsible Individual(s)
1	Input File Setup	AP-163	8/31/12	Clayton
2	LHS Calculations	AP-163	9/7/12	Long
3	BRAGFLO Calculations	AP-163	9/14/12	Long
4	Salado Flow Analysis	AP-163	9/28/12	Clayton

5 Special Considerations

The schedule for the tasks is dependent on the completion of an analysis report documenting the updated corrosion rate by August 31, 2012.

6 Applicable Procedures

All applicable WIPP QA procedures will be followed when conducting these analyses.

- Training of personnel will be conducted in accordance with the requirements of NP 2-1, *Qualification and Training*.
- Analyses will be conducted and documented in accordance with the requirements of NP 9-1, *Analyses*.
- All software used will meet the requirements laid out in NP 19-1, *Software Requirements* and NP 9-1, as applicable.
- The analyses will be reviewed following NP 6-1, *Document Review Process*.
- All required records will be submitted to the WIPP Records Center in accordance with NP 17-1, *Records*.
- New and revised parameters will be created as discussed in NP 9-2, *Parameters*.

7 References

Clayton, D.J., R.C. Camphouse, J.W. Garner, A.E. Ismail, T.B. Kirchner, K.L. Kuhlman, M.B. Nemer. 2010. Summary Report of the CRA-2009 Performance Assessment Baseline Calculation. Sandia National Laboratories, Carlsbad, NM. ERMS 553039.

Cotsworth, E. 2009. EPA Letter on CRA-2009 First Set of Completeness Comments. U.S. EPA, Office of Radiation and Indoor Air, Washington, D.C. ERMS 551444.

Nemer, M.B. 2010. Analysis Package for Salado Flow Modeling: CRA-2009 Performance Assessment Baseline Calculation. Sandia National Laboratories. Carlsbad, NM. ERMS 552956.

Roselle, G.T. 2011. Analysis Plan for Determination of Gas Generation Rates from Iron/Lead Corrosion Experiments, AP-159, Rev 0. Sandia National Laboratories, Carlsbad, NM. ERMS 556297.

U.S. Environmental Protection Agency (EPA). 2010. 40 CFR Part 194 Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the Disposal Regulations: Recertification Decision, Federal Register No. 222, Vol. 75, pp. 70584-70595, November 18, 2010.

Wall, N.A. and D. Enos. 2006. Iron and Lead Corrosion in WIPP-Relevant Conditions, TP 06-02, Rev 1. Sandia National Laboratories, Carlsbad, NM. ERMS 553039.

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