**Summary Highlights of NRC/DOE Technical Exchange and Management Meeting on Total System Performance Assessment and Integration Features, Events, and Processes**

May 15-17, 2001
Las Vegas, Nevada

Introduction and Objectives

This Technical Exchange and Management Meeting on Total System Performance Assessment and Integration (TSPAI) is one in a series of meetings related to the U.S. Nuclear Regulatory Commission (NRC) key technical issue (KTI) and sufficiency review, and the U.S. Department of Energy (DOE) site recommendation decision. Topics within TSPAI KTI will be discussed in two separate technical exchanges. This first technical exchange focuses on the NRC review and comments regarding part of the scenario analysis subissue, specifically the screening of features, events, and processes (FEPs) from the performance assessment. Another technical exchange, currently scheduled for June 25-29, 2001, will focus on the remaining subissues within the TSPAI KTI.

Consistent with NRC regulations on prelicensing consultations and a 1992 agreement with the DOE, staff-level resolution can be achieved during prelicensing consultation. The purpose of issue resolution is to assure that sufficient information is available on an issue to enable the NRC to docket a proposed license application. Resolution at the staff level does not preclude an issue being raised and considered during the licensing proceedings, nor does it prejudge what the NRC staff evaluation of that issue will be after its licensing review. Issue resolution at the staff level, during prelicensing, is achieved when the staff has no further questions or comments at a point in time regarding how the DOE is addressing an issue. The discussions recorded here reflect NRC's current understanding of the screening of FEPs within DOE's performance assessment. This understanding is based on all information available to date which includes limited, focused, risk-informed reviews of selected portions of recently provided DOE documents (e.g., Analysis and Model Reports (AMRs) and Process Model Reports (PMRs)). Pertinent additional information (e.g., changes in design parameters) could raise new questions or comments regarding a previously resolved issue.

Although the status of the TSPAI subissues will not be discussed in this meeting, NRC discussed the issue resolution definitions in the beginning of the meeting. Specifically, NRC stated that issues are "closed" if the DOE approach and available information acceptably address staff questions such that no information beyond what is currently available will likely be required for regulatory decision making at the time of any initial license application. Issues are "closed-pending" if the NRC staff has confidence that the DOE proposed approach, together with the DOE agreement to provide the NRC with additional information (through specified testing, analysis, etc.) acceptably addresses the NRC's questions such that no information beyond that provided, or agreed to, will likely be required at time of initial license application. Issues are "open" if the NRC has identified questions regarding the DOE approach or information, and the DOE has not yet acceptably addressed the questions or agreed to provide the necessary additional information in a potential license application.

Summary of Meeting

At the close of the Technical Exchange and Management Meeting, NRC and DOE reached a number of preliminary agreements which will be carried forward to the June 25-29, 2001, TSPAI Technical Exchange and Management Meeting. The preliminary NRC/DOE agreements made at the meeting are provided in Attachment 1. A table containing all the FEPs discussed during the meeting and their associated NRC/DOE agreed upon path forward is included in Attachment 2. The agenda and the attendance list are provided in Attachments 3 and 4, respectively. Copies of the presenters slides are provided in Attachment 5. Additional FEP comments, not discussed during this meeting (e.g., Unsaturated Zone Flow and Transport FEPs), will be addressed in the June technical exchange. Highlights from the Technical Exchange and Management Meeting are listed below.

Highlights

**1) Opening Comments**

In its opening comments, NRC provided a general overview of performance assessment and scenario analysis (see "Background for Total System Performance Assessment - Features, Events, and Processes Meeting" presentation given by James Firth). NRC stated that the performance assessment is one of many NRC safety requirements and is a systematic analysis of what could happen at a repository. NRC also defined some of the terms that would be used during the meeting, such as scenario, probability, consequence, scenario analysis, screening, and features, events, and processes. Finally, NRC stated that during the meeting it would address two main issues, specifically, whether DOE's list of FEPs is complete and whether DOE has an adequate technical basis to support the screening choice.

**2) TSPAI KTI Subissue 2 - Scenario Analysis**

DOE provided an overview of the FEP methodology, including the identification of FEPs, the classification of FEPs, and the screening of FEPs (see "Total System Performance Assessment and Integration Key Technical Issue Subissue 2 - Scenario Analysis" presentation given by Peter Swift and Geoff Freeze). DOE also discussed its electronic database and DOE's perspective on the status of the TSPAI acceptance criteria.

DOE stated that the objectives of the FEP methodology are to: (1) provide comprehensive documentation that potentially relevant FEPs have been considered, (2) identify the FEPs that should be included in the quantitative performance assessment scenario analysis, (3) document the bases for excluding FEPs from the performance assessment, and (4) map included FEPs to the performance assessment model. DOE discussed the basis for the current list of FEPs; specific sources include: (1) the Nuclear Energy Agency international database; (2) the Yucca Mountain Project literature; (3) DOE internal technical review; and (4) NRC review.

DOE then discussed the classification of FEPs; currently designated as primary and secondary FEPs. DOE stated that primary FEPs encompass a single process or event, or a few closely related or coupled processes. The primary FEPs are aggregated to the coarsest level at which a technically sound screening decision can be made while still maintaining adequate detail for

analysis. Primary FEPs include all issues from underlying secondary FEPs. DOE further stated that the scope of a given primary FEP may be broader than that encompassed by associated secondary FEPs.

Next, DOE discussed the screening of FEPs. DOE stated that FEPs are screened based on regulatory criteria, probability, or consequence (conditional or probability weighted). DOE further stated that screening is performed at the primary FEP level. Based on the results from the Total System Performance Assessment - Site Recommendation, DOE stated that 152 out of 328 primary FEPs have been excluded from the performance assessment.

Lastly, DOE discussed its electronic FEP database and a general overview of the NRC acceptance criteria documented in Revision 3 of the TSPAI Issue Resolution Status Report (IRSR). DOE stated that the database tracks FEP identification and screening, and enhances transparency and traceability. DOE stated that the new database addressed all the FEP issues raised in Revision 3 of the TSPAI IRSR.

Following the DOE presentation, the NRC had a number of questions with regard to DOE's FEP methodology. NRC questioned DOE about the philosophy used for the difference between the scope of secondary FEPs and their associated primary FEP. DOE indicated that they used secondary FEPs from other projects, but that their intent was not to define new secondary FEPs. DOE stated that their intent is that primary FEPs contain all relevant technical information. DOE also stated that the underlying secondary FEPs, from which the primary FEPs were derived are artifacts of the database construction. A question was asked regarding how DOE adds FEPs to the database, specifically why DOE adds FEPs after they are introduced through a FEP AMR, rather than identifying the FEP and then to address the FEP in a later revision to a FEP AMR. DOE indicated that FEPs are added to the database when corresponding analyses indicate that additions are warranted. DOE was asked about how they tracked design assumptions used to screen FEPs from the performance assessment to make sure that the screening assumptions and the final design are consistent. DOE stated that design changes could affect screening arguments. DOE indicated that configuration management controls are adequate for pre-conceptual design, however, controls will adopt more rigor as the design advances.

**3) NRC Positions on Treatment of FEPs**

The NRC discussed its views and comments on FEPs screening methodology (see "FEP Screening Methodology: NRC Staff Views and Comments" presentation given by Michael Lee). NRC stated that proposed 10 CFR Part 63 (Part 63) requires a technical basis for either including or excluding those FEPs that might potentially affect the performance of a geologic repository at Yucca Mountain. However, proposed Part 63 does not specify the manner by which DOE should investigate FEPs. NRC staff then provided their perspective on four issues relating to scenario analysis:

1) Can design be used as a criterion to screen FEPs?

2) Can both qualitative and quantitative arguments be used to screen FEPs?

3) What is the time period of regulatory interest for any FEP screening methodology?

4) To what extent should a FEP resulting as a consequence of human-intrusion be factored into the stylized human intrusion calculation?

The NRC staff's views regarding these issues can be found in "NRC Comments on DOE Features, Events, and Processes - May 15-17, 2001, Technical Exchange" slides which are included in Attachment 5. Following this discussion, DOE questioned whether the final Part 63 would be consistent with the final Environmental Protection Agency (EPA) regulation (40 CFR 197) with regard to the inclusion of unlikely disruptive events in the human intrusion analysis. NRC stated that the final Part 63 would be consistent with the EPA rule in this regard.

Next, NRC presented its preliminary views and comments on the DOE FEP screening methodology. (NRC noted that most of its comments had been introduced as part of the discussions associated with Section 2, "TSPAI KTI Subissue 2 - Scenario Analysis.") Specifically, these comments were:

1) That the FEPs database did not appear to be complete;

2) That several areas had been identified where there may be a lack of correspondence between the scope of the AMRs and the FEPs database;

3) It was not clear that DOE has demonstrated or considered the extent of coupling between FEPs; and

4) The role of the FEP database in DOE decision-making was unclear.

In presenting these comments, the NRC staff noted that DOE was not expected to respond immediately; rather, it was anticipated that specific examples of the staff concerns and DOE responses thereto would be raised in the context of the subsequent discussions for each of the AMRs that would be taking place later in the technical exchange. Finally, NRC provided one general observation. Specifically, that the relegation of FEP attributes among more than one AMR could lead to (a) underestimation of importance of a FEP to performance; or (b) under-representation of the FEP in the performance assessment. Again, NRC stated that this issue will be further discussed in the NRC comments on the DOE FEPs AMRs.

In its overall response, DOE noted the following:

- DOE considers the FEPs database to be complete by virtue of the sources of information used to compile it. In general, DOE noted that practical considerations had driven internal decisions on the number and kind of primary FEPs chosen to represent the range of features, events, and processes believed to be present at Yucca Mountain. If there was a view by NRC staff that a particular FEP was missing, it was requested that it be identified so it could be evaluated by DOE for possible future consideration.

- To the extent that there may be discrepancies, DOE welcomed their identification.

- DOE believes that coupling between FEPs has been addressed by virtue of (a) the individual FEP screening arguments themselves; and (b) the appropriate process models intended to describe the FEPs of interest.

- The value of using a computerized database to manage FEPs information was discussed. However, DOE noted that the primary source of information for FEPs identification was the Nuclear Energy Agency database, project literature search, and the AMRs. Nevertheless, DOE did note that its thinking regarding the role of the FEPs database programmatically was still evolving, especially as elements of its overall performance assessment methodology and configuration management of the DOE design process. As part of its future program planning related to any potential license application submittal, DOE noted that it has not finalized the role of the database.

**4) Discussion of NRC Comments on DOE FEPs**

During this portion of the meeting, NRC and DOE discussed NRC comments related to the FEPs database and supporting FEPs AMRs. The NRC comments were broken down and discussed under the appropriate DOE FEPs AMR (see "NRC Comments on DOE Features, Events, and Processes - May 15-17, 2001, Technical Exchange" slides in Attachment 5). The specific FEPs discussed during this technical exchange, and the NRC/DOE agreed path forward for each related comment, are summarized in Attachment 2. Preliminary NRC/DOE agreements are discussed in Attachment 1 and reference the specific path forward information in Attachment 2. These preliminary agreements will be carried forward to the June 25-29, 2001, Technical Exchange and Management Meeting and will be included in the overall discussion of TSPAI Subissue 2.

During the meeting, NRC raised questions about the scope of several primary FEPs and about the differing level of detail encompassed by the primary FEPs. Rising from the discussions held during the meetings, NRC made the following observation.

Proposed Part 63 requires a systematic analysis of FEPs that might potentially affect the performance of a geologic repository at Yucca Mountain. Although it does not specify the manner by which FEPs should be investigated, proposed Part 63 requires that DOE "...provide the technical basis for either inclusion or exclusion of specific features, events, and processes...." The staff is interested in a transparent, traceable, and technically defensible investigative process that leads to a clear understanding of DOE's basis for FEP inclusion or exclusion. Based on the NRC staff review of the pertinent DOE documents, these attributes are not readily apparent for some FEPs. In addition, the level of information used to describe the scope of primary FEPs appears to vary. Therefore, the comprehensiveness of the FEPs list is not apparent. Specific examples were provided by the NRC during the technical exchange.

In response to this observation, the DOE acknowledged the importance of the FEPs to DOE's TSPA process and the FEP database to indicate the disposition of FEPs. DOE agreed with the NRC's concern, for the most part, and committed to clarify the FEP arguments in specific AMRs. DOE indicated that NRC should continue to focus on the primary FEPs and their associated arguments during its review, noting that the secondary FEPs are historical in nature. As a path forward, DOE also proposed to discuss improvements to the FEPs process at the June technical exchange, including a description of the method for adding new FEPs. In

addition, at the June technical exchange, DOE indicated it would also discuss the role of FEPs versus models, how they fit together, and how they roll up in the TSPA. NRC agreed that this was an acceptable path forward and would clarify details in the telephone conversations preparing for the next technical exchange.

During the discussion of the NRC comments, DOE indicated that several FEPs had been excluded because of conservatism in the uncertainty range for TSPA parameters. NRC indicated that to be transparent, the TSPA disposition should indicate these FEPs are included in the performance assessment, instead of being excluded.

Two other issues were addressed during this part of the meeting. Specifically, that: (1) insufficient information is provided on propagation of uncertainties in spent nuclear fuel dissolution data, and (2) there has been insufficient use of alternative models for spent nuclear fuel dissolution. After discussing these two issues, DOE agreed to provide additional information in the appropriate AMRs (see Attachment 1 for preliminary agreement wording).

**5) Public Comments**

No public comments were made.

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