PEER 11 - Performance Assessment Peer Review Panel - Trauth Memorandum

Sandia National Laboratories

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December 19, 1995

Dr. James Mewhinney
U.S. Department of Energy
Carlsbad Area Office
P.O. Box 3090
Carlsbad, NM 88221

Subject: Performance Assessment Peer Review Panel--Description and Issue Resolution

Dear Dr. Mewhinney:

Enclosed you will find material that discusses the function of the Performance Assessment Peer Review Panel (PAPRP), its charter, scope of reviews, and how the Project has addressed some of the issues raised by the PAPRP. This text includes material developed by Peter Swift and Marilyn Gruebel.

I sent a draft of this material to Dr. G. Ross Heath, Chair of the PAPRP, for his review to ensure that the description of the issues and their resolution was correct.

Please call me at (505) 848-0686 if you have any questions.

Sincerely,

Kathleen M. Trauth

Kathleen M. Trauth
WIPP Compliance Support Department

Enclosure

Copy (w/ enclosure):

G.R. Heath, University of Washington
MS-1328 D.R. Anderson (6749)
MS-1328 H.N. Jow (6741)
MS-1341 D.R. Schafer (6747)
MS-1341 K.M. Trauth (6747)
MS-1395 L.E. Shephard (6800)
MS-1395 P.N. Swift (6821)
MS-0734 M.M. Gruebel

SWCF-A:1.2.07.2;PER;NQ; issues resolution (2 copies)

The Performance Assessment Peer Review Panel--Scope of Reviews, Membership, and Document Reviews

History

The integral role of peer review in the development and the implementation of the WIPP PA methodology (and the accompanying documentation) has been recognized and documented for a number of years, and predates the Peer Review requirements in the proposed 40 CFR Part 194. Planning for the Performance Assessment Peer Review Panel (PAPRP) began in 1986, and the first meeting of the Panel was held July 27-28, 1987.

A philosophy statement first outlined in the 1990 PA (Bertram-Howery et al., 1990) states that the WIPP performance assessment is based on four ideas:..."Fourth, adequate documentation and independent peer review are essential parts of a performance assessment, without which informed judgments on the suitability of WIPP as a waste repository are not possible. An extensive effort is being devoted to documenting and peer reviewing the WIPP performance assessment and the supporting research, including techniques, models, data, and analyses."

The PAPRP was established to be a standing group under contract to the PA Department. The purpose of a standing review group was to ensure that the Panel members could build upon their individual areas of expertise to develop a base of knowledge specific to the WIPP performance assessment. With this knowledge base, the Panel members will be competent to perform a thorough review, within the context of previous performance assessments, management decisions, regulatory constraints, etc. An ever-changing Panel would not be able to develop the depth of knowledge and understanding required to review documents within the time constraints imposed. The purpose of a contractual relationship with Panel members is to ensure that they are able to spend sufficient time on the reviews. The depth of review required would not be possible with a volunteer group.

Questions as to the independence of a peer review panel paid for by DOE can be addressed by examining several pieces of information. First, the credentials of the Panel members show their stature in their respective professional communities. Second, the Charter under which the Panel operates requests comments, both favorable and unfavorable. Third, the set of comments prepared by the Panel for each document review is maintained in the Sandia WIPP Central Files, without censure. These comments concern many difficult issues. This evidence indicates that the Panel performs critical reviews and is not ignoring important issues.

The Peer Panel operates under a Charter (Sandia WIPP Central Files--PA00107), pertinent text of which is reproduced below.

"A peer review is a documented, in-depth, critical evaluation performed by individuals who are independent of the document being reviewed and who have technical expertise at least equivalent to that of the authors. An external Peer Review Panel has been established for significant PA documentation so that the DOE can be assured that the performance evaluation is well-conceived and being carried out with professional competence, and so that scientists and state officials can be assured that the DOE's conclusions as to the suitability of the WIPP as a repository are credible. The participation of the Peer Review Panel will demonstrate to the public and state officials that the performance assessment is being subjected to continuing independent peer review to assure technical validity."

"In addition, those PA reports that document significant task completion or are milestones will be reviewed by the Peer Review Panel."

"The integrated expertise of the Panel will constitute a substantial "reasonableness" check on PA documentation. Because of the limited time available for Panel reviews, however, identification of problems such as computational errors or the use of inaccurate data in PA calculations is beyond the scope of Panel reviews. As with science published in peer-reviewed scientific journals, the ultimate test of PA work will be through independent validation of PA predictions and replication of PA results. Peer Panel review constitutes only one step, albeit an important step, in the evaluation of PA results."

"In addition to workshops for reviewing selected PA reports, the Peer Review Panel will be provided with analysis plans, assumptions, data bases, and documentation in semiannual or quarterly information meetings so that Panel members can maintain the necessary level of understanding of the performance assessment as it progresses. For information meetings, the PA staff will identify technical issues to be addressed, provide working papers or background materials on each topic, give status of knowledge, identify issues that need resolution, and present plans and methodology, all in the context of the overall project. Opportunities will be provided in the presentations for discussions with the Panel. These information meetings will not constitute peer reviews requiring quality assurance documentation. Minutes of meetings will be incorporated into the PA quality assurance files. The Peer Review Panel will not serve as technical advisors to the WIPP PA."

"The Peer Review Panel will not review directly the scientific experiments and observations used by the PA group in its calculations. The Panel may comment on such experiments and observations, either favorably or unfavorably, with emphasis on their completeness, appropriateness, adequacy of documentation, and/or

adequacy of review. Similarly, the Peer Review Panel will not participate directly in reviewing PA calculations by, for example, checking data bases or computer codes. However, the Panel may consider the adequacy of the rationale for using a particular approach and the adequacy of the documentation and review of the PA system."

Membership

"The Sandia PA Program Manager [the manager of the Sandia Performance Assessment Department] will select a Chair for the Peer Review Panel. The Chair will, in turn, select five permanent members of the Peer Review Panel (subject to approval by the Sandia PA Program Manager). Peer Review Panel members will be selected on the basis of their professional stature within the university/scientific/engineering community. Members will be neither directly associated with the WIPP Project nor employees of Sandia. The collective technical expertise of the group will span, as far as possible, the technical issues and areas to be reviewed."

"The Panel Chair will ascertain that no permanent or temporary Panel member has a conflict of interest. If an apparent or potential conflict of interest exists, the Panel Chair and the PA Program Manager will determine if one does exist and how to resolve it."

Document Reviews

"Whenever possible, the peer reviewers will meet with the PA Task Leader [the Sandia staff member who is the task leader for the work being reviewed], author(s), and other PA participants for a workshop to discuss the comments. The Panel Chair will lead the discussion of comments, including comments of any Panel members who cannot attend the workshop, and facilitate agreement on each comment. Changes or additions to the draft in response to Panel comments are limited to those agreed upon by the Panel and concurred with by the PA Task Leader, authors, and PA Program Manager. Conclusions regarding each issue discussed will be recorded to document the workshop proceedings."

"Each Panel member will address the following areas as applicable:

1. Validity of basic assumptions and extrapolations,
2. Alternative interpretations or approaches,
3. Appropriateness, logic and limitations of methodology,
4. Uncertainty of results,
5. Supportability of the conclusions drawn,
6. Consequences of incorrect assumptions or conclusions, and

7. Other issues appropriate to the review subject."

"The Panel Chair and the Peer Panel Task Leader [the Sandia staff member assigned to work with the Peer Panel] will prepare a Peer Panel Review Report. The report will contain all Peer Panel review comments submitted to the PA by the Panel as a whole, including rationale and references, with each comment identified as mandatory or non-mandatory. A statement of potential impact will be presented if the results of the Peer Panel review are considered to have significant effect upon Project schedules. Recommendations such as document revision or need for further data or analyses will be included. The Peer Panel Review report will also include the Peer Panel Review announcement memorandum, the Peer Panel review workshop minutes, and a cover page identifying the Peer Review Panel and containing approval signatures of Panel Members."

Responses to Peer Panel Comments

The Panel Charter was revised in December 1992 to include a formal procedure for resolving comments. Individual volumes of the 1992 PA reviewed after the revision date, and subsequent document reviews, are subject to this requirement.

"The PA Task Leader for the document being reviewed is responsible for obtaining responses from the document authors for all comments identified by the Peer Panel as mandatory."

"After the PA Task Leader has obtained the initial written responses to comments, the Peer Panel Task Leader will review the responses and compile those mandatory comments for which the author of the document did not provide a response that was compatible with the action requested by the Peer Panel. In some instances, an author may not be able to respond to a comment (e.g., because the magnitude of the task is incompatible with available resources or with externally-mandated publication deadlines). In other cases, an author may choose not to respond to a comment (e.g., the author, on reflection, disagrees with the argument in a comment or with its "mandatory" designation). In these instances, the author will prepare, in memo form, an explanation of his or her position and a proposed resolution for each unresolved comment. These explanations, after review by the PA Program Manager or his or her designee, will be forwarded to the Chair of the Peer Review Panel by the Peer Panel Task Leader."

"If the Chair finds that the proposed resolution, either as submitted or with minor modification, is justified by the author's explanation, the Chair will indicate that the mandatory comment has been resolved. If the Chair does not find that the proposed resolution is adequately justified by the author's explanation, the Chair will refer the comment and its proposed resolution back to the Peer Review Panel

for further review and discussion. Final resolution will be established by the PA Program Manager following negotiations between the author of the document and the Peer Review Panel. The Peer Panel Task Leader will prepare a memo for each report reviewed by the Peer Panel that indicates the final disposition of each of the previously unresolved comments."

Permanent Peer Review Panel

"Dr. G. Ross Heath, Chair of the Performance Assessment Peer Review Panel; Dean of the College of Ocean and Fishery Sciences and Professor of Oceanography, University of Washington

Dr. Robert J. Budnitz, Physicist—Energy/Environmental Research and Nuclear Safety; President, Future Resources Associates, Inc., Berkeley, California

Dr. Thomas A. Cotton, Analyst—Public Policy Research and Development; Senior Associate, JK Research Associates, Inc., Washington, DC

Dr. C. John Mann, Professor of Geology, University of Illinois—Urbana

Dr. Thomas H. Pigford, Professor of Nuclear Engineering, University of California—Berkeley

Dr. Frank W. Schwartz, Ohio Eminent Scholar in Hydrogeology, The Ohio State University"

The only change in the membership of the Panel has been the appointment of Dr. Schwartz in 1990 with the resignation of a previous member to fulfill a Presidential appointment to the Nuclear Waste Technical Review Board.

Performance Assessment Peer Review Panel--Issues Resolution

PA is reviewed by various organizations and receives their comments, in addition to comments developed through document reviews conducted by the PAPRP. The WIPP Panel of the National Academy of Sciences (NAS) and the Environmental Evaluation Group (EEG) are among those entities reviewing and commenting on the entire WIPP Project, along with the EPA itself. More than one review group may have raised an issue. In addition, issues may have also been raised internally. The following is not necessarily an exhaustive list.

Issue 1: Need to display confidence bounds around the mean CCDF. This issue was raised in 1989 and 1990 by the NAS, the EEG, and the PAPRP.

Resolution: Beginning in 1990, the WIPP PA has used a methodology that allows for construction of a family of CCDFs from which both a mean curve and selected percentile curves can be derived. This methodology is first discussed in detail in the 1990 PA (Bertram-Howery et al., 1990), and is further discussed in Volumes 1 and 2 of the 1991 PA and Volume 2 of the 1992 PA. References for additional publications can be found in Volume 2 of the 1992 PA. Note that all CCDFs presented in WIPP PAs are conditional on the modeling and data assumptions used in the analyses.

Issue 2: Question on how best to construct scenarios from the events and processes that remain following the screening process (raised by the PAPRP in 1988).

Resolution: Since 1988, the WIPP PA has used a "logic diagram" procedure to construct all possible combinations of events. This procedure differs from the "event tree" approach used in reactor safety assessments and in earlier WIPP PAs in that order of occurrence is not considered, and a smaller number of scenarios can be considered while maintaining comprehensiveness. Documentation of this technique is available in the 1990 PA (Bertram-Howery et al., 1990), in Volume 1 of the 1991 PA, in Guzowski (1990), and in Cranwell et al. (1990).

Issue 3: Need to provide automated data flow between subsystem level computational models within the PA. This issue was raised internally and by the PAPRP in 1988 and 1989 as being the most computationally efficient approach as well as essential for QA.

Resolution: The PA Department began development of CAMCON (Compliance Assessment Methodology Controller) in 1988 to automate linkages between major codes. Development is being finalized. QA procedures for software, parameters, and analyses were written in 1991 and 1992, and were in effect in March of 1993. Documentation of CAMCON is available in Rechard ed. (1992) and Rechard et al. (1993).

Issue 4: Need to provide a means to estimate the probability of human intrusion and to quantify the effectiveness of potential passive marker systems, other than by ad-hoc estimates of fixed probabilities. This issue is based on interpretations of regulatory guidance, and was raised internally, by the PAPRP, and by the EPA Office of Radiation Programs in 1990.

Resolution: Beginning in the 1990 PA, a Poisson model for intrusion probability (intrusions are random in time, with a maximum expected value equal to the EPA guidance of 30/km/10,000 yr), was substituted for previous ad hoc estimates of probability. Expert panels were convened to consider future societies and the degree to which passive markers would be effective in communicating with them. Results of the expert judgment were used in the 1992 PA. Documentation of the Poisson model is available in Volume 2 of the 1991 and 1992 PAs, and in references provided therein. Documentation of the expert judgment elicitation is provided in Hora et al. (1991) and Trauth et al. (1993). The algorithm for deriving drilling rates from the expert judgment is described in a memorandum by Hora in Appendix A of Volume 3 of the 1992 PA.

Issue 5: Need to include effects of gas generation and 2-phase flow in PA modeling. This issue was raised by the NAS, the EEG, and the PAPRP in 1989 and earlier.

Resolution: PA developed the capability to model 2-phase flow in human intrusion scenarios in the fall of 1990, using the BRAGFLO code developed in house. Gas-generation reactions and their dependency on reactant (i.e., brine, iron, and cellulosic waste) availability were included in the code. Technical complexities related to the short time steps required to model rapid pressure drops during intrusion precluded the use of other 2-phase flow codes prior to the development of BRAGFLO. The use of BRAGFLO is first documented in the 1990 PA (Bertram-Howery et al, 1990), and subsequently described in Volume 2 of the 1991 and 1992 PAs, as well as in Volume 4 of the 1992 PA and in SAND92-1933.

Issue 6: Need to display uncertainty in performance estimates resulting from alternative conceptual models for waste-form properties and radionuclide transport in the Culebra. These issues were raised by the NAS, the EEG, and the PAPRP in 1989 and 1990.

Resolution: Beginning in 1990, the PA Department examined conceptual model uncertainty by performing ceteris paribus Monte Carlo analyses, in which vectors of input values were the same for each conceptual model except for the parameters used to describe the specific model change. This technique allows direct comparison of probabilistic outcomes from system-level models using alternative conceptual models for those cases in which the alternative models can be described by parameter variations within the existing conceptual models. For example, potential effects of waste-form modification were examined by repeating the Monte Carlo analyses using various fixed values for radionuclide solubility and waste-form porosity and hydraulic conductivity. Dual- and single-porosity transport models for the Culebra were compared by repeating dual-porosity simulations with matrix porosity set to zero. The first of these analyses are described by Bertram-Howery and Swift (1990). Later analyses are described in the 1990 PA (Bertram-Howery et al., 1990), in the 1991 PA (Helton et al., 1992), and in Volume 4 of the 1992 PA.

Issue 7: Need to couple creep closure process with gas generation and 2-phase flow. This issue was raised by the NAS and the PAPRP in 1990 and 1991.

Resolution: The 1992 PA included the effects of creep closure for the first time. Computational complexity prevented a full coupling of the mechanistic creep model SANCHO with the 2-phase flow code BRAGFLO, and instead SANCHO output, in the form of waste/backfill porosity as a function of moles of gas generated, was used to define time and pressure-dependent waste/backfill porosity in BRAGFLO calculations. See Volume 4 of the 1992 PA for additional information.

Issue 8: Need to include effects of pressure-dependent fracturing of anhydrite interbeds in the Salado Formation. This issue was raised by the NAS, the EEG, and the PAPRP in 1992 and 1993.

Resolution: Beginning in the fall of 1993, PA calculations have used an approximation of pressure-dependent fracturing in which porosity and permeability of the anhydrite interbeds are

varied as a function of pressure at pressures close to lithostatic. Additional data are needed to evaluate the adequacy of this approximation (or to develop another) and to justify the parameter distributions used.

Issue 9: Need to reexamine the event and process screening procedure used in scenario construction. The EEG, the PAPRP, and other reviewers have noted since 1991 that some of the evidence used in screening is out of date, some is incomplete, and some events have never been adequately analyzed.

Resolution: The PA Department has undertaken a major effort in reviewing the screening of features, events, and processes (FEPs) for inclusion in scenarios, some of which involves sample calculations. Supporting documentation for those FEPs screened from consideration on regulatory grounds (specifically excluded from consideration by 40 CFR Part 191 or its supporting documentation, or excluded because of low probability or low consequence as per 40 CFR Part 191) and technical grounds are being developed, and will be maintained in the Sandia WIPP Central Files.

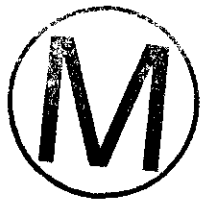
Issue 10: Need to confirm adequacy of two-dimensional modeling in the repository environment (BRAGFLO) and the Culebra (SECO) with three-dimensional modeling. This issue has been raised by the PAPRP, the NAS, and other reviewers.

Resolution: The PA Department is addressing these two questions through the FEPs effort. Calculations performed for FEP S1 "Verification of 2D-radial flaring using 3D geometry [room to room processes]" is being addressed by comparing 2D BRAGFLO calculations against 3D TOUGH28W and 3D BRAGFLO calculations, based on the same physical representation (i.e., model) of the WIPP site. TOUGH28W is a version of TOUGH2 with WIPP-specific features such as creep closure and pressure-induced anhydrite fracturing.

FEP NS9 "Justification of SECO 2D approximations" addresses the SECO issue and the current rationale and justification are documented in a Summary Memo of Record written by T. Corbet. This memo summarizes the use of three-dimensional simulations to evaluate the amount of flow across the upper and lower surfaces of the Culebra.

Issue 11: After reviewing the 1990 and 1991 PAs, the PAPRP requested a more complete and accessible presentation of the data used in the PA calculations.

Resolution: Volume 3 of the 1991 PA contains a first attempt at providing data tables. Further improvements were made for Volume 3 of the 1992 PA which contains data tables that include the new categories of "correlation", "usage" (in mathematical and computational models) and "ranking in past sensitivity analyses".



References

Bertram-Howery, S.G. and P.N. Swift. 1990. *Status Report: Potential for Long-Term Isolation by the Waste Isolation Pilot Plant Disposal System.* SAND90-0616. Albuquerque, NM: Sandia National Laboratories.

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Hora, S.C., D. von Winterfeldt, and K.M. Trauth. 1991. *Expert Judgment on Inadvertent Human Intrusion into the Waste Isolation Pilot Plant.* SAND90-3063. Albuquerque, NM: Sandia National Laboratories.

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Rechard, R.P., A.P. Gilkey, H.J. Iuzzolino, D.K. Rudeen, and K.A. Byle. 1993. *Programmer's Manual for CAMCON: Compliance Assessment Methodology Controller.* Albuquerque, NM: Sandia National Laboratories.

Trauth, K.M., S.C. Hora, and R.V. Guzowski. 1993. *Expert Judgment on Markers to Deter Inadvertent Human Intrusion into the Waste Isolation Pilot Plant.* SAND92-1382. Albuquerque, NM: Sandia National Laboratories.

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PEER REVIEW PANEL CHARTER

Date	Rev. #
September 1988	0
September 1990	1
August 1991	2
December 1992	3

INFORMATION MEETINGS

Date of Meeting
July 27-28, 1987
November 10-11, 1987
April 25-26, 1988
August 3, 1989
February 28, 1990
August 28, 1990
April 9-10, 1991
July 26, 1991
April 5, 1994

DOCUMENT REVIEW MEETINGS

Date of Meeting	Document Reviewed
Sept. 26-27, 1989	SAND89-2027 (Methodology Demo) SAND88-1452 (Draft Forecast)
Oct. 22-23, 1990	SAND90-2347 (90 Prelim Comp)
Nov. 28-29, 1990	SAND90-7103 (90 Sensitivity Analysis) SAND90-2510 (Probability Dists)
Oct. 7-8, 1991	SAND91-0893/1 SAND91-0893/2
Jan. 7-8, 1992	SAND91-0893/3
March 6, 1992	SAND91-0893/4[1]
July 28-29, 1992	SAND91-0893/6[2]
Sept. 30-Oct. 1, 1992	SAND92-0700/3
Dec. 14, 1992	SAND92-0700/1
Feb. 18-19, 1992	SAND92-0700/2
April 13-14, 1993	SAND92-0700/4
May 20-21, 1993	SAND92-0700/5

[1] SAND91-0893/5 was deleted from the publication schedule.

[2] Later renumbered SAND92-1933.