



U.S. Department of Energy
Office of Civilian Radioactive Waste Management

TSPA-SR Features, Events, and Processes (FEPs) Database: Current Status of Implementation

Presented to:

**DOE/NRC Technical Exchange on Total System
Performance Assessment (TSPA) for Yucca Mountain
San Antonio, TX**

Presented by:

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June 6, 2000

**YUCCA
MOUNTAIN
PROJECT**

Outline

- **Key Technical Issue (KTI) Subissues**
- **Yucca Mountain Project (YMP) FEPs Database Revisions**
- **Traceability**
- **Future Updates**

Documentation for Site Recommendation

- **SRCR**
 - Volume 1, Section 4.3
 - Volume 2, Section 3.3.1.1
- **TSPA-SR**
 - Section 1.6
 - Section 2.1
 - Appendix B
- **FEP Analysis/Model Reports (AMRs)**
- **Database Rev 00 and Future Revisions**

Key Technical Issue Subissues

- **Relevant Total System Assessment and Integration (TSPAI) Issue Resolution Status Report (IRSR) Rev. 2 Acceptance Criteria include:**
 - **Section 4.1.1.2: FEPs Identification and Screening**
 - **Section 4.2.2: Classification of Processes and Events**
- **Resolution of TSPAI IRSR Open Issues described in Open Item Table**
- **Matrix of TSPAI IRSR acceptance criteria versus Process Model Reports (PMRs) provided**

FEPs Database Revisions

- Preliminary developmental versions (uncontrolled)
- Rev. 00A - July, 1999 (list to FEP Analysis/Model Report (AMR) Leads)
- Rev. 00B - September, 1999 (to NRC)
- Rev. 00C - November, 1999 (YAP-SV.1Q controlled)
- Rev. 00 - June 30, 2000 (from FEP AMRs Rev 00)
- Rev. 00 ICN 1 / Rev. 01- Future updates (no backfill, other updates)

FEPs Database Revisions

(continued)

- **Rev. 00A - July, 1999**
 - **Initial version of YMP FEPs Database:**
 - ◆ General FEPs from international NEA database, Vers. 1.0
 - ◆ YMP-specific FEPs identified in YMP literature
 - ◆ YMP-specific FEPs identified in Site Recommendation planning workshops
 - **Proposed Primary FEP/Secondary FEP relationships**
 - **Proposed assignments to PMRs and FEP AMRs**
 - ◆ Many assigned to multiple PMRs
 - **Preliminary placeholder screening decisions and text**
 - ◆ not from subject matter experts
 - **Distributed to FEP AMR Leads**

FEPs Database Revisions

(continued)

- **Rev. 00B - September, 1999**
 - Same FEPs as Rev. 00A
 - Limited MS Access user functionality
 - Preliminary placeholder screening decisions and text converted to italics
 - Distributed to NRC at Appendix 7 Meeting on FEPs

FEPs Database Revisions

(continued)

- **Rev. 00C - November, 1999**
 - Same FEPs as Rev. 00A and Rev. 00B
 - Base controlled version
 - ◆ Preliminary placeholder screening decisions and text removed
 - ◆ Ready for input from FEP AMRs Rev. 00

FEPs Database Revisions

(continued)

- **Rev. 00 - June 30, 2000**
 - **Based on technical input from Rev. 00, ICN 0 of FEP AMRs (with backfill)**
 - ◆ **Screening decisions (include/exclude)**
 - ◆ **Screening text**
 - ◆ **Subject matter expert confirmation of Primary/Secondary relationships and PMR assignments**
 - ◆ **Identification of new FEPs**
 - **Enhanced user functionality**
 - ◆ **Directory tree-type organizational guidance**
 - ◆ **Keyword search capability (*)**
 - » (*) = possibly deferred to a later revision

FEPs Database Rev. 00

FEPs

File Edit View Insert Format Records Tools Window Help

Apply Filter Last Filter New Filter Save Filter Retrieve Filter K Summary I Exit

FEPs Tree : Form

0.00 Assessment Basis
0.00 EXTERNAL FACTORS
0.00 DISPOSAL SYSTEM DOMAIN:
0.00.00 WASTES AND ENGINEERED
.01.00.00 Inventory, radionuclide
.02.00.00 Waste form materials ar
.03.00.00 Container materials and
.04.00.00 Buffer/backfill materials
.05.00.00 Seals, cavern/tunnel/sh
.06.00.00 Other engineered featu
.07.00.00 Mechanical processes ar
.08.00.00 Hydraulic/hydrogeologic
2.1.08.01.00 Increased unsaturati
2.1.08.02.00 Enhanced influx (Phil
2.1.08.03.00 Repository dry-out d
2.1.08.04.00 Condensation forms
2.1.08.05.00 Flow through invert
2.1.08.06.00 Wicking in waste and
2.1.08.07.00 Pathways for unsatu
2.1.08.08.00 Induced hydrological
2.1.08.09.00 Saturated groundwa
2.1.08.10.00 Desaturation/dewate
2.1.08.11.00 Resaturation of repo

YMP FEP Database - Summary

YMP FEP Database Number: 2.1.08.06.00 **FEP Class:** Primary entry

FEP NAME: Wicking in waste and EBS

YMP Primary Description: Capillary rise, or wicking, is a potential mechanism for water to move through the waste and engi

Originator Description: Identified as "Wicking" by originator. Capillary rise or wicking is a potential mechanism for liquid r
affect gas generation rates, which are dependent on water availability. etc. (WIPP)

PMR: EBS **AMR:**

Screening Decision: **Screening Basis:**

Record: 829 of 1786

Add FEP

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FEPs Database Rev. 00

FileMaker Pro - [Rev00d.fp3]

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Summary

831

Records: 1792

Sorted

YMP FEP Database - Summary View Rev. 00d

YMP FEP Database Number: 2.1.08.06.00 FEP Class: Primary entry

FEP Name: Wicking in waste and EBS

NEA Category: 2.1.08y

Source Identifier: W2.041

YMP Primary Description: Capillary rise, or wicking, is a potential mechanism for water to move through the waste and engineered barrier system.

Originator Description: Identified as "Wicking" by originator.

Screening Decision and Basis: Capillary rise or wicking is a potential mechanism for liquid migration through unsaturated zones in the repository. Capillary rise in the waste material could affect gas generation rates, which are dependent on water availability, etc. (WIPP)

Screening Argument:

TSPA Disposition:

Cited References:

Record No.: 829

Introduction Directory All Fields Print Exit

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FEPs Database Rev. 00

FEPS

File Edit View Insert Format Records Tools Window Help

Apply Filter Last Filter New Filter Save Filter Retrieve Filter K E Summary I Exit

YMPFEPs - Summary View

YMP FEP Database - Summary View

YMP FEP Database Number: 1 2 03 00 00 **FEP Class:** Secondary entry, see subentries

frmKeyWords : Form

FEP I	F Keyword	E Keyword	P Keyword
	F Key10	E Key10	P Key10
	F Key11	E Key11	P Key11
	F Key12	E Key12	P Key12
	F Key13	E Key13	P Key13
	F Key14	E Key14	P Key14
	F Key15	E Key15	P Key15
	F Key16	E Key16	P Key16
	F Key17	E Key17	P Key17
	F Key18	E Key18	P Key18
	F Key19	E Key19	P Key19
	F Key2	E Key2	P Key2
	F Key20	E Key20	P Key20

OK Cancel

Record: 143 of 1786

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Traceability

- **Sources/reviews contributing to Rev. 00**
 - **FEP AMRs**
 - **Documentation of FEP origins**
 - **Internal PMR reviews**
 - **Repository Safety Strategy 4 Workshops**
 - **NRC NFE Audit of Rev. 00B (*)**
 - **IRSR KTIs and Subissues (*)**
- » (*) = possibly deferred to a later revision

Traceability

(continued)

- **NRC Criteria (TSPA&I IRSR Rev. 2, Sec. 4.1.1.2)**
 - **Criterion T1: The screening process by which FEPs were included or excluded from TSPA is fully described**
- **DOE Implementation of NRC Criteria**
 - **Screening criteria and rationale for include/exclude decision are documented in the FEP AMRs and in the database**

Traceability

(continued)

- **NRC Criteria (TSPA&I IRSR Rev. 2, Sec. 4.1.1.2)**
 - **Criterion T2: Relationships between relevant FEPs are fully described.**
- **DOE Implementation of NRC Criteria**
 - **Related FEPs are grouped within the NEA-based hierarchical numbering scheme. Tree directory allows user to graphically view and identify these groupings**
 - **Related FEPs are grouped by relevant PMR(s)**
 - **All primary FEPs are assigned F, E, and P keywords. Related FEPs can be identified through pull-down menu keyword search**

Traceability

(continued)

- **NRC Criteria (TSPAI IRSR Rev. 2, Sec. 4.2.2)**
 - **Criterion T1: Provide adequate documentation how initial list of processes and events has been grouped into categories**
- **DOE Implementation of NRC Criteria**
 - **Proposed categorization (Rev. 00A) based on:**
 - ◆ **Primary FEPs identified at a level where they can be evaluated with a “single” screening argument or TSPA disposition**
 - ◆ **Secondary FEPs are duplicate or redundant to a Primary FEP**
 - ◆ **Secondary FEPs are subsumed in broader Primary FEP screening arguments or TSPA dispositions**
 - ◆ **Primary FEP Description is YMP specific and encompasses all aspects of Primary FEP and associated Secondary FEPs**
 - **Categorization reviewed and confirmed (with appropriate changes made where necessary) by subject matter experts in FEP AMRs (for Rev. 00)**

Future Updates

- **Rev. 00 ICN 1 / Rev. 01**
 - **Will reflect ICN 1 or Rev. 01 changes to FEP AMRs**
 - ◆ **No backfill (ICN 1)**
 - **Will include other enhancements:**
 - ◆ **New FEPs, if identified**
 - ◆ **Enhancements required to better satisfy NRC Criteria (e.g., interaction matrix)**
 - ◆ **Proposed enhancements not included in Rev. 00**
 - **Will satisfy Site Recommendation sufficiency review**
 - **Expected date is Spring/Summer 2001**

Backup



FEP AMRs

- **BIO: Evaluation of the Applicability of Biosphere-Related Features, Events, and Processes (FEP)**
- **DE: Disruptive Events FEPs**
- **EBS: EBS FEPs/Degradation Modes Abstraction**
- **NFE: Features, Events, and Processes in Thermal Hydrology and Coupled Processes**
- **SYS: Analyses to Support Screening of System-Level Features, Events, and Processes for the Yucca Mountain Total System Performance Assessment -Site Recommendation**
- **SZ: Features, Events, and Processes in SZ Flow and Transport**
- **UZ: Features, Events, and Processes in UZ Flow and Transport**
- **WF: - Miscellaneous Waste-Form FEPs**
 - **Clad Degradation – FEPs Screening Arguments**
 - **Waste Form Colloid-Associated Concentrations Limits: Abstraction And Summary**
- **WP: FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation**

Database Audit Deficiency Summary

- **Database is not comprehensive**
- **Inadequate documentation on the categorization of secondary entries into individual primary entries**
- **Poor correspondence between primary and secondary entries**
- **Inadequate technical basis for many of the preliminary screening arguments**
- **Inadequate representation of FEP coupling**