

Table C-1. List of features, events, and processes related to the degradation of engineered barriers integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review
Degradation of engineered barriers	1.1.02.03.00	Undesirable materials left	
	1.1.07.00.00	Repository design	
	1.1.08.00.00	Quality control	
	1.1.12.01.00	Accidents and unplanned events during operation	
KTI subissues	1.2.04.04.00	Magma interacts with waste	
TEF1	2.1.01.02.00	Co-disposal/colocation of waste	
TEF2	2.1.02.08.00	Pyrophoricity	
ENFE2	2.1.03.01.00	Corrosion of waste containers	
CLST1	2.1.03.02.00	Stress corrosion cracking of waste containers	
CLST2	2.1.03.03.00	Pitting of waste containers	
CLST6	2.1.03.04.00	Hydride cracking of waste containers	
RDTME3	2.1.03.05.00	Microbially mediated corrosion of waste container	
	2.1.03.06.00	Internal corrosion of waste container	
	2.1.03.08.00	Juvenile and early failure of waste containers	
	2.1.03.10.00	Container healing	
	2.1.03.11.00	Container form	
	2.1.03.12.00	Container failure (long term)	
	2.1.06.07.00	Effects at material interfaces	
	2.1.09.03.00	Volume increase of corrosion products	
	2.1.09.06.00	Reduction-oxidation potential in waste and EBS	
	2.1.09.07.00	Reaction kinetics in waste and EBS	
	2.1.09.08.00	Chemical gradients/enhanced diffusion in waste and EBS	
	2.1.09.09.00	Electrochemical effects (electrophoresis, galvanic coupling) in waste and EBS	
	2.1.10.01.00	Biological activity in waste and EBS	
	2.1.11.01.00	Heat output/temperature in waste and EBS	
2.1.11.04.00	Temperature effects/coupled processes in waste and EBS		
2.1.11.06.00	Thermal sensitization of waste containers increases fragility		
2.1.12.01.00	Gas generation		
2.1.12.03.00	Gas generation (H ²) from metal corrosion		
2.1.12.04.00	Gas generation (CO ² , CH ⁴ , H ² S) from microbial degradation		
2.1.13.01.00	Radiolysis		
2.1.13.02.00	Radiation damage in waste and EBS		

Table C-2. List of features, events, and processes related to the mechanical disruption of engineered barriers integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review
Mechanical disruption of engineered barriers	1.1.02.00.00	Excavation/construction	
	1.1.07.00.00	Repository design	
	1.1.08.00.00	Quality control	
	1.1.12.01.00	Accidents and unplanned events during operation	
	1.2.01.01.00	Tectonic activity - large scale	
KTI subissues	1.2.02.01.00	Fractures	
CLST1	1.2.02.02.00	Faulting	
CLST2	1.2.02.03.00	Fault movement shears waste container	
CLST6	1.2.03.01.00	Seismic activity	
IA2	1.2.03.02.00	Seismic vibration causes container failure	
SDS1	1.2.03.03.00	Seismicity associated with igneous activity	
SDS2	1.2.04.04.00	Magma interacts with waste	
SDS3	2.1.03.02.00	Stress corrosion cracking of waste containers	
SDS4	2.1.03.07.00	Mechanical impact on waste container	
RDTME2	2.1.03.08.00	Juvenile and early failure of waste containers	
RDTME3	2.1.03.11.00	Container form	
	2.1.03.12.00	Container failure (long term)	
	2.1.04.02.00	Physical and chemical properties of backfill	
	2.1.04.03.00	Erosion or dissolution of backfill	
	2.1.04.04.00	Mechanical effects of backfill	
	2.1.04.05.00	Backfill evolution	
	2.1.06.01.00	Degradation of cementitious materials in drift	
	2.1.06.02.00	Effects of rock reinforcement materials	
	2.1.06.03.00	Degradation of the liner	
	2.1.06.05.00	Degradation of invert and pedestal	
	2.1.06.06.00	Effects and degradation of drip shield	
	2.1.07.01.00	Rockfall (large block)	
	2.1.07.02.00	Mechanical degradation or collapse of drift	
	2.1.07.03.00	Movement of containers	
	2.1.07.04.00	Hydrostatic pressure on the container	
	2.1.07.05.00	Creeping of metallic materials in the EBS	
	2.1.07.06.00	Floor buckling	
	2.1.09.03.00	Volume increase of corrosion products	
	2.1.09.12.00	Rind (altered zone) formation in waste, EBS, and adjacent rock	
	2.1.11.05.00	Differing thermal expansion of repository components	
	2.1.11.06.00	Thermal sensitization of waste containers increases fragility	
	2.1.11.07.00	Thermally induced stress changes in waste and EBS	
	2.1.13.02.00	Radiation damage in waste and EBS	
	2.2.01.01.00	Excavation and construction-related changes in the adjacent host rock	
	2.2.01.02.00	Thermal and other waste and EBS-related changes in the adjacent host rock	
	2.2.03.02.00	Rock properties of host rock and other units	
	2.2.10.04.00	Thermo-mechanical alteration of fractures near repository	

Table C-3. List of features, events, and processes related to the quantity and chemistry of water contacting waste packages and waste forms integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review	
Quantity and chemistry of water contacting WPs and waste forms	1.1.02.00.00	Excavation/construction		
	1.1.02.01.00	Site flooding (during construction and operation)		
	1.1.02.02.00	Effects of pre-closure ventilation		
	1.1.03.01.00	Error in waste or backfill emplacement		
	1.1.07.00.00	Repository design		
	1.1.08.00.00	Quality control		
	1.1.12.01.00	Accidents and unplanned events during operation		
	KTI subissues	1.2.02.01.00		Fractures
		USFIC3		1.2.06.00.00 Hydrothermal activity
		USFIC4		1.2.10.01.00 Hydrological response to seismic activity
TEF1		2.1.01.01.00 Waste inventory		
TEF2		2.1.01.02.00 Co-disposal/co-location of waste		
ENFE1		2.1.01.03.00 Heterogeneity of waste forms		
ENFE2		2.1.02.01.00 DSNF degradation, alteration, and dissolution		
ENFE3		2.1.02.02.00 CSNF alteration, dissolution, and radionuclide release		
CLST1		2.1.02.03.00 Glass degradation, alteration, and dissolution		
CLST3		2.1.02.05.00 Glass cracking and surface area		
CLST4	2.1.02.08.00	Pyrophoricity		
	CLST6	2.1.02.09.00 Void space (in glass container)		
	SDS3	2.1.02.10.00 Cellulosic degradation		
	RDTME3	2.1.02.11.00	Waterlogged rods	
		2.1.02.12.00	Cladding degradation before YMP receives it	
		2.1.02.13.00	General corrosion of cladding	
		2.1.02.14.00	Microbial corrosion (MIC) of cladding	
		2.1.02.15.00	Acid corrosion of cladding from radiolysis	
		2.1.02.16.00	Localized corrosion (pitting) of cladding	
		2.1.02.17.00	Localized corrosion (crevice corrosion) of cladding	
		2.1.02.18.00	High dissolved silica content of waters enhances corrosion of cladding	
		2.1.02.19.00	Creep rupture of cladding	
		2.1.02.20.00	Pressurization from He production causes cladding failure	
		2.1.02.21.00	Stress corrosion cracking (SCC) of cladding	
		2.1.02.22.00	Hydride embrittlement of cladding	
		2.1.02.23.00	Cladding unzipping	
		2.1.02.24.00	Mechanical failure of cladding	
		2.1.02.25.00	DSNF cladding degradation	
		2.1.03.05.00	Microbially mediated corrosion of waste container	
		2.1.03.06.00	Internal corrosion of waste container	
2.1.03.08.00		Juvenile and early failure of waste containers		
2.1.03.10.00	Container healing			
2.1.03.11.00	Container form			
2.1.03.12.00	Container failure (long term)			
2.1.04.01.00	Preferential pathways in the backfill			

Table C-3. List of features, events, and processes related to the quantity and chemistry of water contacting waste packages and waste forms integrated subissue (cont'd)

ISI	Primary FEP No.	FEP Description	NRC Review
Quantity and chemistry of water contacting WPs and waste forms (continued)	2.1.04.02.00	Physical and chemical properties of backfill	
	2.1.04.03.00	Erosion or dissolution of backfill	
	2.1.04.05.00	Backfill evolution	
	2.1.04.08.00	Diffusion in backfill	
	2.1.06.01.00	Degradation of cementitious materials in drift	
	2.1.06.02.00	Effects of rock reinforcement materials	
	2.1.06.03.00	Degradation of the liner	
	2.1.06.04.00	Flow through the liner	
	2.1.06.05.00	Degradation of invert and pedestal	
	2.1.06.06.00	Effects and degradation of drip shield	
	2.1.06.07.00	Effects at material interfaces	
	2.1.07.06.00	Floor buckling	
	2.1.08.01.00	Increased unsaturated water flux at the repository	
	2.1.08.02.00	Enhanced influx (Philip's drip)	
	2.1.08.03.00	Repository dry-out due to waste heat	
	2.1.08.04.00	Condensation forms on backs of drifts	
	2.1.08.06.00	Wicking in waste and EBS	
	2.1.08.07.00	Pathways for unsaturated flow and transport in the waste and EBS	
	2.1.08.08.00	Induced hydrological changes in the waste and EBS	
	2.1.08.09.00	Saturated groundwater flow in waste and EBS	
	2.1.08.10.00	Desaturation/dewatering of the repository	
	2.1.08.11.00	Resaturation of repository	
	2.1.09.01.00	Properties of the potential carrier plume in the waste and EBS	
	2.1.09.04.00	Radionuclide solubility, solubility limits, and speciation in the waste form and EBS	
	2.1.09.06.00	Reduction-oxidation potential in waste and EBS	
	2.1.09.07.00	Reaction kinetics in waste and EBS	
	2.1.09.08.00	Chemical gradients/enhanced diffusion in waste and EBS	
	2.1.09.09.00	Electrochemical effects (electrophoresis, galvanic coupling) in waste and EBS	
	2.1.09.10.00	Secondary phase effects on dissolved radionuclide concentrations at the waste form	
	2.1.09.11.00	Waste-rock contact	
2.1.09.12.00	Rind (altered zone) formation in waste, EBS, and adjacent rock		
2.1.10.01.00	Biological activity in waste and EBS		
2.1.11.01.00	Heat output/temperature in waste and EBS		
2.1.11.02.00	Nonuniform heat distribution/edge effects in repository		
2.1.11.03.00	Exothermic reactions in waste and EBS		
2.1.11.04.00	Temperature effects/coupled processes in waste and EBS		
2.1.11.08.00	Thermal effects: chemical and microbiological changes in the waste and EBS		
2.1.11.09.00	Thermal effects on liquid or two-phase fluid flow in the waste and EBS		
2.1.11.10.00	Thermal effects on diffusion (Soret effect) in waste and EBS		

Table C-3. List of features, events, and processes related to the quantity and chemistry of water contacting waste packages and waste forms integrated subissue (cont'd)

ISI	Primary FEP No.	FEP Description	NRC Review
Quantity and chemistry of water contacting WPs and waste forms (cont'd)	2.1.12.01.00	Gas generation	
	2.1.12.02.00	Gas generation (He) from fuel decay	
	2.1.12.03.00	Gas generation (H ²) from metal corrosion	
	2.1.12.04.00	Gas generation (CO ² , CH ⁴ , H ² S) from microbial degradation	
	2.1.12.05.00	Gas generation from concrete	
	2.1.13.01.00	Radiolysis	
	2.2.01.01.00	Excavation and construction-related changes in the adjacent host rock	
	2.2.01.02.00	Thermal and other waste and EBS-related changes in the adjacent host rock	
	2.2.01.03.00	Changes in fluid saturations in the excavation disturbed zone	
	2.2.07.10.00	Condensation zone forms around drifts	
	2.2.07.11.00	Return flow from condensation cap/resaturation of dry-out zone	
	2.2.08.01.00	Groundwater chemistry/composition in UZ and SZ	
	2.2.08.04.00	Redissolution of precipitates directs more corrosive fluids to containers	
	2.2.10.01.00	Repository-induced thermal effects in geosphere	
	2.2.10.04.00	Thermo-mechanical alteration of fractures near repository	
	2.2.10.05.00	Thermo-mechanical alteration of rocks above and below the repository	
	2.2.10.06.00	Thermo-chemical alteration (solubility, speciation, phase changes, precipitation/dissolution)	
2.2.10.10.00	Two-phase bouyant flow/heat pipes		
2.2.10.12.00	Geosphere dry-out due to waste heat		
2.2.11.01.00	Naturally-occurring gases in geosphere		

Table C-4. List of features, events, and processes related to the radionuclide release rates and solubility limits integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review	
Radionuclide release rates and solubility limits	1.1.02.03.00	Undesirable materials left		
	1.1.07.00.00	Repository design		
	1.1.08.00.00	Quality control		
	1.1.12.01.00	Accidents and unplanned events during operation		
	1.2.04.04.00	Magma interacts with waste		
KTI subissues	2.1.01.01.00	Waste inventory		
	ENFE3	2.1.01.02.00		Co-disposal/co-location of waste
	ENFE4	2.1.01.03.00		Heterogeneity of waste forms
	ENFE5	2.1.02.01.00		DSNF degradation, alteration, and dissolution
	CLST3	2.1.02.02.00		CSNF alteration, dissolution, and radionuclide release
	CLST4	2.1.02.03.00		Glass degradation, alteration, and dissolution
	CLST5	2.1.02.04.00		Alpha recoil enhances dissolution
	CLST6	2.1.02.05.00		Glass cracking and surface area
		2.1.02.06.00		Glass recrystallization
		2.1.02.07.00		Gap and grain release of Cs, I
		2.1.02.08.00		Pyrophoricity
		2.1.02.09.00		Void space (in glass container)
		2.1.04.02.00		Physical and chemical properties of backfill
		2.1.04.03.00		Erosion or dissolution of backfill
		2.1.04.05.00		Backfill evolution
		2.1.04.08.00		Diffusion in backfill
		2.1.04.09.00		Radionuclide transport through backfill
		2.1.06.03.00		Degradation of the liner
		2.1.06.04.00		Flow through the liner
		2.1.06.05.00		Degradation of invert and pedestal
		2.1.06.07.00		Effects at material interfaces
		2.1.08.05.00		Flow through invert
		2.1.08.07.00		Pathways for unsaturated flow and transport in the waste and EBS
		2.1.08.08.00		Induced hydrological changes in the waste and EBS
		2.1.08.09.00		Saturated groundwater flow in waste and EBS
		2.1.09.01.00		Properties of the potential carrier plume in the waste and EBS
		2.1.09.02.00	Interaction with corrosion products	
	2.1.09.04.00	Radionuclide solubility, solubility limits, and speciation in the waste form and EBS		
	2.1.09.05.00	In-drift sorption		
	2.1.09.06.00	Reduction-oxidation potential in waste and EBS		
	2.1.09.07.00	Reaction kinetics in waste and EBS		
	2.1.09.08.00	Chemical gradients/enhanced diffusion in waste and EBS		
	2.1.09.10.00	Secondary phase effects on dissolved radionuclide concentrations at the waste form		
	2.1.09.11.00	Waste-rock contact		
	2.1.09.12.00	Rind (altered zone) formation in waste, EBS, and adjacent rock		
	2.1.09.13.00	Complexation by organics in waste and EBS		

Table C-4. List of features, events, and processes related to the radionuclide release rates and solubility limits integrated subissue (cont'd)

ISI	Primary FEP No.	FEP Description	NRC Review
Radionuclide release rates and solubility limits (continued)	2.1.09.14.00	Colloid formation in waste and EBS	
	2.1.09.15.00	Formation of true colloids in waste and EBS	
	2.1.09.16.00	Formation of pseudo-colloids (natural) in waste and EBS	
	2.1.09.17.00	Formation of pseudo-colloids (corrosion products) in waste and EBS	
	2.1.09.18.00	Microbial colloid transport in the waste and EBS.	
	2.1.09.19.00	Colloid transport and sorption in the waste and EBS.	
	2.1.09.20.00	Colloid filtration in the waste and EBS	
	2.1.09.21.00	Suspensions of particles larger than colloids	
	2.1.10.01.00	Biological activity in waste and EBS	
	2.1.11.01.00	Heat output/temperature in waste and EBS	
	2.1.11.02.00	Nonuniform heat distribution/edge effects in repository	
	2.1.11.03.00	Exothermic reactions in waste and EBS	
	2.1.11.04.00	Temperature effects/coupled processes in waste and EBS	
	2.1.11.08.00	Thermal effects: chemical and microbiological changes in the waste and EBS	
	2.1.11.09.00	Thermal effects on liquid or two-phase fluid flow in the waste and EBS	
	2.1.11.10.00	Thermal effects on diffusion (Soret effect) in waste and EBS	
	2.1.12.01.00	Gas generation	
	2.1.12.02.00	Gas generation (He) from fuel decay	
	2.1.12.03.00	Gas generation (H ²) from metal corrosion	
	2.1.12.04.00	Gas generation (CO ² , CH ⁴ , H ² S) from microbial degradation	
	2.1.12.06.00	Gas transport in waste and EBS	
	2.1.12.07.00	Radioactive gases in waste and EBS	
	2.1.12.08.00	Gas explosions	
	2.1.13.01.00	Radiolysis	
	2.1.13.02.00	Radiation damage in waste and EBS	
	2.1.14.01.00	Criticality in waste and EBS	
	2.1.14.02.00	Criticality <i>in-situ</i> , nominal configuration, top breach	
	2.1.14.03.00	Criticality <i>in-situ</i> , WP internal structures degrade faster than waste form, top breach	
	2.1.14.04.00	Criticality <i>in-situ</i> , WP internal structures degrade at same rate as waste form, top breach	
	2.1.14.05.00	Criticality <i>in-situ</i> , WP internal structures degrade slower than waste form, top breach	
	2.1.14.06.00	Criticality <i>in-situ</i> , waste form degrades in place and swells, top breach	
	2.1.14.07.00	Criticality <i>in-situ</i> , bottom breach allows flow through WP, fissile material collects at bottom of WP	
	2.1.14.08.00	Criticality <i>in-situ</i> , bottom breach allows flow through WP, waste form degrades in place	
	2.1.14.09.00	Near-field criticality, fissile material deposited in near-field pond	
	2.1.14.10.00	Near-field criticality, fissile solution flows into drift lowpoint	
	2.1.14.11.00	Near-field criticality, fissile solution is adsorbed or reduced in invert	
	2.1.14.12.00	Near-field criticality, filtered slurry or colloidal stream collects on invert surface	
	2.1.14.13.00	Near-field criticality associated with colloidal deposits	
	2.2.01.02.00	Thermal and other waste and EBS-related changes in the adjacent host rock	
	2.2.01.04.00	Elemental solubility in excavation disturbed zone	
	2.2.01.05.00	Radionuclide transport in excavation disturbed zone	
	2.2.07.06.00	Episodic/pulse release from repository	
	2.2.08.07.00	Radionuclide solubility limits in the geosphere	
	3.1.01.01.00	Radioactive decay and ingrowth	

Table C-5. List of features, events, and processes related to the spatial and temporal distribution of flow integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review	
Spatial and temporal distribution of flow	1.1.01.01.00	Open site investigation boreholes		
	1.1.01.02.00	Loss of integrity of borehole seals		
	1.1.02.01.00	Site flooding (during construction and operation)		
	1.1.02.02.00	Effects of pre-closure ventilation		
KTI Subissues	1.2.02.01.00	Fractures		
	1.2.02.02.00	Faulting		
	USFIC1	1.2.04.02.00	Igneous activity causes changes to rock properties	
	USFIC3	1.2.06.00.00	Hydrothermal activity	
	USFIC4	1.2.07.01.00	Erosion/denudation	
	TEF1	1.2.07.02.00	Deposition	
	TEF2	1.2.09.02.00	Large-scale dissolution	
	ENFE1	1.2.10.01.00	Hydrological response to seismic activity	
	SDS2	1.2.10.02.00	Hydrological response to igneous activity	
	SDS3	1.3.01.00.00	Climate change, global	
	RDTME3	1.3.04.00.00	Periglacial effects	
		1.3.05.00.00	Glacial and ice sheet effects, local	
		1.4.01.00.00	Human influences on climate	
		1.4.01.01.00	Climate modification increases recharge	
		1.4.01.02.00	Greenhouse gas effects	
		1.4.01.03.00	Acid rain	
		1.4.01.04.00	Ozone layer failure	
		1.4.04.02.00	Abandoned and undetected boreholes	
		2.1.02.03.00	Glass degradation, alteration, and dissolution	
		2.1.04.02.00	Physical and chemical properties of backfill	
		2.1.04.03.00	Erosion or dissolution of backfill	
		2.1.04.05.00	Backfill evolution	
		2.1.05.01.00	Seal physical properties	
		2.1.05.02.00	Groundwater flow and radionuclide transport in seals	
		2.1.05.03.00	Seal degradation	
		2.1.08.01.00	Increased unsaturated water flux at the repository	
	2.1.08.03.00	Repository dry-out due to waste heat		
	2.1.08.10.00	Desaturation/dewatering of the repository		
	2.1.08.11.00	Resaturation of the repository		
	2.1.11.02.00	Nonuniform heat distribution/edge effects in repository		
2.2.01.03.00	Changes in fluid saturations in the excavation disturbed zone			
2.2.03.01.00	Stratigraphy			
2.2.03.02.00	Rock properties of host rock and other units			
2.2.06.01.00	Changes in stress (due to thermal, seismic, or tectonic effects) change porosity and permeability of rock			
2.2.06.02.00	Changes in stress (due to thermal, seismic, or tectonic effects) produce change in permeability of faults			
2.2.06.03.00	Changes in stress (due to seismic or tectonic effects) alter perched water zones			
2.2.06.04.00	Effects of subsidence			
2.2.07.01.00	Locally saturated flow at bedrock/alluvium contact			

Table C-5. List of features, events, and processes related to the spatial and temporal distribution of flow integrated subissue (cont'd)

ISI	Primary FEP No.	FEP Description	NRC Review
Spatial and temporal distribution of flow (cont'd)	2.2.07.02.00	Unsaturated groundwater flow in geosphere	
	2.2.07.04.00	Focusing of unsaturated flow (fingers, weeps)	
	2.2.07.05.00	Flow and transport in the UZ from episodic infiltration	
	2.2.07.07.00	Perched water develops	
	2.2.07.10.00	Condensation zone forms around drifts	
	2.2.07.11.00	Return flow from condensation cap/resaturation of dry-out zone	
	2.2.10.01.00	Repository-induced thermal effects in geosphere	
	2.2.10.04.00	Thermo-mechanical alteration of fractures near repository	
	2.2.10.05.00	Thermo-mechanical alteration of rocks above and below the repository	
	2.2.10.09.00	Thermo-chemical alteration of the Topopah Spring basal vitrophyre	
	2.2.10.10.00	Two-phase bouyant flow/heat pipes	
	2.2.10.11.00	Natural air flow in UZ	
	2.2.10.12.00	Geosphere dry-out due to waste heat	
	2.2.10.13.00	Density-driven groundwater flow (thermal)	
	2.2.11.02.00	Gas pressure effects	
	2.2.12.00.00	Undetected features (in geosphere)	
	2.3.01.00.00	Topography and morphology	
	2.3.11.01.00	Precipitation	
	2.3.11.02.00	Surface runoff and flooding	
	2.3.11.03.00	Infiltration and recharge (hydrologic and chemical effects)	
2.3.13.01.00	Biosphere characteristics		
2.3.13.03.00	Effects of repository heat on biosphere		

Table C-6. List of features, events, and processes related to the flow paths in the unsaturated zone integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review	
Flow paths in the UZ	1.2.02.01.00	Fractures		
	1.2.04.02.00	Igneous activity causes changes to rock properties		
	1.2.08.00.00	Diagenesis		
	1.2.10.02.00	Hydrological response to igneous activity		
	1.4.01.01.00	Climate modification increases recharge		
KTI subissues	2.1.02.03.00	Glass degradation, alteration, and dissolution		
	2.1.04.02.00	Physical and chemical properties of backfill		
	USFIC4	2.1.04.03.00	Erosion or dissolution of backfill	
	TEF1	2.1.04.05.00	Backfill evolution	
	TEF2	2.1.06.01.00	Degradation of cementitious materials in drift	
	ENFE1	2.1.06.04.00	Flow through the liner	
	SDS3	2.1.06.05.00	Degradation of invert and pedestal	
		2.1.09.12.00	Rind (altered zone) formation in waste, EBS, and adjacent rock	
		2.1.11.02.00	Nonuniform heat distribution/edge effects in repository	
		2.2.01.02.00	Thermal and other waste and EBS-related changes in the adjacent host rock	
		2.2.03.01.00	Stratigraphy	
		2.2.03.02.00	Rock properties of host rock and other units	
		2.2.06.01.00	Changes in stress (due to thermal, seismic, or tectonic effects) change porosity and permeability of rock	
		2.2.06.03.00	Changes in stress (due to seismic or tectonic effects) alter perched water zones	
		2.2.07.02.00	Unsaturated groundwater flow in geosphere	
		2.2.07.04.00	Focusing of unsaturated flow (fingers, weeps)	
		2.2.07.05.00	Flow and transport in the UZ from episodic infiltration	
		2.2.07.08.00	Fracture flow in the UZ	
		2.2.07.09.00	Matrix imbibition in the UZ	
		2.2.08.08.00	Matrix diffusion in geosphere	
	2.2.10.01.00	Repository-induced thermal effects in geosphere		
	2.2.10.04.00	Thermo-mechanical alteration of fractures near repository		
	2.2.10.05.00	Thermo-mechanical alteration of rocks above and below the repository		
	2.2.10.06.00	Thermo-chemical alteration (solubility, speciation, phase changes, precipitation/dissolution)		
	2.2.10.07.00	Thermo-chemical alteration of the Calico Hills unit		
	2.2.10.08.00	Thermo-chemical alteration of the saturated zone		
	2.2.10.09.00	Thermo-chemical alteration of the Topopah Spring basal vitrophyre		
	2.2.10.11.00	Natural air flow in UZ		

Table C-7. List of features, events, and processes related to the radionuclide transport in the unsaturated zone integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review
Radionuclide transport in the UZ	1.1.02.03.00	Undesirable materials left	
	1.2.04.02.00	Igneous activity causes changes to rock properties	
	1.2.08.00.00	Diagenesis	
	1.2.09.02.00	Large-scale dissolution	
KTI subissues	2.1.06.01.00	Degradation of cementitious materials in drift	
USFIC4	2.1.06.03.00	Degradation of the liner	
USFIC6	2.1.06.05.00	Degradation of invert and pedestal	
ENFE4	2.1.09.01.00	Properties of the potential carrier plume in the waste and EBS	
RT1	2.1.09.12.00	Rind (altered zone) formation in waste, EBS, and adjacent rock	
RT3	2.1.09.21.00	Suspensions of particles larger than colloids	
RT4	2.1.12.05.00	Gas generation from concrete	
SDS3	2.2.01.02.00	Thermal and other waste and EBS-related changes in the adjacent host rock	
	2.2.01.05.00	Radionuclide transport in excavation disturbed zone	
	2.2.03.01.00	Stratigraphy	
	2.2.03.02.00	Rock properties of host rock and other units	
	2.2.07.15.00	Advection and dispersion	
	2.2.08.01.00	Groundwater chemistry/composition in UZ and SZ	
	2.2.08.02.00	Radionuclide transport occurs in a carrier plume in geosphere	
	2.2.08.03.00	Geochemical interactions in geosphere (dissolution, precipitation, weathering) and effects on radionuclide transport	
	2.2.08.05.00	Osmotic processes	
	2.2.08.06.00	Complexation in geosphere	
	2.2.08.07.00	Radionuclide solubility limits in the geosphere	
	2.2.08.08.00	Matrix diffusion in geosphere	
	2.2.08.09.00	Sorption in UZ and SZ	
	2.2.08.10.00	Colloidal transport in geosphere	
	2.2.09.01.00	Microbial activity in geosphere	
	2.2.10.01.00	Repository-induced thermal effects in geosphere	
	2.2.10.06.00	Thermo-chemical alteration (solubility, speciation, phase changes, precipitation/dissolution)	
	2.2.10.07.00	Thermo-chemical alteration of the Calico Hills unit	
	2.2.10.09.00	Thermo-chemical alteration of the Topopah Spring basal vitrophyre	
	2.2.11.01.00	Naturally-occurring gases in geosphere	
	2.2.11.03.00	Gas transport in geosphere	
	2.2.14.01.00	Critical assembly forms away from repository	
	2.2.14.02.00	Far-field criticality, precipitation in organic reducing zone in or near water table	
	2.2.14.03.00	Far-field criticality, sorption on clay/zeolite in TSbv	
	2.2.14.04.00	Far-field criticality, precipitation caused by hydrothermal upwell or redox front in the SZ	
	2.2.14.05.00	Far-field criticality, precipitation in perched water above TSbv	
	2.2.14.06.00	Far-field criticality, precipitation in fractures of TSw rock	
	2.2.14.07.00	Far-field criticality, dryout produces fissile salt in a perched water basin	
	2.2.14.08.00	Far-field criticality associated with colloidal deposits	

Table C-8. List of features, events, and processes related to the flow paths in the saturated zone integrated subissue radionuclide transport in the saturated zone

ISI	Primary FEP No.	FEP Description	NRC Review
Flow paths in the SZ	1.2.02.01.00	Fractures	
	1.2.02.02.00	Faulting	
	1.2.06.00.00	Hydrothermal activity	
	1.2.09.02.00	Large-scale dissolution	
	1.2.10.01.00	Hydrological response to seismic activity	
KTI subissues	1.2.10.02.00	Hydrologic response to igneous activity	
USFIC1	1.3.07.01.00	Drought/water table decline	
USFIC4	1.3.07.02.00	Water table rise	
USFIC5	1.4.01.01.00	Climate modification increases recharge	
SDS3	1.4.07.01.00	Water management activities	
SDS4	1.4.07.02.00	Wells	
	1.5.03.02.00	Earth tides	
	2.2.03.01.00	Stratigraphy	
	2.2.03.02.00	Rock properties of host rock and other units	
	2.2.06.01.00	Changes in stress (due to thermal, seismic, or tectonic effects) change porosity and permeability of rock	
	2.2.06.02.00	Changes in stress (due to thermal, seismic, or tectonic effects) produce change in permeability of faults	
	2.2.07.12.00	Saturated groundwater flow	
	2.2.07.13.00	Water-conducting features in the saturated zone	
	2.2.07.14.00	Density effects on groundwater flow	
	2.2.07.15.00	Advection and dispersion	
	2.2.07.16.00	Dilution of radionuclides in groundwater	
	2.2.10.01.00	Repository-induced thermal effects in geosphere	
	2.2.10.02.00	Thermal convection cell develops in SZ	
	2.2.10.03.00	Natural geothermal effects	
	2.2.10.06.00	Thermo-chemical alteration (solubility, speciation, phase changes, precipitation/dissolution)	
	2.2.10.08.00	Thermo-chemical alteration of the saturated zone	
	2.2.10.13.00	Density-driven groundwater flow (thermal)	
	2.2.11.03.00	Gas transport in geosphere	
	2.2.12.00.00	Undetected features (in geosphere)	
	2.3.11.04.00	Groundwater discharge to surface	

Table C-9. List of features, events, and processes related to the radionuclide transport in the saturated zone integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review
Radionuclide transport in the saturated zone	1.2.02.01.00	Fractures	
	1.2.04.02.00	Igneous activity causes changes to rock properties	
	1.4.06.01.00	Altered soil or surface water chemistry	
	2.1.09.21.00	Suspensions of particles larger than colloids	
	2.2.03.01.00	Stratigraphy	
	2.2.03.02.00	Rock properties of host rock and other units	
KTI subissues	2.2.07.15.00	Advection and dispersion	
USFIC5	2.2.07.16.00	Dilution of radionuclides in groundwater	
USFIC6	2.2.07.17.00	Diffusion in the saturated zone	
RT1	2.2.08.01.00	Groundwater chemistry/composition in UZ and SZ	
RT2	2.2.08.02.00	Radionuclide transport occurs in a carrier plume in geosphere	
RT3	2.2.08.03.00	Geochemical interactions in geosphere (dissolution, precipitation, weathering) and effects on radionuclide transport	
RT4	2.2.08.05.00	Osmotic processes	
SDS3	2.2.08.06.00	Complexation in geosphere	
	2.2.08.07.00	Radionuclide solubility limits in the geosphere	
	2.2.08.08.00	Matrix diffusion in geosphere	
	2.2.08.09.00	Sorption in UZ and SZ	
	2.2.08.10.00	Colloidal transport in geosphere	
	2.2.09.01.00	Microbial activity in geosphere	
	2.2.10.01.00	Repository-induced thermal effects in geosphere	
	2.2.10.02.00	Thermal convection cell develops in SZ	
	2.2.10.03.00	Natural geothermal effects	
	2.2.10.06.00	Thermo-chemical alteration (solubility, speciation, phase changes, precipitation/dissolution)	
	2.2.10.08.00	Thermo-chemical alteration of the saturated zone	
	2.2.10.13.00	Density-driven groundwater flow (thermal)	
	2.2.11.01.00	Naturally-occurring gases in geosphere	
	2.2.11.03.00	Gas transport in geosphere	
	2.2.12.00.00	Undetected features (in geosphere)	
	2.2.14.01.00	Critical assembly forms away from repository	
	2.2.14.02.00	Far-field criticality, precipitation in organic reducing zone in or near water table	
	2.2.14.03.00	Far-field criticality, sorption on clay/zeolite in TSbv	
	2.2.14.04.00	Far-field criticality, precipitation caused by hydrothermal upwell or redox front in the SZ	
	2.2.14.05.00	Far-field criticality, precipitation in perched water above TSbv	
2.2.14.06.00	Far-field criticality, precipitation in fractures of TSw rock		
2.2.14.07.00	Far-field criticality, dryout produces fissile salt in a perched water basin		
2.2.14.08.00	Far-field criticality associated with colloidal deposits		

Table C-10. List of features, events, and processes related to the volcanic disruption of waste packages integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review	
Volcanic disruption of waste packages	1.1.02.00.00	Excavation/construction		
	1.1.02.02.00	Effects of pre-closure ventilation		
	1.1.03.01.00	Error in waste or backfill emplacement		
	1.1.04.01.00	Incomplete closure		
	1.1.07.00.00	Repository design		
KTI subissues	1.2.01.01.00	Tectonic activity—large scale		
	CLST1	1.2.02.02.00		Faulting
	CLST2	1.2.04.01.00		Igneous activity
	IA1	1.2.04.02.00		Igneous activity causes changes to rock properties
	IA2	1.2.04.03.00		Igneous intrusion into repository
	SDS1	1.2.04.04.00		Magma interacts with waste
	SDS4	1.2.04.05.00		Magmatic transport of waste
		1.2.04.06.00		Basaltic cinder cone erupts through the repository
		2.1.01.01.00		Waste inventory
		2.1.03.11.00		Container form
	2.1.03.12.00	Container failure (long-term)		
	2.1.04.04.00	Mechanical effects of backfill		
	2.1.07.02.00	Mechanical degradation or collapse of drift		
	2.2.03.01.00	Stratigraphy		
	2.3.01.00.00	Topography and morphology		

Table C-11. List of Features, Events, and Publications Related to the Airborne Transport of Radionuclides Integrated Subissue

ISI	Primary FEP #	FEP description	NRC Review
Airborne transport of radionuclides	1.2.04.07.00	Ashfall	
	1.2.04.06.00	Basaltic cinder cone erupts through the repository	
	3.2.10.00.00	Atmospheric transport of contaminants	
KTI subissues			
IA2			

Table C-12. List of features, events, and processes related to the dilution of radionuclides due to well pumping integrated subissue redistribution of radionuclides in soil

ISI	Primary FEP No.	FEP Description	NRC Review
Dilution of radionuclides in GW due to well pumping	1.3.07.01.00	Drought/water table decline	
	1.3.07.02.00	Water table rise	
	1.4.07.01.00	Water management activities	
	1.4.07.02.00	Wells	
KTI subissues USFIC5	2.1.09.21.00	Suspensions of particles larger than colloids	
	2.2.07.12.00	Saturated groundwater flow	
	2.2.07.13.00	Water-conducting features in the saturated zone	
	2.2.07.14.00	Density effects on groundwater flow	
	2.2.07.16.00	Dilution of radionuclides in groundwater	
	2.2.08.06.00	Complexation in geosphere	
	2.2.08.07.00	Radionuclide solubility limits in the geosphere	
	2.2.08.10.00	Colloidal transport in geosphere	
	2.2.08.11.00	Distribution and release of nuclides from the geosphere	
	2.2.12.00.00	Undetected features (in geosphere)	
	2.3.11.04.00	Groundwater discharge to surface	
	2.3.13.01.00	Biosphere characteristics	
	2.4.04.01.00	Human lifestyle	
	2.4.08.00.00	Wild and natural land and water use	
	2.4.09.01.00	Agricultural land use and irrigation	
2.4.09.02.00	Animal farms and fisheries		
2.4.10.00.00	Urban and industrial land and water use		

Table C-13. List of features, events, and processes related to the redistribution of radionuclides in soil integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review
Redistribution of radionuclides in soil	1.2.04.07.00	Ashfall	
	1.2.07.01.00	Erosion/denudation	
	1.2.07.02.00	Deposition	
	1.4.07.01.00	Water management activities	
	2.3.02.01.00	Soil type	
KTI subissues IA2	2.3.02.02.00	Radionuclide accumulation in soils	
	2.3.02.03.00	Soil and sediment transport	
	2.3.04.01.00	Surface water transport and mixing	
	2.3.11.01.00	Precipitation	
	2.3.11.02.00	Surface runoff and flooding	
	2.3.11.03.00	Infiltration and recharge (hydrologic and chemical effects)	
	2.3.11.04.00	Groundwater discharge to surface	
	2.4.08.00.00	Wild and natural land and water use	
	2.4.09.01.00	Agricultural land use and irrigation	
	2.4.10.00.00	Urban and industrial land and water use	
	3.1.01.01.00	Radioactive decay and ingrowth	
	3.2.07.01.00	Isotopic dilution	
	1.3.07.01.00	Drought/water table decline	
	1.3.07.02.00	Water table rise	
	2.2.08.09.00	Sorption in UZ and SZ	
	2.2.08.11.00	Distribution and release of nuclides from the geosphere	
	2.3.01.00.00	Topography and morphology	
	2.3.09.01.00	Animal burrowing/intrusion	

Table C-14. List of features, events, and processes related to the lifestyle of the critical group integrated subissue

ISI	Primary FEP No.	FEP Description	NRC Review
Lifestyle of the critical group	1.1.05.00.00	Records and markers, repository	
	1.2.04.07.00	Ashfall	
	1.2.07.01.00	Erosion/denudation	
KTI subissues	1.2.07.02.00	Deposition	
USFIC1	1.3.01.00.00	Climate change, global	
USFIC2	1.3.05.00.00	Glacial and ice sheet effects, local	
USFIC3	1.3.07.01.00	Drought/water table decline	
USFIC5	1.3.07.02.00	Water table rise	
RT3	1.4.01.01.00	Climate modification increases recharge	
IA2	1.4.01.04.00	Ozone layer failure	
	1.4.06.01.00	Altered soil or surface water chemistry	
	1.4.07.01.00	Water management activities	
	1.4.07.02.00	Wells	
	1.5.02.00.00	Species evolution	
	2.1.01.01.00	Waste inventory	
	2.2.07.12.00	Saturated groundwater flow	
	2.2.07.16.00	Dilution of radionuclides in groundwater	
	2.2.08.01.00	Groundwater chemistry/composition in UZ and SZ	
	2.2.08.07.00	Radionuclide solubility limits in the geosphere	
	2.2.08.09.00	Sorption in UZ and SZ	
	2.2.08.11.00	Distribution and release of nuclides from the geosphere	
	2.3.02.01.00	Soil type	
	2.3.02.02.00	Radionuclide accumulation in soils	
	2.3.02.03.00	Soil and sediment transport	
	2.3.04.01.00	Surface water transport and mixing	
	2.3.11.01.00	Precipitation	
	2.3.11.02.00	Surface runoff and flooding	
	2.3.13.01.00	Biosphere characteristics	
	2.3.13.02.00	Biosphere transport	
	2.3.13.03.00	Effects of repository heat on biosphere	
	2.4.01.00.00	Human characteristics (physiology, metabolism)	
	2.4.03.00.00	Diet and fluid intake	
	2.4.04.01.00	Human lifestyle	

Table C-14. List of features, events, and processes related to the lifestyle of the critical group integrated subissue (cont'd)

ISI	Primary FEP No.	FEP Description	NRC Review
Lifestyle of the critical group (continued)	2.4.07.00.00	Dwellings	
	2.4.08.00.00	Wild and natural land and water use	
	2.4.09.01.00	Agricultural land use and irrigation	
	2.4.09.02.00	Animal farms and fisheries	
	2.4.10.00.00	Urban and industrial land and water use	
	3.1.01.01.00	Radioactive decay and ingrowth	
	3.2.07.01.00	Isotopic dilution	
	3.2.10.00.00	Atmospheric transport of contaminants	
	3.3.01.00.00	Drinking water, foodstuffs and drugs, contaminant concentrations in	
	3.3.02.01.00	Plant uptake	
	3.3.02.02.00	Animal uptake	
	3.3.02.03.00	Bioaccumulation	
	3.3.03.01.00	Contaminated non-food products and exposure	
	3.3.04.01.00	Ingestion	
	3.3.04.02.00	Inhalation	
	3.3.04.03.00	External exposure	
	3.3.05.01.00	Radiation doses	
	3.3.06.00.00	Radiological toxicity /effects	
	3.3.08.00.00	Radon and radon daughter exposure	