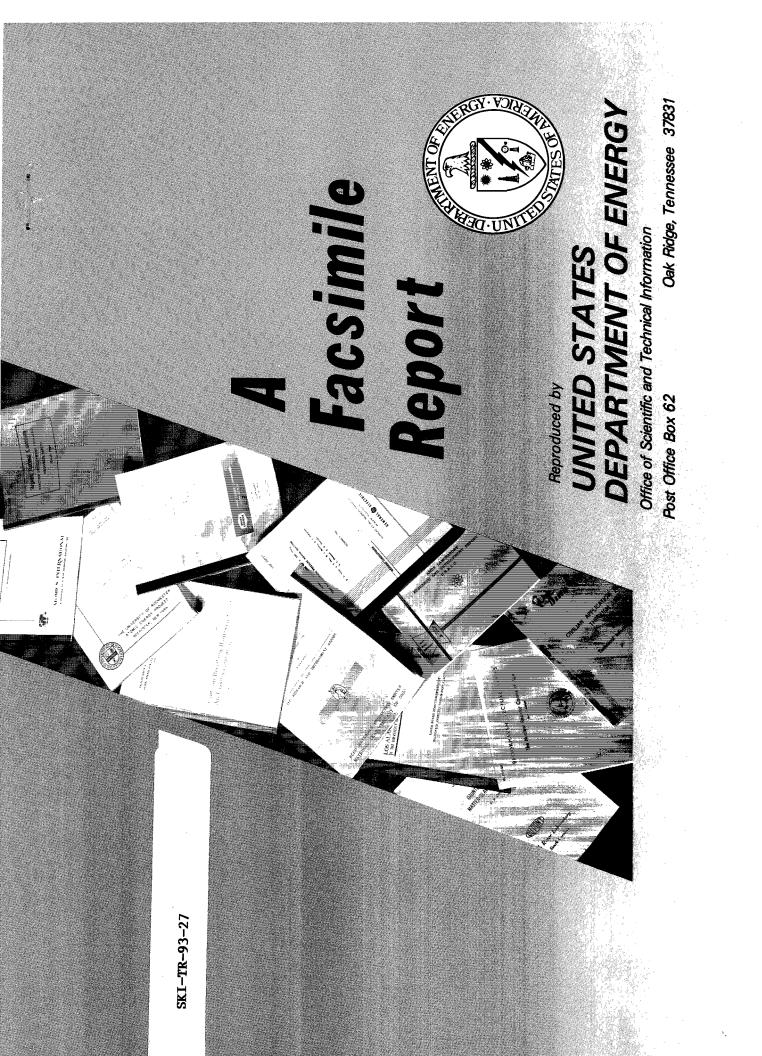
Waste Isolation Pilot Plant

Compliance Certification Application

Reference 605

 Stenhouse, M.J., N.A. Chapman, and T.J. Sumerling. 1993.
 SITE-94 Scenario development FEP Audit List Preparation: Methodology and Presentation. SKI Technical Report 93:27. Stockholm: Swedish Nuclear Power Inspectorate.

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Scenario Development FEP Audit List Preparation: Methodology and Presentation

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SITE-94

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April 1993

This report concerns a study which has been conducted for the Swedish Nuclear Power Inspectorate (SKI). The conclusions and viewpoints presented in the report are those of the author(s) and do not necessarily coincide with those of the SKI.

PREFACE

This report concerns a study which is part of the SKI performance assessment project SITE-94. SITE-94 is a performance assessment of a hypothetical repository at a real site. The main objective of the project is to determine how site specific data should be assimilated into the performance assessment process and to evaluate how uncertainties inherent in site characterization will influence performance assessment results. Other important elements of SITE-94 are the development of a practical and defensible methodology for defining, constructing and analyzing scenarios, the development of approaches for treatment of uncertainties, evaluation of canister integrity, and the development and application of an appropriate Quality Assurance plan for Performance Assessments.

> Johan Andersson Project Manager

gotab Stockholm 1993

SKI Technical Report 93:27

SITE 94 SCENARIO DEVELOPMENT FEP Audit List Preparation: Methodology and Presentation

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April, 1993

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1 Introduction

A preliminary but essential stage of the SITE 94 scenario development process is the identification of all features, events, and processes (FEPs) which are considered important to the long-term isolation of radioactive waste. These FEPs may be of natural or of human origins, and should be relevant to both the disposal site under investigation, and the timescales under consideration. Before combining FEPs into scenarios, an audit of the FEP list is desirable. Thus, the objective of this summary report is to document the specifications and methodology by which an independent FEP list was generated for audit purposes. The intention of the audit is to ensure that all relevant natural and human-induced FEPs are identified at this early stage of scenario development.

The SITE 94 Project considers disposal of spent nuclear fuel according to the KBS3 concept, at a site with characteristics based on the Åspō Hard Rock Laboratory site.

2 Description of Methodology

The methodology adopted for producing such a FEP audit list involved the following tasks:

- Task 1: Compile raw FEP list
- Task 2: Categorise and add screening criteria
- Task 3: Consolidation coding of screened lists
- Task 4: Perform FEP audit

The overall process in developing the FEP audit list is shown schematically in Figure 1. Each of the above tasks is discussed in detail in the subsequent sections.

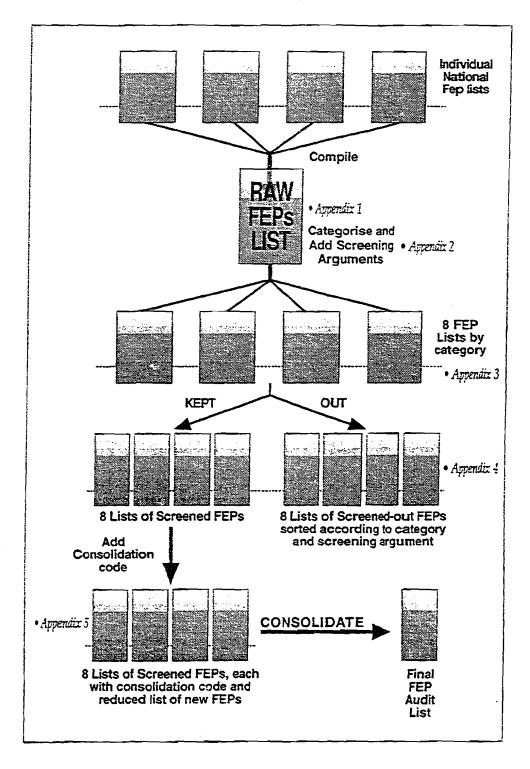


Figure 1. Schematic diagram of FEP audit list generation stages

2.1 Task 1: Compile raw FEP list

Identification of FEPs has been performed previously for a variety of national radioactive waste management programmes, and resultant FEP lists apply to a number of disposal concepts and cover a range of disposal sites. As a starting point for the FEP audit list, therefore, the FEP lists from these national exercises were compiled as an electronic spreadsheet/database.

The database was compiled from the following *published* FEP lists:

- Atomic Energy of Canada Limited (AECL): spent fuel; 275 entries; Goodwin et al., (1991)
- U.K. Department of Environment Dry Run 3; 305 entries: Thorne (1992)
- International Atomic Energy Agency (IAEA): Safety Series: general treatment; 56 entries; IAEA (1981)
- Nagra, Switzerland: Project Gewähr: high level waste (HLW); 44 entries; Project Gewähr (1985)
- SKI/SKB: Swedish scenario development; spent fuel; 157 entries: Andersson (1989)
- Sandia National Laboratory, U.S.A.: HLW; 29 entries: Cranwell et al. (1982)
- U.K. Nirex: L/ILW; 131 entries; Hodgkinson and Sumerling (1989)
- U.K. Department of Environment: Sellafield Assessment: L/ILW; 79 entries; Miller and Chapman (1992)
- Nuclear Energy Agency (NEA): Systematic Approaches to Scenario Development; 122 entries; NEA (1992)

Although Nagra is conducting a scenario development process for Kristallin-1, the FEP list was incomplete at the time of compilation. For this reason, this source of FEPs was not used. In addition, the Kemakta FEP list for the SFR assessment done for SKB was not included, as it was felt that Kemakta, who are responsible for developing the original FEP list, would be influenced by this work.

The final compilation comprises over 1200 entries and is listed in Appendix 1. The level of FEP detail for each national list is highly variable,

as indicated by the respective values for number of entries, and reflects differing degrees of generalisation. However, no screening or additional reductions were performed during this task. For some entries, text was added, but only to provide additional description to FEPs, the meaning of which would otherwise be too vague for subsequent screening.

2.2 Task 2: Categorise and add screening criteria

The list in Appendix 1 contains numerous entries which are neither relevant to the Swedish disposal concept nor to the disposal site. In addition, duplications abound in the raw list. Thus, to make the subsequent screening process easier, the first stage of this task was to separate entries into arbitrary categories. Eight categories were selected in total. *riz.*:

Waste [W]	Container [C]
Buffer/Backfill [B]	Repository [R]
Far-field [F]	Biosphere [L]
Human actions [H]	Geological/climatic evolution [G]

The letters in parentheses were used to code individual entries, and an attempt was made to classify FEPs according to where the FEP occurs (W; C; B; R; F; L) or which category is the responsible agent (G; H). Occasionally, it was difficult to categorise FEPs in this way, in which case the coding applies more to the category which is affected by the FEP. In addition, more than one code letter was applied to a FEP if it was considered to apply to one or more of the categories designated. It should be emphasised that assigning FEPs to the above categories was performed as a matter of convenience, and that this separation process is relatively arbitrary, given the different origins of the original FEP list (Appendix 1).

Screening criteria were then added to identify and to subsequently remove only those FEPs which are irrelevant to the Swedish disposal concept and disposal site. The criteria which were used are based on those applied by Nagra and presented in Sumerling et al. (1993). The preliminary "criteria" – referred to as screening arguments, are presented in Appendix 2. Included in Appendix 2 are NOTES: specific modifications to certain screening arguments, based on consultation with SKI (Johan Andersson, personal communication). An additional code was provided for those FEPs which were either too vague or all-encompassing to be useful. It should be stressed, however, that no FEP entries were destroyed as a result of the screening process – only removed to a separate appendix. The modified screening arguments are summarised in Table 1, each argument having a corresponding code (for convenience, the subsection number of appropriate text in Appendix 2). The FEP lists, sorted by category, and with screening code added, are shown in Appendix 3. Finally, the screening process was performed on the eight category lists of FEPs to separate entries with screening codes from those without. As mentioned previously, no FEPs were removed permanently, screened-out FEPs being compiled in Appendix 4.

2.3

Task 3: Consolidation coding of screened lists

Eight lists of screened FEPs were produced from the screening process performed in Task 2 (in addition to the 8 lists of screened-out FEPs in Appendix 4). In order to consolidate these 8 lists of screened FEPs, an additional. consolidation code was added, as shown in Appendix 5 (CON. CODE). The purpose of this consolidation code was to create a reduced set of 'processes' which included *all* screened FEPs, but which had a sufficiently small number to be manageable. Reduced sets in the range 10-15 'processes' were considered an acceptable compromise – small enough to be manageable, but large enough to retain specific characteristics of the individual FEPs, *i.e.* not too general.

Accordingly, Appendix 5 contains the 8 lists of screened FEPs, each category list prefaced by the set of consolidated 'processes'. For ease of review, individual, screened FEPs are grouped according to consolidation code.

Code	Screening Argument	Specifically Excluded Phenomer
		relating to:
Site a	nd Disposal Concept	
2.1	Waste form and packaging	L/ILW, organic wastes: vitrified wast
2.2	Emplacement and repository	cementitious backfill;
2.3	Host geology	salt deposits: clays;
		near-surface disposal phenomena
2.4	Local and regional	thick soil/sediment sequences;
	surface environment	large topographic influences;
		oceanic processes
2.5	Geo-climatic development	arid climate;
		coastal, fluvial erosion
<u>Assess</u>	<u>sment Basis</u>	
3.1	Repository design/closure	operational phase; retrievability;
		major design changes
3.2	Global/regional disasters	meteorites
		TREATED SEPARATELY
3.3	Acts of war/sabotage	nuclear war; terrorism
	· · · · ·	TREATED SEPARATELY
3.4	Deliberate intrusion	—
3.5	Future human society	futuristic assumptions bout
	and technology	human behaviour and technology
3.6	Post-closure radiological	chemical toxicity
	assessment	impacts to flora/fauna
3.7	Future life evolution	radiation sensitivity;
		metabolism changes
Other		

Table 1: Summary of FEP Screening Arguments

<u>Other</u>

4	General issues	too vague, general; incomprehensibl
		philosophical

*: Arguments 3.2 and 3.3 were assigned screening code 'D'

Task 4: Perform FEP audit

2.4

The FEP lists contained in Appendix 5 were used to perform an audit of the Kemakta FEP list (in Stockholm, April 21st, 1993). Participants in the audit were Neil Chapman and Michael Stenhouse of Intera, and Kristina Skagius and Marie Wiborg of Kemakta (primarily responsible for developing the Kemakta system). The objective of this exercise was to ensure that all relevant features, events and processes had either been incorporated in the influence diagrams already generated by Kemakta (principally of the waste and the engineered systems), or were available for construction of influence diagrams of other parts of the Process System.

During the audit, each FEP in the Intera lists was examined within each category. A tick mark was added if it had been included in the Kemakta list, either as a FEP or as a 'LINK' between two FEPs. Duplicates in the Intera list were eliminated at this stage, and external FEPs were identified as 'EFEP'. For each FEP which was identified for inclusion in the Kemakta system, either as a new FEP or new LINK, a note was made of the addition, together with its cause and effect.

At the time of the audit, the near-field FEPs had been identified and fully documented, and the Intera categories which were used for comparison were WASTE, CANISTER, BUFFER/BACKFILL and REPOSITORY. Similar treatments for the far field and biosphere systems were incomplete, although the format of the influence diagram was expected to be similar to that of the near field. As a result, all Intera FEP categories except BIOSPHERE were examined in detail. For the biosphere, duplicates were identified and eliminated. Occasionally, where two slightly different FEPs overlapped in terms of description, they were combined, thereby reducing the overall number.

The end product of the audit was a final list of all FEPs, still retained under the 8 categories, which have to be considered in the scenario development for the Swedish waste disposal concept. This list is shown in Appendix 6, and the *main headings* for these FEPs are included in Table 2.



	FEP NAME: HEADER
1. 1	NASTE CATEGORY
	Waste characteristics: initial (SYSTEM DESCRIPTION)
	Radionuclide decay and growth
	Radiological/radiation effects
	Gas generation and effects
	Heat generation
	Thermo-mechanical effects
	Thermo-chemical effects
	Electro-chemical effects
	Waste degradation/corrosion/dissolution
	Geochemical reactions/regime
	Radionuclide chemistry
	Specific factors
	ANISTER CATEGORY
	Canister materials/construction (SYSTEM DESCRIPTION)
	Corrosion/degradation processes
	Gas production and effects
	Microbiological effects/microbial activity
	Thermo-mechanical effects
	Electro-chemical effects
	Stress/mechanical effects
	Geochemical reactions/regime
	Radionuclide transport through containers
	Specific factors
÷۲	UFFER/BACKFILL CATEGORY
	Buffer/backfill characteristics (SYSTEM DESCRIPTION)
	Resaturation/desaturation
	Mechanical effects
	Thermal effects
	Electro-chemical effects
	Gas effects
	Microbiological effects/microbial activity
	Backfill degradation
	Geochemical regime
	Radionuclide transport processes
	Radionuclide chemistry
	Specific factors
R	EPOSITORY/NEAR-FIELD ROCK CATEGORY
	Near-field rock; repository elements/materials (SYSTEM)
	Repository degradation
	Hydraulic effects/groundwater flow
	Mechanical effects
	Thermal effects
	Gas effects and transport
	Microbiological/biological activity
	Geochemical regime
	Radionuclide chemistry
	Radionuclide transport processes
	LIGHTAN ICONTO TICTION I DI COOSCO

.

	FEP NAME: HEADER
5. FAR	FIELD CATEGORY
R	ock properties (SYSTEM DESCRIPTION)
н	ydrogeological effects
P	hysical/mechanical effects
П П	hermal effects
G	as effects and transport
M	licrobiological/biological activity
G	eochemical regime
R	adionuclide chemistry
R	adionuclide transport processes
S	pecific factors
6. BIOS	PHERE CATEGORY
н	uman considerations
E	cological factors
s	oil/sediment effects
l s	urface/near-surface water processes
l c	oastal water/ocean processes
G	as effects
M	licrobiological/biological activity
G G	eochemical regime (general)
I R	tadionuclide chemistry
R	adionuclide transport processes
R	tadiological factors
	pecific factors
7. GEO	LOGY/CLIMATE CATEGORY
s	eismic events/major land movement
i R	lock deformation
N	letamorphic processes
	rosion/weathering (surface)
G	Groundwater flow and effects
s	surface water flow and effects
-	ea-level effects
1	Agnetic effects
G	Slaciation/glacial effects
1	Ximate effects (natural)
	pecific factors
	IAN INFLUENCES CATEGORY
	nadvertent intrusion into repository
1 -	Surface activities
s	Subsurface activities
	Vater use
	gricultural and fisheries practices
\$	pecific factors

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APPENDIX 1 Raw FEPs List

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Appendix 1. Raw FEPs List

The composite list presented in the following pages (19) contains all FEPs from the following national exercises, listed in order of appearance (the initial letter coding, *e.g.* AECL, identifies the respective exercises):

- AECL: Canada
- DOE: Dry Run 3, U.K. Department of Environment
- IAEA: Safety Series
- PGA:Nagra, Switzerland
- SKI: SKI/SKB: Sweden
- SNL: Sandia, U.S.
- UKN: U.K. Nirex L/ILW
- HMIP: Sellafield Assessment, U.K. Department of Environment
- NEA: Safety Assessment

<u>NOTE</u>

References for the above lists are given in the main text (page 3). In th 'DOE' list, FEPs often exist at the quaternary level (W.X.Y.Z) and, freesuch cases, the corresponding tertiary heading (<math>W.X.Y) has been incorporated in each FEP as additional description. As a result, these tertiary entries (shaded) become redundant and are excluded from subsequent edited lists. In the same way, AECL primary (X.), and HMIP primary (W.) and secondary (W.X), headers have been retained for clarity, but are excluded from the reduced lists.

	LI FACTORS
AECL1.1	Backfill characteristics
AECL12	Backuill evolution
AECL1.3	Biological activity
AECL1.4	Boundary conditions
AECL1.5	Buffer additives
AECL1.6	Buffer characteristics
AECL1.7	Buffer evolution
AECL1.8	Cave ins
AECL1.9	Chemical gradients
AECL1.10	Chemical interactions (expected)
AECL1.11	Chemical interactions (long-term)
AECL1.12	Chemical interactions (other)
AECL1.13	Chemical kinetics
AECL1.14	Climate change
AECL1.15	
AECL1.16	Complexation by organics
AECL1.17	Concrete
AECL1.18	Container corrosion products
AECL1.19	Container failure (early)
AECL1.20	Container tailure (long-term)
AECL1.21	Container failure (other long-term processes)
AECL1.22	Container healing
AECL123	Containers - partial corrosion
AECL1.24	Convection
AECL1.25	
AECL1.26	
AECL1.27	Coupled processes
AECL1.28	
AECL1.29	Diffusion
AECL1.30	Dispersion
AECL1.31	Eathquakes
AECL1.32	Electrochemical gradients
AECL1.33	Evolution of buffer
AECL1.34	Excessive hydrostatic pressures
AECL1.35	
AECL1.36	Faulty buffer emplacement
AECL1.37	Formation of cracks
AECL1.38	Formation of gases
AECL1.39	Galvanic coupling
AECL1.40 AECL1.41	Geochemical pump
AECL1.42	
AECL1.42	Global effects
	Whydrautic conductivity
AECL1.44	<u>Hydrautic head</u>
AECL1.45	Hydride cracking
AECL1.46	Hydrothermal alteration
AECL1.47 AECL1.48	Incomplete closure
AECL1.48	Incomplete filling of containers
AECL1.49	Interfaces (boundary conditions)
AECL1.50	Intrusion (animal)
AECL1.51	Intrusion (Juman)
AECL1.52	Inventory
AECL1.55	Other wastes (other than vitrified HLW)
AECL1.55	Long-term physical stability
AECL1.56	Long-term transients
AECL1.56	Methylation
AECL1.58	Microbes
AECL1.59	Microorganisms
AECL1.59	Microorgalishis
AECL1.60	Monitoring and remedial activities
AECL1.62	Percolation in shafts
AECL1.63	Pitting
AECL1.64	Preciosure events
AECL1.65	Precipitation and dissolution
AECL1.66	Pseudo-colloids
AECL1.67 AECL1.68	Radiation damage
	Radioactive decay

IDENTIFIER	FEP NAME
AECL1.70	Recharge groundwater
AECL1.71	Rellooding
AECL1.72	Retrievability
AECL1.73	Sabotage and improper operation
AECL1.74	Seal evolution
AECL1.75	Seal failure
AECL1.76	
AECL1.77	Sorption: non-linear
AECL1.78	Source terms (expected)
AECL1.79	Source terms (other)
AECL1.80	Speciation
AECL1.81	Stability
AECL1.82	Stability of gtass
AECL1.83	Swelling pressure
AECL1.84	Temperature rises (unexpected effects)
AECL1.85	Time dependence
AECL1.86	Transport in gases or of gases
AECL1.87	Uncertainties
AECL1.88	Uniform corresion
AECL1.89	Unmodelled design features
AECL1.90	Unsaturated transport
AECL1.91	Vault geometry
	PHERE FACTORS
AECL2.1	Blasting and vibration
AEC122	Bomb plast
AECL2.3	Borehole - well
AECL2.4	Borehole seal failure/open boreholes
AECL25	Boreholes - exploration
AECL2.6	Boreholes - unsealed
AEC127	Cavitation
	Climate change
AECL2.9	Colloid formation
	Complexation by organics
	Conceptual model - hydrology
AECL2.12	Correlation
AECL2.13	Datas
AECL2.14	Dewatering
AECL2.15	Diffusion
ECL2.16	Discharge zones
AECL2.17	Dispersion
AECL2.18	Drought
AECL2.19	Earthmoving
AECL2.20	Eanhquakes
AECL221	Erosion
AECL2.22	Explosion
ECL223	Faulting
	Flood
AECL2.24	Fluvic acid
AECI2.25	
	Gases and gas transport
ECL2.27	Geothermal gradient effects
ECL2.28	Glaciation
	Greenhouse effect
ECL2.30	Groundwater - evolution
	Groundwater composition charge
	Humic acid
EC12.33	Hydrautic properties - evolution
ECL2.34	Intrusion (magmatic)
	Intrusion (mines)
	Isostatic rebound
EC12.37	Magmatic activity
ECL2.38	Magnetic poles
EC12.39	Matrix diffusion
ECL2.40	Metamorphic activity
EC1241	Meteorite
ECL2.42	Methane
ECL2.43	Microbes
EC12.44	Mines
EC12.45	Ozone layer
EC12.46	Precipitation - dissolution
ECL2.47	Pseudo-colloids

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IDENTIFIER	FEP NAME
AECL2.48	© Radioactive decay
AECL2.49	Radiolysis, radiation damage
AECL2.50	Recharge groundwater
AECL2.51	Rock properties
AECL2.52	Rock properties - undetected features
AECL2.53	Sabotage
AECL2.54	Salinity effects on flow
AECL2.55	Saturation
AECL2.56	Shaft seal failure
AECI257	Solution mining
AECL2.58	Sorption
AECL2.59	Sorption - non-linear
AECL2.60	Speciation
AECL2.61	Topography - current
AECL2.62	Topography - future
AECL2.63	Turbulence
AECL2.64	Uncertainties
AECL2.65	Unsaturated rock
AECL2.66	Wauti closure (incomplete)
AECL2.67	Vault heating effects
AECL2.68	Vulcanism
AECL2.69	Wells
AECL2.70	Wells (high demand)
AECLI BIOSE	HEREFACTORS
AECL3.1	Acid rain
AECL32	Alkali flats
AECL3.3	Animal grooming and lighting
AECL3.4	Animal soil ingestion
AECL3.5	Animals' diets
AECL3.6	Artificial lake mixing
AECL3.7	Ashes and sewage studge
AECL3.8	Bacteria and microbes (soil)
AECL39	Bioconcentration
AECL3.10	Biogas production
AECL3.11	Biological evolution
AECL3.12	Biotoxicity
AECL3.13	Bioturbation of soils and sediments
AECL3.14	8 Building materials
AECL3.15	Burrowing animals
AECL3.16	Capillary rise in soil
AECL3.17	Carcasses
AECL3.18	Carcinogenic contaminants
AECL3.19	Charcoal production
AECL3.20	Chemical precipitation
AECL3.21	Chemical toxicity
AECL3.22	Climate
AECL3.23	Climate - evolution
AECL3.24	Collisions, explosions, impacts
AECL325	Colloids
AECL3.26	Convection, turbulence and diffusion (atmospheric)
AECL3.27	Correlation
AECL3.28	Critical group - agricultural labour
AECL3.29	Critical group - clothing and home turnishings
AECL3.30	Critical group - evolution
AECL3.31	Critical group - house location
AECL3.32	Critical group - individuality
AECL3.33	Critical group - leisure pursuits
AECL3.34	Critical group - pets
AECL3.35	Crop fertilization
AECL3.36	Crop storage
AECL3.37	Cure for cancer
AECL3.38	Deposition (wet and dry)
AECL3.39	Dermal sorption - nuclides other than tritium
AECL3.40	Dermal sorption - tritium
AECL3.41	Dispersion
AECL3.42	Dust storms and desentification (massive)
AECL3.43	Earthmoving projects (major)
AECL3.44	© Earthquakes
AECL3.45	Erosion - lateral transport

.

DENTIFIER	FEPNAME
AECL3.47	# Fires (agricultural)
AECL348	Fires (forest and grass)
AECL3.49	Fish farming
	Flipping of earth's magnetic poles
AECL3.51	Flood (short-term)
AECL3.52	Flushing of water bodies
AEC1.3.53	Food preparation
AECL3.54	Game randing
AECL3.55	Gas leakage into underground living space
AECL3.56	Glaciation
AECL3.57	Greenhouse (food production)
AECL3.58	Greenhouse effect
AECL3.59	Groundshine, treeshine
AECL3.60	Hear storage in lakes or underground
AECL3.61	Herbicides, pesticides, fungicides
AECL3.62	Household dust and tumes
AECL3.63	
AECL3.64	Human det
AECL3.65	Human soil ingestion
AECL3.66	Hydroponics
AEC13.67	industrial use of water
AECL3.68	Inject/ingest/inhaling locally produced drugs
AECL3.69	Innusion (deliberate)
	Intrusion (inadvertent)
AECL3.71	Ponic exchange in soil
AECL3.72	
AECL3.73	Lake infilling
AECL3.74	Mutagenic contaminants
	Outdoor spraying of water
AECL3.76	Ozone layer failure
ECL3.77	
	Peat and leaf litter harvesting
ECL3.78	Plant root systems
ECL3.79	Precipitaion (meleoric)
ECL3.80	Radioactive decay
ECL3.81	Padiotoxic contaminants
EC1.3.82	Radon emission
ECL3.83	Rivercourse meander
ECL3.84	Punotí
ECL3.85	Saltation
ECL3.86	Scavengers and predators
	Sessons
ECL3.88	Sediment resuspension in water bodies
ECL3.89	Sedimentation in water bodies
ECL3.90	Sensitization to radiation
ECL3.91	Showers and humidifiers
ECL3.92	Smokking
ECL3.93	Sol
ECL3.94	Soil depth
ECL3.95	Soil leaching
ECL3.96	
	Soil porewater pH
ECL3.97	Soil somtion
ECL3.98	Soil type
EC13.99	Space heating
ECL3.100	Surface water bodies
ECL3_101	Surface water pH
ECL3.102	Suspension in air
ECL3.103	Technological advances in food production
ECL3.104	Teratogenic contaminants
ECL3.105	Terrestrial surface
ECL3.105	Toxicity of mined rock
ECL3.107	Tree sap
ECL3.108	Uncertainties
ECL3,109	Urbanization on the discharge site
ECL3.110	Water leak into underground living space
ECL3.111	Water management projects (major)
	Water source
ECL3.113	Weilands

IDENTIFIER	FEP NAME
DOE1.1.1	Structural container metal corrosion
DOE1.1.1.1	Structural container metal corrosion: Localised
DOE1.1.1.2	Structural container metal corrosion: Bulk
DOE1.1.1.3	Structural container metal corrosion: Crevice
DOE1.1.1.4	Structural container metal corrosion: Stress corrosion cracking
DOE1.12	Physical degradation of concrete
DOE1.1.2.1	Cracking: concrete
DOE1.122	Sealing of cracks: concrete
	Pore blockage: concrete
DOE1.12.4	Alkali-aggregate reaction: concrete
DOE1.1.2.5 DOE1.1.3	Cement-subhate reaction: concrete Chemical degradation of concrete
DOE1.1.3.1	Changes in pore water composition, pH, Eh: concrete
DOE1.1.3.2	Exchame capacity exceeded: concrete
	Alkali-aggregate reaction: concrete
	Cement-subhate reaction: concrete
DOE114	Degradation of wasses
DOE1.1.4.1	Meial conosion: wastes
DOE1.1.4.2	Leaching: wassles
DOE1.1.4.3	Complex formation: wastes
DOE1.1.4.4	Colloid formation: wastes
DOE1.1.4.5	Microbial degradation of organic wastes: wastes
DOE1.1.4.6	Microbial corrosion: wastes
DOE1.1.4.7	Radiolysis wastes
DOE121	
	Hydrogen: corrosion of structural steel
	Hydrogen: corrosion of container steel
DOE1.2.1.3	Hydrogen: corrosion of waste steel
	Hydrogen: corrosion of waste Magnox
DOE1.2.1.5 DOE1.2.1.6	Hydrogen: corresion of waste auminium
	Hydrogen: corrosion of waste Zircaloy
	Whydrogen, effects of microbial growth on concrete
DOE122	Methane and satism discide by microbial degradation
DOE1.2.2.1	Methane-CO2: degradation of Cellulosics
DOE1.2.2.2	Methane/CO2: degradation of Other susceptible organic materials
DOE1.2.2.3	Methane/CO2 production: Aerobic degradation
DOE1.2.2.4	MethanerCO2 production: Anaerobic degradation
DOE1.2.2.5	Methane/CO2 production: Effects of temperature
DOE1.2.2.6	MethanerCO2 production: Effects of lithostatic pressure
	Methane/CO2 production: Effects of microbial growth on properties of concrete
	Methane/CO2 production: Effects of biofilms
	Methane/CO2 production: Effects of hydrogen from metal corrosion
	Methane/CO2 production: Inhibition due to the pressure of toxic materials
	Methane/CO2 production: Carbonate/bicarbonate exchange with concrete
DOE1.2.2.12	
DOE1.2.2.13 DOE1.2.3	Methane/CO2 production: Effects of radiation on microbial populations
DOE123	As generation from concrete
DOE1.2.4.1	Tritiated hydrogen
	Active metane and carbon dioxide
DOE1.2.4.3	Other acive gases
	Toxic gases
DOE1.2.5	Gas vangot
DOE1.2.6.1	Gas transport in the waste container
DOE1.2.6.2	Gas transport In the vaults between containers
	Gas transport Between vaults
	Gas transport in the near-field, including up and around access shafts and adits
DOE1.2.6.5	Gas transport into and through the lar-field
DOE127	Flarenability
DOE1.2.7.1	Fines
DOE1.2.7.2	Explosions
DOE1.3.1	Radioactive decay and ingrowth
DOE1.3.2	Nuclear criticality
DOE1.4.1	Canister or container movement
DOE1.4.2	Changes in in situ stress field
DOE1.4.3	Embrittlement
DOE1.4.4	Subsidemucorapse
DOE1.4.4.1	Repository induced subsidence
DOE1.4.4.2	

IDENTIFIER	
D0E1.4.5	Rock creep
DOE1.4.6	Fracturing
DOELSI	Changes at mostere correct
DOE1.5.1.1	Changes in moisture content Due to dewatering
DOE1.5.1.2	Changes in moisture content Jue to stress relief
D0E1.52	Groundwater flow (unsaturated conditions)
DOE1.5.2.1	Groundwater flow: initial conditions
DOE1.5.2.2	Scroundwater flow due to gas production
DOE1.5.3	Groundwater flow (saturated conditions)
DOE1.5.4	Transport of chemically active substances into the sear-lied
DOE1.5.4.1	Transport of Inorganic ions into the near-field
DOE1.5.4.2	Transport of Humic and turvic acids into the near-field
DOE1.5.4.3	Transport of Microbes into the near-lield
DOE1.5.4.4 DOE1.5.4.5	Transport of Organic complexes into the near-field
DOE1.5.4.5	Differential elastic response
DOE1.6.2	Non-elastic response
DOE183	Fracture changes
DOE1.6.3.1	Fracture changes: aperture
	Fracture changes: length
DOE1.6.4	Hydroiogical cuanges
DOE1.6.4.1	Hydrological changes: Fluid pressure
DOE1.6.4.2	Hydrological changes: Density
DOE1.6.4.3	Hydrological changes: Viscosity
DOE1.6.5	Chemical changes
DOE1.6.5.1	Chemical changes due to Metal corrosion
DOE1.6.5.2	Chemical changes due to Concrete degradation
OOE1.6.5.3	Chemical changes due to Waste degradation
DOE1.6.5.4	Chemical changes due to Gas production
0E1.6.5.5	Chemical changes due to Complex formation
OE1.6.5.6	Chemical changes due to Colloid production
OE1.6.5.7	Chemical changes due to Solubility
	Chemical changes due to Sorption
	Chemical changes due to Species equilibrium
XXE1.6.6	Microbiological effects
OE1.6.6.1 OE1.6.6.2	Microbiological effects due to Cellulose degradation
	Microbiological effects due to Microbial product reactions
	Meteorite impact
0E221	Rence lectoric
	Uclift
OE2.2.1.2	Subsidence
OE2.2.1.3	Lateral and/or vertical flexure
0E222	Magmalic
OE2.2.2.1	Magmatic: Instusive
OE2222	Magmatic: Extrusive
OE2.2.2.3	Magmatic: Hydrothermal
0E223	Metamorphism
0E2.2.3.1	Contact metamorphism
OE2.2.3.2	Regional metamorphism
OE2.2.3.3	Dislocation metamorphism
0E2.2.4	Diagenesis
OE2.2.5	Diapirism
DE225	Seismichy
DE2.2.6.1	Repository-induced seismicity
DE2.26.2	Externally-induced seismicity
DE2.2.6.3	Natural seismicity
DE2.2.7	Facting/racturing
DE2.2.7.1 DE2.2.7.2	Faulting/fracturing: Activation
0E2.27.2 0E2.2.7.3	Faulting/racturing: Cleneration Faulting/racturing: Change of properties
0E2.2.1.3 0E2.2.8	Major incision
DE2.2.9	Weathering
0E2.2.10	Effects of natural cases
DE2.2.10	Geothermal effects
DE2.3.1	Variation in groundwater recharge

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DENTIEIED	FEP NAME
	Rock property changes
DOE2.3.3.1	Rock property changes: Porosity
0.012.0.0.2	
	Rock property changes: Microbial pore blocking
	Rock property changes: Channel formation/closure
	Groundwater for
	Groundwater flow: Darcy
	Groundwater flow: Non-Darcy
DOE2.3.4.3	Groundwater flow: Intergranular (matrix)
DOE2.3.4.4	Groundwater flow: Fracture
DOE2.3.4.5	Groundwater flow: Effects of solution channels
DOE2.3.4.6	Inorganic colloid transport: Porous media
DOE23.5	Inoganic colloid transport: Fractured media
DOE2.3.5.1	Inorganic colloid transport. Effects of pH and Eh
DOE2.3.5.2	Inorganic colloid transport. Effects of ionic strength
DOE2.3.5.3	Salinity: implications of evaporite deposits/minerals
DOE2.3.6	Variations in groundwater temperature
DOE2.4.1	Advection
DCE242	Diflusion
DOE2.4.2.1	Bulk diffusion
DOE2.4.2.2	Mainx diffusion
DOE2 4.2.3	Surface diffusion
	Hydrodynaniic dispersion
	Soluciality concaraints
	Solubility: effects of pH and Eh
	Solubility: effects of ionic strength
DOE2.4.4.3	Solubility: effects of naturally-occurring complexing agents
DOE2.4.4.3 DOE2.4.4.4	
	Solubility: effects of complexing agents formed in the near-field
DOE2.4.4.5	Solubility, effects of naturally-occuring colloids
	Solubility: effects of colloids formed in the near-field
DOE2.4.4.7	Solubility: effects of major ions migrating from the rear-field
DOE2.4.4.8	Solubility: Effects of microbial activity
DOE2.4.5	Soption
	Linear sorption
	Non-Finear sorption
	Reversible sorption
DOE2.4.5.4	Inversible sorption
DOE2.4.5.5	Scription: Effects of pH and En
DOE2.4.5.6	Sorption: Effects of ionic strength
DOE2.4.5.7	Sorption: Effects of naturally-occurring organic complexing agents
DOE2.4.5.8	Sorption: Effects of naturally-occuring inorganic complexing agents
DOE2.4.5.9	Sorption: Effects of complexing agents formed in the near-field
DOE2.4.5.10	Sorption: effects of naturally-occuring colloids
DCE2.4.5.11	Sorption: effects of colloids formed in the near-field
	Sorption: effects of major ions migrating from the near-field
	Sorption: effects of microbial activity
	Fracture mineralisation
DOE2.4.7	Organie colloid transport
	Orcanic colloid transport in Porous media
	Organic colloid transport in Fractured media
	Organic colloid transport all Tractated media
*****	Organic colloid transport: Effects of private the
	Inorganic colloid transport. Energy of some strength
	Inorganic colloid transport: Porous media
	Inorganic colloid transport: Fractured media
	Inorganic colloid transport: Effects of pH and Eh
	Inorganic colloid transport: Effects of ionic strength
	Transport of radionuclides bound to microbes
en en la constante de la constante de la constante de	Sotopic dilution
DOE2.4.11	Gas Transport
DOE2.4.11.1	Gas transport: solution
	Gas transport: gas phase
DOF574.112	Gas-induced groundwater transport
DOE2.4.12	
DOE2.4.12	
DCE2.4.12 DOE2.4.13	Thermally induced groundwater transport Repository thermally-induced groundwater transport
DCE2.4.12 DOE2.4.13 DOE2.4.13.1	Thermally induced groundwater transport

DENTIFIER	FEP NAME
DOE3.1.1	Transient greenhouse gas induced warrang
DOE3.1.1.1	Greenhouse-induced Precipitation
COE3.1.1.2	Greenhouse-induced Temperature
DOE3.1.1.3	Greenhouse-induced Sea level rise
DOE3.1.1.4	Greenhouse-induced Storm surges
DOE3.1.1.5	Greenhouse-induced Ecological effects
DOE3.1.1.6	Greenhouse-induced Potential evaporation
DOE312	Glacial/Interglacial cycling
DOE3.1.2.1	Glacial/interglacial cycling: Precipitation
DOE3.1.2.2	Glacial/interglacial cycling: Temperature
DOE3.1.2.3	Glacial/interglacial cycling: Sea level changes (rise/fail)
DOE3.1.2.4	Glacial/interglacial cycling: Storm surges
DOE3.1.2.5	Glacial/interglacial cycling: Ecological effects
DOE3.1.2.6	Glacial/Interglacial cycling: Seasonally tozen ground
DOE3.1.27	Glacia/interglacial cycling: Permanently trozen ground
DOE3.1.2.8	Glacial/interglacial cycling: Glaciation
DOE3.1.2.9	Glacial/interglacial cycling: Deglaciation
DOE3.1.2.10	Glacial/interglacial cycling: Potential evaporation
X0E3.1.3	Exit from glacial/interglacial cycling
OE3.1.3.1	Glacia/interglacial exit: greenhouse gas induced
OE3.1.3.2	Glacial/interglacial exit due to other causes
X0E3.2.1	Generalised derudation
OE3.2.1.1	Generalised denudation: Fluvial
00E3.2.1.2	Generalised denudation: Aeolan
OE3.2.1.3	Generalised denudation: Glacial
OE322	Localised denudation
OE3.2.2.1	Localised denudation: Fluvial (valley incision)
OE3.2.2.2	Localised denudation: Fuvial (weathering/mass movement)
OE3.2.2.3	Localised depudation: Glacial
OE3.2.2.4 OE3.2.3	"Localised denudation: Coastal
	Sediment redistribution. Fluvial
OE3.2.3.2 CE3.2.3.3	Sediment redistribution: Aedian
0E3.2.3.3 0E3.2.4	
OE3.2.4.1	Effects of sea level change River incision/sedimentation due to seal-level change
OE3.2.4.2	Coastal erosion due to seal-level change
	a al moisture and evaporation due to seal-level change
0E3.3.2	- a surface runoif processes
OE3.3.2.1	sear-surface runoff processes: Overland flow
OE3.3.2.2	Near-surface runofi processes: interflow
0E3.3.2.3	Near-surface runoff processes: Return flow
OE3.3.2.4	Near-surface runoff processes: Macropore flow
	Near-surface runoff processes; Variable source area response
	Groundwater recharge
OE234	Surface flow characteristics (itestimater)
OE3.3.4.1	Surface flow characteristics (treshwater): Stream/river flow
OE3.3.4.2	Surface flow characteristics (freshwater): Sediment transport
OE3.3.4.3	Surface flow characteristics (freshwater): Meander migration or other fluvial response
OE3.3.4.4	Surface flow characteristics (freshwater): Lake formation/sedimentation
OE3.3.4.5	Surface flow characteristics (irestiwater): Effects of sea level change
DE3.3.5	Surface flow characteristics (estuarine)
DE3.3.5.1	Surface flow characteristics (estuarine): Tidal cycling
DE3.3.5.2	Surface flow characteristics (estuarine): Sediment transport
DE3.3.5.3	Surface flow characteristics (estuarine): Successional development
DE3.3.5.4	Surface flow characteristics (estuarine): Effects of sea level change
DE13.6	Coastai watevs
DE3.3.6.1	Coastal waters: Tidal mixing
E3.3.6.2	Coastal waters: Residual current mixing
DE3.3.6.3	Coastal waters: Effects of sea level change
E33.7	Cosa, waters
DE3.3.7.1	Ocean waters: Water exchange
DE3.3.7.2	Ocean waters: Effects of sea level change
DE3.4.1	Tenestr'i Ecological Development
DE3.4.1.1	Terrestrial ecological development: Agricultural systems
E3.4.1.2	Terrestnal ecological development: Semi-natural systems
DE3.4.1.2	Terrestrial ecological development: Natural systems
DE3.4.1.4	Terrestrial ecological development: Effects of succession
<u></u>	Terrestrial ecological development: Estuarine

DENTIFIER	REP NAME
DOE3.4.3	©Coastal waters
DOE3.4.4	Oceans
DOE3.5.1	Erosion
DOE3.5.1.1	Erosion: Fluvial
DCE3.5.1.2	Erosion: Aeolian
	Erosion: Glacial
DOE3.5.1.4	Erosion: Coastal
DOE352	Groundwater discharge to solls
DOE3.5.2.1	Groundwater discharge to soils: Advective
DOE3.5.2.2	Groundwater discharge to soils: Diffusive
DOE3.5.2.3	Groundwater discharge to soils: Biotic
DOE3.5.2.4 DOE3.5.3	Groundwater discharge to soils: Volatilisation Groundwater discharge to wells or springs
DOE3.5.4	Groundwater discharge to freshwaters
DOE3.5.5	Groundwater discharge to estuaries
DOE3.5.6	Groundwater discharge to coastal waters
0053.5.7	Surface water bodies
DOE3.5.7.1	Surface water bodies: Water flow
DOE3.5.7.2	Surface water bodies: Suspended sediments
DOE3.5.7.3	Surface water bodies: Botiom sediments
DOE3.5.7.4	Surface water bodies: Effects on vegetation
DCE3.5.7.5	Surface water bodies: Effects of fluvial system development
DOE3.5.8	Estuaries
DOE3.5.8.1	Estuaries: Water flow
DOE3.5.8.2	Estuaries: Suspended sediments
DOE3.5.8.3	Estuaries: Bottom sediments
DOE3.5.8.4	Estuaries: Effects of salinity variation
	Estuaries: Effects on vegetation
DOE3.5.8.6	Estuaries: Effects of estuarine development
DOE3.5.8.7	Estuaries: Effects of sea-level change
DOE3.5.9	Coastal waters
DOE3.5.9.1 DOE3.5.9.2	Coastal waters: Water transport
DOE3.5.9.3	Coastal waters: Solitom sediment transport
DOE3.5.9.4	Coastal waters: Effects of sea level change
DOE3.5.9.5	Coastal waters: Effects of estuarine development
DOE3.5.9.6	Coastal waters: Effects of coastal erosion
DOE3.5.9.7	Coastal waters: Effects of sea level change
DOE3.5.10	Planis
	Plants: Root uptake
	Plants: Deposition on surfaces
	Plants: Vapour uptake
DOE3.5.10.4	Plants: Internal translocation and retention
	Plants: Washoff and leaching by raistall
	Plants: Leaf-tail and senescence
DOE3.5.10.7 DOE3.5.11	Plants: Cycling processes Animals
	Animals: Uptake by ingestion
	Animals: Optane by Initiality
	Animals: Cycling processes
DOE3.5.11.5	Animals: Effects of relocation and migration
DOE3.6.1	External exposure
DOE3.6.1.1	External exposure: Land
	Extornal exposure: Sediments
DOE3.6.1.3	External exposure: Water books
DOE362	Ingestion
DOE3.6.2.1	Ingestion and Drinking water
DOE3.6.2.2	Ingestion and Agricultural crops
DOE3.6.2.3	Ingestion and Domestic animal products
DOE3.6.2.4	Ingestion and Wild plants
DOE3.6.2.5	Ingestion and Wild animals
DOE3.6.2.6	Digestion and Soils and sediments
T. T. T. A. A. A. A. (1997)	
DOE3.6.3	innalation
DCE3.6.3.1	Inhalation and Soils and sediments
DCE3.6.3.1 DOE3.6.3.2	Inhalation and Soils and sediments
DCE3.6.3.1 DOE3.6.3.2 DOE3.6.3.3	Inhalation and Soils and sediments Inhalation and Gases and vapours (indoor) Inhalation and Gases and vapours (outdoor)
DCE3.6.3.1 DOE3.6.3.2	Inhalation and Soils and sediments

	RAW FEPs LIST
DENTIFIER	FEP NAME
DOE411	
DOE4.1.1.1	Borehole seal failure
DOE4.1.1.2	Borehole seal degradation
DOE4.1.2	Station access annel seal
DOE4.1.2.1	Shatutunnel seal tailure
DOE4.1.2.2	Shah/unnel seal degradation
DOE4 1.2	Subsatemore
DOE4.1.3.1	Subsidence and fault/fracture induction
DOE4.2.1	Deliberate recovery of wastes or associated materials
DOE4.2.2	Malicious intrusion
DOE423	Exploratory drilling
DOE4.2.4	Exploitation drilling
DOE425	Geothermal energy production
DOE426	Resource mining
DOE4.2.7	Tusnelling
DOE4.2.8	Construction of underground storage/disposal facilities
DOE4.2.9	Construction of underground dwellings/shelters
DOE42.10	Archaeological investigations
DOE4.2.11	Injection of Equid wastes
DOE4.2.12	Groundwater abstraction
DOE4.2.13	Underground weapons testing

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TENTIFIER	
IAEA1.1	Climatic change
IAEA1.2	Wydrological change
	Sea level change
IAEA1.4	Denudation
IAEA1.5	Stream erosion
IAEA1.6	Glacial erosion
IAEA1.7	Flooding
IAEA1.8	Sedimentation
IAEA1.9	Diagenesis
IAEA1.10	
IAEA1.11	Faulting/seismicity
IAEA1.12	© Geochemical change
IAEA1.13.1	Fluid interactions: Groundwater flow
IAEA1.13.2	Ruid interactions: Dissolution
IAEA1.13.3	Fluid interactions: Brine pockets
IAEA1.14.1	Uplift/Subsidence: Orogenic
	Uplit/Subsidence: Epeirogenic
AEA1.14.3	Uplitt/Subsidence: Isostatic
IAEA1.15.1	Undetected features: Faults, shear zones
IAEA1.15.2	Undetected features: Breccia pipes
IAEA1.15.3	Undetected features: Lava tubes
IAEA1.15.4	Undetected features, intrusive dykes
IAEA1.15.5	Undetected features: Gas or brine pockets
IAEA1.16.1	Magmatic activity: Extrusive
IAEA1.17	Meteorite impact
IAEA2.1.1	Undetected past intrusion: Boreholes
IAEA2.1.2	Undetected past intrusion: Mine shafts
IAEA221	Inadequate design: Shaft seal failure
IAEA2.2.2	Inadequate design: Exploration borehole seal failure
IAEA2.3	improper operation: Improper waste emplacement
IAEA2.4.1	Transport agent introduction: Irrigation
IAEA2.4.2	Transport agent introduction: Reservoirs
IAEA2.4.3	Transport agent introduction: Intentional artificial groundwater Recharge or withdrawal
IAEA2.4.4	Transport agent introduction: Chemical liquid waste disposal
IAEA2.5	Climatic change (including climate control)
IAEA2.6	Large-scale hydrological change
IAEA2.7.1	Intentional intrusion: War
AEA2.7.2	Intentional intrusion: Sabotage
IAEA2.7.3	Intentional intrusion: Waste recovery
IAEA2.8.1	Inadventent future intrusion: Exploratory drilling
IAEA2.8.2	Inadventent future intrusion: Archaeological exhumation
IAEA2.8.3	Inadvertent future intrusion: Resource mining (mineral, water, hydrocarbon, geothermal, salt, etc).
IAEA3.1.1	Thermal effects: Differential elastic response
IAEA3.1.2	Thermal effects: Non-elastic response
1AEA3.1.3	Thermal effects: Fluid pressure, density, viscosity changes
IAEA3.1.4	Thermal effects: Fluid migration
IAEA3.2.1	Chemical effects: Corrosion
AEA3.2.2	Chemical effects: Interactions of waste package and rock
AEA3.2.3	Chemical effects: Gas generation
IAEA3.2.4	Chemical effects: Geochemical change
IAEA3.3.1	Mechanical effects: Canister movement
IAE43.3.2	Mechanical effects: Local fracturing
AEA3.4.1	Radiological effects: Material property changes
IAEA3.4.2	Radiological effects: Radiolysis
IAEA3.4.3	Radiological effects: Decay product gas generation
IAEA3.4.4	Radiological effects: Nuclear criticality

IDENTIFIER	FEP NAME
PGA1	SLOW NATURAL PROCESSES
PGA1.1	Climate changes
PGA12	Sea-level changes
PGA1.3	Erosion (fluvial and glacial)
PGA1.4	Sedimentation
PGA1.5	Tectonic crustal movements
PGA1.6	Magma intresion
PGA1.7	Volcanism
PGA1.8	Diapirism
PGA1.9	Diagenesis
PGA1.10	Metamorphosis
PGA1.11	Weathening, mineralisation
PGA1.12	Groundwater changes
PGA2	RAPID NATURAL EVENTS
PGA21	Earthquakes
PGA22	Volcanic eruption
PGA2.3	Meteor impact
PGA2.4	Rooding with extreme erosion
PGA2.5	Humicane, storms
PGA2.6	Movements at faults
PGA27	Formation of new faults
FGA3.	CAUSED BY DISPOSAL OF WASTE
PGA3.1	Radiation damage of the matrix
PGA32	© Radiolysis
PGA3.3	Nuclear criticality
PGA3.4	Canister movement in backfill
PGA3.5	Decompressed zones from mining
PGA3.6	Mechanical canister damage
PGA3.7.1	Differing thermal expansion of glass matrix and canister
PGA3.7.2	Differing thermal expansion of canister and backfill
PGA3.7.3	Differing thermal expansion of backfill and host rock
PGA3.7.4	Differing thermal expansion of host rock zones
PGA3.8	Thermal convection
PGA3.9	Thermality induced chemical changes
PGA3.10	Chemical changes due to corrosion
PGA3.11	Drying out and re-saturation
PGA3.12.1	Geochemical changes in backfill
PGA3.12.2	Geochemical changes in host rock
PGA3.13	Physico-chemical phenomena/effects (eq. colloid formation)
PGA3.14	Microbiological phenomena/effects
	Gas production
	Failure of shaft sealing
NGA4.	CAUSED BY MAN
PGA4.1	Direct alterations in hydrogeology
	injection of liquid waste
	Drilling; in sediments
GA4.3.2	Drilling: in host rock
GA4.4	Geothermal energy production in crystalline rock

Backfill material deficiencies	SK13.2.12
	2K13.2.11
Soret effect	SKI3.2.10
Flow through butter/backfill	2KI3 5 8
Preferential pathways in the bufferbackfill	SK13.2.8
Swelling of consion products	SKI3.2.7
noisuttib soshue - noisuttig	SKI3 S e
Themai effects on the butter material	
Erosion of butterhoadmine and a moisona	2KI3'5'\$
Mechanicsi Isilure of butter/backtill	
Movement of canister in butter/backfill	430
Uneven swelling of bentonke	SKI3.2.1.2
Swelling of benionite into tunnels and cracks	SKI3.2.1.1
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Radiation effects on bentonite	-255
Perturbed butter material chemistry	2K1371715
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Colloid generation - source	
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Externel areas	SKIS-3-7.1
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Stress corrosion cracking	
Electro-chemical casching	
गुरास्य स्वर्थके	
Creeping of copper	
Sadopily	·····
Corrosive agents, Sulphides, oxygen etc	
Daining analysis analysis and a standard	
Valual telluric electrochemical reactions	
Repository induced Pb/Cu electrochemical reactions	
Role of chlorides in copper concesion	
Hole of the events channeling within the canister	
atematic contraction due to wate	
Complete effects (electrophonesis)	· · · = · ·
chemical reactions (copper corrosion)	
Release of radionuclides from the failured carrister	
Subtract of the search of the	
Sudden energy release	
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Dissolution chemistry Damaged or deviating luel	ж <mark>и 58</mark>
Solubility within fuel matrix Pecrystallization Pedox potential Dissolution chemistry Dissolution chemistry Damaged or deviating fuel	ж <mark>и 58</mark> жи 52 жи 52
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Tadolysis T2/O2 explosions D-1 reactions C5-migration to glass surface C5-migration to glass surface Tecrystallization Te	жн 58 жн 58 жн 56 жн 56 жн 56 жн 57 жн 57 жн 57
Sas generation. He production Padolysis Tadolysis Db-1 reactions Cs-migration to glass surface Solubility within fuel matrix Tecrystallization Tecrystallization Solubility within fuel matrix Tecrystallization Solubility within fuel matrix Tecrystallization Solubility within fuel matrix Solubility	жн 23 жн 25 жн 26 жн 26 жн 27 жн 27 Хи Хи 27 Жн 27 Жн 27 Жн 27 Жн 27 Жн 27 Жн 27 Жн 27 Жн 27 Жн 27 Хи
Recoil of aprits-decay Secoil of aprits-decay Sas generation: He production Co-migration to glass surface Secrystallization Peter potentiat Camaged or deviating tuel Damaged or deviating tuel	жи 53 жи 52 жи 52 жи 52 жи 53 жи 53 хи 53
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DENTIFIER	FEP NAME
	Oxidizing conditions
SKH1.1	pH-deviations
SKH4.1.3	Colloids, complexing agents
SKH4.1.4	Sorption
SK14.1.5	Matrix diffusion
SKH4.1.6	Reconcentration
SKI4.1.7	Thermochemical changes
SK14.1.8	Change of groundwater chemistry in nearby rock
SKI4.1.9	Complexing agents
SKI4.2.1	Mechanical failure of repository
SK14.2.2	NOENTHY
SK14.221	Excavation/backfilling effects on nearby rock
SK14.2.2.2	Hydraulic conductivity change - Excavation/backfilling effect
SK14.2.2.3	Mechanical effects - Excavation/backfilling effects
SK14.2.3	Extreme channel flow of oxidants and nuclides
SK14.2.4	Thermal buoyancy
SK14.2.5	Changes of groundwater flow
SK14.2.7	Thermo-hydro-mechanical effects
SK14.2.7	Enhanced rock fracturing
	Creeping of rock mass
	Chemical effects of rock reinforcement
	Satine (or fresh) groundwater intrusion
	Non-sealed repository
	Stray materials left
SK15.4	Decontamination materials left
SKI5.5	Chemical sabotage
SKI5.6	Co-storage of other waste
SK15.7	Poorty designed repository
SK15.8	Poorly constructed repository
SK15.9	Unsealed boreholes and/or shafts
SKI5.10	Accidents during operation
	Degradation of hole- and shaft seals
SK15.12	Near storage of other waste
SK15.13	Volcanism
SKI5.14	Resaturation
SK15.15 SK15.16	Earthquakes
	Permainost
	Enhanced groundwater flow
SKI5.19	Ellect of plate movements
SK15.20	Changes of the magnetic field
	Future boreholes and undetected past boreholes
SK15.22	Accumulation of gases under permatrost
SKI5.23	Changed hydrostatic pressure on canister
SKI5.24	Stress changes of conductivity
SKI5.25	Dissolution of tracture fillings/precipitations
SK15.26	Erosion on surface/sediments
SK15.27	Human induced actions on groundwater recharge
SK15.28	Underground dweilings
SKI5.29	Meleorite
SKI5.30	Underground test of nuclear devices
SK15.31	Change in sealevel
SK15.32 SK15.33	Vesent and unsaturation
SK15.33 SK15.34	Geothermal energy production
	Other future uses of crystalline rock
SK15.36	Reuse of boreholes
	Archaeological intrusion
	Explosions
SKI5.39	Postclosure monitoring
SX15.40	Unsuccessful attempt of site improvement
SK15.41	Water producing well
SK15.42	Glaciation
SK15.43	Methane intrusion
SK15.44	Solubility and precipitation
SK15.45	Colloid generation and transport
	Groundwater recharge/discharge

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DENTIFIER	FEP NAME
SKI6.1	Winderected fracture zones
SK06.2	Gas transport
SKI6.3	Far field hydrochemistry - acids, oxidants, nitrate
SKI6.4	Dispersion
SKI6.5	Ditaion
SK16.6	Weathering of flow paths
SKI6.7	Nuclear war
SKI6.8	Human induced climate change
SK16.9	River meandering
SK16.10	No ice age
SKI6.11	lintruding dykes
SK16.12	Undetected discontinuities
SK16.13	Geothermally induced flow
SK16.14	Tectonic activity - large scale
SK17.1	Accumulation in sediments
SK07.2	Accumulation in peat
SK17.3	Intrusion in accumulation zone in the biosphere
SKI7.4	Chemical toxicity of wastes
SKI7.5	Isotopic dilution
SKI7.6	NO ENTRY]
SKI7.7	Human induced changes in surface hydrology
SKI7.8	Altered surface water chemistry by humans
SKI7.9	Loss of records
SKI7.10	Diagenesis
SKI7.11	City on the site

IDENTIFIER	FEP NAME
SNL1.1	Meteorite Impact
SNL2.1	Erosion/Sedimentation
SNL2.2	Glaciation
SNL2.3	Pluvial Periods
SNL2.4	Sea-Level Variations
SNL2.5	Humicanes
SNL2.6	Seiches
SNL2.7	Tsunamis
SNL2.8	Regional Subsidence or Uplift (also applies to subsurface)
SNL29	Mass Wasting
SNL210	Ficoding
SNL3.1	Diapirism
SNL3.2	Seismic Activity
SNL3.3	Volcanic Activity
SNL3.4	Magmatic Activity
SNL3.5	Formation of Dissolution Cavities
SNL3.6	Formation of Interconnected Fracture Systems
SNL3.7	Faulting
SNL4.1	inadvertent intrusions: Explosions
SNL4.2	Inadvenent Intrusions: Drilling
SNL4.3	Inadvertent Intrusions: Mining
SNL4.4	Inadvenent Intrusions; Injection Wells
SNL4.5	Inadvenent Intrusions: Withdrawal Wells
SNL5.1	Hydrologic Stresses: Irrigation
SNL52	Hydrologic Stresses: Damming of Streares or Rivers
SNL6.1	Subsidence and Caving
SNL6.2	Shaft and Borehole Seal Degradation
SNL6.3	Thermality induced Stress/Fracturing in Host Rock
SNL6.4	Excavation-Induced Stress/Fracturing in Host Rock

JEN INFIER	FEP NAME
KN1.1.1	Meotorite Impact
	Solar insolation
KN1.2.1	Plate movement/tectonic change
KN1.2.2	Changes in the Earth's magnetic field
KN1.2.3	Magmatic activity (intrusive, extrusive)
KN1.2.4	Metamorphic activity
KN1.2.5	Diagenesis
KN126 KN127	Uplift and subsidence (e.g. orogenic, isostatic) Diapirism
KN1.2.8	Seismicity
KN1.2.9	Fault activation
	Fault generation
KN1.2.11	Rock heterogeneity (e.g. permeability, mineralogy) affecting water and gas flow
KN1.2.12	Undetected features (e.g. faults, fracture networks, shear zones, brecciation, gas pockets)
KN1.2.13	Natural gas intrusion
KN1.3.1	Precipitation, temperature and soil water balance
KN1.3.2	Extremes of precipitation, show melt and associated flooding
KN1.3.3	Coastal surge, storms and hurricanes
KN1.3.4	Sea-level rise/fail
KN1.3.5	Periglacial effects (eg. permatrost, high seasonality)
KN1.3.6 KN1.3.7	Slacizion (erosion/deposition, glacial loading, hydrogeological change)
ÿ	Land slide
KN1.4.2	Denudation (aeolian and liuvial)
KN1.4.3	River, stream, channel erosion (downcutting)
KN1.4.4	River meander
KN1.4.5	Freshwater sediment transport and deposition
KN1.4.5	Coastal erosion and estuarine development
KN1.4.7	Marine sediment transport and deposition
KN1.4.8	Frost weathering and scilliuction
	Chemical denudation and weathering
	Frost weathering
KN1.5.2	River flow and take level changes
KN1.5.3	Recharge to groundwater
KN1.5.4	Groundwater discharge (to surface water, to springs, to soils, to wells, to marine)
KN1.5.5	Groundwater flow (Darcy, non-Darcy, intergranular fracture, channelling and preferential pathways)
KN1.5.6	Groundwater conditions (saturated/unsaturated)
KN1.5.7	Saline or freshwater intrusion
KN1.5.8	Effects at saline-freshwater interface
KN1.5.9	Natural themal effects
KN1.6.1	Advection and dispersion
KN1.6.2 KN1.6.3	Diffusion Matrix diffusion
KN1.6.4	Gas mediated transport
KN1.6.5	Multiphase flow and gas driven flow
KN1.6.6	Solubility fittat
KN1.6.7	Sorption (linear/non-linear, reversible/irreversible)
KN1.5.8	Dissolution, precipitation and crystalisation
KN1.6.9	Colloid formation, dissolution and transport
KN1.6.10	Complexing agents
	Fracture mineralisation and weathering
KN1.6.12	Accumulation in soils and organic debris
	Mass, isotopic and species dilution
	Plant uptake
	Animal uptake
KN1.7.3	Uptake by deep rooting species
KN1.7.4	Soil and sediment bioturbation
KN1.7.5	Pedogenesis
KN1.7.6	Chemical transformations
KN1.7.7	Microbial interactions
KN1.7.8	Ecological change, eg. iorest fire cycles
KN1.7.9	Ecological response to climate, eg. desert formation
KN1.7.10	Plant and animal evolution
KN2.1.1	
)	
KN2.1.3 🛛 🕴	Shaft or access tunnel seal tailure and degradation
KN2.1.4	
KN1.7.10	Plant and animal evolution Undetected past intrusions, (eg. boreholes, mining) Investigation borehole seal failure and degradation Shaft or access tunnel seal failure and degradation

RAW FEPs LIST

IDENTIFIER	FEP NAME
UKN2.1.6	Material defects, e.g. early canister failure
UKN2.1.7 UKN2.1.8	Common case failures Poor quality construction
UKN2.1.9	
UKN2.1.10	Themai effects (eq. concrete hydration)
UKN221	Radioactive waste disposal error
UKN222	Inadequate backfill or compaction, voidage
UKN223	Co-disposal of reactive wastes (deliberate)
UKN224	Inadvertent inclusion of undesirable materials
UKN2.2.5	Heterogeneity of waste forms (chemical, physical)
UKN2.2.6	Accidents during operation
UKN227	Sabotage
UKN228	Repository flooding during operation
UKN2.2.9	Abandonment of unsealed repository
UKN2.2.10	Poor closure
UKN2.2.11	Post-closure monitoring
UKN2.2.12	Effects of phased operation
UKN23.1	Recovery of repository materials
UKN232	Malicious intrustion, e.g. sabotage, act of war
UKN2.3.3	Exploratory drilling
UKN234	Exploitation drilling
UKN2.3.5	Geothermal energy production
UKN236	Resource mining
UKN23.7	Tunneling
UKN2.3.8	Underground construction
UKN2.3.9	Archaeological investigation
	Injection of liquid wastes
	Groundwater abstraction
UKN2.3.12	Underground nuclear testing
UKN2.4.1	Loss of records
	Dams and reservoirs, built/drained
JKN2.4.3 JKN2.4.4	River rechannelled
JKN2.4.5	A knowl only on the state share the
JKN2.4.6	Altered soil or surface water chemistry
JKN247	Agricultural and isheries practice changes
JKN24.8	Demographic change, urban development
JKN249	Anthropogenic climate change (greenhouse effect)
JKN2.4.10	Quarrying, peat extraction
	Differential elastic response
	Non-elastic response
JKN3.1.3	Host rock fracture aperture changes
JKN3.1.4	Induced hydrological changes (fluid pressure, density convection, viscosity)
JKN3.1.5	Induced chemical changes (solubility, sorption, species equilibrium, mineralisation)
JKN321	Metallic corrosion (citting/uniform, internal and external agents, gas generation eg. H2)
JKN3.2.2	Interactions of host materials and groundwater with repository material (eg, concrete carbonation
JKN3.2.3	Interactions of waste and repository materials with host materials (eg. electrochemical, corrosive a
JKN3.2.4	Non-radioactive solute plume in geosphere (effect on redox, effect on pH, sorption)
JKN3.2.5	Cellulosic degradation
KN32.6	Introduced complexing agents and cellulosics
KN <u>3.2.7</u>	Microbiological effects (on corresion/degradation, on solubility/complexation, gas generation.e.g. (
IKN3.3.1	Canister or container movement
KN3.3.2	Changes in in-situ stress field
KN3 <u>3.3</u>	Embrittlement and cracking
KN3.3.4	Subsidence/collapse
KN3.3.5	Fracturing
KN3.3.6	Gas effects (pressuration, disruption, explosion, fire)
KN3.4.1	Padiolysis
KN3.4.2	Material property changes
KN3.4.3	Nuclear criticality
KN3.4.4 🔅	Radioactive decay and ingrowth (chain decay)

	FEP NAME
HLAP1: NEAR	
	emical/physical degradation
HMIP1.1.1	Container metal corrosion
HMIP1.1.2	Physico-chemical degradation of concrete
HMIP1.1.3	Physico-chemical degradation of wastes and transport to the far-field
HMIP1.1.4	Bectrical effects of metal corrosion
	s production, transport and flammability
HMIP12.1	Hydrogen by metal concision
	Methane and carbon dioxide by microbial degradation
HMIP122	
HMIP123	Gas generation from concrete
HMIP124	Radioacive gases
HMIP1 <u>25</u>	Chemotoxic gases
HMIP1.2.6	Gas transport
HMIP127	Flammability
HMIP1.2.8	Thermo-chemical effects
HAIPIJ Re	Fision phenomena
HMIP1.3.1	· · · · · · · · · · · · · · · · · · ·
HMIP1.3.2	Nuclear criticality
and the second second second	uctural integrity
	Waste-form and backfill consolidation
HMIP1.4.2	Vault collapse
	drogeologica) stiects
HMIP1.5.1	Desaturation (pumping) effects
HMIP1.5.2	Disturbed zone (hydromechanical) effects
HMIP1.5.3	Gas production (unsaturated flow)
HMIP1.5.4	Saturated groundwater flow
HMIP1.5.5	Transport of chemically active substances into the near-field
HAPLS The	
HMTP1.6.1	Thermal effects and Rock-mass changes
	Thermal effects and Hydrogeological changes
HMIP1.6.2	
HMIP1.6.3	Thermal effects and Chemical changes
HMIP1.6.4	Thermal effects and Transport (diffusion) effects
HLAP2 FARF	
HMIP2.1 Geo	logical
HMIP2.1.1	Regional tectonic
HMP2.1.2	Magmatic activity
HMIP2.1.3	Metamorphism
HMIP2.1.4	Diagenesis
HMIP2.1.5	
	Seismicity
HMIP2.1.7	Raulting/racturing
HMIP2.1.8	<u>Major incision</u>
HMIP21.9	Effects of natural gases
HMIP2.2 Hy	
HMIP221	Changes in geometry and driving forces of the flow system
HMIP222	Rock property changes
HMIP223	Groundwater flow
HMIP2.3 Tra	nsport and geochemicsi
HMIP2.3.1	Advection
HMIP2.3.2	
-MIP2.3.3	Hydrodynamic dispersion
-MIP2.3.4	
-MIP2.3.5	Sorption including icn-exchange
HMIP2.3.6	Changes in sorptive surfaces
-MIP2_3_7	Changes in groundwater chemistry and flow direction
HMIP23.8	Colloid transport
HMIP2.3.9	Transport of radionuclides bound to microbes
HMIP2.3.10	Transport of active gases
HMIP2.3.11	Gas induced croundwater transport
-MIP2.3.12	Thermal effects on hydrochemistry

RAW FEPs LIST

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DENTIFIED	R FEP NAME
	eonorphology
HMIP24.1	· · · · · · · · · · · · · · · · · · ·
HMIP242	Localised denudation
HMP3: CLIN	AATOLOGY
HMEP3.1 C	laute change
HMIP3.1.1	Human induced climate change
HMP3.12	Natural climate change
HMIP3.1.3	Exit from glacial/interglacial cycling
HMIP3.1.4	Intensification of natural climate change
HMP4: BOS	PAERE
HMIF4.1 R	ationsciple entry points to the biosphere
HMIP4.1.1	Groundwater discharge to soils and surface waters
HMIP4.1.2	Solid discharge via erosional processes
HMIP4.1.3	% Gas discharge
HMP4.2 T	ranster (concentration/dilution) mechanisms
HMIP421	Soil moisture and evaporation
HMP422	Surface water mixing
HMP423	Sediment transport including bioturbation
HMIP424	Sediment/water/gas interaction with the atmosphere
HMP425	Bioaccumulation and translocation
HMP426	Biogeochemical processes
HMEP4.3 LA	nd and surface water use
HMIP4.3.1	Tenestrial water use
HMIP4.3.2	Estuarine water use
HMP4.3.3	Coasial waters and water use
HMIP4.3.4	*Seas and water use
	man erposiire
HMIP4.4.1	External exposure
HMIP4.4.2	
HMIP4.4.3	inhalation
	II CIRCUIT PATHWAYS
	ested is repository construction
HMIP5.1.1	Loss of integrity of borehole seals
HMIP5.1.2	Loss of integrity of shaft or access tranel seals
HMIP5.1.3	Incomplete near-field chemical conditioning
	velated to repository construction
HMIP5.2.1	Meteorite impact
HMIP522	Deliberate intrusion
HMIP523	Malicious intrusion
HMIP5.2.4	Accidental intrusion

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DENTIFIER	FEP NAME
	RAL PHENOMENA
ana ang ang ang ang ang ang ang ang ang	RA TERRESTRIAL
NEA1.1.1	Meotorite impact
NEA1.1.2	Solar insolation
NEAL2 GEC	
NEA1.2.1	Plate movement/tectonic change
NEA1.2.2	Changes in the Eanth's magnetic field
NEA1.2.3	Magmatic activity (intrusive. extrusive)
NEA1.2.4	Metamorphic activity
NEA1.2.5	Diagenesis
NEA1.2.6	Uplift and subsidence (orogenic, isostatic)
NEA1.2.7	Diapinsm
NEA1.2.8	Seismicity
NEA1.2.9	Fault activation
NEA1.2.10	Fault generation
NEA1.2.11	Rock heterogeneity (permeability, mineralogy), affecting water and gas flow
NEA1.2.12	Undetected features (faults, fracture networks, shear zones, brecciation, gas pockets)
NEA1.2.13	Natural gas intrusion
	MIDLOGICAL
NEA1.3.1	Precipitation, temperature, and solit water balance
NEA1.3.2	Extremes of precipitation, snow melt and associated flooding
NEA1.3.3	Coastal surge, storms, and humicanes
NEA1.3.4	Sea-level risertali
NEA1.3.5	Periglacial effects (permatrost, high seasonality)
NEA1.3.6	Glaciation (erosion/deposition, giacial loading, hydrogeological change)
NEA1.3.7	No ice age
NEALA GEO	MORPHIOLOGICAL
NEA1.4.1	Land slide
NEA1.4.2	Denudation (aeolian and fluvian)
NEA1.4.3	River, stream, channel erosion (downcutting)
NEA1.4.4	River meander
NEA1.4.6	Freshwater sediment transport and deposition
NEA1.4.7	
	Marine sediment transport and deposition
NEA1.4.8	River meander (REPEAT! SEE 1.4.4))
NEA1.4.9	Chemical denudation and weathering
NEA1.4.10	Frost weathering
NEA1.5 HYD	- M ¹ Service Management and a standard s
NEA1.5.1	River flow and lake level changes
NEA1.5.2	Site flooding
NEA1.5.3	Recharge to groundwater
NEA1.5.4	Groundwater discharge (to surface water, springs, soils, wells, and marine)
NEA1.5.5	Groundwater flow (Darcy, non-Darcy, intergranular fracture, channeling and preferential pathways)
NEA1.5.6	Groundwater conditions (saturated/unsaturated)
NEA1.5.7	Saline or treshwater innusion
NEA1.5.8	Effects at saline-trestwater interface
NEA1.5.9	Natural thermal effects
and the second secon	NSPORT AND GEOCHEMICAL
NEA1.6.1	Advection and dispersion
NEA1.6.2	Diffusion
NEA1.6.3	Matrix diffusion
NEA1.6.4	Gas mediated transport
NEA1.6.5	Multiphase flow and gas-driven flow
NEA1.6.6	Solubility limit
NEA1.6.7	Sorption (linear/non-linear, reversible/irreversible)
NEA1.6.8	Dissolution, precipitation, and crystallisation
NEA1.6.9	Colloid formation, dissolution, and transport
NEA1.6.10	Complexing agents
NEA1.6.11	Fracture mineralisation
NEA1.6.12	Accumulation in soils and organic debris
NEA1.6.13	Mass, isotopic and species dilution
NEA1.6.14	Chemical gradients (electrochemical effects and osmosis)

RAW FEPSLIST

DENTFIER	FEP NAME
NEAL TECO	OGICAL
NEA1.7.1	Plant uptake
NEA1.7.2	Animal uptake
NEA1.7.3	Uptake by deep rooting species
NEA1.7.4	Soil and sediment bioturbation
NEA1.7.5	Pedogenesis
NEA1.7.6	Chemical transformations
NEA1.7.7	Microbial interactions
NEA1.7.8	Ecological change (e.g. forest fire cycles)
NEA1.7.9	Ecological response to climate (e.g. desent formation)
NEA1.7.10	Plant and animal evolution
Z. HUMAN A	CTWITIES
21 DESIGN A	HD CONSTRUCTION
NEA2.1.1	Undetected past intrusions (boreholes, mining)
NEA2.1.2	Investigation borehole seal failure and degradation
NEA2.1.3	Shaft or access tunnel seal failure and degradation
NEA2.1.4	Stress field changes, settling, subsidence or caving
NEA2.1.5	Dewatering of host rock
NEA2.1.6	Material defects (e.g. early canister failure)
NEA2 1.7	Common cause failures
NEA2.1.8	Poor quality construction
NEA2.1.9	Design modification
NEA2.1.10	Thermai effects
NEA22 OPER	ATION AND CLOSURE
NEA2.2.1	Radioactive waste disposal error
NEA2.2.2	inadequate backfill or compaction voidage
NEA2.2.3	Co-disposal of reactive wastes (deliberate)
NEA2.2.4	Inadvenent inclusion of undesirable materials
NEA2.2.5	Heterogeneity of waste forms (chemical, physical)
NEA2.26	Accidents during operation
NEA2.2.7	Sabotage
NEA2.28	Repository flooding during operation
NEA2.29	Abandonment of unsealed repository
NEA2.2.10	Poor closure
NEA2.2.11	Post-closure monitoring
NEA2.2.12	Effects of phased operation
	SURE SUBSURFACE ACTIVITIES (INTRUSION)
NEA2.3.1	Recovery of repository materials
NEA2.3.2	Malicious intrusion (sabotage, act of war)
NEA2.3.3	Exploratory drilling
NEA2.3.4	Exploitation drilling
NEA2.3.5	Geothermal energy production
NEA2.3.6	Resource mining
NEA2.3.7	Tunneling
NEA2.3.8	Underground construction
NEA2.3.9	Archaeological investigation
NEA2.3.10	Injection of liquid wastes
NEA2.3.11	Groundwater abstraction
NEA2.3.12	Underground nuclear testing
and the second	URE SURFACE ACTIVITIES
NEA2.4.1	Loss of records
NEA2.4.2	Dams and reservoirs, built/drained
NEA2.4.3	Rivers rechanneled
NEA2.4.4	Irrigation
NEA2.4.5	Altered soil or surface water chemistry
NEA2.4.6	Land use changes
NEA2.4.7	Agricultural and fisheries practice changes
NEA2.4.8	Demographic change, urban development
NEA2.4.9	Antaropogenic climate change (greenhouse effect)
NEA2.4.10	Quartying, near surface extraction

RAW FEPs LIST

IDENTIFIER	FEP NAME
3. WASTER	ND REPOSITORY EFFECTS
3.1 THERM	<u>υ</u> .
NEA3.1.1	Differential elastic response
NEA3.1.2	Non-elastic response
NEA3.1.3	Host rock fracture aperture changes
NEA3.1.4	Induced hydrological changes (fluid pressure, density convection, viscosity)
NEA3.1.5	Induced chemical changes (solubility, sorption, species equilibrium, mineralisation)
NEA32 CH	MCAL .
HEA3.2.1	Metallic corrosion (pitting/unitorm, internal and external agents, gas generation e.g.H2))
NEA3.2.2	Interactions of host materials and groundwater with repository material (e.g. concrete carbonation,
NEA32.3	interactions of waste and repository materials with bost materials (electrochemical, corrosive agents)
NEA3.2.4	Non-radioactive solute plame in geosphere (effect of redox, pH, and sorption)
NEA3.2.5	Cellulosic degradation
NEA326	Introduced complexing agents and cellulosics
NEA3.2.7	Microbiological (effects on corrosion/degradiation, sciubility/complexation, gas generation, e.g. CH40
NEASS ME	HANCAL
NEA3.3.1	Canister or container movement
NEA3.3.2	Changes in in-situ stress field
NEA3.3.3	Enbrittlement and cracking
NEA3.3.4	Subsidence/collapse
NEA3.3.5	Fracturing
NEA3.3.6	Gas effects (pressurisation, disruption, explosion, fire)
NEALA RAI	IOLOGICAL
NEA3.4.1	Radiolysis
NEA3.4.2	Material property changes
NEA3.4.3	Nuclear criticality
NEA3.4.4	Radioactive decay and ingrowth (chain decay)

APPENDIX 2

۰.

Screening Arguments Applied to FEPs

Screening Arguments for SITE 94 Scenario Development

1. INTRODUCTION

This Letter Report presents proposed screening arguments for use in the SKI SITE 94 scenario development project. These will be used to screen cut features, events and processes (FEPs) from a comprehensive catalogue compiled from a number of published and available lists and catalogues.

Screening arguments developed for Nagra for use in safety assessments for the Kristallin-1 project (Sumerling et al. 1993) have been taken as a starting point. This project considers disposal of vitrified high-level waste from nuclear fuel reprocessing in crystalline basement rock in northern Switzerland. The arguments have been adapted to be appropriate to the SITE 94 project, which considers disposal of spent nuclear fuel according to the KBS3 concept at a site with characteristics based on the Åspō Hard Rock Laboratory site, and also to take account of the assessment scope for SITE 94 which differs from the Kristallin-1 project.

Two groups of screening arguments are defined.

- Site and Disposal Concept These allow phenomena that are physically impossible or irrelevant for the given site and disposal concept to be screened out.
- Assessment Basis These define the scope of the safety assessment and allow phenomena outside that scope to be screened out.

Note that the term *argument* is preferred to *criterion* because the conditions for screening are arguments taking account of knowledge of the site and disposal concept, and the desired scope of the assessment. They are not strict 'yes/no' or quantitative criteria that can be rigidly applied rather they are guidance for the scenario development and screening of FEPs. The screening arguments are presented in the following sections.

2. SITE AND DISPOSAL CONCEPT

2.1 Waste Form and Packaging

The waste is spent nuclear fuel rods from BWR and PWR reactors. The fuel rods consist of cylindrical pellets of uranium dioxide in zirconium alloy (zircaloy) cladding tubes. These are bound together in fuel assemblies designed to be handled as a unit from supply to the reactor to final disposal. For disposal 6 to 9 fuel assemblies (depending on fuel type and respecting thermal loading limits) are contained in a steel canister with copper overpack of external dimensions 4.5m x 0.8m diameter. Voids within the canister are filled with copper powder or lead. The wastes will be heat generating.

Phenomena related specifically to other wastes types, eg. L/ILW, organic wastes and vitrified wastes, can be screened out or modified (if possible) to apply to the above concept.

INOTE ADDED:

Consideration should be given to the possibility of voids within the canister.]

2.2 Emplacement and Repository

The copper-steel canisters (containing the wastes) are emplaced individually in vertical deposition holes (7.5m depth x 1.5m diameter) drilled in the floor of self-supporting horizontal tunnels (3.3m width x 4.5m height). The space between waste canister and deposition hole walls (~0.5m) and the upper part of the deposition hole is filled with blocks of highly-compacted sodium bentonite. The horizontal tunnels are backfilled with a sand-bentonite mix. There will be an axial decompressed/damaged zone around the horizontal tunnels which may be excavated by blasting. The disposal tunnels will be arranged in several panels each consisting of tunnels on a more or less parallel grid but avoiding significant water bearing features. Tunnels and shafts will be sealed with highly compacted bentonite and/or concrete and concrete shotcrete and steel rockboits may be used to improve stability of the tunnels during the operational period.

Phenomena related specifically to cementitious backfill can be screened out (or modified) but cement-bentonite reactions may be relevant. Phenomena related to interaction between canisters/waste packages can be screened out.

NOTE ADDED:

Although phenomena related specifically to cementitious backfill should be screened out, interactions between structural concrete in the repository and bentonite **should** be considered.

2.3 Host Geology

The repository will be sited in crystalline (granitic) basement rock at a depth of about 500 metres below ground. The basement rock includes regional fracture zones with a spacing of one to a few kilometres, ranging from metres to tens of metres in width, plus connected 2nd order fracture zones at spacings of typically 500m. a 'respect zone' of 100 m is assumed between disposal tunnels and any such feature. Groundwater at depth includes both saline and freshwater zones.

Phenomena related specifically to other host rocks, eg salt deposits, clays etc., can be screened out. Phenomena related to near-surface disposal, eg. hurricanes, burrowing animals etc., can be screened out.

2.4 Local and Regional Surface Environment

The Aspö site is located below a small island within a sea area enclosed by other small islands on the Baltic coast of Sweden. The region is low topography glaciated basement rock with thin discontinuous soil cover supporting mainly coniferous woodland. Under present-day conditions, possible leakage from the repository is most likely to occur to the marine environments with associated dose pathways. Doses through other pathways are also possible, eg. via a local well.

Phenomena related to large topographic influences, thick soil/sediment sequences, perched water tables, [high yield wells] and oceanic processes can be screened out.

[NOTE ADDED:

Remove high-yield wells from the previous paragraph.]

2.5 Geo-climatic Development

The Scandinavian shield is rising at the present time due to isostatic rebound following the last glaciation. This will result in a relative sea-level fall so that the region will become terrestrial with numerous shallow freshwater lakes in the order of one to a few thousand years in the future. Assuming a continuation of the glacial-interglacial climate cycling observed in the last 0.8 My, the site is expected to be periodically covered by ice in the future, up to a depth of a few kilometres. The basement rock will resist significant erosion and soil/sediment covers (where present) will be thin and transient.

Phenomena related to warm climates can be screened out. Phenomena related to coastal and fluvial erosion can be screened out.

INOTE ADDED:

Although and climates can be excluded, the possibility of a greenhouseinduced warmer, wetter climate should be considered.]

3. Assessment Basis or "Ground-rules"

3.1 Repository Design and Closure

It is assumed that the repository is constructed and operated, as planned, as a final disposal facility for spent nuclear fuel. No other wastes will be disposed in the facility. Some local variation in quality and minor deviations are expected. No repository monitoring or remedial activities are expected.

Phenomena related to operational accidents (which should be dealt with in an assessment of the operational phase), major design changes and disposal of other wastes in the repository can be screened out. However, long-term effects due to the expected operation of the repository should be considered. Retrievability of the wastes is not a consideration. The consequences of possible non-closure or improper closure of the repository should be considered.

[NOTE ADDED:

Failure of repository due to poor quality assurance should be considered.]

3.2 Global and Regional Disasters

It is not reasonable to make assessments of the radiological impacts from a repository for conditions which are associated with some global or regional catastrophe or serious accident that has immediate impacts that are orders of magnitude more serious, eg. in terms of loss of human life. All human endeavours are at risk from extreme natural and human induced events that are not usually accounted for in safety assessments of industrial developments.

Phenomena such as nuclear war, massive sea level rise due to global ice-cap melting and large meteorite strike on the site can be screened out.

[NOTE ADDED:

FEPs in this category will not be coupled to the Process System, and can be separated out for direct treatment. This applies also to 3.3]

3.3 Acts of War and Sabotage

Acts of war, should be excluded from the assessment. Malicious human acts, eg. terrorist acts, aimed at damaging the repository should be considered. However, in the pre-closure period, security measures will be in force to minimise the risk of successful attack; risks in this period might be considered in the assessment of operational plans and impacts; in the post-closure period, a closed repository will be an extraordinarily hard target to damage and a considerably less attractive target than surface industrial installations or civilian targets.

3.3 Acts of War and Sabotage (continued)

Phenomena related to acts of war should be screened out.

[NOTE ADDED:

See previous note (3.3).]

3.4 Deliberate Intrusion

Future deliberate intrusive actions, taken with full knowledge of the nature and content of the repository, eg. to retrieve valuable materials, are excluded from the assessment. It is assumed that any such action would be undertaken after due consideration of safety aspects and with regard to the economic and environmental values of the time.

Phenomena related specifically to deliberate intrusion can screened out, phenomena related to inadvertent intrusion are retained.

3.5 Future Human Society and Technology

Over the timescales considered in post-closure radiological assessment it is recognised that human civilisation and technology is likely to change considerably, but it is not possible to estimate other than in very general terms what changes may occur. Considering that a general tenet of post-closure radiological assessment is to afford future generations and individuals the same level of protection as that specified for current generations and individuals, it is appropriate to assume future human behaviours similar to that observed in the World today. Impacts to hypothetical critical groups dwelling in the future and with habits and technologies broadly similar to some group at some location in the World today can then be regarded as indicators of safety.

The possibility of cure for cancer is not relevant since the aim is to ensure environmental and human protection (good public health management should be based on prevention not cure).

Phenomena related to extreme futuristic assumptions about human behaviour and technology can be screened out.

3.6 Post-Closure Radiological Assessment

The scenario analysis is aimed at providing a framework for calculations of radiological impact (only) to human individuals and populations represented by a critical group. It is assumed that protection of human individuals ensures protection of the environment, see IAEA 1992.

Consideration of radiological impacts to flora and fauna should be screened out. Chemical toxicity effects of the disposed wastes may be addressed as a separate issue and can be screened out of the radiological assessment.

[NOTE ADDED:

FEPs in this category will not be considered in the SITE 94 scenario development process, and can be screened out as a separate item.]

3.7 Future Life Evolution

Humans and plant and animal species may evolve. Especially evolution of food plant and domesticated animals is to be expected. Hence metabolism, radionuclide uptake and radiation sensitivity may change. These changes cannot be anticipated and should not be accounted for in quantitative assessments (see also 2.5).

Assessments should be carried out assuming metabolic and physiological characteristics and radiosensitivity of humans, animals and plants similar to that observed today.

4. **REFERENCES**

IAEA (1992). Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards. Technical Series No. 332, IAEA Vienna.

Sumerling T J, Zuidema P, Grogan H A and van Dorp F (1993). Scenario development for safety demonstration for deep geological disposal in Switzerland, in proc. International Conference on High-level Radioactive Waste Management, Las Vegas 1993.

APPENDIX 3 FEP Lists by Category

including screening arguments

Appendix 3. FEP Lists by Category

The 8 FEP lists in the following pages have been sorted according to the categories identified in section 2.2. The additional coding "XXXX" which occasionally appears under the "ARGUMENT" column is used to screen out those FEPs which, after additional examination, do not belong to the assigned category, or which are obvious duplicates within the same national FEP list. In such cases, the duplicate is identified under the "COMMMENTS" column.

FEPS LIST: WASTE CATEGORY

AECL1.3 WCBR Biological activity AECL1.4 WCBR 4 Boundary conditions AECL1.5 WB 2.1 Buffer additives AECL1.9 WBR Chemical gradients AECL1.10 WCBR 4 Chemical interactions (expected) AECL1.11 WCBR 4 Chemical interactions (ong-term) AECL1.12 WCBR 4 Chemical interactions (other) AECL1.13 WCBR 4 Chemical interactions (other) AECL1.25 WCBR 4 Correlation AECL1.25 WCBR 4 Correlation AECL1.27 WCB Coupled processes AECL1.27 AECL1.32 WCB Electrochemical gradients AECL1.32 AECL1.32 WCB Electrochemical gradients AECL1.33 AECL1.34 W Formation of gases AECL1.40 WBR Geochemical pump AECL1.50 WCBR 4 Interfaces (boundary conditions) AECL1.53 MCB Interfaces (boundary conditions) AECL1.50 WCBR 4 Interfaces (boundary conditions) AECL1.50	SEE AECL1.9 SEE AECL1.4 (DESCRIPTION
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AECL1.85 WC2R 4 Time dependence	
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AECL3.81 WL? Radiotoxic contaminants	i
AECL3.104 W 3.6 Teratogenic contaminants	
DOE1.1.4.1 W Metal corrosion: wastes	
DOE1.1.4.2 W Leaching: wastes	ţ
DOE1.1.4.3 W Complex formation: wastes	
DOE1.1.4.4 W Colloid formation: wastes	
DOE1.1.4.5 W 2.1 Microbial degradation of organic wastes	4
DOE1.1.4.6 W Microbial corresion: wastes	ţ
DOE1.1.4.7 W Radiolysis: wastes	
DOE1.2.1.3 W 2.1 Hydrogen: corrosion of waste steel	1
DOE1.2.1.4 W 2.1 Hydrogen: corrosion of waste Magnox	
DOE1.2.1.5 W 2.1 Hydrogen: corrosion of waste atuminium	
DOE1.2.1.6 W Hydrogen: corrosion of waste Zircaloy	
DOE1.2.1.7 W 2.1 Hydrogen: corrosion of other waste metals	<u> </u>
DOE1.2.1.8 WB 2.1 Hydrogen: effects of microbial growth on concrete	
DOE1.2.2.1 W 2.1 Methane/CO2: degradation of Cellulosics	
DOE1.2.2.2 W 2.1 Methane/CO2: degradation of Other susceptible organic materials	
DOE1.2.2.3 W 2.1 Methane/CO2 production: Aerobic degradation	<u> </u>
DOE1.2.2.4 W 2.1 ? Methane/CO2 production: Anaerobic degradation	1
DOE1.2.2.5 W 2.1 Methane/CO2 production: Effects of temperature	
DOE1.2.2.6 WR 2.1 Methane/CO2 production: Effects of lithostatic pressure	
DOE1.2.2.8 WB 2.2 MethanerCO2 production: Effects of biolitins	
DOE1.2.2.10 W 2.1? Methane/CO2 production: Inhibition due to the pressure of toxic r	
DOE1.2.2.11 WB 2.2 Methane/CO2 production: Carbonate/bicarbonate exchange with	
DOE1.2.2.12 WR 2.1 Methane/CO2 production: Energy and nutrient control of metaboli	
DOE1.2.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial popula	tions
DOE12.3 WB 2.2 Gas generation from concrete	
DOE1.2.4.1 W 2.1 Tritiated hydrogen	
DOE1.2.4.2 W Active methane and carbon dioxide	÷
DOE1.2.4.3 W Other active gases	
DOE12.5 W 2.1 Toxic gases	
DOE1.3.1 W Radioactive decay and ingrowth	
DOE1.3.2 W 3.1? Nuclear criticality	
DOE1.4.3 WC Embrintement	
DOE1.6.5.1 WCR Chemical changes due to Metal corrosion	
DOE1.6.5.3 WeR Chemical changes due to Waste degradation	
DOE1.6.5.4 WER Chemical changes due to Gas production	1
DOE1.6.6.1 W 2.1 Microbiological effects due to Cellulose degradation	

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FEPs LIST: WASTE CATEGORY

DOE1.6.€ 2	WERF	<u> </u>	Microbial activity
DOE1.6.6.3	WERF	1	Microbiological effects due to Microbial product reactions
IAEA3.2.1	WC	}	Chemical effects: Conosion
IAEA3.2.2	WCR	<u> </u>	Chemical effects: Interactions of waste package and rock
IAEA3.2.3	WB	ļ	Chemical effects: Gas generation
IAEA3.2.4	WBR	<u>+</u>	Chemical effects: Geochemical change
IAEA3.4.1	₩ ₩	<u> </u>	Radiological effects: Material property changes
IAEA3.4.2 IAEA3.4.3	W		Radiological effects: Radiolysis
IAEA3.4.3	W W	3.1?	Radiological effects: Nuclear criticality
PGA3.1	w	3.1:	Radiation damage of the matrix
PGA3.2	W	1	Radiolysis
PGA3.3	W	3.1?	Nuclear criticality
PGA3.7.1	WC	2.1	Differing thermal expansion of glass matrix and canister
PGA3.9	WB	1	Thermaily induced chemical changes
PGA3.10	WCB	!	Chemical changes due to corrosion
PGA3.15	W		Gas production
SKI1.1.1	<u>w</u>	3.1?	Criticality
SKI1.1.2		<u> </u>	Radioactive decay, heat
SKH.1.3	W	<u> </u>	Recoil of alpha-decay
SKI1.1.4	W	<u> </u>	Gas generation: He production
SK1.2.1	W		Radiolysis
SK122	WR WC	2.2	H2/O2 explosions
SK11.2.3	WC W	<u></u>	Pb-I reactions
SK11.2.5			1. Cs-migration to glass surface
SKI1.2.6		:	Solubility within fuel matrix
SKI1.2.7			Recrystallization
SKI128	w		Redox potential
SK1.2.9	W	1	Dissolution chemistry
SKI1.3	W	3	Damaged or deviating fuel
SKI1.4	W?H		Sudden energy release
SK12.1.3	W	<u> </u>	Internal corrosion due to waste
SKI2.1.4		ş	Role of the eventual channeling within the canister
SK12.3.1			Thermal cracking
SK03.1.9	WB	<u> </u>	Radiolysis SEE SK12.1
SK03.1.10	WB		Interactions with corrosion products and waste
SK15.6	W	3.1	Co-storage of other waste
SKI7.4	W	3.6	Solubility and precipitation
UKN1.6.14	WCERF	3.0	Chemical gradients (electrochemical effects and osmosis)
UKN1.7.6	WERFL		Chemical transformations
UKN1.7.7	WERFL		Microbial interactions
UKN2.2.3	WH	3.1	Cc-disposal of reactive wastes (deliberate)
UKN2.2.4	WH		Inadvertent inclusion of undesirable materials
JKN2_2.5	W _		Heterogeneity of waste forms (chemical, physical)
JKN3.1.5	WB		Induced chemical changes (solubility, sorption, species equilibrium, mineralisation)
JKN3.2.1	WC		Metallic corrosion (pitting/uniform, internal and external agents, gas generation eg. H2)
JKN3.2.2	WCBR		Interactions of host materials and groundwater with repository material (eg. concrete carbon
KN3.2.3	WCER		Interactions of waste and repository materials with host materials (eg. electrochemical, corros
KN3.2.5		2.1	Cellulosic degradation
JKN3.2.6 JKN3.2.7		2.1	Introduced complexing agents and cellulosics Microbiological effects (on corrosion/degradation, on solubility/complexation, gas generation,
JKN3.3.6	WC	2.1	Record of organization, disruption, explosion, fire)
JKN3.4.1	W	6.(Radiolysis
KN3.4.2		•	Material property changes
KN3.4.3	Ŵ	3.1	Nuclear criticality
KN3.4.4	w		Radioactive decay and ingrowth (chain decay)
MP1.1.3	W		Physico-chemical degradation of wastes and transport to the far-field
MIP1.1.4	WC		Electrical effects of metal corrosion
MIP121	WC		Hydrogen by metal corrosion
MIP1.22	W	2.1	Methane and carbon dioxide by microbial degradation
MIP1.2.3	WB	2.1	Gas generation from concrete
MIP1.2.4	W		Radioactive gases
	W		Chemotoxic gases
MIP1.2.5		•••	Pammability
MIP1.2.5	W	2.1	
MP1.2.5 MP1.2.7 MP1.2.8	WER		Thermo-chemical effects
MP1.2.5 MP1.2.7 MP1.2.8 MP1.3.1	WBR		Thermo-chemical effects Radioactive decay and ingrowth
MIP1.2.5 MIP1.2.7 MIP1.2.8 MIP1.3.1 MIP1.3.2	WBR W W	3.1	Thermo-chemical effects Radioactive decay and ingrowth Nuclear criticality
MIP1.2.5 MIP1.2.7 MIP1.2.8 MIP1.3.1	WBR		Thermo-chemical effects Radioactive decay and ingrowth

FEPS LIST: WASTE CATEGORY

NEA2.2.4	WR	1	Inadventent inclusion of undesirable materials	1
NEA2.2.5	W		Heterogeneity of waste forms (chemical, physical)	
NEA3.2.5	W	2.1	Celiulosic degradation	_
NEA3.2.6	W	2.1	Introduced complexing agents and cellulosics	
NEA3.2.7	W		Microbiological (effects on corresion/degradation, solubility/complexatio	n, gas generation, e.g
NEA3.3.5	WC		Fracturing	
NEA3.4.1	W		Radiolysis	
NEA3.4.2	w	Į.	Material property changes	
NEA3.4.3	W	3.1	Nuclear criticality	
NEA3.4.4	W		Radioactive decay and ingrowth (chain decay)	

FEPS LIST: CONTAINER CATEGORY

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DENTREN	CATEGORY	ARGUMENT	FEP NAME	COMMENT
AECL1.3	WCBR	1	Biological activity	
AECL1.4	WCBR	4	Boundary conditions	
AECL1.19	WCBR	4	Chemical interactions (expected)	
AECL1.11	WCBR	4	Chemical interactions (long-term)	
AECL1.12	WCBR	4	Chemical interactions (other)	;
AECL1.13	WORR		Chemical kinetics	
AECL1.18	c		Container corrosion products	
AECL1.19	C		Container failure (early)	
AECL1.20	C		Container failure (long-term)	
AECL1.21	C	· · · · · · · · · · · · · · · · · · ·	Container failure (other long-term processes)	
AECL1.22			Container healing	
AECL1.23	c	· ·	Containers - partial corrosion	
AECL1.25	WCBR	4	Correlation	Incomprehens
AECL1.26	c		Corrosion	
AECL1.27	WCB		Coupled processes	
AECL1.32	WCB		Electrochemical gradients	
AECL1.39	WC	2.1	Galvanic coupling	······
AECL1.45	c	2.1?	Hydride cracking	
AECL1.49		3.1	incomplete filling of containers	
AECL1.50	WCBR	<u>3_1</u>	Interfaces (boundary conditions)	SEE AECL 1.4
AECL1.50		*	interaces (boomdary conducts)	DESCRIPTION
AECL1.55	WCB		Long-term physical stability	IDESCRIPTION
	088		Microbes	SEE AECL 1.3
AECL1.58				SEE AECL1.3
AECL1.59		~	Scroorganisms	
AECL 1.63	<u> </u>		Pitting	SEE_AECL1.1
AECL1.65	WCBR		erroripitation and dissolution	
AECL1.67	WC?		Reviation damage	
AECI_1.80	WCBR		Sceciation	
ECL1.81	BOWR		Stability	
ECL1.84	WC3R		Temperature rises (unexpected effects)	
ECL1.85	WCBR		Ticae dependence	
ECL1.88	<u>с</u>		Union consion	
OE1.1.1.1	<u> </u>		Structural container metal corrosion: Localised	<u></u>
DOE1.1.1.2	<u> </u>		Structural container metal corrosion: Bulk	;
OE1.1.1.3	<u> </u>		Structural container metal corrosion: Crevice	
DOE1.1.1.4	<u> </u>	··	Structural container metal corrosion: Stress corrosion: cracking	<u>i</u>
DOE1.2.1.2	<u> </u>		Hydrogen: corrosion of container steel	
DOE1.2.6.1	<u> </u>		Gas transport in the waste container	
OE1.4.1	,		Canister or container incvement	· · · · · · · · · · · · · · · · · · ·
OE1.4.3	WC		Embrinlement	·
OE1.6.5.1	WOR		Chemical changes due to Metal corrosion	
AEA3.2.1	WC		Chemical effects: Corrosion	
AEA3.2.2	WCR		Chemical effects: Interactions of waste package and rock	
AEA3.3.1	08		Mechanical effects: Canister movement	
GA3.4	08		Canister movement in backfill	
GA3.6	C		Mechanical canister damage	
GA3.7.1	WC		Differing thermal expansion of glass matrix and canister	
GA3.7.2	<u>C8</u>		Differing thermal expansion of canister and backtill	
GA3.10	WCB		Chemical changes due to corrosion	
KI1.2.3	WC		Pb-I reactions	
K11.5			Release of radionuclides from the failured canister	
KI2.1.1	<u> </u>		Chemical reactions (cooper corrosion)	
KI2.1.2	<u>c</u>		Coupled effects (electrophoresis)	
KI2.1.4	wc		Role of the eventual channeling within the canister	
K12.1.5	<u>c</u>		Role of chlorides in copper corrosion	
Ki2.1.6.1			Repository induced Pb/Cu electrochemical reactions	<u>.</u>
KI2.1.6.2			Natural telkric electrochemical reactions	
K12.1.6.2	<u> </u>		Pitting	

FEPS LIST: CONTAINER CATEGORY

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SK12.1.8	l C	ļ	Corrosive agents, Sulphides, oxygen etc	4
SK12.1.9	BC	1	Backfill effects on Cu conosicn	ł
SKI2.1.10	1 0		Microbes	
SK12.2	C C	4	Creeping of copper	
SK12.3.1	WC	1	Thermal cracking	
SK12.3.2	C	1 2000	Electro-chemical cracking	SEE SK2.1.1
SK12.3.3	1 C	1	Stress corrosion cracking	
SK12.3.4	C	1	Loss of ductility	
SK12.3.5	l c	1	Radiation effects on canister	
SK12.3.6	c		Cracking along welds	1
SK12.3.7.1	C	Ī	External stress	1
SK12.3.7.2	C	•	Hydrostatic pressure on canister	
SK12.3.8	C	i	internal pressure	
SKI24	C	ŧ	Voids in the lead filling	· ·
SK12.5.1	C		Random canister defects - quality control	•
SK12.5.2	C		Common cause canister defects - quality control	
SK13.22	68	1	Movement of canister in butter/backtill	
SK13.2.7	GB	i S	Swelling of corrosion products	
SKI5.23	C	XXXX	Changed hydrostatic pressure on capister	SEE SK12.3.7.2
UKN1.6.14	WCBRF	1	Chemical gradients (electrochemical effects and osmosis)	1
UKN2.1.6	C C	t.	Material defects, e.g. early canister failure	1
UKN3.2.1	WC		Metallic corrosion (pitting/uniform, internal and external agents, gas general	ion en H2)
UKN3.2.2	WCBR			
UKN322 UKN323	WCBR WCBR		Interactions of host materials and groundwater with repository material (ec	1, concrete carbor
				L concrete carbor rochemical, corros
UKN3.2.3 UKN3.2.7	WOER		Interactions of host materials and groundwater with repository material (equilinteractions of waste and repository materials with host materials (eq. elect.	L concrete carbor rochemical, corros
UKN3.2.3 UKN3.2.7 UKN3.3.1	WC8R WC		Interactions of host materials and groundwater with repository material (ec Interactions of waste and repository materials with host materials (eg. elect Microbiological effects (on corrosion/degradation, on solubility/complexation	L concrete carbor rochemical, corros
UKN32.3 UKN32.7 UKN3.3.1 UKN3.3.3	WC28R WC C		Interactions of host materials and groundwater with repository material (ec Interactions of waste and repository materials with host materials (eg. elect. Microbiological effects (on corrosion/degradation, on solubility/complexation Canister or container movement	L concrete carbor rochemical, corros
UKN32.3 UKN32.7 UKN3.3.1 UKN3.3.3	WC28R WC C C		Interactions of host materials and groundwater with repository material (ec Interactions of waste and repository materials with host materials (eg. elect Microbiological effects (on corrosion/degradation, on solubility/complexation Canister or container movement Embrittlement and cracking	L concrete carbor rochemical, corros
UKN32.3 UKN32.7 UKN33.1 UKN33.3 UKN33.4	WCBR WC C C C	2.1	Interactions of host materials and groundwater with repository material (ec Interactions of waste and repository materials with host materials (eg. elect Microbiological effects (on corrosion/degradation, on solubility/complexation Canister or container movement Embrittlement and cracking Subsidence/collapse Fracturing	L concrete carbon rochemical, corros
UKN3.2.3 UKN3.2.7 UKN3.3.1 UKN3.3.3 UKN3.3.4 UKN3.3.5	WC2R WC C C C C	2.1	Interactions of host materials and groundwater with repository material (ec Interactions of waste and repository materials with host materials (eg. elect. Microbiological effects (on corrosion/degradation, on solubility/complexation Canister or container movement Embrittlement and cracking Subsidence/collapse	L concrete carbor rochemical, corros
UKN32.3 UKN32.7 UKN33.1 UKN33.3 UKN33.4 UKN33.5 UKN33.6 HMIP1.1.1	WCBR C C C C C WC	2.1	Interactions of host materials and groundwater with repository material (ec Interactions of waste and repository materials with host materials (eg. elect. Microbiological effects (on corrosion/degradation, on solubility/complexation Canister or container movement Embrittlement and cracking Subsidence/collapse Fracturing Gas effects (pressuration, disruption, explosion, fire)	i, concrete carbor rochemical, corros n, gas generation
UKN32.3 UKN32.7 UKN33.1 UKN33.3 UKN33.4 UKN33.5 UKN33.6 HMIP1.1.1	WCBR C C C C C C WC C	2.1	Interactions of host materials and groundwater with repository material (ec Interactions of waste and repository materials with host materials (eg. elect. Microbiological effects (on corrosion/degradation, on solubility/complexation Canister or container movement Embrittlement and cracking Subsidence/collapse Fracturing Gas effects (pressuration, disruption, explosion, fire) Container metal corrosion	i, concrete carbor rochemical, corros n, gas generation
UKN32.3 UKN32.7 UKN33.1 UKN3.3.3 UKN3.3.4 UKN3.3.5 UKN3.3.6 HMIP1.1.1 HMIP1.1.4	WCBR C C C C C C WC C WC	2.1	Interactions of host materials and groundwater with repository material (ec Interactions of waste and repository materials with host materials (eg. elect. Microbiological effects (on corrosion/degradation, on solubility/complexation) Canister or container movement Embrittlement and cracking Subsidence/collapse Fracturing Gas effects (pressuration, disruption, explosion, fire) Container metal corrosion Electrical effects of metal corrosion	i, concrete carbor rochemical, corros n, gas generation
UKN32.3 UKN32.7 UKN33.1 UKN33.3 UKN33.4 UKN33.5 UKN33.6 HMIP1.1.1 HMIP1.1.4 HMIP1.2.1 HMIP1.4.1	WCBR C C C C C C WC C WC WC	2.1	Interactions of host materials and groundwater with repository material (ec Interactions of waste and repository materials with host materials (eg. elect. Microbiological effects (on corrosion/degradation, on solubility/complexation) Canister or container movement Embrittement and cracking Subsidence/collapse Fracturing Gas effects (pressuration, disruption, explosion, fire) Container metal corrosion Electrical effects of metal corrosion Hydrogen by metal corrosion Waste-form and backfill consolidation	i, concrete carbor rochemical, corros n, gas generation
UKN32.3 UKN32.7 UKN33.1 UKN33.3 UKN33.4 UKN33.5 UKN33.6 HMIP1.1.1 HMIP1.1.4 HMIP1.2.1 HMIP1.4.1	WCBR C C C C C WC C WC WC WC WCB	2.1	Interactions of host materials and groundwater with repository material (eq. Interactions of waste and repository materials with host materials (eq. elect. Microbiological effects (on corrosion/degradation, on solubility/complexation) Canister or container movement Embrittement and cracking Subsidence/collapse Fracturing Gas effects (pressuration, disruption, explosion, fire) Container metal corrosion Electrical effects of metal corrosion Hydrogen by metal corrosion Waste-form and backfill consolidation Material defects (e.g. early canister failure)	, concrete catoor rochemical, corros n, gas generation
UKN32.3 UKN32.7 UKN33.1 UKN33.3 UKN33.4 UKN33.5 UKN33.6 HMIP1.1.1 HMIP1.1.4 HMIP1.2.1 HMIP1.2.1 HMIP1.2.1	WC C C C C C WC C WC WC WC WC R	2.1	Interactions of host materials and groundwater with repository material (ec Interactions of waste and repository materials with host materials (eg. elect. Microbiological effects (on corrosion/degradation, on solubility/complexation) Canister or container movement Embrittement and cracking Subsidence/collapse Fracturing Gas effects (pressuration, disruption, explosion, fire) Container metal corrosion Electrical effects of metal corrosion Hydrogen by metal corrosion Waste-form and backfill consolidation	, concrete carbor rochemical, corros
UKN32.3 UKN32.7 UKN33.1 UKN33.3 UKN33.4 UKN33.5 UKN33.6 HMIP1.1.1 HMIP1.1.4 HMIP1.2.1 HMIP1.2.1 HMIP1.4.1 NEA2.1.6 NEA3.2.1 NEA3.3.1	WCSR C C C C C C C C C C C C C C C C C C	2.1	Interactions of host materials and groundwater with repository material (eq. Interactions of waste and repository materials with host materials (eq. elect. Microbiological effects (on corrosion/degradation, on solubility/complexation) Canister or container movement Embrittement and cracking Subsidence/collapse Fracturing Gas effects (pressuration, disruption, explosion, fire) Container metal corrosion Electrical effects of metal corrosion Hydrogen by metal corrosion Waste-form and backfill consolidation Material defects (e.g. early canister failure) Metallic corrosion (pitting/milform, internal and external agents, gas general	, concrete carbor rochemical, corros
UKN32.3 UKN32.7 UKN33.1 UKN33.3 UKN33.4 UKN33.5 UKN33.6 HMIP1.1.1 HMIP1.1.4 HMIP1.2.1 HMIP1.4.1 NEA2.1.6 NEA3.2.1	WCBR C C C C C C C C C C WC WC WCB C C C C C	2.1	Interactions of host materials and groundwater with repository material (eq. Interactions of waste and repository materials with host materials (eq. elect. Microbiological effects (on corrosion/degradation. on solubility/complexation Canister or container movement Embrittlement and cracking Subsidence/collapse Fracturing Gas effects (pressuration, disruption, explosion, fire) Container metal corrosion Electrical effects of metal corrosion Hydrogen by metal corrosion Waste-form and backfill consolidation Material defects (e.g. early canister failure) Metallic corrosion (pitting/uniform, internal and external agents, gas general Canister or container movement Changes in in-situ stress field	, concrete catoor rochemical, corros n, gas generation
UKN32.3 UKN32.7 UKN33.1 UKN33.3 UKN33.4 UKN33.5 UKN33.6 HMIP1.1.1 HMIP1.1.1 HMIP1.2.1 HMIP1.2.1 HMIP1.2.1 HMIP1.2.1 NEA3.2.1 NEA3.2.1 NEA3.3.1 NEA3.3.2	WCSR C C C C C C C WC WC WC WCS C C C C C C	2.1	Interactions of host materials and groundwater with repository material (eq. Interactions of waste and repository materials with host materials (eq. elect. Microbiological effects (on corrosion/degradation, on solubility/complexation) Canister or container movement Embrittement and cracking Subsidence/collapse Fracturing Gas effects (pressuration, disruption, explosion, fire) Container metal corrosion Electrical effects of metal corrosion Hydrogen by metal corrosion Waste-form and backfill consolidation Material defects (e.g. early canister failure) Metallic corrosion (pitting/milform, internal and external agents, gas general Carister or container movement	, concrete carbor rochemical, corros
UKN32.3 UKN32.7 UKN3.3.1 UKN3.3.4 UKN3.3.5 UKN3.3.6 HMIP1.1.1 HMIP1.1.4 HMIP1.2.1 HMIP1.2.1 HMIP1.4.1 NEA2.1.6 NEA3.2.1 NEA3.3.1 NEA3.3.2 NEA3.3.3	WCSR C C C C C C WC C WC WC WC C C C C C C	2.1	Interactions of host materials and groundwater with repository material (eq. Interactions of waste and repository materials with host materials (eq. elect. Microbiological effects (on corrosion/degradation. on solubility/complexation Canister or container movement Embrittlement and cracking Subsidence/collapse Fracturing Gas effects (pressuration, disruption, explosion, fire) Container metal corrosion Electrical effects of metal corrosion Hydrogen by metal corrosion Waste-form and backfill consolidation Material defects (e.g. early canister failure) Metallic corrosion (pitting/uniform, internal and external agents, gas general Canister or container movement Changes in in-situ stress field Embrittlement and cracking	, concrete catoor rochemical, corros n, gas generation

FEPS LIST: BUFFER/BACKFILL CATEGORY

E1.2.2.8	8 M	2.2	MethanerCO2 production: Effects of bioRims
8.12.13	84	1.S	Hydrogen effects of microbial growth on concrete
E1.1.3.4	8	2.2	Cement-subhate reaction: concrete
51.1.3.3	8	2.2	Alkali-aggregate reaction: concrete
SE1.1.3.2	8	5.2	Excrenge capacity exceeded. concrete
P21134	8	2.2	Alital aggregate reaction. concrete
E1.122	8	2.2	Sealing of cracks: concrete
1 121.13	8	2-2	Crecking: concrete
CC1-30	88	_	noornen beitrinternul
CC1 36	1 28		sesses to to sesses in hogananti
CC1182	MCBR	7	Time dependence
CL1.84	MCBB		Temperature rises (unexpected effects)
CL1.83	8		anssaxi buyans
CL1.81	BCMB		Aujqeis
CC1.80	MOSR		Specialion
1 22.170	8		Sorption: non-linear
927770	8		noitgool
CC1.65	MCB6		Precipitation and dissolution
CL1.59	880		Nicrosoganisms
CL1.58	880		SEE AECLI
CL1.55	MCB 1		Long-term physical stability
05'170	MCSB	*	Interfaces, countary conditions) (Section 2)
97.170	+ 88		Hydrothermal alteration
CL1.43	88		Hydraulic conductivity
07170	MBB		Geodremical pump
22.170	8		Sometion of cracks
96.1.36	8		Faulty buffer emplacement
CC1733	8	XXXX	Evolution of buffer
CC135	1 83M		Electrochemical gradients
CC1130	1 28	_	(Dispersion
67173	88 1		uoiseftig)
82170	8%		Curicality
12170	80M		Coupled processes
CC 1 32	NCBB !	*	Sorrelation for the second solution of the second sec
ECC175t	8		Convection
11103	1 8	5.2	Concrete
ECE 1-13	MCBB		Chemical kinetics
ECL1.12	NOBR	7	Chemical interactions (check)
ECL1.11	880	*	(mencarions (long-term)
ECT 1'10	MCBB	4	Chemical interactions (expected)
6-1-103	Neg		storberg lesimort)
ECLIT	8		Buffer evolution
ECT1'8	8		Butter citeratersics
ECLES	SW	2.1	savinas
FCL1.4	REDW	*	Boundary conditions
ECT1'3	MCBB		Biological activity
ECLIZ	8		noinione libioe8
ECLIPT	8		Sacietta characteristics
SELLING	CATEGORY	ARGUMENT	LEEP NAME

Methane/CO2 production: Effects of inverse promanel compared with concrete Methane/CO2 production: Carbonate/bicarbonate exchange with concrete

PAGE 1

2.2 2.1

8M 88

DOE1229

FEPS LIST: BUFFER/BACKFILL CATEGORY

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DOE123	WB	2.2	Gas generation from concrete
DOE1.5.2.1		2.3	Groundwater flow: initial conditions
DOE1.5.22			Groundwater flow due to gas production
DOE1.5.3	BFF		Groundwater flow (saturated conditions)
DOE1.6.5.3			Chemical changes due to Waste degradation
DOE1.6.5.4		1	Chemical changes due to Gas production
DOE1.6.5.5	BFF	r	Chemical changes due to Complex formation
DOE1.6.5.6	 BAF		Chemical charges due to Colloid production
DOE1.6.5.7	 	<u>-</u>	Chemical changes due to Solubility
DOE1.6.5.8		1	Chemical changes due to Sorption
DOE1.6.5.9		1	Chemical changes due to Species equilibrium
DOE1.6.6.2		1	Microbial activity
DOE1.6.6.3	WBRF	0. 11	Microbiological effects due to Microbial product reactions
DOE2.3.4.4	BAF	<u>i</u>	Groundwater flow: Fracture
DOE23.4.5	866	1	Groundwater flow: Effects of solution channels
DOE2.3.5.1		<u>.</u>	inomanic colloid transport: Effects of pH and Eh
DOE23.5.2	BAF	<u> </u>	Inorganic colloid transport Effects of joint strength
DOE23.6	897	<u>.</u>	Variations in groundwater temperature
DOE2.4.1	87	1	Advection
DOE2.4.2.1		<u> </u>	Bulk diffusion
DOE2421	 #F	1	Matrix diffusion
DOE24.2.3	<u> </u>	<u> </u>	Surface diffusion
DOE24.2.3	 	<u>,</u>	Hydrodynamic dispersion
DOE2.4.4.1	688	<u>, </u>	Solubility: effects of pH and Eh
DOE2.4.4.1		 	Soutomy enects of philand En
DOE2.4.4.2	889.	<u></u>	Solubility: effects of naturally-occurring complexing agents
DOE2.4.4.3 DOE2.4.4.4	 	1	Solubility: effects of complexing agents formed in the near-field
DOE2.4.4.5	BRR	<u>+</u>	Solubility: effects of naturally-occuring colloids
DOE2.4.4.6	BR	<u>;</u>	Solubility: effects of colloids formed in the near-field
DOE2.4.4.8	BRFL	1	Solubility: Effects of microbial activity
DCE2.4.5.1	 868.	<u>1</u>	
DCE2.4.5.2		1	Linear sorption
DOE2.4.5.2	BAR	<u>; </u>	Non-linear sorption
DO52.4.5.4		1	
DOE2.4.5.4	BRR	┼────	Sorption: Effects of pH and Eh
DOE2.4.5.6	888	<u>i</u>	Sorption: Effects of ionic strength
DOE2.4.5.7	887.	<u>!</u>	COMPANIE ELIEUS OF MIRC SAERINGE
DOE2.4.5.8	BRA	<u>+</u>	Sorption: Effects of naturally-occurring organic complexing agents
DCE2.4.5.9		<u> </u>	Support Eners a nationally for any marganic antiplexing agents
DOE2.4.5.10	<u>37</u>	<u> </u>	Sorption: Effects of complexing agents formed in the near-field
		<u>}</u>	Sorption: effects of naturally-occuring colloids
DOE2.4.5.11	<u> </u>	<u> </u>	Sorption: effects of colloids formed in the near-field Sorption: effects of microbial activity
DOE2.4.5.13	<u></u>	<u>,</u>	
	BRP	<u>:</u> •	Organic colloid transport in Porcus media
DOF2.4.7.2	<u> </u>	<u> </u>	Organic colloid transport in Fractured media
DOE2.4.7.3	<u>BFR.</u>	<u> </u>	Organic colloid transport: Effects of pH and Eh
DOE2 4.7.4	BPFL	1	Organic colloid transport: Effects of ionic strength
DOE2.4.8.1	SRR_	!	Inorganic colloid transport: Porous media
CCT1400		1	
DCE2.4.8.2		i	Inorganic colloid transport: Fractured media
DCE2.4.83	ાસ.	<u> </u>	inorganic colloid transport: Effects of pH and Eh
DOE2.4.53 DOE2.4.8.4	ିନ୍ୟୁ BRR,		inorganic colloid transport: Effects of pH and En Inorganic colloid transport: Effects of ionic strength
DCE2.4.53 DOE2.4.84 DCE2.4.9	ः न्द् BRFL BRFL		Inorganic colloid transport: Effects of pH and En Inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes
DCE2.4.3 3 DCE2.4.8.4 DCE2.4.9 DCE2.4.9	ି.ମ. BRF. BRF. BRF.		Inorganic colloid transport: Effects of pH and En Inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution
DCE2.4.6 3 DCE2.4.8.4 DCE2.4.9 DCE2.4.9 DCE2.4.10 DCE2.4.11.1	<u>ିମ୍</u> BRF. BRF. BRF. 3RF. ଅନ୍ମ.		Inorganic colloid transport: Effects of pH and En Inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution
DCE2.4.3 3 DCE2.4.8.4 DCE2.4.9 DCE2.4.10 DCE2.4.11.1 DCE2.4.11.2	୍ରମ. BRF. BRF. 3RF. ଅନ୍ୟ ଅନ୍ୟ		inorganic colloid transport: Effects of pH and En Inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase
DCE24.53 DCE24.54 DCE24.9 DCE24.9 DCE24.10 DCE24.11.1 DCE24.11.2 DCE24.11.2	ः तर. BRR. BRR. 3699. उत्तव. उत्तव. BFF		inorganic colloid transport: Effects of pH and En inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport
DCE24.53 DCE24.54 DCE24.9 DCE24.9 DCE24.10 DCE24.11.1 DCE24.11.2 DCE24.11.2 DCE24.11.2 DCE24.11.2	ःस BRR BRR BRR BRR BRR BRR BFF BR		inorganic colloid transport: Effects of pH and En inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport Repository thermally-induced groundwater transport
DCE24.53 DCE24.54 DCE24.5 DCE24.5 DCE24.10 DCE24.11.1 DCE24.11.2 DCE24.11.2 DCE24.11.2 DCE24.11.2 DCE24.11.1 DCE24.13.1 DCE24.13.2	ःस अस. अस. अस. अस. अस. अस. अस. अस.		inorganic colloid transport: Effects of pH and En inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport
DCE24.53 DCE24.54 DCE24.9 DCE24.9 DCE24.10 DCE24.112 DCE24.112 DCE24.112 DCE24.112 DCE24.113 DCE24.131 DCE24.132	ःस. BRR. BRR. BRR. BRR. BRR. BRR. BRR. BR		inorganic colloid transport: Effects of pH and En inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow
DCE2.4.5 3 DCE2.4.8.4 DCE2.4.9 DCE2.4.10 DCE2.4.11.1 DCE2.4.11.2 DCE2.4.11.2 DCE2.4.12 DCE2.4.13.1 DCE2.4.13.1 LAEA1.13.1	ःस. BRR. BRR. BRR. BRR. BRR. BFF BRR.		inceganic colloid transport: Effects of pH and Eh inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Fluid interactions: Dissolution
DCE2.4.5 3 DOE2.4.8.4 DCE2.4.9 DCE2.4.10 DCE2.4.11.1 DCE2.4.11.2 DCE2.4.12 DCE2.4.13.1 DCE2.4.13.1 DCE2.4.13.1 IAEA1.13.2 IAEA1.13.3	ः तर्. BRFL BRFL BRFL BRFL BRFL BFF BFF BFFL BFFL		inceganic colloid transport: Effects of pH and En Inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Naturally thermally-induced groundwater transport Pluid interactions: Groundwater tow Fluid interactions: Brine pockets
DCE2.4.5 3 DOE2.4.8.4 DCE2.4.9 DCE2.4.10 DCE2.4.11.1 DCE2.4.11.2 DCE2.4.13.1 DCE2.4.13.1 DCE2.4.13.1 IAEA1.13.2 IAEA1.13.3 IAEA3.1.3	ः तर. BRFL BRFL BRFL BRFL BFF BFF BFFL BFFL B		inceganic colloid transport: Effects of pH and Eh Inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Naturally thermally-induced groundwater transport Pluid interactions: Groundwater flow Fluid interactions: Brine pockets Thermal effects: Fluid pressure, density, viscosity changes
DCE2.4.5 3 DOE2.4.8.4 DCE2.4.9 DCE2.4.10 DCE2.4.11 2 DCE2.4.11 2 DCE2.4.12 DCE2.4.12 DCE2.4.13 1 DCE2.4.13.1 DCE2.4.13.1 IAEA1.13.2 IAEA1.13.3 IAEA3.1.3	ः तर. BRFL BRFL BRFL BRFL BRFL BFF BFF BFFL BFF BFF BFF BFF BFF BFF		inceganic colloid transport: Effects of pH and Eh Inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Naturally thermally-induced groundwater transport Pluid interactions: Groundwater flow Fluid interactions: Brine pockets Thermal effects: Fluid pressure, density, viscosity changes Thermal effects: Fluid migration
DCE24.53 DOE24.54 DCE24.9 DCE24.9 DCE24.10 DCE24.112 DCE24.112 DCE24.112 DCE24.112 DCE24.131 DCE24.132 LAEA1.131 LAEA1.132 LAEA1.133 LAEA1.133 LAEA3.1.3 LAEA3.1.4 LAEA3.2.3	ः तर. BRFL BRFL BRFL BRFL BRFL BFF BFF BFFL BFF BFF BFF BFF BFF BFF		inceganic colloid transport: Effects of pH and Eh inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Fluid interactions: Dissolution Fluid interactions: Brine pockets Thermal effects: Fluid pressure, density, viscosity changes Thermal effects: Fluid migration Chemical effects: Gas generation
DCE24.53 DOE24.54 DCE24.9 DCE24.9 DCE24.10 DCE24.112 DCE24.112 DCE24.112 DCE24.112 DCE24.131 DCE24.132 DCE24.132 DCE24.132 DCE24.133 IAEA1.133 IAEA1.133 IAEA3.1.3 IAEA3.1.4 IAEA3.2.3 IAEA3.2.4	ः तर.		inceganic colloid transport: Effects of pH and Eh Inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Fluid interactions: Dissolution Fluid interactions: Brine pockets Thermal effects: Fluid pressure, density, viscosity changes Thermal effects: Fluid migration Chemical effects: Gas generation Chemical effects: Geochemical change
DCE24.53 DOE24.54 DCE24.9 DCE24.9 DCE24.10 DCE24.112 DCE24.112 DCE24.112 DCE24.112 DCE24.131 DCE24.132 LAEA1.131 LAEA1.132 LAEA1.133 LAEA1.133 LAEA3.1.3 LAEA3.1.4 LAEA3.2.3	ः तर. BRFL BRFL BRFL BRFL BRFL BFF BFF BFFL BFF BFF BFF BFF BFF BFF		inceganic colloid transport: Effects of pH and Eh inorganic colloid transport: Effects of ionic strength Transport of radionuclides bound to microbes Isotopic dilution Gas transport: solution Gas transport: gas phase Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Fluid interactions: Dissolution Fluid interactions: Brine pockets Thermal effects: Fluid pressure, density, viscosity changes Thermal effects: Fluid migration Chemical effects: Gas generation

FEPs LIST: BUFFER/BACKFILL CATEGORY

PGA3.4	1 08	1	Canister movement in backfill	
	08	+	Differing thermal expansion of canister and backfill	
PGA3.7.3	I BR	<u>+</u>	Differing thermal expansion of backfill and host rock	
PGA39	WB		Themaly induced chemical changes	
PGA3.10	WCB		Chemical changes due to corrosion	
PGA3.12.1	B	<u> </u>	Geochemical changes in backfill	
PGA3.13	BBB	<u>† </u>	Physico-chemical phenomena/effects (eq. colloid formation)	1
PGA3.14	BRA	<u> </u>	Microbiological phenomena/effects	
SKI2.1.6.2	08	1	Natural telluric electrochemical reactions	
SKI2.1.9	BC	<u></u>	Backfill effects on Cu corrosion	
SKI3.1.1	B		Degradation of the bentonite by chemical reactions	
SKI3.1.2	I B		Saturation of sorption sites	
	<u> </u>		Effects of bentonite on groundwater chemistry	
SKI3.1.4	В	<u> </u>	Colloid generation - source	
SKI3.1.5	B		Coagulation of bentonite	
SKI3.1.6	B	<u> </u>	Sedimentation of bentonite	
SKG3.1.7	в	<u>.</u>	Reactions with cement pore water	
SK03.1.8	в	4	Near field buffer chemistry	
SKI3.1.9	WB	XXXX	Radiolysis	SEE SKI12.1
SKi3.1.10	WB		Interactions with corrosion products and waste	
SKI3.1.11	8	<u>i</u>	Redox front	
SKI3.1.12	<u> </u>	XXXX	Peturbed buffer material chemistry	
SKI3.1.12		<u>, </u>		SEE SK13.1.1
	B BB	;	Radiation effects on bentonite	
KB211		<u>!</u>	Swelling of bentonite into tunnels and cracks	
SKI3.2.1.2	<u> </u>	÷	Uneven sweiling of bentonite	
SKI322		<u>. </u>	Movement of canister in buffer/backfill	
SK13.2.3	<u> </u>		Mechanical failure of buffer/backfill	
SKI3.2.4			Erosion of butter/backfill	
SK13.2.5	В	<u> </u>	Thermai effects on the butter material	
SK13.2.6		<u>}</u>	Diffusion - surface ciffusion	
SKI3.2.7		1	Swelling of corrosion products	
SK3.2.8	B	<u>!</u>	Preferential pathways in the buffer/backfilt	
SK13.2.9	B	<u> </u>	Flow through buffer/backfill	
5K13.2.10	<u> </u>	<u> </u>	Soret effect	
KB2.11	<u></u>	3.1	Sackili material deficiencies	
K13.2.12	<u> </u>	<u> </u>	Gas transport in bentonite	SEE SK32.8
KI4.1.1	BRA		Oxidizing conditions	!
KI4.1.2	BRP_		pH-deviations	
KI4.1.3	289.	<u>xxxx</u>	Colloids, complexing agents	SEE SKI5.45
KI4.1.4	BRR		Sorption	
KI4.1.6			Reconcentration	
KI4.1.7			Thermochemical changes	
KI4.1.9	BRA		Complexing agents	ALSO SKI4.1.
K142.3	977		Extreme channel flow of oxidants and nuclides	· · · · · · · · · · · · · · · · · · ·
KI4.2.4	_ 69		Thermal buoyancy	<u>i</u>
KI4.2.5	EFF		Changes of groundwater flow	
KI4.2.10	<u>8</u>		Chemical effects of rock reinforcement	
KI5.1	BAR .		Saline (or tresh) groundwater intrusion	
K15.14	<u>BR</u>		Resaturation	
KI5.18	27	X	Enhanced groundwater flow	SEE SKI4.2.5
K162	396		Gas transport	
K16.4	884.		Dispersion	
K!6.5	BRA.		Daution	
NL6.1	8		Subsidence and Caving	

FEPS LIST: BUFFER/BACKFILL CATEGORY

UKN1.5.7	877	t —	Saline or freshwater intrusion
UKN1.5.8	877		Effects at satine-treshwater interface
UKN1.5.9	- BFF		Natural themal effects
UKN1.6.1	BRR		Advection and dispersion
UKN1.6.2	BRA		Diffusion
UKN1.6.3	BRFL	i	Matrix diffusion
UKN1.6.4	BRR		Gas mediated transport
UKN1.6.5	BRF.		Multiphase flow and gas driven flow
UKN1.6.6	BRA	<u> </u>	Solubility limit
UKN1.6.7	889.	· · · · · · · · · · · · · · · · · · ·	Sorption (linear/non-linear, reversible/irreversible)
UKN1.6.8	BRA		Dissolution, precipitation and crystalisation
UKN1.6.9	BRA		Colloid formation, dissolution and transport
UKN1.6.10	389.	<u> </u>	Complexing agents
UKN1.6.13	BAR_		Mass, isotopic and species dilution
UKN1.6.14	WCBRF	<u> </u>	Chemical gradients (electrochemical effects and osmosis)
UKN1.7.6	WBRFL	<u> </u>	Chemical transformations
UKN1.7.7	WBRFL		Microbial interactions
UKN2_1.10	BR .		Thermal effects (eg. concrete hydration)
UKN2.2.2	HB		Inadequate backtill or compaction, voidage
UKN3.1.5	WB		Induced chemical changes (solubility, sorption, species equilibrium, mineralisation)
UKN3.22	WCSR		Interactions of host materials and groundwater with repository material (eq. concrete carbor
UKN3.2.3	WCBR	j	Interactions of waste and repository materials with host materials (eg. electrochemical, corros
HMIP123	WB	2.1	Gas generation from concrete
HMIP1.2.6	BFF		Gas transport
HMIP1.2.8	WBB		Thermo-chemical effects
HMIP1.4.1	WCB		Waste-form and backfill consolidation
HMIP1.5.3	BR .		Gas production (unsaturated flow)
HMIP1.5.4		<u> </u>	Saturated groundwater flow
HMIP1.5.5	<u> </u>	<u> </u>	Transport of chemically active substances into the near-field
HMIP1.6.1	88		Thermal effects and Rock-mass changes
HMIP1.62	B R		Thermal effects and Hydrogeological changes
HMIP1.6.3	<u> </u>		Thermai effects and Chemical changes
HMIP1.6.4	BR	<u> </u>	Thermal effects and Transport (diffusion) effects
HMIP2.3.1	879		Advection
HMIP2.3.2	889.	<u> </u>	Diffusion
HMIP2.3.3	BAP		Hydrodynamic dispersion
HMIP2.3.4	BRR		Solubility constraints
HMIP2.3.5	BRA		Sorption including ion-exchange
HMIP2.3.6	5R9.	Í	Changes in sorptive surfaces
HMIP2.3.7	889.		Changes in groundwater chemistry and flow direction
HMIP2.3.8	889.		Colloid transport
HMIP2.3.9	BRA	Ţ	Transport of radionuclides bound to microbes
HMIP2.3.10	BRA	i	Transport of active gases
HMIP2.3.11	BRFL	1	Gas induced groundwater transport
HMIP2.3.12	BRA		Thermal effects on hydrochemistry
HMIP2.3.13	889.		Biogeochemical changes
NEA1.6.1	BRR	i	Advection and dispersion
NEA1.6.2	BRA	1	Diffusion
NEA1.6.3	BRAL		Matrix diffusion
NEA1.6.4	BRAL		Gas mediated transport
NEA1.6.5	BRR_	<u> </u>	Multiphase flow and gas-driven flow
NEA1.6.6	BRFL		Solubility iznit
NEA1.6.7	BRR		Sorption (finear/non-linear, reversible/irreversible)
			Dissolution, precipitation, and crystallisation
NEA1.6.8	BRA	s i	
NEA1.6.9	889.	2	
NEA1.6.10	888		Complexing agents
NEA1.6.13	BAR		Mass, isotopic and species dilution
NEA1.6.14		i	Chemical gradients (electrochemical effects and osmosis)
NEA2.2.2	81		Inadequate backtill or compaction voidage
NEA3.1.1	8	\$;	Differential elastic response
			Non adaptic menones
NEA3.1.2	BR		Non-elastic response
NEA3.1.2 NEA3.1.4	BR		Non-elastic response Induced hydrological changes (fluid pressure, density convection, viscosity)

FEPs LIST: REPOSITORY CATEGORY

AECL1.00 WBR Ispectative conductory SEE AECL19 AECL1.41 R Hydroxile conductory E AECL1.42 R Hydroxile conductory E AECL1.44 R Hydroxile conductory E AECL1.44 R Hydroxile conductory E AECL1.45 R Hydroxile conductory E AECL1.50 WC3P Immorpore operation H AECL1.51 R Immorpore operation H AECL1.52 WC3P Immorpore operation SEE AECL1.4 AECL1.53 WC3P Immorpore operation SEE AECL1.4 AECL1.54 R 2.1 Immorpore operation SEE AECL1.4 AECL1.57 R 2.1 Immorpore operation SEE AECL1.6 AECL1.61 R 3.7 Immorpore operation SEE AECL1.6 AECL1.61 R 3.1 Mericologic attribution SEE AECL1.6 AECL1.62 R Precipation and dissolution SEE AECL1.6 AECL1.64 R </th <th>DENTFER</th> <th>CATEGORY</th> <th>ARGUMEN</th> <th>T FEP NAME COM</th> <th>MENT</th>	DENTFER	CATEGORY	ARGUMEN	T FEP NAME COM	MENT
AEC1.9 R Coverso AEC1.9 WSR I. Chemical interactions (expected) AECL.110 WGSR 4. Chemical interactions (expected) AECL.112 WGSR 4. Chemical interactions (expected) AECL.113 R Control interactions (expected) AECL.115 R CodeXis interactions (expected) AECL.115 R CodeXis interactions (expected) AECL.115 R CodeXis interactions AECL.12 WG2R 4. Correlation AECL.13 R Disperson AECL.14 R Correlation AECL.15 R Disperson AECL.16 R Disperson AECL.17 MC3R A. Correlation AECL.16 R Disperson AECL.17 R B. Expected AECL.14 R Hydrotherbail algeration AECL.14 R Hydrotherbail AECL.14 R Hydrotherbail AECL.14 R Hydrotherbail AECL.14 <td>AECL1.3</td> <td>WCBR</td> <td>1</td> <td>Biological activity</td> <td></td>	AECL1.3	WCBR	1	Biological activity	
AEC2.19 WBR I Chenical interactions (engeters) AECL.10 WCBR 4 Chenical interactions (engeters) AECL.11 WCBR 4 Chenical interactions (engeters) AECL.11 WCBR 4 Chenical interactions (engeters) AECL.113 WCBR Chenical interactions (engeters) AECL.116 R 2.17 Comptization AECL.128 WCBR 4 Convection AECL.128 WCBR Convection Incomprehens AECL.128 WCBR Convection Incomprehens AECL.129 BR Diffusion Incomprehens AECL.130 BR Diffusion Incomprehens AECL.149 BR Hydrautic conductivity Incomprehens AECL.148 BR Hydrautic model Incomprehens	AECL1.4	WCBR	4	Boundary conditions	
AECL1.10 WCBR 4 Chemical interactors (expected) i AECL1.11 WCBR 4 Chemical interactors (expectem)			1		
AECL.11 WGBR 4 Chemical interactions (cleng/serm) AECL.12 WGBR Chemical interactions (cleng)			l		
AEC1.12 WCBR 4 Chemical interactions (other)			<u> </u>		
AECU.13 WCBR Iconexists AECU.14 R 2.012 Consists AECU.14 R 2.12 Consists AECU.14 R 2.12 Consists AECU.12 BR Convestion Incomprehense AECU.12 BR Diffusion Incomprehense AECU.13 R Exconserve hydrosatic pressures H AECU.13 R Incomprehense H AECU.13 R Incomprehense H AECU.13 R Incomprehense H AECU.13 R Incomprehense H AECU.14 R Hydrosatic pressures H AECU.14 R Hydrosatic pressures H AECU.14 R Hydrosatic pressures SEE AECU.19 AECU.14 R Hydrosatic pressures SEE AECU.19 AECU.14 R Hydrosatic pressures SEE AECU.19 AECU.15 WC3R Incomprehence desate SEE AECU.19 AECU				·····································	
AECL1.15 R L. Cockets AECL1.24 R 2.1 Compression AECL1.24 R Conversion Incomprehens AECL1.25 WGR 4 Conversion Incomprehens AECL1.24 R Dispersion Incomprehens AECL1.25 R AL AECL1.34 R Excessive hydrosatic pressures AECL1.35 R AL Excessive hydrosatic pressures AECL1.35 R AL Excessive hydrosatic pressures AECL1.35 R AL Excessive hydrosatic pressures AECL1.36 R AL Excessive hydrosatic pressures AECL1.46 R Hydrasatic conductivity AECL1.46 R Hydrasatic conductivity AECL1.46 R Hydrasatic conductivity AECL1.46 R AECL1.46 R AECL1.46 R AECL1.46 R AECL1.46 R AECL1.46 R AECL1.46 AECL1.46 R AECL1.46 AECL1.46 AECL1.46 AECL1.46 AECL1.46 AECL1.46 AECL1.46 AECL1.46 AECL1.46			4		
AECU.16 R 2.17 Complexion by organics AECU.12 EXC.124 ER Convection Incomprehers AECU.125 WCBR 4 Convection Incomprehers AECU.129 BR Diffusion Incomprehers AECU.130 BR Diffusion Incomprehers AECU.137 R 3.1 Exposions H AECU.137 R 1.5 Exposions H AECU.140 WBR Georhemical pump SEE AECU.15 AECU.141 R Hydrotatic head Incompression AECU.147 R 3.1 Improper operation H AECU.147 R 3.1 Improper operation H AECU.147 R 3.1 Improper operation H AECU.147 R 3.1 Improper operation SEE AECU.15 AECU.147 R 3.1 Metrooparating OEEEAEU.15 AECU.158 WR 4 Incorpere clostating EEAEU.15			<u>.</u>		
AECL1.24 R Convection					
AECU 125 WCBR 4 Convestion Incomprehens AECU 129 BR Diffusion Incomprehens AECU 130 BR Diffusion Incomprehens AECU 130 BR Incomprehens Incomprehens AECU 137 R 3.1 Expressive bydrostatic produces Incomprehens AECU 137 R 3.1 Expressive bydrostatic produces Incomprehens AECU 143 R 1.1 Expressive bydrostatic produces Incomprehens AECU 143 R 1.1 Expressive bydrostatic produces Incomprehens AECU 144 R 1.1 Mode produces Incomprehens Incomprehens AECU 143 R 3.1 Improper operation IH Incomprehens Incomprehens <td></td> <td></td> <td></td> <td></td> <td></td>					
AECQL 129 ER Dibpose AEQL 130 BR Dibpose H AEQL 134 R Excessive hydroxaic pressures H AEQL 144 R Excessive hydroxaic pressures H AEQL 147 BR I Expensive hydroxaic pressures H AEQL 140 BR I Expensive hydroxaic pressures H AEQL 143 BR I Hydroxaic conductivity EXEL AEQL 147 R 1.1 AEQL 146 BR I Hydroxaic conductivity SEE AEQL 14 H AEQL 147 R 3.1 Improper operation H H AEQL 157 R 2.1 Montoting and remedial activities SEE AEQL 14 SEE AEQL 14 AEQL 157 R 2.1 Montoting and remedial activities SEE AEQL 15 SEE AEQL 15 AEQL 157 R 2.1 Montoting and remedial activities SEE AEQL 15 SEE AEQL 15 AEQL 157 R 3.1 Preclosizion as datas SEE AEQL 15 SEE AEQL 15			A		phone
AEQL130 EP Depression AEQL134 R Expressive hydroscalic pressures AEQL135 R 3.1 Explosions H AEQL137 BR Isponitions of cracks H AEQL140 WBR Geochamical sump. SEE AECL19 AEQL144 R Hydraulic conductivity Image: Conductivity Image: Conductivity AEQL144 R Hydraulic conductivity Image: Conductivity Image: Conductivity AEQL144 R Hydraulic conductivity Image: Conductivity Image: Conductivity AEQL144 R Image: Conductivity Image: Conductivity Image: Conductivity AEQL150 WC3R 4 Interfaces (boundary conductors) Image: Conductivity AEQL157 R 2.1 Methylation Image: Conductors Image: Conductors AEQL157 R 2.1 Methylation Image: Conductors Image: Conductors AEQL156 GC3R Image: Conductors Image: Conductors Image: Conductors AEQL168 <t< td=""><td></td><td></td><td></td><td></td><td>CIICILO</td></t<>					CIICILO
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AECL135 R 3.1 Explosions H AECL140 WBR Formation of cracks					
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ECL2.4 FF Borehole seal failure/open boreholes ECL2.6 HFF Boreholes - unsealed SEE AECL2.4 ECL2.7 FF 2.3 Cavitation SEE AECL2.4 ECL2.67 HF? Vauit heating effects Octance SEE AECL2.4 OE1.1.2.3 R Pore blockage: concrete Octance SEE AECL2.4 OE1.1.2.5 R Cement-subplate reaction: concrete Image: concrete Image: concrete OE1.1.1 R Changes in pore water composition, pH. Eh: concrete Image: concrete Image: concrete OE1.2.1 R Hydrogen: cornosion of structural steel Image: concrete Image: concrete OE1.2.2.6 WR 2.1 Methane/CO2 production: Effects of intostatic pressure Image: concrete Image: concrete OE1.2.2.7 R 2.1 Methane/CO2 production: Effects of indication in properties of concrete Image: concrete Image: concrete OE1.2.2.12 WR 2.1 Methane/CO2 production: Effects of indication in microbial populations Image: concrete Image: concrete OE1.2.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations	ECL1.91	R		Vault geometry	
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ECL2.7 FF 2.3 Cavitation ECL2.67 FF? Vauit heating effects OE1.1.23 R Pore blockage: concrete OE1.1.25 R Cement-sulphate reaction: concrete OE1.1.3.1 R Changes in pore water composition, pH. Eh: concrete OE1.2.1.1 R Changes in pore water composition, pH. Eh: concrete OE1.2.1.1 R Hydrogen: comosion of structural steel OE1.2.6 WR 2.1 Methane/CO2 production: Effects of introbial growth on properties of concrete OE1.2.7 R Methane/CO2 production: Effects of microbial growth on properties of concrete OE1.2.7 R Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.9 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.12 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.6.2 R Gas transport In the vauits between containers OE12.6.3 OE1.2.6.3 R Gas transport In the near-field, including up and around access shafts and adits	ECL24			Borehole seal failure/open boreholes	
ECL2.67 HF? Vault heating effects OE1.1.2.3 R Fore blockage: concrete OE1.1.2.5 R Cement-sulphate reaction: concrete OE1.1.3.1 R Changes in pore water composition, pH. Eh: concrete OE1.1.3.1 R Changes in pore water composition, pH. Eh: concrete OE1.2.1.1 R Hydrogen: comosion of structural steel OE1.2.2.6 WR 2.1 Methane/CO2 production: Effects of lithostatic pressure OE1.2.2.7 R Methane/CO2 production: Effects of microbial growth on properties of concrete OE1.2.2.7 R Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.9 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.12 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.6.2 R Gas transport In the vauits between containers OE1.2.6.3 R Gas transport In the near-field, including up and around acce	ECL26				124
OE1.1.2.3 R Pore blockage: concrete OE1.1.2.5 R Cement-sulphate reaction: concrete OE1.1.3.1 R Changes in pore water composition, pH. Eh: concrete OE1.1.3.1 R Changes in pore water composition, pH. Eh: concrete OE1.2.1.1 R Hydrogen: comosion of structural steel OE1.2.2.6 WR 2.1 Methane/CO2 production: Effects of lithostatic pressure OE1.2.2.7 R Methane/CO2 production: Effects of microbial growth on properties of concrete OE1.2.2.9 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.9 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.12 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.6.2 R Gas transport In the vaults Gas transport In the vaults OE1.2.6.3 R Gas transport In the near-field, including up and around access shafts and adits OE1.2.7.1 R 3.1 Erglosions	ECL2.7				
OE1.1.2.5 R Cement-sulphate reaction: concrete OE1.1.3.1 R Changes in pore water composition, pH. Eh: concrete OE1.2.1.1 R Hydrogen: consist of structural steel OE1.2.2.6 WR 2.1 Methane/CO2 production: Effects of lithostatic pressure OE1.2.7 R Methane/CO2 production: Effects of microbial growth on properties of concrete OE1.2.9 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.12 WR 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.9 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.12 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.6.2 R Gas transport in the vauits between containers OE1.2.6.3 R Gas transport in the near-field, including up and around access shafts and adits OE1.2.6.4 R Gas transport in the near-field, including up and around access shafts and adits OE1.2.7.1 R 3.1 Explosions	ECL2.67				· .
OE1.1.3.1 R Changes in pore water composition, pH. Eh: concrete OE1.2.1.1 R Hydrogen: comosion of structural steel OE1.2.2.6 WR 2.1 Methane/CO2 production: Effects of lithostatic pressure OE1.2.2.7 R Methane/CO2 production: Effects of microbial growth on properties of concrete OE1.2.2.9 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.9 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.12 WR 2.1 Methane/CO2 production: Energy and numerit control of metabolism OE1.2.2.13 WR 2.1 Methane/CO2 production: Energy and numerit control of metabolism OE1.2.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.6.2 R Gas transport in the vauits between containers OE1.2.6.3 R Gas transport in the near-field, including up and around access shafts and adits OE1.2.6.4 R Gas transport in the near-field, including up and around access shafts and adits OE1.2.7.2 R 3.1 Explosions	OE1.1.2.3				
OE12.1.1 R Hydrogen: corrosion of structural steel OE12.2.6 WR 2.1 Methane/CO2 production: Effects of lithostatic pressure OE12.2.7 R Methane/CO2 production: Effects of microbial growth on properties of concrete OE12.2.9 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE12.2.9 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE12.2.12 WR 2.1 Methane/CO2 production: Energy and nutrient control of metabolism OE12.2.13 WR 2.1 Methane/CO2 production: Energy and nutrient control of metabolism OE12.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE12.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE12.6.2 R Gas transport in the vauits between containers OE12.6.3 R Gas transport Between vauits OE12.6.4 R Gas transport in the near-field, including up and around access shafts and adits OE12.7.1 R 3.1 Explosions					
OE1226 WR 2.1 Methane/CO2 production: Effects of lithostatic pressure OE1227 R Methane/CO2 production: Effects of microbial growth on properties of concrete OE1229 BR 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE122.12 VR 2.1 Methane/CO2 production: Energy and numeric control of metabolism OE122.13 VR 2.1 Methane/CO2 production: Energy and numeric control of metabolism OE122.13 VR 2.1 Methane/CO2 production: Energy and numeric control of metabolism OE122.13 VR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE12.6.2 R Gas transport in the vauits between containers OE12.6.3 OE12.6.3 R Gas transport Between vauits OE12.6.4 OE12.6.4 R Gas transport in the near-field, including up and around access shafts and adits OE12.7.1 R 3.1 Explosions					
OE1.2.2.7 R Methane/CO2 production: Effects of microbial growth on properties of concrete OE1.2.2.9 BR 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE1.2.2.12 VR 2.1 Methane/CO2 production: Energy and numeral control of metabolism OE1.2.2.12 VR 2.1 Methane/CO2 production: Energy and numerat control of metabolism OE1.2.2.13 VR 2.1 Methane/CO2 production: Energy and numerat control of metabolism OE1.2.2.13 VR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.6.2 R Gas transport in the vauits between containers OE1.2.6.3 OE1.2.6.3 R Gas transport Between vauits OE1.2.6.4 OE1.2.6.4 R Gas transport in the near-field, including up and around access shafts and adits OE1.2.7.1 R 3.1 Explosions		the second s			
OE1229 ER 2.1 Methane/CO2 production: Effects of hydrogen from metal corrosion OE122.12 VR 2.1 Methane/CO2 production: Energy and numeric control of metabolism OE122.13 VR 2.1 Methane/CO2 production: Energy and numeric control of metabolism OE122.13 VR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE12.6.2 R Gas transport in the vauits between containers OE12.6.3 R Gas transport Between vauits OE12.6.4 R Gas transport in the near-field, including up and around access shafts and adits OE12.7.1 R 3.1 Fires OE12.7.2 R					
OE12.2.12 WR 2.1 Methane/CO2 production: Energy and numeric control of metabolism OE12.2.13 WR 2.1 Methane/CO2 production: Effects of radiation on microbial populations OE12.6.2 R Gas transport in the vauits between containers OE12.6.3 R Gas transport Between vauits OE12.6.4 R Gas transport in the near-field, including up and around access shafts and adits OE12.7.1 R 3.1 Fires OE12.7.2	the second s				- <u>-</u>
OE1.2.2.13 WR 2,1 Methane/CO2 production: Effects of radiation on microbial populations OE1.2.6.2 R Gas transport in the vauits between containers					
OE12.6.2 R Gas transport in the vauits between containers OE12.6.3 R Gas transport Between vauits OE12.6.4 R Gas transport in the near-field, including up and around access shafts and adits OE12.7.1 R 3.1 Fires Gas transport in the near-field, including up and around access shafts and adits					
OE12.6.3 R Gas transport Between vaults OE12.6.4 R Gas transport in the near-field, including up and around access shafts and adits OE12.7.1 R 3.1 Fires OE12.7.2				·	
OE12.6.4 R Gas transport in the near-field, including up and around access shafts and adits OE12.7.1 R 3.1 Fires OE12.7.2 R 3.1 Explosions	UE1252 :				
OE12.7.1 R 3.1 Fires OE12.7.2 R 3.1 Explosions	0.51 0.5 5	D	1	Gas iransport Between Vauas	
OE1.2.7.2 R 3.1 Explosions	OE1.2.6.3				•
	OE1 2.6.4	Ri		Gas transport in the near-field, including up and around access shafts and adits	{
	OE1 2.6.4 OE1 2.7.1	R R	3.1	Gas transport in the near-field, including up and around access shafts and adits Fires	

FEPs LIST: REPOSITORY CATEGORY

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DOE1.4.4.1	R		duced subsidence
DOE1.4.5	HF T	2.3? Rock creep	
DOE1.5.1.1	EF		noisture content due to dewatering
DOE1.5.1.2	87 88		noisture content due to stress relief
DOE1.521	55 55		flow: initial conditions
DOE1.522	BAF		flow due to gas production
DOE1.53			flow (saturated conditions)
DOE1.5.4.1	<u>R</u>		Inorganic ions into the near-field
DOE1.5.4.2	R		Humic and fulvic acids into the near-field
DOE1_5.4.3	R		Microbes into the near-field
DOE1_5.4.4			Organic complexes into the near-field
DOE1_5.4.5	<u>R</u>		Colloids into the near-field
DOE1.6.1			lastic response
DOE1.62		Non-elastic r	
DOE1_6.3.1	F		nges: aperture
DOE1.6.32	F	Fracture cha	
DOE1.651	WOR		inges due to Metal corrosion
DOE1.6.5.2	R		anges due to Concrete degradation
DOE1.6.5.3	WBR		anges due to Waste degradation
DOE1.6.5.4	WBR		inges due to Gas production
DOE1.655			anges due to Complex formation
DOE1.656	8ff		anges due to Colloid production
DOE1.6.5.7			anges due to Solubility
DOE11.6.5.8	EFF		inges due to Sorption
DOE1.6.5.9	EFF	Chemical ch	inges due to Species equilibrium
DOE1.6.6.2	WBRF	Microbial ac	
DOET.6.5.3	WERF	Microbiologik	al effects due to Microbial product reactions
DOE2.26.1	Ŧ	Repository-in	duced seismicity
DOE2.2.6.2	AFG	Externally-in	tuced seismicity
DOE2 3.3.1	Æ	Rock proper	y changes: Porosity
DOE2.3.3.2	Æ	Bock proper	y changes: Permeability
DOE2 333	HF-	Rock proper	y changes: Microbial pore blocking
DOE2.3.3.4	æ	Rock proper	y changes: Channel formation/closure
DOE2.3.4.1	Æ	Groundwater	flow: Darcy
DOE2.3.4.2	Æ	Groundwater	flow: Non-Darcy
DOE2.343	Æ	Groundwate	flow: Intergranular (matrix)
DOE2.3.4.4	89F	Groundwater	flow: Fracture
DOE2.3.4.5	8ff	Groundwater	flow: Effects of solution channels
DOE2.3.4.6		inorganic co	loid transport. Porous media
DOE2.3.5.1	895	Inorganic co	loid transport: Effects of pH and Eh
DOE2.3.5.2	BAF	Inorganic co	loid transport. Effects of ionic strength
DOE2.3.6	æ	Variations in	groundwater temperature
DOE2.4.1	BFF	Advection	
DOE2.42.1	8 F	Bulk diffusio	<u> </u>
DOE2,422		Matrix diffus	on
DOE2.43	996	Hydrodynam	c dispersion
DOE2.4.4.1	BRFL		ects of pH and Eh
DOE2.4.4.2	SRR.		iects of ionic strength
DOE2.4.4.3	GRFL		ects of naturally-occurring complexing agents
DOE2.44.4	æ		ects of complexing agents formed in the near-field
DOE2.4.4.5	BRFL		ects of naturally-occurring colioids
DOE2.4.4.6	SR.		ects of colloids formed in the near-field
DOE2.4.4.7	Ŧ		ects of major ions migrating from the near-field
DOE2.4.4.8	BPR		lects of microbial activity
DOE2.4.5.1	SRFL	Linear sorpti	<u> </u>
DOE2.4.5.2	BRAL	Non-linear s	xption
DOE2.4.5.3	BRAL	Reversible s	non
DOE2.4.5.4	BRR.	Irreversible :	
DOE2.4.5.5	BER		ects of pH and Eh
DOE2.4.5.6	BRR.		fects of ionic strength
DOE2.4.5.7	BRFL		ledis of naturally-occurring organic complexing agents
DOE2.4.5.8	889.		tects of naturally-occuring inorganic complexing agents
DOE2.4.5.9	BR		ects of complexing agents formed in the near-field
DOE2.4.5.10	BRR		ects of naturally-occuring colloids
DOE2.4.5.11			eas of colloids formed in the near-field
DOE2.4.5.12			acts of major ions migrating from the near-field
DOE2.4.5.12	889.		eds of microbial activity
	CTTTL.	JULIAN CL	

FEPS LIST: REPOSITORY CATEGORY

research reputies and changes in sector a sector

		· · · · · · · · · · · · · · · · · · ·	16	
DOE2 - 6		<u> </u>	Fracture mineralisation	
DOE2.4.7.1		·	Organic colloid transport in Porous media	
DOE2.4.7.2		<u></u>		:
DOE2.4.7.3	BRF	<u> </u>	Organic colloid transport: Effects of pH and Eh	
DOE2.4.7.4	BRA	1	Organic colloid transport Effects of ionic strength	
DOE2.4.8.1	BRR	<u>}</u>	Inorganic colloid transport: Porous media	
DOE2.4.8.2		1	Inorganic colloid transport: Fractured media	
DOE2.4.8.3	BRA	1	Inorganic colloid transport. Effects of pH and Eh	
DOE2.4.8.4	BRFL	·	Inorganic colloid transport. Effects of ionic strength	
DOE2.4.9	BRR		Transport of radionuclides bound to microbes	
DOE2.4.10	BRR.	1	Isotopic dilution	:
DOE2 4 11.1	BRA	1	Gas transport: solution	
DOE2.4.11.2	BRR		Gas transport: gas phase	
DOE2.4.12	æ	1	Gas-induced groundwater transport	
DOE2.4.13.1	38	1	Repository thermally-induced groundwater transport	
DOE2.4.13.2	BFF	1	Naturally thermally-induced groundwater transport	
DOE2.4.14	RP_	;	Biogeochemical changes	
DOE4.1.1.1	RFL	1	Borehole seal failure	
DOE4.1.1.2	RFL		Borehole seal degradation	
DOE4.1.2.1	R	<u></u>	Shait/tunnel seat failure	
	<u>R</u>		Shaft/tunnel seal degradation	
DOE4.1.2.2		1		
IAEA1.13.1		:	Fluid interactions: Groundwater flow	
IAEA1.13.2	BRR	<u>t</u>	Fluid interactions: Dissolution	
IAEA1.13.3	<u>89</u>		Fuid interactions: Brine pockets	
IAEA2.2.1		: 	Inadequate design: Shaft seal tailure	
LAEA2.2.2	RFL		Inadequate design: Exploration borehole seal tailure	
IAEA23	R	3.1	Improper operation: Improper waste emplacement	
IAEA3.1.1	Ŧ	1	Thermal effects: Differential elastic response	
IAEA3.1.2	Ŧ		Thermal effects: Non-elastic response	
IAEA3.1.3	37	1	Thermal effects: Fluid pressure, density, viscosity changes	
IAEA3.1.4	BRF		Thermal effects: Fluid migration	
IAEA3.2.2	WCR		Chemical effects: Interactions of waste package and rock	
IAEA3.2.4	WER	· · · · · · · · · · · · · · · · · · ·	Chemical effects: Geochemical change	
IAEA3.3.2	88	:	Mechanical effects: Local fracturing	
PGA3.5	R	<u>.</u>	Decompressed zones from mining	
PGA3.7.3		}	Differing thermal expansion of backfill and host rock	
PGA3.7.4			Differing thermal expansion of host rock zones	
		<u>,</u>	Thermal convection	
PGA3.8			Geochemical changes in host rock	······································
PGA3.12.2	388	<u>. </u>	Physico-chemical phenomena/effects (eg. colloid formation)	······
PGA3.13				
PGA3_14		<u>;</u>	Microbiological phenomena/effects	
PGA3.16		<u>i</u>	Failure of shaft sealing	
PGA4.1	F	<u> </u>	Direct alterations in hydrogeology	
PGA42	<u>R</u>	<u>.</u>	Injection of liquid waste	
SKI1.2.2	WR	2.2	H2/O2 explosions	
SKI3.2.1.1	58		Sweiling of bentonite into tunnels and cracks	
SK13.2.1.2	98	1	Uneven swelling of bentonite	
SK14.1.1	BRR		Oxidizing conditions	
SKI4.1.2	BRA	ŧ	pH-deviations	
SKI4.1.3		XXXXX	Colloids, complexing agents	SEE SKI5.45
SKI4.1.4			Sorption	
SKI4.1.5		· · · · · · · · · · · · · · · · · · ·	Matrix diffusion	
SKI4.1.6	BRA	<u>t</u>	Reconcentration	
SK14.1.7	BR	· · · · · · · · · · · · · · · · · · ·	Thermochemical changes	
SKI4.1.8	<u></u>		Change of groundwater chemistry in nearby rock	
SKI4.1.9	BRA	<u> </u>	Complexing agents	ALSO SKH 1.
			Mechanical failure of repository	
SK14.2.1	<u> </u>	·	Excavation/backfilling effects on nearby rock	·····
SK14.2.2.1	<u> </u>		Hydraufic conductivity change - Excavation/backfilling effect	SEE SKI4.2.2
SK14.2.2.2	<u> </u>	<u> </u>		SEE SK4.22
SK14.2.2.3	R	XXXXX	Mechanical effects - Excavation/backfilling effects	000 OR 4.2.2.
SK14.2.3		·	Extreme channel flow of oxidants and nuclides	
SK14.2.4	<u>BR</u>		Thermal buoyancy	·
SK14.2.5		i	Changes of groundwater flow	
	8	1	Thermo-hydro-mechanical effects	
SKI4.2.7				
SKI4.2.7	8		Enhanced rock fracturing	
			Enhanced rock fracturing Creeping of rock mass	

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FEPS LIST: REPOSITORY CATEGORY

SKI5.1	BFF		Saline (or fresh) groundwater intrusion
SK15.11	RF 1		Degradation of hole- and shaft seals
SKI5.14	8		Resaturation
SKI5.18	BFF	XXXX	Enhanced groundwater flow SEE SKI4.2.5
SKI5.22	GR		Accumulation of gases under permatrost
SK15.24	R	XXXX	Stress changes of conductivity SEE SKI 4.2.2
SK15.43	GR		Methane intrusion SEE SKI5.22
SK15.44	WR		Solubility and precipitation
SKI5.45	FF		Colloid generation and transport
SK16.2	BRF		Gas transport
SKI6.4	BRFL		
SKI6.5	888		
SKI6.13			Geothemally induced flow SEE 6.1
SK17.5	BR.		Isotopic dilution
SNL6.1	<u> </u>		Subsidence and Caving
			Shaft and Borehole Seal Law vition
SNL6.3	<u> </u>		
			Thermally Induced Stress/Fracturing in Host Rock
SNL6.4	<u> </u>		Excavation-Induced Stress/Fracturing in Host Rock
	R _		Natural gas intrusion
UKN1.5.2	R		Site flooding
UKN1.5.7	<u>. 89</u>		Saline or freshwater intrusion
0101120.0	997		Effects at saline-freshwater interface
UKN1.5.9	3 9F		Natural thermal effects
UKN1.6.1	BR9		Advection and dispersion
UKN1.6.2	BRA		Diffusion
UKN1.6.3	BRR_		Matrix diffusion
UKN1.6.4	BAB		Gas mediated transport
UKN1.6.5	BRFL		Multiphase flow and gas driven flow
UKN1.6.6	BRR		Solubility limit
UKN1.6.7	BRR.		Sorption (linear/non-linear, reversible/irreversible)
UKN1.5.8	BRA		Dissolution, precipitation and crystalisation
UKN1.6.9	BRR		Colloid formation, dissolution and transport
UKN1.6.10	BRFL		Complexing agents
UKN1.6.11	F F		Fracture minerclise ion and weathering
UKN1.6.13	BRFL		Mass, isotopic and species dilution
UKN1.6.14	WORF		Chemical gradients (electrochemical effects and osmosis)
UKN1.7.6	WERFL		Chemical transformations
UKN1.7.7	WERFL		Microbial interactions
	BR		Investigation borehole seal failure and degradation
			Shaft or access tunnel seal failure and degradation
UKN2.1.4	8		Stress field changes, settling, subsidence or caving
UKN2.1.5	F		Dewatering of host rock
	- <u>-</u>	3.1	Poer quality construction
UKN2.1.9	<u> </u>	3.1	Design modification
UKN2.1.10		<u></u>	Themal effects (eg. concrete hydration)
	<u> </u>	3.1	Repository flooding during operation
		3.1	
UKN2.2.10	<u> </u>	<u> </u>	Poor closure
UKN3.1.1	F_		Oifferential elastic response
			Non-elastic response
UKN3.1.3	<u> </u>		Host rock fracture aperture changes
			Induced hydrological changes (fluid pressure, density convection, viscosity)
	WCBR		Interactions of host materials and groundwater with repository material (eg. concrete carbon
UKN3.2.3	WCBR		Interactions of waste and repository materials with host materials (eg. electrochemical, corros
UKN3.2.4	FF .		Non-radioactive solute plume in geosphere (effect on redox, effect on pH, sorption)
UKN3.3.2	<u> </u>		Changes in In-situ stress field

FEPS LIST: REPOSITORY CATEGORY

HMIP112	R		Physico-chemical degradation of concrete
HMIP126	SHF .		Gas transport
HMIP12.8	WER		Themo-chemical effects
HMIP142	R		Vault collapse
HMIP1.5.1	R		Desaturation (pumping) effects
HMIP1.5.2	R		Disturbed zone (hydromechanical) effects
HMIP1.5.3	88		Gas production (unsaturated flow)
HMIP1.5.4	895		Saturated groundwater flow
HMIP1.5.5	ER.		Transport of chemically active substances into the near-field
HMIP1.6.1	BR		Thermal effects and Rock-mass changes
HMIP1.6.2	BR		Thermal effects and Hydrogeological changes
HMIP1.6.3	B R		Thermal effects and Chemical changes
HMIP1.6.4	88		Themal effects and Transport (diffusion) effects
HMIP2.3.1	386.		Advection
	388		Diffusion
HMIP232			
HMIP23.3	BRFL		Hydrodyrfamic dispersion
HMIP2.3.4	3892		Solubility constraints
HMIP2.3.5	BRFL		Sorption including ion-exchange
HMIP23.6	BRP		Changes in sorptive surfaces
HM!P2.3.7	BRP		Changes in groundwater chemistry and flow direction
HMIP23.8	BRFL		Colloid transport
HMIP2.3.9	BRFL		Transport of radionuclides bound to microbes
HMIP2.3.10	SPR		Transport of active gases
HMIP2.3.11	3RFL		Gas induced groundwater transport
HMIP2.3.12	BRFL		Thermal effects on hydrochemistry
HMIP2.3.13	BRFL		Biogeochemical changes
HMIP5.1.1	B9		Loss of integrity of borehole seals
HMIP5.1.2	R		Loss of integrity of shaft or access tunnel seals
HMIP5.1.3	R		Incomplete near-field chemical conditioning
NEA1.2.13			Natural das intrusion
			Advection and dispersion
NEA1.6_1	BRFL		Diffusion
NEA1.6.2	889.		
NEA1.6.3	BRFL		Marrix diffusion
NEALE.4	887.		Gas mediated transport
NEA1.6.5	BRRL		Multiphase flow and gas-driven flow
NEA1.6.6	BRFL		Solubility fimit
NEA1.6.7	BRAL		Sorption (linear/non-linear, reversible/irreversible)
NEA1.6.8	BRFL		Dissolution, precipitation, and crystallisation
NEA1.6.9	BRFL		Colloid formation, dissolution, and transport
NEA1.6.10	SRFL		Complexing agents
NEA1.6.11	FF		Fracture mineralisation
NEA1.6.13	BRR		Mass, isotopic and species dilution
NEA1.6.14	BFR.		Chemical gradients (electrochemical effects and osmosis)
NEA212	HB		Investigation borehole seal iziture and degradation
NEA2.1.3	HR		Shaft or access tunnel seal failure and degradation
NEA2.1.4	HR		Stress field changes, settling, subsidence or caving
NEA2 1.5			Dewatering of host rock
NEA2.1.6	CR :		Material defects (e.g. early canister failure)
NEA2.1.7	HR		Common cause failures
			Poor quality construction
NEA2.1.8	HR :		Thermal effects
NEA2.1.10	R		
NEA2.2.1	R		Radioactive waste disposal error
NEA2.2.2	<u> </u>		Inadequate backfill or compaction voidage
NEA2.2.3	WR	3.1	Co-disposal of reactive wastes (deliberate)
NEA2.2.4	WR :		Inadvertent inclusion of undesirable materials
NEA2.2.6	<u> </u>	3.1	Accidents during operation
NEA2.2.7	R	D	Sabotage
NEA2.2.8	8	3.1	Repository flooding during operation
NEA2.2.9	R		Abandonment of unsealed repository
NEA2.2.10	R		Poor closure
NEA2.2.11	R	3.1	Post-closure monitoring
NE12.2.12	R		Effects of phased operation
NE43.1.1	58 1		Differential elastic response
NEA3.1.2	BR		Non-elastic response
			Host rock fracture aperture changes
NEA3.1.3			Induced hydrological changes (fluid pressure, density convection, viscosity)
NEA3.1.4	<u>B7F</u>		induced nydrological changes (totic pressure, deskry convention, viscosity)
NEA3.1.5	<u>BR</u>		interactions of host materials and groundwater with repository material (e.g. concrete carbon
NEA3.2.2	<u>R</u>		Interactions of host materials and groundwater with repository material (e.g. concelle carbon Interactions of waste and repository materials with host materials (electrochemical, corrosive
NEA3.2.3	RF .		

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FEPs LIST: FAR-FIELD CATEGORY

DENTRER	CATEGORY	ARGUMENT	FEP NAME	COMMENT
AECL23	HF	2.4	Borehole - well	
AECL24	F		Borehole seal failure/open boreholes	
AECL25	HFF		Borehoies - unsealed	SEE AECL24
AECL27	F	2.3	Cavitation	
AECL2.9	F		Colloid formation	
AECL2.10	F		Complexation by organics	
AECL2.11	F		Conceptual model - hydrology	
AECL2.12	F	4	Correlation	OFPARAMETER
AECL2.12	- HF	<u> </u>	Dewatering	
	F			
AECL2.15			Diffusion	
AECL2.16	<u> </u>		Discharge zones	
AECL2.17	F		Dispersion	
AECL2.22	<u>; </u>	۵	Explosion	SEE AECL22
AECL2.25	F		Fulvic acid	SEE AECL2.10
AECL2.26	F		Gases and gas transport	
AECL2.27	F		Geothermal gradient effects	
AECL2.30	F		Groundwater - evolution	
AECL2.31	F		Groundwater composition change	!
AECL2.32	F	[Humic acid	SEE AECL2.10
AECL2.33	F		Hydraulic properties - evolution	
AECL2.39	F	, <u> </u>	Matrix diffusion	
AECL2.42	F		Methane	IN DEEP GW
AECL2.43			Microbes	
AECL2.46	F		Precipitation - dissolution	
AECL2.47		;	Pseudo-colloids	SEE AECL29
AECL2.48	F	XXXX	Radioactive decay	SEE AECL1.68
AECL2.49	F	2.2	Radiolysis, radiation damage	SEE AECLI.69
AECL2.50	F	<u> </u>	Recharge groundwater	,022 /2021.00
	F		Prock properties	
AECL2.51		: 		
AECL2.52	F	<u>.</u>	Rock properties - undetected features	
AECL2.54	F	<u>}</u>	Salinity effects on flow	·
AECL2.55	F	<u> </u>	Saturation	<u> </u>
AECL2.56	F		Shaft seal failure	
AECL2.58	F		Sorption	
AECL2.59	1	i	Sorption - non-linear	
AECL2.60	<u> </u>	<u> </u>	Speciation	<u> </u>
AECL2.63			Turbuience	G/W
AECL2.65	F		Unsaturated rock	
AECL2.66	1		Vault closure (incomplete)	
AECL2.67	BF?	1	Vault heating effects	<u> </u>
DOE1.2.6.5	F	*	Gas transport into and through the far-field	<u> </u>
DOE1.4.5	F F	2.3?	Rock creep	:
DOE1.5.1.1	F -		Changes in moisture content due to dewatering	
DOE1.5.1.2	F		Changes in moisture content due to stress relief	1
DOE1.5.3	37F		Groundwater flow (saturated conditions)	
DOE1.5.1	E F	1	Differential elastic response	i
DOE1.6.2	F		Non-elastic response	
DOE1.6.3.1	F		Fracture changes: aperture	
DOE1.6.3.2	. .		Fracture changes: length	
DOE1.6.4.1	F		Hydrological changes: Ruid pressure	1
	i F	1	Hydrological changes: Density	
DOE1.6.4.2	F		Hydrological changes: Viscosity	1
DOE1.6.4.3		1	Chemical changes due to Complex formation	<u>}</u>
DOE1.6.5.5	<u> </u>			
DOE1.6.5.6			Chemical changes due to Colloid production	
DOE1.6.5.7	<u> </u>	<u> </u>	Chemical changes due to Solubility	
DOE1.6.5.8	EFF	<u>!</u>	Chemical changes due to Sorption	
DOE1.6.5.9	B ¥		Chemical changes due to Species equilibrium	
DOE1.6.6.2	WERF		Microbial activity	;
DOE1.6.6.3	WERF	1	Microbiological effects due to Microbial product reactions	

FEPs LIST: FAR-FIELD CATEGORY

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DOE2.2.6.1	F	Repository-induced seismicity
DOE2.2.6.2	- RFG	Externally-induced seismicity
DOE2.2.6.2	FG FG	Natural seismicity
DOE2.3.3.1	<u>9</u>	Rock property changes: Porosity
		Rock property changes: Permeability
DOE2.3.32	F	Rock property changes: Microbial pore blocking
DOE2.3.3.3	<u><u></u><u></u><u></u><u></u><u></u></u>	Rock property changes: microal pole occurring Rock property changes: Channel formation/closure
DOE2.3.3.4		
DOE2.3.4.1	IT	Groundwater flow: Darcy
DOE2.3.4.2		Groundwater tow: Non-Darcy
DOE2.3.4.3		Groundwater flow: Intergranular (matrix)
DOE2.3.4.4		Groundwater flow: Fracture
DOE2.3.4.5	BRF	Groundwater flow: Effects of solution channels
DO52.3.4.6	F	Inorganic colloid transport Porous media
DOE2.3.5.1	BAF	Inorganic colloid transport Effects of pH and Eh
DOE2.3.5.2	BH	Inorganic colloid transport: Effects of ionic strength
DOE2.3.5.3	F	2.3 Salinity: implications of evaporite deposits/minerals
DOE2.3.6	BAL	Vanations in groundwater temperature
DOE2.4.1	aff	Advection
DOE2.4.2.1	SHE	Bulk diffusion
DOE2.4.2.2	BRF	Matrix diffusion
DOE2.4.2.2 DOE2.4.3	397	Hydrodynamic dispersion
DOE2.4.3	BRR.	Solubility: effects of pH and Eh
		Solubility: effects of private the
DOE2.4.4.2	<u>BR9.</u>	Solubility: effects of naturally-occurring complexing agents
DOE2.4.4.3	BRA	Sciubing elleds of hald all occurring contract agents
DOE2.4.4.5	BRA	Solubility: effects of naturally-occurring colloids
DOE2.4.4.7	IT	Southing, energy of major tors migrand norm me not
DOE2.4.4.8	BAB	Coldenney. Checks of macrona damage
DOE2.4.5.1	889	Linear sorption
DOE2.4.5.2	BAR.	Non-linear sorption
DOE2.4.5.3	_BRA	Reversible sorption
DOE2.4.5.4	BRR	Inversible scription
DOE2.4.5.5	BRA	Sorption: Effects of pH and En
DOE2.4.5.6	BRAL	Sorption: Effects of ionic strength
DOE2.4.5.7	BRR	Sorption: Effects of naturally-occurring organic complexing agents
DOE2.4.5.8	SRA	Sorption: Effects of naturally-occuring inorganic complexing agents
DOE2.4.5.10	BRA	Sorption: effects of naturally-occuring colloids
DOE2.4.5.12	F	Sorption: effects of major ions migrating from the near-field
DOE2.4.5.13	BRA	Sorption: effects of microbial activity
DOE2.4.6	Ħ	Fracture mineralisation
DOE2.4.7.1	BRR	Organic colloid transport in Porous media
DOE2.4.7.2	BAR	Organic colloid transport in Fractured media
DOE2 7.3	BRA	Organic colloid transport Effects of pH and Eh
DOE2.4.7.4	BRFL	Organic colloid transport Effects of ionic strength
DOE2.4.8.1	BRR	Inorganic colloid transport Porous media
		Inorganic colloid transport: Fractured media
DOE2.4.8.2		Inorganic colloid transport. Hactured theua Inorganic colloid transport: Effects of pH and Eh
DOE2.4.8.3	BRFL	Inorganic colloid transport. Effects of private En
DOE2.4.8.4	BPR	
DOE2.4.9	BRA	Transport of radionuclides bound to microbes
DOE2.4.10	BRA	Isotopic dilution
DOE2.4.11.1	BRA	Gas transport: s^ tion
DOE2.4.11.2	BRA	Gas transport, gas phase
DOE2.4.12	BFF	Gas-induced groundwater transport
DOE2.4.13.2	397	Naturally thermally-induced groundwater transport
DOE2.4.14	A9L	Biogeochemical changes
DOE3.3.2.4	FL.	Near-surface runoif processes: Macropore flow
DOE3.3.2.5	FL.	Near-surface runoif processes: Variable source area response
DOE3.3.3	F	Groundwater recharge
DOE4.1.1.1	RR	Borehole seal failure
DOE4.1.1.2	Rf.	Borehole seal degradation
UVL4.1.1.4	116	

TEPS LIST: FAR-FIELD CATEGORY

,		
Kl4'1'9	7488	Reconcentration
Kit1.5	4	Matrix diffusion
\$11\$D	1998	 noiquos
XI4113	HHE	 Collords, complexing agents SEE SKE
Kit15	866	Shorterysb-Hg
KI4C1.1	566	 suaitibras pristikas
CA4.1	L H	 Direct alterations in hydrogeology
\$1.EA2	356	 stoaila/enamonary phenomena/etisects
EL.EAD	7-31-6	Physico-chemical phenomena/effects (eq. colloid formation)
S.ST.EAD	±	Geochermical changes in host rock
8.543	H H	 Themail convection
6A3.7.4	्रम	sense to the primate events of the sense of
ST.FAD	i 🔳	Septer changes
11.140	1 18	 Weathering, mineralisation
4.1.EA3/	-ttE	 Themail effects: Fluid migration
E.1.2A3/	352	Themal effects: Fluid pressure, density, viscosity changes
S-1.2A3	H	 Themail effects: Non-elssisc response
1.1.EA3	÷ ±	Themal effects: Differential elastic response
1EV222	198	 Inadequate design. Exploration borehole seat failure
15221	#	Inadequate design: Shaft seal tailure
EET.13.3	358	 Fluid interactions: Brine pockets
S.ET.13.2	1-1-1-1-6	 Fluid interactions: Dissolution
LELIAJ	-3-58	 Fluid interacions: Groundwater flow

KN1.6.8	<u></u>		Dissolution, precipitation and crystalisation
Z'9'INX	1 255		Somion (linear/non-linear, reversible/meversible)
<u>KN1'9'9</u>	<u>- 1996 </u>		jing thirds?
KR1'9'2	1996		woli navid see dre woli seendidum
KN1'9'1	<u></u>		Cas mediated using the second
KA1'6'3	888		noisutito xmbM
KN1'6'5 KN1'6'1	<u></u>		Diffusion
6'9'INX	- ਸ਼ੁਲਦ		noisnagaid and noisnag
KA128			Signal the second states and the second stat
Z'S'INX			Effects & same-frequencies interface
9'S'INX	<u>- 956</u>		Saline or freements and the same area and the
KA1'2'2			Groundwater flow (Darcy, non-Darcy, intergranular fracture, channelling and protorential part Groundwater conditions (saturated/unsaturated)
*S'1NX	- 1		Groundwater discharge (to surface water, to spings, to soils, to wells, to marine)
KALES	- <u></u>		Hecharge to groundwiter
KN1515			Underected features (e.g. faults, tracture networks, shear zones, brecciation, gas pockets)
KA15.9	Ð	;	Fredericity fortunes (on targing require reprinds, shear zones, breactaring and poters).
79"IN			
E:97N			Excertain incoded Stress Fracturing in Host Rock
NF6.2	<u>≠</u> 		Themeally induced Streastrang in Host Rock
νι ε 3 Υ.Ζ.Υ			Isotopic ditation Statt and Boehole Seal Degradation
KIE 13	- 2 		Geothermally induced flow
KIE 13	<u> </u>	!	Underected discontinuities
9-91			
	7998		Investigation of flow parties SKIS25
×:0 t	300		uoisiadsigi
2.90	3		Far field hydrochemistry - acids, oxidans, nitrate
2.90	÷		Case transport
1.91	3		Underected indume zones
97 51			CHORDARGEL LECTRICESCIBLIGE
57'51)			Colloid generation and transport
KI2'52	3		Descolution of fracture fillings/precipitations
81.21	-545	XXXX	Eutranced groundwater from SEE SKIA25
LL'SD	±		Degradation of hole-and stages their and the more and the stages of the stages of the stage of t
1.21>	÷		indiana (at the state intra-sort
1452	358		Changes of groundwater flow
0453	356		Extreme channel flow of oxidants and nuclides
6'1'71>	1999		Complexing agents
91.41	74748		Reconcentration
5.1.415	1		noisuttib xintem
t"[#])	884		noignos
21.41	HHE :	XXXX	Collords, complexing agents
21.40	ਸ਼ਿਸ਼		2 Shorteineb-Hg
1.1.34)	ප්ර		snoitibroo prizibixo;
I PAS	E H		Direct alterations in hydrogeology
\$1.EAE	3566		sidential phenomenale and a superior
EL.EAE	738		Physico-chemical phenomena/effects (eq. colloid formation)
SISTERS	±		Geochermical changes in host rock
8.545	±		Themail convection
4.7.EAE	بط		sens x n tech is noisneare inmedia primetia
ST.FAE	E I		Secondwater changes
11.1AE	<u> </u>		Meathering, mineralisation
EA3.1.4	-#5		Themai effects: Fluid migration
E.L.EA3	-#8		Themal effects: Fluid pressure, density, viscosity changes
EA3.1.2	H		Themail effects: Non-elastic response
EA3.1.1	<u> </u>		Themal effects: Differential elastic response
EV222	HH		Inadequate design: Exploration borehole seat failure
EA2.2.1	#		suitet less there are designed and the second secon
E.E1.1A3	#		Fluid interactions: Brine pockets
SE1.132	- 1996		Pluid interactions: Dissolution

FEPs LIST: FAR-FIELD CATEGORY

UKN1.6.9	BRR	Colloid formation, dissolution and transport
UKN1.6.10	BRFL	Complexing agents
UKN1.6.11	Ŧ	Fracture mineralisation and weathering
UKN1.6.13	BRFL	Mass, isotopic and species dilution
UKN1.6.14	WCBRF	Chemical gradients (electrochemical effects and osmosis)
UKN1.7.6	WERFL	Chemical transformations
UKN1.7.7	WERE	Microbial interactions
UKN2.1.2	RFL	Investigation borehole seal failure and degradation
UKN2.1.3	Æ	Shait or access tunnel seal failure and degradation
UKN2.1.5	F	Dewalering of host rock
UKN3.1.1	HF-	Differential elastic response
UKN3.1.2	EF.	Non-elestic response
UKN3.1.3	HF -	Host rock fracture aperture changes
UKN3.1.4	 FF	Induced hydrological changes (Buid pressure, density convector, viscosity)
UKN324		Non-radicacive solute plume in geosphere (effect on redcx, effect on pH, sorption)
HMIP1.2.6	BFF	Gas transport
HMIP1.5.4	 BAF	Saturated groundwater flow
HMIP219		Effects of natural geses
HMIP221		▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖▖
HMIP222	- <u>-</u>	Changes in geometry and driving forces of the flow system
HMIP223	<u>F</u>	Rock property changes
		Groundwater flow
HMIP2.3.1	<u>BRR</u>	Advection
HMIP232		Diffusion
HMIP233	<u> </u>	Hydrodynamic dispersion
HMIP2.3.4	BRR.	Solubility constraints
HMIP2.3.5	BRFL	Sorption including ion-exchange
-IMIP2.3.6		Changes in sorptive surfaces
HMIP2.3.7		Changes in groundwater chemistry and flow direction
HMIP23.8	888	Colloid transport
-MIP23.9		Transport of radionuclides bound to microbes
HMIP2.3.10		Transport of active gases
-iMIP2.3.11	BRR	Gas induced groundwater transport
HMIP2.3.12	BRFL	Thermal effects on hydrochemistry
HMIP2.3.13	BRF	Biogeochemical changes
HMIP5.1.1	<u></u>	Loss of integrity of borehole seals
NEA1.2.13		Natural gas intrusion
EA1.5.3	<u> </u>	Recharge to groundwater
VEA1.5.5	F	Groundwater flow (Darcy, non-Darcy, intergranular fracture, channeling and preferential pathw
EA1.5.6	F	Groundwater conditions (saturated/unsaturated)
EA1.5.7	4	Saline or freshwater intrusion
EA1.5.8	F	Effects at saline-freshwater interface
EA1.5.9		Natural thermal effects
VEA1.6.1	BRR	Advection and dispersion
EA1.6.2	BRR.	Diffusion
EA1.6.3	889.	Matrix diffusion
EA1.6.4	SRR.	Gas mediated transport
EA1.6.5	BRR	Multiphase flow and gas-driven flow
EA1.6.6	BRR.	Solubility limit
EA1.6.7	BRR	Sorption (linear/non-linear, reversible/irreversible)
EA1.6.8	889.	Dissolution, precipitation, and crystallisation
EA1.6.9	889.	Colloid formation, dissolution, and transport
EA1.6.10	BAA	Complexing agents
EA1.6.11		Fracture mineralisation
EA1.6.13	BRR.	Mass, isolopic and species diution
IEA1.6.14		Chemical gradients (electrochemical effects and osmosis)
EA3.1.4	3ff	induced hydrological changes (fluid pressure, density convection, viscosity)
EA3.2.3	 F	Incuced hydrological changes (hub pressure, density convection, viscosity)
EA3.2.1	7	2.2 Non-radioactive solute plume in geosphere (effect of redox, pH, and sorption)

FEPs LIST: BIOSPHERE CATEGORY

DENTHER	CATEGORY	ARGUMENT	FEP NAME	COMMENT
AECL1.51	1 L	2.3	Intrusion (animal)	
AECL2.13	HL	2.4	Dams	
AECL2.16	R	1	Discharge zones	2
ECL3.1	HGL	Ð	Ació rain	
AECL3.2	GL	2.4	Alkali flats	
AECL3.3			Animal grooming and fighting	
		1		
AECL3.4	<u> </u>		Animal soil ingestion	
ECL3.5	<u> </u>		Animais' diets	·
AECL3.5		2.3?	Artificial lake mixing	· · · · · · · · · · · · · · · · · · ·
AECL3.8		÷	Bacteria and microbes (soil)	· · · · · · · · · · · · · · · · · · ·
ECL3.9			Bioconcentration	
AECL3.11	<u> L</u>	3.7	Biological evolution	i .
AECL3.12	L L	<u>i</u>	Biotoxicity	×
AECL3.13	L		Bioturbation of soils and sediments	
ECL3.14	i L	1	Building materials	3
AECL3.15	1 L	1	Burrowing animals	÷
AECL3.16	: L	i	Capillary rise in soil	
AECL3.17	L		Carcasses	
AECL3.18	L L	}	Carcinogenic contaminants	
AECL3.19	HL HL		Charcoal production	,
AECL3.20	1		Chemical precipitation	
AECL3.20 AECL3.21		1 96	·	SEE 3.21
	<u> </u>	3.6	Chemical toxicity	OEE 0.21
AECL3.25	<u> </u>	<u> </u>		
AECL3.26	L		Convection, turbulence and diffusion (atmospheric)	07 51511
AECL3.27	<u> </u>	4	Correlation	OF PARAMETE
ECL3.28	<u> </u>		Critical group - agricultural labour	
AECL3.29	<u> </u>		Critical group - clothing and home furnishings	:
AECL3.30	: L	1	Critical group - evolution	
AECL3.31	L	1	Critical group - house location	-
AECL3.32	L		Critical group - individuality	
AECL3.33	· Ľ		Critical group - leisure pursuits	
AECL3.34	L	1	Critical group - pets	
AECL3.35	H	2.3?	Crop lertilization	
AECL3.36	HL	2.3?	Crop storage	
AECL3.38	<u> </u>	<u> </u>	Deposition (wet and dry)	
		<u> </u>	Dermal sorption - nuclides other than tritium	
AECL3.39	<u> </u>			
AECt3.40	<u> </u>	2.1	Dermal sorption - utition	
AECL3.41	L_	-	Dispersion	
AECL3.46	GL	2.5	Erosion - wind	·
AECL3.47	<u> </u>	2.3?	Fires (agricultural)	
AECL3.48	<u> </u>	2.3?	Fires (forest and grass)	·
AECL3.49	HL		Fish farming	
AECL3.51	G.	2.3	Flood (short-term)	·
AECL3.52	L	2	Flushing of water bodies	
AECL3.54	HL		Game ranching	
AECL3.55	L	1	Gas lec. uge into underground living space	1
AECL3.57	GL	;	Greenhouse (food production)	
AECL3.60	H		Heat storage in lakes or underground	
AECL3.61	H	2.3?	Herbicides, pesticides, fungicides	
AECL3.62			Household dust and fumes	
AECL3.62	L		Houseplants	
		<u>.</u>		· · · · · · · · · · · · · · · · · · ·
AECL3.64	<u> </u>		Human diet	•
AECL3.65	<u> </u>	<u> </u>	Human soil ingestion	
AECL3.66	<u> </u>	3.5	Hydroponics	
AECL3.71	<u> </u>	£	ionic exchange in soil	
AECL3 72	1 L		Irrigation	
AECL3.73	HL	2.4?	Lake infilling	
AECL3.74	i L	3.6	Mutagenic contaminants	
AECL3.75	: HL	:	Outdoor spraying of water	

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	second of bound section of the program T:		-995	DOE2.4.9
	Inorganic colloid transport: Effects of ionic strength		388	DOE2.4.8.4
	Inorganic colloid transport: Effects of pH and Eh		3362	DOE2 4.8.3
	Inorganic colloid transport. Fractured media		855	DOE2.4.8.2
	inorganic colloid transport. Porous media		388	DOE24.81
	Organic colloid transport: Effects of ionic strength		1998	DOE2474
	Organic colloid transport: Effects of pH and Eh		845	DOE2+73
	Organic colloid transport in Fractured media		199	DOE2472
	Organic colloid transport in Porous media		<u></u>	DOE24.5.13
	Sorption: effects of microbial activity		1 288	DOE54210
	Sorption: Effects of naturally-occuring inorganic complexing agents		1 286	DOE5458
	Strege price and the principal strength organic contracts		385	DOE24.57
·	Sorption: Effects of ionic strength		<u>1998</u>	DOE2.4.5.6
	Sorption: Effects of pH and En		1 1995	DOE2455
	longerse service and the service services and the service		1 1998	DOE5424
	Heversible sortion		1999	DOE24.5.3
	noninear sorprior		388	DOE54.52
	Linear sorphon		385	DOE2 4.5.1
<u> </u>	Solubility: Effects of microbial activity		1 1998	DOE2448
	Solubility effects of naturally occuring colloids		1 1998	DOES 4 4 2
	Solubility: effects of naturally-occurring complexing agents		388	DOE2443
	Solubility effects of ionic strength		388	DOE2442
	Solubility effects of pH and Eh		3448	DOE24.4.1
	DUNA		G	AECL2114
	spinsleaw	5.42	1 7	AECL3.113
i	Water source		<u>1</u> H	AECL3.112
	Water leak into underground living scace	2.3	; <u> </u>	VECL3.110
	Unsation on the discharge site		<u> </u>	AECL3.109
	Uncertainties	7	1 1	VECT3 108
	des aau		1	VECT3:101
	Toxicity of mined rock	5.47	1	VECC13.106
	Sobries Istresons	7	1 1	AECL3.105
	In the more according to the terms according		<u> </u>	VECT3.101
	Surface water docks			VECT3.100
	Soloce heater cochus		74	VEC13.99
E-0053080CS	acti nos		7	VECT3 38
	notiques lies	<i></i>		VECTOBY
	Soil porewater pH		1 1	VECT336
	Soil leaching		1 7	VECT3 252
	Soli deprin		7	VECT334
	Post		1 7	VECT3 33
<u>├</u>			TH	VECT3.92
	statibinut has showord?		1 74	VECT331
<u> </u>	Service of notesting and a service of notesting and a service of the service of t	3.5	1 7	VECT3.90
	Sedimeatation in water bodies		1 7	VECL3.89
	Sediment resuspension in water bodies		1	AECL3.88
	SUOSEOS	7	1	VEC13.87
	sozenengers and pre-stores		1 1	VEC13.36
	noitstas	535	1	AECL3.85
	Runoff		1	VECT3.84
j.	Rivercourse meander	2.4	67	VEC13.83
	noissine nobeli		1	VECT385
1	Singuiniants		- MT5	VECL3.81
SEE AECLI.68	Badioactive decay	XXXX	<u>MT5</u>	VECT330
!	Frechtaion (mereoric)			VECT379
1 1	Plant root systems		1 1	VECT3.78
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	iptent and test futer harvesting	535	TH TD	VECT3 11

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DOE2.4.10	BRR	Isotopic dilution
DOE2.4.11.1	BRE	Gas transport solution
DOE2.4.11.2	892	Gas transport: solution
DOE2.4.14	AFL	
DOE3.1.1.5		Biogeochemical changes
		Greenhouse-induced Ecological effects
DOE3.1.2.5	lG	Giacial/intergiacial cycling: Ecological effects
DOE3.3.2.1	L	Near-surface runoff processes: Overland flow
DOE3.3.2.2	<u> </u>	Near-surface runoff processes: Intenflow
DOE3.3.2.3	L	Near-surface runoff processes: Return flow
DOE3.3.2.4	<u> </u>	Near-surface runoff processes: Macropore flow
DOE3.3.2.5	FL	Near-surface runoff processes: Variable source area response
DOE3.3.4.1	L	Surface flow characteristics (freshwater): Stream/river flow
DOE3.3.4.2	L	Surface flow characteristics (freshwater): Sediment transport
DOE3.3.4.3	L	Surface flow characteristics (freshwater): Meander migration or other fluvial res
DOE3.3.4.4	L	Surface flow characteristics (freshwater): Lake formation/sedimentation
DOE3.3.4.5	L	Surface flow characteristics (freshwater): Effects of sea level change
DOE3.3.5,1 i	LI	Surface flow characteristics (estuarine): Tidal cycling
DOE3.3.5.2	Ł	Surface flow characteristics (estuarine): Sediment transport
DOE3.3.5.3		Surface flow characteristics (estuarine): Successional development
DOE3.3.5.4		Surface flow characteristics (estuarine): Effects of sea level chaoge
DOE3.3.6.1	<u> </u>	Coastal waters: Tidal mixing
DOE3.3.6.2	L	Coastal waters: Total mixing
DOE3.3.5.3		Coastal waters: Effects of sea level change
DOE3.3.7.1	<u> </u>	Ocean waters: Waler exchange
DOE3.3.7.2	<u> </u>	Ocean waters: Effects of sea level change
DOE3.4.1.1	L	Terrestrial ecological development: Agricultural systems
DOE3.4.1.2	L!	Terrestrial ecological development: Semi-natural systems
DOE3.4.1.3	<u> </u>	Terrestrial ecological development: Natural systems
DOE3.4.1.4	<u> </u>	Terrestrial ecological development: Effects of succession
DOE3.4.2	<u> </u>	Terrestrial ecological development: Estuarine
DOE3.4.3	L 1	Coastal waters
DOE3.4.4	L_1	Oceans
DOE3.5.2.1	L	Groundwater discharge to soils: Advective
DOE3.5.2.2	L	Groundwater discharge to soils: Diffusive
DOE3.5.2.3	<u> </u>	Groundwater discharge to soils: Biotic
DOE3.5.2.4	L	Groundwater discharge to soils: Volatilisation
DOE3.5.3	L	Groundwater discharge to wells or springs
DOE3.5.4	L	Groundwater discharge to freshwaters
DOE3.5.5	L	Groundwater discharge to estuaries
DOE3.5.6	<u> </u>	Groundwater discharge to coastal waters
DOE3.5.7.1	<u> </u>	Surface water bodies: Water flow
DOE3.5.7.2	<u> </u>	Surface water bodies: Suspended sediments
DOE3.5.7.3 (Surface water bodies: Bottom sediments
DOE3.5.7.4	<u> </u>	Surface water bodies: Effects on vegetation
DOE3.5.7.5	<u> </u>	Surface water bodies: Effects of fluvial system development
DOE3.5.8.1		Estuaries: Water flow
DOE3.5.8.1		Estuaries: Suspended sediments
	<u>L</u>	
DOE3.5 8.3	<u>L</u>	Estuaries: Bottom sediments
DOE3.5.8.4	L	Estuaries: Effects of satinity variation
DOE3.5.8.5	L	Estuaries: Effects on vegetation
DOE3.5.8.6	L	Estuaries: Effects of estuarine development
DOE3.5.8.7	<u> </u>	Estuaries: Effects of sea-level change
DOE3.5.9.1	<u> </u>	Coastal waters: Water transport
DOE3.5.9.2	L	Coastal waters: Suspended sediment transport
DOE3.5.9.3	L	Coastal waters: Bottom sediment transport
DOE3.5.9.4	L	Coastal waters: Effects of sea level change
DOE3.5.9.5	L	Coastal waters: Effects of estuarine development
DOE3.5.9.6	L	Coastal waters: Effects of coastal erosion
DOE3.5.9.7	L	Coastal waters: Effects of sea level change

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DOES.310.3 L IPARIS: Vector graine DOES.310.4 L Plants: Weinfort and exercises and recention Image: Sector and the exercises and recention DOES.310.6 L Plants: Usefort and exercises Image: December and the exercises DOES.310.7 L Plants: Usefort and exercises Image: December and the exercises DOES.311.2 L Administ: Enterior and recention Image: December and the exercises DOES.311.3 L Administ: Enterior and recention Image: December and the exercises DOES.311.4 L External exposure: March and the exercises Image: December and the exercises DOES.32.1 L External exposure: March and the exercises DOES.32.1 DOES.32.2 DOES.32.2 L Impedicion and Agrochanel orgots DOES.32.2 December and Agrochanel orgots DOES.32.2 <th></th> <th></th> <th></th> <th></th>				
DOES3.10.4 L Plants: Internal Translocation and Asennon.	DOE3.5.10.2		Plants: Deposition on surfaces	
DOES.5.10.5 L Penety, Weshof and Wesching by rainfall 1 DOES.5.10.7 L Penety, Lexificatian of sensectione				· · · · · · · · · · · · · · · · · · ·
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DOE5.5114 L Minimals: Opeling processes DOE5.5115 L Animals: Steps of relocation and migration DOE5.5115 L External exposure: Sedments DOE5.512 L External exposure: Sedments DOE5.521 L Impestion and Agrocultural exposure DOE5.522 L Impestion and Agrocultural exposure DOE5.523 L Impestion and Meta animals DOE5.524 L Impestion and Weig animals DOE5.525 L Impestion and Sels and sedments DOE5.524 L Impestion and Sels and sedments DOE5.525 L Implation and Gases and vipcours (autodor) DOE5.532 L Implation and Gases and vipcours (autodor) DOE5.533 L Implation and Sels and sedments DOE5.54.12 PRL Implation and Sels and sedments DOE5.54.13 L Implation and Sels and sedments DOE5.54.11 PRL Borehole seal faiture DOE5.54.12 PRL Implation and Sels and sedments DOE5.54.11 PRL Mecorbiological phenomentav	DOE3.5.11.2	<u> </u>	Animals: Uptake by inhalation	
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DOE5.8.1.1 L External exposure: Sedments DOE3.8.1.2 L External exposure: Water bodies DOE3.8.2.1 L Illegeston and Argenitural ergs DOE3.8.2.2 L Illegeston and Argenitural ergs DOE3.8.2.3 L Illegeston and Argenitural ergs DOE3.8.2.4 L Illegeston and Wild plants DOE3.8.2.5 L Illegeston and Wild plants DOE3.8.2.6 L Illegeston and Solis and sediments DOE3.8.3.1 L Illegeston and Solis and vapours (Ladoor) DOE3.8.3.1 L Illegeston and Solis and vapours (Ladoor) DOE3.8.3.1 L Illegeston and Solis and vapours (Ladoor) DOE3.8.3.1 L Illegeston and Sale and vapours (Ladoor) DOE3.8.3.1 L Illegeston and Sale and vapours (Ladoor) DOE3.8.3.1 L Illegeston and Sale and vapours (Ladoor) DOE3.8.3.2 L Illegeston and Sale and vapours (Ladoor) DOE3.8.3.3 L Illegeston and Sale and vapours (Ladoor) DOE3.8.3.4 Ref Illegeston and Sale and vapours (Ladoor)	DOE3.5.11.5	E.		
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NEA2.4.6 H_ Land use changes NEA2.4.7 H_ Agricultural and fisheries practice changes	NEA1.7.10	<u>ن</u> ز	
NEA2.4.6 H_ Land use changes NEA2.4.7 H_ Agricultural and fisheries practice changes	NEA2.4.5	<u>н</u>	
NEA2.4.7 H. Agricultural and fisheries practice changes		HL	Land use changes
			Agricultural and fisheries practice changes
	NEA2.4.8	HL	Demographic change, urban development

FEPS LIST: GEOLOGIC/CLIMATIC CATEGORY

DENTRER	CATEGORY	ARGUMEN	TEPNAME	COMMENT
AECL1.14	G	1	Climate change	
AECE1.31	6	T	Earthquakes	
AECL1.41	G		Glaciation	
AECL1.42	G	4	Global effects	
AECL28	G		Climate change	
AEC1218	G	2.5	Drought	SEE AECL28
AEC1220	G	1	Earthquakes	
AECL221	G	ţ	Erosion	
AECL223	G	1	Faulting	SEE AECL22
AECL224	G	2.5	Rood	SEE AECL28
AECL228	G	:	Glaciation	
AECL2.29	G		Greenhouse effect	SEE AECL28
AECL2.34	G	2.5	Intrusion (magmatic)	SEE AECL24
AECL236	G		Isostatic rebound	SEE AECL22
AECL237	G	2.5	Magmatic activity	SEE AECL26
AECL238	G		Magnetic poles	SEE AECL28
AECL240	G		Metamorphic activity	
AECL2.41	G	D	Meleorite	·
AEC12.45	G	D	Ozone layer	SEE AECL28
AECL2.61	G	;	Topography - current	
AECL2.62	G		Topography - future	
AEC12.68	G	2.5	Vulcanism	
AECLII	HGL	D	Acid rain	
AECL32	đ	2.4	Alkali fats	
AECL322	G		Climate	
AECL323	G		Climate - evolution	
AECL324	HG		Collisions, explosions, impacts	
AECL3.42	G	2.5	Dust storms and desertification (massive)	
AECL3.42	G		Earthquakes	
AECL3.45	G		Erosion - lateral transport	
AECL3.45	a.	2.5	Erosion - wind	
AECL3.50	G	2.5		
			Flipping of earth's magnetic poles	
AECL3.51 AECL3.56	GL G	2.3	Flood (short-term)	
AECL3.57				
	<u> </u>		Greenhouse (food production)	
AECL3.58	G	·	Greenhouse effect	
AECL3.59	<u>G</u>		Groundshine, treeshine	
AECL3.76	<u>a</u>	D	Ozone layer failure	
AECL3.83		2.4	Rivercourse meander	
AEC13.105		4	Terrestrial surface	
AECL3.114			Wind	
DOE1.4.4.2	G I	2.3	Natural subsidence	
DOE1.4.6	<u> </u>		Fracturing	
DOE21.1	G	D	Meteorite impact	
OE22.1.1	G			
OE22.1.2	G		Subsidence	
OE22.1.3	G		Lateral and/or venical flexure	
OE222.1		2.5	Magmatic: Intrusive	
OE22.2.2	G	2.5	Magmatic: Extrusive	
OE2.2.2.3	G	2.5	Magmatic: Hydrothermai	
OE22.3.1	G		Conract metamorphism	
OE223.2	G		Regional metamorphism	
OE2.2.3.3	G		Dislocation metamorphism	
OE22.4	G	2.3?	Diagenesis	
OE22.5	G	2.3	Drapirism	
OE22.6.2	HTG		Externally-induced seismicity	
OE2.2.6.3	FG I		Natural seismicity	
OE2.2.7.1	G		Faulting/fracturing: Activation	
OE2.2.7.2	G		Faulting/fracturing: Generation	
OE2.2.7.3	G		Faulting/fracturing: Change of properties	
OE2.2.8	G		Major incision	
OE22.9	G		Weathering	
OE2.2.10	G		Effects of natural gases	1
OE2.2.11	G		Geothermal effects	
OE2.3.1	G		Variation in groundwater recharge	
	G			
OE2.3.2	the second s		Groundwater losses (direct evaporation, springflow)	
OE3.1.1.1 OE3.1.1.2	G		Greenhouse-induced Precipitation	
	G		Greenhouse-induced Temperature	1
DE3.1.1.3	G		Greenhouse-induced Sea level rise	

FEPs LIST: GEOLOGIC/CLIMATIC CATEGORY

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DOB.1.1:5 LD Construction Construction DOB.1.1:6 G Construction of Control o	DOE3.1.1.4	G	2.4?	Greenhouse induced Storm surges
DOB1.1.1.6 G Greenhouse-Induced Potenal emporation DOB1.2.2 G IGlocal/Interplaced explains/ Engine Temperature DOB1.2.3 G IGlocal/Interplaced explains/ Engine Temperature DOB1.2.4 G 2.4 IGlocal/Interplaced explains/ Engine Temperature DOB1.2.5 LG IGlocal/Interplaced explands/ Form surges Image: Status DOB1.2.6 G IGlocal/Interplaced explands/ Formarenthy Incen ground DOE31.2.8 DOS1.2.8 G IGlocal/Interplaced explains/ Explands/ Internamenthy Incen ground DOE31.2.8 DOS1.2.9 G IGlocal/Interglaced explains/ Explands/ Internamenthy Incen ground DOE31.2.1 DOS1.2.1 G IGlocal/Interglaced explains/ Explands/ Internamenthy Incen ground DOE31.3.1 DOS1.3.1 G IGlocal/Interglaced explains/ Explands/ Internamenthy Incen DOE32.1.1 DOS2.2.1.3 G IGlocal/Interglaced explains/ Explands/ Internamenthy Incen DOE32.2.1 DOS2.2.2.1 G 2.5 Iocal/Interglaced explains/ Explands/ Internamenthy Incen DOE32.2.1 DOS2.2.1.3 G Iocal/Intereglaced explains/ Explands/ Internamenthy Incen <t< td=""><td></td><td></td><td>2.4:</td><td></td></t<>			2.4:	
DOE1.2.1 G IGlacial/Interplact opting: Properties DOE1.2.2 G IGlacial/Interplact opting: Stars reverse DOE1.2.3 G Cabcial/Interplact opting: Stars reverse DOE1.2.4 G 2.4 IGlacial/Interplact opting: Stars reverse DOE1.2.4 G 2.4 IGlacial/Interplact opting: Stars reverse DOE1.2.4 G IGlacial/Interplact opting: Stars reverse DOE1.2 DOE1.2.5 IG IGlacial/Interplact opting: Stars reverse DOE1.2 DOE1.2.8 G IGlacial/Interplact opting: Desplaction DOE1.2 DOE1.2.1 G IGlacial/Interp			<u></u>	
DOE1.2.2 G Islandinterglacial cycling: Temperature DOE1.2.2.4 G 2.4 Islandinterglacial cycling: Sea level damage (rise/tal) DOE1.2.4 G 2.4 Islandinterglacial cycling: Seasonally hozen ground DOE1.2.6 G Islandinterglacial cycling: Seasonally hozen ground DOE1.2.1 G Islandinterglacial cycling: Seasonally hozen ground DOE1.1.2.6 G Islandinterglacial cycling: Seasonally hozen ground DOE1.1.1 G Islandinterglacial cycling: Potential exponation DOE1.1.2.6 G Islandinterglacial cycling: Potential exponation DOE1.2.1 G 2.5 Islandinterglacial cycling: Potential exponation DOE1.2.1 G 2.5 Islandinterglacial cycling: Potential exponation DOE2.2.1.1 G 2.5 Islandinterglacial cycling: Potential exponation DOE2.2.1.3 G 2.5 Isl				
DC91.2.3. G Clacalifiereplacial opting: Sea level changes (rise/Tai) DC91.12.4. G 2.4. Glacalifiereplacial opting: Ecological effects DC91.2.6. G Clacalifiereplacial opting: Ecological effects DC91.2.7. G Clacalifiereplacial opting: Ecological effects DC91.3.1. G Clacalifiereplacial exit, genehouse gas induced DC91.1.1. G Clacalifiereplacial exit, genehouse gas induced DC91.1.1. G Clacalifiereplacial exit, genehouse gas induced DC92.1.1. G 2.5. Closenalised demutation: Rowal DC92.1.1. G 2.5. Localised demutation: Florid (valet incision) DC92.2.1.1. G 2.5. Localised demutation: Clacal DC92.2.2.4. G 2.5. Localised demutation: Clacal DC92.2.3. G 2.5. Localised demutation: Clacal DC92.2.4.			;	
DOB12.2.4 G 2.4 (Glacial/interglacial optim): Soloma serges i DOB12.5 LG Glacial/interglacial optim): Seguonally horan ground DOB12.2 DOB12.2 G Glacial/interglacial optim): Seguonally horan ground DOB12.2 DOB12.2.8 G Glacial/interglacial optim; Seguonally horan ground DOB12.2 DOB12.2.8 G Glacial/interglacial cycling: Detrained regoration DOB12.2 DOB12.2.8 G Glacial/interglacial cycling: Detrained regoration DOB12.2 DOB1.2.1 G Clacaci/interglacial cycling: Detrained regoration DOB12.2 DOB1.2.2 G Clacaci/interglacial cycling: Detrained regoration DOB12.2 DOB1.2.1 G 2.5 Generalised demudation: Florid (valer incision) DOB12.2.1 DOB1.2.2.1 G 2.5 Localised demudation: Clacal DOB12.2.1 G 2.5 DOB1.2.2.3 G 2.5 Localised demudation: Clacal DOB12.2.1 G 2.5 Localised demudation: Clacal DOB1.2.2.3 G 2.5 Localised demudation: Clacal DOB12.2.2			<u>.</u>	
LOB3.12.5 LG Glacial/interglacial (ording: Secondally increm ground) DOB3.12.6 G Glacial/interglacial (ording: Secondally increm ground) DOB3.12.7 G Glacial/interglacial (ording: Secondally increm ground) DOB3.12.8 G Glacial/interglacial (ording: Secondally increm ground) DOB3.12.9 G Glacial/interglacial (ording: Secondally increm ground) DOB3.12.10 G Glacial/interglacial (ording: Secondally increm ground) DOB3.13.1 G Glacial/interglacial ext genehouse ges induced DOB3.13.1 G Glacial/interglacial ext genehouse ges induced DOB3.13.1 G Claceal/interglacial ext genehouse ges induced DOB3.2.1.1 G 2.5 Localised demudation: Revial (value) indision) DOB3.2.2.1 G 2.5 Localised demudation: Clacial DOB3.2.2.2 G 2.5 Sectiment redistribution: Clacial				
DOB1.2.6 G Iclacabinerglacid ording: Permanently frozen ground DOB1.2.8 G Iclacabinerglacid ording: Permanently frozen ground DOB1.2.8 G Iclacabinerglacid ording: Permanently frozen ground DOB1.2.9 G Iclacabinerglacid ording: Permanently frozen ground DOB1.2.1 G Iclacabinerglacid ording: Permanently frozen ground DOB1.2.2 G Iclacabinerglacid ording: Permanently frozen ground DOB1.3.1 G Iclacabinerglacid ording: Permanently exponence DOB1.3.2 G Iclacabinerglacid ording: Permanently exponence DOB1.2.1 G 2.5 Iclocaliad denudation: Prvial DOB2.2.1.3 G Iclocaliad denudation: Florid (valey indicion) DOB2.2.2.1 G 2.5 Iclocaliad denudation: Florid (valey indicion) DOB2.2.2.1 G 2.5 Iclocaliad denudation: Clacad DOB2.2.3 G 2.5 Iclocaliad denudation: Clacad DOB2.2.3.1 G 2.5 Islocaliad enduation: Clacad DOB2.2.3.1 G 2.5 Islocaliad enduation: Pervial DOB2.3.1				
DOB1.2.7 G Glada/Interglacial cycling: Permanently Inczen ground DOB1.2.8 G Glada/Interglacial cycling: Gladation DOB1.2.9 G Glada/Interglacial cycling: Pertential evaporation DOB1.1.2.10 G Glada/Interglacial cycling: Pertential evaporation DOB1.3.1 G Glada/Interglacial exit greinhouse gas inclued DOB1.1.1 G 2.5 Generalised denudation: Prival DOB2.1.1 G 2.5 Generalised denudation: Rival DOB2.2.1.3 G 1.0 Gladavini reglacial denudation: Rival (valley inclsion) DOB2.2.1.3 G 1.0 Calenarised denudation: Rival (valley inclsion) DOB2.2.2.3 G 1.0 Generalised denudation: Rival (valley inclsion) DOB2.2.3 G 1.0 Calenarity Reglacial denudation: Rival (valley inclsion) DOB2.2.3.1 G 2.5 Isodiment redistribution: Rival (valley inclsion) DOB2.2.3.2 G 2.5 Isodiment redistribution: Rival (valley inclsion) DOB2.2.1 G 2.5 Isodiment redistribution: Rival (valley inclsion) DOB2.2.1			<u>. </u>	
OP312.8 G Clackal/Interglaced cycling Clackal/interglaced cycling Clackal/interglaced cycling Decision D0512.10 G Clackal/Interglaced cycling Decision Decision D0513.3.1 G Clackal/Interglaced cycling Decision Decision D0513.2.2 G Clackal/Interglaced ceru due to one causes Decision Decision D052.2.1.2 G 2.5 Generalised denudator: Finval (valley incision) Decision) D052.2.2 G 2.5 Localised denudator: Finval (valley incision) Decision) D052.2.2.3 G 1.Localised denudator: Finval (valley incision) Decision) Decision) D052.2.2.4 G 2.5 Localised denudator: Casal Decision) Decision) D052.2.2.3 G 2.5 Sediment redistributor: Casal Decision Decision Decision D052.2.2.4 G 2.6 Sediment redistributor: Clasal Decision Decision Decision D052.2.1 G 2.5 Eroson: Clasaid Decision: Clasaid Decision: Clasai			<u> </u>	
DCB1.2.9 G Glada/Interplacial opting: Posterial evaporation DCB3.1.2.10 G Glaca/Interplacial ext, greenhouse gas induced DCB3.1.3.1 G Glaca/Interplacial ext, greenhouse gas induced DCB3.1.3.2 G Glaca/Interplacial ext, greenhouse gas induced DCB3.1.1 G 2.5 Generalised denudation: Rival DCB3.2.1.1 G 2.5 Generalised denudation: Glacial DCB3.2.1.2 G 2.5 Localised denudation: Glacial DCB3.2.2.1 G 2.5 Localised denudation: Glacial DCB2.2.3 G 2.5 Sediment redistribution: Hevial (weathering/acial extite) DCB2.2.4.1 G 2.4 River incision/wediment and evaporation due to sea-level change DCB2.3.1.1 G 2.5 Eroson: Aceian				
DOB3.1.2.10 G IOBacial/Interglacial exit greenouse ges induced DOB3.1.3.1 G IOBacial/Interglacial exit greenouse ges induced DOB3.3.2 G IOBacial/Interglacial exit greenouse ges induced DOB3.2.1 G 2.5 IOeneralised denudation: Fivial DOB3.2.1.3 G IOeneralised denudation: Fivial DOB3.2.2 DOB3.2.2.1 G 2.5 Iocealised denudation: Fivial (valey incision) DOB3.2.2.1 G 2.5 Iocealised denudation: Fivial (valey incision) DOB3.2.2.4 G 2.5 Iocealised denudation: Fivial (valey incision) DOB3.2.2.4 G 2.5 Iocealised denudation: Fivial DOB3.2.2.3 G 2.5 Iscellment redistribution: Acolian DOB3.2.2.4 G 2.5 Iscellment redistribution: Acolian DOB3.2.3.1 G Sediment redistribution: Acolian DOB3.3.1 DOB3.3.1 G Soli mosture and exponation due to sea-level change DOB3.3.1 DOB3.5.1.2 G 2.5 Isrosion due to sea-level change DOB3.5.1.3 G Isr				
DOE3.13.1 G I Glacia/interglacial ext, greenhouse gas induced DOE3.1.3.2 G Glacia/interglacial ext due to other causes DOE3.2.1.1 G 2.5 Idemeralised denudation: Rival DOE3.2.1.3 G 2.5 Idemeralised denudation: Rival DOE3.2.1.3 G 2.5 Idemeralised denudation: Rival (valley incision) DOE3.2.1.3 G 2.5 Idemetation: Florid (valley incision) DOE3.2.2.1 G 2.5 Idecalised denudation: Florid (valley incision) DOE3.2.2.3 G 1.tocalised denudation: Glacal 2.5 DOE3.2.3.1 G 2.5 Ideclinet incision: Asolian DOE3.2.3.1 G 2.5 Ideclinet incision: Asolian DOE3.2.3.2 G 2.5 Ideclinet incision/sedimentation due to sea-level change DOE3.2.4.1 G 2.4 River incision/sedimentation due to sea-level change DOE3.3.1.1 G 2.5 Idecision and exportion due to sea-level change DOE3.5.1.3 G Erosion: Asolian 2.5 DOE3.5.1.4 G 2.5				
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IAEA1.6 G Glacial erosion IAEA1.7 G Flooding IAEA1.8 G Sedimentation IAEA1.9 G 2.3? Diagenesis IAEA1.10 G 2.3 Diaprism IAEA1.11 G 2.3 Diaprism IAEA1.12 G Geochemical change IAEA1.14 G Uplit/Subsidence: Orogenic IAEA1.14.1 G Uplit/Subsidence: Epeirogenic IAEA1.14.3 G Uplit/Subsidence: Isostatic IAEA1.15.1 G Undetected features: Faults, shear zones IAEA1.15.2 G Undetected features: Lava tubes IAEA1.15.3 G Undetected features: Lava tubes IAEA1.15.4 G Undetected features: Lava tubes IAEA1.15.4 G Undetected features: Cas or brine pockets IAEA1.15.5 G Undetected features: Cas or brine pockets IAEA1.16.1 G 2.5 Magmatic activity: Extrusive IAEA1.17 G D Meteorite impact	LAEA1.4	G	•	Denudation
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IAEA1.3 G Sedimentation IAEA1.9 G 2.3? Diagenesis IAEA1.10 G 2.3 Diapirism IAEA1.11 G Faulting/seismicity IAEA1.12 G Geochemical change IAEA1.14 G Uplit/Subsidence: Orogenic IAEA1.14.1 G Uplit/Subsidence: Epeirogenic IAEA1.14.2 G Uplit/Subsidence: Isostatic IAEA1.14.3 G Uplit/Subsidence: Isostatic IAEA1.15.1 G Undetected features: Brexia pipes IAEA1.15.2 G Undetected features: Lava tubes IAEA1.15.3 G Undetected features: Intusive dykes IAEA1.15.4 G Undetected features: Cas or brine pockets IAEA1.15.5 G Undetected features: Cas or brine pockets IAEA1.15.4 G Undetected features: Cas or brine pockets IAEA1.15.4 G Undetected features: Cas or brine pockets IAEA1.15.4 G Undetected features: Cas or brine pockets IAEA1.15.7 G D Meteorite impact	IAEA1.6	G	1	Glacial erosion
IAEA1.9 G 2.3? Diagenesis IAEA1.10 G 2.3 Diapirism IAEA1.11 G Faulting/seismicity IAEA1.12 G Geochemical change IAEA1.14.1 G Upliti/Subsidence: Orogenic IAEA1.14.1 G Upliti/Subsidence: Epeirogenic IAEA1.14.3 G Upliti/Subsidence: Isostatic IAEA1.15.1 G Undetected features: Isostatic IAEA1.15.2 G Undetected features: Brexis pipes IAEA1.15.3 G Undetected features: Lava tubes IAEA1.15.4 G Undetected features: Cas or brine pockets IAEA1.15.5 G Undetected features: Cas or brine pockets IAEA1.15.4 G Undetected features: Cas or brine pockets IAEA1.15.7 G D Meteorite impact	IAEA1.7	G	<u> </u>	Flooding
IAEA1.10 G 2.3 Diapirism IAEA1.11 G Faulting/seismicity IAEA1.12 G Geochemical change IAEA1.14.1 G Uplitl/Subsidence: Orogenic IAEA1.14.2 G Uplitl/Subsidence: Epeirogenic IAEA1.14.3 G Uplitl/Subsidence: Isostatic IAEA1.15.1 G Undetected features: Faults, shear zones IAEA1.15.2 G Undetected features: Brexca pipes IAEA1.15.3 G Undetected features: Lava tubes IAEA1.15.4 G Undetected features: Intusive dykes IAEA1.15.5 G Undetected features: Cas or brine pockets IAEA1.15.5 G Undetected features: Cas or brine pockets IAEA1.15.7 G D Meteorite impact	IAEA1.8	G	1	Sedimentation
IAEA1.11 G Faulting/seismicity IAEA1.12 G Geochemical change IAEA1.14.1 G Uplitl/Subsidence: Orogenic IAEA1.14.2 G Uplitl/Subsidence: Epeirogenic IAEA1.14.3 G Uplitl/Subsidence: Isostatic IAEA1.15.1 G Uplitl/Subsidence: Isostatic IAEA1.15.2 G Undetected features: Faults, shear zones IAEA1.15.2 G Undetected features: Lava tubes IAEA1.15.3 G Undetected features: Intusive dykes IAEA1.15.4 G Undetected features: Cas or brine pockets IAEA1.15.5 G Undetected features: Cas or brine pockets IAEA1.15.1 G 2.5 Magmatic activity: Extrusive IAEA1.17 G D Meteorite impact	IAEA1.9	G	2.3?	Diagenesis
IAEA1.12 G Geochemical change IAEA1.14.1 G Uplift/Subsidence: Orogenic IAEA1.14.2 G Uplift/Subsidence: Epeirogenic IAEA1.14.3 G Uplift/Subsidence: Isostatic IAEA1.15.1 G Uplift/Subsidence: Isostatic IAEA1.15.2 G Undetected features: Faults, shear zones IAEA1.15.3 G Undetected features: Lava tubes IAEA1.15.4 G Undetected features: Intusive dykes IAEA1.15.5 G Undetected features: Cas or brine pockets IAEA1.15.1 G 2.5 Magmatic activity: Extrusive IAEA1.17 G D Meteorite impact	IAEA1.10	G	2.3	Diapirism
IAEA1.12 G Geochemical change IAEA1.14.1 G Uplift/Subsidence: Orogenic IAEA1.14.2 G Uplift/Subsidence: Epeirogenic IAEA1.14.3 G Uplift/Subsidence: Isostatic IAEA1.15.1 G Uplift/Subsidence: Isostatic IAEA1.15.2 G Undetected features: Faults, shear zones IAEA1.15.3 G Undetected features: Lava tubes IAEA1.15.4 G Undetected features: Intusive dykes IAEA1.15.5 G Undetected features: Cas or brine pockets IAEA1.15.1 G 2.5 Magmatic activity: Extrusive IAEA1.17 G D Meteorite impact	IAEA1.11	G	!	Faulting/seismicity
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IAEA1.15.1 G Undetected features: Faults, shear zones IAEA1.15.2 G Undetected features: Breccia pipes IAEA1.15.3 G Undetected features: Lava tubes IAEA1.15.4 G Undetected features: Intrusive dykes IAEA1.15.5 G Undetected features: Gas or brine pockets IAEA1.16.1 G 2.5 IAEA1.17 G D				
IAEA1.15.2 G Undetected features: Brecia pipes IAEA1.15.3 G Undetected features: Lava tubes IAEA1.15.4 G Undetected features: Intrusive dykes IAEA1.15.5 G Undetected features: Gas or brine pockets IAEA1.16.1 G 2.5 Magmatic activity: Extrusive IAEA1.17 G D Meteorite impact				
LAEA1.15.3 G Undetected features: Lava tubes IAEA1.15.4 G Undetected features: Intrusive dykes IAEA1.15.5 G Undetected features: Gas or brine pockets IAEA1.16.1 G 2.5 IAEA1.17 G D				
IAEA1.15.4 G Undetected features: Intrusive dykes IAEA1.15.5 G Undetected features: Gas or brine pockets IAEA1.16.1 G 2.5 IAEA1.17 G D IAEA1.17 G D			<u> </u>	
IAEA1.15.5 G Undetected features: Gas or brine pockets IAEA1.16.1 G 2.5 IAEA1.17 G D				
LAEA1.16.1 G 2.5 Magmatic activity: Extrusive LAEA1.17 G D Meteorite impact				
IAEA1.17 G D Meteorite impact		<u>~</u>		
		G		
TASA2.5 G Climatic change (including climate control)		<u> </u>		Magmatic activity: Extrusive
	LAEA1.17	G		Magmatic activity: Extrusive Meteorite impact
IAEA2.6 G Large-scale hydrological change	IAEA1.17 IAEA2.5	G G G G	D	Magmatic activity: Extrusive Meteorite impact Climatic change (including climate control)

FEPS LIST: GEOLOGICICLIMATIC CATEGORY

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PGA1.1	G	}	Climate changes	1
PGA12	G	}	Sea-level changes	
PGA1.3	G	1	Erosion (fluvial and glacial)	GLACIAL
PGA1.4	G	;	Sedimentation	
PGA1.5	G	1 2.5	Tectoric crustal movements	
	i <u>G</u>	2.5	Magma intrusion	
PGA17	G	2.5	Volcanism	
PGA1.8	G	2.3	Diapinsm	
PGA1.9	G	2.3?	Diagenesis	
	<u> </u>	<u> </u>	Metamorphosis	
PGA2.1	G	<u> </u>	Earthquakes	
PGA22	<u> </u>	2.5	Volcanic eruption	
PGA23	G	<u> </u>	Meteor impact	
PGA24	G	2.4	Flooding with extreme erosion	
PGA2.5	G	2_3	Humicane, storms	
PGA26	G	<u></u>	Movements at faults	
PGA2.7	G	<u>:</u>	Formation of new faults	
SK1426	G	<u>:</u>	Faulting	·
SK15_13	G	2.5	Voicanism	
SKI5.15	G	1	Eanhquakes	<u>+</u>
SK15.16	G	<u>} </u>	Uplift and subsidence	
SKI5.17	G	<u>;</u>	Permafrost	<u> </u>
SK15.19		2.5	Effect of plate movements	
	G	<u></u>	Changes of the magnetic field	
SK15.22	GR	1	Accumulation of gases under permatrost	
SK15.26	<u> </u>	<u>.</u>	Erosion on surface/sediments	
SK15.29	G	<u> </u>	Meteorite	
SKI5.31	G	<u></u>	Change in sealevel	
×15.32		:2.5	Desert and unsaturation	
SK15.42	G	<u> </u>	Glaciation	
SK15.43	5	·	Methane intrusion	SEE \$K15.22
SK16.10		<u></u>	No ice age	·
SK16.11	G	2.5	intruding dykes	
SK16.14		2.5	Tectonic activity - large scale	
SKI7.10		2.3?	Diagenesis	
SNL1.1	G	D	Meteorite Impact	
SNL2.1	G		Erosion/Sedimentation	
NL2.2	G		Glaciation	
NL2.3			Pluvial Periods	
NL2.4	G		Sea-Level Variations	
NL2.5	G	2.3	Hunicanes	
NL2.6	G	<u>??</u>	Seiches	
NL2.7	<u> </u>	· 	Tsunamis	·
NL2.8	G		Regional Subsidence or Uplifit (also applies to subsurface)	
NL2.9		2.3?	Mass Wasting	
NL2.10	G	2.3?	Flooding	
NL3.1	<u> </u>	2.3	Diapirism	
NL3.2	<u>G</u>		Seismic Activity	
NL3.3	<u> </u>	2.5	Volcanic Activity	
NL3.4	<u> </u>	2.5	Magmatic Activity	
NL3.5	<u> </u>	2.3	Formation of Dissolution Cavities	
NL3.6			Formation of Interconnected Fracture Systems	
NL3.7	<u>G</u>		Faulting	
KN1.1.1	<u> </u>	D	Meteorite Impact	
KN1.1.2	<u> </u>		Solar insolation	
KN1.2.1	G	2.5	Plate movement/tectonic change	
KN1.2.2	G		Changes in the Earth's magnetic field	
12/14/00 S	G	2.5	Magmatic activity (intrusive, extrusive)	
KN1.2.3	~ `		Metamorphic activity	
KN1.2.4	G			
KN1.2.4 KN1.2.5	G	2.3?	Diagenesis	
KN1.2.4		2.3?		

FEPs LIST: GEOLOGIC/CLIMATIC CATEGORY

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UKN1.2.9	Œ		Fault activation	1
UKN1.2.10	G		Fault generation	1
UKN1.2.11	G		Rock heterogeneity (e.g. permeability, mineralogy) affecting water and gas flo	
UKN1.2.12	RG		Undetected features (e.g. faults, fracture networks, shear zones, brecciation,	gas pockets)
UKN1.3.1	<u> </u>		Precipitation, temperature and soil water balance	<u> </u>
UKN1.3.2	<u> </u>		Extremes of precipitation, snow melt and associated flooding	- <u> </u>
UKN1.3.3 1 UKN1.3.4	<u> </u>	2.3	Coastal surge, stoms and humicanes	<u> </u>
UKN1.3.5	G		Periglacial effects (eq. permafrost, high seasonality)	
UKN1.3.6	G		Glaciation (erosion/deposition, glacial loading, hydrogeological change)	
UKN1.3.7	G		No ice age	1
UKN1.4.1			Land side	<u>}</u>
UKN1.4.2	G	2.4	Denudation (aeolian and fluvial)	
UKN1.4.3	G	2.4	River, stream, channel erosion (downcutting)	1
UKN1.4.4	G	2.4	River meander	
UKN1.4.5	G		Freshwater sediment transport and deposition	1
UKN1.4.6	G		Coastal erosion and estuarine development	
UKN1.4.7	G	_	Marine sediment transport and deposition	ł
UKN1.4.8	G		Frost weathering and sollfluction	
UKN1.4.9	G		Chemical desudation and weathering	
UKN1.4.10	G!		Frost weathering	
UKN1.5.1	G		River flow and lake level changes	
JKN2.4.9	HG		Anthropogenic climate change (greenhouse effect)	<u> </u>
HMIP2.1.1	G	2.5	Regional tectonic	
HMIP2.12	<u> </u>	2.4	Magmatic activity	
HMIP2.1.3	<u> </u>		Metamorphism	i
HMIP2.1.4	<u> </u>	<u></u>	Diagenesis	
HMIP2.1.5	G	2.3		
HMIP2.1.6 HMIP2.1.7			Seismicity	
HMIP2.1.8	<u> </u>		Faulting/fracturing	
HMIP24.1	G		Major incision	
HMIP242	G		Localised denudation	
HMIP3.1.1	на –		Human induced climate change	·
HMIP3.12	G		Natural climate change	
HMIP3.1.3	G		Exit from glacial/interglacial cycling	
HMIP3.1.4	G		Intensification of natural climate change	·
HMIP5.2.1	G	D	Meteorite impact	1
NEA1.1.1	G	·	Meotorite impact	i
NEA1.1.2	G		Solar insolation	i
NEA1.2.1	G	2.5	Plate movement/tectonic change	ţ
NEA1.2.2	G		Changes in the Earth's magnetic field	1
NEA1.2.3	G	2.5	Magnatic activity (intrusive, extrusive)	1
NEA1.2.4	G		Metamorphic activity	
NEA1.2.5	G	2.3	Diagenesis	<u>}</u>
NEA1.2.6	G		Uplift and subsidence (orogenic, isostatic)	:
NEA1.2.7	G	2.3	Diapinism	<u> </u>
NEA1.2.8	G		Seismicity	<u> </u>
NEA1.2.9	G		Fault activation	<u>.</u>
NEA1.2.10	G		Fault generation	
NEA1.2.11	G		Rock heterogeneity (permeability, mineralogy), affecting water and gas flow	i
NEA1.2.12 NEA1.3.1	G		Undetected features (faults, fracture networks, shear zones, brecciation, cas Precipitation, temperature, and soil water balance	DUNEIS)
NEA1.3.2	G		Extremes of precipitation, show melt and associated flooring	- <u>i</u>
NEA1.3.2	G		Coastal surge, storms, and hurricanes	
NEA1.3.4	G		Sea-level rise/fail	
NEA1.3.5	G		Periolacial effects (permafrost, high seasonality)	1
NEA1.3.6	G		Glaciation (erosion/deposition, glacial loading, hydrogeological change)	
NEA1.3.7	G		No ice age	1
NEA1.4.1	G		Land side	1
NEA1.4.2	G	2.4	Denudation (aeolian and fluvian)	
NEA1.4.3	G	2.4	River, stream, channel erosion (downcutting)	
NEA1.4.4	G	2.4	River meander	
NEA1.4.6	G	2.4?	Freshwater sediment transport and deposition	
NEA1.4.7	G	2.4?	Marine sediment transport and deposition	4
NEA1.4.8	G	XXXX	River meander (REPEAT! - SEE 1.4.4))	1
NEA1.4.9	G		Chemical denudation and weathering	
NEA1.4.10	G		Frost weathering	
NEA1.5.1	GL	_	River flow and lake level changes	
NEA1.5.2	G	3.1	Site flooding	ļ

FEPs LIST: HUMAN FACTORS CATEGORY

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IDENTIFIER	CATEGORY	ARGUMENT	FEP NAME	: COMMENT
AECLT.52	н н	1	Intrusion (human)	· · · · · · · · · · · · · · · · · · ·
AECL1.73	<u>н</u>	i D	Sabotage and improper operation	·
AECL2.1	HR	3.1	Blasting and vibration	
AECL2.2	H	D	Bomb blast	<u> </u>
AECL23	HF	2.4	Borehole - well	
AECL2.5	н	1	Boreholes - exploration	
AECI26	HFF	1	Boreholes - unsealed	SEE AECI24
AECL2.13	HL	2.4	Dams	z
AEC12.14	: HF	2	Dewatering	
AECL2.19	Н	·	Earthmoving	MAJOR PROJE
AECL2.22	· RI	D	Explosion	SEE AECI22
AECL2.35		2.3	(Intrusion (mines)	
AECL2.44	н	2.3	Mines	SEE AECL2.3
AECL2.53	H H		Sabotage	
AECL2.57	H	2.3	Solution mining	·
AECL2.66	HF	<u> </u>	Vauit dosure (incomplete)	······
			Wells	
AECL2.69	<u> </u>			
AECL2_70	<u> </u>		Wells (high demand)	·
AECL3.1	Ha		Acid rain	
AECL3.5	HL		Antificial take mixing	·
AECL3.7	н		Ashes and sewage sludge	·
AECL3.10	<u> </u>	2.4	Biogas production	<u> </u>
AECL3.19	HŁ		Charcoal production	
AECL3.24	HG	D	Collisions, explosions, impacts	
AECL3.35	HL	2.3?	Crop tertilization	:
AECL3.36	HL	2.3?	Crop storage	
AECL3.37	н	3.7	Cure for cancer	
AECL3.43	н	2.4	Earthmoving projects (major)	SEE 3.43
AECL3.49	HL		Fish farming	
AECL3.53	н		Food preparation	
AECL3.54	HL		Game ranching	
AECL3.60	H	•	Heat storage in lakes or underground	· · · ·
AECL3.61	HL	2.3?	Herbicides, pesticides, fungicides	
AECL3.66	HL H	3.5	Hydroponics	· · · · · · · · · · · · · · · · · · ·
AECL3.67	H		Industrial use of water	
AECL3.68	<u> </u>		Inject/indest/inhaling locally produced drugs	
AECL3.69	H		Intrusion (deliberate)	
	<u> </u>			
AECL3.70			Intrusion (inadvertent)	
AECL3.73	HL	and the second s	Lake infilling	
AECL3.75	<u> </u>		Outdoor spraying of water	
AECL3.77	<u>HL</u>	2.3?	Peat and leaf litter harvesting	
AECL3.91	HL		Showers and humidifiers	
AECL3.92	<u> </u>		Smoking	
AECL3.99	HL.		Space heating	SOURCESOFS
AECL3.103	<u> </u>		Technological advances in food production	:
AECL3.109	HL		Urbanization on the discharge site	
AECL3.111	н	2.4	Water management projects (major)	
AECL3.112	HL		Water source	
DOE4.2.1	H	3.4	Deliberate recovery of wastes or associated materials	
DOE4.2.2	н	3.4	Malicious intrusion	1
OOE4.2.3	H		Exploratory drilling	:
OE4.2.4	н		Exploitation drilling	······
OE4.2.5	н		Geothermal energy production	
OCE4.2.6	H		Resource mining	
XXE42.7	н		Tunnelling	· · · · · · · · · · · · · · · · · · ·
DOE4.2.8	<u>— н і</u>		Construction of underground storage/disposal facilities	······
)OE4.2.9	н і		Construction of underground dwellings/shekers	·····
	<u> </u>		Archaeological investigations	
OE4.2.10			injection of liquid wastes	
OE4.2.11	<u> </u>			
054.2.12	<u> </u>		Groundwater abstraction	
OE4.2.13	н	D ;	Underground weapons testing	

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FEPS LIST: HUMAN FACTORS CATEGORY

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IDENTIFIER	CATEGORY	ARGUMENT	FEP NAME	COMMENT
IAEA2.1.1	н	1	Undetected past intrusion: Boreholes	ì
IAEA2.1.2			Undetected past intrusion: Mine shatts	
		;	Transport agent introduction: Irrigation	
IAEA2.4.2	<u> </u>		Transport agent introduction: Reservoirs	
IAEA2.4.3			Transport agent intro Juction: Intentional artificial groundwater Recharge or	withricawal
		<u>.</u>	Transport agent introduction: Chemical liquid waste disposat	, ,
IAEA2.7.1		D	Intentional intrusion: War	
IAEA27.2		D	Intentional intrusion: Sabotage	
IAEA2.7.3		D	Intentional intrusion: Waste recovery	
IAEA27.3	<u> </u>	<u> </u>		
IAEA28.2	<u> </u>	<u>. </u>	Inadvenent future intrusion: Exploratory drilling	
AEA28.2		<u>. </u>	Inadvertent future intrusion: Archaeological exhumation	
		·	Inadvertent future intrusion: Resource mining (mineral, water, hydrocarbon	. geomerinal, sail.
PGA4_2	H	!	Injection of liquid waste	
PGA4.3.1	<u> </u>	2.4	Drilling: in sediments	
	<u></u>	<u>}</u>	Drilling: in host rock	
PGA4.4		<u> </u>	Geothermal energy production in crystalline rock	· · · · · · · · · · · · · · · · · · ·
SKH.4		D	Sudden energy release	
010012.11		3.1	Backfill material deficiencies	·
		!	Non-sealed repository	
SK15,3	H		Stray materials left	
SKI5.4	н	i	Decontamination materials left	
SKI5.5	H	D	Chemical sabotage	
SKI5.7	н	3.1?	Poorty designed repository	
SKI5.3	Н	3.1?	Poorly constructed repository	···
SKI5.9	H H		Unsealed boreholes and/or shafts	
SKI5.10	H	3.1	Accidents during operation	
SK15.12	н	3.1	Near storage of other waste	
SK15.21	H		Future boreholes and undetected past boreholes	
SKI5.27	Н	с	Human induced actions on groundwater recharge	
			Underground dwellings	· · · · · · · · · · · · · · · · · · ·
A	<u> </u>	Ð	Underground test of nuclear devices	
		3.4?	Waste retrieval, mining	
			Geothermal energy production	
		3.5	Other future uses of crystalline rock	
		3.5	Reuse of boreholes	
	<u> </u>	<u> </u>	Archaeological intrusion	
SKI5.38	<u>н</u> Н	- D	Explosions	
SK15.38				
SK15.40		<u>3.1</u> 3.1	Postclosure monitoring Unsuccessful attempt of site improvement	
SKI5.40 SKI5.41		3.1		<u> </u>
	<u> </u>		Water producing well	· · · · · · · · · · · · · · · · · · ·
SK16.7	<u> </u>	D	Nuclear war	
SK16.8	H	·	Human induced climate change	
SK17.3		<u> </u>	Intrusion in accumulation zone in the biosphere	
SK17.7	H	<u> </u>	Human induced changes in surface hydrology	
SK17.8	н	<u> </u>	Altered surface water chemistry by humans	
SK17.9		:	Loss of records	
SKI7.11	<u> </u>	·	City on the site	
SNL4.1		·	Inadvertent Intrusions: Explosions	_ ;
SNL4.2	<u>H</u>		nadvertent Intrusions: Drilling	
SNL4.3	<u> </u>	2.3	Inadvertent Intrusions: Mining	
SNL4.4		1	Inadvertent Intrusions: Injection Wells	
SNL4.5	i H	:	Inadvertent Intrusions: Withdrawal Wells	
SNL5.1	н	-	Hydrologic Stresses: Irrigation	
SNL5.2	н	i	Hydrologic Stresses: Damming of Streams or Rivers	

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FEPs LIST: HUMAN FACTORS CATEGORY

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		A DAY IN THE A		
COMMENT		ARGUMENT		the second s
<u>_</u>	Underected past inituations, (eg. boreholes, mining)		<u>н</u>	
<u>;</u>	Poor duality construction			ONS 1 8
<u>1</u>	Design modification	3.1	н 8Н	6'L ZN
	Fadioactive waste disposal error		H H	N2 2.1
· · · · · · · · · · · · · · · · · · ·	Inadequate backfill or compaction, voidage		8H	2.2.2N
	Co-disposal of readive wester (deliperate)	1.5	HM	N2 2.3
;	Actional industry distribution of underlight	<u> </u>	HM	12.2.4
	notistado primita sinabicida		н.	
	eperodes		<u>н</u>	1220
	Poor dosing		<u>H</u>	12 2 10
	Poor dosure monitoring		OH	12 2 11
	Post-closure monitoring			12.2.12
<u> </u>	Effects of phased operation Recovery of repository materials			1.5.21
· · · · · · · · · · · · · · · · · · ·	to the second of the second of the		H	2.3.2
	Exploration drilling	·	<u> </u>	533
	Exploitation distributed	5.3	н	534
	Geothermal energy production		н	5.5.5
	อนามม ออกจรอย	5.3	H	9.6.2
	Turnening Turnening		<u>н</u>	7.5.5
	Underground construction		н	8.5.5
	Acteological Investigation		: H	53.9
	seisen di liquid masies	<u> </u>	Н	01.5.5
	Groundwater abstraction		Н	11.5.5
	ອີ້ມາເຮອງ ມີສອງການ ການຄວາມອານາ	0	н	21.5.5
	Loss of records		н	1.45
	Dams and reservoirs, buwdrained		н	545
	River rechannelled	5.4		5.4.3
	noitspint	;	н	24.4
· · · · · · · · · · · · · · · · · · ·	sabuerd asu draft	1	H	546
· ·	sapristication and same same services and same		н	L.A.S
	Demographic change, urban development		Н	24.8
	Ambropogenic climate change (greenhouse effect)			6.4.5
	Cuarying pear extraction	5.3	н	54.10
	Human induced climate change		<u>9</u> H	112
	Deliberate intrusion	3.4	н	22.2
	noizurai intrusion		Н	223
	Accidental Intrusion		H	PS.24
	(pudetected past intrusions (boreholes, mining)		н	511
	noisobarda para antici leas and noisopara		н	212
	notation of acceleration set tailore and degradation		H	5.1.3
	Stress field changes, settling, subsidence or caring		H H	21.4
	Dewalering of host rock		<u> </u>	51.5
	Material detects (e.g. early canaler failure)		H	1 912
			H	7.1.5
	Docida modification		<u> </u>	513
	signification signification memory of reposition		<u> </u>	23.1
	Aslicious intrusion (sabotage, ac of war)		<u> </u>	532
	printing to technication of the second secon		н	533
	enilling noitstioldz		H	234
			<u> </u>	<u> </u>

Cuarrying, rear surface extraction	5.3	· H
Aninopogoan change (greenhouse effect)		9
Demographic change, urban development		H
segments some of schedient bus terministic		H
Sapratic changes		ਸ
Altered soil or surface water chemistry		'H
Ingetion		Н
Paver extransional second seco	5.4	Н
Dams and reservoirs, built/dramed	5.4	H
Spicoal jo sso]		Н
Dinderground nuclear testing	0	н
(Croundwater abstraction		н
setsew burpi to noteen		H
noitspiteshori listigation		н
		н
ວັນສອບບາງ	;	н
Drinin somosen	5.4	н
Geothermal energy production		н
prilling noissiolog3	5.4	н
Exploratory drilling		н
Malicious intrusion (sabolage, ad of war)	3.4	н
Stenatem Yotisodan to Yiayooan	1.5	н
Design motification	3.1	н
Poor quality construction		Н

NE 5410 NEA2.4.8

NEA2.4.7 NEA2.4.6 NEA2.4.5 NEA2.4.4

NEA2.4.3

NEA2.4.2

NEA2.4.1

NEA2.3.11

NEA2.3.10 NEA2.3.9 8.E.SA3W

NEA2.3.7 NEA2.3.6 **NEA2.3.5**

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APPENDIX 4 Screened-out FEP Lists

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WASTE CATEGORY SCREENED OUT FEPs

IDENTIFIER	CATEGORY	ARGUMENT	FEP NAME
AECL1.5	WB	2.1	Buffer additives
AECL1.39	WC	2.1	Galvanic coupling
AECL1.82	w	2.1	Stability of glass
DOE1.1.4.5	w	2.1	Microbial degradation of organic wastes: wastes
DOE1.2.1.3	W	2.1	Hydrogen: corrosion of wasie steel
DOE1.2.1.4	W	2.1	Hydrogen: corrosion of waste Magnox
DOE1.2.1.5	w	2.1	Hydrogen: corrosion of waste aluminium
DOE1217	w	2.1	Hydrogen: corrosion of other waste metals
DOE1.2.1.8	WB	2.1	Hydrogen: effects of microbial growth on concrete
DOE1221	W	2.1	Niethane/CO2: degradation of Cellulosics
DOE1.2.22	w	2.1	Methane/CO2: degradation of Other susceptible organic materials
DOE1223		2.1	Methane/CO2 production: Aerobic degradation
DOE1225	w	2.1	Methane/CO2 production: Effects of temperature
DOE1226	WR	2.1	Methane/CO2 production: Effects of fithostatic pressure
DOE1.2.2.12	WR	2.1	Methane/CO2 production: Energy and nutrient control of metabolism
DOE12212	WR	2.1	Methace/CO2 production: Effects of radiation on microbial populations
DOE122.13	W	2.1	Tritizled hydrogen
DOE125	w	2.1	Toxic gases
DOE1.6.6.1	w	2.1	Microbiological effects due to Cellulose degradation
PGA3.7.1	wc	2.1	Differing thermal expansion of glass matrix and canister
UKN3.2.5	W	2.1	Cellulosic degradation
UKN3.2.5	W	2.1	Introduced complexing agents and cellulosics
UKN3.3.6			
HMIP1.22		2.1	Cas effects (pressuration, disruption, explosion, fire)
HMIP1.22		2.1	
HMIP123	WB W		Gas generation from concrete
	W	2.1	IRammability
NEA3.2.5		2.1	Cellulosic degradation
NEA3.2.6 DOE1.2.2.4		2.1	Methane/CO2 production: Anaerobic degradation
DOE1.2.2.4	W	2.1?	Methane/CO2 production: Inhibition due to the pressure of toxic materials
DUCI 22.10			inemanarovz provocious. namenion que lo me pressure or locio likitetidis
DOE1.2.2.8	WB	2.2	Methane/CO2 production: Effects of biofilms
DOE1.2.2.11	WB		Methane/CO2 production: Enects of biolants Methane/CO2 production: Carbonate/bicarbonate exchange with concrete
DOE1.2.2.11	WB		
SKI1.2.2	WB		Gas generation from concrete
JULI 2.2	V W ² 5	<u> </u>	H2/O2 explosions
AECL1.54		3.1	Other wastes (other than vitrified HLW)
SKI5.6	W	3.1	Co-storage of other waste
UKN223	WH :		
UKN3.4.3	W :	3.1	Co-disposal of reactive wastes (deliberate)
UKN3.4.3			Nuclear criticality
	W :		Nuclear criticality
NEA2.2.3	WR		Co-disposal of reactive wastes (deliberate)
NEA3.4.3	<u></u>		Nuclear criticality
AECL1.28	<u></u>		Criticality
DOE1.3.2 AEA3.4.4			Nuclear criticality
			Radiological effects: Nuclear criticality
PGA3.3			Nuclear criticality
SKI1.1.1	W	3.1?	
ECLO 104	14/		
AECL3.104	<u>W</u>		Teratogenic contaminants
SK17.4	W	3.6	Chemical toxicity of wastes
ECI 1 4	14000		
AECL1.4	WCER		Boundary conditions
AECL1.10	WCBR		Chemical interactions (expected)
AECL1.11	WCBR		Chemical verections (long-term)
ECL1.12	WCBR		Chemical interactions (other)
AECL1.25	WCBR		Correlation
ECL1.50	WCER		Interfaces (boundary conditions)
AECL1.56	WR		Long-term transients
ECL1.85	WCBR	4	Time dependence
		İ	
	WL?	XXXX	Radioactive decay
ECL3.80			
ECL3.80	WB		Radiolysis
		_XXXXX	

CONTAINER CATEGORY SCREENED OUT FEPs

DENTRER	CATEGORY	ARGUMENT	FEP NAME
AECL1.39	WC	2.1	Galvanic coupling
PGA3.7.1	WC	2.1	Differing thermal expansion of glass matrix and canister
UKN3.3.6	WC	2.1	Gas effects (pressuration, disruption, explosion, fire)
NEA3.3.6	C	2.1	Gas effects (pressurisation, disruption, explosion, fire)
AECL1.45	C	2.1?	Hydride cracking
AECL1.49	<u> </u>	3.1	Incomplete filling of containers
AECL1.4	WC2R	4	Boundary conditions
AECL1.10	WCBR	4	Chemical interactions (expected)
AECL1.11	WCBR	4	Chemical interactions (long-term)
AECL1.12	WCBR	4	Chemical interactions (other)
AECL1.25	WORR	4	Correlation
AECL1.50	WORR	4	interfaces (boundary conditions)
AECL1.85	WCBR	4	Time dependence
SK12.3.2	<u> </u>		Electro-chemical cracking
SK15.23	c		Changed hydrostatic pressure on canister

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BUFFER/BACKFILL CATEGORY SCREENED OUT FEPs

DENTFER	CATEGORY	ARGUMENT	FEP NAME
AECL1.5	WB	2.1	Buffer additives
DOE1.2.1.8	WB	2.1	Hydrogen: effects of microbial growth on concrete
DOE1.2.2.9	BR	2.1	Methane/CO2 production: Effects of hydrogen from metal corrosion
HMIPT23	WB	2.1	Gas generation from concrete
15014 47			
AECL1.17	8	2.2	Concrete
DOE1.1.2.1	8	2.2	Cracking: concrete
DOE1.1.22	В	2.2	Sealing of cracits: concrete
DOE1.1.2.4	В	2.2	Alkali-aggregate reaction: concrete
DOE1.1.3.2	<u> </u>	2.2	Exchange capacity exceeded: concrete
DOE1.1.3.3	B	2.2	Alkaii-aggregate reaction: concrete
DOE1.1.3.4	<u> </u>	2.2	Cement-subhate reaction: concrete
DOE1.2.28	WB	2.2	Methane/CO2 production: Effects of biofilms
DOE1.2211	WB	2.2	Methane/CO2 production: Carbonate/bicarbonate exchange with concrete
DOE1.2.3	WB	2.2	Gas generation from concrete
DOE1.5.2.1		2.3	Groundwater flow: initial conditions
SKI3.2.11		3.1	Backfill material deficiencies
AECL1.4	WCBR	4	Boundary conditions
AECL1.10	WCBR	4	Chemical interactions (expected)
AECL1.11	WCER	4	Chemical interactions (long-term)
AECL1.12	WCBR	4	Chemical interactions (other)
AECL1.25	WCBR	4	Correlation
AECL1.50	WCBR	4	Interfaces (boundary conditions)
AECL1.85	WCBR	4	Time dependence
SK13.1.5	8	4	Near field buffer chemistry
1501100			
AECL1.33	<u>B</u>		Evolution of buffer
SKB.1.9	WB		Radiolysis
SKI3.1.12	8		Perturbed buffer material chemistry
SK14.1.3	869.		Colloids, complexing agents
SKI5.18	BRF	XXXX	Enhanced groundwater flow

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REPOSITORY CATEGORY: SCREENED OUT FEPs

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DENTIFIER	CATEGORY	ARGUMENT	FEP NAME
AECL1.57	B	2.1	Methylation
DOE1.2.2.6	WR	2.1	Methane/CO2 production: Effects of lithostatic pressure
DOE1.2.2.9	88	2.1	Methane/CO2 production: Effects of hydrogen from metal corrosion
DOE1.2212	WB	2.1	Methane/CO2 production: Energy and nutrient control of metabolism
DOE1.2.2.13	WB	2.1	Methane/CO2 production: Effects of radiation on microbial populations
AECL1.16	R	2.1?	Complexation by organics
			· · · · · · · · · · · · · · · · · · ·
SKH.2.2	. <u>98</u>	2.2	H2/O2 explosions
AECL2.7	F.	2.3	Cavitation
DOE1.5.2.1	<u> </u>	2.3	Groundwater flow: initial conditions
	·	·	
DOE1.4.5	Ŧ	2.3?	Rock creep
UKN1.5.2	<u> </u>	2.3?	Site flooding
1.501 4.55			
AECL1.35	<u> </u>	3.1	Explosions
AECL1.47	<u> </u>	3.1	Improper operation
AECL1.60	<u> </u>	3.1	Monitoring and remedial activities
AECL1.64	<u> </u>	3.1	Preciosure events
AECL1.72		3.1	Retrievability
AECL2.1	<u> </u>	3.1	Blasting and vibration
DOE1.2.7.1 DOE1.2.7.2	<u> </u>	3.1	Fires
IAEA2.3	<u> </u>	3.1	Explosions
UKN2.1.8	HR H	3.1	Improper operation; Improper waste emplacement
		<u>3.1</u> 3.1	Poor quality construction
UKN22.8			Design modification
NEA2.2.3		<u>3.1</u> 3.1	Repository flooding during operation :Co-disposal of reactive wastes (deliberate)
NEA2.2.5		3.1	Accidents during operation
	8	3.1	Repository flooding during operation
NEA2.2.11		3.1	Post-closure monitoring
NLA2.2.11	· •••	3.1	
AECL1.61	R	3.7	Mutation
	· · ·		······································
AECL1.4	WOBR	4	Boundary conditions
AECL1.10	· · · · · · · · · · · · · · · · · · ·	4	Chemical interactions (expected)
AECL1.11	WCBR	4	Chemical interactions (long-term)
AECL1.12	WORR	4	Chemical interactions (other)
AECL1.25	WCBR	4	*Correlation
AECL1.50	WCBR	4	Interfaces (boundary conditions)
AECL1.56	WR	4	Long-term transients
AECL1.85	WCBR	. 4	Time dependence
		:	
SK14.1.3	589.	2000	Colloids, complexing agents
SK14.2.2.2	R	<u> </u>	Hydraulic conductivity change - Excavation/backfilling effect
SKI4.2.2.3	R	<u>xxxx</u>	Mechanical effects - Excavation/backfilling effects
SKI5.18	97F	XXXX	Enhanced groundwater flow
SK15.24	<u> </u>	XXXX	Stress changes of conductivity
		·	
NEA2.2.7	R	ē	Sabotage

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FAR-FIELD CATEGORY: SCREENED OUT FEPs

DENTRER	CATEGORY	ARGUMENT	FEP NAME
AECL2.49		2.2	Radiolysis, radiation damage
NEA3.2.4	F	2.2	Non-radioactive solute plume in geosphere (effect of redox, pH, and sorption)
AECL2.7	f f	2.3	Cavitation
DOE2.3.5.3	F	2.3	Salinity: implications of evaporite deposits/minerals
DOE1.4.5	FF	2.3?	Rock creep
AECI2.3	HF	2.4	Borehole - well
AECL2.12	F	4	Correlation
AECL2.48	F		Radioactive decay
SKI4.1.3	BRFL	X	Colloids, complexing agents
SKI5.18	BFF	XXXX	Enhanced groundwater flow
AECL2.22	FH	D	Explosion

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BIOSPHERE CATEGORY: SCREENED OUT FEPs

DENTFER	CATEGORY	ARGUMENT	FEP NAME
AECL3.40	1 L	2.1	Dermal sorption - tritium
	1	!	
AECL3.6		2.3?	Antificial lake mixing
AECL3.35	HL	2.3?	Crop fertilization
AECL3.36	HL	2.3?	Crop storage
AECL3.47	L	2.3?	Fires (agricultural)
AECL3.48	ί Ε	2.3?	Fires (forest and grass)
AECL3.61	HL	2.3?	Herbicides, pesticides, fungicides
AECL3.77	i HL	2.3?	Peat and leaf litter harvesting
AECL3.85	: L	2.3?	Saltation
UKN1.7.8	; L	2.3?	Ecological change, eq. torest fire cycles
	i		
AECL2_13	HL	2.4	Dams
AECL3.2	GL	2.4	Alkali flats
AECL3.83	a	2.4	Rivercourse meander
SKI6.9	<u> </u>	2.4	River meandering
AECL3.73	HL	2.4?	Lake infilling
AECL3.106	L		Toxicity of mined rock
AECL3.113	τ.	2.4?	Wetlands
	<u> </u>		·····
AECL3.46	a	2.5	Erosion - wind
UKN1.7.9	L	2.5	Ecological response to climate, eg. descrit formation
AECL3.66	HL	3.5	Hydroponics
AECL3.90	1 L	3.5	Sensitization to radiation
	:	1	
AECL3.21	L	3.6	Chemical toxicity
AECL3.74	i L	3.5	Mutagenic contaminants
	;		
AECL3.11	L	3.7	Biological evolution
UKN1.7.10	L	3.7	Plant and animal evolution
	1		
AECL3.27	L	4	Correlation
AECL3.87	L	4	Seasons
AEC13.105	GL	4	Terrestrial surface
AECL3.108	-	4	Uncertainties
AECL3.1	HGL.	D	Acid rain
AECL3.75		D	Ozone layer tailure
AECL3.80	WL?	XXXX	Radioactive decay
SKi4.1.3	BRF	X	Colloids, complexing agents
AECL1.51	L	2.3	Intrusion (animal)
AECL3.51		2.3	Flood (shcrt-term)
AECL3.110	L	2.3	Water leak into underground living space
HMIP4.1.2	L	2.3	Solid discharge via erosional processes

GEOLOGY/CLIMATE CATEGORY SCREENED OUT FEPs LIST

DENTER	CATEGORY	ARGUMENT	FEP NAME
AECL3.51	i a	1 2.3	Flood (short-term)
DOE1.4.4.2	G	2.3	Natural subsidence
DOE2.2.5	G	2.3	Diapirism
LAEA1.10	G	2.3	Diapirism
PGA1.8	G	2.3	Diapinsm
FGA2.5	G	2.3	Humicane, storms
SNL2.5	G	2.3	Humicanes
SNL3.1	G	2.3	Diapirism
SNL3.5	G	2.3	Formation of Dissolution Cavities
UKN1.2.7	G	2.3	Diapirism
UKN1.3.3	G	2.3	Coastal surge, storms and humicanes
HMIP2.1.5	G	2.3	Diapirism
NEA1.2.5	G	2.3	Diagenesis
NEA1.2.7	G	2.3	Diapirism
NEA1.3.3	G	2.3	Coastal surge, storms, and hurricanes
DOE2.2.4	G	2.3?	Diagenesis
IAEA1.9	G	2.3?	Diagenesis
PGA1.9	G	2.3?	Diagenesis
SK17.10	G	2.3?	Diagenesis
SNL2.9	G	2.3?	Mass Wasting
SNL2.10	G	2.3?	Plooding
UKN1.2.5	G	2.3?	Diagenesis
HMIP2.1.4	G	2.3?	Diagenesis
AECL32	GL	2.4	Aikali flats
AECL3.83	GL	2.4	Rivercourse meander
DOE3.1.2.4	G	2.4	Glacial/Interglacial cycling: Storm surges
DOE3.2.4.1	G	2.4	River incision/sedimentation due to sea level change
PGA2.4	G	2.4	Flooding with extreme erosion
UKN1.4.2	G	2.4	Denudation (aeolian and fluvial)
UKN1.4.3	G	2.4	River, stream, channel erosion (downcutting)
UKN1.4.4	G	2.4	River meander
HMIP2.1.2	G	2.4	Magmatic activity
NEA1.4.2	G	2.4	Denudation (aeolian and fluvian)
NEA1.4.3	G	2.4	River, stream, channel erosion (downcutting)
NEA1.4.4	G	2.4	River meander
DOE3.1.1.4	G	2.4?	Greenhouse-induced Storm surges
NEA1.4.6	G		Freshwater sediment transport and deposition
VEA1.4.7	G	2.4?	Marine sediment transport and deposition

GEOLOGY/CLIMATE CATEGORY SCREENED OUT FEPs LIST

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DENTFIER	CATEGORY	ARGUMENT	FEP NAME
AECL2.18	G	2.5	Drought
AECL2.24	G	2.5	Flood
AECL2.34	G	2.5	Intrusion (magmatic)
AECL2.37	G	2.5	Magmatic activity
AECL2.68	G	2.5	Vuicanism
AECL3.42	G	2.5	Dust stoms and desentification (massive)
AECL3.46	a a	2.5	Erosion - wind
DOE2221	G	2.5	Magmatic: Intrusive
DOE2.2.2.2	G	2.5	Magmatic: Extrusive
DOE2223	G	2.5	Magmatic: Hydrothermal
DOE3.2.1.1	G	2.5	Generalised denudation: Fluvial
DOE3.2.1.2	G	2.5	Generalised denudation: Aeolian
DOE3.2.2.1	G	2.5	Localised denudation: Fluvial (valley incision)
DOE3.2.2.2	G	2.5	Localised denudation: Fluvial (weathering/mass movement)
DOE3.2.2.4		2.5	Localised denuclation: Coastal
DOE3.2.3.1	. –	2.5	Sediment redistribution: Fluvial
DOE3.2.3.2		2.5	Sediment redistribution: Aeolian
DOE3.5.1.1		2.5	Erosion: Fluvial
DOE3.5.1.1 DOE3.5.1.2		2.5	Erosion; Aeolian
DOE3.5.1.2 DOE3.5.1.4			Erosion: Aeolan
IAEA1.16.1		2.5	
PGA1.5	G	2.0	Magmatic activity: Extrusive
		2.5	Tectonic crustal movements
PGA1.5		2.5	Magma intrusion
		4.4	Vokanism
PGA22		2.5	Volcanic eruption
SKI5.13	G	2.5	Volcanism
SKI5.19	G	2.5	Effect of plate movements
SKI5.32	G	2.5	Desert and unsaturation
SKI5.11	G		intruding dykes
SKI6.14	G		iTectonic activity - large scale
SNL3.3	G	2.5	Volcanic Activity
SNL3.4		2.5	Magmatic Activity
UKN1.2.1	<u> </u>	2.5	Plate movement/tectonic change
UKN1.2.3		2.5	Magmatic activity (intrusive, extrusive)
	G	2.5	Regional tectonic
NEA1.2.1	6	2.5	Plate movement/tectonic change
NEA1.2.3	G	2.5	Magmatic activity (intrusive, extrusive)
	<u> </u>	1	
NEA1.5.2	G	3.1	Site flooding
	<u>}</u>		
AECL1.42	G	4	Global effects
AECL3.105	<u> </u>	4	Terrestrial surface
	·	<u> </u>	
AECL2.41		<u>D</u>	Meteorite
AECL2.45	G	D	Ozone layer
AECL3.1		D	Acid rain
AECL3_24	<u> </u>	<u>D</u>	Collisions, explosions, impacts
	<u> </u>	<u>D</u>	Ozone layer failure
DOE2.1.1	G	D	Meteorite impact
AEA1.17	G	<u>D</u>	Meteorite impact
PGA2.3	G	D	Meteor impact
SK15.29	<u> </u>	D	Meteorite
SNL1.1	<u> </u>	D	Meteorite Impact
UKN1.1.1	: G	D	Meteorite Impact
	G		Meteorite impact
NEA1.1.1	G	D	Meotorite impact
NEA1.4.8	G	XXXX	River meander (REPEATI - SEE 1.4.4))

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HUMAN FACTORS CATEGORY: SCREENED OUT FEPS LIST

DENTRER	CATEGORY	ARGUMENT	FEP NAME	
AECL2.35	I H	2.3	Intrusion (mines)	
AECL2.44	H	2.3	Mines	
AECL2.57	н	2.3	Solution mining	
SNL4.3	Н	2.3	Inadvertent Intrusions: Mining	
UKN2.3.4	Н	2.3	Exploitation drilling	
UKN2.3.6	н	2.3	Resource mining	
UKN2,4.10	н	2.3	Quarrying, peat extraction	
NEA24.10	н	2.3	Quarving, near surface extraction	
AECL3.6	HL	2.3?	Artificial lake mixing	
AECL3.7	н	2.3?	Ashes and sewage sludge	
AECL3.35	HL	23?	Crop fertilization	
AECL3.36	HL	2.3?	Crop storage	
AECL3.61	HL	2.3?	Herbicides, pesticides, fungicides	
AECL3.68	н		Inject/ingest/inhaling locally produced drugs	
AECL3.77	HL		Peat and leaf litter harvesting	
DOE42.4	н		Exploitation drilling	
DOE4.2.6	H		Resource mining	
AECL2.3	HF	2.4	Borehoie - well	
AECL2.13	HL		Dams	
AECL3.10	н		Biogas production	
AECL3.111	H		Water management projects (major)	
PGA4.3.1	н		Drilling in sediments	
	H		Dams and reservoirs, built/drained	
UKN2.4.3	H		River rechannelled	
	H		Explaining	
NEA2.3.6	<u>н</u>		Resource mining	
NEA2 4.2	H		Dams and reservoirs, built/drained	
NEA2.4.3	<u> </u>		Rivers rechanneled	
	н		Earthmoving projects (major)	
AECL3.73	HL I		Lake infilling	
12023.13				
AECL2.1	HB	3.1	Blassing and vibration	
SKI3.2.11			Backfill material deficiencies	
SKI5.10	 		Accidents during operation	
SKI5.12	н		Near storage of other waste	
SKI5.39	<u> </u>		Postclosure monitoring	
SK15.40	H H		Unsuccessful attempt of site improvement	
UKN2.1.8	HR H			
UKN2.1.9	<u> </u>		Poor quality construction Design modification	
UKN2.2.3	WH 1		Co-disposal of reactive wastes (deliberate)	
		3.1	Co-disposal of reactive wastes (deliberate)	
UKN2.2.6	<u>H</u>		Accidents during operation	
UKN2.2.11	HD		Post-closure monitoring	
NEA2.1.9	H		Design modification	
NEA2.3.1	<u> </u>		Recovery of repository materials	
SK15.7	H		Poorly designed repository	
SKI5.8	н	3.17	Poorly constructed repository	

HUMAN FACTORS CATEGORY: SCREENED OUT FEPs LIST

DENTFER	CATEGORY	ARGUMENT	FEP NAME
AECL3.69	Н	3.4	Intrusion (deliberate)
DOE4.2.1	H	3.4	Deliberate recovery of wastes or associated materials
DOE4.2.2	н	3.4	Malicious intrusion
UKN2.3.1	HĐ I	3.4	Recovery of repository materials
HMIP522	: H	3.4	Deliberate intrusion
HMIP523	н	3.4	Malicious intrusion
NEA2.3.2	н	3.4	Malicious intrusion (sabotage, act of war)
SK15.33	I H	3.4?	Waste retrieval, mining
	[
AECL3.66	HL_	3.5	Hydroponics
AECL3.103	н	3.5	Technological advances in food production
SK15.35	н	3.5	Other future uses of crystalline rock
			<u></u>
AECL3.37	<u> </u>	3.7	Cure for cancer
AECL1.73	н	Ð	Sabotage and improper operation
AECL22	<u>H</u>	D	Bomb blast
AECL2.22	<u> </u>	D	Explosion
AECL2.53	H	D	Sabotage
AECL3.1	HGL	0	Acid rain
AECL3.24	HG	D	Collisions, explosions, impacts
DOE4.2.13	Н	D	Underground weapons testing
!AEA2.7.1	<u> </u>	D	Intentional intrusion: War
AEA2.7.2	н	D	Intentional intrusion: Sabolage
IAEA2.7.3	н	D	Intentional intrusion: Waste recovery
SKI1.4	W?H		Sudden energy release
SK15.5	H		Chemical sabotage
SKI5.30	<u> </u>	D	Underground test of nuclear devices
SK15.38	H		Explosions
SK16.7	н	D	Nuclear war
UKN2.2.7	<u> </u> H	D	Sabotage
UKN23.2	н	D	Malicious intrusion, e.g. sabotage, act of war
UKN2.3.12	H	C	Underground nuclear testing
NEA2.3.12	н	D	Underground nuclear testing

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APPENDIX 5

Screened FEP Lists

sorted according to consolidation code

CONSOLIDATED FEPS LIST FOR WASTE

DENTIFIER	FEP NAME	COMMENT
1. WASTE		
1_1	Waste characteristics	iuel stability, heterogeneity
1.2	Radionuclide inventory	
1.3	Radionuclide decay and growth	
1.4	Radiological/radiation effects	radiation damage, radiolysis, embritlement, He
1.5	Gas generation and effects	
1_5 1_6 1.7	Heat generation	chemical changes, radioactive gases, pressurisation
1.7	Themo-mechanical effects	thermal pulse
1.8	Thermo-chemical effects	imaterial property changes
1.9	Electro-chemical effects	gradients, galvanic coupling
1.10	Waste degradation/corrosion/dissol	lution metal corrosion, leaching, zircaloy
1.11	Geochemical reactions/regime	chemical gradients & kinetics, geochemical pump, redox potential, recryst.
1.12	Radionuclide chemistry	solubility, speciation, complex formation, colloid formation
1.13	Specific factors	Pb-I reactions, Cs migration, damaged/deviating fuel, channeling

WASTE CATEGORY SCREENED FEPs (sorted)

DENTIFIER	CATEGORY	CON CODE	FEP NAME
1.1	Waste charac	teristics	
AECL1.53	WOR	1.1	Inventory
AECL1.55	WCB	1.1	Long-term physical stability
AECL1.81	BCWR	1.1	Stability
UKN2.2.5	W	1.1	Heterogeneity of waste forms (chemical, physical)
NEA2.2.5	W	1.7	Heterogeneity of waste forms (chemical, physical)
5			
1.3	Radionuclide	decay and grow	M
AECL1.68	W	1.3	Radioactive decay
DOE1.3.1	W	1.3	Radioactive decay and ingrowth
UKN3.4.4	W	1.3	Radioactive decay and ingrowth (chain decay)
HMIP1.3.1	W	1.3	Radioactive decay and ingrowth
NEA3.4.4	W .	1.3	Radioactive decay and ingrowth (chain decay)
1.4	Radiological/	adiation effect	ls
AECL1.67	I WC?		Radiation damage
AECL1.69	W?	1.4	Radiolysis
DOE: 1.4.7	W	1.4	Radiolysis: wastes
DOE1.4.3	WC	1.4	Embrittlement
AEA3.4.1	W	1.4	Radiological effects: Material property changes
IAEA3.4.2	W	1.4	Radiological effects: Radiolysis
AEA3.4.3	W	1_4	Radiological effects: Decay product gas generation
PGA3.1	W	1.4	Radiation damage of the matrix
PGA32	W :	14	Radiolysis
SKI1.1.3	W	1 4	Recoil of alpha-decay
SK11.1.4	W	1.4	Gas generation: He production
SK11.2.1	W	1.4	Radiolysis
UKN3.4.1	w	1.4	Radiolysis
UKN3.4.2	W	1.4.1.7.1.8	Material property changes
HMIP124	w	1.4.1.5	Radioactive gases
NEA3.4.1	W	1.4	Radiolysis
NEA3.4.2	W	1,4,1.7,1.8	Material property changes
C. S.	de estatemente		
1.5	Gas generatio	n and effects	
AEGL1.27			Coupled processes
AECL1.38	W	1.5	Formation of gases
DOE1.2.1.6	i W	1.5	Hydrogen: corrosion of waste Zircaloy
DOE1.2.4.2	W	1.5	Active methane and carbon dioxide
DOE1.2.4.3	W	1.5	Other active gases
DOE1.6.5.4	WER	1.5.1.11	Chemical changes due to Gas production
AEA3.2.3	WB	1.5,1.11	Chemical effects: Gas generation
PGA3.15	W I	1.5	Gas production
SKI1.2.4	W	1.5	Gas generation
HMIP121	WC	1.5,1.10	Hydrogen by metal corrosion
		MARK THE SHOULD DO N	
1.6	Heat generati	DR	
AECL1.84	WCBR	1.6	Temperature rises (unexpected effects)
SKI1.1.2	W	1.6	Radicactive decay, heat
	i marina di		
1.7	Thermo-mech	inical effects	
AECL1.27			Coupled processes
SK12.3.1	WC	1.7	Thermal cracking
UKN3.2.3	WOBR	1.7.1.8,1.9	Interactions of waste and repository materials with host materials (eg. electroc
UKN3.4.2	W	1.4.1.7.1.8	Material property changes
NEA3.4.2	w	1.4.1.7.1.8	Material property changes
		100 - 19 C.C.C.	
6-20-290, -200- 1.8	Themo-chemi	cal effects	and a second
AECL1.27			Coupled processes
PGA3.9	WB	1.3	Thermally induced chemical changes
UKN3.2.3	WORR	1.7.1.5 . 5	Interactions of waste and repository materials with host materials (eg. electroc
UKN3.4.2	W	1.4,1.7,1.8	Material property changes
	WBR	1.4.1.7.1.0	Thermo-chemical effects
HMIP1.28	W	1.4.1.7.1.8	Material property changes
NEA3.4.2	v Alexandra (Mariana)	ı.⇒,/,1.0	movements hadren august
	Internet of the		n an
1.9	Electro-chemi		Counted manages
AECL1.27		-	Coupled processes
AECL1.32	WCB	1.9	Electrochemical gradients
UKN3.2.3	WCBR	1.7,1.8,1.9	Interactions of waste and repository materials with host materials (eg. electroc Electrical effects of metal corrosion
HMIP1.1.4	ND I	1,9	

WASTE CATEGORY SCREENED FEPs (sorted)

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DENTIFIER	CATEGORY		FEP NAME
		dation/corrosio	
AECL1.65	WC8R	1.10	Precipitation and dissolution
			Source terms (expected)
AECL1.79		1.10.1.11,1.12	Source terms (other)
DOE1.1.4.1	<u>i w _</u>	1.10,1.11	Metal corrosion: wastes
DOE1.1.4.2	w	1.10	Leaching: wastes
DOE1.6.5.1	WOR	1.10, 1.11	Chemical changes due to Metal corrosion
DOE1.6.5.3	WBR	1.10, 1.11	Chemical changes due to Waste degradation
iAEA3.2.1	WC	1,10, 1,11	Chemical effects: Corrosion
SK12.1.3	: W	1.10	Internal corrosion due to waste
SKI3.1.10	WB		Interactions with corrosion products and waste
	WC	1.10	Metallic corrosion (pirting/uniform, internal and external agents, gas generation
HMIP1.1.3	W	1.10	
	WC	1.5,1.10	Physico-chemical degradation of wastes and transport to the far-field
	- WC		Hydrogen by metal corrosion
NEA3.3.5		1.10	Fracturing
		reactions/regim	
AECL1.9	WER	1.11	Chemical gradients
AECL1.13	WCBR	1.11	Chemical kinetics
AECL1.40	WBR	1.11	Geochemical pump
AECL1.78	W	1.10.1.11.1.12	Source terms (expected)
AECL1.79	W	1.10,1.11,1.12	Source terms (other)
DOE1.1.4.1	W	1.10,1.11	Metal corrosion: wastes
DOE1.1.4.3	W	1.11.1.12	Complex formation: wastes
DOE1.6.5.1	WCR	1.10. 1.11	Chemical changes due to Metal concision
DOE1.6.5.3	WER	1.10, 1.11	Chemical changes due to Waste degradation
DOE1.6.5.4	WER	1.5,1.11	Chemical changes due to Gas production
AEA3.2.1	WC WC		Chemical charges due to das production
IAEA3.2.1	WB	1.19. 1.11	
		1.5,1.11	Chemical effects: Gas generation
IAEA3.2.4		1.11	Chemical effects: Geochemical change
PGA3.10		1.11	Chemical changes due to corrosion
SKI1.2.6	W		Solubility within fuel matrix
SK11.2.7	<u> </u>	1.11.1.12	Recrystallization
SKI1.2.8	. w	1.11	Redox potential
SK11.2.9	W	1.11	Dissolution chemistry
SKI3.1.10	WB	1.10,1.11	Interactions with corrosion products and waste
UKN1.6.14	WORRE	1.11	Chemical gradients (electrochemical effects and osmosis)
UKN1.7.6	WERFL	1.11	Chemical transformations
HMIP1.4.1	WCB	1.11	Waste-form and backfill consolidation
			le de la deserve War de management de serve de la company de la company de la company de la company de la compa
1.12	Radionuclide	chomictry	
AECL1.78	W		Source terms (expected)
ALOCI10			
AECI 1 70			Source terms (other)
AECL1.79	w	1.10,1.11,1.12	Source terms (other)
AECL1.80	W WCBR	1.10,1.11,1.12	Speciation
AECL1.80 DOE1.1.4.3	W WCBR W	1.10,1.11,1.12 1.12 1.11,1.12	Speciation
AECL1.80 DOE1.1.4.3 SKI1.2.6	W WCSR W W	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12	Speciation
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7	W WCSR W W W	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12	Speciation Complex formation: wastes Solubility within fuel matrix Recrystalfization
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44	W WCSR W W W	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12	Speciation Complex formation: wastes Solubility within fuel matrix Recrystallization Solubility and precipitation
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7	W WCSR W W W	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12	Speciation Complex formation: wastes Solubility within fuel matrix Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisati
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44	W WCSR W W W	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12	Speciation Complex formation: wastes Solubility within fuel matrix Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisati
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5	W WCSR W W W	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.12 1.12	Speciation Complex formation: wastes Solubility within fuel matrix Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisati
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5	W WCSR W W W WR WB	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.12 1.12	Speciation Complex formation: wastes Solubility within fuel matrix Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisati
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5 1.13	W WCSR W W W WR WB	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.12 1.12 0.15 0.15	Speciation Complex formation: wastes Solubility within fuel matrix Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisati
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5 1.13 DOE1.1.4.4 SKI1.2.3	W WCSR W W WR WB Specific facto	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.12 1.12 1.13 1.13	Speciation Complex formation: wastes Solubility within fuel matrix Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisati Colloid formation: wastes Pb-1 reactions
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5 1.13 DOE1.1.4.4 SKI1.2.3 SKI1.2.5	WCSR W W WR WR WB Specific facto W WC WC	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.12 1.12 1.13 1.13 1.13	Speciation Complex formation: wastes Solubility within fuel mainx Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisati Colloid formation: wastes Pb-1 reactions I, Cs-migration to glass surface
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5 1.13 DOE1.1.4.4 SKI1.2.3 SKI1.2.5 SKI1.3	W WC3R W W WR WB Specific facts W WC W W W W W W	1.10,1.11,1.12 <u>1.12</u> 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.12 1.12 1.13 <u>1.13</u> <u>1.13</u> <u>1.13</u> <u>1.13</u>	Speciation Complex formation: wastes Solubility within fuel mainx Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisati Colloid formation: wastes Pb-1 reactions I, Cs-migration to glass surface Damaged or deviating fuel
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5 I.13 DOE1.1.4.4 SKI1.2.3 SKI1.2.5 SKI1.3 SKI2.1.4	W WC3R W W WR WB Specific facto W WC W WC	1.10,1.11,1.12 <u>1.12</u> 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.12 1.13 1.13 1.13 1.13 1.13 1.13	Speciation Complex formation: wastes Solubility within fuel mainx Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisati Colloid formation: wastes Pb-1 reactions I, Cs-migration to glass surface Damaged or deviating fuel Role of the eventual channeling within the canister
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5 DOE1.1.4.4 SKI1.2.3 SKI1.2.3 SKI1.2.5 SKI1.3 SKI2.1.4 UKN2.2.4	W WCSR W W WR WB Specific facto W WC W WC WH	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.12 1.13 1.13 1.13 1.13 1.13 1.13 1.13 1.13	Speciation Complex formation: wastes Solubility within fuel matrix Recrystatization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisati Colloid formation: wastes Pb-1 reactions I, Cs-migration to glass surface Damaged or deviating fuel Role of the eventual channeling within the canister Inducetent inclusion of undesirable materials
AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5 I.13 DOE1.1.4.4 SKI1.2.3 SKI1.2.5 SKI1.3 SKI2.1.4	W WC3R W W WR WB Specific facto W WC W WC	1.10,1.11,1.12 <u>1.12</u> 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.12 1.13 1.13 1.13 1.13 1.13 1.13	Speciation Complex formation: wastes Solubility within fuel matrix Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisation) Colloid formation: wastes Pb-1 reactions I, Cs-migration to glass surface Damaged or deviating fuel Role of the eventual channeling within the canister Inadvertent inclusion of undesirable materials
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AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5 JOE1.1.4.4 SKI1.2.3 SKI1.2.5 SKI1.3 SKI2.1.4 UKN2.2.4 NEA2.2.4 NEA2.2.4 AECL1.3 AECL1.3 AECL3.81 DOE1.1.4.6	W WCSR W W WS Specific facto W WC WC WC WH WC WH WC WH WC WH WC WH WC WH	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.12 1.13	Speciation Complex formation: wastes Solubility within fuel matrix Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisation) Colloid formation: wastes Pb-1 reactions I. Cs-migration to glass surface Damaged or deviating fuel Role of the eventual channeling within the canister Inadvertent inclusion of undesirable materials Biological activity Radictoxic contaminants Microbial corresion: wastes
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AECL1.80 DOE1.1.4.3 SKI1.2.6 SKI1.2.7 SKI5.44 UKN3.1.5 	W WC3R W WR WR WB Specific facts W WC W WC WC W WC W WC W W WC W W WC W	1.10,1.11,1.12 1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.11,1.12 1.12 1.13 1.13 1.13 1.13 1.13 1.13 1.13 1.13 1.13 1.13 1.13 1.13 1.3	Speciation Complex formation: wastes Solubility within fuel mainx Recrystalfization Solubility and precipitation Induced chemical changes (solubility, sorption, species equilibrium, mineralisation) Colloid formation: wastes Pb-1 reactions I. Cs-migration to glass surface Damaged or deviating fuel Role of the eventual channeling within the canister Inadvertent inclusion of undesirable materials Biological activity Radictoxic contaminants Microbial corresion: wastes Microbial activity Microbial activity Microbial activity Microbial activity Microbial activity Microbial activity Microbial interactions of waste package and rock Microbial interactions Interactions of host materials and groundwater with repository material (eg.

CONSOLIDATED FEPs LISTFOR CANISTER

DENTIFIER	FEP NAME	COMMENT	
2. CANISTER			
2.1	Canister materials/construction		
2.2	Corresion/degradation processes	metal corrosion, leaching, pitting	
2.3	Gas production and effects		
2.4	Microbiological effects		
2.5	Thermo-mechanical effects	thermal puise	
2.6	Electro-chemical effects	gradients, galvanic coupling	
2.7	Stress/mechanical effects	material property changes	
2.8	Geochemical reactions/regime		
2.9	Radionuclide transport through containers		
2.10	Specific factors	colloids	

CONTAINER CATEGORY SCREENED FEPs (sorted)

DENTIFIER	CATEGORY	CONLODE	FEP NAME
2.1	Canister mat	erials/constru	uction
AECL1.53	WCR	2.1	Inventory
SKI123	wc	2.1	Pb-I reactions
SKi2.4	С	2.1	Voids in the lead filling
2.2	Corrosion/de	radation pro	cesses
AECL1.19	С	2.2,2.7	Container failure (early)
AECL1.20	÷ Č	2.2.2.7	Container failure (long-term)
AECL1.22	c	2.2	Container healing
AECL1.23	C C	2.2	Containers - partial corrosion
AECL1.26	c	2.2	
AECL1.58	GR	2.2	Microbes
AECL1.63	<u> </u>	2.2	Pitting
AECL1.65	WC8R	2.2.2.8	Precipitation and dissolution
AECL1.67	WC?	2.2	Radiation damage
AECL1.88	C	2.2	Uniform corrosion
DOE1.1.1.1	- <u>c</u>	2.2	
DOE1.1.1.2		2.2	Structural container metal corrosion: Localised
DOE1.1.1.2			
DOE1.1.1.3 DOE1.1.1.4		2.2	Structural container metal corrosion: Crevice
DOE1.1.1.4 DOE1.4.3	<u> </u>	2.2	Structural container metal corrosion: Stress corrosion cracking
	WC	2.2.2.7	Embritiement
DOE1.6.5.1	WCR	2.2	Chemical changes due to Metal corrosion
IAEA3.2.1	wc	2.2.2.8	Chemical effects: Corrosion
SK12.1.1	<u> </u>	2.2	Chemical reactions (copper corrosion)
SK12.1.5	<u> </u>	2.2	Role of chlorides in copper corrosion
SK12.1.7	<u> </u>	2.2	Pitting
SKI2.1.8	<u> </u>	2.2	Corrosive agents, Sulphides, oxygen etc
SK12.1.9		2.2	Backfill effects on Cu corrosion
SK13.2.7	: 03	2.2.2.7	Swelling of corrosion products
UKN3.2.1	WC	2.2	Metallic corrosion (pitting/uniform, internal and external agents, gas generati
UKN3.3.3	<u> </u>	2.2.2.7	Embritilement and cracking
HMIP1.1.1	c	2.2	Container metal corrosion
HMIP121	<u>WC</u>	2.2.2.3	Hydrogen by metal corrosion
NEA3.2.1	C	2.2	Merallic corrosion (pitting/uniform, internal and external agents, gas general
NEA3.3.3	c	2.2.2.7	Embrittlement and cracking
2.3	_Gas producti	on and effect	<u>\$</u>
DOE1.2.1.2	<u> </u>	2.3	Hydrogen: corrosion of container steel
DOE1.2.6.1	<u> </u>	2.3	Gas transport in the waste container
HMIP121	WC	2.2,2.3	Hydrogen by metal corrosion
2.4	Microbiologic	ai effects	
AECL1.3	WCBR	2.4	Biological activity
AECL1.59	: 028	2.4	Microorganisms
SKI2 1.10	C	2.4	Microbes
UKN3.2.7	WC	2.4	Microbiological effects (on corrosion/degradation, on solubility/complexation
	a de carette e	lar çoğu geri, sa	
2.5	Thermo-mech	anical effect	
AECL1.27	WCB		Coupled processes
PGA3.7.2	68	2.5	Differing thermal expansion of canister and backfill
SKI2.3.1	WC	2.5	Thermal cracking
2.5	Electro-chem	ical effects	
AECL1.27	WCB		Coupled processes
AECL1.32	WC8	2.6	Electrochemical gradients
SK12.1.2		2.6	Coupled effects (electrophoresis)
SKI2.1.6.1	c	2.6	Repository induced Pb/Cu electrochemical reactions
SKI2.1.6.1 SKI2.1.6.2		2.6	Natural telluric electrochemical reactions
	WC	2.6	Electrical effects of metal corrosion
HMIP1.1.4			

CONTAINER CATEGORY SCREENED FEPs (sorted)

DENTFER	CALEG /AI	$-\omega \kappa \omega$	DE FEP NAME
2.7	Stress/mect		
AECL1.19	i c	2.2.2.1	
AECL1.20	C	2.2.2.7	
AECL1.27	WCB		2.7 : Coupled processes
AECL1.55	WCB	2.7	Long-term physical stability
DOE1.4.1	C	2.7	Canister or container movement
DOE1.4.3	YC	2.2.2.7	
IAEA3.3.1	08	2.7	Mechanical effects: Canister movement
PGA3.4		2.7	Canister movement in backfill
PGA3.6	I C	2.7	Mechanical canister damage
SKI22	C	2.7	Creeping of copper
SK12.3.3	T c	2.7	Stress corrosion cracking
SK12.3.4	- c	2.7	Loss of ductility
SK12.3.6	č	2.7	
SK12.3.7.1			Cracking along welds
SKI2.3.7.2			External stress
SKI2.3.8	<u> </u>		Hydrostatic pressure on canister
SK12.3.8	<u> </u>	2.7	Internal pressure
SK13.2.7		2.7	Movement of canister in buffer/backfill
		2.2.2.7	Swelling of corrosion products
UKN3.3.1	C	2.7	Canister or container movement
UKN3.3.3	<u> </u>	2.2,2.7	Embritilement and cracking
JKN3.3.4 JKN3.3.5	C	2.7	Subsidence/collapse
	<u> </u>	2.7	Fracturing
VEA3.3.1	<u> </u>	2.7	Canister or container movement
VEA3.3.2	C	2.7	Changes in in-situ stress field
EA3.3.3	C C	2.2.2.7	Embrittlement and cracking
IEA3.3.4 IEA3.3.5	C WC	2.7	Subsidence/collapse
NEA3.3.4 NEA3.3.5	C WC Geochemical	2,7 2.7 reactions/r	Subsidence/collapse [Fracturing gime
IEA3.3.4 IEA3.3.5 8 ECL1.13	C WC Geochemical WCBR	2.7 2.7 reactions/r 2.8	Subsidence/collapse Fracturing egime Chemical kinetics
IEA3.3.4 IEA3.3.5 8 ECL1.13 ECL1.18	C WC Geochemical WCBR C	2.7 2.7 reactions/re 2.8 2.8	Subsidence/collapse Fracturing gime Chemical kinetics Container corrosion products
IEA3.3.4 IEA3.3.5 ECL1.13 ECL1.18 ECL1.65	C WC Geochemical WCBR C WCBR	2.7 2.7 reactions/m 2.8 2.8 2.2.2.8	Subsidence/collapse Fracturing Gime Chemical kinetics Container corrosion products Precipitation and dissolution
IEA3.3.4 IEA3.3.5 ECL1.13 ECL1.13 ECL1.65 ECL1.80	C WC Geochemical WCBR C WCBR	2.7 2.7 reactions/m 2.8 2.8 2.2.2.8 2.8 2.8 2.8	Subsidence/collapse Fracturing Gene Chemical kinetics Container corrosion products Precipitation and dissolution Speciation
NEA3.3.4 NEA3.3.5 ECL1.13 ECL1.13 ECL1.18 ECL1.65 ECL1.80 NEA3.2.1	C WC Geochemical WCBR C WCBR WCBR	2.7 2.7 7eactions/m 2.8 2.8 2.2.2.8 2.8 2.2.2.8 2.2.2.8	Subsidence/coltapse Fracturing Gime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion
IEA3.3.4 IEA3.3.5 ECL1.13 ECL1.18 ECL1.65 ECL1.80 IEA3.2.1 IEA3.2.2	C WC Geochemical WCBR C WCBR WCBR WCBR	2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.8	Subsidence/coltapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock
HEA3.3.4 HEA3.3.5 HECL1.13 HECL1.13 HECL1.18 HECL1.18 ECL1.65 ECL1.80 HEA3.2.1 HEA3.2.2 GA3.10	C WC Geochemical WCBR C WCBR WCBR WCBR WCR WCR	2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.8	Subsidence/coltapse Fracturing Greenical kinetics Chemical kinetics Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste package and rock
IEA3.3.4 IEA3.3.5 IECL1.13 IECL1.18 IECL1.18 IECL1.65 IECL1.80 IEA3.2.1 IEA3.2.2 GA3.10 KN1.6.14	C WC Geochemical WCBR C WCBR WCBR WCR WCR WCB WCB	2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.8	Subsidence/coltapse [Fracturing [Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste package and rock Chemical gradients (electrochemical effects and osmosis)
EA3.3.4 EA3.3.5 ECL1.13 ECL1.13 ECL1.65 ECL1.80 ECL1.80 ECL1.80 ECL1.80 ECL1.80 ECL1.80 ECL3.21 EA3.2.2 GA3.10 KN1.6.14 KN3.2.3	C WC Geochemical WCBR C WCBR WCBR WCB WCB WCBR WCBR	2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.8	Subsidence/collapse [Fracturing [Chemical kinetics Container corrosion products Precipitation and dissolution [Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock [Chemical effects: Interactions of waste
EA3.3.4 EA3.3.5 ECL1.13 ECL1.13 ECL1.65 ECL1.80 ECL1.80 ECL1.80 ECL1.80 ECL1.80 ECL1.80 ECL3.21 EA3.2.2 GA3.10 KN1.6.14 KN3.2.3	C WC Geochemical WCBR C WCBR WCBR WCR WCR WCB WCB	2.7 2.7 2.8 2.8 2.8 2.2.2.8 2.8 2.2.2.8 2.8 2.2.2.8 2.8	Subsidence/coltapse [Fracturing [Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste package and rock Chemical gradients (electrochemical effects and osmosis)
IEA3.3.4 IEA3.3.5 IECL1.13 IECL1.13 IECL1.65 IECL1.80 IEA3.2.1 IEA3.2.2 GA3.10 KN1.6.14 KN3.2.3 MIP1.4.1	C WC Geochemical WOBR C WCBR WCBR WCB WCB WCB WCB	2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.8	Subsidence/collapse Fracturing igime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste package and rock Chemical effects interactions of waste package and rock Chemical effects interactions of waste package and rock Chemical effects and osmosis) Interactions of waste and repository materials with host materials (eg. elect Waste-form and backfill consolidation
HEA3.3.4 HEA3.3.5 HECL1.13 ECL1.13 ECL1.65 ECL1.80 HEA3.2.1 HEA3.2.2 GA3.10 KN1.6.14 KN1.6.14 KN1.2.3 MIP1.4.1	C WC Geochemical WCBR C WCBR WCBR WCB WCB WCB WCB WCB WCB WCB WCB	2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.8 2.8	Subsidence/collapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste and repository materials with host materials (eg. elect Waste-form and backfill consolidation trough containers
LEA3.3.4 NEA3.3.5 ECL1.13 ECL1.13 ECL1.65 ECL1	C WC Geochemical WCBR C WCBR WCB WCB WCB WCB WCB WCBR WCBR	2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.8	Subsidence/collapse [Fracturing [Chemical kinetics [Container corrosion products Precipitation and dissolution [Speciation [Chemical effects: Corrosion [Chemical effects: Interactions of waste package and rock [Chemical effects: Interactions of waste and repository materials with host materials (eg. elect [Waste-form and backfill consolidation [Polosition effects: Interactions of waste package and rock [Polosition effects: Interactions of waste package and packfill consolidation [Polosition effects: Interactions of waste package and packfill consolidation [Polosition effects: Interactions of waste package and packfill consolidation [Polosition effects: Interactions of waste package and packfill consolidation [Polosition effects: Interactions of waste package and packfille package and packfille package [Polosition effects: Interactions of waste package [Polosition effects: Interactions [Polosition effects: Interaction effects [Polosition effects: Interaction effects [Polosition effects: Interactions [Polosition effects: Interaction effects [Polosition effects: Interaction effects [Polosition effects: I
LEA3.3.4 NEA3.3.5 ECL1.13 ECL1.13 ECL1.65 ECL1	C WC Geochemical WCBR C WCBR WCBR WCBR WCB WCB WCBR WCB WCBR WCB WCB WCB WCB WCB WCB	2.7 2.7 2.8 2.8 2.2.2.8 2.8 2.2.2.8 2.8 2.8 2.8	Subsidence/collapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste and repository materials with host materials (eg. elect Waste-form and backfill consolidation trough containers
VEA3.3.4 VEA3.3.5 VECL1.13 VECL1.13 VECL1.18 VECL1.65 VECL1.65 VECL1.80 VECL1.65 VECL1.80 VECL1.65 VECL1.80 VECL1.65 VEC	C WC Geochemical WCBR C WCBR WCB WCB WCB WCB WCB WCBR WCBR	2.7 2.7 2.8 2.8 2.2.2.8 2.8 2.2.2.8 2.8 2.8 2.8	Subsidence/collapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste package and rock Chemical gradients (electrochemical effects and osmosis) Interactions of waste and repository materials with host materials (eg. elect Waste-form and backfill consolidation trough_containers Release of radionucfides from the failured canister
HEA3.3.4 HEA3.3.5 HECL1.13 HECL1.13 HECL1.18 HECL1.18 ECL1.65 ECL1.80 NEA3.2.1 HEA3.2.2 GA3.10 KN1.6.14 KN3.2.3 MIP1.4.1 S KI1.5 HECL1.84 HECL1.84	C WCBR C WCBR C WCBR WCBR WCBR WCBR WCBR	2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.8 2.2.2.8 2.8	Subsidence/collapse [Fracturing [Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical gradients (electrochemical effects and osmosis) Interactions of waste and repository materials with host materials (eg. electr Waste-form and backfill consolidation trough containers Release of radionucfides from the failured canister Temperature rises (unexpected effects)
IEA3.3.4 IEA3.3.5 IECL1.13 IECL1.13 IECL1.18 IECL1.20 IECL1.21 IECL1.21 IECL1.22 IECL1.23 IECL1.24 IECL1.24	C WC Geochemical WCBR C WCBR WCBR WCBR WCBR WCBR WCBR WC	2.7 2.7 2.7 2.8 2.8 2.8 2.2.8 2.8 2.8 2.8 2.8 2.8 2	Subsidence/collapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical gradients (electrochemical effects and osmosis) Interactions of waste and repository materials with host materials (eg. electrode waste-form and backfill consolidation trough containers Release of radionuclides from the failured canister Temperature rises (unexpected effects) Bole of the eventual channeling within the canister
VEA3.3.4 VEA3.3.5 VEA3.3.5 VECL1.13 VECL1.13 VECL1.18 VECL1.65 VECL1.80 VEA32.2 GA3.10 KN1.6.14 KN3.2.3 MIP1.4.1 VEA3.2.3 MIP1.4.1 VEA3.2.3 MIP1.4.1 VEA3.2.3 VEA3.3.3 VEA3.2.3 VEA3.3.3.3 VEA3.	C WC WCBR C WCBR WCBR WCBR WCBR WCBR WCB	2.7 2.7 2.8 2.8 2.2.2.8 2.8 2.2.2.8 2.8 2.8 2.8	Subsidence/coltapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste and repository materials with host materials (eg. elect Waste-form and backfill consolidation trough containers Release of radionuclides from the failured canister Temperature rises (unexpected effects) Role of the eventual channeling within the canister Radiation effects on canister
HEA3.3.4 HEA3.3.5 HEA3.3.5 HECL1.13 ECL1.13 ECL1.18 ECL1.65 ECL1.80 HEA3.2.1 HEA3.2.2 GA3.10 KN1.6.14 KN3.2.3 MIP1.4.1 S CL1.84 KN3.2.3 MIP1.4.1 S CL1.84 KN3.2.3 KN1.5 CL1.84 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN3.2.3 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN3.2.3 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN3.2.3 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN1.5 KN3.2.3 KN1.5 KN3.2.3 KN1.5 KN1.5 KN1.5 KN3.2.3 KN1.5 KN1.5 KN1.5 KN3.2.3 KN1.5 KN1.5 KN3.2.3 KN1.5 KN1	C WC WCBR C WCBR C WCBR WCBR WCB WCB WCB WCB WCB WCB WCBR WCB WCB WCBR WCB WCBR WCBR	2.7 2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.8 2.8 2.8 2.8	Subsidence/coltapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste and repository materials with host materials (eg. elect Waste-form and backfill consolidation inough containers Release of radionuclides from the failured canister Temperature rises (unexpected effects) Role of the eventual channeling within the canister Radiation effects on canister Random canister delects - quality control
VEA3.3.4 VEA3.3.5 VECL1.13 VECL1.13 VECL1.65 VECL1.65 VECL1.65 VECL1.80 AEA3.2.1 AEA3.2.2 GA3.10 KN1.6.14 KN3.2.3 MIP1.4.1 S CL1.84 KI1.5 CL1.84 KI2.5.1 KI2.5.2	C WC Geochemical WCBR C WCBR WCBR WCB WCB WCB WCB WCB WCB WCB WCB WCB WCB	2.7 2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.8	Subsidence/coltapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste and repository materials with host materials (eg. elect Waste-form and backfill consolidation trough containers Release of radionuclides from the failured canister Interacture rises (unexpected effects) Role of the eventual channeling within the canister Radiation effects on canister Random canister delects - quality control Icommon cause canister delects - quality control
VEA3.3.4 VEA3.3.5 VECL1.13 VECL1.13 VECL1.18 VECL1.65 VECL1.80 AEA3.2.1 AEA3.2.1 AEA3.2.2 GA3.10 KN1.6.14 KN3.2.3 MIP1.4.1 VECL1.84 KI1.5 VECL1.84 KI2.1.4 KI2.5.2 KI2.5.1 KI2.5.2 KN2.1.6	C WC WCBR C WCBR C WCBR WCB WCB WCB WCB WCB WCB WCB WCBR WCB WCBR WCBR	2.7 2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.8 2.8 2.8 2.8	Subsidence/coltapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical gradients (electrochemical effects and osmosis) Interactions of waste and repository materials with host materials (eg. elect Waste-form and backfill consolidation trough containers Release of radionuclides from the failured canister Interpretature rises (unexpected effects) Role of the eventual channeling within the canister Radiation effects on canister Random canister delects - quality control Common cause canister delects - quality control Material delects, e.g. early canister taiture
VEA3.3.4 VEA3.3.5 VECL1.13 VECL1.13 VECL1.18 VECL1.65 VECL1.65 VECL1.80 VEA3.2.1 VEA3.2.1 VEA3.2.2 GA3.10 VEA3.2.2 GA3.10 VEA3.2.2 VEA3.2 VEA	C WC Geochemical WCBR C WCBR WCBR WCB WCB WCB WCB WCB WCB WCB WCB WCB WCB	2.7 2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.2.2.8 2.8	Subsidence/coltapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste and repository materials with host materials (eg. elect Waste-form and backfill consolidation trough containers Release of radionuclides from the failured canister Interacture rises (unexpected effects) Role of the eventual channeling within the canister Radiation effects on canister Random canister delects - quality control Icommon cause canister delects - quality control
VEA3.3.4 VEA3.3.5 VECL1.13 VECL1.13 VECL1.65 VECL1.65 VECL1.80 AEA3.2.1 AEA3.2.1 AEA3.2.2 GA3.10 KN1.6.14 KN3.2.3 MIP1.4.1 VECL1.84 KI2.5 CL1.84 KI2.5.1 KI2.5.2 CN2.1.6 EA2.1.6	C WC Geochemical WCBR C WCBR WCBR WCBR WCB WCBR WCBR WCB	2.7 2.7 2.7 2.8 2.8 2.2.2.8 2.8 2.8 2.8 2.8 2.8 2.8	Subsidence/collapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste package and rock Chemical gradients (electrochemical effects and osmosis) Interactions of waste and repository materials with host materials (eg. electric Waste-form and backfill consolidation trough containers Release of radionucfides from the failured canister Imperature rises (unexpected effects) Role of the eventual channeling within the canister Radiation effects on canister Radiation effects on canister Random canister delects - quality control Common cause canister delects - quality control Material delects (e.g. early canister failure)
NEA3.3.4 NEA3.3.5 2.8 NECL1.13 NECL1.18 NECL1.65 NECL1.65 NECL1.80 AEA3.2.1 GA3.10 KKN1.6.14 KKN3.2.3 MIP1.4.1 .9 KI1.5	C WC WCBR C WCBR C WCBR WCB WCB WCB WCB WCB WCB WCB WCBR WCB WCBR WCBR	2.7 2.7 2.7 2.8 2.8 2.2.2.8 2.2.2.8 2.8 2.8 2.8 2.8	Subsidence/collapse Fracturing egime Chemical kinetics Container corrosion products Precipitation and dissolution Speciation Chemical effects: Corrosion Chemical effects: Interactions of waste package and rock Chemical effects: Interactions of waste and repository materials with host materials (eg. electric Waste-form and backfill consolidation trough containers Release of radionuclides from the failured canister Interperature rises (unexpected effects) Role of the eventual channeling within the canister Radiation effects on canister Random canister delects - quality control Icommon cause canister delects - quality control Material delects, e.g. early canister taiture

CONSOLIDATED FEPs LIST FOR BUFFER/BACKFILL

DENTIFIER	FEP NAME	COMMENT
3. BUFFER/	BACKFIL	
3.1	Buffer/backfill characteristics	hydraulic properties
3.2	Resaturation/desaturation	
3.3	Mechanical effects	swelling
3.4	Thermal effects	
3.5	Electro-chemical effects	
3.6	Gas effects	
3.7	Microbiological/biological effects	
3.8	Backfill degradation	chemical/physical changes
3.9	Geochemical regime	chemical gradients & kinetics, redox potential
3.10	Radionuclide transport processes	advection, dispersion, diffusion
3.11	Radionuclide chemistry	solubility, sorption, speciation, complex/colloid tormation
3.12	Specific factors	

BUFFER/BACKFILL CATEGORY SCREENED FEPS (sorted)

DENTFER	+ CATEGORY	CON CODE	FEP NAME
3.1	Butter/backfil		
AECL1.1	B	3.1	Backfill characteristics
AECL1.6	В	3.1	Buffer characteristics
AECL1.81	BCWR	3.1.3.8	Stability
SK13.2.8	. 8	3.1.3.10	Preferential pathways in the buffer/backfill
a constant			
3.2	Resaturation	desaturation	
AECL1.2	B		Backfill evolution
AECL1.7	8		Buffer evolution
AECLI.43	BR	3.2	Hydraulic conductivity
SK:5.14	BR	3.2	Resauration
A NOV THE TOP OF	า ใจกระเมษิยมสุข พร	see see all a see al	
3.3	Mechanical el	listas andresista Flacts	
AECL1.2			Backfill evolution
AECL1.7	8		Buffer evolution
AECL1.83	8	3.3	Swelling pressure
IAEA3.3.1	08	3.3	Mechanical effects: Canister movement
AEA3.3.2		3.3	Mechanical effects: Local fracturing
PGA3.4		3.3	Carister movement in backfill
SKB.2.1.2 SKB.2.2	<u> </u>	3.3	Uneven swelling of bentanite Movement of canister in buffer/backfilt
SKI3.2.3	8	3.3	Movement of carister in bullenbackill
SKB.2.7	<u> </u>	3.3	
www	 	3.3 11911-00	Swelling of corrosion products
ialanaan 795 •	ing in a nanana a in ing ba		
3.4	Thermal effec		Comunition
AECL1.24	BR WCB	3.4	Coupled processes
AECL1.27		3.4,3.9	
AECL1.46	<u>88</u>		Hydrothermal alteration
AECL1.84	WCBR		Temperature rises (unexpected effects)
DOE2.3.6	87		Variations in groundwater temperature
DOE2.4.13.1	BR		Repository thermally-induced groundwater transport
DOE2.4.13.2		3.4	Naturally thermally-induced groundwater transport
IAEA3.1.3	<u> </u>		Thermal effects: Fluid pressure, density, viscosity changes
IAEA3.1.4	<u>87</u>		Thermal effects: Fluid migration
PGA3.7.2			Differing thermal expansion of canister and backfild
PGA3.7.3	ER		Differing thermal expansion of backfill and host rock
PGA3.9	WB		Thermally induced chemical changes
SKB.2.5	<u> </u>		Thermai effects on the buffer material
SKB.2.10	B		Soret effect
SKH.2.4	<u> </u>		Thermal buoyancy
UKN1.5.9	<u> </u>		Natural mermal effects
UKN2.1.10	BR		Thermal effects (eq. concrete hydration)
HMIP1.2.8	WER		Thermo-chemical effects
HMIP1. <u>6.1</u>	88		Thermai effects and Rock-mass changes
HMIP1.5.3	<u> </u>		Thermal effects and Chemical changes
HMP1.6.4	BFA		Thermal effects and Transport (diffusion) effects
HMIP2.3.12	BARL	3.4	Thermal effects on hydrochemistry
3.5	Electro-chemic		
AECL1.32	WC8	3.5	Electrochemical gradients
SK12.1.6.2	08	3.5	Natural telluric electrochemical reactions
	우리 영화 관계에서		
3.6	Gas effects		
AECL1.85	8	3.6,3.10	Transport in gases or of gases
XOE 1.5.2.2	BR I	3.5	Groundwater flow due to gas production
OCE2.4.11.1	8999.	3.6	Gas transport solution
OE2.4.11.2	644	3.6	Gas transport gas prase
OE2.4.12	EFF		Gas-induced groundwater transport
AEA3.2.3	WB		Chemical effects: Gas generation
KB.2.12	8		Gas transport in bentonite
¥16.2	57		Gas transport
KN1.6.4	BAR		Gas mediated transport
KN1.6.5	899		Multiphase flow and gas driven flow
MP1.2.6	397		Gas transport
MP1.5.3	<u> </u>		Gas production (unsaturated flow)
MP2.3.10	8941		Transport of active gases
MP2.3.11	899.		Gas induced groundwater transport
IEA1.6.4	8नग		Gas mediated groundwater tailsport
IEA1.6.5			Multiphase flow and gas-driven flow

BUFFER/BACKFILL CATEGORY SCREED:ED:FEPs (sorted)

DENTFER	CATEGORY	CON CODE	FEPNAME
3.7	Microbiologia		
AECL1.3	WCER	3,7	Biological activity
AECL1.58		3.7	.Microbes
AECL1.59		3.7	
DOE1.6.6.2	WEFF	3.7	Microorganisms
DOE1.6.6.3	WEFF	3.7	Microbiological effects due to Microbial product reactors
PGA3.14	BAR	3.7	Microbiological phenomena/effects
UKN1.7.7	WBAT	3.7	Microbial interactions
		i e march de	
3.8	Backfill degr	anita	ne an ann an Anna an Anna an Anna an Anna an Anna ann an Anna ann an Anna ann an Anna an Anna an Anna an Anna a Anna anna a
AECL1.2	B		Back5II evolution
AECL1.7	<u> </u>		Buffer evolution
AECL1.37	E E	3.8	Formation of cracks
AECL1.55	WCB	3.8	Long-term physical stability
AECL1.81	BCWR	3.1,3.8	Sability
SKB.1.1	8	3.8	Degradation of the bentonite by chemical reactions
SKI3.1.5		3.8	Coequision of bentonite
SKB.1.13	<u> </u>	3.8	Radiation effects on bentonite
SKI3.2.4	B	3.8	Erosion of buffer/backfil
		• 3.0 1991-1985 (1985)	ETOSION OF DETREMARKER
3.9	Geochemical	n je der Rek II. Treine	n <mark>na se </mark>
AECL1.9	WER	3.9	Chemical gradients
AECL1.13	WCBR	3.9	Chemical gradients
AECL1.27	WC8	3.4.3.9	Coupled processes
AECL1.40	WER	3.9	Geochemical pump
AECL1.65	WCBR		Precipitation and dissolution
DOE1.6.5.3	WER	<u>3.9</u> 3.71	
DOE1.6.5.4	WER	3.9	Chemical changes due to Waste degradation
DOE1.6.5.5	BF	3.9	Chemical changes due to Gas production
DOE1.6.5.6		3.9	Chemical changes due to Colloid production
DOE1.6.5.6 DOE1.6.5.7	877	3.9	
DOE1.6.5.8	87	3.9	Chemical changes due to Solubility
DOE1.6.5.9	87	3.9	Chemical changes due to Species equilibrium
DOE2.4.10		3.9	
IAEA1.13.3	BFF	3.9	Isotopic dilution
IAEA3.2.4	WER	3.9	iFiuid interactions: Brine pockets
PGA3.10	WC8	3.9	Chemical changes due to corrosion
PGA3.12.1	8	3.9	Geochemical changes in backfill
SKI2.1.9	BC	3.9	Backfill effects on Cu corrosion
SKB.1.2	8	3.9.3.11	
SKI3.1.3	8	3.9	Saturation of sorption sites
SKI3.1.7	<u> </u>	3.9	Effects of bentonite on groundwater chernistry
SKB.1.1 SKB.1.10	WB	3.9	Reactions with cement pore water
SKB.1.10	8	3.9	Redox front
SKI4.1.1	BAR	3.9	Oxidizing conditions
SKI4.1.1	BAR	3.9	.pH-deviations
		.	
ISK14.1.7 ISK15.1	<u> </u>	3.9	Thermochemical changes
UKN1.5.7	87F	3.9	Saline (or fresh) groundwater intrusion
UKN1.5.7	877	3.9	Effects at saline-freshwater interface
UKN1.6.13			
UKN1.6.13	WCSFF		Mass, isotopic and species dilution :Chemical gradients (electrochemical effects and osmosis)
UKN1.7.6	WBRFL	3.9 3.9	
UKN3.1.5			Chemical transformations Induced chemical changes (solubility, sorption, species equilibrium, mineralisati
UKN3.2.2	WS	<u>3.9</u> 3.9	
		3.9	Interactions of host materials and groundwater with repository material (eg. of Warte from and backfill operation)
HMIP1.4.1	WC8		Waste-form and backfill consolidation
HMIP23.7	<u> </u>	3.9.3.11	Changes in groundwater chemistry and flow direction
HMIP23.13	BAR.	3.9	Biogeochemical changes
NEA1.6.13	BAFL BAFL	3.9	Mass, isotopic and species dilution
NEA1.6.14			Chemical gradients (electrochemical effects and osmosis)
NEA3.1.5	· 83	3.9	"Induced chemical changes (solubility, scrption, species equilibrium, mmeralisati

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BUFFER/BACKFILL CATEGORY SCREENED FEPs (sorted)

	CATEGORY	CON. CODE	FEP NAME
3.10	Radionuclid	e transport pi	TOCRESSES
AECL1.29	B R	3.10	Diffusion
AECL1.30	BR	3,10	Dispersion
AECL1.86	BR	3.6.3.10	Transport in gases or of gases
AECL1.90	B	3.10	Unsaturated transport
DOE1.5.3		3.10	Groundwater ilow (saturated conditions)
		3.10	Groundwater flow: Fracture
DOE2.3.4.4	<u></u>	<u> </u>	
DOE2.3.4.5	<u>87</u>	3.10	Groundwater flow: Effects of solution channels
DOE2.4.1	<u> </u>	3.10	Advection
DOE2.4.2.1	87	3.10	Bulk diffusion
DOE2.4.2.2	<u>) BFF</u>	3.10	Matrix diffusion
DOE2.4.2.3	i B_	3.10	Surface diffusion
DOE2.4.3	9 7	3_10	Hydrodynamic dispersion
IAEA1.13.1	- 	3.10	Fluid interactions: Groundwater Sow
SK3.2.5	B	3,10	Diffusion - surface diffusion
SKI3.2.8	8	3.1,3.10	Preferential pathways in the buffer/backfill
SKI3.2.9	В	3.10	Flow through buffer/backfill
SK13.2.10	B	3.4,3.10	Soret effect
SKB.2.12	8		Gas transport in bentonite
SK14.2.4	<u> </u>		Thermal buoyancy
SK04.2.5		3.10	Changes of groundwater flow
SK16.4	BAR	3.10	Dispersion
SK16.5	<u>6997.</u>	3.10	Dilution
UKN1.6.1	3HFL	3.10	Advection and dispersion
UKN1.6.2		3.10	Diffusion
UKN1.6.3	399.	3.10	Matrix diffusion
UKN1.6.4	BHR.	3.6.3.10	Gas mediated transport
UKN1.6.5	BRP.	3.6,3.10	Multiphase flow and gas driven flow
	BFF	3.6.3.10	Gas transport
HMIP1.5.4	EFF	3.10	Saturated groundwater flow
		3.10	Transport of chemically active substances into the near-field
HM@2.3.1	886.	3.10	Advection
HMIP2.3.2		3.10	Diffusion
	<u> </u>	Association and a second second	
HMIP2.3.3	BAAL	3.10	Hydrodynamic dispersion
NEA1.6.1	8999	3.10	Advection and dispersion
NEA1.6.2	BAR	3.10	Diffusion
NEA1.5.3) 3767.	3.10	Matrix diffusion
	·		
3.11	Radionuclide	chercistry	
AECL1.65			Our similar han and Franchister
	WOBR	3.9.3.11	Precipitation and dissolution
AECL1.76	WOBR BR	3.9,3.11	Sorption
		· · · · · · · · · · · · · · · · · · ·	
	BR	3.11	Sorption
AECL1.77	BR BR WCBR	3.11 3.11 3.11	Sorption Sorption: non-linear Speciation
AECL1.77 AECL1.80 DOE2.4.4.1	ER ER WCER BRFL	3.11 3.11 3.11 3.11	Sorption Sorption: ron-linear Speciation Solubility: effects of pH and En
AECL1.77 AECL1.80 XOE2.4.4.1 XOE2.4.4.2	ER ER WOER ERFL ERFL ERFL	3.11 3.11 3.11 3.11 3.11	Sorption Sorption: ron-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength
AECL1.77 AECL1.80 XOE2.4.4.1 XOE2.4.4.2 XOE2.4.4.3	87 87 87 87 87 87 87 87 87 87 87 87 87 8	3.11 3.11 3.11 3.11 3.11 3.11 3.11	Sorption Sorption: ron-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents
AECL1.77 AECL1.80 OCE2.4.4.1 DOE2.4.4.2 DOE2.4.4.3 DOE2.4.4.4	87 87 87 87 87 87 87 87 87 87 87 87 87 8	3.11 3.11 3.11 3.11 3.11 3.11 3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of complexing agents formed in the near-field
AECL1.77 AECL1.80 OOE2.4.4.1 OOE2.4.4.2 OOE2.4.4.3 OOE2.4.4.3 OOE2.4.4.4 OOE2.4.4.5	87 87 87 87 87 87 87 87 87 87 87 87 87 8	3.11 3.11 3.11 3.11 3.11 3.11 3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of complexing agents formed in the near-field Solubility: effects of naturally-occurring colloids
AECL1.77 AECL1.80 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	BR BR WO3R BRFL SRFL SRFL BRFL	3.11 3.11 3.11 3.11 3.11 3.11 3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of complexing agents formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field
AECL1.77 AECL1.80 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	BR BR WO2FR BRTL	3.11 3.11 3.11 3.11 3.11 3.11 3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of ionic strength Solubility: effects of complexing agents formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: Effects of microbial activity
AECL1.77 AECL1.80 XXE2.4.4.1 XXE2.4.4.2 XXE2.4.4.3 XXE2.4.4.4 XXE2.4.4.5 XXE2.4.4.6 XXE2.4.4.8 XXE2.4.4.8 XXE2.4.5.1	BR BR W02R BR	3.11 3.11 3.11 3.11 3.11 3.11 3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of complexing agents formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field
AECL1.77 AECL1.80 XXE2.4.4.1 XXE2.4.4.2 XXE2.4.4.3 XXE2.4.4.4 XXE2.4.4.5 XXE2.4.4.5 XXE2.4.4.8 XXE2.4.5.1 XXE2.4.5.2	BR BR WO2FR BRTL	3.11 3.11 3.11 3.11 3.11 3.11 3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of naturally-occurring coiloids Solubility: effects of naturally-occurring coiloids Solubility: effects of complexing agents formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: Effects of microbial activity Linear sorption Non-linear sorption
AECL1.77 AECL1.80 XXE2.4.4.1 XXE2.4.4.2 XXE2.4.4.3 XXE2.4.4.4 XXE2.4.4.5 XXE2.4.4.6 XXE2.4.4.8 XXE2.4.4.8 XXE2.4.5.1	BR BR W02R BR	3.11 3.11 3.11 3.11 3.11 3.11 3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of naturally-occurring complexing agents Solubility: effects of complexing agents formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of microbial activity Linear sorption
AECL1.77 AECL1.80 XXE2.4.4.1 XXE2.4.4.2 XXE2.4.4.3 XXE2.4.4.4 XXE2.4.4.5 XXE2.4.4.5 XXE2.4.4.8 XXE2.4.5.1 XXE2.4.5.2	BR BR W03R BR	3.11 3.11 3.11 3.11 3.11 3.11 3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of naturally-occurring coiloids Solubility: effects of naturally-occurring coiloids Solubility: effects of complexing agents formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: Effects of microbial activity Linear sorption Non-linear sorption
ECL1.77 AECL1.80 XXE2.4.4.1 XXE2.4.4.2 XXE2.4.4.3 XXE2.4.4.3 XXE2.4.4.4 XXE2.4.4.5 XXE2.4.4.6 XXE2.4.4.6 XXE2.4.5.1 XXE2.4.5.1 XXE2.4.5.2 XXE2.4.5.3 XXE2.4.5.4	BR	3.11 3.11 3.11 3.11 3.11 3.11 3.11 3.11	Sorption Sorption Sorption Sorption Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of ionic strength Solubility: effects of complexing agents formed in the near-field Solubility: effects of naturally-occurring colloids Solubility: effects of colloids formed in the near-field Solubility: effects of incrobial activity Linear sorption Reversible sorption
AECL1.77 AECL1.80 XXE2.4.4.1 XXE2.4.4.2 XXE2.4.4.3 XXE2.4.4.4 XXE2.4.4.4 XXE2.4.4.5 XXE2.4.4.5 XXE2.4.4.5 XXE2.4.5.1 XXE2.4.5.1 XXE2.4.5.2 XXE2.4.5.3	BR BRL	3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of naturally-occurring colloids Solubility:
AECL1.77 AECL1.80 DOE2.4.4.1 DOE2.4.4.2 DOE2.4.4.3 DOE2.4.4.3 DOE2.4.4.5 DOE2.4.4.5 DOE2.4.4.5 DOE2.4.4.5 DOE2.4.5.1 DOE2.4.5.2 DOE2.4.5.4 DOE2.4.5.5 DOE2.4.5.5	BR BR	3.11 3.11	Sorption :Sorption: non-linear :Speciation Solubility: effects of pH and En :Solubility: effects of ionic strength :Solubility: effects of ionic strength :Solubility: effects of onnolexing agents formed in the near-field :Solubility: effects of colloids formed in the near-field :Solubility: effects of colloids formed in the near-field :Solubility: effects of colloids formed in the near-field :Solubility: effects of microbial activity Linear sorption Non-linear sorption :Reversible sorption :Sorption: Effects of pH and Eh :Sorption: Effects of pH and Eh
ECL1.77 AECL1.80 XOE2.4.4.1 XOE2.4.4.2 XOE2.4.4.3 XOE2.4.4.3 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.5.1 XOE2.4.5.1 XOE2.4.5.3 XOE2.4.5.5 XOE2.4.5.5 XOE2.4.5.6 XOE2.4.5.7	BR BR WO28 BR BR	3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of complexing agents formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of microbial activity Linear sorption Reversible sorption Threversible sorption Sorption: Effects of pH and Eh Sorption: Effects of naturally-occurring organic complexing agents
AECL1.77 AECL1.80 XXE2.4.4.1 XXE2.4.4.2 XXE2.4.4.3 XXE2.4.4.3 XXE2.4.4.5 XXE2.4.4.5 XXE2.4.4.6 XXE2.4.4.8 XXE2.4.5.1 XXE2.4.5.1 XXE2.4.5.1 XXE2.4.5.2 XXE2.4.5.4 XXE2.4.5.5 XXE2.4.5.6 XXE2.4.5.7 XXE2.4.5.3	BR BR	3.11 3.11	Sorption !Sorption: non-linear !Speciation Solubility: effects of pH and En !Solubility: effects of ionic strength !Solubility: effects of naturally-occurring complexing agents !Solubility: effects of naturally-occurring colloids !Solubility: effects of nicrobial activity !Linear sorption !Non-linear sorption !Reversible sorption !Sorption: Effects of pH and Eh !Sorption: Effects of naturally-occurring organic complexing agents !Sorption: Effects of naturally-occurring inorganic complexing agents !Sorption: Effects of naturally-occurring inorganic complexing agents
ECL1.77 AECL1.80 OCE2.4.4.1 DOE2.4.4.2 OOE2.4.4.3 OOE2.4.4.3 OOE2.4.4.4 OOE2.4.4.5 OOE2.4.4.8 OOE2.4.4.8 OOE2.4.4.8 OOE2.4.4.8 OOE2.4.5.1 DOE2.4.5.2 OOE2.4.5.2 OOE2.4.5.3 OOE2.4.5.5 OOE2.4.5.6 OOE2.4.5.3 OOE2.4.5.9	BR	3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of naturally-occurring complexing agents Solubility: effects of naturally-occurring colloids Solubility: effects of naturally-occurring colloids Solubility: effects of colloids formed in the near-field Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Sorption: Effects of pH and Eh Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of complexing, agents formed in the near-field
ECL1.77 AECL1.80 VOE2.4.4.1 VOE2.4.4.2 VOE2.4.4.3 VOE2.4.4.4 VOE2.4.4.5 VOE2.4.4.5 VOE2.4.4.6 VOE2.4.4.6 VOE2.4.5.1 VOE2.4.5.2 VOE2.4.5.3 VOE2.4.5.3 VOE2.4.5.5 VOE2.4.5.5 VOE2.4.5.7 VOE2.4.5.9 VOE2.4.5.9 VOE2.4.5.10 VOE2.5.10 VOE2.5.10 VOE2.5.10 VOE2.5.10 VOE2.5.10 VOE2.5.10 VOE2.5.10 VOE2	BR BRR	3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of naturally-occurring complexing agents Solubility: effects of naturally-occurring colloids Solubility: effects of naturally-occurring colloids Solubility: effects of naturally-occurring colloids Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Reversible sorption Sorption: Effects of pH and Eh Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of naturally-occurring colloids
ECL1.77 AECL1.80 XOE2.4.4.1 XOE2.4.4.2 XOE2.4.4.3 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.5.1 XOE2.4.5.1 XOE2.4.5.4 XOE2.4.5.4 XOE2.4.5.5 XOE2.4.5.5 XOE2.4.5.6 XOE2.4.5.7 XOE2.4.5.9 XOE2.4.5.10 XOE2.4.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5.11 XOE2.5	BR	3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of complexing agents formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of colloids formed in the near-field Solubility: effects of microbial activity Linear sorption Reversible sorption Reversible sorption Sorption: Effects of pH and Eh Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of complexing, agents formed in the near-field Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of complexing, agents formed in the near-field Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of naturally-occurring iolidids Sorption: effects of con
ECL1.77 AECL1.80 XOE2.4.4.1 XOE2.4.4.2 XOE2.4.4.3 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.5.1 XOE2.4.5.2 XOE2.4.5.4 XOE2.4.5.4 XOE2.4.5.5 XOE2.4.5.5 XOE2.4.5.5 XOE2.4.5.7 XOE2.4.5.1 XOE2.4.5.10 XOE2.4.5.11 XOE2.4.5.13 XOE2.4.5.14 XOE2.4.5.15 XOE2.5.15 XOE2.5.15 XOE2.5.15 XOE2.5.15 XOE2.5.15 XOE2.5.15 XOE2.5.15 XOE	BR	3.11 3.11	Sorption :Sorption: non-linear :Speciation Solubility: effects of pH and En :Solubility: effects of ionic strength :Solubility: effects of onnolexing agents formed in the near-field :Solubility: effects of complexing agents formed in the near-field :Solubility: effects of colloids formed in the near-field :Solubility: effects of microbial activity Linear sorption :Reversible sorption :Reversible sorption :Sorption: Effects of pH and Eh :Sorption: Effects of naturally-occurring organic complexing agents :Sorption: Effects of naturally-occurring organic complexing agents :Sorption: Effects of naturally-occurring ionganic complexing agents :Sorption: effects of complexing colloids :Sorption: effects of naturally-occurring colloids :Sorption: effects of microbial activity
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ECL1.77 AECL1.80 XOE2.4.4.1 XOE2.4.4.2 XOE2.4.4.2 XOE2.4.4.3 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.4.5 XOE2.4.5.1 XOE2.4.5.3 XOE2.4.5.4 XOE2.4.5.4 XOE2.4.5.5 XOE2.4.5.7 XOE2.4.5.9 XOE2.4.5.9 XOE2.4.5.9 XOE2.4.5.10 XOE2.5.10 XOE2.5.10 XOE2.5.10 XOE2.5.10 XOE2.5.10 XOE2.5.10 XO	BR WODER BRFL SRFL	3.11 3.11	Sorption Sorption: non-linear Speciation Solubility: effects of pH and En Solubility: effects of ionic strength Solubility: effects of naturally-occurring complexing agents Solubility: effects of naturally-occurring complexing agents Solubility: effects of naturally-occurring colloids Solubility: effects of naturally-occurring colloids Solubility: effects of colloids formed in the near-field Solubility: effects of naturally-occurring colloids Solubility: effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Inversible sorption Sorption: Effects of pH and Eh Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: Effects of colloids formed in the near-field Sorption: effects of colloids formed in the near-field Sorption: effects of colloids formed in the near-field Sorption: effects of microbial activity Fluid interactions: Dissolution Saturation of sorption sites Sorption Reconcentration
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BUFFER/BACKFILL CATEGORY SCREENED FEPs (sorted)

DENTFER	CATEGORY	CON CODE	FEP NAME
3.11	Radionuclide		
UKN1.6.10	BAR	3.11	Complexing agents
HMIP23.4	BAR	3.11	Solubility constraints
HMIP23.5	897	3.11	Sorption including ion-exchange
HMIP23.6	898	3.11	Changes in scriptive surfaces
HMIP23.7	BAR.		Changes in groundwater chemistry and flow direction
HMIP23.9	899.	3.11	Transport of radionucides bound to microbes
HMIP23.10			Transport of active gases
HMIP23.11	BAR.	3.6.3.11	
NEA1.6.4	897	3.6,3.11	Gas mediated transport
NEA1.6.5	BAR	3.6.3.11	Multiphase flow and gas-driven flow
NEA1.6.6	BAR		Solubility limit
NEA1.6.7	BHR.	3.11	Scription (linear/non-linear, reversible/irreversible)
NEA1.6.8	899	3.11	Dissolution, precipitation, and crystullisation
3.12	Specific facto		
AECL1.36	i 8	3.12	Faulty buffer empiacement
DOE2.3.5.1	- HEF	3.12	thorganic colloid transport: Effects of pH and En
DOE2.3.5.2	87	3.12	Inorganic colloid transport Effects of ionic strength
DOE2.4.7.1	BAPL	3.12	Organic colloid transport in Porous media
DOE2.4.7.2		3.12	Organic colloid transport in Fractured media
DOE2.4.7.3	899	3.12	Organic colicid transport: Effects of pH and Eh
DOE2.4.7.4	899	3,12	Organic colloid transport. Effects of join and C.
DOE2.4.8.1	899	3.12	Inorganic colloid transport Porous media
DOE2.4.8.2	3976.	3.12	Inorganic colloid transport Fractured media
DOE2.4.8.3	BAR	3.12	Inorganic colloid transport: Effects of pH and Eh
DOE2.4.8.4	BPR	3.12	Inorganic colloid transport: Effects of lonic strength
DOE2.4.9	BRFL	3.12	Transport of radionucides bound to microbes
PGA3.13	BAR	3.12	Physico-chemical phenomena/effects (eg. colloid formation)
SKI3.1.4	8	3.12	Colloid generation - source
SK14.2.3	. ar	3.12	Extreme channel flow of oxidents and nuclides
UKN1.6.9	896	3.12	Colloid formation, dissolution and transport
UKN2.2.2	HB	3.12	Inadequate backfill or compaction, voidage
HMIP23.8	BAA	3.12	Colloid transport
NEA1.6.9	<u> </u>	3.12	Colloid formation, dissolution, and transport
NEA1.6.10	BAR	3.12	Complexing agents
NEA2.2.2	BR i	3.12	Inadequate backfill or compaction voidage
	de en la compañía		anachara sarana or corribation Annelle
SKI3.1.6	В	xxx	Sedimentation of bentonite
SK13.2.1.1	 		:Sweiling of bentanite into tunnels and cracks
SKH.210	B		Chemical effects of rock reinforcement
SNL6.1	<u>5</u>		Subsidence and Caving
UKN323	WCBR		Interactions of waste and repository materials with host materials (eg. electrod
HMIP1.6.2	BR		Themail effects and Hydrogeological changes
NEA3.1.1	<u> </u>		Differential elastic response
NEA3.1.2	<u>5</u>		Non-elastic response
NEA3.1.2	<u>6</u>		
110 <u>40</u> .1.4			Induced Protological changes (fluid pressure, density convection, viscosity)

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CONSOLIDATED FEPS LIST FOR REPOSITORY

IDENTIFIER	FEP NAME	COMMENT
4 REPOSIT	DRY	
4.1	Repository_elements/materials	inventory
4.2	Repository degradation	including shafts, seals, normal evolution
4.3	Hydraulic effects/groundwater flow	resaturation, dewatering
4.4	Mechanical effects	swelling
4.5	Thermal effects	
4.6	Gas effects and transport	
4.7	Microbiological/biological activity	
4.8	Gecchemical regime	chemical gradients & kinetics, redox potential, thermochemical
4.9	Radionuclide chemistry	solubility, speciation, sorption, complex formation
4.10	Radionuclide transport processes	ladvection, dispersion, diffusion
4.11	Specific factors	colloids, poor QA, material delects, undetected features

REPOSITORY CATEGORY: SCREENED FEPs (sorted)

IDENTFIER	CATEGORY	CON CODE	FEP NAME
4.1	Repository	elements/mate	nais
AECL1.53	WCR	4.1	Inventory
AECL1.91	R	4.1	Vauit geometry
4.2	Colorester:	adan o manakan. Kalamatan	and a second
	Repository (1
AECLI.8		4.2	Cave ins
AECL1,74	<u> </u>	4.2	Seal evolution
AECL1.75	<u> </u>	4.2	Seal failure
DOE2.3.3.1	<u>. म</u>	4.2	Rock property changest Porosity
DOE2.3.3.2	- 77	4.2.4.3	Rock property changes: Permeability
DOE2.3.3.3	: FF	4.2,4.3,4.7	Rock property changes: Microbial pore blocking
DOE23.3.4	- F	4.2.4.4	Rock property changes: Channel formation/closure
DOE4.1.1.1	ARL	4.2	Borehole seal failure
DOE4.1.1.2		4.2	Borehole seal degradation
DOE4.1.2.1	R	4.2	Shafu/tunnel seal failure
DOE4.1.2.2	R	4.2	Shatviunnel seal decradation
PGA3.16	R	4.2.4.11	Failure of shaft sealing
SKH2.9	ß	4.2	Creeping of rock mass
SK5.11			
		<u> </u>	Degradation of hole- and shaft seals
SNL6.1	<u> </u>		Subsidence and Caving
SNL6.2	<u> </u>		Shaft and Borence Seal Degradation
UKN2,1.2	<u>FR</u>	4.2	Investigation borehole seal tailure and degradation
UKN2.1.3	<u> </u>	4.2	Shaft or access tunnel seal tailure and degradation
UKN2.1.4	R	4.2.4.4	Stress field changes, settling, subsidence or caving
HMP1.1_2	R	4.2.4.8	Physico-chemical degraciation of concrete
HMIP1.4.2	<u> </u>	4.2	Vault collapse
HMIP5.1.1	HPL	4.2	Loss of integrity of borehole seals
HMIP5.1_2	R	4.2	Loss of integrity of shaft or access tunnel seals
NEA2.1.2	HR	4.2	Investigation borehole seal failure and degradation
NEA2.1.3	· HR	4.2	Shaft or access tunnel seal failure and degradation
NEA2.1.4	HR	4.2.4.4	Stress field changes, setting subsidience or caving
NEA2.1.7	HB	4.2	Common cause failures
States States 2007	iy exercite a		
4.3	Hydraulic e	ifects/groundw	ater flow
AECL: 34	<u> </u>	4.3	Excessive hydrostatic pressures
AECL1.43	.	4.3	Hydraulic conductivity
AECL1.44	R	4.3	Hydraulic head
AECL1.70	R	4.3,4.10	Recharge groundwater
AECL1.71	8	4.3	Reflooding
AECL1.90	· 68.	4.3.4.10	Unsaturated transport
DOE1.5.1.1	F F	4.3	Changes in moisture content due to dewatering
DOE1.5.1.2	F	4.3,4.4	Changes in moisture content due to stress relief
DOE1.5.2.2	88	4.3	Groundwater flow due to gas production
DOE1.5.3	ं अन्	4.3	Groundwater flow (saturated conditions)
DOE1.6.3.1	F		Fracture changes: aperture
DOE1.6.3.2	- <u>-</u>		
DCE23.3.2		4.3	Fracture changes: length
	<u></u>	4.2,4.3	Rock property changes: Permeability
DOE2.3.3.3	<u> </u>		Rock property changes: Microbial pore blocking
DOE2.3.4.1	<u> </u>		Groundwater flow: Darcy
DCE23.4.2	<u></u>	4.3	Groundwater flow: Non-Darcy
DCE2.3.4.3	<u> </u>	4.3	Groundwater flow: Intergranular (matrix)
DOE2.3.4.4	· 075	4.3	Groundwater flow: Fracture
	<u>87</u>		Groundwater flow: Effects of solution channels
DOE2.3.4.5	877	4.3	Gouridwater tow. Elects of solution stratelets
DOE2.3.4.5 DOE2.4.12		4.3	Gas-induced groundwater transport
	87F 87F	4.3	
DOE2.4.12	87F 87F 87	4.3	Gas-induced groundwater transport
DOE2.4.12 DOE2.4.13.1	87F 87F 87	4.3 4.6.4.3 4.5.4.3	Gas-induced groundwater transport Repository thermally-induced groundwater transport
DOE2.4.12 DOE2.4.13.1 DOE2.4.13.2 IAEA1.13.1	87 87 87 97 97	4.3 4.6.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.3	Gas-induced groundwater transport Repository thermaliy-induced groundwater transport Naturally thermaliy-induced groundwater transport Fluid interactions: Groundwater flow
DOE2.4.12 DOE2.4.13.1 DOE2.4.13.2 IAEA1.13.1 IAEA3.1.4	877 877 877 977 977 877 877	4.3 4.6.4.3 4.5.4.3 4.5.4.3 4.3 4.5.4.3	Gas-induced groundwater transport Repository thermaliy-induced groundwater transport Naturally thermaliy-induced groundwater transport Fluid interactions: Groundwater flow Thermal effects: Fluid migration
DOE2.4.12 DOE2.4.13.1 DOE2.4.13.2 IAEA1.13.1 IAEA3.1.4 PGA4.1	BT BT BT BT BT FT	4.3 4.6.4.3 4.5.4.3 4.5.4.3 4.3 4.5.4.3 4.3	Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Thermal effects: Fluid migration Direct alterations in hydrogeology
DOE2.4.12 DOE2.4.13.1 DOE2.4.13.2 IAEA1.13.1 IAEA3.1.4 PGA4.1 SKI4.2.5	87 87 87 87 87 87 87 87 87 87 87 87 87 8	4.3 4.6.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.3 4.3	Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Thermal effects: Fluid migration Direct alterations in hydrogeology Changes of groundwater flow
DOE2.4.12 DOE2.4.13.1 DOE2.4.13.2 IAEA1.13.1 IAEA3.1.4 PGA4.1 SKI4.2.5 SKI4.2.7		4.3 4.6.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.3 4.3 4.3 4.3	Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Thermal effects: Fluid migration Direct alterations in hydrogeology Changes of groundwater flow Thermo-hydro-mechanical flects
DOE2.4.12 DOE2.4.13.1 DOE2.4.13.2 IAEA1.13.1 IAEA3.1.4 PGA4.1 SKI4.2.5 SKI4.2.7 SKI5.14		4.3 4.6.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.3 4.3 4.3 4.3 4.3 4.3	Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Thermal effects: Fluid migration Direct alterations in hydrogeology Changes of groundwater flow Thermo-hydro-mechanical flects Resaturation
DOE2.4.12 DOE2.4.13.1 DOE2.4.13.2 IAEA1.13.1 IAEA3.1.4 PGA4.1 SKI4.2.5 SKI4.2.7 SKI5.14 SKI6.13		4.3 4.6.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3	Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Thermal effects: Fluid migration Direct alterations in hydrogeology Changes of groundwater flow Thermo-hydro-mechanical flects Resaturation Geothermally induced flow
DOE2.4.12 DOE2.4.13.1 DOE2.4.13.2 IAEA1.13.1 IAEA3.1.4 PGA4.1 SKI4.2.5 SKI4.2.7 SKI5.14 SKI6.13 UKN2.1.5		4.3 4.6.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.5.4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3	Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Thermal effects: Fluid migration Direct alterations in hydrogeology Changes of groundwater flow Thermo-hydro-mechanical flects Resaturation Geothermally induced flow Dewatering of host rock
DOE2.4.12 DOE2.4.13.1 DOE2.4.13.2 IAEA1.13.1 IAEA3.1.4 PGA4.1 SKI4.2.5 SKI4.2.7 SKI5.14 SKI6.13 UKN2.1.5 UKN3.1.4		4.3 4.6.4.3 4.5.4.3 4.5.4.3 4.3 4.3 4.3 4.3 4.3 4.3.4.4.5 4.3 4.3.4.5 4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3 4.3	Gas-induced groundwater transport Repository thermally-induced groundwater transport Naturally thermally-induced groundwater transport Fluid interactions: Groundwater flow Thermal effects: Fluid migration Direct alterations in hydrogeology Changes of groundwater flow Thermo-hydro-mechanical flects Resaturation Geothermally induced flow Dewatering of host rock Induced hydrological changes (fluid pressure, density convection, viscos ty)
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REPOSITORY CATEGORY: SCREENED FEPs (sorted)

DERINGER CATEGORY CON CODE FEP NAME 4.4 Mechanical effects		CHIERON	CON 0005	
ACC1137 BR 4.4 "Formation of cracks ACC1137 BXWR 4.4 "Changes in n-situ stress field DOE14.2.1 R 4.4 "Changes in moisture content due to stress relied" DOE15.1.2 FF 4.3.4.4 "Changes in moisture content due to stress relied" DOE15.1 FF 4.3.4.4 "Changes in moisture content due to stress relied" DOE22.6.2 FF 4.4 "Reconstruct index seeminety" DOE22.6.1 FF 4.4 "Reconstruct index seeminety" DOE22.6.2 FFG 4.4 "Reconstruct index seeminety" DOE22.6.1 FF 4.4.5 Thermal effects: Mon-skatck response DOE22.6.2 FFG 4.4.5 Thermal effects: Mon-skatck response DOE23.6.2 FF 4.4.5 Thermal effects: Mon-skatck and houst rock FGA3.3 FF 4.4.5 Differing thremal expansion of backt and houst rock FGA3.1.3 FF 4.4.5 Differing thremal expansion of backt and houst rock FGA3.2 FF 4.4 Sereling of backting effects on hearty cock SK12.1 FF 4.4.4 Sereling of backtis and houst rock				
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IAEA3.1.3 BFF 4.4.4.5 Thermal effects: Fluid pressure, density, viscosity changes IAEA3.1.4 BFF 4.5.4.3 Thermal effects: Fluid migration PGA3.7.3 BR 4.4.4.5 Differing thermal expansion of backfill and host rock PGA3.7.4 FF 4.4.4.5 Differing thermal expansion of backfill and host rock PGA3.7.4 FF 4.4.4.5 Differing thermal expansion of host rock zones PGA3.8 FF 4.5 Thermal expansion of host rock zones PGA3.8 FF 4.5 Thermal buoyancy SKI4.24 BR 4.5 Thermal buoyancy SKI4.27 R 4.3.4.4.5 Thermally induced flow SKI6.13 FF 4.3.4.5 Geothermally induced Stress/Fracturing in Host Rock UKN1.5.9 BFF 4.5 Inhermal effects UKN2.1.10 BR 4.5.4.4 Thermal effects and Rock-mass changes HMIP1.6.1 BR 4.5.4.3 Thermal effects and Rock-mass changes HMIP1.6.2 BR 4.5.4.3 Thermal effects and Rock-mass changes		FF	4,4,4.5	Thermal effects: Differential elastic response
IAEA3.1.4 BF 4.5,4.3 Thermal effects: Fluid migration PGA3.7.3 BR 4.4,4.5 Differing thermal expansion of backfill and host rock PGA3.7.4 FF 4.4,4.5 Differing thermal expansion of host rock zones PGA3.7.4 FF 4.4,4.5 Differing thermal expansion of host rock zones PGA3.7.4 FF 4.4,4.5 Differing thermal expansion of host rock zones PGA3.8 FF 4.5 Thermal convection SKI4.24 BR 4.5 Thermal buoyancy SKI6.13 FF 4.3,4.4,5 Geothermally induced flow SKI6.3 FF 4.3,4.5 Geothermally induced flow SNI6.3 FF 4.4.5 Thermal leffects UKN15.9 BFF 4.5 Natural thermal effects UKN2.1.10 BR 4.5 Thermal effects and Rock-mass changes HMIP16.1 SR 4.5.4.4 Thermal effects and Rock-mass changes HMIP16.2 BR 4.5.4.3 Thermal effects and Hydrogeological changes	A3.1.2	F		
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PGA3.7.4 FF 4.4.4.5 Differing thermal expansion of host tock zones PGA3.8 FF 4.5 Thermal convection SKI4.24 BR 4.5 Thermal buoyancy SKI4.27 R 4.3.4.4.4.5 Thermal buoyancy SKI6.13 FF 4.3.4.5 Geothermality induced flow SNL6.3 FF 4.4.4.5 Thermal effects UKN1.5.9 BF 4.4.4.5 Thermal effects UKN2.10 BR 4.5 Thermal effects UKN2.1.10 BR 4.5.4.4 Thermal effects and Rock-mass changes HMIP1.6.1 SR 4.5.4.3 Thermal effects and Rock-mass changes	A3.1.4	BHF 1		
PGA3.8 FF 4.5 Thermal convection SKI4.2.4 BR 4.5 Thermal buoyancy SKI4.2.7 R 4.3.4.4.4.5 Thermo-hydro-mechanical effects SKI6.13 FF 4.3.4.5 Geothermally induced flow SNL6.3 FF 4.4.4.5 Thermal buoyancy SNL6.3 FF 4.4.4.5 Thermally induced Stress/Fracturing in Host Rock UKN1.5.9 BFF 4.5 Natural thermal effects UKN2.1.10 BR 4.5.4.4 Thermal effects (eg. concrete hydration) HMIP1.6.1 SR 4.5.4.4 Thermal effects and Rock-mass changes HMIP1.6.2 BR 4.5.4.3 Thermal effects and Rock-mass changes	37.3	BR	4.4.4.5	Differing thermal expansion of backfill and host rock
PGA3.8 FF 4.5 Thermal convection SKI4.2.4 BR 4.5 Thermal buoyancy SKI4.2.7 R 4.3.4.4.4.5 Thermo-hydro-mechanical effects SKI6.13 FF 4.3.4.5 Geothermally induced flow SNL6.3 FF 4.4.4.5 Thermal buoyancy SNL6.3 FF 4.4.4.5 Thermally induced Stress/Fracturing in Host Rock UKN1.5.9 BFF 4.5 Natural thermal effects UKN2.1.10 BR 4.5.4.4 Thermal effects (eg. concrete hydration) HMIP1.6.1 SR 4.5.4.4 Thermal effects and Rock-mass changes HMIP1.6.2 BR 4.5.4.3 Thermal effects and Rock-mass changes	43.7.4	F	4.4.4.5	Differing thermal expansion of host rock zones
SKI4.24 BR 4.5 Thermal buoyancy SKI4.27 R 4.3.4.4.5 Thermo-hydro-mechanical effects SKI6.13 FF 4.3.4.5 Geothermally induced flow SNL6.3 FF 4.4.4.5 Thermally induced Stress/Fracturing in Host Rock UKN1.5.9 BFF 4.5 Thermal effects UKN2.10 BR 4.5.1 Thermal effects (eg. concrete hydration) HMIP1.6.1 BR 4.5.4.4 Thermal effects and Rock-mass changes HMIP1.6.2 BR 4.5.4.3 Thermal effects and Hydrogeological changes				
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UKN1.5.9 BFF 4.5 Natural thermal effects UKN2.1.10 BR 4.5 Thermal effects (eg. concrete hydration) HMIP16.1 BR 4.5.4.4 Thermal effects and Rock-mass changes HMIP16.2 BR 4.5.4.3 Thermal effects and Hydrogeological changes		F I		
HMIP1.6.1 BR 4.5.4.4 Themsal effects and Rock-mass changes HMIP1.6.2 BR 4.5.4.3 Thermal effects and Hydrogeological changes		BHF		
HMIP1.6.1 BR 4.5.4.4 Thermal effects and Rock-mass changes HMIP1.6.2 BR 4.5.4.3 Thermal effects and Hydrogeological changes				
HMIP1.6.2 ER 4.5.4.3 Thermal effects and Hydrogeological changes				
				Thermal effects and Hydrogeological changes
HMP1.6.3 BR 4.5.4.8 Thermal effects and Chemical changes		83		Thenmal effects and Chemical changes
HMP16.4 ER 4.5.4.10 Thermal effects and Transport (diffusion) effects				Thermal effects and Transport (diffusion) effects
HMIP23.12 SPFL 4.5.4.8 Thermal effects on hydrochemistry				
NEA21.10 R 4.5 Thermal effects				Thermal effects

REPOSITORY CATEGORY: SCREENED FEPs (sorted)

	CATEGORY	CON CODE	IFEP NAME
4.6		and transport	
AECL1.86	_		Transport in gases or of gases
DOE1.2.1.1	<u> Bi</u>	4.6	Hydrogen: corrosion of structural steel
DOE1.2.2.7		4.6	Methane/CO2 production: Effects of microbial growth on properties of concre
DOE1.2.6.2	R	4.6	
	·		Gas transport in the variits between containers
DOE1.2.6.3		4.6	Gas transport Between vaults
DOE1.2.6.4		4.6	Gas transport in the near-field, including up and around access shafts and adits
DOE2.4.11.1	BAR	4.6.4.10	Gas transport solution
DOE2.4.11.2	BR	4.6	Gas transport gas phase
DOE2.4.12		4.6.4.3	Gas-induced groundwater transport
SK15.22	GR	4.6	Accumulation of gases under permatrost
SKI5.43	G GR	4.6	Methane intrusion
SKIS.2	ar	4.6	Gas transport
UKN1.2.13	R	4.6	Natural gas intrusion
UKN1.5.4	877	4.6.4.10	Gas mediated transport
UKN1.5.5	BAA	4.6,4.10	Multiphase flow and gas driven flow
HMIP1.26	EF	4.6	Gas transport
HMIP1.5.3	ER.	4.6	Gas production (unsaturated flow)
HMIP23.10			Transport of active gases
HMIP23.11		4.6.4.10	Gas induced groundwater transport
NEA1.2.13	<u> </u>	4.6.4.10	
NEA1.5.4			Natural gas intrusion
NEA1.5.5	BRR.	4.6.4.10	Multiphase flow and gas-driven flow
4.7	Microbiologie	cal/biological	
AECL1.3	WCBR	4.7	Biological activity
AECL 1.58	COR .	4.7	Microbes
AECL 1.59		4.7	Microorganisms
DOE1.5.4.3		4.7.4.8	Transport of Microbes into the near-field
	WEFF	4.7	Microbial activity
DOE 1.6.6.3)	·	Microbial activity
00722.3.3.3	<u> </u>		Rock property changes: Microbial pore blocking
DOE2.4.9	<u>BARL</u>	4.7.4.8	Transport of radionuclides bound to microbes
1.00.00	8999	4.7	Microbiological phenomena/effects
UKN1.7.7	WBRFL	4.7	Microbial interacions
HMIP239	BAR.	4.7. 4.10	Transport of radionuclides bound to microbes
HMIP23.13	877	4.7	Biogeochemical stanges
HMIP23.13	in a star i se	4.7	
HMIP23.13 4.8	Geochemical	4.7 regime	
HMIP23.13 4.8 AECL1.9	Geochemical WER	4.7 ragime 4.8	Chemical gradients
HMIP2313 4.8 AECL1.9 AECL1.13	Geochemical WER WCBR	4.7 regime 4.8 4.8	Chernical gradients Chernical kinetics
HMIP2313 4.8 AECL1.9 AECL1.13 AECL1.40	Geochemical WER WCBR WER	4.7 regime 4.8 4.8 4.8	Chemical gradients Chemical ionetics Geochemical pump
HMIP23.13 4.8 AECL1.9 AECL1.13 AECL1.40 DOE1.1.2.3	Geochemical WBR WCBR WBR R	4.7 regime 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical ionetics Geochemical pump Pore blockage: concrete
HMIP2313 4.8 AECL19 AECL19 AECL140 DOE1123 DOE1125	Geochemical WER WCBR WBR R R R	4.7 ragime 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical ionetics Geochemical pump Pore blockage: concrete Cement-suiphate reaction: concrete
HMIP2313 4.8 AECL1.9 AECL1.13 AECL1.40 DOE1.1.2.3 DOE1.1.2.5 DOE1.1.3.1	Geochemical WER WCBR R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical innetics Cecchemical pump Pore blockage: concrete Cement-suphate reaction: concrete Changes in pore water composition, pH, Eh: concrete
HMIP2313 4.8 AECL1.9 AECL1.13 AECL1.40 DOE1.1.2.3 DOE1.1.2.5 DOE1.1.3.1 DOE1.5.4.1	Geochemical WER WCBR R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical innetics Geochemical pump Pore blockage: concrete Cement-suphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Changes in pore water composition, pH, Eh: concrete Transport of Inorganic ions into the near-field
HMIP2313 4.8 AECL1.9 AECL1.9 AECL1.40 DOE1.12.3 DOE1.12.5 DOE1.1.3.1 DOE1.5.4.1 DOE1.5.4.2	Geochemical WER WCBR R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical innetics Geochemical journp Pore blockage: concrete Cement-suphate reaction: concrete Changes in pore water composition, pH, Eh: concrete ITransport of Inorganic ions into the near-field Transport of Humic and fulvic acids into the near-field
HMIP2313 4.8 AECL19 AECL19 AECL140 DOE1123 DOE1125 DOE11541 DOE1542 DOE1543	Geochemical WER WCBR R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical inetics Geochemical pump Pore blockage: concrete Cement-suiphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Transport of horganic ions into the near-field Transport of Humic and fulvic acids into the near-field Transport of Microbes into the near-field
HMIP2313 4.8 AECL13 AECL13 AECL140 DOE1123 DOE1125 DOE1541 DOE1542 DOE1543 DOE1544	Geochemical WER WCER R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical innetics Geochemical journp Pore blockage: concrete Cement-suphate reaction: concrete Changes in pore water composition, pH, Eh: concrete ITransport of Inorganic ions into the near-field Transport of Humic and fulvic acids into the near-field
HMIP2313 4.8 AECL13 AECL13 AECL140 DOE1123 DOE1123 DOE1541 DOE1542 DOE1544 DOE1544 DOE1544	Geochemical WER WER R R R R R R R R R R R K K R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical gradients Chemical ionetics Geochemical pump Pore blockage: concrete Cement-suiphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Transport of horganic ions into the near-field Transport of Hunic and tuivic acids into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion
HMIP2313 4.8 AECL19 AECL19 AECL10 DOE1123 DOE1125 DOE1541 DOE1541 DOE1543 DOE1543 DOE1544 DOE1651 DOE1651	Geochemical WER WCBR R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical pump Pore blockage: concrete Changes in pore water composition, pH, Eh: concrete Changes in pore water composition, pH, Eh: concrete ITransport of horganic ions into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation
HMIP2313 4.8 AECL13 AECL13 AECL140 DOE1.123 DOE1.125 DOE1.541 DOE1.54.1 DOE1.54.2 DOE1.54.3 DOE1.65.1 DOE1.6.52 DOE1.6.53	Geochemical WBR WCBR R R R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical gradients Chemical ionetics Geochemical pump Pore blockage: concrete Cement-suiphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Transport of horganic ions into the near-field Transport of Hunic and tuivic acids into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion
HMIP2313 4.8 AECL19 AECL19 AECL10 DOE1123 DOE1125 DOE1541 DOE1541 DOE1543 DOE1543 DOE1544 DOE1651 DOE1651	Geochemical WBR WCBR R R R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical pump Pore blockage: concrete Changes in pore water composition, pH, Eh: concrete Changes in pore water composition, pH, Eh: concrete ITransport of horganic ions into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation
HMIP2313 4.8 AECL13 AECL13 AECL140 DOE1.123 DOE1.125 DOE1.541 DOE1.54.1 DOE1.54.2 DOE1.54.3 DOE1.65.1 DOE1.6.52 DOE1.6.53	Geochemical WBR WCBR R R R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical innetics Geochemical pump Pore blockage: concrete Changes in pore water composition, pH, Eh: concrete Changes in pore water composition, pH, Eh: concrete ITransport of horganic ions into the near-field Transport of Humic and fulvic acids into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion IChemical changes due to Waste degradation IChemical changes due to Waste degradation
HMIP2313 4.8 AECL1.9 AECL1.13 AECL1.40 DOE1.12.3 DOE1.12.5 DOE1.5.4.1 DOE1.5.4.2 DOE1.5.4.3 DOE1.5.4.4 DOE1.6.5.1 DOE1.6.5.3 DOE1.6.5.4	Geochemical WER WCBR R R R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical gradients Chemical ionetics Geochemical pump Pore blockage: concrete Cement-suiphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Transport of horganic ions into the near-field Transport of Humic and fulvic acids into the near-field Transport of Microbes into the near-field Transport of Microbes into the near-field Transport of Microbes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Waste degradation Chemical changes due to Waste degradation Chemical changes due to Gas production
HMIP2313 4.8 AECL19 AECL19 AECL140 DOE1123 DOE1125 DOE1131 DOE1541 DOE1542 DOE1654 DOE1652 DOE1653 DOE1654 DOE1655 DOE1655	Geochemical WER WER R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical inetics Geochemical pump Pore blockage: concrete Cement-sulphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Transport of horganic ions into the near-field Transport of Humic and fulvic acids into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Concrete degradation Chemical changes due to Concrete degradation Chemical changes due to Concrete degradation Chemical changes due to Concrete formation
HMIP2313 4.8 AECL13 AECL13 AECL140 DOE1123 DOE1123 DOE1541 DOE1542 DOE1544 DOE1653 DOE1653 DOE1654 DOE1655 DOE1655 DOE1655 DOE1655 DOE1657	Geochemical WER WER R R R R R R R R R R R R R R R S R S F S F	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical gradients Chemical pump Pore blockage: concrete Cement-supplate reaction: concrete Changes in pore water composition, pH, Eh: concrete Changes in pore water composition, pH, Eh: concrete Transport of horganic ions into the near-field Transport of Humic and fulvic acids into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Concrete degradation Chemical changes due to Concrete degradation Chemical changes due to Gas production Chemical changes due to Complex formation Chemical changes due to Solubility
HMIP2313 4.8 AECL13 AECL140 DOE1123 DOE1123 DOE1542 DOE1544 DOE1654 DOE1654 DOE1653 DOE16555 DOE16555 DOE16555 DOE16555 DOE16555 DOE16555 D	Geochemical WER WER R R R R R R R R R R R R R R R S R S F S F	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical gradients Chemical pump Pore blockage: concrete Cement-sulphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Changes in pore water composition, pH, Eh: concrete Transport of horganic ions into the near-field Transport of humic and fulvic acids into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation Chemical changes due to Maste degradation Chemical changes due to Complex formation Chemical changes due to Colorebe formation Chemical changes due to Colorebe formation Chemical changes due to Colorebe formation
HMIP2313 4.8 AECL1.3 AECL1.3 AECL1.40 DOE1.12.3 DOE1.5.4.1 DOE1.5.4.1 DOE1.5.4.2 DOE1.6.5.2 DOE1.6.5.3 DOE1.6.5.4 DOE1.6.5.4 DOE1.6.5.5 DOE1.6.5.6 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.9	Geochemical WBR WCR R R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical gradients Chemical innetics Geochemical pump Pore blockage: concrete Changes in pore water composition, pH, Eh: concrete Changes in pore water composition, pH, Eh: concrete Transport of longanic ions into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation Chemical changes due to Complex formation Chemical changes due to Complex formation Chemical changes due to Complex formation Chemical changes due to Colloid production Chemical changes due to Solubility Chemical changes due to Solubility Chemical changes due to Species equilibrium
HMIP2313 4.8 AECL1.9 AECL1.13 AECL1.40 DOE1.1.2.3 DOE1.1.2.5 DOE1.1.3.1 DOE1.5.4.1 DOE1.5.4.2 DOE1.5.4.3 DOE1.6.5.1 DOE1.6.5.2 DOE1.6.5.3 DOE1.6.5.4 DOE1.6.5.5 DOE1.6.5.6 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.9 DOE1.6.5.9 DOE2.4.6	Geochemical WER WER R R R R R R R R R R R R R R R S R S R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients IChemical innetics Geochemical pump Pore blockage: concrete Cement-suiphate reaction: concrete IChanges in pore water composition, pH, Eh: concrete ITransport of horganic ions into the near-field Transport of Microbes into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation Chemical changes due to Gas production Chemical changes due to Complex formation Chemical changes due to Colloid production Chemical changes due to Solubility C
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HMIP2313 4.8 AECL19 AECL19 AECL113 AECL140 DOE1123 DOE1125 DOE1541 DOE1541 DOE1544 DOE1652 DOE1653 DOE1653 DOE1655 DOE1655 DOE1655 DOE1655 DOE1655 DOE1658 DOE1658 DOE1658 DOE1658 DOE1658 DOE1658 DOE1658 DOE1658 DOE1658 DOE1658 DOE1658 DOE249 DOE2414	Geochemical WER WER R R R R R R R R R R R R R R S R S F S F	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical innetics Geochemical pump Pore blockage: concrete Cement-sulphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Transport of horganic ions into the near-field Transport of Humic and fulvic acids into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation Chemical changes due to Concrete degradation Chemical changes due to Complex formation Chemical changes due to Coloid production Chemical changes due to Solubility Chemical changes
HMIP2313 4.8 AECL13 AECL140 DOE1123 DOE1125 DOE1541 DOE1541 DOE1544 DOE1654 DOE1654 DOE1653 DOE1654 DOE1655 DOE246 DOE245 DOE25 DOE555 DOE55 DOE555 DOE555 DOE555 DOE555 DOE555 DOE5555	Geochemical WER WER R R R R R R R R R R R R R R R S R S R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical innetics Geochemical pump Pore blockage: concrete Cement-suphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Transport of Inorganic ions into the near-field Transport of Humic and fulvic acids into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation Chemical changes due to Complex formation Chemical changes due to Complex formation Chemical changes due to Colloid production Chemical changes due to Solubility Chemical c
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HMIP2313 4.8 AECL1.3 AECL1.3 AECL1.3 AECL1.40 DOE1.12.3 DOE1.12.5 DOE1.5.4.1 DOE1.5.4.1 DOE1.5.4.2 DOE1.6.5.1 DOE1.6.5.2 DOE1.6.5.4 DOE1.6.5.4 DOE1.6.5.4 DOE1.6.5.5 DOE1.6.5.6 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.9 DOE2.4.9 DOE2.4.1 JAEA1.13.2 JAEA1.13.3 JAEA3.2.2	Geochemical WBR WCBR WBR R R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical gradients Chemical pump Pore blockage: concrete Cement-supplate reaction: concrete Changes in pore water composition, pH, Eh: concrete Changes in pore water composition, pH, Eh: concrete Transport of Inorganic ions into the near-field Transport of Microbes into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation Chemical changes due to Concrete degradation Chemical changes due to Complex formation Chemical changes due to Complex formation Chemical changes due to Solubility Fracture mineralisation Transport of radonuclides bound to microbes Biogeochemical changes Fluid interactions: Dissolution Fluid interactions: Brine pockets Chemical effects: Interactions of waste package and rock
HMIP2313 4.8 AECL1.3 AECL1.40 DOE1.12.3 DOE1.12.3 DOE1.5.4.1 DOE1.5.4.2 DOE1.5.4.2 DOE1.5.4.3 DOE1.6.5.2 DOE1.6.5.3 DOE1.6.5.4 DOE1.6.5.4 DOE1.6.5.6 DOE1.6.5.7 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.9 DOE2.4.6 DOE2.4.9 DOE2.4.14 IAEA1.13.2 IAEA3.2.2 IAEA3.2.4	Geochemical WER WER R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients IChemical innetics Geochemical pump Pore blockage: concrete Cement-sulphate reaction: concrete IChanges in pore water composition, pH, Eh: concrete ITransport of Inorganic ions into the near-field Transport of Microbes into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation Chemical changes due to Concrete degradation Chemical changes due to Complex formation Chemical changes due to Complex formation Chemical changes due to Colloid production Chemical changes due to Solubility Chemical changes
HMIP2313 4.8 AECL1.3 AECL1.3 AECL1.3 AECL1.40 DOE1.12.3 DOE1.12.5 DOE1.5.4.1 DOE1.5.4.1 DOE1.5.4.2 DOE1.6.5.1 DOE1.6.5.2 DOE1.6.5.4 DOE1.6.5.4 DOE1.6.5.4 DOE1.6.5.5 DOE1.6.5.6 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.9 DOE2.4.9 DOE2.4.1 DOE2.4.13.3 IAEA1.13.2 IAEA1.13.3 IAEA3.2.2	Geochemical WBR WCBR WBR R R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8.4.10 4.8.4.10 4.8.4.10 4.8	Chemical gradients IChemical idnetics Geochemical pump Pore blockage: concrete IChement-sulphate reaction: concrete IChanges in pore water composition, pH, Eh: concrete ITransport of horganic ions into the near-field ITransport of Humic and fulvic acids into the near-field ITransport of Organic complexes into the near-field IChemical changes due to Metal corrosion IChemical changes due to Concrete degradation IChemical changes due to Complex formation IChemical changes due to Complex formation IChemical changes due to Solubility IChemical changes Biogeochemical changes
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HMIP2313 4.8 AECL1.9 AECL1.13 AECL1.40 DOE1.1.2.3 DOE1.1.2.5 DOE1.1.3.1 DOE1.5.4.1 DOE1.5.4.2 DOE1.5.4.3 DOE1.6.5.1 DOE1.6.5.2 DOE1.6.5.3 DOE1.6.5.4 DOE1.6.5.5 DOE1.6.5.5 DOE1.6.5.7 DOE1.6.5.8 DOE1.6.5.8 DOE1.6.5.9 DOE2.4.6 DOE2.4.9 DOE2.4.14 IAEA1.13.2 IAEA3.2.2 IAEA3.2.2 IAEA3.2.4 PGA3.12.2	Geochemical WER WCR R R R R R R R R R R R R R R R S R S R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients IChemical innetics Geochemical pump Pore blockage: concrete IChement-sulphate reaction: concrete IChanges in pore water composition, pH, Eh: concrete ITransport of horganic ions into the near-field ITransport of Humic and fulvic acids into the near-field ITransport of Organic complexes into the near-field IChemical changes due to Metal corrosion IChemical changes due to Concrete degradation IChemical changes due to Complex formation IChemical changes due to Complex formation IChemical changes due to Solubility IChemical changes Biogeochemical changes
HMIP2313 4.8 AECL1.9 AECL1.13 AECL1.40 DOE1.12.3 DOE1.12.5 DOE1.13.1 DOE1.5.4.1 DOE1.5.4.2 DOE1.5.4.2 DOE1.6.5.3 DOE1.6.5.2 DOE1.6.5.4 DOE1.6.5.5 DOE1.6.5.5 DOE1.6.5.6 DOE1.6.5.7 DOE1.6.5.8 DOE1.6.5.9 DOE1.6.5.9 DOE2.4.6 DOE2.4.9 DOE2.4.14 IAEA1.13.2 IAEA3.2.2 IAEA3.2.2 PGA3.13 PGA3.13	Geochemical WER WER R R R R R R R R R R R R R R R S R S R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical innetics Geochemical pump Pore blockage: concrete Cement-sulphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Transport of horganic ions into the near-field Transport of Humic and fulvic acids into the near-field Transport of forganic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation Chemical changes due to Controlex formation Chemical changes due to Controlex formation Chemical changes due to Solubility Fracture mineralisation Transport of radionuclides bound to microbes Biogeochemical changes Fluid interactions: Brine pockets Chemical effects: Interactionis of waste package and rock Chemical effects: Interactionis of waste package and rock Physico-chemical changes in host rock Physico-chemical ohenomena/effects (eg. colloid formation)
HMIP2313 4.8 AECL1.9 AECL1.13 AECL1.40 DOE1.12.3 DOE1.12.5 DOE1.54.1 DOE1.54.1 DOE1.54.2 DOE1.54.2 DOE1.54.4 DOE1.65.4 DOE1.65.3 DOE1.65.4 DOE1.65.5 DOE1.65.6 DOE1.65.6 DOE1.65.7 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE2.4.6 DOE2.4.1 IAEA1.13.2 IAEA1.13.2 IAEA3.22 PGA3.12 PGA3.13 SKI4.1.1 SKI4.1.2	Geochemical WBR WCB R R R R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical innetics Geochemical pump Pore blockage: concrete Cement-suphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Transport of Inorganic ions into the near-field Transport of Microbes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation Chemical changes due to Concrete degradation Chemical changes due to Complex formation Chemical changes due to Colloid production Chemical changes due to Solubility Chemical changes due
HMIP2313 4.8 AECL1.9 AECL1.13 AECL1.40 DOE1.12.5 DOE1.12.5 DOE1.54.1 DOE1.54.1 DOE1.54.2 DOE1.54.2 DOE1.54.4 DOE1.65.3 DOE1.65.4 DOE1.65.4 DOE1.65.5 DOE1.65.5 DOE1.65.6 DOE1.65.6 DOE1.65.7 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE1.65.8 DOE2.4.9 DOE2.4.14 IAEA1.13.2 IAEA3.22 IAEA3.24 PGA3.13 SKI4.1.1	Geochemical WER WER R R R R R R R R R R R R R R R R	4.7 regime 4.8 4.8 4.8 4.8 4.8 4.8 4.8 4.8	Chemical gradients Chemical pump Pore blockage: concrete Cement-sulphate reaction: concrete Changes in pore water composition, pH, Eh: concrete Changes in pore water composition, pH, Eh: concrete Transport of horganic ions into the near-field Transport of Nurice and fulvic acids into the near-field Transport of Organic complexes into the near-field Chemical changes due to Metal corrosion Chemical changes due to Concrete degradation Chemical changes due to Concrete formation Chemical changes due to Coloid production Chemical changes due to Solubility Chemi

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REPOSITORY CATEGORY: SCREENED FEPs (sorted)

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IDENTIFIER	CATEGORY	CONL CODE	FEP NAME
4.8	Geocher	regime (co	ntinued)
SKH.1.9	BAR	4.8.4.9	Complexing agents
SK14.2.10	1 58	4.8	Chemical effects of rock reinforcement
SKI5.1	1 BFF	4.8	Saline (or fresh) groundwater intrusion
UKN1.5.7	BFF	4.8	Saline or freshwater intrusion
UKN1.5.8	मर	4.8	Effects at saline-freshwater interface
UKN1.6.11	I FF	4.8	Fracture mineralisation and weathering
UKN1.6.14	WCBFF	4.8	Chemical gradients (electrochemical effects and osmosis)
UKN1.7.6	WEFFL	4.8	Chemical transformations
UKN3.2.2	WCBR	4.8	Interactions of host materials and groundwater with repository material (e
UKN3.2.3	WCBR	4.8	Interactions of waste and repository materials with host materials (eg. elec
UKN3.2.4	i HF	4.8	Non-radioactive solute plume in geosphere (effect on redox, effect on pH, s
HMIP1.1.2	R	4.2,4.8	Physico-chemical degradation of concrete
HMIP1.2.8	WER:	4.8	Thermo-chemical effects
HMIP1.5.5	BR	4.8	Transport of chemically active substances into the near-field
HMIP1.6.3	88	4.5,4.8	Thermal effects and Chemical changes
HMIP2.3.7	BHH	4.8.4.3	Changes in grounowater chemistry and flow direction
HMIP2.3.12	1 BAR.	4.5.4.8	Thermal effects on hydrochemistry
NEA1.6.11	H H	4.8	Fracture mineralisation
NEA1.6.14	897	4.8	Chemical gradients (electrochemical effects and osmosis)
NEA3.1.5	BR	4.8	induced chemical changes (solubility, sorption, species equilibrium, minerali
NEA3.2.2	R	4.8	Interactions of host materials and groundwater with repository material (e.e.
NEA3.2.3	RF	4.8	Interactions of waste and repository materials with host materials (electroci
	herrendatuerel	na an a	
4.9	Radionuclide		j
AECL1.65	WCER	4.9	Precipitation and dissolution
AECL1.76	88	4.9	Sorpton
AECL1.77	BR I	4.9	Sorption: non-linear
AECL 1.80	WCBR	4.9	Speciation
DOE2.4.4.1	897.	4.9	Solubility: effects of pH and Eh
DOE2.4.4.2	8471	_4.9	Salubility: effects of ionic strength
DOE2.4.4.3	<u></u>	4.9	Solubility: effects of naturally-occurring complexing agents
DOE2.4.4.4		4.9	Solubility: effects of complexing agents formed in the near-field
DOE2.4.4.5	BAA	4.9	Solubility: effects of naturally-occuring colloids
DOE2.4.4.6	<u> </u>	4.9	Solubility: effects of colloids formed in the near-field
DOE2.4.4.7	<u> </u>	4.9	Solubility: effects of major ions migrating from the near-field
DOE2.4.4.8	<u> </u>	4.9	Solubility: Effects of microbial activity
DOE2.4.5.1	BAFL	4.9	Linear sorption
DOE2.4.5.2	BATEL	4.9	Non-linear sorption
DOE2.4.5.3	BAR	4.9	Reversible sorption
DOE2.4.5.4	BAR	4.9	Irreversible sorption
DOE2.4.5.5	<u></u>	4.9	Sorption: Effects of pH and Eh
DOE2.4.5.6	8RC	4.9	Sorption: Effects of ionic strength
DOE2.4.5.7	BAR	4.9	Sorption: Effects of naturally-occurring organic complexing agents
DOE2.4.5.8	BAAL I	4.9	Sorption: Effects of naturally-occuring inorganic complexing agents
DOE2.4.5.9	8	4.9	Sorption: Effects of complexing agents formed in the rear-field
OCE2.4.5.10	BAR .	4.9,4.11	Sorption: effects of naturally-occuring colloids
DOE2.4.5.11	ER	4.9	Sorption: effects of colloids formed in the near-field
DOE2.4.5.12	FF	4.9	Sorption: effects of major ions migrating from the near-field
OE2.4.5.13	644.	4.9	Sorption: effects of microbial activity
OCE2.4.10	8999	4.9	Isotopic dilution
K <u>H.</u> 1.4	8997.	4.9	Sorption
KI4.1.5	87	4.9	Matrix diffusion
KI4.1.6	BRPL i	4.8,4.9	Reconcentration
KI4.1.9	8 A A. :	4.8.4.9	Complexing agents
КБ.44	WR	4.9	Solubility and precipitation
KI7.5	APL :	4.9	Isotopic dilution
KN1.6.6	BAR	4.9	Solubility iimit
KN1.6.7	39971	4.9	Sorption (linear/non-linear, reversible/sreversible)
KN1.6.8	8999.	4.9	Dissolution, precipitation and crystalisation
KN1.6.10	BAR	4.9	Complexing agents
KN1.6.13	869	4.9	Mass, isotopic and species dilution
MP2.3.4	8999	4.9	Solubility constraints
MP235	3 A P.		Sorption including ion-exchange
MIP2.3.5	3 A .		Changes in sorptive surfaces
EA1.6.6	847.		Solubility limit
EA1.6.7	BRFL		Sorption (linear/non-linear, reversible/irreversible)
EA1.6.8	597.		Dissolution, precipitation, and crystallisation
EA1.6.10	BAR		Complexing agents

REPOSITORY CATEGORY: SCREENED FEPs (sorted)

IDENTFIER	1 CATEGORY	CON CODE	FEP NAME
4.10	Radionuclide		
AECL1.29	i BR	4.10	Diffusion
AECL 1.30	I BR	4.10	Dispersion
			Hydrothermal alteration
AECL1.70	R		Recharge groundwater
AECL1.86	BR -		Transport in gases or ofigases
AECL1.90			Unsaturated transport.
DOE1.5.4.1			Transport of Inorganic ions into the near-field
DOE1.5.4.2	R		Transport of Humic and fulvic acids into the near-field
DOE1.5.4.4	R R		Transport of Organic complexes into the near-field
DOE2.4.1			Advection
DOE2.4.2.1	<u> </u>	<u> </u>	Bulk diffusion
DOE24.2.1		4.10	Matrix diffusion
DOE2.4.3			
DOE2.4.11.1			Hydrodynamic dispersion
SKI6.4	BHT		Gas transport solution
SK16.5	BARL		Dispersion
UKN1.6.1	BAR		
	899		Advection and dispersion
UKN1.6.3 UKN1.6.4	BAR		Matrix diffusion
UKN1.6.5	BAFL		
HMIP1.6.4			Multiphase flow and gas driven flow
			Thermal effects and Transport (diffusion) effects
HMIP231 HMIP232	<u> </u>		Diffusion
HMIP232 HMIP233	897.		
			Hydrodynamic dispersion
HMIP233	<u> </u>		Transport of radionucides bound to microbes
	<u>8978.</u> 8979.		Transport of active gases
			Gas induced groundwater transport
NEA1.6.1	BRFL		Advection and dispersion
NEA1.6.2	BAR.		Diffusion
NEA1.6.3			Matrix diffusion
NEA1.6.4	<u> </u>		Gas mediated transport
NEA1.6.5	; 8947.	4.6,4.10	Multiphase flow and gas-driven itow
4.11	Specific facto	215	
AECL1.15	R	4,11	Colloids
AECL1.48	R	4.11	Incomplete closure
AECL1.62	R	4.11	Percolation in shafts
AECL1.66	R	4.11	Pseudo-colloids
AECL1.89	i R	4,11	Unmodelled design features
AECL24	F	4.11	Borehole seal failure/open boreholes
AECL2.6	HFF	4.11	Boreholes - unsealed
DOE1.5.4.5	R	4,11	Transport of Colloids into the near-field
DOE2.3.4.6	I F	4,11	Inorganic colloid transport: Porous media
DOE2.3.5.1	877	4.11	Inorganic colloid transport: Effects of pH and Eh
DOE2.3.5.2	1 BFF	4.11	inorganic colloid transport. Effects of ionic strength
DOE2.4.5.10	5ARL	i 4.9,4.11	Sorption: effects of naturally-occuring; coiloids
DOE24.7.1	1 BAR.	4.11	Organic colloid transport in Porous media
DOE2.4.7.2	1	4.11	Organic colloid transport in Fractured media
DOE2.4.7.3	977FL	4,11	Organic colloid transport: Effects of pH and Eh
DOE2.4.7.4		4.11	Organic colloid transport Effects of ionic strength
DOE2.4.8.1	BAR.	4.11	horganic colloid transport: Porous media
DOE2.4.8.2	8999.	4.11	Inorganic colloid transport: Fractured media
DOE24.8.3	BAR	4,11	Inorganic colloid transport: Effects of pH and Eh
DOE2.4.8.4	i 6777.	4.11	Inorganic colloid transport: Effects of ionic strength
IAEA2.2.1	FF I	4.11	Inadecuate design: Shaft seal failure
IAEA2.2.2	RFL	4.11	Inadequate design: Exploration borehole seal failure
PGA3.16	R	4.2.4.11	Failure of shaft sealing
SK14.2.3	1 BFF	4.11	Extreme channel flow of oxidants and nuclides
SK15.45	F	4.11	Colloid generation and transport
UKN1.6.9		4.11	Colloid formation, dissolution and transport
UKN2.2.10		4.11	Poor closure
HMIP238	899	4.11	Coiloid transport
HMIP5.1.3		4.11	Incomplete near-field chemical conditioning
NEA1.6.9		4.11	Colloid formation, dissolution, and transport
NEA2.1.6	UR	4.11	Material defects (e.g. early carister failure)
NEA2.1.8		4.11	Poor quality construction
NEA2.2.1		4.11	Radioactive waste disposal error
NEA2.2.2		4.11	Inadequate backful or compaction voidage
NEA2.2.4	WR	4,11	Inadvertent inclusion of undesirable materials
NEA2.2.9	1 -	4,11	Abandonment of unsealed repository
NEA2.2.10	8	4,11	Poor closure
NEA2.2.12	R	4.11	Effects of phased operation
	ter and the second s		Checks of pressed operation
PGA4.2	R	XXXX	Injection of liquid waste

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CONSOLIDATED FEPs LIST FOR FAR FIELD

IDENTIFIER	FEP NAME	COMMENT		
5. FAR FIEL	0			
5.1	Rock property effects	porosity, permeability, fracture changes		
5.2	Hydrogeological effects	hydraulic effects, groundwater flow		
5.3	Physical/mechanical effects	seismicity, fault activation		
5.4	Thermal effects	elastic-, non-elastic response		
5.5	Gas effects and transport			
5.6	Microbiological/biological activity			
5.7	Geochemical regime	chemical gradients & kinetics, redox potential, thermochemical		
5.0	Radionuclide chemistry	solubility, speciation, sorption, complex formation		
5.9	Radionuclide transport processes	advection, dispersion, diffusion		
5.10	Specific factors	colloids, poor QA & design, borehole seal failure, undetected features		

DENTIFIER	CATEGORY	CONL CODE	
	Rock property		
AECL2_14	HE	5.1.5.2	Dewaterino
AECL2.51			Bock properties
DOE1.6.3.1	F	5.1	
DOE1.6.3.2	E E		Fracture changes: aperture
	-	5.1	Fracture changes: length
	F :	5.1	Rock property changes: Porcsity
DOE2.3.3.2	<u> </u>	5.1	Rock property changes: Permeability
DOE2.3.3.3	<u>F</u>	5.1	Rock property changes: Microbial pore blocking
DOE2.3.3.4	<u> </u>	5.1	Rock property changes: Channel formation/closure
DOE2.4.6	H H	5.7,5.1	Fracture mineralisation
UKN1.6.11		5.7,5.1	Fracture mineralisation and weathering
UKN2.1.5	F	5.1,5.2	Dewatering of host rock
HMIP2.2.2	F	5.1	Rock property changes
			· · · · · · · · · · · · · · · · · · ·
5.2	Hydrogeologic	al affacte	
AECL2.11	i F t	5.2	Conceptual model - hydrology
AECL2.14			
			Dewatering
AECL2.15	<u> </u>	5.2	Discharge zones
AECL2.27	<u>F</u>	5.4,5.2	Geothermai gradient effects
AEC12.30	F	5.2	Groundwater - evolution
AECL2.33	F	5.2	Hydrautic properties - evolution
	F	5.2	Recharge groundwater
AECL2.54	E F	5.2	Salinity effects on flow
AECL2.55	F		Saturation
AECL2.63	F		Turbulence
AECL2.65	F	5.2	Unsaturated rock
DOE1.5.1.1	Ŧ	5.2	Changes in moisture content due to dewatering
DOE1.5.1.2			Changes in moisture content due to stress relief
		5.2,5.3	
DOE1.5.3	BAL	5.2	Groundwater flow (saturated conditions)
DOE1.6.4.1	<u>F</u>	5.2	Hydrological changes: Fluid pressure
DOE1.6.4.2	<u> </u>	5.2	Hydrological changes: Density
DOE1.6.4.3	F	5.2	Hydrological changes: Viscosity
DOE2.3.4.1	j 🕂 🕇	5.2	Groundwater flow: Darcy
DOE2.3.4.2		5.2	Groundwater flow: Non-Darcy
DOE2.3.4.3		5.2	Groundwater flow, Intergranular (matrix)
DOE2.3.4.4	BAF	5.2	Groundwater flow: Fracture
DOE2.3.4.5	BRF	5.2	Groundwater flow: Effects of solution channels
DOE2.3.6	BFF	5.4.5.2	Variations in groundwater temperature
DOE2.4.12	BHF	5.6.5.2	Gas-induced groundwater transport
DOE2.4.13.2	BAF	5.4.5.2	Naturally thermally induced groundwater transport
DOE3.3.2.4	E I	5.2	Near-surface runoff processes: Macropore flow
	• · · · · · · · · · · · · · · · · · · ·		
DOE3.3.2.5	<u>R</u>	5.2	Near-surface runoff processes: Variable source area response
DOE3.3.3	F 1	5.2	Groundwater recharge
IAEA1.13.1	BRF_	5.2	Fluid interactions: Groundwater flow
IAEA1.13.2	BRA	5.2,5.8	Fluid interactions: Dissolution
IAEA1.13.3	BAF	5.2,5.7	Fuid interactions: Brine pockets
IAEA3.1.3	BAF	5.4,5.2	Thermal effects: Fluid pressure, density, viscosity changes
IAEA3.1.4	89F	5.4.5.2	Thermal effects: Fluid migration
PGA4.1	FF	5.2	Direct alterations in hydrogeology
SK14.2.3	BAF		Extreme channel flow of oxidants and nuclides
SK42.5	BAF	5.2	Changes of groundwater flow
SK5.1	BAE	5.2	Saline (or fresh) groundwater intrusion
SKI5.46	F	5.2	Groundwater recharge/discharge
SKI6.13	<u> </u>	5.4,5.2	Geothermally induced flow
UKN1.5.3	F 1	5.2	Recharge to groundwater
UKN1.5.4	R.	5.2	Groundwater discharge (to surface water, to springs, to soils, to wells, to marin
UKN1.5.5	F	5.2	Groundwater flow (Darcy, non-Darcy, intergranular fracture, channelling and pr
UKN1.5.6	F	5.2	Groundwater conditions (saturated/unsaturated)
UKN2.1.5	FF (5.1.5.2	Dewatering of host rock
UKN3,1.4	I FF i	5.2	Induced hydrological changes (fluid pressure, density convection, viscosity)
HMIP1.5.4	BAF	5.2	Saturated groundwater flow
HMIP2.2.1	F		Changes in geometry and driving forces of the flow system
	·		Groundwater flow
		5.2	
HMIP2.2.3	889L	5.7.5.2	Changes in groundwater chemistry and flow direction
HMIP2.3.7			
HMIP2.3.7 HMIP2.3.11	BAR	5.5,5.2	Gas induced groundwater transport
HMIP2.3.7	BARL F	<u>5.5,5.2</u> 5.2	Recharge to groundwater
HMIP2.3.7 HMIP2.3.11			
HMIP2.3.7 HMIP2.3.11 NEA1.5.3	F	5.2	Recharge to groundwater

IDENTIFIER	CATEGORY	CON CODE	FEP NAME
5.3	Physical/mec		
DOE1.5.1.2	T F	5.2,5.3	Changes in moisture content due to stress relief
DOE2.26.1	HF -	5.3	Repository-induced seismicity
DOE2262	RG	5.3	Externally-induced seismicity
DOE2263		5.3	Natural seismicity
SNL6.3	<u> </u>		Thermally induced Stress/Fracturing in Host Rock
	F	5.4,5.3	Excavation-Induced Stress/Fracturing in Host Rock
SNL6.4		5.3	
UKN1.2.9	<u> </u>	5.3	Fault activation
UKN3.1.1	<u> </u>	5.3	Differential elastic response
UKN3.1.2	<u> </u>	5.3	Non-elastic response
UKN3.1.3	l #	5.3	Host rock fracture aperture changes
			T
5.4	Thermal effect		
AECL227	F	5.4,5.2	Geothermal gradient effects
DOE1.6.1	I #	5.4	Differential elastic response
DOE1.62	<u> F</u>	5.4	Non-elastic response
DOE2.3.6	89F	5.4.5.2	Variations in groundwater temperature
DOE2.4.13.2	BAF	5.4,5.2	Naturally thermally-induced groundwater transport
IAEA3.1.1	H I	5.4	Thermal effects: Differential elastic response
IAEA3.1.2	F I	5.4	Thermal effects: Non-elastic response
IAEA3.1.3	BAF	5.4,5.2	Thermal effects: Fluid pressure, density, viscosity changes
IAEA3.1.4	89F	5.4.5.2	Thermal effects: Fluid micration
PGA3.7.4	F	5.4	Differing thermal expansion of host rock zones
PGA3.8	T F	5.4	Thermal convection
SK16.13		5.4.5.2	Geothermally induced flow
SNL63	- 		Thermally Induced Stress/Fracturing in Host Rock
UKN1.5.9	BAF		Natural thermal effects
HMIP2.3.12	689		Thermal effects on hydrochemistry
NEA1.5.9			Natural thermal effects
NCA 1.3.9		3.4	indulaç urbindi circus
5.5	Gas effects a		1
AECL2.26	F I		
	And the owner of the		Gases and gas transport
AECL2.42			Methane
DOE1.2.6.5	÷*		Gas transport into and through the far-field
SK16.2	BAF		Gas transport
UKN1.6.4	BRA		Gas mediated transport
UKN1.8.5	BAR	5.5.5.9	Multiphase flow and gas driven flow
HMIP1.2.6	BAF		Gas transport
HM!P2.1.9	<u> </u>		Effects of natural gases
HMIP2.3.10	BAFL		Transport of active gases
HMIP2.3.11	BRA	5.5,5.2	Gas induced groundwater transport
NEA1.2.13	RF		Natural gas intrusion
NEA1.6.4	BAR	5.5,5.9	Gas mediated transport
NEA1.6.5	SRFL	5.5,5.9	Multiphase flow and gas-driven flow
5.6	Nicrobiologica	l/biological	activity
AECL2.43	F	5.6	Microbes
DOE1.6.6.2	WORF	5.6	Microbial activity
DOE1.6.6.3	WERF		Microbiological effects due to Microbial product reactions
	BAR.	5.6,5.9	Transport of radionuclides bound to microbes
OE2.4.11.1		5.6,5.9	Gas transport solution
OE2.4.11.2	BAR		Gas transport gas phase
OE24.12	BTF		Gas-induced groundwater transport
PGA3.14	BAR		Microbiological phenomena/effects
JKN1.7.7	WBRFL		Microbial interactions
MIP2.3.9			Transport of radionucides bound to microbes
	897		
-MIP2.3.13	BAR.	5.6.5.7	Biogeochemical changes

PAGE 2

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IDENTIFIER	CATEGORY	CON CODE	FEPNAME
5.7	Geochemical		
AECL231	F		Groundwater composition change
DOE1.6.5.5		<u> </u>	Chemical changes due to Complex formation
DOE1.6.5.6			Chemical changes due to Colloid production
DOE1.6.5.7	89		
			Chemical changes due to Solubility
DOE1.6.5.8	<u>89F</u>		Chemical changes due to Sorotion
DOE1.5.5.9	<u>987</u>		Chemical changes due to Species equilibrium
DOE2.4.6	- 79		Fracture mineralisation
DOE24.14	<u> </u>		Biogeochemical changes
IAEA1.13.3	BAF		Fluid interactions: Brine pockets
PGA1.11	<u> </u>		Weathering, mineralisation
PGA1.12	<u> </u>	5.7	Groundwater changes
PGA3.12.2	<u>i ff</u>	5.7	Geochemical changes in host rock
PGA3.13	BRFL	5.7	Physico-chemical phenomena/effects (eg. colloid formation)
SK14_1.1	BAR	5.7	Oxidizing conditions
SKI4.1.2	BRFL	5.7	pH-deviations
SK15.25	F	5.7	Dissolution of fracture fillings/precipitations
SK16.3	<u> </u>		Far field hydrochemistry - acids, oxidants, nitrate
SKI6.6	F		Weathering of flow paths
UKN1.5.7	1 BRF		Saline or freshwater intrusion
UKN1.5.8	87		Effects at saline-treshwater interface
UKN1.6.11	HE I		Fracture mineralisation and weathering
UKN1.5.14	WCBRF		
	<u>.</u>		Chemical gradients (electrochemical effects and osmosis)
UKN1.7.5	WBRFL		Chemical transformations
UKN3.2.4	<u> </u>		Non-radioactive solute plume in geosphere (effect on recox, effect on pH, sor
HMIP2.3.7	BRA		Changes in groundwater chemistry and flow direction
HMIP23.13	BRFL		Biogeochemical changes
NEA1.5.7	<u> </u>		Saline or freshwater intrusion
NEA1.5.8	<u> </u>	5.7	Effects at saline-freshwater interface
NEA1.6.11	<u> </u>	5.7	Fracture mineralisation
NEA1.6.14	889		Chemical gradients (electrochemical effects and osmosis)
NEA3.2.3	- FF	5.7	interactions of waste and repository materials with host materials (electrochen
5.8	Radionuciide	chemistry	
AECL2.10	F	5.8	Complexation by organics
AECL2.25	F	5.8	Fulvic acid
AECI2.32	F	5.8	Humic acid
AECL2.46	F	5.8	Precipitation - dissolution
AECL2.58	F	5.8	Sorption
AECL2.59	F		Sorption - non-linear
AECL2.60	F		
DOE1.6.5.5	BAF	······································	Chemical changes due to Complex formation
DOE1.5.5.6	 BRF		Chemical changes due to Colloid production
DOE1.6.5.7	897		Chemical changes due to Solubility
DOE1.6.5.8			Chemical changes due to Solution
DOE1.5.5.9			Chemical changes due to Sorpaon
			Solubility: effects of pH and En
DOE2.4.4.1	BRA.		
DOE2.4.4.2			Solubility: effects of ionic strength
DOE2.4.4.3	BAR		Solubility: effects of naturally-occurring complexing agents
DOE2.4.4.5			Solubility: effects of naturally-occuring colloids
DOE2.4.4.7	<u>i </u>	5.8	Solubility: effects of major ions migrating from the near-field
DOE2.4.4.8		5.8	Solubility: Effects of microbial activity
DOE2.4.5.1	BRA	5.8	Linear sorption
DOE2.4.5.2	BRA.		Non-linear sorption
DOE2.4.5.3		5.8	Reversible sorption
		5.8	Irreversible sorption
DOE2.4.5.4	889		
			Sorption: Effects of pH and En
DOE2.4.5.4	388		
DOE2.4.5.4 DOE2.4.5.5 DOE2.4.5.6	388	5.8	Sorption: Effects of pH and En Sorption: Effects of ionic strength
DOE2.4.5.4 DOE2.4.5.5 DOE2.4.5.6 DOE2.4.5.7	3891. 3891. 8891.	5.8 5.8 5.8	Sorption: Effects of pH and En Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents
DOE2.4.5.4 DOE2.4.5.5 DOE2.4.5.6	389. 389. 889. 389.	5.8 5.8 5.8	Sorption: Effects of pH and En Sorption: Effects of ionic strength

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DENTIFIER	CATEGORY	CON CODE	FEPNAME
5.8	Radionuclide	<u>.</u>	
DOE2.4.5.12		5.8	Sorption: effects of major ions migrating from the near-field
DOE2.4.5.13		5.8	Sorption: effects of microbial activity
DOE24.10	BRR	5.8	Isotopic diuton
IAEA1.13.2	BRR	5.2,5.8	Huid interactions: Dissolution
SK14.1.4	BRFL	5.8	Sorption
SKH4.1.6	BRFL	5.8	Reconcentration
SK14.1.9	889	5.8	Complexing agents
SK16.5	389.	5,8	Dilution
SKI7.5	RPL	5.8	Isotopic dilution
UKN1.6.6	BAR	5.8	Solubility limit
UKN1.6.7	BRR	5.8	Sorption (linear/non-linear, reversible/irreversible)
UKN1.6.8	844	5.8	Dissolution, precipitation and crystalisation
UKN1.6.10	8999.	5.8	Complexing agents
UKN1.6.13	BRA	5.8	Mass, isotopic and species dilution
HMIP2.3.4	BRR	5.8	Solubility constraints
HMIP235	BRA.	5.8	Sorption including ion-exchange
HMIP23.6	BRA	5.8	Changes in sorptive surfaces
NEA1.6.6	BAR	5.8	Solubility Smit
NEA1.6.7	BRR.	5.8	Sorption (linear/non-linear, reversible/irreversible)
NEAT.6.8	BRR	5.8	Dissolution, precipitation, and crystallisation
NEA1.6.10	BRR	5.8	Complexing agents
NEA1.6.13	889 B	5.8	Mass, isotopic and species dilution
	Radionuclide		
AECL2.15	<u> </u>	5.9	Diffusion
AECL2.17	F	5.9	Dispersion
AECL2.39	F	5.9	Matrix diffusion
DOE2.4.1	89F		Advection
DOE2.4.2.1	84	5.9	Bulk diffusion
DOE2422	<u>89F</u> _	5.9	Matrix diffusion
DOE2.4.3	BAF		Hydrodynamic dispersion
DOE2.4.9	BAR	5.6.5.9	Transport of radionuclides bound to microbes
DOE2.4.11.1	BAR		Gas transport solution
SKI4.1.5	BAR	5.6,5.9	Gas transport gas phase
SK162	<u># </u> BBF		Matrix diffusion
SK16.4	887		Dispersion
UKN1.6.1	BAR		Advection and dispersion
UKN1.6.2	888.	5.9	Diffusion
UKN1.6.3	BRR	5.9	Marix diffusion
UKN1.6.4	889		Gas mediated transport
UKN1.6.5	BRR		Multiphase flow and gas driven flow
HMIP126	BFF		Gas ransport
HMIP2.3.1	SRFL		Advection
HMIP2.3.2	888	the second se	Difusion
HMIP233	BAR		Hydrodynamic dispersion
HM1P23.9	BRFL		Transport of radionucides bound to microbes
HMIP2.3.10	6691		Transport of active gases
NEA1.6.1	688.		Advection and dispersion
NEA1.0.2	BRA		Diffusion
NEA1.6.3	BRA		Matrix diffusion
NEA1.6.4	BAR		Gas mediated transport
NEA1.6.5	BARL		Multiphase flow and gas-driven flow

IDENTIFIER	CATEGORY	CON. CODE	FEPNAME
5.10	Specific facto	rs	
AECL2.4	HF 1	5.10	Borehole seal failure/open poreholes
AECL2.6	HIF	5.10	Boreholes - unsealed
AECL2.9	F	5.10	Colloid formation
AECL2.47	i F i	5.10	Pseudo-colloids
AECL2.52	F	5.10	Rock properties - undetected features
AECL2.56	F	5.10	Shait seal failure
AECL2.66	HF :	5.10	Vault closure (incomplete)
AECL2.67	BF?	5.10	Vauk heating effects
DOE2.3.4.5	. AF	5.10	Inorganic coloid transport: Porous media
DOE2.3.5.1	69F	5.10	Inorganic colloid transport: Effects of pH and Eh
DOE2.3.5.2	BRF :	5.10	Inorganic colloid transport: Effects of ionic strength
DOE2.4.7.1	BRR_	5.10	Organic colloid transport in Porous media
DOE2.4.7.2	BRAL	5.10	Organic colloid transport in Fractured media
DOE2.4.7.3	BRP.	5.10	Organic colloid transport: Effects of pH and Eh
DOE2.4.7.4	BRFL	5.10	Organic colloid transport: Effects of ionic strength
DOE2.4.8.1	BRA	5.10	Inorganic colloid transport: Porous media
DOE2.4.8_2	BRFL	5.10	Inorganic colloid transport: Fractured media
DOE2.4.8.3	889L	5.10	Inorganic colloid transport: Effects of pH and Eh
DOE2.4.8.4	3991	5.10	Inorganic colloid transport: Effects of ionic strength
DOE4.1.1.1	RP_	5.10	Borehole seal failure
DOE4.1.1_2	87_	5.10	Borehole seal degradation
IAEA2.2.1	FF .	5.10	Inadequate design: Shaft sezl failure
IAEA2.2.2	AFL	5.10	Inadequate design: Exploration borehole seal failure
SK14_2.3	69	5.2.5.10	Extreme channel flow of oxidants and nuclides
SKI5.11	FF	5.10	Degradation of hole- and shaft seals
SKI5.45	F F	5,10	Colloid generation and transport
SK!6_1	F	5.10	Undetected fracture zones
SK16_12	. F	5.10	Undetected discontinuities
SNL6.2	RFL	5.10	Shaft and Borehole Seal Degradation
UKN1.2.12	FG	5,10	Undetected features (e.g. faults, fracture networks, shear zones, brecciation, g
UKN1.6.9	BRFL	5.10	Colloid formation, dissolution and transport
UKN2.1.2	RFL I		Investigation borehole seal failure and degradation
UKN2.1.3	FF I		Shaft or access tunnel seal failure and degradation
HMIP2.3.8	BPR_ I	5.10	Colloid transport
HMIP5.1.1	RR.	5.10	Loss of integrity of borehole seals
NEA1.6.9	889		Colloid formation, dissolution, and transport

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CONSOLIDATED FEPS LIST FOR BIOSPHERE

DENTHER	FEP NAME	COMMENT
& BIOSPHEI	9E	
6.1	Human considerations	living conditions (space heating), land use
ô.2	Ecological factors	plants, animals
6.3	Soil/sediment effects	terrestrial sediment, including organic component, peat
6.4	Surface/near-surface water processes	groundwater discharge
6.5	Coastal water/ocean processes	including deep ocean sediment
6.6	Gas effects	
6.7	Microbiological/biological activity	bioturbation,
ô.8	Geochemical regime (general)	chemical gradients & kinetics, redox potential, thermochemical
6.9	Radionuclide chemistry	solubility, speciation, sorption, complex formation
6.10	Radionuclide transport processes	advection, dispersion, diffusion
6.11	Radiological factors	critical group, wind, air suspension, irrigation
6.12	Specific factors	smoking, shaft/borehole seal failure, undetected leatures

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IDENTIFIER	CATEGORY	CONL CODE	FONAUE
	Human consi		
AECL3.19	HL HL		Charcoal production
AECL3.49	HL		Fish farming
AECL3.54			Game ranching
			Heat storage in lakes or underground
			Space heating
	HL.		Urbanization on the discharge site
10000.100		• · · · · · · · · · · · · · · · · · · ·	Greenhouse-induced Ecological effects
	<u> </u>		Intrusion in accumulation zone in the biosphere
NEA2.4.6			Land use changes
NEA2.4.7		·	Agricultural and fisheries practice changes
NEA2.4.8	HL		Demographic change, urban development
		Contraction of the contraction of	and a second state of the second second second second and a second second second second second second second s
6_2	Ecological ta	ctors	
AECI.3.3			Animal grooming and fighting
AECL3.4	ι <u>ι</u> Ι L	-	Animal soil ingestion
AECL3.5	L		Animals' diets
AECL3.54	HL	·······	Game ranching
AECL3.63		· · · · · · · · · · · · · · · · · · ·	Houseplants
AECL3.78			Plant root systems
AECL3.86	L		Scavengers and predators
AECL3.107	L		Tree sap
			Greenhouse-induced Ecological effects
DOE3.1.2.5			Glacial/interclacial cycling: Ecological effects
DOE3.4.1.1	L	,	Terrestrial ecological development: Agricultural systems
DOE3.4.1.2		<u> </u>	Terrestrial ecological development. Semi-natural systems
DOE3.4.1.3	-		Terrestrial ecological development. Sekirkadiai systems
DOE3.4.1.4	ι <u>ι</u>		Terrestrial ecological development: Effects of succession
DOE3.4.2	! L		Terrestrial ecological development. Estuarine
DOE3.5.10.1			Plants: Root uptake
DOE3.5.10.2			Plants: Deposition on surfaces
DOE3.5.10.3	L L		Plants: Vapour uptake
DOE3.5.10.4			Plants: Internal translocation and retention
DOE3.5.10.5	L		Plants: Washoft and leaching by rainfall
DOE3.5.10.6	L	·	Plants: Leaf-tail and senescence
DOE3.5.10.7	L	· · ·	Plants: Cycling processes
DOE3.5.11.1			Animals: Uptake by ingestion
DOE3.5.11.2	L		Animals: Uptake by initialation
DOE3.5.11.3	l L	6.2	Animais: Internal translocation and retention
DOE3.5.11.4	L L	+	Animais: Cycling processes
DOE3.5.11.5	L	-	Animals: Effects of relocation and migration
	HL	6.1.6.2.6.12	Intrusion in accumulation zone in the biosphere
	GL		Precipitation, temperature and soil water balance
	i L		Plant uptake
UKN1.7.2	L L		Animal uptake
UKN1.7.3			Uptake by deep rooting species
NEA1.7.1	L		Plant uptake
NEA1.7.2	<u> </u>		Animal uptake
NEA1.7.3	<u> </u>		Uptake by deep rooting species
NEA1.7.8	<u> </u>		Ecological change (e.g. forest fire cycles)
NEA1.7.9			Ecological response to climate (e.g. desert formation)
NEA1.7.10	1 1		Plant and animal evolution

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DENTIFIER	CATEGORY	CONLCODE	FEP NAME
6.3	Soll/sedimen	t effects	
AECL3.16	1 L	6.3	Capillary rise in soil
AECt3.65	1 1	6.3,5.11	iHuman scillingestion
AECL3.71	i L	6.3	Honic exchange in soil
AECL3.72	<u>}</u>	6.3	Irrigation
AEC13.75	I HL	6.3,6.4	Outdoor spraying of water
AECL3.88	I L	6.3.5.4	Sediment resuspension in water bodies
AECL3.89	i L	6.3	Sedimentation in water bodies
AECL3.93	† <u> </u>	6.3	Sol
AECL3.94	<u> </u>	6.3	Soil depth
AECL3.95	L L	6.3	Soil leaching
	<u> </u>		
AECL3.96		6.3.6.8	I Soil porewater pH
AECL3.97	<u> </u>	6.3.6.9	Soil sorption
AECL3.98	<u> </u>	6.3	Soli type
DOE3.5.2.1	L	6.3,6.4	Groundwater discharge to soils: Advective
DOE3.5.2.2	L	6.3.6.4	Groundwater discharge to sois: Diffusive
DOE3.5.2.3	<u>1 L</u>	6.3.6.4	Groundwater discharge to soils: Biotic
DOE3.5.2.4	<u> </u>	6.3.6.4	Groundwater discharge to soils: Volatilisation
DOE3.5.3	<u> </u>	6.3,6.4	Groundwater discharge to wells or springs
DOE3.5.4	<u>; L</u>	6.3,6.4	Groundwater discharge to freshwaters
SK17.1	<u> </u>	6.3	Accumutation in sediments
SK172	L	6.3	Accumulation in peat
UKN1.6.12	L	6.3	Accumulation in soils and organic debris
UKN1.7.4	L	6.3	Soil and sediment bioturbation
UKN1.7.5	L	6.3	Pedogenesis
UKN2.4.5	L	6.3,6.8	Altered soil or surface water chemistry
HMIP4.1.7		6.3,6.4	Groundwater discharge to soils and surface waters
HMIP4.2.1	· L	6.3	Soil moisture and evaporation
HMIP4.2.3	L		Sediment transport including bioturbation
HMIP4.2.4	L		Sediment/water/gas interaction with the atmosphere
NEA1.6.12	L		Accumulation in soils and organic debris
NEA1.7.4	L		Soil and sediment biotration
NEA1,7.5	L		Pedooenesis
NEA2.4.5	HL	6.3	Altered soil or surface water chemistry
	issa san na sa		· · · · · · · · · · · · · · · · · · ·
	Surface/near-s	urface water	DIDCESSES
VECI.2.16	H	6465	Discharge zones
AECL2.16	<u> </u>		Discharge zones
AECL3.52	L	6.4	Flushing of water bodies
AECL3.52 AECL3.75	<u> </u>	6.4 6.3.5.4	Flushing of water bodies Outdoor spraying of water
AECL3.52 AECL3.75 AECL3.84	L HL L	6.4 6.3.6.4 6.4	Flustring of water bodies Outdoor spraying of water Runoff
AECL3.52 AECL3.75 AECL3.84 AECL3.88		6.4 6.3.5.4 6.4 6.3.6.4	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100	E HL L L	6.4 6.3.5.4 6.3.6.4 6.3.6.4 6.4	Flusting of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.101		6.4 6.3.5.4 6.3.6.4 6.3.6.4 6.4 6.4 6.4	Flusting of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water oH
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.101 AECL3.112	<u>E</u> <u>H1</u> <u>L</u> <u>L</u> <u>H1</u>	6.4 6.3.6.4 6.3.6.4 6.3.6.4 6.4 6.4 6.4 6.4.5	Flusting of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water oH Water source
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.101 AECL3.112 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	E HL L L HL HL	6.4 6.3,6.4 6.4 6.3,6.4 6.4 6.4 6.4 6.4 6.4 6.4	Flustning of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water bodies Surface water pH Water source Near-surface runoff processes: Overland flow
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.101 AECL3.112 XXE3.32.1 XXE3.32.2	L HL L L HL HL L	6.4 6.3.6.4 6.4 6.3.6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water bodies Surface water oble Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.101 AECL3.112 DOE3.3.2.1 DOE3.3.2.2 DOE3.3.2.3		6.4 6.3.6.4 6.3.6.4 6.3.6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4	Flusting of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water ohl Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.101 AECL3.112 DOE3.32.1 DOE3.32.2 DOE3.32.3 DOE3.32.4		6.4 6.3.6.4 6.3.6.4 6.3.6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4	Flusting of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water oH Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Macropore flow
AECL3.52 AECL3.75 AECL3.75 AECL3.88 AECL3.100 AECL3.101 AECL3.111 AECL3.112 AECL3.122 DOE3.32.1 DOE3.32.2 DOE3.32.3 DOE3.32.5		6.4 6.3,6.4 6.4 6.3,6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4	Flusting of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water bodies Surface water bodies Surface water bodies Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Wariable source area response
AECL3.52 AECL3.75 AECL3.75 AECL3.88 AECL3.100 AECL3.101 AECL3.112 ODE3.3.2.1 DOE3.3.2.3 DOE3.3.2.4 DOE3.3.2.5 DOE3.3.4.1		6.4 6.3,6.4 6.4 6.3,6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4 6.4	Flusting of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water bodies Surface water bodies Surface water bodies Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Macropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestiwater): Stream/river flow
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.100 AECL3.100 AECL3.100 OE3.3.2.1 DOE3.3.2.2 DOE3.3.2.3 DOE3.3.2.4 DOE3.3.2.4 DOE3.3.4.1 DOE3.3.4.2		6.4 6.3.5.4 6.3.6.4 6.4	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water oH Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Macropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestinwater): Stream/river flow Surface flow characteristics (frestinwater): Sediment transport
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.100 AECL3.100 DEG3.32.1 DOE3.32.2 DOE3.32.4 DOE3.32.4 DOE3.32.4 DOE3.3.4.1 DOE3.3.4.3		6.4 6.3,6.4 6.3,6.4 6.4	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water bodies Surface water oH Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Macropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestrivater): Stream/river flow Surface flow characteristics (frestrivater): Mander migration or other fluvial response
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.100 AECL3.100 AECL3.100 OE3.3.2.1 DOE3.3.2.2 DOE3.3.2.3 DOE3.3.2.4 DOE3.3.2.4 DOE3.3.4.1 DOE3.3.4.2		6.4 6.3,6.4 6.3,6.4 6.3,6.4 6.4	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water bodies Surface water oH Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Macropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestrivater): Stream/river flow Surface flow characteristics (frestrivater): Meander migration or other fluvial resurface flow characteristics (frestrivater): Lake formation/sectimentation
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.100 AECL3.100 DEG3.32.1 DOE3.32.2 DOE3.32.4 DOE3.32.4 DOE3.32.4 DOE3.3.4.1 DOE3.3.4.3		6.4 6.3,6.4 6.3,6.4 6.3,6.4 6.4	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water bodies Surface water oH Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Macropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestrivater): Stream/river flow Surface flow characteristics (frestrivater): Meander migration or other fluvial response
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.101 AECL3.101 AECL3.101 OE33.2.1 OE33.2.2 OE33.2.3 OE33.2.4 OE33.2.4 OE33.4.1 OE33.4.2 OE33.4.3 OE33.4.4		6.4 6.3,6.4 6.3,6.4 6.3,6.4 6.4	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water bodies Surface water oH Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Nacropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestrivater): Stream/river flow Surface flow characteristics (frestrivater): Meander migration or other fluvial resurface flow characteristics (frestrivater): Lake formation/sectimentation
AECL3.52 AECL3.75 AECL3.75 AECL3.88 AECL3.88 AECL3.100 AECL3.101 AECL3.101 AECL3.112 XOE33.22 XOE33.23 XOE33.24 XOE33.25 XOE33.24 XOE33.24 XOE33.4.2 XOE33.4.2 XOE33.4.4 XOE33.4.5		6.4 6.3,6.4 6.3,6.4 6.3,6.4 6.4	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water obdies Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Macropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestrivater): Stream/river flow Surface flow characteristics (frestrivater): Stream/river flow Surface flow characteristics (frestrivater): Meander migration or other fluvial re Surface flow characteristics (frestrivater): Lake formation/sedimentation Surface flow characteristics (frestrivater): Effects of sea_level change
AECL3.52 AECL3.75 AECL3.75 AECL3.88 AECL3.100 AECL3.101 AECL3.101 AECL3.112 DOE3.32.1 DOE3.32.2 DOE3.32.3 DOE3.32.4 DOE3.34.2 DOE3.34.2 DOE3.34.3 DOE3.34.5 DOE3.34.5 DOE3.3.5.1		$ \begin{array}{r} 6.4 \\ \overline{ 6.3.6.4} \\ \overline{ 6.4} \\ $	Flusting of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water bodies Surface water ohl Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Nacropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestrivater): Stream/river flow Surface flow characteristics (frestrivater): Meander migration or other fluvial resultace flow characteristics (frestrivater): Lake formation/sectimentation Surface flow characteristics (frestrivater): Effects of sea_level change Surface flow characteristics (estuarine): Tidal cycling
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.100 AECL3.100 AECL3.100 OE33.2.1 OOE33.2.2 OOE33.2.3 OOE33.2.4 OOE33.4.2 OOE33.4.3 OOE33.4.4 OOE33.4.5 OOE33.5.1 OOE33.5.2 OOE33.5.3		$ \begin{array}{r} 6.4 \\ 6.3.6.4 \\ 6.4 \\ $	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water oH Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Macropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestriwater): Stream/river flow Surface flow characteristics (frestriwater): Sediment transport Surface flow characteristics (frestriwater): Lake formation/sedimentation Surface flow characteristics (struarine): Effects of sea level change Surface flow characteristics (estuarine): Sediment transport Surface flow characteristics (struarine): Effects of sea level change Surface flow characteristics (estuarine): Sediment transport Surface flow characteristics (estuarine): Successional development
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.100 AECL3.100 DEG3.32.1 DOE3.32.2 DOE3.32.3 DOE3.32.4 DOE3.32.4 DOE3.3.4.3 DOE3.3.4.3 DOE3.3.4.4 DOE3.3.4.3 DOE3.3.4.1 DOE3.3.4.3 DOE3.3.4.3 DOE3.3.5.1 DOE3.3.5.1 DOE3.3.5.2 DOE3.3.5.4		$\begin{array}{c} 6.4 \\ \hline 6.3, 5.4 \\ \hline 6.3, 6.4 \\ \hline 6.4 \\$	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water bodies Surface water oH Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Macropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestrivater): Stream/river flow Surface flow characteristics (frestrivater): Sediment transport Surface flow characteristics (frestrivater): Lake formation or other fluvial re Surface flow characteristics (frestrivater): Lake formator/sedimentation Surface flow characteristics (estuarine): Tidal cycling Surface flow characteristics (estuarine): Successional development Surface flow characteristics (estuarine): Successional development
AECL3.52 AECL3.75 AECL3.84 AECL3.88 AECL3.100 AECL3.100 AECL3.100 AECL3.100 OE33.2.1 OOE33.2.2 OOE33.2.3 OOE33.2.4 OOE33.4.2 OOE33.4.3 OOE33.4.4 OOE33.4.5 OOE33.5.1 OOE33.5.2 OOE33.5.3		$\begin{array}{c} 6.4 \\ \hline 6.3, 5.4 \\ \hline 6.3, 6.4 \\ \hline 6.3, 6.4 \\ \hline $	Flushing of water bodies Outdoor spraying of water Runoff Sediment resuspension in water bodies Surface water bodies Surface water oH Water source Near-surface runoff processes: Overland flow Near-surface runoff processes: Interflow Near-surface runoff processes: Interflow Near-surface runoff processes: Return flow Near-surface runoff processes: Macropore flow Near-surface runoff processes: Variable source area response Surface flow characteristics (frestriwater): Stream/river flow Surface flow characteristics (frestriwater): Sediment transport Surface flow characteristics (irestriwater): Lake formator/sedimentation Surface flow characteristics (irestrivater): Effects of sea level change Surface flow characteristics (estuarine): Tidal cycling Surface flow characteristics (estuarine): Seciment transport Surface flow characteristics (estuarine): Seciment transport

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DENTFIER	CATEGORY	CONLCODE	FEP NAME
6.4	Surface/near-	surface water	processes (continued)
DOE3.5.2.4	L		Groundwater discharge to soils: Volatilisation
DOE3.5.3	Ł		Groundwater discharge to wells or springs
DOE3.5.4	L		Groundwater r scharge to freshwaters
DOE3.5.7.1			Surface water bodiest Water flow
	L L		Surface water bodiest Suspended sediments
DOE3.5.7.2	· · · · · · · · · · · · · · · · · · ·		
	LL		Surface water bodies: Bottom sediments
DOE3.5.7.4		<u> </u>	Surface water bodies: Effects on vegetation
DOE3.5.7.5			Surface water bodies: Effects of fluvial system development
SKI5.41			Water producing weil
UKN1.3.1	GL	6.2.6.4	Precipitation, temperature and soil water balance
	<u>: FL</u>		Groundwater discharge (to surface water, to springs to soils, to wells, to marin
HMIP4.1.1	: L	6.3.6.4	Groundwater discharge to soils and surface waters
HMIP422	i F	6.4	Surface water mixing
HMIP4.2.4	L	6.3,6.4,6.11	Sediment/water/gas interaction with the atmosphere
HMIP4.3.1	L L	6.4	Terrestria! water use
NEA1.5.1	GL	6.4	River flow and lake level changes
NEA1.5.4	Ł		Groundwater discharge (to surface water, springs, soils, wells, and manne)
	harri a da	'an air an	
6.5	Coastal wate	COCRAD DECCO	55AC
AECL2.16	R.		Discharge zones
AECL3.112			Water source
DOE3.3.6.1	<u> </u>		Coastal waters: Tidal mixing
DOE3.3.6.2	<u> </u>		Coastal waters: Residual current mixing
DOE3.3.6.3	<u> </u>		Coastal waters: Effects of sea level change
DOE3.3.7.1	L	· · · · · · · · · · · · · · · · · · ·	Ocean waters: Water exchange
DOE3.3.7.2	Ε <u></u>	6.5	Ocean waters: Effects of sea level change
DOE3.4.3	<u>i L</u>	6.5	Coastal waters
DOE3.4.4	L	6.5	Oceans
DOE3.5.5	L	6.5	Groundwater discharge to estuaries
DOE3.5.6	L	6.5	Greunowater discharge to coastal waters
DOE3.5.8.1	L		Estuaries: Water flow
DOE3582	1		Estuaries: Suspended sediments
DOE3.5.8.3	L		Estuaries: Bottom sediments
DOE3.5.8.4	L		Estuaries: Effects of salinity variation
DOE3.5.8.5	ĩ	· · · · · · · · · · · · · · · · · · ·	Estuaries: Effects on vegetation
DOE3.5.8.6	<u> </u>		Estuaries: Effects of estuarine development
DOE3.5.8.7			Estuaries: Elfects of sea-level change
DOE3.5.9.1	L	<u> </u>	Coastal waters: Water transport
DOE3.5.9.2	<u> </u>		Coastal waters: Suspended sediment transport
DOE3.5.9.3	L		Coastal waters: Bottom sediment transport
DOE3.5.9.4	L		Coastal waters: Effects of sea level change
DOE3.5.9.5	L	6.5	Coastal waters: Effects of estuarine development
DOE3.5.9.6	L L		Coastal waters: Effects of coastal erosion
DOE3.5.9.7	<u> </u>	A COLORED TO A COL	Coastal waters: Effects of sea-level change
HMIP4.3.2	L_L		Estuarine water use
HMIP4.3.3	ίί		Coastal waters and water use
HMIP4.3.4	L	6.5	Seas and water use
6.6	Gas effects		
AECL3.55	L	6.6	Gas leakage into underground living space
AECL3.82	L	6.6	Radon emission
DOE2.4.11.1	BAPL	6.6	Gas transport solution
DOE2.4.11.2		6.6	Gas transport gas phase
UKN1.5.4	BAFL	6.6,6.10	Gas mediated transport
	· · · · · · · · · · · · · · · · · · ·		
UKN1.6.5	BATL	6.6.6.10	Multiphase flow and gas criven flow
HMIP2.3.10	BAR		Transport of active gases
HMIP2.3.11	BAR.	· · · · · · · · · · · · · · · · · · ·	Gas induced groundwater transport
HMIP4.1.3	L	6.6	Gas discharge
	BAR		Gas discharge

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	CAIEGORT	: CONLOODE	FEP NAME
6.7	Microbiologia	<u> </u>	
AECL3.8	L	6.7	Bacteria and microbes (soil)
AECL3.9	T L	6.7	Bioconcentration
AECL3.12	T 1	6.7	Biotoxicity
AECL3.13	<u> </u>	6.7	Bioturbation of soils and sediments
AECL3.15	1 1	6.7	Burrowing animals
	÷	6.7	
DOE2.4.9			Transport of radionuclides bound to microbes
DOE2.4.14		0.1.0.0	Biogeochemical changes
PGA3.14	BHR	6.7	Microbiological phenomena/effects
UKN1.7.7	WBRFL	6.7	Microbial interactions
HMIP2.3.9	BAR	6.7.6.10	Transport of radionuclides bound to microbes
HMIP2.3.13	BAPL	6.7,6.8	Biogeochemical changes
HMIP4_23	<u> </u>	6.3,6.7	Sediment transport including bioturbation
HMIP4.25	Ε.	6.7	Bioaccumulation and translocation
HMIP4.26	[L	6.7,6.8	Biogeochemical processes
NEA1.7.7		6.7	Microbial interactions
	Geochemical		
AECL3.20	<u> </u>	6.8	Chemical precipitation
AECL3.96	<u> </u>	6.3.6.8	Soil porewater pH
DOE2.4.14	RFL	6.7,6.3	Biogeochemical changes
IAEA1.13.2	BAFL	6.8	Fluid interactions: Dissolution
PGA1.11	FL I	6.8	Weathering, mineralisation
PGA3.13	BAFL 1	6.8.6.12	Physico-chemical phenomena/effects (eg. colloid formation)
SKH.1.1	BAPL	6.8	Oxidizing conditions
SKH4.1.2	BAAL	6.8	ott deviations
UKN1.7.5	WERE	6.8	Chemical transformations
UKN2.4.5		6.3.6.8	Altered soil or surface water chemistry
HMIP2.3.7	BAR	6.8	Changes in groundwater chemistry and flow direction
	89991		Themal effects on hydrochemistry and now direction
HMIP2.3.12		6.8	
HMIP2.3.13	<u> </u>	6.7.6.8	Biogeochemical changes
HM204.2.6	i L	6.7,6.8	Biogeochemical processes
NEA1.6.14	BAFL	6.8	Chemical gradients (electrochemics' effects and osmosis)
NEA1.7.6	<u> </u>	6.8	Chemical transformations
		·····	1
	Radionuclide		
AECL3.97			Sold scription
DOE2.4.4.1	8971		Solubility: effects of pH and Eh
DOE2.4.42		6.9	Solubility: effects of ionic strength
DOE2.4.4.3	BARL	5.9	Solubility: effects of naturally-occurring complexing agents
DOE2.4.4.5			
	BAR.		Solubility: effects of naturally-occuring colloids
OCE2.4.4.8	89972. 89973.	6.9	Solubility: Effects of microbial activity
OOE2.4.4.8 OOE2.4.5.1	8971. 8971. 8971.	6.9 6.9	Solubility: Effects of microbial activity
OCE2.4.48 OCE2.4.5.1 OCE2.4.5.2	877. 877. 877. 877.	6.9	Solubility: Effects of microbial activity
OOE2.4.4.8 OOE2.4.5.1	8971. 8971. 8971.	6.9 6.9 6.9	Solubility: Effects of microbial activity
OCE2.4.48 OCE2.4.5.1 OCE2.4.5.2	877. 877. 877. 877.	6.9 6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	8771 8771 8771 8771 8771 8771	6.9 6.9 6.9 6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	8471 8471 8471 8471 8471 8471 8471 8471	6.9 6.9 6.9 6.9 6.9 6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Irreversible sorption
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	847. 847. 847. 847. 847. 847. 847.	6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Irreversible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength
DOE2.4.4.8 DOE2.4.5.1 DOE2.4.5.2 DOE2.4.5.3 DOE2.4.5.4 DOE2.4.5.5 DOE2.4.5.6 DOE2.4.5.7	877. 877. 877. 877. 877. 877. 877. 877.	6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption kreversible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	887. 887. 877. 877. 877. 877. 877. 877.	6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Inversible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	887. 887. 887. 887. 887. 887. 887. 887.	6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Inversible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of naturally-occurring colloids
OOE2.4.4.8 OOE2.4.5.1 OOE2.4.5.2 OOE2.4.5.3 OOE2.4.5.4 OOE2.4.5.5 OOE2.4.5.6 OOE2.4.5.8 OOE2.4.5.8 OOE2.4.5.10 OOE2.4.5.10	BFR.	6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Sorption: Effects of pH and Eh Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: effects of naturally-occurring colloids Sorption: effects of microbial activity
DOE2.4.4.8 DOE2.4.5.1 DOE2.4.5.2 DOE2.4.5.3 DOE2.4.5.4 DOE2.4.5.5 DOE2.4.5.6 DOE2.4.5.7 DOE2.4.5.8 DOE2.4.5.10 DOE2.4.5.13 DOE2.4.5.13	BFL BFL SFL	6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Kreversible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: effects of naturally-occurring colloids Sorption: effects of microbial activity Isotopic dilution
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DE2.4.48 DOE2.4.51 DOE2.4.52 DOE2.4.53 DOE2.4.54 DOE2.4.55 DOE2.4.56 DOE2.4.57 DOE2.4.58 DOE2.4.510 DOE2.4.510 DOE2.4.510 DOE2.4.510 DOE2.4.510 DOE2.4.510 DOE2.4.511 DOE2.4.513 DOE2.4.513 DOE2.4.513 DOE2.4.513 MOE2.4.513 MOE2.4.10 KH4.14 KH4.16	SFL	6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Irreversible sorption Sorption: Effects of pH and Eh Sorption: Effects of indic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: effects of microbial activity Isotapic dilution Sorption Reconcentration
DE2.4.48 DOE2.4.51 DOE2.4.52 DOE2.4.53 DOE2.4.54 DOE2.4.55 DOE2.4.56 DOE2.4.58 DOE2.4.510 DOE2.4.5110 DOE2.4.5111 DOE2.4.51110 DOE2.4.51110 DOE2.4.51110 DOE2.4.51110 DOE2.4.51110 DOE2.4.51110 DOE2.4.51110 DOE2.4.5110 DOE2.4.5110 DOE2.4.5110 KI4.1.4 KI4.1.6 KI4.1.9	SFL	6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Sorption: Effects of pH and Eh Sorption: Effects of indic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring inorganic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: effects of microbial activity Isotopic dilution Sorption Reconcentration Complexing agents
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DE2.4.48 DOE2.4.48 DOE2.4.51 DOE2.4.52 DOE2.4.53 DOE2.4.54 DOE2.4.55 DOE2.4.56 DOE2.4.57 DOE2.4.58 DOE2.4.510 DOE2.4.513 DOE2.4.513 DOE2.4.510 DOE2.4.513 DOE2.4.513 DOE2.4.514 DOE2.4.515 DOE2.4.516 DOE2.4.517 DOE2.4.518 DOE2.4.518 DOE2.4.519 DOE2.4.510 DOE2.4.513 DOE2.4.514 DOE2.4.515 DOE2.4.510 DOE2.4.513 DOE2.4.514 DOE2.4.515 DOE2.4.510 DOE2.4.511 DOE2.4.512 DOE2.4.513 DOE2.4.513 DOE2.4.514 DOE2.4.515 DOE2.4.515 DOE2.4.516 DOE2.4.517 DOE2.4.517 DOE2.4.517 DOE2.4.517 <td>BRL BRL BRL</td> <td>6.9 6.9</td> <td>Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Irreversible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: effects of naturally-occurring colloids Sorption: effects of microbial activity Isotopic dilution Sorption Beconcentration Complexing agents Dilution</td>	BRL	6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Irreversible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: effects of naturally-occurring colloids Sorption: effects of microbial activity Isotopic dilution Sorption Beconcentration Complexing agents Dilution
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OOE2.4.4.8 OOE2.4.5.1 OOE2.4.5.2 OOE2.4.5.3 OOE2.4.5.4 OOE2.4.5.5 OOE2.4.5.7 OOE2.4.5.7 OOE2.4.5.7 OOE2.4.5.7 OOE2.4.5.13 OOE2.4.5.14 SKI4.1.4 SKI6.5 KI7.5 IKN1.6.6	BRL	6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Inversible sorption Sorption: Effects of pH and Eh Sorption: Effects of naturally-occuring organic complexing agents Sorption: Effects of naturally-occuring colloids Sorption: effects of naturally-occuring colloids Sorption: effects of microbial activity Isotopic dilution Sorption Reconcentration Complexing agents Dilution Isotopic dilution Solubility limit
DOE2.4.4.8 DOE2.4.5.1 DOE2.4.5.2 DOE2.4.5.3 DOE2.4.5.4 DOE2.4.5.5 DOE2.4.5.6 DOE2.4.5.7 DOE2.4.5.8 DOE2.4.5.8 DOE2.4.5.10 SKH.1.1 SKH.1.1 SKH.1.5 KKN1.5.6 KKN1.5.7 KKN1.6.8	SFL	6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Reversible sorption Sorption: Effects of pH and Eh Sorption: Effects of indic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: Effects of microbial activity Isotopic dilution Sorption Reconcentration Complexing agents Dilution Sotubility Imiti Sorption (Inear/non-linear, reversible/rreversible) Dissolution, precipitation and crystalisation
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	SFL SFL	6.9 6.9 <td>Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption knewsible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: effects of naturally-occurring colloids Sorption: effects of microbial activity Isotopic dilution Sorption Reconcentration Complexing agents Solubility limit Sorption (linear/non-linear, reversible/rreversible) Dissolution, precipitation and crystalisation</td>	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption knewsible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: effects of naturally-occurring colloids Sorption: effects of microbial activity Isotopic dilution Sorption Reconcentration Complexing agents Solubility limit Sorption (linear/non-linear, reversible/rreversible) Dissolution, precipitation and crystalisation
DE2.4.48 DOE2.4.51 DOE2.4.52 DOE2.4.53 DOE2.4.54 DOE2.4.55 DOE2.4.56 DOE2.4.57 DOE2.4.58 DOE2.4.510 DOE2.4.513 DOE2.4.513 DOE2.4.510 DOE2.4.513 DOE2.4.510 KK4.1.4 KK4.1.5 KK1.5 KN1.6.5 KN1.6.10 KN1.6.13	BRL	6.9 6	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Irreversible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of instraily-occurring organic complexing agents Sorption: Effects of instraily-occurring colloids Sorption: effects of instraily-occurring colloids Sorption: effects of instraily-occurring colloids Sorption Reconcentration Complexing agents Dilution Sorption (linear/non-linear, reversible/irreversible) Dissolution, precipitation and crystalisation Complexing agents Mass, isotopic and species citution
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DE2.4.48 DOE2.4.51 DOE2.4.52 DOE2.4.53 DOE2.4.54 DOE2.4.55 DOE2.4.56 DOE2.4.57 DOE2.4.58 DOE2.4.510 DOE2.4.5110 DOE2.4.5120 DOE2.4.5131 DOE2.4.513 DOE2.4.513 NOE2.4.513 KK1.5.5 KN1.6.6 KN1.6.6 KN1.6.10 KN1.6.13 MP2.3.5	BRL	6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Irreversible sorption Sorption: Effects of pH and Eh. Sorption: Effects of inaturally-occurring organic complexing agents Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: effects of naturally-occurring colloids Sorption: effects of microbial activity Isotopic dilution Sorption Reconcentration Complexing agents Dilution Sotopic dilution Solubility limit Sorption, precipitation and crystalisation Complexing agents Dissolution, precipitation and crystalisation Solubility constraints
DE2.4.48 DDE2.4.48 DDE2.4.51 DDE2.4.52 DDE2.4.53 DDE2.4.54 DDE2.4.55 DDE2.4.56 DDE2.4.57 DDE2.4.58 DDE2.4.510 DDE2.4.5110 DDE2.4.513 DDE3.51 KN1.6.613 MIP2.3.6	BRL BRL	6.9 6.9	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Irreversible sorption Sorption: Effects of pH and Eh. Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: effects of naturally-occurring colloids Sorption: effects of microbial activity Isotopic dilution Sorption Sorption Beconcentration Complexing agents Dilution Sotopic dilution Solubility limit Solubility constraints Solubility constraints Solubility constraints Sorption including ion-exchange Changes in sorptive surfaces
XXX XXXX XXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX		6.9 6	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Reversible sorption Sorption: Effects of pH and Eh Sorption: Effects of indic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: Effects of microbial activity Isotopic dilution Sorption Reconcentration Complexing agents Dilution Solubility limit Sorption, linear, reversible/irreversible) Dissolution, precipitation and crystalisation Complexing agents Solubility constraints Sorption including ion-exchange Changes in sorptive surfaces Solubility limit
DOE2.4.4.8 DOE2.4.5.1 DOE2.4.5.2 DOE2.4.5.3 DOE2.4.5.4 DOE2.4.5.5 DOE2.4.5.6 DOE2.4.5.7 DOE2.4.5.8 DOE2.4.5.13 DOE2.4.5.14 SKH1.5 KKN1.6.5 KKN1.6.6 KKN1.6.7 KKN1.6.8 KKN1.6.10 KKN1.6.13 MIP2.3.4 MIP2.3.6 EA1.6.6	SFL SFL	6.9 6	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Kernsible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: Effects of incrobial activity Isotopic dilution Sorption incredient activity Botopic dilution Sorption (linear/non-linear, reversible/irreversible) Dissolution, precipitation and crystalisation Complexing agents Sorption including ion-exchange Changes in sorptive surfaces Solubility limit Sorption including ion-exchange Changes in sorptive surfaces Solubility limit Sorption (linear/non-linear, reversible/irreversible)
DOE2.4.4.8 DOE2.4.5.1 DOE2.4.5.2 DOE2.4.5.3 DOE2.4.5.4 DOE2.4.5.5 DOE2.4.5.6 DOE2.4.5.7 DOE2.4.5.8 DOE2.4.5.8 DOE2.4.5.10 DOE2.4.5.13 DOE2.4.5.10 DOE2.4.5.13 DOE2.4.5.13 DOE2.4.5.14 DOE2.4.5.15 DOE2.4.5.10 DOE2.4.5.13 DOE2.4.5.14 DOE2.4.5.15 DOE2.4.5.10 DOE2.4.5.13 DOE2.4.5.14 DOE2.4.5.15 DOE2.4.5.13 DOE2.4.5.14 KH4.1.6 KKI1.6 KKN1.6.7 KKN1.6.8 KKN1.6.10 KKN1.6.13 MIP2.3.4 MIP2.3.6 EA1.6.6 EA1.6.6		6.9 6	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Reversible sorption Sorption: Effects of pH and Eh Sorption: Effects of indic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: Effects of microbial activity Isotopic dilution Sorption Reconcentration Complexing agents Dilution Solubility limit Sorption, linear/non-linear, reversible/rreversible) Dissolution, precipitation and crystalisation Complexing agents Solubility constraints Sorption including ion-exchange Changes in sorptive surfaces Solubility limit
XXX XXXX XXXX XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	SFL SFL	6.9 6	Solubility: Effects of microbial activity Linear sorption Non-linear sorption Reversible sorption Kernsible sorption Sorption: Effects of pH and Eh Sorption: Effects of ionic strength Sorption: Effects of naturally-occurring organic complexing agents Sorption: Effects of naturally-occurring colloids Sorption: Effects of incrobial activity Isotopic dilution Sorption incredient activity Botopic dilution Sorption (linear/non-linear, reversible/irreversible) Dissolution, precipitation and crystalisation Complexing agents Sorption including ion-exchange Changes in sorptive surfaces Solubility limit Sorption including ion-exchange Changes in sorptive surfaces Solubility limit Sorption (linear/non-linear, reversible/irreversible)

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DENTFIER	CATEGORY	CON CODE	FEP NAME
	Radionuclide		
AECL3.38	L		Deposition (wet and dry)
AECL3.41			Dispersion
SK16.4		·	Dispersion
UKN1.6.1			Advection and dispersion
UKN1.6.2	BAA.		Diffusion
UKN1.6.3			Matrix diffusion
UKN1.6.4	899		
UKN1.6.5	899.		Gas mediated transport
			Multiphase flow and gas driven flow
HMIP2.3.1	BRFL		Advection
HMIP2.3:2	BAR		Diffusion
HLAP233	BAR		Hydrodynamic dispersion
HMIP2.3.9	BAR		Transport of radionuclides bound to microbes
HMIP23.10	899		Transport of active gases
HMIP2.3.11	BAA		Gas induced groundwater transport
NEA1.6.1	899		Advection and dispersion
NEA1.6.2	BAR.		Diffusion
NEA1.5.3	BAFL		Matrix diffusion
NEA1.6.4	BARL		Gas mediated transport
NEA1.6.5	BRFL	6.6.6.10	Multiphase flow and gas-driven flow
	(* 11. in 11		
6.11 -	Radiological	factors	
AECL3.14	1 L	6_11	Building materials
AECL3.17	i L	6.11	Carcasses
AECL3.18	L	6.11	Carcinogenic contaminants
AECL3.26	L	6.11	Convection, turbulence and diffusion (atmospheric)
AECL3.28	! L	6.11	Critical group - agricultural labour
AECL3.29	L	6.11	Critical group - clothing and home furnishings
AECL3_30	I L	,	Critical group - evolution
AECL3.31	L		Critical group - house location
AECL3.32	L		Critical group - individuality
AECL3.33	<u> </u>		Critical group - leisure pursuits
AECL3.34	L		Critical group - pets
AECL3.3			Dermal sorption - nuclides other than tritium
AEC13.5	L	<u> </u>	Household dust and fumes
AECLS	L		Human diet
AECL3.65	L L		Human soil ingestion
AECL3.79	L		Precipitation (meteoric)
AECL3.81	WL?		Radiotoxic contaminants
AECL3.91	HL.		Showers and humidifiers
AECL3.99	HL		Space heating
AECL3.102	<u> </u>		Suspension in air
AECL3.102			Tree sap
AECL3.107 AECL3.114			Wind
		<u> </u>	
DOE3.6.1.1			External exposure: Land
DOE3.6.1.2	÷		External exposure: Sediments
DOE3.6.1.3	L	· · · · ·	External exposure: Water bodies
DOE3.6.2.1			Ingestion and Drinking water
DOE3.6.2.2	<u> </u>		Ingestion and Agricultural crops
DOE3.6.2.3	<u> </u>		Ingestion and Domestic animal products
DOE3.6.2.4			Ingestion and Wild plants
DOE3.6.2.5	<u> </u>	6.11	Ingestion and Wild animals
	<u> </u>	6.11	Ingestion and Soils and sediments
DOE3.5.3.1	L	6.11	Inhalation and Soils and sectments
DOE3.5.3.2	÷		Inhalation and Gases and vapours (indoor)
DOE3.6.3.3	~	5.11	Inhatation and Gases and vapours (outdoor)
DOE3.6.3.4	L	6.11	Inhalation and Biotic material
DOE3.6.3.5	L	6.11	Inhalation and Salt particles
	HL	6.4.6.11	Water producing well
SK15.41			
SKI5.41	<u> </u>	6.3.6.4.6.11	Sediment/water/gas interaction with the atmosphere
SK15.41 HMIP4.2.4	<u>ι</u> ι		External exposure
SK15.41 HMIP4.2.4		6.11	

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DENTFIER	CATEGORY	CONL CODE	FEP NAME
5.12	Specific fact	ors	
AECL3.25	L	6.12	Colloids
AECL3.57	G	6.12	Greenhouse (food production)
AECL3.92	HL_	6.12	Smoking
DOE2.4.7.1	BAPL	6.12	Organic colloid transport in Porous media
DOE2_4.7.2	3FFL	6.12	Organic colloid transport in Fractured media
DOE2.4.7.3	BARL	6.12	Organic colloid transport Effects of pH and Eh
DOE2.4.7.4	BHFL	6.12	Organic colloid transport. Effects of ionic strength
DOE2.4.8.1	BRFL	6.12	inorganic colloid transport: Porous media
DOE2.4.8.2	BAR	6.12	Inorganic colloid transport. Fractured media
DOE2.4.8.3	BARL	6.12	Inorganic colloid transport: Effects of pH and Eh
DOE2.4.8.4	899.	6.12	Inorganic colloid transport: Effects of ionic strength
DOE4.1.1.1	AFL.	6.12	Borehoie seal failure
DOE4.1.1.2	HRL	6.12	Borehole seal degradation
AEA222	HR.	6.12	Inadequate design: Exploration borehole seal failure
PGA3.13	BAR	6.8,6.12	Physico-chemical phenomena/effects (eg. colloid formation)
SKI7.3	H	6.1,6.2,6.12	Intrusion in accumulation zone in the biosphere
SNL6.2	HFL	6.12	Shaft and Borehole Seal Degradation
UKN1.6.9	BRFL.	6.12	Colloid formation, dissolution and transport
UKN2.1.2	FFL.	6.12	Investigation borehole seal failure and degradation
HMIP2.3.8	BAR	6.12	Colloid transport
HMIPS.1.1	HFL	6.12	Loss of integrity of borehole seals
NEA1.6.9	BAR.		Colloid formation, dissolution, and transport
NEA2.4.8	H	6.1,6.12	Demographic change, urban development

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CONSOLIDATED FEPS LIST FOR GEOLOGY/CLIMATE

DENTIFIER	FEP NAME	COMMENT
7. GEOLOG	V/CLIMATE CHANGES	
7.1	Seismic events/major land movement	including uplift, subsidence
7.2	Rock deformation	faults, fractures
7.3	Metamorphic processes	
7.3 7.4	Erosion/weathering (surface)	including denudation and topography effects, land slide
7.5	Groundwater flow and effects	including denudation and topography effects, land slide
7.6	Surface water flow and effects	
7.7	Sea level effects	
7.8	Magnetic effects	
7.9	Glaciation/glacial effects	including permatrost
7.10	Climate effects (natural)	general effects, including extremes
7.11	Specific factors	greenhouse-induced climate effect, undetected features, gas effects, ge

DENTFER	CATEGORY	CONL CODE	FEPNAME
7.1	Seismic eve	nts/major land	movement
AECL1.31	G	7.1	Eantiquakes
AECL220	G	7.1	Earthquakes
AECL2.36	G	7.1	Isostatic rebound
AECL3.44	<u> </u>	7.1	Earthquakes
DOE2.2.1.1	G		Uplift
	G		
DOE2.2.1.2		7.1	Subsidence
DOE2.26.2	HFG	7.1	Externally-induced seismicity
DOE2.2.6.3	FG	7.1	Natural seismicity
DOE4.1.3.1	<u> </u>	7.1	Subsidence and fault/fracture induction
IAEA1.1	G		Climatic change
IAEA1.14.3	G		Upint/Subsidence: Isostatic
PGA2.1	<u> </u>		Earthquakes
SK!5.15	<u> </u>		Eanhquakes
SNL27	<u> </u>		Tsunamis
SNL2.8	G	7.1	Regional Subsidence or Uplifit (also applies to subsurface)
SNL3.2	G		Seismic Activity
UKN1.2.6	G	7.1	Uplifit and subsidence (e.g. orogenic, isostatic)
UKN1.2.8	G		Seismicity
HMIP2.1.6	G	7.1	Seismicity
HMIP3.1.2	G		Natural climate change
NEA1.2.6	G		Uplift and subsidence (orogenic, isostatic)
NEA1.2.8	G		Seismicity
7.2	Rock deform	ation	
AECL2.23	G		Faulting
DOE1.4.6	G		Fracturing
DOE2.2.1.3	G G		Lateral and/or vertical flexure
DOE2.2.7.1	G		Faulting/racturing: Activation
DOE2.2.7.2	G		Faulting/fracturing: Generation
DOE2.2.7.2	G		Faulting/fracturing: Change of properties
DOE2.27.3 DOE2.2.8	G		
	<u> </u>		Major incision
IAEA1.11			Faulting/seismicity
PGA2.6	G		Movements at faults
PGA27	<u> </u>		Formation of new faults
SK14.2.6			Faulting
SKI5.16	G		Uplift and subsidence
SNL3.6	G		Formation of Interconnected Fracture Systems
SNL3.7	G		Faulting
UKN1.2.9		·	Fault activation
UKN1.2.10	G		Fault generation
HMIP2.1.7	G		Faulting/tracturing
HMIP21.8	G	7.2	Major incision
NEA1.2.9	G	7.2	Fault activation
NEA1.2.10	G	7.2	Fault generation
		, in the second s	
7.3	Metamorphic	processes	
AECL2.40	G		Metamorphic activity
DOE2.2.3.1	G		Contact metamorphism
DOE2.2.3.2	G		Regional metamorphism
DOE2.2.3.3	G		Dislocation metamorphism
PGA1.10	<u>G</u>		Metamorphosis
JKN1.2.4	<u>G</u>		Wetamorphic activity
-MIP21.3	G		Metamorphism
EA1.24	<u> </u>	7.3	Netamorphic activity

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DENTFER	CATEGORY	CON CODE	EP NAME
	Erosion/weat		
AECL2.21	G	7.4	
AECL2.61	G	7.4	Topography - current
AECL2.62	- <u>G</u>		Topography - future
AECL3.45	G		Erosion - lateral transport
DOE2.2.9	G	7.4	Weathering
DOE3.2.1.3	G	7.4	Generalised denudation: Glaciat
DOE3.2.1.3		7.4.7.9	Localised denudation: Glacial
DOE3.2.4.2	G	7.4.7.7	Coastal erosion due to sea-level change
DOE3.5.1.3	·		Erosion: Giacial
	G	7.4	Denudation
IAEA1.5	<u>; G</u>	7.4.7.6	Stream erosion
IAEA1.6	G	7.4.7.9	Glacial erosion
IAEA1.8	G		ISedimentation
		7.4	
PGA1.3	G	7.4	Erosion (fluvial and glacial)
PGA1.4	G	7.4	Sedimentation
SKI5.26	G	7.4	Erosion on surface/sediments
SNL21	G	7.4	Erosion/Sedimentation
UKN1.4.1	G	7.4	Land slide
UKN1.4.5	G	7.4	Freshwater sediment transport and deposition
	<u> </u>	7.4	Coastal erosion and estuarine development
UKN1.4.7	G	7.4	Marine sediment transport and deposition
UKN1.4.8	G	7.4	Frost weathering and solifluction
UKN1.4.9	<u>: G</u>	7.4	Chemical denudation and weathering
UKN1.4.10	G	7.4	Frost weathering
HMIP2.4.1	G	7.4	Generalised denudation
HMIP2.4.2	G	7.4	Localised denudation
NEA1.4.1	G	7.4	Land slide
NEA1.4.9	G	7.4	Chemical denudation and weathering
NEA1.4.10	G	7.4	Frost weathering
7.5	Groundwater	flow and effe	ets
DOE2.3.1	i G	7.5	Variation in groundwater recharge
DOE2.3.2	G	7.5	Groundwater losses (direct evaporation, springflow)
IAEA1.2	G	7.5,7.6	Hydrological change
IAEA2.6	G	7.5,7.6	Large-scale hydrological change
7.6	Surface wate	r flow and eff	
AEA1.2	G	7.5.7.6	Hydrological change
IAEA1.5	G		Stream erosion
AEA1.7	· · · · · · · · · · · · · · · · · · ·	7.6,7.10	
IAEA2.6	G	7.5,7.6	Large-scale hydrological change
UKN1.3.1		7.6.7.10	Precipitation, temperature and soil water balance
UKN1.3.2	G		Extremes of precipitation, snow melt and associated flocding
UKN1.5.1	1	7.6	River flow and lake level changes
NEA1.3.1	G		Precipitation, temperature, and soil water balance
NEA1.5.1	G.		River flow and lake level changes
7.7	Sea-level effe	×ts	
DOE3.1.1.3		7.7,7.11	Greenhouse-induced Sez level rise
DOE3.1.1.3	G	7.7.7.9	Glacial/interglacial cycling: Sea level changes (rise/fail)
DOE3.1.2.3 DOE3.2.4.2		7.4.7.7	Coastal erosion due to sea-level change
		7.7	Soil moisture and evaporation due to sea-level change
IAEA1.3	·	7.7	Sea level change
PGA12		7.7	Sea-level changes
SK15.31	G	7.7	Change in sealevel
SNL2.4	G	7.7	Sea-Level Variations
UKN1.3.4	G	7.7	Sea-level rise/fail
NEA1.3.4	G	7.7	Sea-level rise/fall

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DENTFIER		CONL CODE	
7.8	Magnetic effe	ects	
AECL2.38	G	7.8	Machetic poles
AECL3.50	G	7.8	Flipping of earth's magnetic poles
SKI5.20	G	7.8	Changes of the magnetic field
UKN1.2.2	G	7.8	Changes in the Earth's magnetic field
NEA1.2.2	G	7.8	Changes in the Earth's magnetic field
20 0 0820920, 2016			
7.9	Glaciation/gla	cial effects	l
AECL1.41	G	7.9	Glaciation
AECL2.28	G	7.9	Glaciation
AECL3.56	G	7.9	Glaciation
DOE3.1.2.1	G	7.9	Glacial/interglacial cycling: Precipitation
DOE3.1.2.7	G	7.9	Glacial/interglacial cycling: Temperature
DOE3.1.2.2 DOE3.1.2.3	G	7.7.7.9	Glacial/interglacial cycling: Sea level changes (rise/fall)
	a a	7.9	Glacial/interglacial cycling: Ecological effects
DOE3.1.2.5			Glacial/interglacial cycling: Seasonally frozen ground
DOE3126	G	7.9	Glacial/interglacial cycling: Permanently frozen ground
DOE3.1.2.7	G	7.9	
DOE3.1.2.8	G	7.9	Glacial/interglacial cycling: Glaciation
DOE3.1.2.9	G	7.9	Glacial/interglacial cycling: Deglaciation
DOE3.1.2.10	G	7.9	Glacial/interglacial cycling: Potential evaporation
DOE3.1.3.1	G	7.9.7.11	Glacial/interglacial exit: greenhouse gas induced
DOE3.1.3.2	G	7.9	Glacial/interglacial exit due to other causes
DOE3.2.2.3	G	7.4,7.9	Localised denudation: Glaciat
DOE3.2.3.3	G	7.9	Sediment redistribution: Glacial
DOE3.5.1.3	G	7.4.7.9	Erosion: Glacial
IAEA1.6	G	7.4.7.9	Glacial ercsion
SKI5.17	G	7.9	Permafrost
SK15.22	GR	7.9.7.11	Accumulation of gases under permatrost
SK15.42	G	7.9	Glaciation
SK16.10	G		No ice age
SNL22	G	7.9	Glaciation
UKN1.3.5	G		Periglacial effects (eg. permafrost, high seasonality)
	G	7.9	Glaciation (erosion/deposition, glacial loading, hydrogeological change)
UKN1.3.6	G		Exit from glacial/interglacial cycling
HMIP3.1.3			Periglacial effects (permatrost, high seasonality)
NEA1.3.5	G	7.9	Glaciation (ercsion/deposition, glacial loading, hydrogeological change)
NEA1.3.6	G	7.9	
NEA1.3.7	G	7.9,7.10	No ice age
7.10	Climate effec		
AECL1.14	G	7.10	Climate change
AECL2.8	G	7.10	Climate change
AECL3.22	G		Climate
AECL3.23	G	7.10	Climate - evolution
IAEA1.1	G	7.10	Climatic change
IAEA1.7	G	7.6,7.10	Flooding
IAEA2.5	G	7.10	Climatic change (including climate control)
PGA1.1	G	7.10	Climate changes
SKI6.10	G	7.9,7.10	No ice age
SNL23	G	7.10	Pluvial Periods
UKN1.1.2	G	7.10	Solar insolation
UKN1.3.1	GL	7.6,7.10	Precipitation, temperature and soil water balance
UKN1.3.2	G	7.6,7.10	Extremes of precipitation, snow melt and associated flooding
UKN1.3.7	G	7.10	No ice age
	<u></u>		Natural climate change
HMIP3.1.2	<u> </u>	7.10	
HMIP3.1.3	G	7,9,7.10	Exit from glacial/interglacial cycling
HMIP3.1.4	G	7.10	Intensification of natural climate change
NEA1.1.2	G	7.10	Solar insolation
NEA1.3.1	G	7.6.7.10	Precipitation, temperature, and soil water balance
NEA1.3.2	G	7.10	Extremes of precipitation, snow melt and associated flooding

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DENTFIER	CATEGORY	CONL CODE	FEP NAME
7.11	Specific fact	ors	
AECL2.29	G	7_11	Greenhouse effect
AEC1.3.57	GL	7.11	Greenhouse (food production)
AECL3.58	G	7.11	Greenhouse effect
AECL3.59	G	7.11	Groundshine, treeshine
AECL3.114	GL	7.11	Wind
DOE2.2.10	G	7.11	Effects of natural gases
DOE2.2.11	G	7.11	Geothermal effects
DOE3.1.1.1	G	7.11	Greenhouse induced Precipitation
DOE3.1.1.2	G	7.11	Greenhouse-induced Temperature
DOE3.1.1.3	G	7.7.7.11	Greenhouse-induced Sea level rise
DOE3.1.1.5	םי ו	7.11	Greenhouse-induced Ecological effects
DOE3.1.1.6	G	7.11	Greenhouse-induced Potential evaporation
DOE3.1.3.1	G	7.9,7.11	Glacial/interglacial exit: greenhouse gas induced
AEA1.12	G	7.11	Geochemical change
IAEA1.15.1	G	7.11	Undetected features: Faults, shear zones
IAEA1.15.2	G	7.11	Undetected features: Breccia pipes
IAEA1.15.3	G	7.11	Undetected leatures: Lava tubes
IAEA1.15.4	G	7.11	Undetected features: Intrusive dykes
IAEA1.15.5	G	7.11	Undetected features: Gas or brine pockets
SK15.22	GR	7.9,7.11	Accumulation of gases under permafrost
SK15.43	: GR	7.11	Methane intrusion
SNL27	G	7.1,7.11	Tsunamis
UKN1.2.11	G	7.11	Rock heterogeneity (e.g. permeability, mineralogy) affecting water and gas flo
UKN1.2.12	R3	7.11	Undetected features (e.g. faults, tracture networks, shear zones, brecciation, s
UKN2.4.9	HG	7.11	Anthropogenic climate change (greenhouse effect)
HMIP3.1.1	HG	7.11	Human induced climate change
NEA1.2.11	G	7.11	Rock heterogeneity (permeability, mineralogy), affecting water and gas low
NEA1.2.12	G	7.11	Undetected features (faults, fracture networks, shear zones, brecciation, gas (
NEA2.4.9	НG	7.11	Anthropogenic climate change (greenhouse effect)
	;		
IAEA1.14.1	G	XXXX	Uplift/Subsidence: Orogenic
IAEA1.14.2	G	XXXX	Uplift/Subsidence: Epeirogenic

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CONSOLIDATED FEPS LIST FOR HUMAN INFLUENCES

DENTHER	FEP NAME	COMMENT
8. HUMAN I	MFLLIENCES	
8.1	Inadvenent intrusion	drilling (boreholes), archaeological investigations
8.2	Surface activities	iland/earth moving, land use practices (non-agricultural)
8.3	Subsurface activities	tunneling, underground construction, injection of liquid wastes
8.4	Water use	groundwater abstaction (wells), industrial, geothermal
8.5	Agricultural and fisheries practices	charcoal production, farming
8.6	Radiological factors	ismoking, transport agents,
8.7	Specific factors	shaft/borehole seal failure, undetected features, urbanisation, loss of records

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HUMAN FACTORS CATEGORY: SCREENED FEPs LIST (sorted)

DENTFER	CATEGORY	CONLOODE	FEP NAME
8.1	Insdvertent	intrusion	
AECL1.52		i 8.1	Intrusion (human)
AECI25	H	8.1	Boreholes - exploration
AECL3.70	н	8.1	Intrusion (inadventent)
DOE4.2.3	н	8.1	Exploratory drilling
DOE4.2.10	<u> </u>		Archaeological investigations
	<u> </u>		
IAEA2.8.1	<u> </u>	8.1	Inadventent future intrusion: Exploratory drilling
IAEA2.3.2	н		Inadvenent luture intrusion: Archaeological exhumation
IAEA2.8.3	H	8.1	Inadventent future intrusion: Resource mining (mineral, water, hydrocarbon, ge
PGA4.3.2	<u> </u>	8.1	Drilling: in hest rock
SKI5.21	<u> </u>		Future boreholes and undetected past boreholes
SKI5.36	<u> </u>	8.1	Reuse of boreholes
SK15.37	н	8.1	Archaeological intrusion
SKI7.3	<u>HL</u>	8.1	Intrusion in accumulation zone in the biosphere
SNL4.1	÷ H	8.1	Inadvenent Intrusions: Explosions
SNL4.2	Н	8.1	Inadvertent Intrusions: Drilling
SNL4.4	н	8.1	Inadvertent Intrusions: Injection Wells
SNL4.5	н	8.1	Inadvertent Intrusions: Withdrawal Wells
UKN23.3	н	8.1	Exploratory drilling
UKN2.3.9	н	8.1	Archaeological Investigation
HMIP524		8.1	Accidental intrusion
NEA2.3.3	<u>н</u>	8.1	Exploratory critting
NEA2.3.9	<u> </u>	8.1	Archaeological investigation
INCAL 3.9	An	; 0.1	A CHRONOYCAI HIVESUYAINII
8.2	Surface activ		<u>}</u>
AECL2.19	H	8.2	Earthmoving
SKI7.7	<u> </u>	8.2	Human induced changes in surface hydrology
SKT7.8	<u> </u>	<u> </u>	Altered surface water chemistry by humans
SNL5.1	H		Hydrologic Stresses: Imigation
SNL52	<u>н</u>		Hydrologic Stresses: Damming of Streams or Rivers
UKN2.4.6	<u> </u>	8.2	Land use changes
NEA2.4.5	<u> </u>	8.2,8.4	Altered soil or surface water chemistry
NEA2.4.6	HL.	8.2	Land use changes
8.3	Subsurface	activities	
AECL214	HF	8.3	Dewatering
AECL2.69	н	8.3	Wells
AECL2.70	н	8.3	Wells (high demand)
AECL3.60	HL		Heat storage in lakes or underground
DOE4.2.5	н	8.3	Geothermal energy production
DOE4.2.7	Н	8.3	Tunnelling
DOE4.2.8	н	8.3	Construction of underground storage/disposal tacilities
DCE4.2.9	Н	8.3	Construction of underground dwellings/shelters
DOE4.2.3	<u>н</u>	8.3	Injection of liquid wastes
PGA4.2	<u> </u>	8.3	injection of liquid waste
PGA4.4	н	8.3	Geothermal energy production in crystalline rock
SKI5.28	<u> </u>	8.3	Underground dwellings
SKI5.34	<u> </u>	8.3	Geothermal energy production
UKN2.3.5	<u> </u>	8.3	Geothermal energy production
UKN2.3.7	<u> </u>	8.3	Tunnelling
UKN2.3.8	<u>н</u>	8.3	Underground construction
UKN2.3.10	<u>н</u>	8.3	Injection of liquid wastes
NEA2.3.5	н	8.3	Geothermal energy production
NEA2.3.7	н	8.3	Tunneling
NEA2.3.8	н	8.3	Underground construction
NEA2.3.10	н	8.3	Injection of liquid wastes
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HUMAN FACTORS CATEGORY: SCREENED FEPs LIST (sorted)

	CATEGORY	; CONLCODE	
8.4	Water use	4	
AECL3.60	HL	8.3,8.4	Heat storage in lakes or underground
AECL3.67	н	8.4	Industrial use of water
AECL3.75	HL	8.4.8.6	Outdoor spraying of water
AECL3.112	HL	8.4	Water source
DOE4.2.12	н	8.4	Groundwater abstraction
ISKI5.27	Н	3.4	Human induced actions on groundwater recharge
SKI5.41	HL	8.4	Water producing well
SKI7.8	i H	8.2,8.4	Altered surface water chemistry by humans
SNL5.1		8.2.8.4	Hydrologic Stresses: Inigation
		+	Groundwater abstraction
UKN2.3.11	<u> </u>	8.4	
UKN2.4.4	<u> </u>	8.4,8.5	Irrigation
NEA2.3.11	<u> </u>	8.4	Groundwater abstraction
NEA2.4.4	<u> </u>	8.4.8.5	Irrigation
NEA2.4.5) HL	3.2.8.4	Altered soil or surface water chemistry
			-
8.5	Agricultural		
AECL3.19	<u>HL</u>	8.5	Charcoal production
AECL3.49	HL.	8.5	Fish lanving
AECL3.54	<u>i HL</u>	8.5	Game ranching
UKN2.4.4	H	8.4.8.5	Irrigation
UKN2.4.7	<u> </u> H	8.5	Agricultural and fisheries practice changes
NEA2.4.4	H	8.4.8.5	Irrigation
NEA2.4.7	HL.	8.5	Agricultural and fisheries practice changes
8.6	Radiological	factors	
AECL3.53	н	8.6	Food preparation
AECL3.75	HL	8.4.8.6	Outdoor spraying of water
AECL3.91	HL	8.6	Showers and humidifiers
AECL3.92	HL	8.6	Sunoking
AECL3.99	HL	8.6	Space heating
IAEA2_4.1	н	8.6	Transport agent introduction: Irrigation
IAEA2.4.2	Н	8.6	Transport agent introduction: Reservoirs
IAEA2.4.3	H		Transport agent introduction: Interctional artificial groundwater Recharge or with
IAEA2.4.4	- instance	0.0	
		9.6	Transport agent introduction: Chemical light waste disposal
ancn2.4.4	; H	8.6	Transport agent introduction: Chemical liquid waste disposal
			Transport agent introduction: Chemical liquid waste disposal
8.7	Specific facto	ors	
8.7 AECL2.5	Specific facto	8.7	Boreholes - unsealed
8.7 AECL25 AECL266	Specific facto	8.7 8.7	Boreholes - unsealed Vault closure (incomplete)
8.7 AECL2.5 AECL2.66 AECL3.109	Specific factor HAF HF HL	8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site
8.7 AECL2.5 AECL2.66 AECL3.109 IAEA2.1.1	Specific factor HF HF HL H	8.7 8.7 8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes
8.7 AECL2.5 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2	Specific factor HFF HF HL H H	8.7 8.7 8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine stafts
8.7 AECL2.5 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2	Specific factor HFF HF HL H H H	8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine staffs Non-sealed repository
8.7 AECL2.5 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3	Specific factor HFF HF HL H H H	8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4	Specific factor HFF HF HL H H H H H	8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9	Specific factor HF HL H H H H H H H	8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.3 SKI5.4 SKI5.9 SKI5.21	Specific factor HF HL H H H H H H H H	8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and undetected past boreholes
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.9 SKI5.21 SKI6.8	Specific factor HF HL H H H H H H H H H H	8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI6.8 SKI7.9	Specific factor HF HF H H H H H H H H H H H	8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Ursealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11	Specific factor HF HF H H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Utrsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI6.8 SKI7.9	Specific factor HF HF H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining)
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11	Specific factor HF HF H H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Utrsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11 UKN2.1.1	Specific factor HF HF H H H H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining)
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11 UKN2.1.1 UKN2.2.1	Specific factor HF HF H H H H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eq. boreholes, mining) Radioactive waste disposal error
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI5.9 SKI5.21 SKI5.9 SKI7.11 UKN2.1.1 UKN2.2.1 UKN2.2.2 UKN2.2.4	Specific facto HFF HF H H H H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eq. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI5.9 SKI5.21 SKI5.9 SKI7.11 UKN2.1.1 UKN2.2.1 UKN2.2.2	Specific facto HFF HF HL H H H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Yault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadvertent inclusion of undesirable materials Abandonment of unsealed repository Poor closure
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.9 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11 UKN2.1.1 UKN2.2.1 UKN2.2.1 UKN2.2.2 UKN2.2.4 UKN2.2.9	Specific factor HF HF H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Valit closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadventent inclusion of undesirable materials Abandonment of unsealed repository
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.3 SKI5.3 SKI5.3 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11 UKN2.2.1 UKN2.2.1 UKN2.2.4 UKN2.2.4 UKN2.2.10 UKN2.2.12	Specific factor HF H H H H H H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Yault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadvertent inclusion of undesirable materials Abandonment of unsealed repository Poor closure
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.4 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11 UKN2.2.1 UKN2.2.4 UKN2.2.4 UKN2.2.10 UKN2.2.12 UKN2.2.12 UKN2.2.12	Specific factor HF H H H H H H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Yault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadvenent inclusion of undesirable materials Abandonment of unsealed repository Poor closure Effects of phased operation
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11 UKN2.1.1 UKN2.2.1 UKN2.2.4 UKN2.2.9 UKN2.2.10 UKN2.2.12 UKN2.4.1 UKN2.4.8	Specific factor HF HF H H H H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Yault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadequate backfill or compaction, voidage Inadvenent inclusion of undesirable materials Abandonment of unsealed repository Poor closure Effects of phased operation Loss of records Demographic change, urban development
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11 UKN2.2.1 UKN2.2.1 UKN2.2.9 UKN2.2.10 UKN2.2.12 UKN2.4.1 UKN2.4.9	Specific factor HF HF HF H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Yault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadventent inclusion of undesirable materials Abandonment of unsealed repository Poor closure Effects of phased operation Loss of records Demographic change, urban development Anthropogenic climate change (greenhouse effect)
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.9 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11 UKN2.2.1 UKN2.2.1 UKN2.2.4 UKN2.2.10 UKN2.2.12 UKN2.2.12 UKN2.4.1 UKN2.4.9 	Specific factor HF HF H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Underazation on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine stafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadvenent inclusion of undesirable materials Abandonment of unsealed repository Proor closure Elfects of phased operation Loss of records Demographic change, urban development Anthropogenic climate change Human induced climate change
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKJ5.2 SKJ5.3 SKJ5.4 SKJ5.9 SKJ5.9 SKJ5.9 SKJ5.9 SKJ5.21 SKJ6.8 SKJ7.9 SKJ7.11 UKN2.2.1 UKN2.2.1 UKN2.2.1 UKN2.2.10 UKN2.2.10 UKN2.2.10 UKN2.2.10 UKN2.2.12 UKN2.4.1 UKN2.4.9 HMIP3.1.1 NEA2.1.1	Specific factor HF H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadventent inclusion of undesirable materials Abandonment of unsealed repository Poor closure Effects of phased operation Loss of records Demographic change, urban development Anthropogenic climate change Undetected past intrusions (boreholes, mining)
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI5.9 SKI5.21 SKI5.9 SKI7.9 SKI7.11 UKN2.2.1 UKN2.2.1 UKN2.2.1 UKN2.2.12 UKN2.2.12 UKN2.2.12 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.2 UKN2.4.1 UKN2.4.1 UKN2.4.2 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.2 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.1 SKI5.2 SKI	Specific factor HFF HF H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Valit closure (incomplete) Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadvenent inclusion of undesirable materials Abandonment of unsealed repository Poor closure Effects of phased operation Loss of records Demographic change, urban development Anthropogenic climate change Undetected past intrusions (boreholes, mining) Common cause failures
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI7.11 UKN2.2.1 UKN2.2.1 UKN2.2.1 UKN2.2.12 UKN2.2.12 UKN2.2.12 UKN2.4.1 UKN	Specific factor HE H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Valit closure (incomplete) Undetected past intrusion: Boreholes Undetected past intrusion: Boreholes Undetected past intrusion: Mine stafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadventent inclusion of undesirable materials Abandonment of unsealed repository Poor closure Effects of phased operation Loss of records Demographic change, urban development Anthropogenic climate change Undetected past intrusions (boreholes, mining) Common cause failures Poor quality construction
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.2 SKI5.4 SKI5.9 SKI5.4 SKI5.9 SKI5.21 SKI6.8 SKI7.9 SKI5.21 SKI6.8 SKI7.9 SKI5.21 SKI6.8 SKI7.9 SKI5.21 SKI6.2 UKN2.2.1 UKN2.2.1 UKN2.2.1 UKN2.2.12 UKN2.2.2.12 UKN2.2.2.12 UKN2.2.2.12 UKN2.2.2.12 UKN2.2.2.2 UKN2.2.2 UKN2.2.2 UKN2.2.2 UKN2	Specific factor HE H H H H H H H H H H H H H	8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadventent inclusion of undesirable materials Abandonment of unsealed repository Poor closure Effects of phased operation Loss of records Demographic change, urban development Anthropogenic climate change Undetected past intrusions (boreholes, mining) Common cause failures Poor quality construction Loss of records
8.7 AECL2.6 AECL2.66 AECL3.109 IAEA2.1.1 IAEA2.1.2 SKI5.2 SKI5.3 SKI5.4 SKI5.9 SKI5.21 SKI5.9 SKI7.9 SKI7.11 UKN2.2.1 UKN2.2.1 UKN2.2.1 UKN2.2.1 UKN2.2.10 UKN2.2.12 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.1 UKN2.4.1 UKN2.4.1 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.3 UKN2.4.1 UKN2.4.3 U	Specific factor HE H H H H H H H H H H H H H	8.7 8.7 8.7 8.7	Boreholes - unsealed Vault closure (incomplete) Urbanization on the discharge site Undetected past intrusion: Boreholes Undetected past intrusion: Mine shafts Non-sealed repository Stray materials left Decontamination materials left Unsealed boreholes and/or shafts Future boreholes and undetected past boreholes Human induced climate change Loss of records City on the site Undetected past intrusions, (eg. boreholes, mining) Radioactive waste disposal error Inadequate backfill or compaction, voidage Inadventent inclusion of undesirable materials Abandonment of unsealed repository Poor closure Effects of phased operation Loss of records Demographic change, urban development Anthropogenic climate change Undetected past intrusions (poreholes, mining) Human induced climate change Undetected past intrusions (poreholes, mining) Common cause failures Poor quality construction

HUMAN FACTORS CATEGORY: SCREENED FEP3 LIST (sorted)

DENTFER	CATEGORY	CON COL	E IFEP NAME	
OTHER (not	relevant)			
NEA2.1.2	I HR	XXXX	Investigation borehole seal failure and degradation	
NEA2.1.3	HR	1 XXXX	Shaft or access tunnel seal failure and degradation	
NEA2.1.4	I HR	1 XXXX	Stress field changes, settling, subsidence or caving	
NEA2.1.5	HR	1 2000	Dewatering of host rock	

APPENDIX 6 Final List of FEPs

Appendix 6. Final List of FEPs

The following pages (13) contain the final list of FEPs generated as a result of the audit held at Kemakta on April 21st, 1993. Additions to FEP descriptions, based on discussions during the audit, have been added in parentheses, mainly in UPPER CASE.

The key to the coding (letters) added to the left-hand column of the tables (AUDIT CODE) is given below.

- EFEP A feature, event or process (FEP) which is external to the Process System.
 - F new FEP
 - L new link in the influence diagram
 - L* new link to other parts of the Process System (e.g. far-field, biosphere)

The eight categories have been retained for FEP descriptions. For the biosphere, several FEP descriptions may be combined. Rather than reduce these FEPs to one entry, however, the original descriptions have been retained and 'group' has been added to one of the first two columns. Shading has also been added, where appropriate, to help identify individual groups.

E I	Role of the eventual channeling within the canater (new FEP: PREFERENTIAL PATHWAY
i	Damaged or deviating fuel
	(L Cs-migration to fuel surface
<u> </u>	
1	Colloid formation: wastes
	Waste: specific factors
L_	Columbia pre y filiation
l	Recrystallization
T	xintern laut nintin ytilidulos!
1	Complex formation: wastes
1	Speciation
İ —	Waste: radionucide chemistry
<u>i</u> —	Interactions with corrosion products and waste
<u> </u>	Dissolution chemistry
<u> </u>	Redox potential
<u> </u>	Recrystalization
	xinsm Hout nirthiw yhildulo2
1	Chemical effects: geochemical change
٦	Cremical changes due to gas production
	Chemical changes due to meral conosion
	Complex formation: wastes
,	
	Chemical kinetics (INCLUDE in FEP description)
<u> </u>	Chemical gradients, comosis (INCLUDE in FEP description)
	Waste: geochemical reactions/regime
<u> </u>	Eracturing Eracturing
	Merallic corrosion (pitting/unitom, internal and external agents, gas generation eg. H2)
1	Sitemai conosion due to waste
	Chemical changes due to metal corrosion
<u> </u>	saisem
<u> </u>	
	Saisen conoson
	Source terms (other)
	Source terms (expected)
	Precipitation and dissolution
	Waste degradation/corrosion/discolution
٦	Electrical effects of merial correction
3	Electrochemical gradients
_	Waste: electro-chemical effects
	Thermally induced chemical changes (water chemistry)
	Waste: themo-chemical effects
<u> </u>	
	saprent ynadong lenaid le
	Thermal cracking
	Waste: thermo-mechanical effects
	Badioactive decay, heat
	Waster freet generation
	Hydrogen by metal corresion
	Chemical changes due to gas production
٦	Active methane, carbon dioxide and other active gases
	sases lo notisento?
	Waste: gas generation and effects
	Cass generation: He production
	Recoil of alpha-decay
٦	Insmittinding embuding including including embilitionent
<u> </u>	Satolysis
	Waste: rediological/rediation effects
	Waste: radionuclide decay and growth
	Hererogeneity of waste forms (chemical, physical)
	Knikders leoisynd mai finger
	Ιμαθιτοιλ
	No:14K2254 W2152 21215 212154 DESCRIPTION
300	Weste character (initial): SYSTEM DESCRIPTION

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FINAL FEPS: WASTE CATEGORY

FINAL FEPs: CANISTER

CODE	
	Canister materiels/construction: SYSTEM DESCRIPTION
	Inventory
	Canister: corrosion/degradation processes
ee	Container tailure (early)
	Container failure (long-term)
	Container healing (include in FEP description: corrosion)
	Corrosion (including partial corrosion)
	Pitting
	Precipitation and dissolution
	Radiation damage to container (embrittlement)
	Unitorm corrosion
	Structural container metal corrosion: localised
	Structural container metal corrosion bulk
	Structural container metal corrosion crevice
	Structural container metal corrosion: stress corrosion cracking
	Chemical changes due to metal conosion
	Chemical reactions (copper compsion)
	Role of chlorides in copper corrosion
	Corrosive agents, Sulphides, oxygen etc
	Backfill effects on Cu corrosion
	Swelling of corrosion products
-	Canister: gas production and effects
	Hydrogen: corrosion of container steel
	Gas transport In the waste container
	Canister: microbiological effects/microbial activity
	Canister: thermo-mechanical effects
F	Dittering thermal expansion of canister and backfill
Ľ	Thermal cracking
	Canister: electro-chemical effects
F	Electrochemical gradients
Ŀ	Coupled effects (electrophoresis)
	Natural telluric electrochemical reactions (INCLUDE in FEP description)
	Canister: stress/mechanical effects
Ŧ	
<u> </u>	Canister movement
	Mechanical canister damage (failure)
	Creeping of copper
æ	Stress conceion cracking
	Cracking along welds
	External stress
	Hydrostatic pressure on canister
	Internal pressure
	Swelling of corrosion products
	Canister: geochemical reactions/regime
	Chemical kinetics
	Container corrosion products
	Precipitation and dissolution
	Speciation of corrosion products (INCLUDE in water chemistry)
	Chemical effects: Interactions of waste package and rock
	Chemical gradients (electrochemical effects and osmosis)
	Canister: radionuclide transport through containers
	Release of radionuclides from the failured canister
	Canister: specific factors
	Role of the eventual channeling within the canister (PREFERENTIAL PATHWAY
	Radiation effects on canister
₽₽	

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FINAL FEPs: BUFFER/BACKFILL

AUDIT	
CODE	FEP NAME
	Buffer/backfill characteristics: SYSTEM DESCRIPTION
	Backfill characteristics
	Hydraulic conductivity
	Long-term physical stability
	Buffer/backfill: resalaration/desaturation
	Buffer/backfill: mechanical effects
F	Preferential pathways in the buffer/backfill
	Mechanical effects: local fractures/cracks (PREFERENTIAL PATHWAYS)
	Mechanical failure of buffer/backfill (PREFERENTIAL PATHWAYS)
	Swelling pressure
	Movement of canister in buffer/backfill
	Uneven swelling of bentonite
	Swelling of corrosion products
	Buffer/backfill: thermal effects
	Convection (contaminant transport)
	Hydrothermal alteration
	Variations in groundwater temperature
	Differing thermal expansion (canister-backfill; buffer-host rock)
	Thermal effects on the buffer material
	Soret effect
۲.	Natural thermal effects (temperature LINK to FAR FIELD)
٤*	Thermal effects (eg. concrete hydration: LINK to FAR FIELD)
	Thermo-chemical effects
	Thermal effects and transport (diffusion) effects
	Buffer/backfill: electro-chemical effects
	Natural telluric electrochemical reactions
	Buffer/backfill: gas effects
	Groundwater flow due to gas production
	Gas transport: gas phase and in solution
	Chemical effects: gas generation
_L	Transport of active gases
	Buffer/backfill: microbiological effects/microbial activity
	Buffer/backfill: degradation
	Degradation of the bentonite by chemical reactions
	Coagulation of bentonite
	Radiation effects on bentonite
	Erosion of buffer/backfill

FINAL FEPs: BUFFER/BACKFILL

AUDIT	
CODE	FEP NAME
	Buffer/backfill: geochemical regime
	Chemical gradients (INCLUDE in FEP description: water chemistry)
	Chemical kinetics (INCLUDE in FEP description: water chemistry)
	Precipitation and dissolution
	Chemical changes due to waste degradation (CHEMICAL CHANGES)
L	Chemical changes due to gas production (CHEMICAL CHANGES)
	Chemical changes due to complex formation (CHEMICAL CHANGES)
	Chemical changes due to colloid production (CHEMICAL CHANGES)
	Chemical changes due to sorption (CHEMICAL CHANGES)
	Chemical changes due to speciation (CHEMICAL CHANGES)
F	Isotopic dilution
	Chemical changes due to corrosion
	Saturation of sorption sites
	Effects of bentchite on groundwater chemistry
	Reactions with cement pore water (INCLUDE in chemical degradation)
	Redox front
	Thermochemical changes
	Saline (or fresh) groundwater intrusion
	Effects at saline-freshwater interface
	Changes in groundwater flow direction (INCLUDE in FEP description)
Ł	Biogeochemical changes
	Buffer/backfill: radionuclide transport processes
	Groundwater flow; advection/dispersion (saturated conditions)
L	Diffusion (bulk, matrix, surface)
FLL	Unsaturated transport
	Groundwater flow: fracture
L	Groundwater flow: effects of solution channels (PREFERENTIAL PATHWAYS
	Soret effect
FF	Transport of chemically active substances into the near-field
	Buffer/backfill: radionuclide chemistry
	Precipitation, dissolution, recrystallisation, reconcentration
	Sorption (linear, non-linear, irreversible)
	Speciation
	Solubility effects (pH and Eh; ionic strength, complexing agents, colloids)
	Sorption effects (pH and Eh; ionic strength, complexing agents, colloids)
	Changes in scrptive surfaces
	Transport of radionuclides bound to microbes
	Buffer/backfill: specific factors
FP	
	Colloid transport (inorganic and organic; porous and fractured media)
	Extreme channel flow of exidants and nuclides (PREFERENTIAL PATHWAYS)
EEP	Inadequate backfill or compaction, voidage
	Anion exchange

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CODE	FEP NAME
	Near-field rock: elements/materials: SYSTEM DESCRIPTION
	Inventory
	Vault geometry
	Rock properties (porosity, permeability, hydraulic head, conductivity)
	Near-field cock: degradation
-	Rock property changes (fractures, pore blocking, channel formation/closure)
	Borehole seal failure (including investigation boreholes and shaft/tunnel)
	Borehole seal degradation (including investigation boreholes and shaft/tunnel) Creeping of rock mass
	Subsidence and caving
	Physico-chemical degradation of concrete Near-field rock: hydraulic effects/groundwater flow
FLL	Unsaturated transport
	Groundwater flow due to gas production
-	Groundwater flow (saturated conditions; including fracture flow)
<u> </u>	Groundwater flow: effects of solution channels (PREFERENTIAL PATHWAYS)
<u> </u>	Repository thermally-induced groundwater transport
L	Naturally thermally-induced groundwater transport
	Thermo-hydro-mechanical effects
	Resaturation
	Disturbed zone (hydromechanical) effects
	Saturated groundwater flow
	Changes in groundwater chemistry and flow direction
	Near-field rock: mechanical effects
	Formation of cracks
Ł	Changes in in-situ stress field
i	Changes in moisture content due to stress relief
F	Differential elastic response
F	Non-elastic response
BBP	Repository-induced seismicity
FFP	Externally-induced seismicity
	Differing thermal expansion of host rock zones
972	Uneven swelling of bentonite
	Thermally-induced stress/fracturing in host rock
	Excavation-induced stress/fracturing in host rock
4.5	Near-field rock: thermal effects
1	Convection
i	Hydrothermal alteration
Í	Variations in groundwater temperature
	Thermal effects (e.g. concrete hydration)
,	Thermal effects and transport (diffusion) properties
	Thermal effects on hydrochemistry
	Thermal differential elastic response
	Thermal non-elastic response
	Near-field rock: gas effects and transport
i :	Transport in gases or of gases
	Hydrogen: corrosion of structural steel
-	Methane/CO2 production: effects of microbial growth on properties of concrete
	Gas transport in the near field, as gas phase and in solution
	the sum define at mose under completent
#P	Accumulation of gases under permatrost

AUDIT					
CODE	FEP NAME				
	Near-field rock: microbiological/biological activity				
	Microbial activity				
	Transport of microbes into the near-field				
	Rock property changes: microbial pore blocking				
	Biogeochemical changes				
	Near-field rock: geochemical regime				
	Chemical gradients (INCLUDE in FEP description: water chemistry)				
	Chemical kinetics (INCLUDE in FEP description: water chemistry)				
	Pore blockage: concrete				
	Cement-sulphate reaction: concrete				
	Changes in pore water composition, pH, Eh: concrete				
	Chemical changes due to waste degradation (CHEMICAL CHANGES)				
L	Chemical changes due to gas production (CHEMICAL CHANGES)				
	Chemical changes due to complex formation (CHEMICAL CHANGES)				
	Chemical changes due to colloid production (CHEMICAL CHANGES)				
	Chemical changes due to sorption (CHEMICAL CHANGES)				
	Chemical changes due to speciation (CHEMICAL CHANGES)				
	Fracture mineralisation				
	Fluid interactions: dissolution				
	Chemical effects: interactions of waste package and rock				
	Physico-chemical phenomena/effects (eg. colloid formation)				
	Reconcentration				
	Thermochemical changes				
	Chemical effects of rock reinforcement				
_ ET ₽	Saline (or fresh) groundwater intrusion				
	Effects at saline-freshwater interface				
	Non-radioactive solute plume in geosphere (effect on redox, effect on pH, sorption)				
	Physico-chemical degradation of concrete				
	Changes in groundwater flow direction				
	Near-field rock: radionuclide chemistry				
	Precipitation, dissolution, recrystallisation, reconcentration				
	Sorption (linear, non-linear, irreversible)				
	Speciation				
	Solubility effects (pH and Eh; ionic strength, complexing agents, colloids)				
	Sorption effects (pH and Eh; ionic strength, complexing agents, colloids)				
	Changes in sorptive surfaces				
ļ	Dilution (mass, isotopic, species)				
<u> </u>	Near-field rock: radionuclide transport processes				
<u> </u>	Groundwater flow; advection/dispersion (saturated conditions)				
L	Diffusion (bulk, matrix, surface)				
	Soret effect				
	Transport of radionuclides bound to microbes				
<u>├</u>	Near-field rock: specific factors				
<u> </u>					
	Unmodelled design features				
	Inadequate design: shaft seal and exploration borehole seal failure				
	Open boreholes Extreme channel flow of oxidants and nuclides (PREFERENTIAL PATHWAYS)				
	Poor quality construction				
	Material defects (e.g. early canister failure)				
	Abandonment of unsealed repository				
_999	Effects of phased operations				

FINAL FEPs: FAR-FIELD

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CODE	FEPNAME
	Rock properties: SYSTEM DESCRIPTION
	Rock properties (porosity, permeability, discharge zones, fractures)
	Hydrogeological effects
	Rock property changes (porosity, pemeability, fractures, pore blocking)
	Dewatering
	Geothermal gradient effects
	Salinity effects on flow
	Saturated groundwater flow
	Variations in groundwater temperature
	Gas-induced groundwater transport
	Naturally thermally-induced groundwater transport
	Groundwater recharge
	Thermal effects: fluid pressure, density, viscosity changes
	Thermas effects: fluid migration
HP	Saline (or fresh) groundwater intrusion
	Groundwater conditions (saturated/unsaturated)
	Changes in geometry and driving forces of the flow system
	Changes in groundwater flow direction
	Physical/mechanical effects
HB	Repository-induced seismicity
978	
	Fault activation
F	Differential elastic response
F	Non-elastic response
	Thermal effects
	Geothermal gradient effects
L	Thermal differential elastic response
L	Thermal non-elastic response
	Gas effects and transport
	Gas transport into and through the far-field (gas phase and in solution)
	Multiphase flow and gas driven flow
	Effects of natural gases
	Transport of active gases
	Microbiological/biological activity
	Microbial activity
	Transport of radionuclides bound to microbes
L	Biogeochemical changes

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FINAL FEPs: FAR-FIELD

AUDIT	
CODE	FEPNAME
	Geochemical regime
	Groundwater composition changes (pH, Eh, chemical composition)
	Fracture mineralisation
	Weathering, mineralisation
	Dissolution of fracture fillings/precipitations
Ĺ	Far field hydrochemistry - acids, oxidants, nitrate
88	Saline or freshwater intrusion
88	Effects at saline-freshwater interface
	(Chemical gradients (electrochemical effects and osmosis)
Ŀ	Non-radioactive solute plume in geosphere (effect on redox, effect on pH, sorption
	(LINK to NEAR FIELD)
	Radionuclide chemistry
	Complexation by organics (including humic and fulvic acids)
	Precipitation, dissolution, recrystallisation, reconcentration
	Sorption (linear, non-linear, inteversible)
	Speciation
	Chemical changes due to sorption, complex formation, speciation, gas, solubility
	Solubility effects (pH and Ehr, ionic strength, complexing agents, colloids)
	Sorption effects (pH and Eh; ionic strength, complexing agents, colloids)
	Changes in sorbive surfaces
_	Transport of radionuclides bound to microbes
	Dilution (mass, isotopic, species)
5.9	Radionuclide transport processes
	Groundwater flow, advection/dispersion (saturated conditions)
	Diffusion (bulk, matrix, surface)
FLL	Unsaturated transport
	Groundwater flow; fracture
<u>L</u>	Groundwater flow: effects of solution channels (PREFERENTIAL PATHWAYS)
	Soret effect
	Transport of radionuclides bound to microbes
	Gas-mediated transport
	Specific factors
878P	
	Colloids: formation & effects (including inorganic and organic colloid transport)
EBP	
<u>F</u>	
- G	
- <u>66</u>	Extreme channel flow of oxidants and nuclides

FINAL FEPS: BIOSPHERE

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AUDIT		IFEP NAME
unc		1 considerations
	inumed	Charcoal production
		Space heating
_ 33	1	Land use changes
	(ECOIO	ical factors
	<u> </u>	Animal habits (grooming and fighting, soil ingestion, diets; scavengers/predators)
	·	Houseplants
	<u>}</u>	Tree sap
	<u> </u>	Terrestrial ecological development: natural and agricultural systems
	<u>-</u>	Terrestrial ecological development: Effects of succession
	÷	Terrestrial ecological development: Estuarine
	<u>i</u>	Plants: Root uptake, including deep-rooting species (PLANTS)
	<u>(</u>	Plants: Deposition on surfaces (PLANTS)
	<u> </u>	Plants: Vapour uptake (PLANTS)
	<u> </u>	Plants: Internal translocation and retention (PLANTS)
	<u> </u>	Plants: Washoff and leaching by rainfall (PLANTS)
		Plants: Leaf-tall and senescence (PLANTS)
	1	Plants: Cycling processes (PLANTS)
		Animals: Uptake by ingestion (ANIMALS)
	1	Animals: Uptake by inhalation (ANIMALS)
	1	Animals: Internal translocation and retention (ANIMALS)
	į	Animals: Cycling processes (ANIMALS)
	1	Animals: Effects of relocation and migration (ANIMALS)
		Precipitation, temperature and soil water balance
——	ţ	Ecological change (e.g. forest fire cycles)
۲.	1	Ecological response to climate, including glacial/interglacial cycling (e.g. desert formatix
	1	(LINK IO CLIMATE)
	Soil/se	diment effects
		Capillary rise in soil
	<u> </u>	Soil properties (type, depth, porewater pH, moisture, sorption)
	;	Soil leaching
		lonic exchange in soil
		Sediment resuspension in water bodies
	· · · · · · · · · · · · · · · · · · ·	Sedimentation in water bodies
		Groundwater discharge to soils: advective, diffusive, biotic, volatilisation
		Accumulation in sediments
		Accumulation in soils and organic debris, including peat
		Pedogenesis
		Evaporation of soil moisture
	Curfage	
	3011808	Ineer-surface water processes
!		Groundwater discharge (to surface water, springs, and wells)
		Flushing of water bodies
		Surface water bodies: properties (e.g. pH)
		Near-surface runoff processes: overland flow, interflow, return flow, macropore flow
	Ny series	Near-surface runoff processes: Variable source area response
group		Surface flow characteristics (Testiwater): Streenvitver flow
dionb		Surface llow characteristics (iteshwater). Sediment transport
group		Surface flow characteristics (freshwater): Meander migration or other fluvial response
group		Surface low characteristics (instituter): Lake formation/sedimentation
group		Surface flow characteristics (trestwater). Effects of sea, level change
	group	
i	group	Surface flow characteristics (estuarine): Sediment transport
	group	Surface flow characteristics (estuarine): Successional development
1	group	Surface flow characteristics (estuarine): Effects of sea level change
group	wiedd y	Surface water bodies: Water flow
		Surface water bodies: Suspended sedanecus
ရကာမည္း		Surface water bodies: Botom sediments
group (Surface water bodies: Effects on vegetation
group		ter en la company de Calender Coloria de La Calendar de Calender de Calender de La Calender de Calender de Cale
dtonb dtonb		Surface water bodies: Effects of invite system development
group		Surface water bodies: Effects of finitial system development
dtonb dtonb		Surface water mixing
dtonb dtonb		for the second second second second second second second second second second second second second second second

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FINAL FEPs: BIOSPHERE

AUDIT		
CODE	1	FEP NAME
.	Coastal	water/ocean processes
GTOUD		Coastal waters. Tidal mixing
group		Coastal waters: Resultial current excerc
group		Coastal waters: Effects of sea level change
4		Ocean waters: Water exchange
		Ocean waters: Effects of sea level change
	<u> </u>	Groundwater discharge to estuaries
	<u>i</u>	Groundwater discharge to marine waters including coastal
group		Estuaries. Water flow
dicito.		Estuaries: Suspended sediments
Giono		Estuaries: Bottom sediments
droup		Estuaries: Effects of salinity variation
aroup		Estuartes: Effects on vegetation
group	1.000	Estuanes: Effects of estuarine development
group		Estuaries: Effects of sea level change
•		Coastal waters: Water transport
		Coastal waters: Suspended sediment transport
		Coastal waters: Bottom sediment transport
		Coastal waters: Effects of sea level change
		Coastal waters: Effects of estuarine development
		Coastal waters: Effects of coastal erosion
		Coastal waters: Effects of sea-level change
		Estuarine water use
		Coastal water use
	<u> </u>	Sea water use
	Gas effe	
	1	Gas leakage into underground living space
	i	Radon emission
	i —	Gas transport: gas phase and in solution
		Gas discharge
· •	Microbie	ological/biological activity
	1	Microbial activity
		Bicaccumulation and translocation
	1	Biotoxicity
		Soil and sediment transport including bioturbation
	<u>.</u>	Burrowing animals
		Transport of radionucides bound to microbes
L		Biogeochemical changes
	Geocher	mical regime (general)
	1	Soil and surface water chemistry (pH, Eh)
		Fluid interactions: dissolution, precipitation
		Weathering, mineralisation
	1	Physico-chemical phenomena/effects (eq. colloid formation)
	1	Altered soil or surface water chemistry (pH, Eh)
	<u> </u>	Thermal effects on hydrochemistry
	1	Chemical gradients (electrochemical effects and osmosis)
	Redion	ictide chemistry
	Inderetin	Complexation by organics (including humic and fulvic acids)
		Precipitation, dissolution, recrystallisation, reconcentration
	•	Soption (linear, non-linear, interestible)
		Sorption (invest, non-wreat, ineversione)
		Chamical changes due to sometion complex formation enaniation and coloniality
	<u>.</u>	Chemical changes due to sorption, complex formation, speciation, gas, solubility
		Solubility effects (pH and Eh; ionic strength, complexing agents, colloids)

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FINAL FEPS: BIOSPHERE

CODE	1	FEP NAME
		uclide transport processes
	1	Water flow: advection and dispersion
	1	Diffusion (bulk, matrix, surface)
		Gas mediated transport
	<u> </u>	Transport of active gases: gas phase and in solution
	:	Transport of radionuclides bound to microbes
	Bartiolo	gical factors
	11001010	Building maerials
		Carcasses
	<u> </u>	Carcinogenic contaminants
		Convection, turbulence and diffusion (atmospheric)
00000		Critical group - agricultural labour
Guorab		Critical group - clothing and home lumisitings
dronb		Critical group - evolution
group		Critical group - house location
duorith		Critical group - individuality
group		Critical group - Interforceany Critical group - Leisure pursuals
duonb		
dronb		Critical group - pets Dermal sorption - nuclides other than tritium
		Household dust and fumes
	1	Human det
_		
		Food preparation
	<u> </u>	Human soil ingestion
		Precipitation (meteoric)
		Deposition (wet and dry)
		Radiotoxic contaminants
		Showers and humidifiers
	<u> </u>	Suspension in air
to co área		Wind
dtonb		External exposure: Land External exposure: Sadimonis
dionb		External exposure: Sediments
dronb		External exposure: Water bodies
		ingestion and Drinking water
		Ingestion and Agricultural crops
		Ingestion and Domestic animal products
		Ingestion and Wild plants
		Ingestion and Wild animals
- 10010020021	group	Ingestion and Soils and sediments
group		Inhaiztion and Soils and sediments
group	le se	Inhelation and Gases and vapours (indoor)
dicorib		Inhalation and Gases and vapours (outdoor)
dtorb		Industation and Slotte material
group		Inimation and Salt particles
		Sediment/water/gas interaction with the atmosphere
	Specific	
		Colloids: formation and effects (including inorganic and organic colloid transport)
		Greenhouse-induced ecological effects (including food production)
		Smoking
FFP		Boreholes - unsealed
1		Loss of integrity of borehole seals: seal failure or degradation
æ		Inadequate design: Exploration borehole seal failure
		Intrusion in accumulation zone in the biosphere (animals)

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FINAL FEPS: GEOLOGY/CLIMATE CATEGORY

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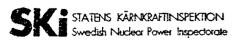
AUDIT	
CODE	
	Seismic events/major land movement
	Earthquakes
	Regional uplift and subsidence (e.g. orogenic, isostatic)
===	Externally-induced seismicity
88	Natural seismicity
	Rock deformation
	Faulting/fracturing: activation
	Faulting/fracturing: generation
	Faulting/iracturing: change of properties
	Major incision
	Movements at faults
	Formation of new faults
	Formation of interconnected fracture systems
	Metamorphic processes
	Erosion/weathering (surface)
	Erosion
	Changes in topography
	Weathering
	Extreme erosion and denudation: glacial-induced (e.g. coastal/stream erosion
	Coastal erosion due to sea-level change
	Erosion: Glacial
	Stream erosion
	Sedimentation
æ	Land side
1.	Freshwater sediment transport and deposition (LINK to BIOSPHERE)
L.	Marine sediment transport and deposition (LINK to BIOSPHERE)
	Solifluction
	Groundwater flow and effects
L.	Variation in groundwater recharge (LINK to BIOSPHERE)
	Surface water flow and effects
	Hydrological change
	Floeding
	Precipitation, temperature and soil water balance
	Show met
	River flow and take level changes
	Sea-level affects
E	Sea level change
	Magnetic effects
HP	Changes in the Earth's magnetic field
	Glaciation/glacial effects
æ	Glaciation
	Glacial/interglacial cycling effects (including sea level changes)
	Permatrost
BB	
	Accumulation of gases under permafrost
89 _	No ice age
	Climate effects (natural)
	Pluvial periods
_ 88	
	Specific factors
ੋਬਲੇ	Anthropogenic climate change (greenhouse effect)
L	Greenhouse-induced effects (e.g. sea level change, precipitation, temp.)
	Wind

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FINAL FEPS: HUMAN CATEGORY

AUDIT	
CODE	
	Inadvertent intrusion into repository
	Archaeological investigations
	Future intrusion: exploratory boreholes
	Reuse of boreholes
- BEP	
878	Explosions
- BEB	
89	Wahdrawal wells
	Surface activities
BB	
L.	Altered soil or surface water chemistry by human activities (LINK to BIOSPHERE)
882	Human induced changes in surface hydrology
FP	Heat storage in lakes
HP	Hydrologic Stresses: inigation
FFP (Hydrologic Stresses: damming of streams or rivers
	Subsurface activities
	Dewatering
	Wells
1	Wells (high demand)
EB	Heat storage underground
FFP i	Geothermal energy production
	Tunnelling
HP	Construction of underground storage/disposal facilities
EE	Construction of underground dwellings/sheiters
BBB	Injection of liquid wastes
ľ	Water use
	Industrial use of water
	Outdoor spraying of water
	Groundwater abstraction
цр	Human induced actions on groundwater recharge
]	Irrigation
FP	Reservoirs
FFP i	Intentional artificial groundwater recharge or withdrawal
	Agricultural and fisheries practices
	Fish farming
	Game ranching
BB	Agricultural and fisheries practice changes
	pecific factors
	Demographic change, urban development
	Undetected past intrusions (boreholes, mining)
EB	Stray materials left
	Decontamination materials left
	Loss of records
	Radioactive waste disposal error
978P (Inadvenent inclusion of undesirable materials



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