

Summary Highlights of U.S. Nuclear Regulatory Commission/U.S. Department of Energy Technical Exchange on Total System Performance Assessments for Yucca Mountain

June 6-7, 2000

San Antonio, Texas

(Videoconference connections to Rockville, Maryland and Las Vegas, Nevada)

Introduction and Objectives

The U.S. Department of Energy (DOE) and the U.S. Nuclear Regulatory Commission (NRC) held a Technical Exchange to discuss and review progress on the following: 1) the Total System Performance Assessment (TSPA)– Site Recommendation; 2) the TSPA – Site Recommendation Models, and, 3) issue resolution for the Total System Performance Assessment and Integration (TSPA-I) Key Technical Issue. The objective of the exchange was to provide the NRC with a better understanding of the integration of the individual process models within the Total System Performance Assessment (TSPA), and to discuss further the NRC's issues and resolution.

NRC staff presented their perspective on the status of resolution of each of the four subissues associated with this Key Technical Issue - System Description and Demonstration of Multiple Barriers, Scenario Analysis, Model Abstraction, and Demonstration of the Overall Performance Objective. These presentations identified the specific NRC review criteria and status of their review.

DOE presented overviews of the individual process models, their relationship with other TSPA model components, and how the models were integrated to produce the results. The details of model development, screening of features, events and processes and scenario development were deferred to the upcoming Process Model Report technical exchanges.

Summary

The TSPA technical exchange was one in a series of technical exchanges related to the NRC's sufficiency review and the DOE's site recommendation process. Information discussed during the technical exchange was related to information that would be discussed in upcoming technical exchanges on DOE's Process Model Reports. The information needed to close the subissues was not available during the technical exchange and therefore at the close of the technical exchange, all four of the TSPA and Integration subissues remained open. The meeting agenda and attendance list are provided as Attachments 1 and 2, respectively. Highlights from the technical exchange are provided below, including the lessons learned. Copies of the presenters' slides are provided as Attachment 3.

Highlights

1) Schedule: NRC staff indicated that new acceptance criteria would be included in Revision 3 of the TSPA Issue Resolution Status Report scheduled for release by September, 2000, and in the Yucca Mountain Review Plan, which is scheduled for release the fall of 2000. The Commission

Staff stated that these were not new criteria, but a reflection of development of the Yucca Mountain Review Plan.

DOE indicated that the Site Recommendation Consideration Report would be released in mid-December 2000 and that data used to support the report would be limited to the information available at the end of June 2000. DOE intends to perform an impact analysis for changes to data supporting the TSPA, and acknowledged that changes might require another run of the TSPA code. DOE also added that the review draft of the TSPA – Site Recommendation Model Document and the TSPA – Site Recommendation Technical Report were expected to be available by the end of August 2000.

2) Content and Design: DOE provided the following new information regarding the content of TSPA – Site Recommendation and supporting documentation:

- The inner waste package barrier is now 50 mm thick;
- Backfill is no longer part of the repository design;
- The nominal scenario class results in zero waste package failures in 10,000 years;
- 300 realizations are planned for the base case for TSPA – Site Recommendation. However, 100 realizations are planned for sensitivity studies; results are fairly stable for 100-300 realizations;
- TSPA – Site Recommendation would include calculations for 21 radionuclides for dose calculations and more than 21 radionuclides for groundwater protection calculations;
- DOE intends to take credit for cladding;
- DOE would calculate the effects from human intrusion assuming that the intrusion occurs at any of three times;
- Analysis/Model Reports would be updated to reflect the no backfill design;
- TSPA – Site Recommendation Model Document would include a detailed discussion of the models, inputs and connections, and would also describe verification and, in some instances, hand calculations used to support verification.

3) DOE's "Gap Analysis": DOE provided a "Gap Analysis" that identified the results of the self-assessment on progress related to each acceptance criteria in the NRC's TSPAI Issue Resolution Status Report, Revision 2 and suggested a path forward for resolving the Commission Staff's concerns related to each acceptance criterion (the "Gap Analysis" is provided as Attachment 4). DOE's objective in providing the "Gap Analysis" was to obtain feedback from NRC staff concerning the status of issue resolution. NRC staff indicated that they would provide feedback on the "Gap Analysis" and will evaluate how the NRC would address issue resolution in the upcoming technical exchanges.

4) Scenario Analysis: With regard to identification and screening of features, events and processes, DOE indicated that all of the comments presented by the NRC in the Technical Exchange or through the earlier Evolution of the Near-Field Environment Key Technical Issue audit of scenario analysis would not be completely addressed in the next revision of the database of Features, Events and Processes, which is scheduled to be complete in July 2000. DOE also acknowledged ongoing work to describe the relationship between primary and secondary features, events and processes and provide a stronger technical basis for some features, events and processes, and that the appropriate Analysis/Model Reports would be updated once the work was complete. NRC stated that it needed

to see a description of the process used to ensure that its effort to identify features, events, and processes was comprehensive.

NRC indicated it would provide feedback on the screening of features, events and processes in the upcoming technical exchanges and that it would document its feedback on DOE's feature, event and process analysis, based on review of the Process Model Reports. NRC agreed that DOE could treat "not credible" as a variant for screening on low probability. In response to an issue raised concerning whether the mean of the probability distribution could be used to screen events, NRC indicated that it would provide a position on the use of mean in a probability distribution for screening features, events and processes and would develop a policy on how features, events and processes are considered for the analysis of human intrusion.

5) Model Abstraction: DOE has not yet bounded thermal-hydrologic-chemical effects. DOE plans to investigate within the TSPA model the importance and sensitivity of the near-field environment and waste package environment. NRC raised concerns that coupled processes cannot always be decoupled to look for effects and significance, and added that the DOE is looking at the decoupled effects without considering the interactions. With regard to expert elicitation, NRC wants to ensure that, where possible, actual data is obtained to support the models and indicated that the DOE should not rely on expert elicitation if additional data is available.

6) Engineered Barrier Degradation: DOE indicated that the inert nature of Alloy-22 in the expected repository environments is a favorable outcome arising from the combined effects of the natural and engineered barriers. NRC indicated that because waste package performance is very significant to performance estimates, DOE should pay great attention to the assumptions underlying the performance estimates (e.g., the environment of the waste package).

7) Volcanic Disruption of Waste Packages/Airborne Transport of Radionuclides: DOE presented information on progress on the following issues:

- DOE is no longer taking credit for waste package survival during an eruptive event, which removes the Commission Staff's concern regarding the lack of technical bases for the credit taken;
- Modification of the grain size of both the ash and the waste material is now considered;
- Demonstration of the ability to replicate the 1995 Cerro Negro Event with the Department's version of ASHPLUME;
- Improvements made in the technical bases for parameters related to mass loading and inhalation.

NRC continues to have significant concerns related to the probability of igneous activity. One mechanism for addressing the concern is for DOE to provide, in the license application, sensitivity analyses for the effects of igneous activity where an annual probability of 10^{-7} is assumed. It was noted that issues related to igneous activity would be discussed during the meetings on the disruptive events Process Model Report and the biosphere Process Model Report scheduled for late-August 2000.

8) System Description and Multiple Barriers: For TSPA – Site Recommendation, DOE is using degraded performance of individual barriers to address the NRC’s requirements related to multiple barriers. Degraded performance will be achieved by setting multiple parameters that contribute to the performance of a barrier at their 5th and 95th percentile value, whichever results in poorer performance for the barrier. DOE plans to perform full neutralization calculations for their own purposes (i.e., not to address the issue of multiple barriers), to see if degraded performance provides needed information.

DOE and NRC agreed that a meeting should take place after 10 Code of Federal Regulations Part 63 is promulgated to clarify the NRC’s expectations for multiple barriers. NRC indicated that it would provide guidance on how the requirements for multiple barriers apply to the igneous intrusion scenario and with feedback that addresses ways in which DOE’s documentation of TSPA – Site Recommendation could be improved. NRC indicated that it would continue to evaluate the approach where the 95th and 5th percentiles for parameter values are used to analyze the under-performance of barriers and that it would address DOE’s concern about providing justification for neutralization analyses outside of parameter distributions used in its other performance assessment calculations.

9) Calculation of the Overall Performance Objective: DOE’s calculations for human intrusion do not include igneous activity; NRC and DOE agreed that more discussion is needed on the issue of convergence for the TSPA – Site Recommendation analyses, including intrusive volcanism and the overall dose calculations.

10) Quality Assurance: The Repository Safety Strategy (RSS), Revision 4, (i.e., both the supporting analyses and the decision process) is being developed under a process consistent with DOE’s Quality Assurance Requirements Document. In the absence of a completed RSS, Revision 4, the previous revision was used for planning and prioritizing work efforts and data qualification activities. DOE indicated that it was a conscious decision to use the document as an interim means to move forward with verification efforts, that Revision 4 of the RSS would be issued as a Quality Assurance document and to the extent that the principle factors are changed from Revision 3 DOE would verify the additional data as necessary.

NRC indicated that it plans to verify that the approach that DOE uses to revisit data and model verification, in response to changes in the principle factors from RSS, Revision 3 to Revision 4, to confirm that the process was controlled under a quality assurance process.

11) Public Comments: State of Nevada representatives raised an issue concerning water usage rates and location for the critical group. They stated that some well data indicates that the dilution rate and location assumptions for the critical group may not be realistic and that the use of this well data would help in defining the critical group and calculating the associated dose. NRC indicated that they felt that they understand and have addressed the issue being raised, have tried to identify reasonable criteria and considered the effect of water use and dose when reviewing the recommendations of the National Academy of Sciences, and that it is not feasible to predict the precise location and number of persons that may inhabit a given area in the future.

State of Nevada representatives indicated that there are protocols that the NRC and DOE have established for exchanging information, that the protocols should be followed, and that the site recommendation schedule should not affect the approach used to share information. There was also objection to the NRC's use of a "closed-pending," issue resolution category, stating that "open" and "closed" have established definitions, whereas "closed-pending" does not. They also stated that the DOE should be required to evaluate the repository performance out past the 10,000 years included in the NRC's proposed rule.



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