



## Department of Energy

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QA: N/A  
Project No. WM-00011

AUG 29 2003

OVERNIGHT MAIL

**ATTN: Document Control Desk**  
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TRANSMITTAL OF REPORT ADDRESSING ADDITIONAL INFORMATION NEEDS  
(AIN) FOR KEY TECHNICAL ISSUE (KTI) AGREEMENTS TOTAL SYSTEM  
PERFORMANCE ASSESSMENT AND INTEGRATION (TSPAI) 2.05 AND 2.06

References: (1) Ltr, Schlueter to Ziegler, dtd 8/2/02  
(2) Ltr, Brocoum to Schlueter, dtd 4/5/02

This letter transmits *KTI Letter Report, Response to Additional Information Needs on TSPAI 2.05 and TSPAI 2.06*, REG-WIS-PA-000003, Revision 00, ICN 04, which provides additional information in response to Reference 1.

The subject KTI agreements were originally addressed in the U.S. Department of Energy (DOE) document *The Enhanced Plan for Features, Events, and Processes (FEPs) at Yucca Mountain*, submitted in Reference 2. After reviewing this document, the U.S. Nuclear Regulatory Commission (NRC) identified nine AINs for Agreement TSPAI 2.05 and five AINs for Agreement TSPAI 2.06 that must be addressed to complete these KTI agreements. The enclosed report addresses each of these AINs and provides clarification of items described in *The Enhanced Plan for Features, Events, and Processes (FEPs) at Yucca Mountain*.

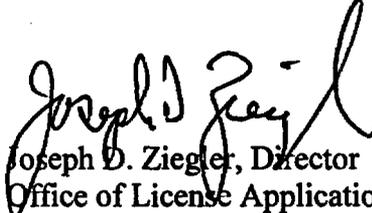
The conclusion of this report refers to the DOE's proposal to meet periodically with the NRC to provide progress assessments. This process began with a demonstration of the Enhanced FEPs Database to on-site NRC representatives in Las Vegas, Nevada, on June 6, 2003. As noted in Reference 1, TSPAI KTI agreement item 2.06 may be satisfied without the need for additional meetings.

The DOE considers Agreements TSPAI 2.05 and 2.06 to be fully addressed by the enclosed report, and, pending review and acceptance by the NRC, they should be closed.

NMSSOM  
wm-11

AUG 29 2003

There are no new regulatory commitments in the body or enclosure to this letter. Please direct any questions concerning this letter and its enclosure to Carol L. Hanlon at (702) 794-1324 or Mark C. Tynan at (702) 794-5457.

  
Joseph D. Ziegler, Director  
Office of License Application and Strategy

OLA&S:TCG-1131

Enclosure:

*KTI Letter Report, Response to Additional  
Information Needs on TSPA I 2.05 and  
TSPA I 2.06, REG-WIS-PA-000003,  
Revision 00, ICN 04*

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AUG 29 2003

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REG-WIS-PA-000003 REV 00 ICN 04

August 2003

## **KTI Letter Report**

# **Response to Additional Information Needs on TSPAI 2.05 and TSPAI 2.06**

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**Under Contract Number**  
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**ENCLOSURE**

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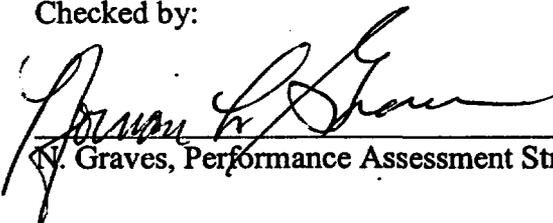
KTI Letter Report—Response to Additional Information Needs on TSPAI 2.05 and TSPAI 2.06  
REG-WIS-PA-000003 REV 00 ICN 04  
August 2003

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## CHANGE HISTORY

<u>Revision Number</u>	<u>Interim Change No.</u>	<u>Date of Revision</u>	<u>Description of Change</u>
0	0	03/21/03	Initial Issue.
0	1	03/31/03	Editorial Changes in response to AP-REG-014, <i>Information for Material or Regulatory Response</i> review of transmittal letters. No change bars shown.
0	2	04/25/03	Editorial Changes in response to additional LAP comments. No change bars shown.
0	3	07/24/03	Editorial Changes in response to DOE comments. No change bars shown.
0	4	08/25/03	Editorial Changes in response to DOE comments. No change bars shown.

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## ACRONYMS AND ABBREVIATIONS

AIN	Additional Information Need
AMR	Analysis/Model Report
DOE	U.S. Department of Energy
FEPs	features, events and processes
KTI	Key Technical Issue
LA	License Application
NEA	Nuclear Energy Agency
NRC	U.S. Nuclear Regulatory Commission
SR	Site Recommendation
TSPA	total system performance assessment
TSPAI	Total System Performance Assessment and Integration

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## 1. BACKGROUND

This report addresses additional information needs (AINs) on Total System Performance Assessment and Integration (TSPAI) Key Technical Issue (KTI) Agreement items 2.05 and 2.06. These agreements between the U.S. Department of Energy (DOE) and the U.S. Nuclear Regulatory Commission (NRC) read (NRC 2002, p. A-28) as follows:

**TSPAI 2.05:** "It is not clear to the NRC that the current list of FEPs (i.e., the list of FEPs documented in TDR-WIS-MD-000003, 00/01) is sufficiently comprehensive or exhibits the necessary attribute of being auditable (e.g., transparent and traceable). As discussed in the two TSPAI technical exchanges, there are unclear aspects of the approach that DOE plans to use to develop the necessary documentation of those features, events, and processes that they have considered. Accordingly, to provide additional confidence that the DOE will provide NRC with: (1) auditable documentation of what has been considered by the DOE, (2) the technical basis for excluding FEPs, and (3) an indication of the way in which included FEPs have been incorporated in the performance assessment; DOE will provide NRC with a detailed plan (the Enhanced FEP Plan) for comment. In the Enhanced FEP Plan, DOE will address the following items: (1) the approach used to develop a pre-screening set of FEPs (i.e., the documentation of those things that DOE considered and which the DOE would use to provide support for a potential license application), (2) the guidance on the level-of-detail that DOE will use for redefining FEPs during the enhanced FEP process, (3) the form that the pre-screening list of FEPs will take (e.g., list, database, other descriptions), (4) the approach DOE would use for the ongoing evaluation of FEPs (e.g., how to address potentially new FEPs), (5) the approach that DOE would use to evaluate and update the existing scope and description of FEPs, (6) the approach that DOE would use to improve the consistency in the level of detail among FEPs, (7) how the DOE would evaluate the results of its efforts to update the existing scope and definition of FEPs, (8) how the enhanced FEP process would support assertions that the resulting set of FEPs will be sufficiently comprehensive (e.g., represents a wide range of both beneficial and potential adverse effects on performance) to reflect clearly what DOE has considered, (9) how DOE would indicate their disposition of included FEPs in the performance assessment, (10) the role and definition of the different hierarchical levels used to document the information (e.g., "components of FEPs" and "modeling issues"), (11) how the hierarchical levels used to document the information would be used within DOE's enhanced FEP process, (12) how the Enhanced FEP Plan would result in documentation that facilitates auditing (i.e., lead to a process that is transparent and traceable), (13) DOE's plans for using configuration management controls to identify FEP dependencies on ongoing work and design changes. DOE will provide the Enhanced Plan to NRC by March 2002."

**TSPAI 2.06:** "Provide justification for the approach to: (1) the level of detail used to define FEPs; (2) the degree of consistency among FEPs; and (3) comprehensiveness of the set of FEPs initially considered (i.e., before screening). DOE proposes to meet with NRC periodically to provide assessments of the DOE's progress, once it has initiated the enhanced FEP process, and on changes to the approach documented in the Enhanced FEP Plan. During these progress meetings DOE agrees to provide a justification for their approach to: (1) the level of detail used to define FEPs; (2) the degree of consistency among FEPs; and (3) comprehensiveness of the pre-screening set of FEPs."

By letter dated April 5, 2002, DOE provided information pertaining to TSPAI Agreement 2.05 (Brocoum 2002) by transmitting *the Enhanced Plan for Features, Events and Processes (FEPs) at Yucca Mountain* (BSC 2002) (referred to as the Enhanced FEP Plan hereafter) to the NRC. Subsequently, during a Technical Exchange and Management Meeting held on April 15-16, 2002, DOE requested that NRC review the information provided on April 5, 2002, as it pertains to TSPAI Agreement 2.06 (Schlueter 2002a).

As stated in its April 5, 2002 letter (Brocoum 2002), the additional information contained in the Enhanced FEP Plan (BSC 2002) describes the DOE approach for developing the documentation of considered FEPs. Section 3.3 of the Enhanced FEP Plan summarizes the plan basis for addressing each of the items in TSPAI 2.05. With regard to TSPAI 2.06, the Enhanced FEP Plan includes justification for the approach used to determine the level of detail used to define FEPs, the degree of consistency among FEPs, and the comprehensiveness of the set of FEPs initially considered (i.e., before screening). DOE expected that the information presented in the Enhanced FEP Plan would address the documentation aspects of the agreements. DOE also agreed to meet with the NRC periodically to provide assessment of progress on implementing the Enhanced FEP Plan.

## **1.1 NRC COMMENTS ON THE KTI LETTER REPORT**

The NRC staff determined that the Enhanced FEP Plan (BSC 2002) does not fully satisfy the intent of the TSPAI Agreement 2.05. "The Enhanced FEP Plan does address, at some level, each of the thirteen items listed in the agreement. However, the Enhanced FEP Plan does not clarify a number of unclear aspects of DOE's approach, nor does it provide, in some areas, the information and detail that would give the NRC staff confidence that DOE's approach would result in the information necessary to allow a detailed review of this part of a potential license application." (Schlueter 2002b)

The NRC staff also determined that the Enhanced FEP Plan does not provide the information or detail necessary to allow a detailed review of DOE's initial (or pre-screening) list of FEPs. "Based on the information contained in the Enhanced FEP Plan, additional information is needed before the intent of TSPAI Agreement 2.06 is satisfied. This information is needed to enable the staff to conduct a detailed review of the potential license application and does not need to be conveyed in conjunction with future NRC/DOE interactions." (Schlueter 2002b)

Specific additional information needs were identified in 14 AINs (nine for TSPAI 2.05 and five for TSPAI 2.06) (Schlueter 2002b). These AINs requested clarification of schedule, methods of aggregating FEPs and the resulting level of detail, FEPs with mixed include and exclude decisions, demonstration of completeness, and auditability.

## **1.2 PROPOSED RESOLUTION**

Changes are being made in the FEP documentation system, as documented in the Enhanced FEP Plan (BSC 2002). These changes are to address KTI TSPAI Agreements 2.05 and 2.06, and the additional information needs in the NRC letter (Schlueter 2002b). Additional changes to the FEP documentation system are described herein; the changes are supplemental to and, in some cases, supercede the enhancements initially documented in the Enhanced FEPs Plan (BSC 2002).

The additional changes are necessary to better address the KTI TSPAI Agreements 2.05 and 2.06, and to further improve clarity. The additional changes, discussed in Section 2 below, address the additional information needs with respect to further clarification and consideration of suggested improvements. The information provided herein clarifies and modifies the approach described in the Enhanced FEP Plan, which will not be revised.

## **2. DETAILS OF THE PROPOSED RESOLUTION**

The Enhanced FEP Plan (BSC 2002, Section 3.2.1) identified the development of a FEP matrix constructed from multiple hierarchical levels to classify FEPs and promote navigation within the database, that documents the FEP list and screening decision in a single consolidated location. It also identified criteria for FEPs and FEP components to define the level of detail. To address the review comments and AINs identified in Schlueter (2002b), the following general changes are being implemented.

As described in the Enhanced FEP Plan, FEPs will be aggregated to the coarsest level at which a technically sound screening decision can be made. However, in a change subsequent to the Enhanced FEP Plan, FEP components will not be used to identify finer details of a FEP. Instead a list of keywords for each FEP will be added to facilitate navigation and enhance the ability of database users to find the treatment of specific finer details within a FEP. Additionally, the entire list of Nuclear Energy Agency (NEA) FEPs (which provided the basis for some of the finer details formerly represented by secondary FEPs) will be mapped in the database to the Yucca Mountain FEPs to help confirm that finer details have been addressed.

The matrix of physical subsystems versus processes described in Section 3.2.1 of the Enhanced FEP Plan (BSC 2002) will be improved. The physical system will be developed in three hierarchical levels. Similarly, the process hierarchy will include three levels. Figure 1 herein shows this conceptually. The intersection of any third level process (or event) with any third level physical subsystem (or feature) will define the level at which FEPs and keywords will be associated with the subsystem and process description of the repository. For each of these intersections that is a credible combination of process and subsystem, there will be associated FEPs and keywords. Figure 2 herein shows one potential example. The database will identify all FEPs and keywords associated with a process-subsystem combination. There will be no secondary FEPs or FEP components.

The database will allow navigation using the physical subsystem or process hierarchies (i.e., from the matrix), and in reverse from the FEP list or keyword list. The FEPs and keywords will be linked to the NEA classification list (for completeness) and the SR FEP list (for traceability), with forward or reverse navigation.

			REPOSITORY PROCESSES AND EVENTS													
			NOMINAL							DISRUPTIVE						
			Flow / Seepage	Transport	Chemical	Mechanical	Thermal	Microbial	Radiological	....	Seismic	Igneous	Criticality	Human Intrusion	Other	....
<b>REPOSITORY SUBSYSTEM PHYSICAL ELEMENTS AND FEATURES</b>	<b>ENGINEERED BARRIER SYSTEM</b>	Drift Cavity														
		Ground Support														
		Drip Shield														
		WP				I = 1 X = 4										
		Cladding														
		WF														
		Pallet														
		Invert														
		Seals														
	<b>GEOSPHERE</b>	Surface														
		UZ Above Repository														
		UZ Below Repository														
		SZ														
	<b>BIOSPHERE</b>	Ash Pathway														
		Groundwater Pathway														

Example Entries

NOTE: The specific subsystems and processes, and the example entries in the table are for illustration only.  
 Legend: Shading indicates the combination of subsystem and process is not applicable to the repository.  
 Numbers in a cell indicate the number of Included FEPs and the number of Excluded FEPs [e.g. Waste Package – Mechanical has 1 Included FEP and 4 Excluded FEPs].

Figure 1. Sample figure showing subsystem and process hierarchy approach

<b>FEP Name:</b>	<b>Early failure of waste packages</b>
<b>FEP Number:</b>	2.1.03.08.0A
<b>Screening Decision:</b>	Included
<b>Keywords:</b>	Waste Package Closure Welds Fabrication Welds Early Failure Stress Corrosion Cracking Emplacement Error

<b>FEP Name:</b>	<b>Mechanical impact on waste package</b>
<b>FEP Number:</b>	2.1.03.07.0A
<b>Screening Decision:</b>	Excluded – Low Consequence
<b>Keywords:</b>	Waste Package Rockfall Drift Collapse Seismic Ground Motion Vibration Dislodgment Drip Shield Gas Pressure Corrosion Products Stress Corrosion Cracking

<b>FEP Name:</b>	<b>Hydrostatic pressure on waste package</b>
<b>FEP Number:</b>	2.1.07.04.0A
<b>Screening Decision:</b>	Excluded – Low Probability
<b>Keywords:</b>	Waste Package Hydrostatic Pressure

<b>FEP Name:</b>	<b>Creep of metallic materials in the waste package</b>
<b>FEP Number:</b>	2.1.07.05.0A
<b>Screening Decision:</b>	Excluded – Low Consequence
<b>Keywords:</b>	Waste Package Thermally-Induced Creep Deviatoric Stress Gas Pressure Internal Void Space

<b>FEP Name:</b>	<b>Volume increase of corrosion products impacts waste package</b>
<b>FEP Number:</b>	2.1.09.03.0B
<b>Screening Decision:</b>	Excluded – Low Consequence
<b>Keywords:</b>	Waste Package Corrosion Products Swelling Oxide Wedging

NOTE: Information is for illustration only, and is not an entry from the database

Figure 2. Example of a listing produced when the *Waste Package – Mechanical* cell is selected in Figure 1

The level of detail in the FEP list is a compromise between the number of FEPs in the list (for clarity as a list) and the depth of description for each FEP (for clarity of each item of the list). For any potential FEP, the discussion and description are subdivided repeatedly until the smallest temporal or spatial scale is reached that is pertinent to barrier or total system performance. Simplifications to process models are developed with the scales of interest in mind. These types of simplifications are discussed within the process AMRs themselves. Those AMRs also directly point to included FEPs at the level of detail of the FEP list. Each group of process AMRs feeds a FEP AMR, which repeats the inclusion arguments and adds arguments for excluded FEPs (in many cases excluded FEPs are not associated with a specific process AMR).

Specific information to address NRC staff's additional information needs is provided in the following sections.

## **2.1 ADDITIONAL INFORMATION NEEDS FOR TSPA I 2.05**

The following provides the basis for addressing the nine AINs identified by the NRC for the TSPA I Agreement 2.05. Each item identified by the NRC staff includes a reference to the part of TSPA I Agreement 2.05 that is not addressed in sufficient detail, as appropriate (Schlueter 2002b). The response to each AIN follows the AIN text below.

**AIN 1:** "The schedule for making the significant decisions identified in the Enhanced FEP Plan; including those identified in Section 3.3 (e.g., configuration control, when AMR authors will have the list of FEPs that they will need to address, FEP AMR updates, organization of the FEP matrix)."

**Response to AIN 1:** The tasks listed in the Enhanced FEPs Plan, as modified by the general changes above, are the steps to develop the FEPs for TSPA-LA. The following tasks are complete at the time of this letter report:

- The process has been discussed with the AMR authors in a number of meetings.
- The database structure has been selected.
- The process and subsystem hierarchies are complete.
- The list of SR FEPs has been modified to produce a draft LA FEP list. Modifications include splitting "broad FEPs" and mixed included/excluded FEPs into multiple FEPs, removing some "broad FEPs" that were completely addressed in multiple more specific FEPs, and identifying new candidate FEPs.
- A draft LA FEP list was distributed in January 2003 and has been updated twice since then.
- Software development of the database application is complete, and the software has been submitted for independent verification and validation.
- FEP AMR authors are aware of the screening process and documentation requirements.

The following tasks are ongoing:

- The FEP AMRs are being checked for concurrence with the Enhanced FEP Plan and the process changes identified herein, during the formal AMR review process.
- FEP configuration control includes reviews of Interface Exchange Documents (pertaining to the interface between the products of the repository design and performance assessment organizations), with the reviews being used to identify needed changes to the FEP database and reconsideration of FEP screening arguments based on design changes.
- FEP configuration control includes use of the FEP database features to track changes to the proposed FEPs and the associated screening arguments.
- Designers and AMR authors are being consulted on the need for additional candidate FEPs to be screened as the database is populated.

The following milestones are scheduled:

- The FEP database will be available in the Technical Management Database System, and the supporting software will be available in the Software Configuration Management System in March 2004.
- The technical report documenting the FEP development process for TSPA-LA and the database origins and contents will be available in the Controlled Document System in June 2004.

**AIN 2:** “Information supporting the assertion that the approach of using keywords to describe FEP components will provide sufficient information on what has been considered or a description of the approach that DOE will use to document what has been considered. As previously discussed, a general example may help to illustrate the modified approach. [TSPAI Agreement 2.05 (1)]”

**Response to AIN 2:** Figure 2 herein provides an example of how keywords can describe and, in some cases, define the FEPs to be considered for screening. The keywords help to identify specific details of FEPs and facilitate navigation within the database. A FEP is defined by the combination of the third-levels of the physical system and process hierarchies (i.e., a FEP matrix intersection) and the keywords; these are the basis for the FEP description in the AMRs and the FEP database. The FEP screening arguments will be documented at the level of detail necessary to isolate the subprocesses or subsystems individually involved in the screening argument at the temporal and spatial scales of interest for TSPA-LA. The keywords are the vehicle for summarizing the level of detail at which a particular FEP is developed. FEP components will no longer be used.

**AIN 3:** “Additional detail describing how DOE will apply its criteria on level of detail for redefining FEPs, so that it is clear how DOE will balance the competing goals of coarseness and specificity when defining FEPs. As previously discussed, a general example may help to illustrate the proposed approach. [TSPAI Agreement 2.05 (2)]”

**Response to AIN 3:** The three-level subsystem and process hierarchies provide a description of the system and its performance that can be comprehended in a single view. Each subsystem-process matrix intersection defines the upper limit of coarseness for a FEP. The FEP screening arguments will be documented in the FEP AMRs at the level of detail necessary to isolate the subprocesses or subsystems individually involved in the screening argument at the temporal and spatial scales of interest for TSPA-LA. This will result in multiple FEPs for some matrix cells, corresponding to those technical areas with complex processes that need more detailed screening. Inspection of the variations in the level of detail will be facilitated by the navigation features of the database that will allow moving between the single high-level matrix view and views of the individual FEPs and screening arguments within a single matrix cell. Figures 1 and 2 herein illustrate the level of detail and the balance of coarseness and specificity.

**AIN 4:** “Adequate Justification for DOE's approach to limit *a priori* the number of FEPs to several hundred. [TSPAI Agreement 2.05 (2)]”

**Response to AIN 4:** There is no *a priori* limit on the number of FEPs. The 328 primary SR FEPs are the starting point, and that number will increase as some FEPs are split to eliminate broad FEPs and eliminate combined included/excluded FEP situations.

**AIN 5:** “DOE should clarify whether their Enhanced FEP Process will, or will not, lead to instances where FEPs are considered both included and excluded. DOE should clarify where it believes this may be appropriate, why it believes that this result is appropriate, and should provide examples illustrating this. [TSPAI Agreement 2.05 (6)]”

**Response to AIN 5:** The Enhanced FEPs Process will not lead to instances of single FEPs that have both included and excluded elements. FEPs will be re-organized and subdivided where necessary, so that each FEP has a single screening decision.

**AIN 6:** “Additional detail regarding the methods that DOE will use to evaluate their approach against the Yucca Mountain Review Plan criteria (as excerpted) and the principles that will be used to guide the subjective evaluation that DOE plans to conduct. For example, it is unclear whether audits of the pre-screening list of FEPs will be conducted to support the ‘subjective’ decision. [TSPAI Agreement 2.05 (7)]”

**Response to AIN 6:** The YMRP acceptance criteria inform the DOE about the metrics that NRC reviewers will use to evaluate the License Application. These criteria will be considered as the FEP database and screening arguments are developed. The FEP database is the top level of a pyramid that includes the set of FEP AMRs and the larger set of process level AMRs. All three levels undergo formal checking and technical discipline review as part of the product development process including review against the YMRP acceptance criteria. This work, combined with the prior work to develop the SR product, documents the evolution of the FEP list from the generic international database to the list that will be part of the License Application documentation.

**AIN 7:** “Clarify how DOE will address the completeness of the ‘FEP components’ considered in the screening of FEPs or the modeling of FEPs and clarify how FEP components will be addressed in the screening arguments for their associated FEPs. [TSPAI Agreement 2.05 (8)]”

**Response to AIN 7:** FEP components will no longer be used. However, there will be improved clarity of the FEP database provided through the FEP-matrix-based organizational structure and the capability to view it at a high enough level to comprehend its entirety. This will facilitate the FEP organization's evaluation of completeness and the subject matter experts' identification of subprocesses or subsystems not included in their modeling and screening arguments. Similarly, the clarity of the database will assist oversight bodies in developing independent assessments of completeness. The mapping of the NEA classification list to the LA FEPs and the cross-referencing of the SR FEP list to the LA FEPs will also facilitate evaluation of completeness.

**AIN 8:** "Clarify how the approach outlined in the Enhanced FEP Plan will not result in FEPs being designated FEP components issues nor will it lead to sufficient ambiguity as to make the FEP list incapable of being audited. [TSPAI Agreement 2.05 (10)]"

**Response to AIN 8:** The software view of the subsystem-process hierarchy will facilitate development of a FEP database free of ambiguities and omissions. Elimination of secondary FEPs, FEP components, and combined include/exclude FEPs will reduce ambiguities and result in a database that is transparent.

**AIN 9:** "Additional information clarifying how the Enhanced FEP Process will address questions of auditability, such as: (1) mutual exclusivity of FEPs (e.g., overlapping of FEPs) and (2) how auditability will be preserved with the proposed approach (i.e., the varying level of detail in defining FEPs and use of Hierarchical Level 4). [TSPAI Agreement 2.05 (12)]"

**Response to AIN 9:** The separation of the subsystem axis from the process axis in the hierarchical views of the database will highlight the mutual exclusivity of most of the boxes in a two-dimensional view of the database. For those subsystem-process combinations with some overlap (e.g., a thermal process column could overlap with several other process columns), the two-dimensional database view will identify the set of FEPs (through highlighting and/or listing related FEPs) that support the overlapping columns for a given subsystem row. This will make evaluation of potential overlap more straightforward. The balance of the high level view and the FEP screening at the appropriate level of detail for the individual situation, combined with the elimination of FEP components, will also improve clarity. The traceability features included in the LA FEP database will be an independent crosscheck back to the SR FEP list and to the NEA classification list.

## **2.2 ADDITIONAL INFORMATION NEEDS FOR TSPAI 2.06**

The following provides the basis for addressing the five AINs for the TSPAI 2.06 agreement. Each item identified by the NRC staff also includes a reference to the part of TSPAI Agreement 2.06 that is not addressed in sufficient detail, as appropriate (Schlueter 2002b). The response to each AIN follows the AIN text below.

**AIN 1:** "A description of the approach used to determine the degree of aggregation used to define those FEPs appearing within the initial list of FEPs should be provided. This description should include a discussion of the important decisions made during its implementation and it should address instances where FEPs are not mutually exclusive, if they were to occur. The information provided should be have [sic] sufficient detail so as to allow the NRC to evaluate

whether hypothesized FEPs were, or were not, included in the initial list of FEPs and to support its conclusions. Justification for the level of detail used to define FEPs that reflects the FEPs that comprise the pre-screening list of FEPs, where the justification includes an appropriate discussion of the mutual exclusivity or overlapping of FEPs. If the number of FEPs in the pre-screening list of FEPs is limited because of a criterion used by DOE, justification for the use of this criterion needs to be provided. Justification for considering FEPs as both included and excluded needs to be provided, if this approach is used by DOE. [TSPAI Agreement 2.06 (1)]”

**Response to AIN 1:** There is no limit on FEPs in the screening list (which is the sum of the included and excluded FEPs). The number of LA FEPs will be developed from the SR FEPs, the splitting of some broad FEPs and mixed included/excluded FEPs (see AIN-4 for TSPAI-2.05), and from discussions with subject matter experts. The SR FEPs were developed iteratively using international FEP databases, site-specific literature, and discussions and reviews within the project. FEPs will only be aggregated if the screening argument applies across the range of the aggregation at the temporal and spatial scales of interest for TSPA-LA. The development of the LA FEPs will be documented in an AP-3.11Q technical report. See the response to AIN-9 for TSPAI-2.05 for a discussion of exclusivity and overlap.

**AIN 2:** “Justification for the degree of consistency among FEPs reflecting the FEPs that comprise the pre-screening list of FEPs needs to be provided. The basis for why the FEP components identified by the DOE should not be considered FEPs also needs to be provided. [TSPAI Agreement 2.06 (2)]”

**Response to AIN 2:** The FEPs components will be eliminated. The scope of each screening argument will define the scope of the FEP it supports. See the response to AIN-3 for TSPAI-2.05 for a discussion of the balance between FEPs level of detail and the capability to view the FEP database globally.

**AIN 3:** “If DOE uses the criteria of multiple reviews by subject matter experts and external reviewers as a basis for the completeness of the FEP list (pp. 37, 40), DOE should provide the documentation about the organization and nature of the reviews and how the review applies to the list of FEPs initially considered (i.e., the pre-screening list of FEPs arising from the Enhanced FEP Process), describe the process used to conduct the review, and the results of each review. [TSPAI Agreement 2.06 (3)]”

**Response to AIN 3:** Pages 37 and 40 of the Enhanced FEPs Plan referred to the reviews conducted in support of the SR, which are applicable to the LA FEP effort as well. In addition, the development of the LA FEPs includes technical staff review of prior work. As the LA FEP database is populated and the AMR screening arguments are confirmed or modified, the completeness will be evaluated based on the overall database and its predecessors, including the NEA database. The LA FEP database will facilitate a review of the NEA FEPs (and their mapping to the LA FEPs) and the SR FEPs (and their cross-referencing to the LA FEPs) by providing electronic access to and searching of the FEPs in a single location. The formal review of the FEP list will be the review of the FEP technical report, which is prepared in accordance with AP-3.11Q and reviewed in accordance with AP-2.14Q. The organization and nature of the review process is prescribed by AP-2.14Q.

**AIN 4:** “Also, DOE should provide a rationale for why reviews of different FEP lists would apply to the completeness of the actual list, because there may be changes in level of detail, etc. DOE should clarify how previous reviews of different FEP lists will support assertions that the FEP list arising from the Enhanced FEP Process is sufficiently complete. This should include a discussion of the role of FEP components and how they pertain to completeness of DOE's consideration of features, events, and processes. [TSPAI Agreement 2.06 (3)]”

**Response to AIN 4:** As noted in the Enhanced FEP Plan (BSC 2002, Section 2.3.1), the NEA states that, “comprehensiveness ... will have to be judged against a record of continuous and open reviews ...”. The past reviews of FEP lists are part of this continuous review process and support the completeness of the LA FEP list. The FEP Team has the responsibility to evaluate the populated LA FEP database and to interact with subject matter experts, to ensure the completeness of the FEP list. The clarity features of the enhanced process are designed to enable the completion of this task. As stated above, the simplifications described in this letter report, such as the elimination of FEP components, will support assessment of completeness. In addition, event trees and interface diagrams will be considered to support the demonstration of completeness.

**AIN 5:** “If DOE uses the FEP matrix to support an assertion that its list of FEPs initially considered is complete, DOE needs to provide additional information that supports the appropriateness of the FEP matrix for this purpose. This additional information should describe how the organization and content of the, as described in Appendix A (A-1), FEP matrix, and its use, supports the assertion of completeness as an attribute of the pre-screening list of FEPs. If Hierarchical Level 4 is to be used to provide part of the technical basis for the completeness of the initial list of FEPs and it is not implemented uniformly, then additional information justifying the appropriateness of DOE's approach towards Hierarchical Level 4 should be provided.

**Response to AIN 5:** The responses to AIN-7 for TSPAI-2.05 and AIN-4 for TSPAI-2.06 discuss the approach to evaluating completeness of the FEP list. FEP screening will be at the level of detail for which the screening logical argument is applicable, for each situation.

### **3. CONCLUSIONS**

The Enhanced FEP Plan, the additional information in Section 2 of this letter report, and DOE's proposal to meet periodically with NRC to provide progress assessments, collectively address Agreement items TSPAI 2.05 and TSPAI 2.06 and the additional information needs for these agreements.

### **4. REFERENCES**

#### **4.1 DOCUMENTS CITED**

162463 Brocoum, S. 2002. "Transmittal of Report Addressing Key Technical Issues (KTI)." Letter from S. Brocoum (DOE/YMSCO) to J.R. Schlueter (NRC), April 5, 2002, 0408022112, OL&RC:TCG-0844 [No Enclosures]. ACC: MOL.20020716.0095.

- 158966 BSC (Bechtel SAIC Company) 2002. *The Enhanced Plan for Features, Events, and Processes (FEPs) at Yucca Mountain*. TDR-WIS-PA-000005 REV 00. Las Vegas, Nevada: Bechtel SAIC Company. ACC: MOL.20020417.0385.
- 159538 NRC (U.S. Nuclear Regulatory Commission) 2002. *Integrated Issue Resolution Status Report*. NUREG-1762. Washington, D.C.: U.S. Nuclear Regulatory Commission, Office of Nuclear Material Safety and Safeguards. TIC: 253064.
- 161434 Schlueter, J. 2002a. "U.S. Nuclear Regulatory Commission/U.S. Department of Energy Technical Exchange and Management Meeting on Key Technical Issue Agreements (April 15-16, 2002)." Letter from J. Schlueter (NRC) to S. Brocoum (DOE/YMSCO), April 15, 2002, 0506022546, with enclosure. ACC: MOL.20020724.0088.
- 161286 Schlueter, J. 2002b. "Total System Performance Assessment and Integration Agreement 2.05 and 2.06." Letter from J. Schlueter (NRC) to J.D. Ziegler (DOE/YMSCO), August 2, 2002, 0809023757, with enclosure. ACC: MOL.20021010.0014.

#### 4.2 CODES, STANDARDS, REGULATIONS, AND PROCEDURES

- 162464 AP-2.14Q, Rev. 2, ICN 2. *Review of Technical Products and Data*. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20030206.0001.
- 162500 AP-3.11Q, Rev. 3, ICN 4. *Technical Reports*. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: DOC.20030331.0002.