

# **WASTE ISOLATION PILOT PLANT**

## **SPALLINGS**

### **PEER REVIEW PLAN**

**June 20, 2003**

## INTRODUCTION

This peer review plan describes the process and documentation requirements for a peer review of the proposed spallings conceptual model to be used in the Waste Isolation Pilot Plant (WIPP) performance assessment (PA). This plan defines the management approach, resources, schedule, and technical requirements for using peer reviews to confirm the adequacy of the new conceptual model for spallings.

### 1.1 BACKGROUND

Peer review of conceptual models developed by the U.S. Department of Energy (DOE) for the WIPP is required by 40 CFR § 194.27 (EPA, 1996), promulgated by the U.S. Environmental Protection Agency (EPA). In accordance with this criterion, the Carlsbad Field Office (CBFO) of the DOE will have a peer review conducted of specific conceptual models that are being revised due to knowledge gained since the original conceptual models were developed. When approved, the revised conceptual models will be used in the Compliance Recertification Application (CRA) for the WIPP Project.

Sandia National Laboratories (SNL) is responsible for the development, maintenance, and conduct of WIPP PA's. As part of the PA methodology included in the Compliance Certification Application (CCA)(DOE, 1996), the DOE identified and developed conceptual models that describe the features, events, and processes relevant to the WIPP disposal system and its subsystems. These conceptual models were peer reviewed by the Conceptual Model Peer Review Panel (CMPRP) and the Panel's results were approved by the EPA during the original WIPP certification (EPA, 1998a).

The spallings conceptual model is one of 24 conceptual models used in the WIPP PA. The spallings model describes a potential release of degraded solid waste materials when repository gas pressure exceeds the hydrostatic pressure in the drilling fluid at the bottom of an intrusion borehole. The CMPRP found that the spallings conceptual model implemented in the CCA was inadequate to describe the detailed spallings process. However, the CMPRP also concluded that "the spallings volumes used in the CCA are reasonable, and may actually overestimate the actual waste volumes that could potentially be expected to be released by the spallings process at the WIPP" (Wilson et al., 1997, Section 4). The EPA agreed with the CMPRP that the spallings conceptual model was inadequate but the results were acceptable for use in PA (EPA, 1998b, Section 7).

After the CCA and Performance Assessment Verification Test (PAVT) were completed, work continued on the development of a new spallings model that would be more technically defensible than the original model. The major elements of the new spallings

model include consideration of multiphase flow processes in the intrusion borehole, consideration of fluidization and transport of waste particulates from the intact waste mass to the borehole, and a numerical solution for the coupled mechanical/hydrological response of the waste as a porous medium. New software, called DRSPALL, has been prepared to calculate the volume released during a potential spallings event.

## **1.2 REQUIREMENTS**

The requirement for conducting a peer review of conceptual models is specified in 40 CFR § 194.27 (a)(1). The requirements for the peer review process and its documentation are specified in 40 CFR § 194.27(b) and (c). In summary, the peer review process shall be a documented, critical review performed by peers who possess qualifications at least equal to those of the individuals who conducted the original work. A peer review is an in-depth critique of assumptions, calculations, extrapolations, alternate interpretations, methodology and acceptance criteria employed, and the conclusions drawn from the original work.

The peer reviewers shall be independent of the work being reviewed; in other words, the peer reviewer a) was not involved as a participant, supervisor, technical reviewer, or advisor in the work being reviewed, and b) to the extent practical, has sufficient freedom from funding considerations to ensure the work is impartially reviewed. Therefore, the peer-review provides additional assurance to the regulator and the public that the subject matter is reasonable, accurate and valid for its intended use.

## **1.3 PURPOSE**

The purpose of this plan is to describe the scope, approach, and process the peer review panel will use in conducting a peer review of the WIPP spallings conceptual model.

## **1.4 SCOPE**

The Spallings Peer Review panel will determine if the new conceptual model for spallings reasonably represents the failure of solid wastes and their subsequent transport to the surface from a borehole intrusion into a high pressure repository. The scope of this peer review is limited to assessing the new conceptual model for spallings and its implementation in WIPP PA.

## PEER REVIEW PLANNING AND IMPLEMENTATION

### 2.1 APPROACH

This plan documents the approach to conducting the peer review process. The Spallings Peer Review will be conducted using a rigorous proceduralized approach that meets all the requirements of NUREG-1297 (NRC, 1988), in accordance with 40 CFR § 194.27(b). The DOE-CBFO has prepared a management procedure, MP 10.5, Revision 5, February 1, 2003 (DOE, 2002a), for conducting peer reviews in accordance with NUREG-1297. The DOE-CBFO procedure ensures that the peer review will be a documented, critical review performed by qualified peers who are independent of the work being reviewed. Specifically, the Spallings Peer Review Manager will:

- Follow MP 10.5, Revision 5, February 1, 2003 requirements. In the event of a conflict between MP 10.5, Revision 5, February 1, 2003 and NUREG-1297, NUREG-1297 will take precedence over MP 10.5, Revision 5, February 1, 2003.
- Administer and document the peer review process. Activities include documenting the selection of panel members, assignment of a panel leader, panel member independence documentation, and recording and archiving meeting minutes.
- Negotiate a schedule for the peer review with the DOE CBFO Assistant Manager, or designee.
- Conduct and document peer review panel caucuses.
- Communicate interim peer review findings in hardcopy to the DOE CBFO Assistant Manager, or designee.
- Produce a formal written report of the peer review findings and conclusions.
- Implement applicable quality assurance (QA) requirements for document preparation, control and records archiving.

#### 2.1.1 DESCRIPTION OF CONCEPTUAL MODEL TO BE REVIEWED

A new conceptual model for spallings is being proposed. The new conceptual model for spallings includes: (1) the development of numerical techniques to solve the coupled mechanical-hydrologic equations for gas flow and fracture of the waste in the repository, and (2) the use of a conceptual model for multiphase flow in the intrusion borehole.

Detailed descriptions of the model components will be provided to the peer review panel through written documentation and oral presentations.

Peer review of the new conceptual model for spallings will include:

- The conceptual model for the spallings process in the repository and in the intrusion borehole.
- The mathematical representation of the new spallings conceptual model.
- The numerical solution of the mathematical representation through the DRSPALL computer program. The words “computer program” and “code” are used interchangeably in this plan.
- Incorporation of the numerical results from the DRSPALL code into the direct release calculations for PA.

When approved, the new conceptual model for spallings will be used to calculate potential spallings volumes for the Compliance Recertification Application, replacing the original spallings model. *Review of the new conceptual model for spallings will not include consideration of the validity of the original conceptual model peer review.*

### **2.1.2 COMPOSITION OF PEER REVIEW PANEL**

The peer review panel will be composed of a minimum of three individuals who possess the subject matter technical expertise to a degree at least equivalent to that needed for the original work.

Each panel member will become familiar with the WIPP containment system by reviewing documents on a required reading list and through a formal orientation process conducted by the peer review manager. In addition, they will be presented with a basic description of how the conceptual models for PA are represented in numerical models, algorithms, and codes. The panel members will be presented the parameter inputs to the spallings code, results of prior PAs, sensitivity analyses, and critical comments from previous reviews. Finally, each panel member will become familiar with the peer review process through formal training in the appropriate peer review procedure(s).

### **2.1.3 LOGISTICS AND MANAGEMENT**

Required reading material necessary to support the Spallings Peer Review will be provided by the DOE CBFO Assistant Manager, or designee, for distribution to the panel in time to support the first technical meeting which is scheduled for mid July.

## **2.2 PEER REVIEW PROCESS**

The cognizant DOE CBFO Assistant Manager, or designee, is responsible for the peer review. A peer review contractor and Peer Review Manager will be selected by the CBFO Technical Assistance Contractor (CTAC). The responsible DOE CBFO AM, or

designee, shall concur with the peer review manager nominated by the service provider. The Peer Review Manager has prepared this Peer Review Plan and the DOE CBFO Assistant Manager, or designee, has reviewed and approved it. This Plan meets the requirements of MP 10.5, Revision 5, February 1, 2003. MP 10.5 shall supersede any discrepancies between this Plan and MP 10.5.

The Peer Review Manager will use a selection committee to select candidates for the peer review panel. Upon verification that the peer review panel members meet the criteria outlined in MP 10.5, Revision 5, February 1, 2003, Attachment 1, an orientation and training meeting will be scheduled. The peer review panel members shall complete their review of required reading materials prior to the orientation meeting.

Throughout the review, the panel is encouraged to engage in frank discussions with the individuals responsible for the work under review. However, the peer review panel must observe all rules for interaction with DOE CBFO, SNL, and stakeholders, as outlined in MP 10.5, Revision 5, February 1, 2003.

The results of the panel's review shall be formally documented in a report. This report will be prepared independently of the DOE CBFO to ensure the independence of the Panel's conclusions.

MP 10.5, Revision 5, February 1, 2003 states that the DOE CBFO QA Manager is authorized to conduct independent assessments of the peer review process to ensure that all aspects of the peer review conform to the guidance of NUREG-1297, MP 10.5, Revision 5, February 1, 2003, and the latest version of the CBFO Quality Assurance Program Description (DOE, 2002b). The DOE CBFO QA Manager shall inform the Peer Review Manager of any requests for audits or assessments. The Peer Review Manager shall comply with and resolve all issues arising from such audits or assessments.

### **2.3 ADEQUACY CRITERIA**

Conceptual models that have been selected and developed by the DOE must meet commonly accepted technical and scientific standards based on an in-depth evaluation. The peer review panel shall use the evaluation criteria in NUREG-1297 as the basis for their review. The evaluation criteria in NUREG-1297 are as follows:

- Validity of assumptions,
- Alternate interpretations,
- Uncertainty of results and consequences if wrong,
- Appropriateness and limitations of methodology and procedures,
- Adequacy of application,
- Accuracy of calculations,

- Validity of conclusions, and
- Adequacy of requirements and criteria.

Adequacy of the revised conceptual model for spallings will be determined based on whether or not it reasonably represents possible future states of the disposal system.

## **2.4 SCHEDULE**

Attachment A presents the schedule of peer review activities for the process described in Section 2.1.3. This schedule will serve as the baseline schedule from which requested schedule deviations will be evaluated by the Peer Review Manager and the CBFO. Revisions to the baseline schedule will not require revision to this plan, but must be approved by the DOE CBFO Assistant Manager, or designee.

## **2.5 DELIVERABLES**

The Peer Review Manager will provide weekly status reports addressing peer review progress against the schedule to the DOE CBFO Assistant Manager, or designee. The DOE CBFO Assistant Manager, or designee, will work with the Peer Review Manager to ensure that timely information is delivered to the peer review panel. A final report with the panel's findings will be delivered to the cognizant DOE CBFO Assistant Manager, or designee.

### **2.5.1 Peer Review Report**

The peer review report shall, at a minimum:

- Be signed by each peer review panel member
- Describe the work or issues that were reviewed
- Describe the conclusions reached by the peer review panel (e.g., peer review panel observation comments and overall conclusions).
- Provide additional statements by the peer review panel members reflecting dissenting views or additional comments, as appropriate
- List the peer review panel members and provide acceptability information (i.e., technical qualifications and independence) for each member.

## QUALITY ASSURANCE

The peer review process shall be conducted and documented in a controlled manner and in compliance with the CBFO Quality Assurance Program Description, DOE/CBFO-94-1012, Revision 5 and other applicable QA procedures. The DOE CBFO QA Manager may appoint a QA observer to attend the orientation, training, and meetings of the peer review panel. The DOE CBFO QA Manager may schedule an assessment or audit of the peer review process and records prior to, or upon completion of the peer review. Communication between the EPA and the DOE CBFO QA Manager may also result in audits or assessments of the peer review process.



## RECORDS MANAGEMENT

Records generated as a result of peer review activities defined in this peer review plan and designated as QA records shall be maintained by the Peer Review Manager in accordance with DOE CBFO MP 4.5, Generating, Receiving, Storing, and Controlling Active CBFO Project Records (DOE, 2001a), and MP 4.9, Quality Assurance Records (DOE, 2001b). Records include:

- Spallings Peer Review Plan
- Peer Review Procedure(s)
- Contract documents
- Peer Review Panel Member Verification of Education/Employment Forms
- Determination of Peer Review Panel Member Independence Forms
- Peer Review Panel Selection Justification/Decision Forms
- Peer Review Panel Member Orientation and Training Forms
- Meeting minutes and presentation materials
- Peer review Manager qualification documentation
- Peer Review Panel Member selection documentation
- Peer Review Panel Member contract documents
- Any Observer inquiry forms completed
- Written materials presented to the Peer Review Panel by CBFO or investigators
- Written information presented to the peer review panel members by observers
- Peer Review Report(s)

QA records shall be maintained by the Peer Review Manager until completion of the peer review. Upon completion of the peer review process, the original copy of the QA records (when possible) shall be formally transferred and delivered to the DOE CBFO Assistant Manager, or designee.

## DOCUMENT CONTROL

The peer review plans, procedures, and other documents that require document control will be processed in accordance with applicable DOE-CBFO controlled document procedures.

## REFERENCES

DOE (U.S. Department of Energy), 1996. Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant, DOE/CAO 1996-2184, October 1996.

DOE (U.S. Department of Energy), 2001a. Quality Assurance Records, CBFO Management Procedure MP 4.5, Revision 2, February 16, 2001.

DOE (U.S. Department of Energy), 2001b. Quality Assurance Records, CBFO Management Procedure MP 4.9, Revision 1, March 4, 2001.

DOE (U.S. Department of Energy), 2002a. Peer Review, CBFO Management Procedure MP 10.5, Revision 5, February 1, 2003.

DOE (U.S. Department of Energy) 2002b. Quality Assurance Program Document (QAPD), DOE/CBFO-94-1012, Revision 5, May 2003

EPA (U.S. Environmental Protection Agency). 1996. 40 CFR Part 194: Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations Final Rule. Federal Register, Vol. 61, No. 28, pp.5224-5245, February 9, 1996.

EPA (U.S. Environmental Protection Agency). 1998a. 40 CFR Part 194: Criteria for the Certification and Re-certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations: Certification Decision; Final Rule. Federal Register, Vol. 63, No. 95, pp. 27353-27406, May 18, 1998.

EPA (U.S. Environmental Protection Agency). 1998b. Technical Support Document for §194.23 - Models and Computer Codes. Docket A-93-02, Item V-B-6. May 1998

NRC (U.S. Nuclear Regulatory Commission). 1988. Peer Review for High-level Nuclear Waste Repositories, General Technical Position, NUREG-1297, February 1988.

Wilson, C., Porter, D., Gibbons, J., Oswald, E., Sjoblom, G., and F. Caporuscio. 1997. Conceptual Models Third Supplementary Peer Review Report, April 1997. Prepared for the U.S. Department of Energy, Carlsbad Area Office, Office of Regulatory Compliance, April 1997.

## Attachment A

### Schedule for Spallings Peer Review

<b>Task Name</b>	<b>Completion Date</b>
1. Identify Peer Review Contractor and Manager	
2. Receive Contract Authorization	
3. Identify Panel Selection Committee	
4. Reserve Meetings Rooms	
5. Identify Panel Members	
6. Justify Selection/Non-Selection	
7. Verify Panel Member Education	
8. Approve Panel Member Travel	
9. Prepare Final Peer Review Plan	
10. Prepare Orientation Notebook	
11. Select Peer Review Panel Chair Person	
12. DOE Delivers Spallings Documentation	
13. Orient Peer Panel	
14. Prepare 1st Meeting Agenda	
15. 1st Peer Panel Meeting	
16. 2nd Peer Panel Meeting	
17. Prepare Final Report	

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