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**Civilian Radioactive Waste Management System  
Management & Operating Contractor**

**The Development of Information Catalogued in REV00 of the YMP FEP Database**

**TDR-WIS-MD-000003 REV 00**

**June 2000**

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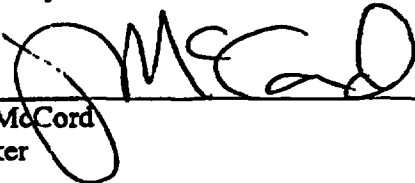
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## ACRONYMS

AECL	Atomic Energy of Canada, Ltd.
AMR	Analysis / Model Report
AP	Administrative Procedure
Bio, BIO	biosphere
CA	comparison approach
CRIT	criticality
CRWMS	Civilian Radioactive Waste Management System (DOE)
CSNF	commercial spent nuclear fuel
DE	disruptive events
DOE	U.S. Department of Energy
DSNF	Department of Energy spent nuclear fuel
E	event
EBS	engineered barrier system
F	feature
FEPs	features, events, and processes
FFC	far-field criticality
FR	Federal Register
HMIP	Her Majesty Inspectorate of Pollution
HTML	Hypertext Markup Language
ICN	Interim Change Number
IDGE	in-drift geochemical environment
INEEL	Idaho National Engineering and Environmental Laboratory
IRSR	Issue Resolution Status Report
ISC	in-situ criticality
M&O	Management and Operating Contractor
MB	megabytes
MLD	master logic diagram
NAGRA	National Cooperative for the Disposal of Radioactive Waste (Nationale Genossenschaft Fur die Lagerung Radioaktiver Abfalle) (Switzerland)
NEA	Nuclear Energy Agency
NFC	near-field criticality
NFE	near-field environment
NRC	U.S. Nuclear Regulatory Commission
OECD	Organisation for Economic Cooperation and Development
P	process
QA	Quality Assurance
PMR	Process Model Report
QAP	Quality Administrative Procedure
QARD	Quality Assurance Requirements and Description
REV	Revision

REV00	Revision 00
REV00A	Revision 00A
REV00B	Revision 00B
REV00C	Revision 00C
REV01	Revision 01
RSS	Repository Safety Strategy
SAM	Safety Assessment Management, Ltd.
SKB	Svensk Kärnbränslehantering AB (Swedish Nuclear Fuel and Waste Management Co.)
SKI	Swedish Nuclear Power Inspectorate
SYS	system-level
SZ	saturated zone
TH	thermal-hydrology
TSPA	Total System Performance Assessment
TSPAI	Total System Performance Assessment and Integration
TSPA-SR	Total System Performance Assessment for Site Recommendation
UZ	unsaturated zone
WF	waste form
WF Misc	waste form - miscellaneous
WF Clad	waste form - cladding
WF Col	waste form -colloids
WIPP	Waste Isolation Pilot Plant (DOE, Carlsbad, NM)
WP	waste package
YAP	Yucca Mountain Administrative Procedure
YMP	Yucca Mountain Project
YSCP	YMP Site Characterization Plan



## 1. INTRODUCTION

Under the provisions of the U.S. Department of Energy's (DOE's) Interim Guidance (Dyer, 1999), a performance assessment is required to demonstrate compliance with the postclosure performance objectives for the Yucca Mountain Project (YMP). Dyer (1999, Section 102(j)) defines a performance assessment as a systematic analysis that (1) identifies the features, events, and processes (FEPs) that might affect the performance of the geologic repository, (2) examines the effects of such FEPs on the performance of the geologic repository, and (3) estimates the expected annual dose to a specified receptor group. The performance assessment must also provide the technical basis for inclusion or exclusion of specific FEPs in the performance assessment (Dyer 1999, Section 114). To address these requirements, the YMP has adopted an approach to selecting scenarios for analysis in the Total System Performance Assessment for the Site Recommendation (TSPA-SR) that is based on the identification and screening of FEPs potentially relevant to the postclosure performance of the proposed Yucca Mountain repository (CRWMS M&O 2000, Section 2.2.).

The purpose of this report is to document (a) the origin and development of a comprehensive list of FEPs potentially relevant to the postclosure performance of the repository, (b) the development, structure, and use of an electronic database capable of storing and retrieving information about the inclusion and/or exclusion of these FEPs in TSPA-SR, and (c) the status of YMP FEPs identification and screening activities for TSPA-SR relative to the NRC acceptance criteria cited in the Total System Performance Assessment and Integration (TSPAI) Issue Resolution Status Report (IRSR) (NRC 2000, Sections 4.1.1.2 and 4.2). This report and the associated database will also serve as a communication tool to assist reviewers during the site recommendation and license application processes.

The electronic YMP FEP Database REV00 (Appendix D of this report) catalogs the YMP FEPs and their associated screening information, which are an integral part of the scenario analysis for TSPA-SR. The five-step scenario analysis approach for TSPA-SR is consistent with the five elements of Subissue 2, Scenario Analysis outlined in the TSPAI IRSR (NRC 2000, Section 4.2). The five steps are:

1. Identification of FEPs
2. Classification of FEPs
3. Screening of FEPs
4. Formation of Scenario Classes
5. Screening of Scenario Classes

The information in the YMP FEP Database REV00 (Appendix D) was developed external to the database - no original information or calculations were generated within the database itself. REV00 of the database contains the following information, which specifically addresses the first three steps of the scenario analysis approach (and correspondingly, the first three elements of TSPAI IRSR Subissue 2):

- YMP FEP List - comprehensive list of FEPs that have the potential to influence repository performance.

- FEP Classifications - categorization of FEPs in accordance with a hierarchical organizational structure that groups similar FEPs together and allows for relationships between FEPs to be identified.
- FEP Screening Decisions and Supporting Documentation - for each FEP the technical basis for inclusion or exclusion in the TSPA-SR analyses is summarized as taken from FEP Analysis/Model Reports (AMRs).

The information catalogued in the database, specifically the included (screened in) FEPs, provides the basis for scenario class formation and screening, the final two steps of the scenario analysis approach. However, these two steps (and correspondingly, the fourth and fifth elements of TSPA IRSR Subissue 2) are outside the scope of the database and are planned to be addressed in the TSPA-SR.

The origin and development of the YMP FEP list is described in Section 2 of this report. The development of the FEP classifications and the organizational structure of the database are described in Section 3. These two sections also contain discussions of future (i.e., subsequent to REV00) enhancements. The FEP screening decisions and supporting documentation (collectively referred to as the screening discussions) were taken from FEP AMRs, listed in Table 1. Each FEP AMR was associated with a Process Model Report (PMR) subject area.

Table 1. FEP AMRs Contributing Screening Information to the YMP FEP Database REV00

PMR Subject Area	FEP AMR DI	Reference
Unsaturated Zone Flow and Transport (UZ)	ANL-NBS-MD-000001 REV00	CRWMS M&O 2000i
Saturated Zone Flow and Transport (SZ)	ANL-NBS-MD-000002 REV00	CRWMS M&O 2000g
Biosphere (Bio)	ANL-MGR-MD-000011 REV00	CRWMS M&O 2000f
Disruptive Events (DE)	ANL-WIS-MD-000005 REV00	CRWMS M&O 2000c
Waste Package Degradation (WP)	ANL-EBS-PA-000002 REV00	CRWMS M&O 2000j
Waste Form Degradation (WF)		
- Miscellaneous FEPs (WF Misc)	ANL-WIS-MD-000009 REV00	CRWMS M&O 2000k
- Cladding FEPs (WF Clad)	ANL-WIS-MD-000008 REV00	CRWMS M&O 2000b
- Colloid FEPs (WF Col)	ANL-WIS-MD-000012 REV00	CRWMS M&O 2000n
Near Field Environment (NFE)	ANL-NBS-MD-000004 REV00	CRWMS M&O 2000h
Engineered Barrier System Degradation, Flow, and Transport (EBS)	ANL-WIS-PA-000002 REV00	CRWMS M&O 2000d
System-Level FEPs (SYS*)	ANL-WIS-MD-000019 REV00B	CRWMS M&O 2000m
Criticality FEPs (CRIT*)	Not available for database REV00	N/A

\* Not a PMR.

Each FEP AMR was prepared in accordance with AP-3.10Q, *Analyses and Models*, and provided qualified documentation of the screening decisions for each FEP relevant to the subject area. Technical details of specific screening discussions and screening criteria are documented in the FEP AMRs, not in this report. However, a general discussion of the nature of the screening discussions and future enhancements is presented in Section 4 of this report.

The YMP FEP Database REV00 (Appendix D) evolved from preliminary versions REV00A, REV00B, and REV00C. The evolution of the database versions leading to REV00 is described in more detail in Section 5 of this report.

A summary of the development and contents of the YMP FEP Database REV00 is provided in Section 6. The summary section also discusses the transparency and traceability, comprehensiveness, categorization, and screening of the YMP FEPs relative to the TSPAI IRSR subissues. Instructions for using the database are provided in Appendix B.

The Quality Assurance (QA) program applies to the development of this technical report. The Performance Assessment Operations responsible manager has evaluated this development activity in accordance with QAP-2-0, *Conduct of Activities*. The QAP-2-0 activity evaluation, *Conduct of Performance Assessment* (CRWMS M&O 1999a), has determined that the preparation and review of this technical report is subject to *Quality Assurance Requirements and Description* (QARD) DOE/RW-0333P (DOE 2000) requirements. Though QAP-2-0, *Conduct of Activities*, has been replaced by AP-2.16Q, *Activity Evaluation*, this activity evaluation remains in effect. A development plan for these activities (CRWMS M&O 2000a) was prepared, issued, and utilized in accordance with AP-2.13Q, *Technical Product Development Planning*. The technical report itself was prepared in accordance with AP-3.11Q, *Technical Reports*.

The database is controlled in accordance with the processes described on the Process Control Evaluation for Supplement V Form (CRWMS M&O 1999b). These processes were developed under YAP-SV.1Q, *Control of the Electronic Management of Data*, to ensure the accuracy, completeness, and security at the data transfer from the FEP AMRs to the database. As described in CRWMS M&O (2000a), these processes are also applicable to the new procedure AP-SV.1Q, *Control of the Electronic Management of Data*.

This technical report describes a database that catalogs technical information that was developed in supporting AMRs, but is not used to generate any new or independent technical information. Therefore, this technical report and the associated database will not affect the critical characteristics of the system and will not be directly relied upon to address safety or waste isolation issues.

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## 2. IDENTIFICATION OF THE YMP FEP LIST

The development of a comprehensive list of FEPs potentially relevant to the postclosure performance of the proposed Yucca Mountain repository is an ongoing, iterative process based on site-specific information, design, and regulations. The list of FEPs catalogued in the YMP FEP Database REV00 (Appendix D) was developed using the following approach:

- Develop an initial list of general FEPs from other radioactive waste disposal programs.
- Supplement the general list with FEPs from project-specific literature.
- Augment the list through brainstorming and iterative review from CRWMS M&O subject matter experts (e.g., at technical workshops and in technical reports)
- Augment the list with feedback from external sources (e.g., NRC/DOE Technical Exchange and Appendix 7 Meetings, NRC IRSRs).

This approach combines the bottom-up (i.e., non-systematic, all-inclusive) identification of an initial FEP list with a top-down (i.e., systematic) series of reviews.

### 2.1 INTERNATIONAL FEPs

The YMP FEPs list was initially populated with 1261 FEPs compiled by other radioactive waste programs. The FEPs were taken from Version 1.0 of an electronic FEP database (Safety Assessment Management (SAM) 1997) maintained by the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-Operation and Development (OECD). The NEA database contains FEPs from seven programs, and is the most complete attempt internationally at compiling a comprehensive list of FEPs potentially relevant to radioactive waste disposal. Consistent with the diverse backgrounds of the waste disposal programs contributing to the NEA list, FEPs were identified by a variety of methods, including expert judgment, informal elicitation, event tree analysis, stakeholder review, and regulatory stipulation.

Version 1.0 of the NEA database exists in draft form only. It contains extensive descriptions of potentially relevant FEPs from each of the seven programs along with program-specific technical discussions regarding their applicability. The YMP FEPs list includes the relevant portions of each of the NEA FEPs, but does not include the program-specific details unless they are also relevant to YMP. SAM (1997, Section 2.3) identifies the publications listed in Table 2 as the basis for the NEA FEPs. However, in many cases the draft NEA database contains more extensive FEP descriptions than the supporting publications. The number of FEPs in the database from each of these international programs is also listed in Table 2.

Table 2. Origin of the 1261 FEPs in the NEA Database

Nation	Organization	Type of Study	Number of FEPs (*)	Reference
Canada	Atomic Energy of Canada, Ltd. (AECL)	Scenario Analysis	281	Goodwin et al. 1994
International	Nuclear Energy Agency (NEA)	Scenario Working Group	146	NEA 1992

Table 2. Origin of the 1261 FEPs in the NEA Database (cont.)

Nation	Organization	Type of Study	Number of FEPs (*)	Reference
Sweden	Swedish Nuclear Power Inspectorate (SKI)	SITE-94	106	Chapman et al. 1995
Sweden	Joint – SKI and Swedish Nuclear Fuel Management Co. (SKB)	Scenario Development	158	Andersson 1989
United Kingdom	Her Majesty's Inspectorate of Pollution (HMIP)	Intermediate and low-level waste disposal	79	Miller and Chapman 1993
Switzerland	National Cooperative for Disposal of Radioactive Waste (Nagra)	Kristallin-1	245	NAGRA 1994
United States	DOE Waste Isolation Pilot Plant (WIPP)	Compliance Application	246	DOE 1996

\* These include FEPs from both the cited reference and the draft NEA database.

## 2.2 YMP-SPECIFIC FEPS

The 1261 NEA FEPs in the YMP FEP list were supplemented with 292 YMP-specific FEPs identified in a search of YMP literature (Barr 1999). Because the YMP is the only repository proposed for an unsaturated fractured tuff, many of these FEPs represent events and processes not otherwise included in the international compilation. The 1988 Site Characterization Plan (DOE 1988, Section 8.3.5.13) itemized 99 specific issues, from which 91 YMP-specific FEPs were identified. The other 8 issues were considered to be better captured or subsumed in other similar but more broadly defined FEPs. Other project documents provided the general basis for 201 additional YMP-specific FEPs as described in Barr (1999). The origins of the 292 YMP-specific FEPs are summarized in Table 3.

Table 3. Origin of the 292 FEPs Identified by a Review of YMP Literature

Source Document	Number of FEPs	Reference
YMP Site Characterization Plan	91	DOE 1988
Other YMP Documents	201	Barr 1999

## 2.3 ITERATIVE CRWMS M&O REVIEW OF THE YMP FEP LIST

The resulting YMP list of 1553 FEPs identified from the NEA database and YMP literature was taken to a series of technical workshops convened between December, 1998 and April, 1999 (Table 4). At these workshops, the FEPs relevant to each subject area were reviewed and discussed by subject matter experts within the project. During these reviews and the associated brainstorming, workshop participants identified 82 additional YMP-specific FEPs, as summarized in Table 4. Workshop participants also proposed several issues that were related to FEPs already in the database, in which case the existing FEP descriptions were expanded to include the new issues.

Table 4. Origin of the 82 FEPs Identified at YMP Workshops Held 12/98 – 4/99

Workshop	Date	Number of FEPs	Reference
Unsaturated-Zone Flow and Transport (UZ)	Dec. 14-16, 1998	0	**
DOE Spent Nuclear Fuel FEPs (DSNF)	Jan. 19, 1999	40	Eide, 2000
Waste Form (WF)	Feb. 2-4, 1999	12	*
Disruptive Events (DE)	Feb. 9-11, 1999	18 6	CRWMS M&O, 1998 *
Saturated Zone Flow/Transport and Biosphere (SZ/Bio)	Feb. 17-19, 1999	1	*
Thermal Hydrology and Coupled Processes (TH)	Mar. 24-25, 1999	1	*
In-Drift Geochem. Environment and EBS Transport (IDGE/EBS)	Apr. 13-15, 1999	2	*
Waste Package Degradation (WP)	Apr. 20-21, 1999	2	*

\* Indicates that new FEPs were generated by roundtable discussion and subsequently entered directly into database.

\*\* Indicates that no new FEPs were generated at this workshop.

Except for the 40 FEPs from the DSNF Workshop and 18 criticality-related FEPs from the DE Workshop, these additional YMP-specific FEPs were developed informally during roundtable discussions at the workshops and have no formal documentation. Eide (2000, Tables 1 and 2) documents 25 YMP DSNF-related FEPs derived using a master logic diagram (MLD) approach and an additional 15 DSNF FEPs derived using a comparison approach (CA) between DSNF and Commercial Spent Nuclear Fuel (CSNF). The origin of the 18 criticality FEPs from CRWMS M&O (1998, Section 3.1) is noted in specific entries in the database. These FEPs include in-situ criticality (ISC), near-field criticality (NFC), and far-field criticality (FFC).

A second round of reviews by subject matter experts was performed in 1999 and 2000 in association with the development of FEP AMRs (listed in Table 1). During the preparation of the FEP AMRs, subject matter experts reviewed the existing FEPs relevant to their subject area and where necessary identified new or missing FEPs. This review and documentation process identified 9 additional FEPs as summarized in Table 5.

Table 5. Origin of the 9 FEPs Identified in FEP AMRs

FEP AMR Subject Area and ID	Number of FEPs	Reference
WF Misc ANL-WIS-MD-000009	2	CRWMS M&O 2000k
WF Clad ANL-WIS-MD-000008	2	CRWMS M&O 2000b
WF Col ANL-WIS-MD-000012	3	CRWMS M&O 2000n
EBS ANL-WIS-MD-000002	2	CRWMS M&O 2000d

For FEPs related to EBS degradation, flow, and transport, a systematic top-down study (CRWMS M&O 2000e) was performed to identify any potential FEPs not on the list of FEPs distributed to the EBS FEP AMR (CRWMS M&O 2000d). The results of the top-down study confirmed the existing EBS-related FEPs and identified the two new FEPs noted in Table 5, which were incorporated into the EBS FEP AMR (CRWMS M&O 2000d).

## 2.4 EXTERNAL REVIEW OF THE YMP FEP LIST

An interim version of the YMP FEP list was provided to the NRC in association with the NRC/DOE Appendix 7 Meeting on the FEPs Database held September 8, 1999. A subsequent NRC audit of this interim version of the YMP FEP list identified one potential FEP unrelated to any existing FEPs (Pickett and Leslie 1999, Section 3.3). The audit also identified three potential FEPs that were possibly related to existing FEPs. Two of these FEPs were subsequently determined to be redundant to or subsumed in existing FEPs. The other two FEPs, noted in Table 6, were added to the YMP FEP list.

Table 6. Origin of the 2 FEPs Identified in External Reviews

Review	Number of FEPs	Reference
NRC NFE Audit	2	Pickett and Leslie, 1999

## 2.5 FUTURE DEVELOPMENT OF THE YMP FEP LIST

While the FEPs catalogued in the YMP FEP Database REV00 are considered to be reasonably comprehensive (see Section 6.1.2 for further discussion), the YMP FEP list is open and may continue to expand if additional FEPs are identified either within the CRWMS M&O and DOE or from external sources. New FEPs, if identified, will be incorporated into subsequent revisions of the database.

REV01 of the database is planned to be completed to support TSPA-SR REV01, conditional on the completion of REV01 of FEP AMRs where necessary. In addition, this report is planned to be updated to REV01 to describe the changes. The YMP FEP list in REV01 of the database may be updated through the following activities:

- A systematic review of NRC IRSR Key Technical Issues and Subissues is planned to identify any new FEPs.
- A review of Version 1.2 of the NEA database to identify any new FEPs.
- Resolution of any outstanding NRC NFE audit issues identified in Pickett and Leslie (1999).



### 3. YMP FEP CLASSIFICATIONS

#### 3.1 DATABASE STRUCTURE

Many FEP classification schemes are possible, and there is no inherently correct way to order FEPs. The structure of the YMP FEP Database REV00 (Appendix D) follows the NEA classification scheme (SAM 1997, Section 3), in which FEPs are organized under a hierarchical structure of layers, categories, and headings. The NEA structure comprises a comprehensive group of subject areas potentially relevant to radioactive waste disposal that was developed to systematically classify the FEPs from seven different international programs (Section 2.1). The NEA classification scheme was selected because it maintains consistency between NEA and YMP databases, which facilitates reviewing for completeness.

The structure of the NEA FEP Database Version 1.0 is defined by 4 layers, 12 categories, and 134 headings. The search of YMP literature for FEPs by Barr (1999) identified an additional heading relevant to YMP (the Nuclear Criticality heading in the Geologic Environment category) that was not in the NEA database. Therefore, the YMP FEP Database REV00 has 4 layers, 12 categories, and 135 headings. The hierarchical relationship between these layers, categories, and headings is shown in Table 7.

Table 7. Hierarchical Structure of the YMP FEP Database REV00

Layers	Categories	Headings (*)
0. Assessment Basis		0.1.01 Impacts of concern 0.1.02 Timescales 0.1.03 Spatial domain 0.1.04 Repository assumptions 0.1.05 Future human action assumptions 0.1.06 Future human behavior assumptions 0.1.07 Dose response assumptions 0.1.08 Aims of the assessment 0.1.09 Regulatory requirements and exclusions 0.1.10 Model and data issues
1. External Factors	1.1 Repository Issues	1.1.01 Site investigation 1.1.02 Excavation/construction 1.1.03 Emplacement of wastes 1.1.04 Closure and sealing 1.1.05 Records and markers 1.1.06 Waste allocation 1.1.07 Design 1.1.08 Quality control 1.1.09 Schedule and planning 1.1.10 Administrative control of site 1.1.11 Monitoring 1.1.12 Accidents and unplanned events 1.1.13 Retrievability

Table 7. Hierarchical Structure of the YMP FEP Database REV00 (cont.)

Layers	Categories	Headings (*)
1. External Factors (cont.)	1.2 Geologic Processes and Effects	1.2.01 Tectonic movements 1.2.02 Deformation 1.2.03 Seismicity 1.2.04 Volcanic activity 1.2.05 Metamorphism 1.2.06 Hydrothermal activity 1.2.07 Erosion and sedimentation 1.2.08 Diagenesis 1.2.09 Salt diapirism and dissolution 1.2.10 Hydrologic response to geologic changes
	1.3 Climatic Processes and Effects	1.3.01 Climate change, global 1.3.02 Climate change, regional 1.3.03 Sea level changes 1.3.04 Periglacial effects 1.3.05 Glacial and ice sheet effects 1.3.06 Warm climate effects 1.3.07 Hydrologic response to climate change 1.3.08 Ecological response to climate change 1.3.09 Human response to climate change
	1.4 Future Human Actions (Active)	1.4.01 Human influences on climate 1.4.02 Inadvertent/deliberate human actions 1.4.03 Un-intrusive site investigation 1.4.04 Drilling activities 1.4.05 Mining and other underground activities 1.4.06 Surface environment 1.4.07 Water management (wells, reservoirs) 1.4.08 Social developments 1.4.09 Technological developments 1.4.10 Remedial actions 1.4.11 Explosions and crashes
	1.5 Other	1.5.01 Meteorite impact 1.5.02 Species evolution 1.5.03 Miscellaneous (earth tides)
2. Disposal System Domain: Environmental Factors	2.1 Wastes and Engineered Features	2.1.01 Inventory 2.1.02 Waste form 2.1.03 Waste container 2.1.04 Backfill 2.1.05 Seals, cavern/tunnel/shaft 2.1.06 Other features (drip shield, invert) 2.1.07 Mechanical processes and conditions 2.1.08 Hydrogeologic processes and conditions 2.1.09 Geochemical processes and conditions 2.1.10 Biological processes and conditions 2.1.11 Thermal processes and conditions 2.1.12 Gas sources and effects 2.1.13 Radiation effects 2.1.14 Nuclear criticality

Table 7. Hierarchical Structure of the YMP FEP Database REV00 (cont.)

Layers	Categories	Headings (*)
<p>2. Disposal System Domain: Environmental Factors (cont.)</p>	<p>2.2 Geologic Environment</p>	<p>2.2.01 Excavation disturbed zone 2.2.02 Host rock 2.2.03 Geologic units, other 2.2.04 Discontinuities, large scale 2.2.05 Contaminant transport pathways 2.2.06 Mechanical processes and conditions 2.2.07 Hydrogeologic processes and conditions 2.2.08 Geochemical processes and conditions 2.2.09 Biological processes and conditions 2.2.10 Thermal processes and conditions 2.2.11 Gas sources and effects 2.2.12 Undetected features 2.2.13 Geological resources 2.2.14 Nuclear criticality</p>
	<p>2.3 Surface Environment</p>	<p>2.3.01 Topography 2.3.02 Soil 2.3.03 Aquifers / water-bearing features, near surface 2.3.04 Lakes, rivers, streams, springs 2.3.05 Coastal features 2.3.06 Marine features 2.3.07 Atmosphere 2.3.08 Vegetation 2.3.09 Animal populations 2.3.10 Meteorology 2.3.11 Hydrologic regime and water balance 2.3.12 Erosion and deposition 2.3.13 Ecological / biological / microbial systems</p>
	<p>2.4 Human Behavior</p>	<p>2.4.01 Human characteristics 2.4.02 Adults, children, infants 2.4.03 Diet and fluid intake 2.4.04 Habits, non-diet-related 2.4.05 Community characteristics 2.4.06 Food and water processing and preparation 2.4.07 Dwellings 2.4.08 Wild / natural land and water use 2.4.09 Rural / agricultural land and water use 2.4.10 Urban / industrial land and water use 2.4.11 Leisure and other uses of environment</p>
<p>3. Disposal System Domain: Radionuclide / Contaminant Factors</p>	<p>3.1 Contaminant Characteristics</p>	<p>3.1.01 Radioactive decay and ingrowth 3.1.02 Chemical/organic toxin stability 3.1.03 Inorganics 3.1.04 Volatiles 3.1.05 Organics 3.1.06 Noble Gases</p>

Table 7. Hierarchical Structure of the YMP FEP Database REV00 (cont.)

Layers	Categories	Headings (*)
3. Disposal System Domain: Radionuclide / Contaminant Factors (cont.)	3.2 Contaminant Release / Migration Factors	3.2.01 Dissolution, precipitation, crystalization 3.2.02 Speciation and solubility 3.2.03 Sorption / desorption processes 3.2.04 Colloids 3.2.05 Chemical/complexing agents, effect on transport 3.2.06 Microbiological / plant-mediated processes 3.2.07 Water-mediated transport 3.2.08 Solid-mediated transport 3.2.08 Gas-mediated transport 3.2.10 Atmospheric transport 3.2.11 Animal, plant, microbe mediated transport 3.2.12 Human-action-mediated transport 3.2.13 Foodchains, uptake of contaminants in
	3.3 Exposure Factors	3.3.01 Drinking water, food, drugs, concentrations in 3.3.02 Environmental media, concentrations in 3.3.03 Non-food products, concentrations in 3.3.04 Exposure modes 3.3.05 Dosimetry 3.3.06 Radiological toxicity / effects 3.3.07 Non-radiological toxicity / effects 3.3.08 Radon exposure

\* some heading descriptions are paraphrased

Each of the 1646 FEPs in the YMP FEP list identified in Section 2 of this report was assigned (mapped) to a single heading in the YMP FEP Database. For the 1261 FEPs adopted from other international programs (Table 2), preliminary mappings were based on the relationships identified in the NEA database, although some adjustments were made to reflect YMP-specific conditions. The task of finding unique mappings was complicated by the fact that many FEPs in the NEA database are mapped to multiple headings. In cases where more than one heading was identified, the most relevant one for YMP was selected and cross-references were made to the others. This approach eliminated duplicative entries in the YMP FEP Database. For the 385 YMP-specific FEPs (Tables 3 through 6), which are not included in the NEA database, preliminary mappings were made to the most relevant heading. The preliminary mappings were reviewed during the 12/98 - 4/99 workshops (Table 4) and during preparation of the FEP AMRs (Table 1) and some changes in mapping were made as defined by subject matter experts.

Each of the 1646 FEPs in the YMP FEP list is an individual entry (record) in the YMP FEP Database as are the 151 layer, category, and heading entries that define the YMP FEP classifications. Therefore, the YMP FEP Database REV00 (Appendix D) contains a total of 1797 individual entries. The mapping of FEP entries to the heading entries resulted in a database where all related entries were grouped together under the same classification heading (with overarching categories and levels). Links between database entries and specific FEP AMR/PMR subject areas (see Section 3.4) allow for additional groupings to be examined. A further categorization of the entries, to better facilitate systematic screening, is described in Section 3.2.

### 3.2 PRIMARY AND SECONDARY FEPS

There is no uniquely correct level of detail at which to define and/or aggregate FEPs. In the case where FEPs are too narrowly defined, it is infeasible to develop specific screening decisions for each FEP. Instead, it becomes more efficient to develop more broadly based screening decisions that apply to multiple, related FEPs. In the case where FEPs are too coarsely defined, it becomes difficult to isolate important subissues and consequently some important subissues may get excluded while other unimportant issues may get included. For efficiency, FEPs need to be aggregated at the coarsest level at which technically sound screening decisions can be made, while still maintaining adequate detail for the purposes of the analysis.

The all-inclusive bottom-up approach used to develop the YMP FEP list resulted in considerable redundancy in the FEP list, because the same FEPs were frequently identified by multiple sources. This was especially true of the international FEPs, where each of the seven programs would often identify the same FEP (e.g., meteorite impact). It was also true of the YMP-specific FEPs (and some of the more general international FEPs), where variations of the same FEP would be identified in various literature or reviews.

To eliminate the redundancy and to create a more efficient aggregation of FEPs to carry forward into the screening process (Section 4), each of the 1797 entries catalogued in the YMP FEP Database REV00 was further identified as either a primary, secondary, or classification (layer, category, or heading) entry. Assignments to each of the three types of entries were based on the follow criteria:

**Primary FEP Entry** - Database entries that encompass a single process or event, or a few closely related or coupled processes or events that can be addressed by a specific screening discussion. Each primary FEP is addressed by a YMP-specific screening discussion taken from one or more FEP AMRs. A primary FEP may also include one or more related secondary FEPs that are covered by the same screening discussion.

**Secondary FEP Entry** - Database entries that are (1) redundant to another FEP (e.g., several NEA contributors identified the same FEP), (2) specific to another program (and captured more generally in a different YMP-specific FEP), or (3) better captured or subsumed in another similar but more broadly-defined YMP-specific FEP. Each secondary FEP is mapped to a primary FEP and must be completely addressed by the screening discussion of that primary FEP.

**Classification (Layer, Category, Heading) Entry** - Database entries that represent the hierarchical levels of classification within the database (see Table 7). Classification entries are neither primary FEPs nor secondary FEPs. They are defined too broadly to be addressed by a single screening discussion (as with a primary FEP) and cannot be encompassed by overlying FEP (as with a secondary FEP). Rather, they classify one or more underlying related primary FEPs and do not require screening discussions.

Based on the preliminary mapping of the FEP entries to the heading entries (described in Section 3.1), a preliminary attempt was made to identify primary, secondary, and classification entries. The following steps were followed:

1. The 4 layer, 12 category, and 135 heading entries were initially defined as classification entries (as described in Step 4 below, some heading entries were subsequently re-classified as primary FEPs).
2. The FEP entries mapped under each heading were informally separated into groups of related FEPs (e.g., under 2.1.03 Waste Container were such groupings as corrosion, mechanical damage, and early failures).
3. Each of the informal groupings of related FEPs from step 2 was further evaluated to identify FEPs that would likely require separate screening discussions. These independent FEPs were identified as primary FEPs (with no associated secondary FEPs).
4. In some cases, the informal groupings of FEPs under a specific heading entry were closely enough related that they could all be addressed by a screening discussion at the overlying heading level. In these cases, the heading entry (previously defined as a classification entry in step 1) was designated as a primary FEP. The underlying FEPs were designated as secondary FEPs to the heading level primary FEP.
5. Each of the remaining informal groupings of related FEPs from step 2 (that were not mapped as independent in step 3 or heading level in step 4) was further evaluated to better identify (a) multiple FEPs covering related or coupled processes or events that could likely be addressed by a single screening discussion, or (b) redundant FEPs. The resulting groups of FEPs were each selected to be represented by a primary FEP.
6. Each of the primary FEP groups identified from step 5 were examined to select a specific primary FEP. The primary FEP was chosen from the group of related or redundant FEPs as the FEP that best represented and was most inclusive of the group of FEPs as a whole. The other FEPs in the group were designated as secondary FEPs to the selected primary FEP.
7. For each of the primary FEPs (selected in steps 3, 4, and 6), a YMP primary FEP description was prepared. This description was based on the FEP description provided by the originator (e.g., the NEA database or YMP literature). The originator description was (a) edited to ensure that it was specific to YMP, and (b) expanded to ensure that all aspects of the related secondary FEPs were also addressed.

Because any categorization of FEPs is subjective, the preliminary identification of primary, secondary, and classification entries was reviewed by subject matter experts. During the 12/98 - 4/99 workshops (Table 4) some primary and secondary categorizations were revised and some of the FEPs were remapped to different headings. During preparation of the FEP AMRs (Table 1), additional changes to primary and secondary FEP mappings and to the YMP primary FEP descriptions were identified. The FEP AMRs also confirmed that the remaining mappings were appropriate and that the YMP primary FEP descriptions did encompass all aspects of the related secondary FEPs.

After all the reviews and confirmations, the YMP FEP Database REV00 (Appendix D) contains 111 classification entries (151 less 40 heading entries that are also primary FEPs), 323 primary FEP entries (including the 40 headings) and 1363 secondary FEP entries.

The objective of the categorization into primary, secondary, and classification entries was to identify a subset of FEP entries, the primary FEPs, which capture all of the issues relevant to the postclosure performance of the proposed Yucca Mountain repository and that can be addressed at an appropriate level of screening. As a result of the categorization described in this section, it was only necessary to develop screening decisions and supporting documentation (as described in Section 4) for the 323 primary FEPs, not for all 1797 YMP FEP list entries. A minor exception was found in the input AMRs. Two secondary FEPs, 2.1.02.08.04 and 1.4.01.03.01, were addressed explicitly. All other secondary FEPs were screened at the overlying primary FEP level.

### 3.3 ORGANIZATION AND NUMBERING OF DATABASE ENTRIES

The organization of the FEP entries within the YMP FEP Database REV00 to follow the NEA hierarchical structure is controlled by the YMP FEP database number associated with each FEP entry. This number has the form x.x.xx.xx.xx and defines classification (layer, category, heading), primary, and secondary entries as follows:

x.0.00.00.00 Layer

x.x.00.00.00 Category

x.x.xx.00.00 Heading (some of these are also Primary FEPs)

x.x.xx.xx.00 Primary FEP (where the first x.x.xx is the overlying Heading)

x.x.xx.xx.xx Secondary FEP (where the first x.x.xx.xx is the overlying primary FEP)

With this numbering scheme, the YMP FEP database number always identifies which heading a primary FEP is mapped to and which primary FEP a secondary FEP is associated with.

The Microsoft Access version of REV00 (see Section 5.4) has an option to display the database with a directory tree indicating the YMP FEP database numbers and FEP names. The directory tree can be expanded or contracted with a mouse click, in similar fashion to a Microsoft Windows Explorer directory view. This directory tree functionality (described in more detail in Appendix B) can be used to easily view the numbering scheme, see where in the database hierarchy a particular FEP is assigned, and identify related FEPs.

The Microsoft Access version also has the capability to perform keyword searches from a pull-down menu. This functionality allows FEPs with common feature, event, or process keywords to be identified. The lists of keywords are not yet implemented. However, for subsequent revisions, keywords will be assigned to all primary FEPs.

### 3.4 DATABASE FIELDS

For each of the 1797 entries in REV00 of the database, there are 26 data/text fields. Each of these fields is described below. Fields which contain input or confirmation from the FEP AMRs are noted with a double underline.

**YMP FEP Database Number:** Numeric identifier that places the FEP in the proper location within the database structure. The numbering scheme follows a hierarchical structure classifying FEPs into layers (x...), categories (x.x...), headings (x.x.xx...), primary FEPs (x.x.xx.xx...), and secondary FEPs (x.x.xx.xx.xx).

**FEP Name:** Short, descriptive title of FEP.

**FEP Class:** Identification of primary, secondary, and classification (layer, category, heading) entries. Primary FEPs are those FEPs for which the YMP has developed and documented screening discussions. Secondary FEPs are mapped to primary FEPs either because they are redundant with the associated primary FEP or because they represent a subcase of the primary FEP that is more effectively addressed at a higher level. Secondary FEPs are retained in the database for completeness, but users of the database are referred to the related Primary FEPs for the screening discussions.

**Related FEPs:** Identification of entries containing related information. For primary FEPs, other related primary FEPs (if any) are listed. For secondary FEPs, the associated primary FEP is listed. For heading classification entries, underlying primary FEPs are listed. However, for layer and category classification entries, underlying headings are assumed to be related and are not listed explicitly.

**Source Identifier:** Alphanumeric identifier that provides traceability to the originator (e.g., NEA contributing program, YMP workshop, FEP AMR, etc.) as shown in Table 8. Note that the Source Identifier is not related to the NEA structure or YMP FEP Database Number.

**NEA Category:** Alphanumeric identifying the preliminary mapping of the FEPs relative to the NEA database headings. This field is based on preliminary mapping and has been superceded by the YMP FEP Database Number field. It is retained only for traceability to earlier versions of the database. Note that for new FEPs that were identified during and subsequent to the 12/98 - 4/99 workshops, the Source Identifier is repeated in the NEA Category field.

**YMP Primary FEP Description:** Description of each FEP and its potential relevance to YMP, typically edited from the originator description. Where secondary FEPs are associated with a primary FEP, the description also includes all of the features, events, and processes described by the secondary FEPs.

**Originator FEP Description:** Verbatim text of FEP description from originator documentation. Originator is noted in parentheses where possible.

**Screening Decision:** A statement of whether the FEP is included in the quantitative TSPA models or excluded from the TSPA on specific criteria provided by the regulations.

**Screening Argument:** A summary discussion of the technical basis for the Screening Decision, with citations to appropriate Analysis Model Reports (for excluded FEPs, this is the key text).



**TSPA Disposition:** A summary discussion of the treatment of the FEP in the TSPA, with citations and cross-references to the appropriate Analysis Model Reports (for included FEPs, this is the key text).

**PMR:** Identifies the Process Model Report (PMR) subject area that was assigned initial responsibility for technical evaluation of the FEP. This field was not updated for REV00, instead the subject area where the FEP was ultimately addressed is listed in the Input AMR field.

**Input AMR:** Identifies the FEP Analysis/Model Report (AMR) where the qualified screening discussion is documented. Verbatim text for several fields including the Screening Decision, Screening Argument, TSPA Disposition, Supplemental Discussion, and References are taken from the Input AMR. The Input AMR identifier also indicates the subject area in which the FEP is grouped.

**IRSR:** Identifies NRC IRSR subissues related to the FEP.

**Supplemental Discussion:** Additional information supporting the Screening Decision, beyond what is summarized in the Screening Argument and TSPA Disposition fields.

**References:** References cited in the Screening Argument and/or TSPA Disposition summaries.

**Modified by:** Name of last person to modify FEP record.

**Mod Date:** Date of last modification to FEP record.

**Mod Time:** Time of last modification to FEP record.

**Record Number:** Numeric identifier of record sequence.

**F Keyword:** Identifier feature keyword from a specified list that is used for keyword searches. For REV00 this field is blank.

**E Keyword:** Identifier event keyword from a specified list that is used for keyword searches. For REV00 this field is blank.

**P Keyword:** Identifier process keyword from a specified list that is used for keyword searches. For REV00 this field is blank.

**Workshop:** Identifies all of the Workshops held between 12/98 - 4/99 where the FEP was reviewed and discussed. This field is retained only for traceability back to preliminary versions of the database.

**Owner:** Technical subject matter expert given responsibility to address the FEP at the 12/98 - 4/99 workshops. This field has been superceded by the Input AMR field, which now establishes FEP ownership. For REV00 this field is blank.

**Notes:** Miscellaneous notes and comments related to the FEP.

Table 8. Abbreviations Used in Source Identifier Field

Source (see Tables 2 through 6)	Source Identifier Format
AECL	Ax.xxx
NEA	Nx.x.xx
SKI/SKB	Jx.x.xx
SKI	Sxxx
HMIP	HMIPx.x.x
Nagra	Kx.xx
DOE-WIPP	Wx.xxx
YMP Site Characterization Plan (SCP)	YSCPxx
Other YMP Documents	Ymxx
UZ Workshop	UZ/xxxx
DSNF Workshop	CA-x, MLD-x
WF Workshop	WF/xxxx
DE Workshop	DE/xxxx, ISC-x, NFC-x, FFC-x
SZ/Bio Workshop	SZ/xxxx, BIO/xxxx
TH Workshop	TH/xxxx
IDGE Workshop	ID/xxxx
WP Workshop	WP/xxxx
NEA Layer, Category, Heading	NEA xxxxxxxx
Other Layer, Category, Heading	Non-NEA xxxxxxxx
WF Miscellaneous FEP AMR	WF Misc AMR-x
WF Cladding FEP AMR	WFCld AMR-x
WF Colloid FEP AMR	WFCol AMR-x
EBS FEP AMR	EBS AMR-x
NRC NFE Audit	NRC-x

### 3.5 FUTURE DEVELOPMENT OF THE YMP FEP CLASSIFICATIONS

REV01 of the database is planned to be completed to support TSPA-SR REV01, conditional on the completion of REV01 of FEP AMRs where necessary. In addition, this report is planned to be updated to REV01 to describe the changes. The classifications, categorizations, and the identification of relationships between FEPs in REV01 of the database may be updated through the following activities:

- Addition of separate keyword lists for features, events, and processes to enable the keyword search capability that is described in Section 3.3 and Appendix B.
- Further review of current primary / secondary mappings by subject matter experts during revisions to FEP AMRs.
- Addition of explicit statements identifying how secondary FEPs relate to primary FEPs (i.e., redundant, subsumed, etc.). These statements would be confirmed by subject matter experts.

- Identification of mapping between FEPs and entries in a proposed database of NRC IRSR Key Technical Issues and subissues.
- Identification of mapping between FEPs and process model factors from the Repository Safety Strategy (RSS).
- Development of an interaction matrix of FEP relationships, if necessary.

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## 4. YMP FEP SCREENING DECISIONS AND SUPPORTING DOCUMENTATION

### 4.1 SCREENING CRITERIA

Each primary FEP (and, by association, each secondary FEP) was screened for inclusion or exclusion in the TSPA on the basis of three criteria, developed from DOE's Interim Guidance (Dyer 1999). The three criteria are as follows:

**Regulatory** - DOE's Interim Guidance (Dyer 1999, Subpart E) provides regulatory guidance regarding certain assumptions about the TSPA. FEPs which are inconsistent with these assumptions may be excluded (screened out) from the TSPA by regulation. The most notable examples are the regulatory specification of the human intrusion scenario and the critical group characteristics.

**Probability** - The probability criterion is stated in DOE's Interim Guidance (Dyer 1999, Section 114):

- (d) Consider only events that have at least one chance in 10,000 of occurring over 10,000 years.

FEPs with a lower probability of occurrence may be excluded (screened out) from the TSPA on the basis of low probability.

**Consequence** - The consequence criteria are stated in DOE's Interim Guidance (Dyer 1999, Section 114):

- (e) Provide the technical basis for either inclusion or exclusion of specific features, events and processes of the geologic setting in the performance assessment. Specific features, events, and processes of the geologic setting must be evaluated in detail if the magnitude and time of the resulting expected annual dose would be significantly changed by their omission.
- (f) Provide the technical basis for either inclusion or exclusion of degradation, deterioration, or alteration processes of engineered barriers in the performance assessment, including those processes that would adversely affect the performance of natural barriers. Degradation, deterioration, or alteration processes of engineered barriers must be evaluated in detail if the magnitude and time of the resulting expected annual dose would be significantly changed by their omission.

FEPs whose exclusion would not significantly change the expected annual dose may be excluded (screened out) from the TSPA on the basis of low consequence.

### 4.2 SCREENING GUIDELINES AND IMPLEMENTATION

Because DOE's Interim Guidance (Dyer 1999, Section 114) allows exclusion of FEPs on the basis of either low probability or low consequence, a FEP need not be shown to be both of low

probability and low consequence to be excluded. Therefore, the order in which the criteria are applied is not essential. In some cases, a component of the FEP was included while another component of the FEP was excluded. In practice, regulatory criteria are examined first, and then either probability or consequence criteria examined next at the discretion of the analyst.

As noted in Section 1, the FEP screening was performed by subject matter experts and documented in FEP AMRs (listed in Table 1). Specific screening data from the FEP AMRs was then imported into the YMP FEP Database REV00, in accordance with the data transfer controls (CRWMS M&O 1999b). The screening data is catalogued in the database. The verification of the technical accuracy and completeness of the screening data is the responsibility of the FEP AMRs.

The specific database fields containing screening data from the FEP AMRs were identified in Section 3.4. To satisfy the screening criteria of DOE's Interim Guidance (Dyer 1999, Section 114) and to satisfy the TSPAI IRSR subissues pertaining to FEPs and scenario analysis (NRC 2000, Sections 4.1.1.2 and 4.2), guidelines have been established for the content of four of these fields: YMP Primary FEP Description, Screening Decision, Screening Argument, and TSPA Disposition. Because the technical defensibility of the content of these fields is the responsibility of the FEP AMRs, the content cannot be changed outside of the FEP AMRs. Therefore, these guidelines apply to the FEP AMRs. Key aspects of the guidelines are summarized below:

**YMP Primary FEP Description** - must be relevant to YMP and must include all of the related features, events, and processes identified in associated secondary FEPs.

**Screening Decision** - must state whether the FEP is included or excluded from the TSPA.

For excluded FEPs, the exclusion criteria (regulation, low probability, low consequence) must be explicitly identified.

For partially included / partially excluded FEPs, the various components that are included and excluded must be identified (e.g., FEP 1.2.02.01.000 Fractures has Include (existing), Exclude - Low Consequence (future changes)).

**Screening Argument** - For excluded FEPs this is the main screening discussion. A summary of the technical basis for exclusion must be presented (and the summary must address all secondary FEP issues).

Low probability exclusions must include an explicit comparison of the probability of occurrence to the regulatory criteria ( $<10^{-4}$  in 10,000 years). The probability must be quantified where possible, although non-quantitative low probability arguments are acceptable for "not credible" FEPs.

Low consequence exclusions must include an explicit statement that there is "no significant change in the expected annual dose". The change in expected annual dose must be quantified where possible and the interpretation of "significant change" must be described (it may be different for each FEP). It is acceptable to quantify the change in an intermediate performance measure (e.g. radionuclide mass release to the saturated zone). However, in that case, the qualitative link to change in expected annual dose must be explicitly stated.

Regulatory exclusions must identify a specific regulation and clearly state the rationale.

**TSPA Disposition** - For included FEPs this is the main screening discussion. A summary discussion of the treatment of the FEP in the TSPA must be presented. A statement of the scenario class, model and/or abstraction is desirable.

The screening discussion content, input from the FEP AMRs (Table 1), will be further reviewed for adherence to these guidelines. Where necessary, revisions will be made to the affected FEP AMRs.

In some cases, a primary FEP may affect multiple facets of the project, may be relevant to more than one FEP AMR subject area, or may not fit neatly within the FEP AMR structure. In these cases, rather than create multiple separate FEPs, the FEP was assigned to more than one FEP AMR. These shared FEPs then had separate screening discussions prepared in the separate FEP AMRs. While informal meetings were held to resolve any contradictory screening discussions for shared FEPs, the multiple screening discussions input to the database were not integrated. As a result, shared FEPs in REV00 may contain duplicative screening information. Similarly, some FEP AMRs modified the YMP Primary FEP Descriptions to ensure that all implications of the secondary FEPs were subsumed in the YMP Primary FEP Descriptions. Where these modified FEPs were shared FEPs, multiple YMP Primary FEP Descriptions were input to the database but not integrated. The first description listed in the database was the original description disseminated to all sharing FEP AMRs. If no description is listed in the database for a particular sharing FEP AMR, then by default that FEP AMR used the original description.

#### **4.3 FUTURE DEVELOPMENT OF THE YMP FEP SCREENING DATA**

REV01 of the database is planned to be completed to support TSPA-SR REV01, conditional on the completion of REV01 of FEP AMRs where necessary. In addition, this report is planned to be updated to REV01 to describe the changes. The FEP screening data in the database may be updated through the following activities:

- Addition of screening data for criticality FEPs. As noted in Table 1, criticality FEP screening data were not available. One or more criticality FEP AMRs are planned. Upon completion, the screening data will be transferred to the database from these FEP AMRs.
- Addition of screening data for the NRC NFE audit FEPs (Table 6). These FEPs were not assigned to a FEP AMR and therefore REV00 of the database does not contain any screening information for them. The NRC NFE audit FEPs will be assigned to a FEP AMR for inclusion in REV01 of the database.
- Addition of screening data for FEP 2.2.01.04.00. Ownership of this FEP was transferred from one FEP AMR to another, but the screening discussion was inadvertently omitted from both affected FEP AMRs. It will be re-assigned to the appropriate FEP AMR for inclusion in REV01 of the database.
- Addition of screening decisions based on the current "no backfill" design. The screening discussions in REV00 of the database are based on a repository design that includes backfill. The FEP AMRs will be revised to ICN 1 to add screening discussions for the "no backfill" design. This information will be transferred to the database.

- **Integration of screening information and YMP primary descriptions for shared FEPs (see Section 4.2)**
- **Identification of the scenario class (Nominal, Disruptive, or Human Intrusion) in the Screening Decision field for included FEPs.**
- **Creation of a master list of subject areas where regulatory exclusions may apply, tied to specific regulations. This master list will enhance the defensibility of regulatory exclusions.**
- **Revisions to screening discussions that did not meet the content guidelines outlined in Section 4.2. These revisions must be made in the FEP AMRs rather than in the database directly. Reviews of REV00 screening discussions may identify those FEPs requiring revision.**



## 5. DEVELOPMENT HISTORY OF YMP FEP DATABASE

### 5.1 REV00A

To initiate the FEP screening process for TSPA-SR, a YMP FEP list was distributed electronically on July 1, 1999 to representatives of the FEP AMRs and the associated PMRs listed in Table 1. This preliminary YMP FEP list was catalogued in a preliminary version of the YMP FEP Database identified as REV00A. The YMP FEP list in REV00A contained 1786 entries, categorized as 310 primary and 1476 secondary FEP entries (in REV00A non-primary classification entries were not distinguished from secondary FEP entries). REV00A contained the preliminary YMP Primary FEP Descriptions and draft placeholder text for Screening Decisions, Screening Arguments, and TSPA Dispositions. The placeholder text consisted of preliminary brainstorming information compiled by non-subject matter experts. REV00A also contained a preliminary mapping of primary and secondary FEPs and preliminary FEP AMR and PMR assignments.

Guidance to the FEP AMR subject matter experts (see Section 4.2) requested reviews, edits, and/or replacements to the placeholder text for all of their assigned primary FEPs. The guidance also requested a review to confirm (or suggest changes) that the YMP Primary FEP Descriptions included all relevant issues from associated secondary FEPs and that the primary / secondary mappings and FEP AMR assignments were appropriate.

REV00A, while containing uncontrolled information, marked a transition from the developmental to the operational stage in YMP FEP work. Previous versions of the database had been created for testing, informal internal distribution, and distribution at the 12/98 - 4/99 technical workshops (see Table 4). Information contained in these previous versions had been entered carefully and managed in accordance with standard good working practices, but no formal procedures had been applied that would allow (or require) the database to meet quality assurance (QA) standards for electronic information management (e.g., YAP-SV.1Q, *Control of the Electronic Management of Data*).

The master copy of REV00A was created in Claris FileMaker Pro Version 4.1. The distribution copies, which contain identical information, were in Microsoft Access 97 format.

### 5.2 REV00B

The YMP FEP Database REV00B (CRWMS M&O 1999d) was created from REV00A for distribution to NRC personnel attending a DOE/NRC Appendix 7 Meeting on FEPs on September 8, 1999. REV00B was created in Microsoft Access 97 format as a direct copy of the Microsoft Access version of REV00A. REV00B contained minor changes from REV00A designed to ensure that the recipients (NRC and other personnel) were aware that they had a preliminary version of the FEP Database. Specific changes included adding text to the initial "splash" screen to identify the preliminary status of REV00B and altering the font of the draft placeholder text to italics. There were no changes to the number, organization, or content of the FEP entries themselves.

### 5.3 REV00C

REV00C (CRWMS M&O 1999c) was derived from, and is similar to, REV00A and REV00B. It contains the same 1786 entries (310 primary FEP entries and 1476 secondary FEP entries). REV00C was the first revision with information controlled in accordance with the processes outlined in CRWMS M&O 1999b. REV00C was created in preparation for input of screening information developed in the FEP AMRs. Changes from REV00A are described in detail in the documentation for REV00C (CRWMS M&O 1999c). The major changes were:

1. Draft placeholder text (screening decision and supporting documentation) was deleted from the database.
2. Introductory text was added to the database as a separate FileMaker file.

The master copy of REV00C was created in Claris FileMaker Pro Version 4.1. The FileMaker passwords are "ympfep99" for full function mode and "view" for read-only mode. The FileMaker version included two files: Rev00c.fp3 (containing FEP information) and FEPIntro00c.fp3 (containing introductory text).

A distribution version of REV00C was produced in Microsoft Access 97. The FEP information was transferred from the FileMaker file Rev00c.fp3 using an electronic data transfer procedure similar to the one described in the Appendix C. The corresponding Microsoft Access file was FEPs00c.mdb. FEPs00c.mdb contains all the FEP entry information but the layout formatting and custom toolbar functionality, available in previous Microsoft Access 97 versions, was removed. Introductory text from FEPIntro00c.fp3 was copied to Microsoft Word 97 file FEPIntro00c.doc.

### 5.4 REV00

REV00 (Appendix D) was developed as described in this report and supersedes all prior versions. The FEP AMR subject matter experts reviewed each of their assigned primary FEP entries and the associated secondary FEP entries (distributed as REV00A) and produced a screening decision and supporting documentation within their FEP AMR. The subject matter experts also reviewed and either confirmed or suggested changes to the YMP Primary FEP Descriptions, the primary / secondary mappings, and the FEP AMR assignments. REV00 was initiated by transferring the qualified screening data from the FEP AMRs to REV00C in accordance with the data transfer controls in CRWMS M&O (1999b). A complete list of changes from REV00C to REV00, including notes on the data transfer from the FEP AMRs to the database, is documented in Microsoft Word 97 file Changes\_to\_Rev00c.doc. In addition to the input of screening data from the FEP AMRs, other major changes from REV00C were:

1. Eleven (11) new primary FEPs were added based on FEP AMR reviews (Table 5) and the NRC NFE audit (Table 6).
2. Two (2) FEPs were elevated from secondary FEPs to primary FEPs based on FEP AMR reviews.
3. Layer, category, and heading entries were identified as classification entries rather than secondary FEPs.
4. Cross-references to the NEA category were replaced with cross-references to the YMP FEP database number.
5. Gaps in the numbering scheme, erroneously present in REV00C, were eliminated.

6. A custom toolbar was added to Microsoft Access that provided enhanced features for searching, sorting, and editing the FEP entries, and for viewing a directory tree of the FEPs and their relationships.

REV00 contains 1797 entries, categorized as 111 classification entries (151 less 40 heading entries that are also primary FEPs), 323 primary FEP entries (including the 40 headings) and 1363 secondary FEP entries.

The master copy of REV00 is maintained in Claris FileMaker Pro Version 4.1. The FileMaker passwords are "ympfep99" for full function mode and "view" for read-only mode. The FileMaker version includes two files: Rev00.fp3 (containing FEP information) and FEPIntro00.fp3 (containing introductory text).

A distribution version was produced in Microsoft Access 97. The FEP information was transferred from the FileMaker file Rev00.fp3 using the data transfer procedure described in the Appendix C. The corresponding MS Access file is FEPs00.mdb. FEPs00.mdb contains all the FEP information and also includes custom toolbars for editing, sorting, filtering, viewing the directory tree, and performing keyword searches. Introductory text from FEPIntro00.fp3 is contained in Microsoft Word 97 file FEPIntro00.doc.

All of the FileMaker, Microsoft Access, and Microsoft Word files listed in this section are included on the compact disc attached to this report in Appendix D.

Claris FileMaker Pro 4.1 (database manager), Microsoft Access 97 (database manager), and Microsoft Word 97 (word processor), are all commercially available software. Applications using this software were not directly used for quality-affecting work and are exempt from AP-SI.1Q, *Software Management*.

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## 6. SUMMARY

The YMP FEP Database REV00 (Appendix D) contains three types of information: a list of potentially relevant FEPs (the YMP FEP list); an organizational structure that categorizes the YMP FEP list into groups of related FEPs (the YMP FEP Classification); and screening decisions and supporting documentation.

The database structure is hierarchical, consisting of overarching classification entries (levels, categories, and headings), primary FEPs, and secondary FEPs. The primary FEPs collectively capture all of the issues relevant to the postclosure performance of the proposed Yucca Mountain repository. Each primary FEP requires a screening discussion identifying the technical basis for inclusion or exclusion of FEPs in the TSPA-SR analyses. Secondary FEPs are subsumed in or redundant to overlying primary FEPs and do not require screening discussions.

The YMP FEP Database REV00 (Appendix D) contains 111 classification entries (151 less 40 heading entries that are also primary FEPs), 323 primary FEP entries (including the 40 headings) and 1363 secondary FEP entries, for a total of 1797 entries. For each database entry, there are 26 data/text fields available for classification, description, and/or screening information.

Screening discussions for each of the 323 primary FEPs were prepared by subject matter experts and documented in FEP AMRs. The screening discussions were then imported from the FEP AMRs into the YMP FEP database. Guidelines were established to ensure that the content of the screening data was sufficient to satisfy regulatory screening criteria. Screening discussions are planned to be reviewed and revised as appropriate to better satisfy the criteria.

This document may be affected by technical product input information that requires confirmation. Any changes to the document that may occur as a result of completing the confirmation activities will be reflected in subsequent revisions. The status of the input information quality may be confirmed by review of the Document Input Reference System database.

### 6.1 EVALUATION OF RELEVANT TSPA IRSR ACCEPTANCE CRITERIA

Acceptance criteria for FEPs identification, classification, and screening are provided in the TSPA IRSR (NRC 2000, Sections 4.1.1.2 and 4.2). Specific criteria are discussed below.

#### Subissue 1 - Transparency and Traceability, FEPs Identification and Screening

These acceptance criteria address the screening process by which FEPs were included or excluded and the relationship between relevant FEPs. The origins of all YMP FEPs are described in Section 2 of this report (and tracked in database field Source Identifier). The screening process by which FEPs were included or excluded from the TSPA is described in Section 4. Additional details on the screening process are provided in the individual FEP AMRs (listed in Table 1).

Relationships between relevant FEPs are identified in several ways. Related FEPs are inherently grouped together in accordance with the NEA-based hierarchical numbering scheme (Section 3.1). The tree directory functionality (Appendix B) allows database users to graphically view and identify these groupings. Related FEPs are also grouped according to subject area (using

database field Input AMR). Finally, in future revisions, related FEPs will be able to be identified using the keyword search pull-down menu (Appendix B).

#### **Subissue 2 - Scenario Analysis, Identification of Initial FEPs**

These acceptance criteria address the comprehensiveness of the FEP list. The YMP FEP list was initially developed from a comprehensive list of FEPs from other international radioactive waste disposal programs (Section 2.1) and was supplemented with additional YMP-specific FEPs from project literature, technical workshops, and reviews (Sections 2.2 through 2.4). These bottom-up compilations produced an extensive, wide-ranging set of FEPs with the potential to influence repository performance.

The comprehensiveness of the YMP FEP list derives in part from the NEA-based database structure. The NEA structure comprises a comprehensive group of subject areas (i.e., headings) potentially relevant to radioactive waste disposal that was developed to systematically classify the FEPs from seven different international programs. Continuous iterative review (i.e., at workshops and in FEP AMRs) of all database subject areas assures a strong degree of comprehensiveness, and ensures that no subject area is overlooked. Further assurance of comprehensiveness arises from the results of the most recent iterative reviews (Table 5 and Table 6). Only 9 and 2 new FEPs, respectively, were identified, and these new FEPs were variants of existing FEPs rather than representing entirely new subject areas. The diminishing returns of these iterative reviews suggest that the REV00 YMP FEP list is quite comprehensive.

#### **Subissue 2 - Scenario Analysis, Classification of FEPs**

These acceptance criteria address the grouping and categorization of FEPs. The all-inclusive bottom-up approach used to develop the YMP FEP list resulted in considerable redundancy in the FEP list. To eliminate the redundancy and to create a more efficient aggregation of FEPs to carry forward into the screening process, each of the 1797 entries catalogued in the YMP FEP Database REV00 was identified as either a primary, secondary, or classification (layer, category, or heading) entry. The process and criteria for assigning FEPs to one of these categories is described in Section 3.2. Because any categorization of FEPs is subjective, the preliminary identification of primary, secondary, and classification entries was reviewed and, where necessary, revised by subject matter experts.

This categorization resulted in a list of 323 primary FEPs that were carried forward for screening. Screening of the secondary (and classification) FEPs was not required because the aspects of the secondary FEPs were encompassed by the primary FEPs.

#### **Subissue 2 - Scenario Analysis, Screening of FEPs**

These acceptance criteria address the screening of the FEPs. The regulatory criteria for screening FEPs on the basis of low probability, low consequence, or regulatory specification are summarized in Section 4.1. To satisfy these regulatory screening criteria and to satisfy the TSPAI IRSR FEP screening acceptance criteria, guidelines were established for the content of the screening discussions. However, in some cases the screening discussions input from the FEP AMRs did not fully satisfy the guidelines, and consequently, the screening information catalogued in the YMP FEP Database REV00 for some FEPs does not completely address the acceptance criteria of this subissue. Subsequent revisions of the FEP AMRs are planned to fully address this subissue and will be reflected in subsequent revisions of the database.

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**APPENDIX A**

**GLOSSARY**

## APPENDIX A - GLOSSARY

**Classification (Layer, Category, Heading) Entry**– Database entries that represent the hierarchical levels of classification within the database. Classification entries are neither primary FEPs nor secondary FEPs. They are defined too broadly to be addressed by a single screening discussion (as with a primary FEP) and cannot be encompassed by overlying FEP (as with a secondary FEP). Rather, they classify one or more underlying related primary FEPs and do not require screening discussions.

**Database**– A collection of information in a single database file or in a set of related database files.

**Disruptive FEP**–A retained FEP that has a probability of occurrence during the period of performance less than 1.0 (but greater than the cutoff of  $10^{-4}/10^4$  year)

**Disruptive scenario**–Any scenario that contains all expected FEPs and one or more disruptive FEPs.

**Event**–A natural or anthropogenic phenomenon that has a potential to affect disposal system performance and that occurs during an interval that is short compared to the period of performance.

**Excluded FEP** - A FEP that is identified by the FEP screening process as not requiring analysis based on specific criteria provided by the regulations.

**Expected FEP** –A retained FEP that, for the purposes of the TSPA, is assumed to occur with a probability equal to 1.0 during the period of performance.

**Feature**–An object, structure, or condition that has a potential to affect disposal system performance.

**FEP**–A feature, event, or process.

**Field (Database Field)**– The basic unit of data entry in a record. One of several blocks of information (data/text) contained in a record.

**Included FEP**– A FEP that is identified by the FEP screening process as requiring analysis in the quantitative TSPA.

**Nominal scenario** – The scenario that contains all expected FEPs and no disruptive FEPs.

**Primary FEPs**– FEPs that encompass a single process or event, or a few closely related or coupled processes or events that can be addressed by a specific screening discussion. Each primary FEP is addressed by a YMP-specific screening discussion taken from one or more FEP AMRs. A primary FEP may also include one or more related secondary FEPs that are covered by the same screening discussion.

**Process**—A natural or anthropogenic phenomenon that has a potential to affect disposal system performance and that operates during all or a significant part of the period of performance.

**Record (Database Record)**— One set of fields in a database. Each record contains data about a single FEP.

**Retained FEP**—A FEP that is identified by the screening process as requiring analysis in the quantitative TSPA.

**Secondary FEPs**— FEPs that are (1) redundant to another FEP (e.g., several NEA contributors identified the same FEP), (2) specific to another program (and captured more generally in a different YMP-specific FEP), or (3) better captured or subsumed in another similar but more broadly-defined YMP-specific FEP. Each secondary FEP is mapped to a primary FEP and must be completely addressed by the screening discussion of that primary FEP.

**Scenario**—A subset of the set of all possible futures of the disposal system that contains futures resulting from a specific combination of FEPs.

**Scenario class**—A set of scenarios that share sufficient similarities that they can usefully be aggregated for the purposes of a specific analysis.

**Screening Argument**— A summary discussion of the technical basis for the Screening Decision.

**Screening Decision**— A statement of whether the FEP is included in the quantitative TSPA models or excluded from the TSPA on specific criteria provided by the regulations.

**TSPA Disposition**— A summary discussion of the treatment of an included FEP in the TSPA.

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**APPENDIX B**

**USER GUIDANCE FOR THE MICROSOFT ACCESS 97 VERSION OF  
THE YMP FEP DATABASE REV00**

## APPENDIX B - USER GUIDANCE FOR THE MICROSOFT ACCESS 97 VERSION OF THE YMP FEP DATABASE REV00

### INTRODUCTION

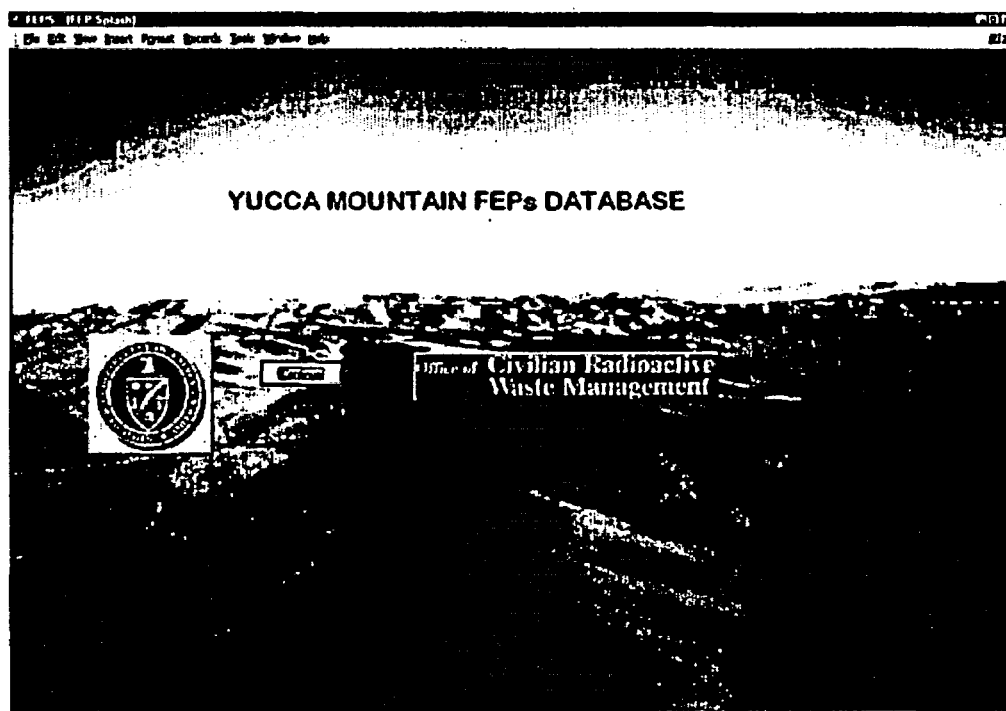
Versions of the YMP FEP Database REV00 were created for both FileMaker Pro 4.1 and Microsoft Access 97. The Filemaker version is the master copy and is only used for controlled changes to the database. The Access version is produced for distribution, and therefore requires some guidance for users. This Appendix provides basic guidance on how to navigate the database, assuming some user familiarity with Microsoft Access.

### PROGRAM SETUP

Microsoft Access 97 must be installed on your system under Windows 95, Windows 98, or Windows NT 4 prior to database installation. Minimum system requirements are 32 MB of memory and a Pentium 100 MHz processor. A Pentium II or faster processor and 64MB of memory is recommended.

To install the YMP FEP Database REV00 and its associated files, run the program SetupFEPS.EXE contained on the compact disc attached in Appendix D. The default directory for installation is C:\Program Files\FEPS.

To run the FEPs database, select Start/Feps Database/FEPS Database, which will open REV00 in Microsoft Access 97. You should see a startup screen similar to Figure B-1.



The illegible information in this figure has no technical impact on the meaning of this report.

Figure B-1. FEPs Database Startup Screen.



Click the Continue button. You may have to wait a few seconds.

## DATABASE VIEWS

After leaving the startup screen you will see a screen similar to Figure B-2 below, which is the "Directory" view of the database (other possible database views are "Summary" and "All Fields"). The Directory view includes a list of all FEP entries (records) with a limited display of information about each one. At a minimum, there will be information for: YMP FEP Database Number, FEP Name, and FEP Class.

YMP FEP Database No.	FEP NAME	FEP Class	NEA CATEGORY	PMR	Record No.
	Assessment Basin	Secondary entry, see subentries	0		1
0.1010000	Impacts of Concern	Secondary entry, see subentries under 3.3.05, 3.3.06, 3.3.07	001		2
0.1020000	Timescales of concern	Primary entry, see also 0.1.00	002	ST3, TSPA	3
0.1030000	Spatial domain of concern	Primary entry	003	ST3, TSPA	4
0.1040000	Repository Assumptions	Secondary entry, see 1.1.00	004		5
0.1050000	Future human action assumptions	Secondary entry, see 1.4.00a	005		6
0.1060000	Future human behavior (target group) assumptions	Secondary entry, see 2.4.00d	006		7
0.1070000	Dose response assumptions	Secondary entry, see subentries under 3.3.05	007		8
0.1080000	Aims of the assessment	Secondary entry, see 0.1.00	008		9
0.1090000	Regulatory requirements and exclusions	Primary entry	009	ST3, TSPA	10

The illegible information in this figure has no technical impact on the meaning of this report.

Figure B-2. FEPs Database Directory View

To view additional information about the active FEP entry (indicated by the pointer location on the left scroll bar), click on the Directory/Summary/All Fields pull-down menu in the custom toolbar at the top of the screen. Select "Summary" to select a view with additional fields of information. Section 3.4 contains a list and description of each field in the database. A sample Summary view is shown in Figure B-3. It may look slightly different for REV00.

**YMP FEP Database - Summary View**

YMP FEP Database Number: 00000000 FEP Class: Secondary entry, see definition

FEP NAME: Assessment Data NEA Category: 0  
Source Identifier: NEA Layer

YMP Primary Description: This layer of FEPs describes topics related to the purpose of the assessment, the performance measure of interest, and regulatory framework within which the assessment is conducted

Originator Description: NEA DEFINITION Assessment basis factors are factors that the analyst will consider in determining the scope of the analysis. These may include factors related to regulatory requirements, definition of desired evaluation endpoints and requirements in a particular phase of assessment. Decisions of this part will affect the phenomenological scope of a particular phase of assessment, i.e. what "physical FEPs" will be included. "Assessment Basis" is a layer in the International FEP List and is divided into individual sub-headings, and FEPs

PMR: AMR: MSR:

Screening Decisions: Screening Basis:

Screening Argument:

TSPA Disposition:

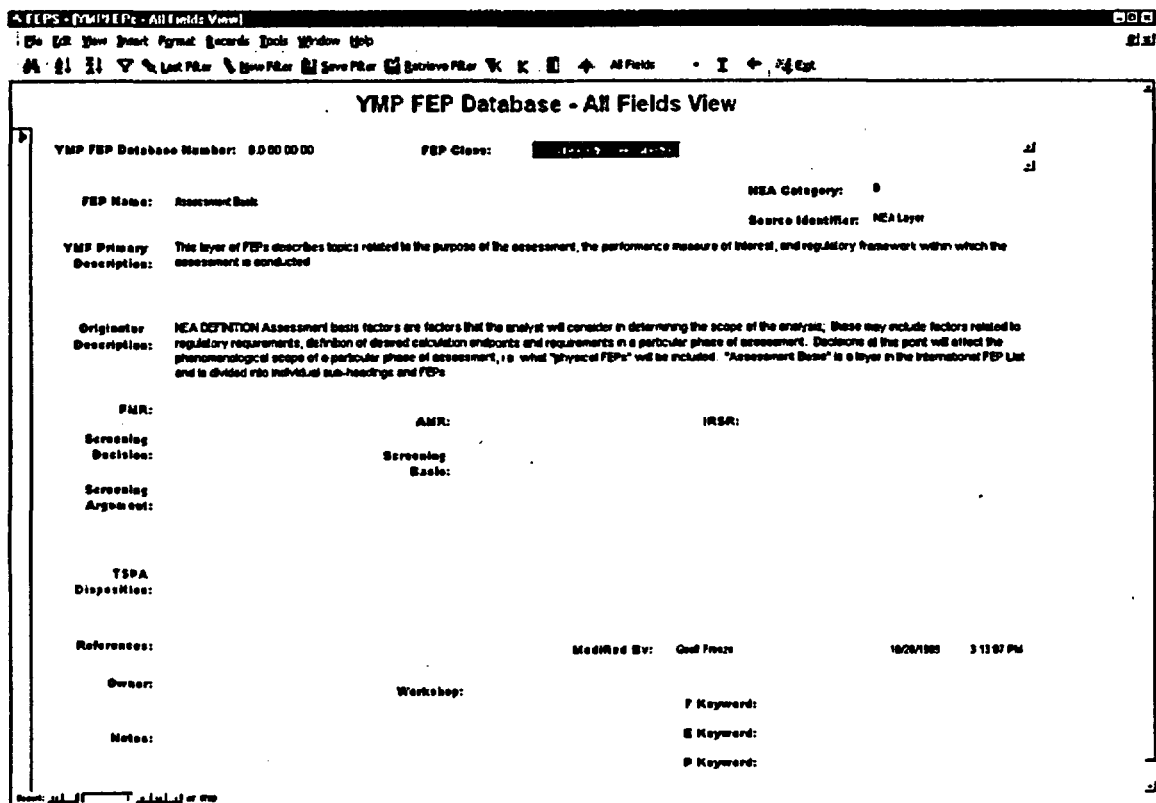
References: Record No. 1

Records 1 of 1792

The illegible information in this figure has no technical impact on the meaning of this report.

Figure B-3. FEPs Database Summary View

After the Summary view has been selected, the user can return to the Directory view by using the pull-down menu to re-select "Directory." From this pull-down menu, the user may also select the "All Fields" view, which shows the contents of all fields for each FEP. A sample All Fields view is also shown in Figure B-4. It might look slightly different for REV00.



The illegible information in this figure has no technical impact on the meaning of this report.

Figure B-4. FEPs Database All Fields View

## CUSTOM TOOLBAR

The YMP FEP Database custom toolbar, shown in Figure B-5, provides several enhanced capabilities to view, search, sort, and edit the database. These capabilities all use basic built-in functions available in Microsoft Access 97. The custom toolbar can also be used to access introductory information about the database. It is anticipated that the user guidance contained in this Appendix will be made available from the custom toolbar in a future revision.



The illegible information in this figure has no technical impact on the meaning of this report.

Figure B-5. FEPs Database Custom Toolbar

## Searching and Sorting

There are three means of searching the database to find information; the "Find" feature, the "Filter" feature, or the "Keyword Search" feature. FEP records can also be sorted based on information in a selected field. All of these features can be activated from the custom toolbar.

**Find** - To initiate a search using the Find tool, click on the field that you want to search on (see Section 3.4 for the list of available fields) and then click on the "binoculars" in the toolbar (the field may be selected from any view, however, not all fields are available in all views). The Find dialogue box shown in Figure B-6 will appear.

The illegible information in this figure has no technical impact on the meaning of this report.

Figure B-6. FEPs Database Find Dialogue Box

Type in the word or term you are looking for. You can use asterisks in front of or after the word to broaden the search. For example, in the case shown in Figure B-6, we want to search a single field for entries beginning with the number 2. Note that you must turn off the "Search Only Current Field" option if you want to search all the fields in the database, and you must change "Match" from "Whole Field" to "Any Part of Field" if that is what you want.

**Filter** - There are several buttons on the custom toolbar (Figure B-5) for filtering FEP entries.

**New Filter:** Click on the "New Filter" button in the custom toolbar. The currently selected view will appear with all blank fields in it. Type the term or word you want to filter the database on in the appropriate field. Use asterisks around the term unless you are trying to match the entire contents of the field.

Within one set of fields, multiple criteria may be stated. If you would like to filter on additional criteria in a different field using an "or" condition, go to the bottom lower left of the screen and click on the "or" tab. You may now enter additional criteria for the search. If you wish to search for more than one piece of information in a single field, enter your terms in the form [\*X\* and \*Y\*] (without the brackets). The filter function will also recognize "or" and "not" commands within a single field.

**Apply Filter:** To execute the filter, click on "Apply Filter," which is the funnel icon to the left of the Last Filter button. The result of the filter will be the set of all entries matching your criteria.

**Remove Filter/Sort:** To return to the full list of records, click on the "Apply Filter" funnel icon again (to un-apply the filter), or click on the "Remove Filter/Sort" icon (the funnel with an "X" to the right of Retrieve Filter). The Remove Filter/Sort icon will also remove any sort you may have applied and will undo a Keyword Search.

**Last Filter:** To perform an new filter that is similar the previously applied filter, select the "Last Filter" button, and you can edit the previous filter, rather than starting a new one from scratch. Press "Apply Filter" to display the results of your edited filter.

**Save Filter:** You can save a filter by clicking on the "Save Filter" button. It will ask for a unique name and then save the filter under that name for future use (Figure B-7).

The screenshot shows a dialog box titled "Saved Filters". It contains two input fields: "Filter Name" with the text "Volcanism" and "Filter:" with the text "((FEPS.[FEP Name]='Volcanism'))". Below the fields are four buttons: "Print Filter", "Delete", "Apply", and "Close".

The illegible information in this figure has no technical impact on the meaning of this report.

Figure B-7. FEPs Database Saved Filters Dialogue Box

**Retrieve Filter:** To retrieve a saved filter, click on the "Retrieve Filter" button and then on the selection button to show the saved filters. After selecting the desired filter click on "Apply Filter." Remember that after applying the filter you need to click on the "Apply Filter" again to un-apply the filter and return to the full list of FEP records. Alternatively you could use the Remove Filter/Sort icon to return to the full list.

**Keyword Search** - Clicking the "K" button in the custom toolbar searches for a keyword in one of the F Keyword, E Keyword or P Keyword fields, and displays all records containing that keyword. REV00 only provides the capability to select one keyword in one column. REV00 does not currently contain keywords, but keyword lists will be added in future revisions. Because the Keyword Search (Figure B-8) works by creating and applying a filter, the Remove Filter/Sort icon in the Toolbar can be used to end a Keyword Search.

frmKeywords : Form

F Keyword	E Keyword	P Keyword
F Key1	E Key1	P Key1
F Key10	E Key10	P Key10
F Key100	E Key100	P Key100
F Key101	E Key101	P Key101
F Key102	E Key103	P Key102
F Key103	E Key104	P Key103
F Key104	E Key105	P Key104
F Key105	E Key106	P Key105
F Key106	E Key107	P Key106
F Key107	E Key108	P Key107
F Key108	E Key109	P Key108
F Key109	E Key11	P Key109

OK Cancel

The illegible information in this figure has no technical impact on the meaning of this report.

Figure B-8. FEPs Database Keyword Search

**Sort** - The Sort buttons (labeled AZ and ZA) apply to the currently selected field, and sort in ascending (A to Z, 0 to 9) and descending order (Z to A, 9 to 0), respectively. The database entries can be sorted on any field. To undo a sort, click the "Remove Filter/Sort" icon (funnel icon with an "X"), which will also remove any filters you may have applied.

### Editing

**Edit Mode** - Clicking on the "E" icon allows you to edit the FEPs database. When you start editing, you will be asked for a password (currently set as the letter "f"). Note that changes you make to the FEPs Database in Edit Mode are automatically saved. This is a feature of Access that cannot be disabled.

**Restore FEPs** - Clicking on the left arrow icon restores the FEPs Database to its original contents. Any changes you have made to the database in Edit Mode will be removed.

### Other Custom Toolbar Features

**Directory Tree** - Clicking on the Tree icon displays a Directory Tree of the FEPs in a split screen with the currently selected view (an example is shown in Figure B-9). The Directory Tree can be expanded or contracted with mouse clicks, similar to a Windows Explorer directory. The hierarchy of the Directory Tree is based on the YMP FEP Database Number, which groups similar FEPs together. Note that Filters are disabled when Directory Tree is enabled.

YMP FEP Database No.	FEP NAME	FEP Class
1.2.02.02 00	Faulting SZ-FEPs Related to Future Tectonic Activity	Primary entry, see also 2.2.07a1, 1.2.10b
1.2.02.02.01	Faulting	Secondary entry, see
1.2.02.02.02	Fault generation	Secondary entry, see
1.2.02.02.03	Fault activation	Secondary entry, see
1.2.02.02.04	Movements along small-scale faults	Secondary entry, see

The illegible information in this figure has no technical impact on the meaning of this report.

Figure B-9. FEPs Database Directory Tree View

**Introductory Information** - Clicking the "I" icon displays introductory information about the development and content of the YMP FEP Database REV00 in a Word document.

**Exit** - Clicking this button item lets you exit the FEP Database.

#### GENERAL NOTES

1. If the Retrieve Filter or Saved Filter window is open, then the custom toolbar becomes inactive. To use the custom toolbar, close the Filter window.
2. When setting up a Filter, the "exclude" functionality can be accomplished by typing the word "not" in front of the term you are selecting. Remember to use "and" instead of "or" when using "not."
3. If you select New Filter and do not enter any text into the filter screen (i.e., a blank filter), clicking the Apply Filter button (to return to the regular screen) causes the Apply Filter button to become disabled. To re-enable it, click Last Filter or New Filter and enter text to filter.
4. There is a known bug in Microsoft Access 97 in which some Access databases do not always unload correctly from memory. If this occurs, the Microsoft Access button will remain on your Windows Toolbar even after you have selected Exit. To remove the "stuck" Microsoft Access, press Ctrl-Alt-Del and then:

- In Windows 95 and 98, select the stuck task, which is either named "FEPS" or "Microsoft Access." and end the task
- In Windows NT, press the Task Manager button. When Task Manager appears, Click on the Applications tab. From the list of running applications, select the stuck task, which is either named "FEPS" or "Microsoft Access." and click the End Task button.
- This database has not been tested with Windows 2000.



**APPENDIX C**

**PROCEDURE FOR TRANSFERRING THE YMP FEPS DATA FROM A FILEMAKER  
PRO 4.1 DATABASE TO A MICROSOFT ACCESS 97 DATABASE**

## APPENDIX C - PROCEDURE FOR TRANSFERRING THE YMP FEPS DATA FROM A FILEMAKER PRO 4.1 DATABASE TO A MICROSOFT ACCESS 97 DATABASE

### 1. Preparing the Access Database:

- a. Execute Windows Explorer.
- b. Select the folder containing the file *FepsMaster.mdb*.
- c. Right click on the file *FepsMaster.mdb*.
- d. Click *Copy*.
- e. On a blank part of the right pane in the Windows Explorer window, right click.
- f. Click *Paste*.
- g. Note the presence of a new file, *FEPs00.mdb*. This is the file into which we will import the FileMaker data.

### 2. Exporting the Data from FileMaker:

- a. Execute Windows Explorer.
- b. Select the folder containing the FileMaker database, *Rev00.fp3*.
- c. Double click the file.
- d. If FileMaker was installed correctly, it will open and load the selected database. (NOTE: A password will be required to open the database, see Section 5.4)
- e. Check the upper left corner of the window. There will be a total number of records (1797). There might also be a "Found" number of records. If there is a second number and it is not equal to the first, execute the appropriate FileMaker commands to ensure that all records are selected.
- f. Click *File*.
- g. Click *Import/Export*.
- h. Click *Export Records*.
- i. A dialog box titled, "Export Records to File" will appear. In the Save As Type combo box, select *HTML Table (\*.HTM)*.
- j. Enter a name in the File name box.
- k. Click *Save*.
- l. On the "Specify Field Order for Export" window, ensure that all fields are listed in the right-hand pane, then select *Export*.
- m. Exit FileMaker.

### 3. Importing the Data:

- a. Start Microsoft Access.
- b. Leaving the selection bar on *More Files*, click *OK*.
- c. Navigate to the folder containing the database created above.
- d. Single click on the database name.
- e. Holding down a shift key, click *Open*.
- f. Select *File*.
- g. Select *Get External Data*.
- h. Select *Import*.

- i. In the combo box labeled "Files of type", choose *HTML Documents (\*.html; \*.htm)*.
- j. Click on the file created in step 2 above, *FEPs00.mdb*.
- k. Click *Import*.
- l. On the "Import HTML Wizard", click the check box for *First Row Contains Column Headings*.
- m. Click *Next*.
- n. Click *Next* (to create a new table).
- o. Click *Advanced*.
- p. Click *Specs*.
- q. Choose *FEPS HTML Import Specification*.
- r. Click *Open*.
- s. Click *OK*.
- t. Click *Next*.
- u. Select *Choose My Own Primary Key*. If the system does not choose *YMP FEP Database Number*, choose it.
- v. Click *Next*.
- w. For "Import to Table", enter *FEPS*.
- x. Click *Finish*.
- y. Ensure that you receive the message, "Finished importing file x x x to table FEPS." Click *OK*.
- z. You might notice a table entitled *Table\_ImportErrors*. If so, check the contents of that table against the imported data table to ensure that no important data was lost. Sometimes Access will erroneously report truncated memo fields.

4. **Final:**

- a. Select table *FEPS* and click *Design*.
- b. Scroll down to the field *Mod Time*. Click on *Data Type* (should be "Text").
- c. Using the list box, select *Data Type Date/Time*.
- d. At the bottom of the screen, on the *General* tab, click on *Format*.
- e. Using the list box, select *Long Time*.
- f. Using the menu bar, select *File Close*. The program will ask if you want to save the changes. Click *Yes*.
- g. Close the Access database.
- h. If desired, the HTML file created in step 2 may be deleted.
- i. To use the FEP Database, reopen the file created in step 1 without depressing the shift key. The Yucca Mountain FEP Database splash screen will display and the system should operate normally.

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**APPENDIX D**

**MACHINE READABLE MEDIA ATTACHMENT - COMPACT DISC CONTAINING  
DATABASE AND SUPPLEMENTARY FILES FOR YMP FEPS DATABASE REV00**

**APPENDIX D - MACHINE READABLE MEDIA ATTACHMENT - COMPACT DISC  
CONTAINING DATABASE AND SUPPLEMENTARY FILES FOR YMP FEPS  
DATABASE REV00**

**FILE LISTING**

The compact disc attached in this Appendix contains all files needed to view the YMP FEPS Database REV00 using either FileMaker Pro 4.1 or Microsoft Access 97. A listing of files is provided below. All files on the electronic record have a QA designator of QA:QA.

Table D-1. List of Files for YMP FEP Database REV00

Filename	Application	File Description
Rev00.fp3	FileMaker Pro 4.1	REV00 of Database
FEPIntro00.fp3	FileMaker Pro 4.1	Introductory text for REV00
FEPs00.mdb	Microsoft Access 97	REV00 of Database
FEPIntro00.doc	Microsoft Word 97	Introductory text for REV00
Changes_to_Rev00c.doc	Microsoft Word 97	List of changes made to REV00C to produce REV00 and notes on data transfer from FEP AMRs
feps.EX-	Wise InstallBuilder	Ancillary file used for building a SetupFEBS.EXE.
feps.wse	Wise InstallBuilder	ASCII installation builder script
feps.WSM	Wise InstallBuilder	Ancillary file used for building a SetupFEPS.EXE
FEPSMaster.mdb	Microsoft Access 97	Database template used for creating a Microsoft Access FEP database
Rev00.HTM	FileMaker Pro 4.1 Microsoft Access 97	Data exported from FileMaker Pro database in HTML (Hypertext Markup Language). Also source of data for Microsoft Access database
SetupFEPS.EXE	Executable	Installation program for Access version of database
<i>The SetupFEPS.EXE file is a compressed file used to install the FEP database and any ancillary files. Besides the database itself (FEPs00.mdb) and the introductory text (FEPIntro00.doc), this file contains compressed images of the following programs:</i>		
Unwise.exe	Wise InstallBuilder	Used to remove the FEP database from the target system
Install.log	Wise InstallBuilder	Records the installation process. Necessary for running Unwise.exe. (Built rather than installed by SetupFEPS.exe)
comcat.dll	Microsoft Access 97	Microsoft Component Catalog Manager Library
comctl32.ocx	Microsoft Access 97	Microsoft Windows Common Controls
condig32.ocx	Microsoft Access 97	Microsoft Common Dialog Control
FEPS Database.lnk	Operating System	Shortcut to the FEPs00.mdb (Built rather than installed by SetupFEBS.exe)
FEPS Introduction.lnk	Operating System	Shortcut to the FEPIntro00.doc. (Built rather than installed by SetupFEPS.exe)

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2. Record Date  
07/05/2000

3. Accession Number

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4. Author Name(s)  
GEOFF FREEZE

5. Author Organization

N/A

6. Title  
THE DEVELOPMENT OF INFORMATION CATALOGUED IN REV00 OF THE YMP FEP DATABASE

7. Document Number(s)  
TDR-WIS-MD-000003

8. Version  
REV.00

9. Document Type  
CD-ROM

10. Medium  
CD-ROM

11. Access Control Code  
PUB

12. Traceability Designator  
DC #25939

13. Comments  
THIS IS A ONE-OF-A-KIND DOCUMENT DUE TO THE CD-ROM ENCLOSED AS PART OF APPENDIX D  
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MS Access  
MS Word  
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