

February 8, 2002

Dr. Stephan Brocoum, Assistant Manager
Office of Licensing and Regulatory Compliance
U.S. Department of Energy
Yucca Mountain Site Characterization Office
P.O. Box 364629
North Las Vegas, NV 89036-8629

SUBJECT: REVIEW OF DOCUMENTS PERTAINING TO KEY TECHNICAL ISSUE
AGREEMENTS

Dear Dr. Brocoum:

During Technical Exchange and Management Meetings held on August 16-17, 2000, October 11-12, 2000, January 8-9, 2001, February 6-8, 2001, and August 6-10, 2001, the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Department of Energy (DOE) reached agreement on a number of issues within the Unsaturated and Saturated Flow Under Isothermal Conditions (USFIC), Structural Deformation and Seismicity (SDS), Thermal Effects on Flow (TEF), Repository Design and Thermal-Mechanical Effects (RDTME), and Total System Performance Assessment and Integration (TSPA) Key Technical Issues (KTIs). By letters dated February 2, April 25, and October 1, 2001, DOE provided documents pertaining to NRC/DOE agreements, including a number of documents pertaining to agreements within these KTIs. The NRC staff has reviewed these documents as they relate to the identified KTIs and the results of the staff's review are enclosed.

After you have had the opportunity to review this letter, we will contact you to arrange a meeting to discuss these issues further. Mr. James Andersen is our point of contact for this letter. He can be reached at (301) 415-5717.

Sincerely,

/RA/

C. William Reamer, Chief
High-Level Waste Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure: As stated

cc: See attached distribution list

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Letter to S. Brocoum from C.W. Reamer dated February 8, 2002

cc:

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NRC Review of DOE Documents Pertaining to Key Technical Issue Agreements

The U.S. Nuclear Regulatory Commission (NRC) goal of issue resolution during this interim pre-licensing period is to assure that the U.S. Department of Energy (DOE) has assembled enough information on a given issue for NRC to accept a license application for review. Resolution by the NRC staff during pre-licensing does not prevent anyone from raising any issue for NRC consideration during the licensing proceedings. Also, and just as importantly, resolution by the NRC staff during pre-licensing does not prejudice what the NRC staff evaluation of that issue will be after it's licensing review. Issues are resolved by the NRC staff during pre-licensing when the staff has no further questions or comments about how DOE is addressing an issue. Pertinent new information could raise new questions or comments on a previously resolved issue.

This enclosure addresses several NRC/DOE agreements made during the Unsaturated and Saturated Flow Under Isothermal Conditions (USFIC) (see NRC letter dated October 27, 2000, which summarized the meeting), Structural Deformation and Seismicity (SDS) (see NRC letter dated October 27, 2000, which summarized the meeting), Thermal Effects on Flow (TEF) (see NRC letter dated October 27, 2000, which summarized the meeting), Repository Design and Thermal-Mechanical Effects (RDTME) (see NRC letter dated October 27, 2000, which summarized the meeting), and Total System Performance Assessment and Integration (TSPA) (see NRC letter dated October 27, 2000, which summarized the meeting). By letters dated February 2, April 25, and October 1, 2001, DOE submitted a number of documents to address some of these agreements. The documents submitted and associated Key Technical Issue (KTI) agreements are discussed below:

1) Unsaturated and Saturated Flow Under Isothermal Conditions Agreement 6.01

Wording of the Agreement: The DOE will provide the final sensitivity analysis on matrix diffusion (for UZ) in the TSPA-SR, Rev. 0. Due date: December 2000. The saturated zone information will be available in TSPA-SR, Rev.1, expected to be available in June 2001.

NRC Review: The NRC has reviewed the Total System Performance Assessment (TSPA) for the Site Recommendation (TDR-WIS-PA-000001, Rev 00, ICN 01) as it pertains to this agreement. The sensitivity analysis on matrix diffusion was requested so that NRC staff can gain improved risk insight regarding the importance of matrix diffusion in TSPA analyses. DOE provided the requested sensitivity analysis for matrix diffusion in the unsaturated zone (UZ) in the TSPA-SR document; sensitivity analysis for matrix diffusion in the saturated zone (SZ) was provided in the Supplemental Science and Performance Analyses (SSPA), Volume 2. Results of the sensitivity analyses for the SZ show nearly negligible differences in TSPA dose calculations between simulations with no matrix diffusion and simulations with enhanced matrix diffusion (e.g., in SSPA, Volume 2, compare Figures 3.2.10-2a-b to Figure 3.2.10-3a-b). The low risk-significance of matrix diffusion in the SZ is a result of reasonably modest assumptions regarding diffusion rates and flowing interval spacing. Results of the sensitivity analyses for matrix diffusion in the UZ show that a significant reduction in the simulated dose rate history occurs when credit is taken for matrix diffusion (e.g., see TSPA-SR, Figure 5.2-14). It is not entirely clear to NRC staff why the risk significance of matrix diffusion in the UZ is moderate to high compared to the relatively low risk significance of matrix diffusion in the SZ. This ambiguity should be clarified, however, when DOE provides the additional information requested by NRC staff

Enclosure

in TSPAI Agreement 3.29. Additionally, DOE has agreed to obtain further validation of the conceptual model for matrix diffusion in the UZ through completion of tracer transport testing in the Alcove 8-Niche 3 test (see USFIC Agreement 6.03).

Additional Information Needed: None at this time.

Status of Agreement: NRC staff find that the information provided by DOE per USFIC Agreement 6.01 is adequate. In a letter dated July 11, 2001, DOE stated that the SZ portion of this agreement will be formally documented in the Input and Results Base Case SZ Flow and Transport Model Analysis and Model Report (AMR), therefore, the NRC staff will continue to list this agreement as "Partly Received."

2) Structural Deformation and Seismicity Agreement 1.01

Wording of the Agreement: Provide the updated FEPs [features, events, and processes]: Disruptive Events AMR. DOE will provide the updated FEPs AMR to the NRC. Expected availability is January 2001.

NRC Review: The NRC reviewed FEPs: Disruptive Events (ANL-WIS-MD-000005, Rev 00, ICN 01) as it pertains to this agreement. The FEPs document was discussed during the two TSPAI technical exchanges held in May and August 2001. During these technical exchanges, the NRC and DOE reached a number of separate agreements pertaining to FEPs (see TSPAI Agreements 2.01 to 2.04). With these specific TSPAI agreements in place, the NRC believes this agreement can be listed as complete.

Additional Information Needed: Resolution of SDS subissues depends on the satisfactory resolution of the SDS portion of TSPAI Agreements 2.01 through 2.04.

Status of Agreement: SDS Agreement 1.01 is "Complete."

3) Structural Deformation and Seismicity Agreement 2.02

Wording of the Agreement: Provide the updated FEPs: Disruptive Events AMR, the Seismic Design Input Report, and the update to the Seismic Topical Report. DOE will provide the updated FEPs AMR to NRC. Expected availability is January 2001. DOE will provide STR 3 to the NRC for their review. Expected availability is January 2002. The Seismic Design Inputs Report is expected to be available to the NRC by September 2001.

NRC Review: The NRC reviewed FEPs: Disruptive Events (ANL-WIS-MD-000005, Rev 00, ICN 01) as it pertains to this agreement. The FEPs document was discussed during the two TSPAI technical exchanges held in May and August 2001. During these technical exchanges, the NRC and DOE reached a number of separate agreements pertaining to FEPs (see TSPAI Agreements 2.01 to 2.04). With these specific TSPAI agreements in place, the NRC believes this portion of the agreement is complete.

Additional Information Needed: Resolution of SDS subissues depends on the satisfactory resolution of the SDS portion of TSPAI Agreements 2.01 through 2.04.

Status of Agreement: Since additional documents are needed for this agreement, SDS Agreement 2.02 will continue to be listed as “Partly Received.”

4) Repository Design and Thermal-Mechanical Effects Agreement 2.02

Wording of the Agreement: Provide the substantive technical content of Topical Report 3. The DOE will provide the preliminary seismic design input data sets used in Site Recommendation design analyses to the NRC by April 2001. The DOE will provide the draft final seismic design inputs for license application via an Appendix 7 meeting after calculations are complete prior to delivery of Seismic Topical Report 3.

NRC Review: The NRC reviewed the Preliminary Seismic Design Input Data and discussed the input data with DOE via telephone on December 10, 2001. It is the NRC staff’s understanding that DOE plans to provide a geotechnical investigation report for the surface handling facilities in the summer of 2002. After receiving the report, the NRC staff would like to have the Appendix 7 meeting, as discussed in the agreement, to discuss it. It is also the NRC staff’s understanding that the draft final seismic design inputs for license application will be provided to the NRC in early FY03, and the Seismic Topical Report 3 sometime after that.

Additional Information Needed: None at this time.

Status of Agreement: Since DOE still needs to provide the draft final seismic design inputs for license application and the Seismic Topical Report 3, RDTME Agreement 2.02 will continue to be listed as “Partly Received.”

5) Total System Performance Assessment and Integration Agreement 3.20

Wording of the Agreement: Provide access to data supporting the synthetic meteorologic records (4JA.s01 and Area12.s01) (UZ1.3.2). DOE will provide data supporting the synthetic meteorologic records (specifically, data files 4JA.s01 and Area12.s01). These data files will be provided to NRC September 2001.

NRC Review: DOE provided the synthetic meteorological data sets in a letter dated October 1, 2001. The NRC has reviewed the data files and believe they satisfy the intent of the agreement.

Additional Information Needed: None at this time.

Status of Agreement: TSPAI Agreement 3.20 is “Complete.”

6) Thermal Effects on Flow Agreement 2.10

Wording of the Agreement: Represent the full variability/uncertainty in the results of the TEF simulations in the abstraction of thermodynamic variables to other models, or provide technical basis that a reduced representation is appropriate (considering risk significance). The DOE will discuss this issue during the TSPAI technical exchange tentatively scheduled for April 2001.

NRC Review: This issue was not discussed during the TSPA technical exchange due to an oversight by the NRC and DOE, hence, this agreement has no path forward. The NRC concern is that the full range of model and parameter uncertainty be incorporated in the TSPA. The multiscale thermohydrologic model (MSTH) is an ensemble of process models linked by abstractions. The MSTH is also linked directly or indirectly to other process models. For example, the NRC is concerned that variability/uncertainty in calibrated properties is treated by using high and low infiltration boundary conditions in addition to the mean in the least-squares inversion to obtain calibrated properties. The NRC believes this accounts for variability/uncertainty only in the infiltration boundary condition. As discussed in TEF IRSR, Rev 03, there are other sources of variability/uncertainty that are not accounted for in this methodology. These include: model uncertainty as seen in results from various alternative conceptual models and data uncertainty in (i) measurement error, bias, and scale-dependence in the saturation, water potential, and pneumatic pressure data used for model parameter calibration, (ii) heterogeneity and spatial variability in thermohydrologic properties, and (iii) variability in model results using the various property sets found to be valid for thermohydrologic modeling and model uncertainty as seen in results from various alternative conceptual models.

The NRC has reviewed the other TEF agreements and believe that the supporting material for satisfying this issue is covered by TEF Agreements 2.08, 2.11, and 2.12. TEF Agreement 2.08 states that DOE will "provide ... results of the outlined items on page 20 of the OI 7 presentation", TEF 2.11 states that DOE will "incorporate uncertainty from all significant sources" in the calibrated properties, and TEF 2.12 states that DOE will "provide ... resolution of issues on page 5 of the OI 8 presentation" on representation of model uncertainty. The NRC staff believes that TEF Agreements 2.08, 2.11, and 2.12 form the basis for determining the full range of possible state variables (temperature, pressure, relative humidity, liquid and vapor flux, etc.). TEF Agreement 2.10 would be satisfied if: (i) the full range of state variables are abstracted for use in TSPA, or (ii) a basis is provided for a reduced representation of model and parameter uncertainty in the TSPA. Documentation of either option should be presented in future AMRs completed prior to license application.

Additional Information Needed: DOE should inform the NRC staff how it plans to address this issue and where it will be documented.

Status of Agreement: TEF Agreement 2.10 needs additional information to support a licensing review.