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Integrated Issue Resolution Status Report

Appendices A through D

U.S. Nuclear Regulatory Commission
Office of Nuclear Material Safety and Safeguards
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Division of High-Level Waste Repository Safety
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

ABSTRACT

This Integrated Issue Resolution Status Report provides background information about the status of prelicensing interactions between the U.S. Department of Energy (DOE) and the U.S. Nuclear Regulatory Commission (NRC) concerning a potential high-level waste geologic repository at Yucca Mountain, Nevada. The NRC staff has, for many years, engaged in prelicensing interactions with DOE and various stakeholders. In recent years, DOE and NRC have reached a number of agreements related to key technical issues important to repository performance after permanent closure and items important to safety during the period before permanent closure. During the prelicensing period, the NRC staff also have undertaken a risk insights initiative to enhance the use of available risk information and develop, as a common basis for understanding, the significance of features, events, and processes that may affect the performance of potential engineered and natural barriers at Yucca Mountain.

This report provides an overview of available information and status (as of March 2004, with exceptions as noted) of the Key Technical Issue agreements reached between DOE and NRC. The report also documents the risk insights (Appendix D) and information considered by the NRC staff in formulating their views, including the results of in-depth reviews of available DOE and contractor documents; the independent confirmatory work of NRC and its contractor, the Center for Nuclear Waste Regulatory Analyses; published literature; and other publicly available information.

This report may be of value to stakeholders in understanding the technical rationale used by the NRC staff to identify certain information as being necessary for a quality license application. The staff has not made any determination about compliance with regulations applicable to a potential repository at Yucca Mountain. If DOE submits a license application for a potential repository at Yucca Mountain, the staff will review the information provided by DOE and make determinations based on information provided at that time.

APPENDIX A

The following table provides the status of the Key Technical Issue–Agreement–Integrated Subissue Crosswalk as of August 2004. For those Agreements that relate to more than one Integrated Subissue (ISI), the additional ISIs are listed on separate lines.

KTI Agreement - ISI

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.1.01	ENG1	Provide the documentation for Alloy 22 and titanium for the path forward items listed on slide 8. [establish credible range of brine water chemistry; evaluate effect of introduced materials on water chemistry; determine likely concentrations and chemical form of minor constituents in YM waters; characterize YM waters with respect to the parameters which define the type of brine which would evolve; evaluate periodic water drip evaporation] DOE will provide the documentation in a revision to AMR "Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier" by LA.	Complete
CLST.1.02	ENG1	Provide the documentation for the path forward items listed on slide 12. [surface elemental analysis of alloy test specimens is necessary for determination of selective dissolution; surface analysis of welded specimens for evidence of dealloying; continue testing including simulated saturated repository environment to confirm enhancement factor] DOE will provide the documentation in a revision to AMR "General and Localized Corrosion of Waste Package Outer Barrier" by LA.	Received
CLST.1.03	ENG1	Provide documentation that confirms the linear polarization resistance measurements with corrosion rate measurements using other techniques. DOE will provide the documentation in a revision to AMR "General and Localized Corrosion of Waste Package Outer Barrier" by LA.	Received
CLST.1.04	ENG1	Provide the documentation for Alloy 22 and titanium for the path forward items listed on slide 14. [continue testing in the LTCTF; add new bounding water test environments to LTCTF (SSW & BSW); install thinner coupons in LTCTF with larger surface area/volume rations; install high sensitivity probes of Alloy 22 in some of the LTCTF vessels; materials testing continues during performance confirmation] DOE will provide the documentation in a revision to AMR "ANL-EBS-MD-000003 and ANL-EBS-MD-000004" by LA.	Received
CLST.1.05	ENG1	Provide additional details on sensitivities, resolution of measurements, limitations, and deposition of silica for the high sensitivity probes. DOE will document the results of the sensitivity probes including limitation and resolution of measurements as affected by silica deposition in the Alloy 22 AMR and Ti Corrosion AMR (ANL-EBS-MD-000003 and ANL-EBS-MD-000004) prior to LA.	Complete
CLST.1.06	ENG1	Provide the documentation on testing showing corrosion rates in the absence of silica deposition. DOE will document the results of testing in the absence of silica deposits in the revision of Alloy 22 AMR (ANL-EBS-MD-000003) prior to LA.	Received
CLST.1.07	ENG1	Provide the documentation for the alternative methods to measure the corrosion rate of the waste package material (e.g., ASTM G-102 testing) or provide justification for the current approach. DOE will document the alternative methods of corrosion measurement in the revision of Alloy 22 AMR (ANL-EBS-MD-000003), prior to LA.	Complete
CLST.1.08	ENG1	Provide the documentation for Alloy 22 and titanium for the path forward items listed on slide 16 and 17. [calculate potential-pH diagrams for multi-component Alloy 22; grow oxide films at higher temperatures in autoclaves, in air and/or electrochemically to accelerate film growth for compositional and structural studies below; resolve kinetics of film growth: parabolic or higher order, whether film growth becomes linear, and if, as film grows it becomes mechanically brittle and spalls off; determine chemical, structural, and mechanical properties of films, including thicken films; correlate changes in Ecorr measured in LTCTF with compositional changes in passive film over time; perform analyses on cold-worked materials to determine changes in film structural properties; perform examination of films formed on naturally occurring Josephinite; compare films formed on Alloy 22 with other similar passive film Alloys with longer industrial experience] DOE will provide the documentation in the revision to AMRs (ANL-EBS-MD-000003 and ANL-EBS-MD-000004) prior to LA.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.1.09	ENG1	Provide the data that characterizes the passive film stability, including the welded and thermally aged specimens. DOE will provide the documentation in a revision to AMRs (ANL-EBS-MD-000003 and ANL-EBS-MD-000004) prior to LA.	Received
CLST.1.10	ENG1	Provide the documentation for Alloy 22 and titanium for the path forward items listed on slide 21 and 22. [measure corrosion potentials in the LTCTF to determine any shift of potential with time toward the critical potentials for LC; determine critical potentials on welded and welded and aged coupons of Alloy 22 vs those for base metal - particularly important if precipitation or severe segregation of alloying elements occurs in the welds; separate effects of ionic mix of specimens in YM waters on critical potentials - damaging species from potentially beneficial species; determine critical potentials in environments containing heavy metal concentrations] DOE will provide the documentation in a revision to AMRs (ANL-EBS-MD-000003 and ANL-EBS-MD-000004) prior to LA.	Received
CLST.1.11	ENG1	Provide the technical basis for the selection of the critical potentials as bounding parameters for localized corrosion, taking into account MIC. DOE will provide the documentation in a revision to AMRs (ANL-EBS-MD-000003 and ANL-EBS-MD-000004) prior to LA.	Received
CLST.1.12	ENG1	Provide the documentation for Alloy 22 and titanium for the path forward items listed on slides 34 and 35. [qualify and optimize mitigation processes; generate SCC data for mitigated material over full range of metallurgical conditions; new vessels for LTCTF will house many of the SCC specimens; continue SSRT in same types of environments as above, specimens in the same range of metallurgical conditions; determine repassivation constants needed for film rupture SCC model to obtain value for the model parameter ‘n’; continue reversing direct current potential drop crack propagation rate determinations in same types of environments and same metallurgical conditions as for SSRT and LTCTF tests; evaluate SCC resistance of welded and laser peened material vs non-welded unpeened material; evaluate SCC resistance in induction annealed material; evaluate SCC resistance of full thickness material obtained from the demonstration prototype cylinder of Alloy 22] DOE will provide the documentation in a revision to AMRs (ANL-EBS-MD-000005 and ANL-EBS-MD-000006) prior to LA.	Received
CLST.1.13	ENG1	Provide the data that characterizes the distribution of stresses due to laser peening and induction annealing of Alloy 22. DOE will provide the documentation in a revision to AMR (ANL-EBS-MD-000005) prior to LA.	Received
CLST.1.13	PRE	Provide the data that characterizes the distribution of stresses due to laser peening and induction annealing of Alloy 22. DOE will provide the documentation in a revision to AMR (ANL-EBS-MD-000005) prior to LA.	Received
CLST.1.13	ENG2	Provide the data that characterizes the distribution of stresses due to laser peening and induction annealing of Alloy 22. DOE will provide the documentation in a revision to AMR (ANL-EBS-MD-000005) prior to LA.	Received
CLST.1.14	PRE	Provide the justification for not including the rockfall effect and deadload from drift collapse on SCC of the waste package and drip shield. DOE will provide the documentation for the rockfall and dead-weight effects in the next revision of the SCC AMR (ANL-EBS-MD-000005) prior to LA.	Received
CLST.1.14	ENG2	Provide the justification for not including the rockfall effect and deadload from drift collapse on SCC of the waste package and drip shield. DOE will provide the documentation for the rockfall and dead-weight effects in the next revision of the SCC AMR (ANL-EBS-MD-000005) prior to LA.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.1.15	ENG1	Provide the documentation for Alloy 22 and titanium for the path forward items listed on slide 39. [install specimens cut from welds of SR design mock-up in LTCTF and in other SCC test environments - determine which specimen geometry is most feasible to complement SCC evaluation; evaluate scaling and weld process factors between thin coupons and dimensions in actual welded waste package containers - including thermal/metallurgical structural effects of multi-pass weld processes; provide representative weld test specimens for MIC work, thermal aging and localized corrosion evaluations] DOE will provide documentation for Alloy 22 and Ti path forward items on slide 39 in a revision to the SCC and general and localized corrosion AMRs (ANL-EBS-MD-000003, ANL-EBS-MD-000004, ANL-EBS-MD-000005) by LA.	Received
CLST.1.16	ENG2	Provide the documentation on the measured thermal profile of the waste package material due to induction annealing. DOE stated that the thermal profiles will be measured during induction annealing, and the results will be reported in the next SCC AMR (ANL-EBS-MD-000005) prior to LA.	Complete
CLST.1.16	ENG1	Provide the documentation on the measured thermal profile of the waste package material due to induction annealing. DOE stated that the thermal profiles will be measured during induction annealing, and the results will be reported in the next SCC AMR (ANL-EBS-MD-000005) prior to LA.	Complete
CLST.1.16	PRE	Provide the documentation on the measured thermal profile of the waste package material due to induction annealing. DOE stated that the thermal profiles will be measured during induction annealing, and the results will be reported in the next SCC AMR (ANL-EBS-MD-000005) prior to LA.	Complete
CLST.1.17	ENG2	Provide additional detail on quality assurance acceptance testing. DOE stated that it would provide guidance and criteria in the next revision of the Technical Guidance Document (TGD) for LA. The development of the LA sections and associated programs and process controls for the procurement and fabrication of waste package materials and components will be included. This will include consideration of the controls for compositional variations in Alloy 22. The TGD revision will be issued by June 2001, contingent upon NRC publication of the final 10 CFR 63 and the Yucca Mountain Review Plan.	Complete
CLST.1.17	ENG1	Provide additional detail on quality assurance acceptance testing. DOE stated that it would provide guidance and criteria in the next revision of the Technical Guidance Document (TGD) for LA. The development of the LA sections and associated programs and process controls for the procurement and fabrication of waste package materials and components will be included. This will include consideration of the controls for compositional variations in Alloy 22. The TGD revision will be issued by June 2001, contingent upon NRC publication of the final 10 CFR 63 and the Yucca Mountain Review Plan.	Complete
CLST.1.17	PRE	Provide additional detail on quality assurance acceptance testing. DOE stated that it would provide guidance and criteria in the next revision of the Technical Guidance Document (TGD) for LA. The development of the LA sections and associated programs and process controls for the procurement and fabrication of waste package materials and components will be included. This will include consideration of the controls for compositional variations in Alloy 22. The TGD revision will be issued by June 2001, contingent upon NRC publication of the final 10 CFR 63 and the Yucca Mountain Review Plan.	Complete
CLST.2.01	PRE	Either provide documentation using solid element formulation, or provide justification for not using it, for the drip shield - rockfall analysis. DOE stated that shell elements include normal stresses and transverse stresses in the calculations and provide more accurate results for thin plates and use far fewer elements. Therefore, shell elements will be used instead of solid elements. This justification will be documented in the next revision of AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, prior to LA.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.2.01	ENG2	Either provide documentation using solid element formulation, or provide justification for not using it, for the drip shield - rockfall analysis. DOE stated that shell elements include normal stresses and transverse stresses in the calculations and provide more accurate results for thin plates and use far fewer elements. Therefore, shell elements will be used instead of solid elements. This justification will be documented in the next revision of AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, prior to LA.	Received
CLST.2.02	PRE	Provide the documentation for the point loading rockfall analysis. DOE stated that point loading rock fall calculations will be documented in the next revisions of AMRs ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, and ANL-UDC-MD-000001, Design Analysis for UCF Waste Packages, both to be completed prior to LA.	Received
CLST.2.02	ENG2	Provide the documentation for the point loading rockfall analysis. DOE stated that point loading rock fall calculations will be documented in the next revisions of AMRs ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, and ANL-UDC-MD-000001, Design Analysis for UCF Waste Packages, both to be completed prior to LA.	Received
CLST.2.03	PRE	Demonstrate how the Tresca failure criterion bounds a fracture mechanics approach to calculating the mechanical failure of the drip shield. DOE stated that it believes its current approach of using ASME Code is appropriate for this application. Additional justification for this conclusion will be included in the next revision of AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, to be completed prior to LA.	Received
CLST.2.03	ENG2	Demonstrate how the Tresca failure criterion bounds a fracture mechanics approach to calculating the mechanical failure of the drip shield. DOE stated that it believes its current approach of using ASME Code is appropriate for this application. Additional justification for this conclusion will be included in the next revision of AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, to be completed prior to LA.	Received
CLST.2.04	ENG1	Provide information on the effect of the entire fabrication sequence on phase instability of Alloy 22, including the effect of welding thick sections using multiple weld passes and the proposed induction annealing process. DOE stated that the aging studies will be expanded to include solution annealed and induction annealed Alloy 22 weld and base metal samples from the mock-ups as well as laser peened thick, multi-pass welds. This information will be included in revisions of the AMR “Aging and Phase Stability of the Waste Package Outer Barrier,” ANL-EBS-MD-000002, before LA.	Received
CLST.2.04	PRE	Provide information on the effect of the entire fabrication sequence on phase instability of Alloy 22, including the effect of welding thick sections using multiple weld passes and the proposed induction annealing process. DOE stated that the aging studies will be expanded to include solution annealed and induction annealed Alloy 22 weld and base metal samples from the mock-ups as well as laser peened thick, multi-pass welds. This information will be included in revisions of the AMR “Aging and Phase Stability of the Waste Package Outer Barrier,” ANL-EBS-MD-000002, before LA.	Received
CLST.2.04	ENG2	Provide information on the effect of the entire fabrication sequence on phase instability of Alloy 22, including the effect of welding thick sections using multiple weld passes and the proposed induction annealing process. DOE stated that the aging studies will be expanded to include solution annealed and induction annealed Alloy 22 weld and base metal samples from the mock-ups as well as laser peened thick, multi-pass welds. This information will be included in revisions of the AMR “Aging and Phase Stability of the Waste Package Outer Barrier,” ANL-EBS-MD-000002, before LA.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.2.05	ENG2	Provide the “Aging and Phase Stability of Waste Package Outer Barrier,” AMR, including the documentation of the path forward items listed in the “Subissue 2: Effects of Phase Instability of Materials and Initial Defects on the Mechanical Failure and Lifetime of the Containers” presentation, slides 5 & 6. [data input to current models is being further evaluated and quantified to reduce uncertainty; aging of Alloy 22 samples for microstructural characterization, tensile property test, and Charpy impact test is ongoing; theoretical modeling will be employed to enhance confidence in extrapolating aging kinetic data to repository thermal conditions and time scale - modeling will utilize thermodynamic principles of the processes; Alloy 22 samples for SCC compact tension test are being added to aging studies; test program will be expanded to include welded and cold worked materials; effects of stress mitigation techniques such as laser peening and induction annealing on phase instability will be investigated; aging test facility will be expanded to include aging at lower temperatures] DOE stated that the “Aging and Phase Stability of the Waste Package Outer Barrier” AMR, ANL-EBS-MD-000002, Rev. 00 was issued 3/20/00. This AMR will be revised to include the results of the path forward items before LA.	Received
CLST.2.05	PRE	Provide the “Aging and Phase Stability of Waste Package Outer Barrier,” AMR, including the documentation of the path forward items listed in the “Subissue 2: Effects of Phase Instability of Materials and Initial Defects on the Mechanical Failure and Lifetime of the Containers” presentation, slides 5 & 6. [data input to current models is being further evaluated and quantified to reduce uncertainty; aging of Alloy 22 samples for microstructural characterization, tensile property test, and Charpy impact test is ongoing; theoretical modeling will be employed to enhance confidence in extrapolating aging kinetic data to repository thermal conditions and time scale - modeling will utilize thermodynamic principles of the processes; Alloy 22 samples for SCC compact tension test are being added to aging studies; test program will be expanded to include welded and cold worked materials; effects of stress mitigation techniques such as laser peening and induction annealing on phase instability will be investigated; aging test facility will be expanded to include aging at lower temperatures] DOE stated that the “Aging and Phase Stability of the Waste Package Outer Barrier” AMR, ANL-EBS-MD-000002, Rev. 00 was issued 3/20/00. This AMR will be revised to include the results of the path forward items before LA.	Received
CLST.2.05	ENG1	Provide the “Aging and Phase Stability of Waste Package Outer Barrier,” AMR, including the documentation of the path forward items listed in the “Subissue 2: Effects of Phase Instability of Materials and Initial Defects on the Mechanical Failure and Lifetime of the Containers” presentation, slides 5 & 6. [data input to current models is being further evaluated and quantified to reduce uncertainty; aging of Alloy 22 samples for microstructural characterization, tensile property test, and Charpy impact test is ongoing; theoretical modeling will be employed to enhance confidence in extrapolating aging kinetic data to repository thermal conditions and time scale - modeling will utilize thermodynamic principles of the processes; Alloy 22 samples for SCC compact tension test are being added to aging studies; test program will be expanded to include welded and cold worked materials; effects of stress mitigation techniques such as laser peening and induction annealing on phase instability will be investigated; aging test facility will be expanded to include aging at lower temperatures] DOE stated that the “Aging and Phase Stability of the Waste Package Outer Barrier” AMR, ANL-EBS-MD-000002, Rev. 00 was issued 3/20/00. This AMR will be revised to include the results of the path forward items before LA.	Received
CLST.2.06	ENG2	Provide the technical basis for the mechanical integrity of the inner overpack closure weld. DOE will provide the documentation in AMR, ANL-UDC-MD-000001, Rev. 00, Design Analysis for UFC Waste Packages in the next revision, prior to LA.	Complete
CLST.2.06	PRE	Provide the technical basis for the mechanical integrity of the inner overpack closure weld. DOE will provide the documentation in AMR, ANL-UDC-MD-000001, Rev. 00, Design Analysis for UFC Waste Packages in the next revision, prior to LA.	Complete
CLST.2.06	ENG1	Provide the technical basis for the mechanical integrity of the inner overpack closure weld. DOE will provide the documentation in AMR, ANL-UDC-MD-000001, Rev. 00, Design Analysis for UFC Waste Packages in the next revision, prior to LA.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.2.07	ENG1	Provide documentation for the fabrication process, controls, and implementation of the phases which affect the TSPA model assumptions for the waste package (e.g., filler metal, composition range). DOE stated that updates of the documentation on the fabrication processes and controls (TDR-EBS-ND-000003, Waste Package Operations Fabrication Process Report and TDP-EBS-ND-000005, Waste Package Operations FY-00 Closure Weld Technical Guidelines Document) will be available to the NRC in January 2001.	Complete
CLST.2.07	ENG2	Provide documentation for the fabrication process, controls, and implementation of the phases which affect the TSPA model assumptions for the waste package (e.g., filler metal, composition range). DOE stated that updates of the documentation on the fabrication processes and controls (TDR-EBS-ND-000003, Waste Package Operations Fabrication Process Report and TDP-EBS-ND-000005, Waste Package Operations FY-00 Closure Weld Technical Guidelines Document) will be available to the NRC in January 2001.	Complete
CLST.2.07	PRE	Provide documentation for the fabrication process, controls, and implementation of the phases which affect the TSPA model assumptions for the waste package (e.g., filler metal, composition range). DOE stated that updates of the documentation on the fabrication processes and controls (TDR-EBS-ND-000003, Waste Package Operations Fabrication Process Report and TDP-EBS-ND-000005, Waste Package Operations FY-00 Closure Weld Technical Guidelines Document) will be available to the NRC in January 2001.	Complete
CLST.2.08	PRE	Provide documentation of the path forward items in the "Subissue 2: Effects of Phase Instability of Materials and Initial Defects on the Mechanical Failure and Lifetime of the Containers" presentation, slide 16. [future rockfall evaluations will address (1) effects of potential embrittlement of WP closure material after stress annealing due to aging, (2) effects of drip shield wall thinning due to corrosion; (3) effects of hydrogen embrittlement on titanium drip shield; and (4) effects of multiple rock blocks falling on WP and drip shield; future seismic evaluations will address the effects of static loads from fallen rock on drip shield during seismic events] DOE stated that the rockfall calculations addressing potential embrittlement of the waste package closure weld and rock falls of multiple rock blocks will be included in the next revision of the AMR ANL-UDC-MD-000001, Design Analysis for UCF Waste Packages, to be completed prior to LA. Rock fall calculations addressing drip shield wall thinning due to corrosion, hydrogen embrittlement of titanium, and rock falls of multiple rock blocks will be included in the next revision of the AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, to be completed prior to LA. Seismic calculations addressing the load of fallen rock on the drip shield will be included in the next revision of the AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, to be completed prior to LA.	Received
CLST.2.08	ENG1	Provide documentation of the path forward items in the "Subissue 2: Effects of Phase Instability of Materials and Initial Defects on the Mechanical Failure and Lifetime of the Containers" presentation, slide 16. [future rockfall evaluations will address (1) effects of potential embrittlement of WP closure material after stress annealing due to aging, (2) effects of drip shield wall thinning due to corrosion; (3) effects of hydrogen embrittlement on titanium drip shield; and (4) effects of multiple rock blocks falling on WP and drip shield; future seismic evaluations will address the effects of static loads from fallen rock on drip shield during seismic events] DOE stated that the rockfall calculations addressing potential embrittlement of the waste package closure weld and rock falls of multiple rock blocks will be included in the next revision of the AMR ANL-UDC-MD-000001, Design Analysis for UCF Waste Packages, to be completed prior to LA. Rock fall calculations addressing drip shield wall thinning due to corrosion, hydrogen embrittlement of titanium, and rock falls of multiple rock blocks will be included in the next revision of the AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, to be completed prior to LA. Seismic calculations addressing the load of fallen rock on the drip shield will be included in the next revision of the AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, to be completed prior to LA.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.2.08	ENG2	Provide documentation of the path forward items in the "Subissue 2: Effects of Phase Instability of Materials and Initial Defects on the Mechanical Failure and Lifetime of the Containers" presentation, slide 16. [future rockfall evaluations will address (1) effects of potential embrittlement of WP closure material after stress annealing due to aging, (2) effects of drip shield wall thinning due to corrosion; (3) effects of hydrogen embrittlement on titanium drip shield; and (4) effects of multiple rock blocks falling on WP and drip shield; future seismic evaluations will address the effects of static loads from fallen rock on drip shield during seismic events] DOE stated that the rockfall calculations addressing potential embrittlement of the waste package closure weld and rock falls of multiple rock blocks will be included in the next revision of the AMR ANL-UDC-MD-000001, Design Analysis for UCF Waste Packages, to be completed prior to LA. Rock fall calculations addressing drip shield wall thinning due to corrosion, hydrogen embrittlement of titanium, and rock falls of multiple rock blocks will be included in the next revision of the AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, to be completed prior to LA. Seismic calculations addressing the load of fallen rock on the drip shield will be included in the next revision of the AMR ANL-XCS-ME-000001, Design Analysis for the Ex-Container Components, to be completed prior to LA.	Received
CLST.2.09	PRE	Demonstrate the drip shield and waste package mechanical analysis addressing seismic excitation is consistent with the design basis earthquake covered in the SDS KTI. DOE stated that the same seismic evaluations of waste packages and drip shield (revision of AMRs ANL-UDC-MD-000001 and ANL-XCS-ME-000001) will support both the SDS KTI and the CLST KTI, therefore consistency is ensured. These revisions will be completed prior to LA.	Received
CLST.2.09	ENG2	Demonstrate the drip shield and waste package mechanical analysis addressing seismic excitation is consistent with the design basis earthquake covered in the SDS KTI. DOE stated that the same seismic evaluations of waste packages and drip shield (revision of AMRs ANL-UDC-MD-000001 and ANL-XCS-ME-000001) will support both the SDS KTI and the CLST KTI, therefore consistency is ensured. These revisions will be completed prior to LA.	Received
CLST.3.01	ENG4	The agreement addresses CLST Subissues 3 & 4. In the revision to the "Summary of In-Package Chemistry for Waste Forms," AMR, the NRC needs to know whether and how initial failures are included in the in-package chemistry modeling, taking into account the multiple barrier analysis. DOE stated that the Summary of In-Package Chemistry for Waste Forms ANL-EBS-MD-000050 deals with time since waste package breach, instead of time of waste package failures. The model is appropriate for the current implementation in the TSPA scenarios because breaches do not occur until after aqueous films may be sustained. Multiple barrier analyses are discussed in the TSPAI IRSR, and therefore will be discussed in the TSPA KTI Technical Exchange.	Complete
CLST.3.01	TSPAI	The agreement addresses CLST Subissues 3 & 4. In the revision to the "Summary of In-Package Chemistry for Waste Forms," AMR, the NRC needs to know whether and how initial failures are included in the in-package chemistry modeling, taking into account the multiple barrier analysis. DOE stated that the Summary of In-Package Chemistry for Waste Forms ANL-EBS-MD-000050 deals with time since waste package breach, instead of time of waste package failures. The model is appropriate for the current implementation in the TSPA scenarios because breaches do not occur until after aqueous films may be sustained. Multiple barrier analyses are discussed in the TSPAI IRSR, and therefore will be discussed in the TSPA KTI Technical Exchange.	Complete
CLST.3.02	ENG3	The agreement addresses CLST Subissues 3 & 4. In the revision to the "Summary of In-Package Chemistry for Waste Forms," AMR, address specific NRC questions regarding radiolysis, incoming water, localized corrosion, corrosion products, transient effects, and a sensitivity study on differing dissolution rates of components. DOE stated that these specific questions are currently being addressed in the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 and related AMRs and calculations. To be available in January 2001.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.3.02	ENG4	The agreement addresses CLST Subissues 3 & 4. In the revision to the "Summary of In-Package Chemistry for Waste Forms," AMR, address specific NRC questions regarding radiolysis, incoming water, localized corrosion, corrosion products, transient effects, and a sensitivity study on differing dissolution rates of components. DOE stated that these specific questions are currently being addressed in the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 and related AMRs and calculations. To be available in January 2001.	Received
CLST.3.03	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide a more detailed calculation on the in-package chemistry effects of radiolysis. DOE stated that the calculations recently performed as discussed at the 9/12/00 Technical Exchange and preceeding teleconferences are being documented. These calculations will be referenced and justified in the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 and will be available in January 2001.	Received
CLST.3.04	TSPAI	The agreement addresses CLST Subissues 3 & 4. Need consistency between abstractions for incoming water and sensitivity studies conducted for in-package calculations, in particular, taking into account the interaction of engineered materials on the chemistry of water used for input to in-package abstractions. DOE stated that the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 will discuss the applicability of abstractions for incoming water, taking into account the revised Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR. The revision will be available in January 2001.	Received
CLST.3.04	ENG3	The agreement addresses CLST Subissues 3 & 4. Need consistency between abstractions for incoming water and sensitivity studies conducted for in-package calculations, in particular, taking into account the interaction of engineered materials on the chemistry of water used for input to in-package abstractions. DOE stated that the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 will discuss the applicability of abstractions for incoming water, taking into account the revised Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR. The revision will be available in January 2001.	Received
CLST.3.04	ENG4	The agreement addresses CLST Subissues 3 & 4. Need consistency between abstractions for incoming water and sensitivity studies conducted for in-package calculations, in particular, taking into account the interaction of engineered materials on the chemistry of water used for input to in-package abstractions. DOE stated that the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 will discuss the applicability of abstractions for incoming water, taking into account the revised Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR. The revision will be available in January 2001.	Received
CLST.3.05	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide the plan for experiments demonstrating in-package chemistry, and take into account subsequent NRC comments, if any. DOE stated that the current planning provides for the analysis of additional in-package chemistry model support. This analysis will determine which parts of the model are amenable to additional support by testing, and which parts are more amenable to sensitivity analysis, or use of analogues. Based on these results, longer range testing will be considered. If testing is determined to be appropriate, test plans will be written in FY01 and made available to the NRC.	Received
CLST.3.06	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide additional technical basis for the failure rate and how the rate is affected by localized corrosion. DOE stated that the technical basis for local corrosion conditions will be added to by additional discussion of local chemistry in the Summary of In-package Chemistry for Waste Forms revision ANL-EBS-MD-000050 which will be available in January 2001. Current Clad Degradation Summary Abstraction AMR Section 6.3, ANL-WIS-MD-000007 and Clad Degradation - Local Corrosion of Zirconium and its Alloys Under Repository Conditions AMR, ANL-EBS-MD-000012 contain the overall technical basis.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.3.07	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide data to address chloride induced localized corrosion and SCC under the environment predicted by in-package chemistry modeling. DOE stated that the technical basis for the models used for localized corrosion and SCC will be expanded in future revisions of the Clad Degradation Summary Abstraction AMR, ANL-WIS-MD-000007, available by LA.	Received
CLST.3.08	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide the documentation on the distribution for cladding temperature and stress used for hydride embrittlement. DOE stated that the stresses are documented in the Initial Cladding Conditions AMR, ANL-EBS-MD-000048. CAL-UDC-ME-000001 contains the waste package internal temperatures. Waste package surface temperatures were provided within the TSPA model (ANL-EBS-HS-000003, Rev 00, ICN 01 and ANL-EBS-MD-000049). The updated versions of these documents will be available in January 2001.	Received
CLST.3.09	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide a technical basis for critical stress that is relevant for the environment in which external SCC takes place. DOE stated that critical stress from SCC experiments under more aggressive conditions will be cited in the Revision of the Cladding Degradation Summary Abstraction AMR, ANL-WIS-MD-000007, which will be available in January 2001.	Received
CLST.3.10	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide analysis of the rockfall and vibratory loading effects on the mechanical failure of cladding, as appropriate. DOE stated that the vibratory effects are documented in Sanders et. al. 1992 SAND90-2406, A Method For Determining The Spent-Fuel Contribution To Transport Cask Containment Requirements. This will be discussed in the SDS KTI meeting. The analysis of the rockfall effects on the mechanical failure of cladding will be addressed if the agreed to updated rockfall analysis in Subissue #2, Item 8 and Subissue #1, Item 14 demonstrate that the rock will penetrate the drip shield and damage the waste package.	Received
CLST.4.01	ENG4	The agreement addresses CLST Subissues 3 & 4. In the revision to the “Summary of In-Package Chemistry for Waste Forms,” AMR, the NRC needs to know whether and how initial failures are included in the in-package chemistry modeling, taking into account the multiple barrier analysis. DOE stated that the Summary of In-Package Chemistry for Waste Forms ANL-EBS-MD-000050 deals with time since waste package breach, instead of time of waste package failures. The model is appropriate for the current implementation in the TSPA scenarios because breaches do not occur until after aqueous films may be sustained. Multiple barrier analyses are discussed in the TSPAI IRSR, and therefore will be discussed in the TSPA KTI Technical Exchange.	Complete
CLST.4.01	TSPAI	The agreement addresses CLST Subissues 3 & 4. In the revision to the “Summary of In-Package Chemistry for Waste Forms,” AMR, the NRC needs to know whether and how initial failures are included in the in-package chemistry modeling, taking into account the multiple barrier analysis. DOE stated that the Summary of In-Package Chemistry for Waste Forms ANL-EBS-MD-000050 deals with time since waste package breach, instead of time of waste package failures. The model is appropriate for the current implementation in the TSPA scenarios because breaches do not occur until after aqueous films may be sustained. Multiple barrier analyses are discussed in the TSPAI IRSR, and therefore will be discussed in the TSPA KTI Technical Exchange.	Complete
CLST.4.02	ENG3	The agreement addresses CLST Subissues 3 & 4. In the revision to the “Summary of In-Package Chemistry for Waste Forms,” AMR, address specific NRC questions regarding radiolysis, incoming water, localized corrosion, corrosion products, transient effects, and a sensitivity study on differing dissolution rates of components. DOE stated that these specific questions are currently being addressed in the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 and related AMRs and calculations. To be available in January 2001.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.4.02	ENG4	The agreement addresses CLST Subissues 3 & 4. In the revision to the "Summary of In-Package Chemistry for Waste Forms," AMR, address specific NRC questions regarding radiolysis, incoming water, localized corrosion, corrosion products, transient effects, and a sensitivity study on differing dissolution rates of components. DOE stated that these specific questions are currently being addressed in the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 and related AMRs and calculations. To be available in January 2001.	Complete
CLST.4.03	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide a more detailed calculation on the in-package chemistry effects of radiolysis. DOE stated that the calculations recently performed as discussed at the 9/12/00 Technical Exchange and preceeding teleconferences are being documented. These calculations will be referenced and justified in the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 and will be available in January 2001.	Complete
CLST.4.04	ENG4	The agreement addresses CLST Subissues 3 & 4. Need consistency between abstractions for incoming water and sensitivity studies conducted for in-package calculations, in particular, taking into account the interaction of engineered materials on the chemistry of water used for input to in-package abstractions. DOE stated that the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 will discuss the applicability of abstractions for incoming water, taking into account the revised Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR. The revision will be available in January 2001.	Complete
CLST.4.04	ENG3	The agreement addresses CLST Subissues 3 & 4. Need consistency between abstractions for incoming water and sensitivity studies conducted for in-package calculations, in particular, taking into account the interaction of engineered materials on the chemistry of water used for input to in-package abstractions. DOE stated that the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 will discuss the applicability of abstractions for incoming water, taking into account the revised Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR. The revision will be available in January 2001.	Complete
CLST.4.04	TSPAI	The agreement addresses CLST Subissues 3 & 4. Need consistency between abstractions for incoming water and sensitivity studies conducted for in-package calculations, in particular, taking into account the interaction of engineered materials on the chemistry of water used for input to in-package abstractions. DOE stated that the revision of the Summary of In-Package Chemistry for Waste Forms AMR, ANL-EBS-MD-000050 will discuss the applicability of abstractions for incoming water, taking into account the revised Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR. The revision will be available in January 2001.	Complete
CLST.4.05	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide the plan for experiments demonstrating in-package chemistry, and take into account subsequent NRC comments, if any. DOE stated that the current planning provides for the analysis of additional in-package chemistry model support. This analysis will determine which parts of the model are amenable to additional support by testing, and which parts are more amenable to sensitivity analysis, or use of analogues. Based on these results, longer range testing will be considered. If testing is determined to be appropriate, test plans will be written in FY01 and made available to the NRC.	Complete
CLST.4.06	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide additional technical basis for the failure rate and how the rate is affected by localized corrosion. DOE stated that the technical basis for local corrosion conditions will be added to by additional discussion of local chemistry in the Summary of In-package Chemistry for Waste Forms revision ANL-EBS-MD-000050 which will be available in January 2001. Current Clad Degradation Summary Abstraction AMR Section 6.3, ANL-WIS-MD-000007 and Clad Degradation - Local Corrosion of Zirconium and its Alloys Under Repository Conditions AMR, ANL-EBS-MD-000012 contain the overall technical basis.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.4.07	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide data to address chloride induced localized corrosion and SCC under the environment predicted by in-package chemistry modeling. DOE stated that the technical basis for the models used for localized corrosion and SCC will be expanded in future revisions of the Clad Degradation Summary Abstraction AMR, ANL-WIS-MD-000007, available by LA.	Complete
CLST.4.08	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide the documentation on the distribution for cladding temperature and stress used for hydride embrittlement. DOE stated that the stresses are documented in the Initial Cladding Conditions AMR, ANL-EBS-MD-000048. CAL-UDC-ME-000001 contains the waste package internal temperatures. Waste package surface temperatures were provided within the TSPA model (ANL-EBS-HS-000003, Rev 00, ICN 01 and ANL-EBS-MD-000049). The updated versions of these documents will be available in January 2001.	Complete
CLST.4.09	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide a technical basis for critical stress that is relevant for the environment in which external SCC takes place. DOE stated that critical stress from SCC experiments under more aggressive conditions will be cited in the Revision of the Cladding Degradation Summary Abstraction AMR, ANL-WIS-MD-000007, which will be available in January 2001.	Complete
CLST.4.10	ENG4	The agreement addresses CLST Subissues 3 & 4. Provide analysis of the rockfall and vibratory loading effects on the mechanical failure of cladding, as appropriate. DOE stated that the vibratory effects are documented in Sanders et. al. 1992 SAND90-2406, A Method For Determining The Spent-Fuel Contribution To Transport Cask Containment Requirements. This will be discussed in the SDS KTI meeting. The analysis of the rockfall effects on the mechanical failure of cladding will be addressed if the agreed to updated rockfall analysis in Subissue #2, Item 8 and Subissue #1, Item 14 demonstrate that the rock will penetrate the drip shield and damage the waste package.	Complete
CLST.4.11	ENG4	See also CLST Subissue 3 agreements. In addition, in the revision to the "Defense High Level Waste Glass Degradation," AMR, address specific NRC questions regarding (a) the inconsistency of the rates in acid leg for glasses, (b) the technical basis for use of boron versus silica in the radionuclide release from glass, and (c) clarification of the definition of long term rates of glass dissolution. DOE stated that these questions will be addressed in the Defense High Level Waste AMR revision and will be available in January 2001.	Complete
CLST.5.01	ENG3	Provide Revision 1 to the Topical Report. DOE stated that it will provide the Disposal Criticality Analysis Methodology Topical Report, Revision 01, to NRC during January 2001.	Received
CLST.5.01	ENG1	Provide Revision 1 to the Topical Report. DOE stated that it will provide the Disposal Criticality Analysis Methodology Topical Report, Revision 01, to NRC during January 2001.	Received
CLST.5.01	ENG2	Provide Revision 1 to the Topical Report. DOE stated that it will provide the Disposal Criticality Analysis Methodology Topical Report, Revision 01, to NRC during January 2001.	Received
CLST.5.01	TSPAI	Provide Revision 1 to the Topical Report. DOE stated that it will provide the Disposal Criticality Analysis Methodology Topical Report, Revision 01, to NRC during January 2001.	Received
CLST.5.01	ENG4	Provide Revision 1 to the Topical Report. DOE stated that it will provide the Disposal Criticality Analysis Methodology Topical Report, Revision 01, to NRC during January 2001.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.5.02	TSPAI	Provide the Disruptive Events FEPs AMR, the FEPs database, and the Analyses to Support Screening of System-Level Features, Events, and Processes for the Yucca Mountain Total System Performance Assessment-Site Recommendation. DOE stated that it will provide the FEPs AMRs, the Analyses to Support Screening of System-Level Features, Events, and Processes for the Yucca Mountain Total System Performance Assessment-Site Recommendation AMR, and the FEPs database to NRC during January 2001.	Complete
CLST.5.03	TSPAI	DOE will provide an updated technical basis for screening criticality from the post-closure performance assessment. The technical basis will include (1) a determination of whether the formation of condensed water could allow liquid water to enter the waste package without the failure of the drip shield, and (2) an assessment of improper heat treatment, if it is shown to result in early failure of waste packages, considering potential failure modes. The documentation of the technical basis is comprised of (1) Analysis of Mechanisms for Early Waste Package Failure AMR, (2) Probability of Criticality Before 10,000 years calculation, and (3) Features, Event, and Process System Level and Criticality AMR. The first document will be provided to NRC in FY02, the second and third documents will be provided in FY03.	Received
CLST.5.03	ENG2	DOE will provide an updated technical basis for screening criticality from the post-closure performance assessment. The technical basis will include (1) a determination of whether the formation of condensed water could allow liquid water to enter the waste package without the failure of the drip shield, and (2) an assessment of improper heat treatment, if it is shown to result in early failure of waste packages, considering potential failure modes. The documentation of the technical basis is comprised of (1) Analysis of Mechanisms for Early Waste Package Failure AMR, (2) Probability of Criticality Before 10,000 years calculation, and (3) Features, Event, and Process System Level and Criticality AMR. The first document will be provided to NRC in FY02, the second and third documents will be provided in FY03.	Received
CLST.5.03	ENG1	DOE will provide an updated technical basis for screening criticality from the post-closure performance assessment. The technical basis will include (1) a determination of whether the formation of condensed water could allow liquid water to enter the waste package without the failure of the drip shield, and (2) an assessment of improper heat treatment, if it is shown to result in early failure of waste packages, considering potential failure modes. The documentation of the technical basis is comprised of (1) Analysis of Mechanisms for Early Waste Package Failure AMR, (2) Probability of Criticality Before 10,000 years calculation, and (3) Features, Event, and Process System Level and Criticality AMR. The first document will be provided to NRC in FY02, the second and third documents will be provided in FY03.	Received
CLST.5.04	SZ2	Provide the list of validation reports and their schedules. DOE stated that the geochemical model validation reports for "Geochemistry Model Validation Report: Degradation and Release" and "Geochemistry Model Validation Report: Material Accumulation" are expected to be available during 2001. The remainder of the reports are expected to be available during FY2002 subject to the results of detailed planning and scheduling. DOE understands that these reports are required to be provided prior to LA. A list of model validation reports was provided during the technical exchange and is included as an attachment to the meeting summary.	Received
CLST.5.04	ENG4	Provide the list of validation reports and their schedules. DOE stated that the geochemical model validation reports for "Geochemistry Model Validation Report: Degradation and Release" and "Geochemistry Model Validation Report: Material Accumulation" are expected to be available during 2001. The remainder of the reports are expected to be available during FY2002 subject to the results of detailed planning and scheduling. DOE understands that these reports are required to be provided prior to LA. A list of model validation reports was provided during the technical exchange and is included as an attachment to the meeting summary.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
CLST.5.04	ENG1	Provide the list of validation reports and their schedules. DOE stated that the geochemical model validation reports for “Geochemistry Model Validation Report: Degradation and Release” and “Geochemistry Model Validation Report: Material Accumulation” are expected to be available during 2001. The remainder of the reports are expected to be available during FY2002 subject to the results of detailed planning and scheduling. DOE understands that these reports are required to be provided prior to LA. A list of model validation reports was provided during the technical exchange and is included as an attachment to the meeting summary.	Received
CLST.5.05	ENG1	Provide information on how the increase in the radiation fields due to the criticality event affects the consequence evaluation because of increased radiolysis inside the waste package and at the surfaces of nearby waste packages or demonstrate that the current corrosion and dissolution models encompass the range of chemical conditions and corrosion potentials that would result from this increase in radiolysis. DOE stated that the preliminary assessment (calculation) of radiolysis effects from a criticality event will be available to NRC during February 2001. The final assessment of these conditions will be available to NRC prior to LA.	Received
CLST.5.05	ENG4	Provide information on how the increase in the radiation fields due to the criticality event affects the consequence evaluation because of increased radiolysis inside the waste package and at the surfaces of nearby waste packages or demonstrate that the current corrosion and dissolution models encompass the range of chemical conditions and corrosion potentials that would result from this increase in radiolysis. DOE stated that the preliminary assessment (calculation) of radiolysis effects from a criticality event will be available to NRC during February 2001. The final assessment of these conditions will be available to NRC prior to LA.	Received
CLST.5.05	ENG3	Provide information on how the increase in the radiation fields due to the criticality event affects the consequence evaluation because of increased radiolysis inside the waste package and at the surfaces of nearby waste packages or demonstrate that the current corrosion and dissolution models encompass the range of chemical conditions and corrosion potentials that would result from this increase in radiolysis. DOE stated that the preliminary assessment (calculation) of radiolysis effects from a criticality event will be available to NRC during February 2001. The final assessment of these conditions will be available to NRC prior to LA.	Received
CLST.5.06	ENG2	Provide a “what-if” analysis to evaluate the impact of an early criticality assuming a waste package failure. DOE stated that it would provide the requested analyses prior to LA. Actual schedule to be provided pending DOE planning process.	Complete
CLST.5.06	ENG1	Provide a “what-if” analysis to evaluate the impact of an early criticality assuming a waste package failure. DOE stated that it would provide the requested analyses prior to LA. Actual schedule to be provided pending DOE planning process.	Complete
CLST.5.06	TSPAI	Provide a “what-if” analysis to evaluate the impact of an early criticality assuming a waste package failure. DOE stated that it would provide the requested analyses prior to LA. Actual schedule to be provided pending DOE planning process.	Complete
CLST.5.07	TSPAI	Provide sensitivity analyses that will include the most significant probability/consequence criticality scenarios. DOE stated that it would provide the requested analyses prior to LA. Actual schedule to be provided pending DOE planning process.	Complete
CLST.5.07	ENG4	Provide sensitivity analyses that will include the most significant probability/consequence criticality scenarios. DOE stated that it would provide the requested analyses prior to LA. Actual schedule to be provided pending DOE planning process.	Complete
CLST.5.07	ENG1	Provide sensitivity analyses that will include the most significant probability/consequence criticality scenarios. DOE stated that it would provide the requested analyses prior to LA. Actual schedule to be provided pending DOE planning process.	Complete
CLST.5.07	ENG2	Provide sensitivity analyses that will include the most significant probability/consequence criticality scenarios. DOE stated that it would provide the requested analyses prior to LA. Actual schedule to be provided pending DOE planning process.	Complete

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CLST.6.01	ENG1	Provide documentation for the path forward items in the "Subissue 6: Alternate EBS Design Features - Effect on Container Lifetime" presentation, slides 7 & 8. [perform more sensitivity measurements of general corrosion rates - same approach as taken for Alloy 22; confirm no deleterious effects of fluoride ion and trace heavy metal ions in water on corrosion behavior of titanium - similar approach to that taken in electrochemically based studies on Alloy 22; establish damaging hydrogen levels in titanium alloys - Grade 2 vs Grades 7 and 16 vs Grade 5 and 24 - evaluate hydrogen charged notched tensile speciems and hydrogen pickup of galvanically coupled LTCTF specimens; conduct SCC testing of titanium, similar to approach taken for Alloy 22; confirm intergranular or internal oxidation of titanium is not applicable under YM thermal and environmental conditions] DOE stated that the documentation of the path forward items will be completed and as results become available, they will documented in the revisions of AMRs (ANL-EBS-MD-000005, Stress Corrosion Cracking of the Drip Shield, the Waste Package Outer Barrier and the Stainless Structural Material, and ANL-EBS-MD-000004, General Corrosion and Localized Corrosion of the Drip Shield), to be completed by LA.	Received
CLST.6.02	ENG1	Provide additional justification for the use of a 400 ppm hydrogen criterion or perform a sensitivity analysis using a lower value. DOE stated that additional justification will be found in the report "Review of Expected Behaviour of Alpha Titanium Alloys under Yucca Mountain Condition" TDR-EBS-MD-000015, which is in preparation and will be available in January 2001.	Received
CLST.6.03	ENG1	Provide the technical basis for the assumed fraction of hydrogen absorbed into titanium as a result of corrosion. DOE stated that additional justification will be found in the report "Review of Expected Behaviour of Alpha Titanium Alloys under Yucca Mountain Condition" TDR-EBS-MD-000015, which is in preparation and will be available in January 2001.	Received
CLST.6.04	ENG1	Provide temperature distribution (CCDF) of the drip shield as a function of time under the current EBS design. DOE stated that the temperature distribution will be provided in the next revision of the AMR, ANL-EBS-MD-000049, Rev 00, ICN 01, which will be available in January 2001.	Complete
CLST.6.04	PRE	Provide temperature distribution (CCDF) of the drip shield as a function of time under the current EBS design. DOE stated that the temperature distribution will be provided in the next revision of the AMR, ANL-EBS-MD-000049, Rev 00, ICN 01, which will be available in January 2001.	Complete
ENFE.1.01	ENG3	Provide updated FEPs AMRs with additional technical bases for those FEPs previously identified by the NRC in Rev. 03 of the ENFE IRSR as inadequately screened. In Rev 03 of the ENFE IRSR, the NRC identified 17 FEPs associated with Subissue 1 for which no screening arguments were identified in the FEPs data base, screening arguments were inconsistent with other project documents, or inadequate exclusion arguments were provided. The lack of screening arguments has been addressed in Rev 00 of the FEPs data base and Rev 00 of the supporting AMRs. Current revisions (or ICNs) of the FEPs AMRs, scheduled for completion in January 2001, will partially address the remaining NRC comments. Consideration of the remaining NRC comments will be provided in subsequent FEPs AMR revisions, expected to be available as periodic revisions, the entirety of which will be available prior to license application.	Complete
ENFE.1.01	TSPAI	Provide updated FEPs AMRs with additional technical bases for those FEPs previously identified by the NRC in Rev. 03 of the ENFE IRSR as inadequately screened. In Rev 03 of the ENFE IRSR, the NRC identified 17 FEPs associated with Subissue 1 for which no screening arguments were identified in the FEPs data base, screening arguments were inconsistent with other project documents, or inadequate exclusion arguments were provided. The lack of screening arguments has been addressed in Rev 00 of the FEPs data base and Rev 00 of the supporting AMRs. Current revisions (or ICNs) of the FEPs AMRs, scheduled for completion in January 2001, will partially address the remaining NRC comments. Consideration of the remaining NRC comments will be provided in subsequent FEPs AMR revisions, expected to be available as periodic revisions, the entirety of which will be available prior to license application.	Complete

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ENFE.1.02	TSPAI	Provide the FEPs database. The DOE will provide the FEPs data base to the NRC during March 2001.	Complete
ENFE.1.03	UZ2	Provide the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR, Rev. 01 and 02, including (1) information on the quantity of unreacted solute mass that is trapped in dry-out zone in TOUGHREACT simulations, as well as how this would affect precipitation and the resulting change in hydrologic properties and (2) documentation of model validation consistent with the DOE QA requirements. The DOE will provide documentation of model validation, consistent with the DOE QA requirements, in the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR (MDL-NBS-HS-000001) Rev 01, expected to be available to the NRC in March 2001. The DOE will provide information on the quantity of unreacted solute mass that is trapped in the dryout zone in TOUGHREACT simulations in the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR Rev 02, expected to be available to the NRC in FY 02.	Received
ENFE.1.03	ENG3	Provide the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR, Rev. 01 and 02, including (1) information on the quantity of unreacted solute mass that is trapped in dry-out zone in TOUGHREACT simulations, as well as how this would affect precipitation and the resulting change in hydrologic properties and (2) documentation of model validation consistent with the DOE QA requirements. The DOE will provide documentation of model validation, consistent with the DOE QA requirements, in the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR (MDL-NBS-HS-000001) Rev 01, expected to be available to the NRC in March 2001. The DOE will provide information on the quantity of unreacted solute mass that is trapped in the dryout zone in TOUGHREACT simulations in the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR Rev 02, expected to be available to the NRC in FY 02.	Received
ENFE.1.04	UZ2	Provide additional technical bases for the DOE's treatment of the effects of cementitious materials on hydrologic properties. The DOE will provide additional information on the effects of cementitious materials in an update to the Unsaturated Zone Flow and Transport PMR (TDR-NBS-HS-000002), available in FY 02. Information provided will include results of evaluation of the magnitude of potential effects on hydrologic properties and radionuclide transport characteristics of the unsaturated zone.	Received
ENFE.1.04	ENG3	Provide additional technical bases for the DOE's treatment of the effects of cementitious materials on hydrologic properties. The DOE will provide additional information on the effects of cementitious materials in an update to the Unsaturated Zone Flow and Transport PMR (TDR-NBS-HS-000002), available in FY 02. Information provided will include results of evaluation of the magnitude of potential effects on hydrologic properties and radionuclide transport characteristics of the unsaturated zone.	Received
ENFE.1.05	UZ2	Address the various sources of uncertainty (e.g., model implementation, conceptual model, and data uncertainty (hydrologic, thermal, and geochemical)) in the THC model. The DOE will evaluate the various sources of uncertainty in the THC process model, including details as to how the propagation of various sources of uncertainty are calculated in a systematic uncertainty analysis. The DOE will document that uncertainty evaluation in the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR (MDL-NBS-HS-000001) Rev 02 (or in another future document), expected to be available in FY 02.	Received
ENFE.1.05	ENG3	Address the various sources of uncertainty (e.g., model implementation, conceptual model, and data uncertainty (hydrologic, thermal, and geochemical)) in the THC model. The DOE will evaluate the various sources of uncertainty in the THC process model, including details as to how the propagation of various sources of uncertainty are calculated in a systematic uncertainty analysis. The DOE will document that uncertainty evaluation in the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR (MDL-NBS-HS-000001) Rev 02 (or in another future document), expected to be available in FY 02.	Received

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ENFE.1.06	TSPAI	Provide the technical basis for excluding entrained colloids in the analysis of FEP 2.2.10.06.00 (Thermo-Chemical Alteration) or an alternative FEP. The DOE will provide the technical basis for screening entrained colloids in the analysis of FEP 2.2.10.06.00 in a future revision of the Features, Events, and Processes in UZ Flow and Transport AMR (ANL-NBS-MD-000001), expected to be available in FY 02.	Received
ENFE.1.06	ENG3	Provide the technical basis for excluding entrained colloids in the analysis of FEP 2.2.10.06.00 (Thermo-Chemical Alteration) or an alternative FEP. The DOE will provide the technical basis for screening entrained colloids in the analysis of FEP 2.2.10.06.00 in a future revision of the Features, Events, and Processes in UZ Flow and Transport AMR (ANL-NBS-MD-000001), expected to be available in FY 02.	Received
ENFE.1.07	ENG3	Provide physical evidence that supports the model of matrix fracture interaction precipitation effects (e.g., coring). The DOE will provide the following evidence that supports the model of matrix/fracture interaction precipitation effects: (1) Existing data from the Single Heater Test (SHT) of post-test overcoring Mineralogy-Petrology (Min-Pet) analysis (SHT final report [MOL.20000103.0634] and DTN LASL831151.AQ98.001) is expected to be provided to the NRC in March 2001. (2) Results of ongoing side-wall sampling Min-Pet analyses of DST samples are expected to be provided to the NRC in FY 02. (3) The DOE expects to provide the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR (MDL-NBS-HS-000001) Rev 01 to the NRC as evidence of matrix-fracture interaction in March 2001.	Received
ENFE.2.01	ENG3	Provide updated FEPs AMRs with additional technical bases for those FEPs previously identified by the NRC in Rev. 03 of the ENFE IRSR as inadequately screened. In Rev 03 of the ENFE IRSR, the NRC identified 24 FEPs associated with Subissue 2 for which no screening arguments were identified in the FEPs data base, screening arguments were inconsistent with other project documents, or inadequate exclusion arguments were provided. The lack of screening arguments has been addressed in Rev 00 of the FEPs data base and Rev 00 of the supporting AMRs. Current revisions (or ICNs) of the FEPs AMRs, scheduled for completion in January 2001, will partially address the remaining NRC comments. Consideration of the remaining NRC comments will be provided in subsequent FEPs AMR revisions, expected to be available as periodic revisions, the entirety of which will be available prior to license application.	Complete
ENFE.2.01	TSPAI	Provide updated FEPs AMRs with additional technical bases for those FEPs previously identified by the NRC in Rev. 03 of the ENFE IRSR as inadequately screened. In Rev 03 of the ENFE IRSR, the NRC identified 24 FEPs associated with Subissue 2 for which no screening arguments were identified in the FEPs data base, screening arguments were inconsistent with other project documents, or inadequate exclusion arguments were provided. The lack of screening arguments has been addressed in Rev 00 of the FEPs data base and Rev 00 of the supporting AMRs. Current revisions (or ICNs) of the FEPs AMRs, scheduled for completion in January 2001, will partially address the remaining NRC comments. Consideration of the remaining NRC comments will be provided in subsequent FEPs AMR revisions, expected to be available as periodic revisions, the entirety of which will be available prior to license application.	Complete
ENFE.2.02	TSPAI	Provide the FEPs database. The DOE will provide the FEPs data base to the NRC during March 2001.	Complete
ENFE.2.03	ENG3	Provide the technical basis for FEP 1.2.06.00 (Hydrothermal Activity), addressing points (a) through (e) of NRC Subissue 2 slide handed out at the January 2001 ENFE technical exchange. The DOE will provide additional technical bases for the screening of FEP 1.2.06.00 (Hydrothermal Activity), in a future revision of the Features, Events, and Processes in UZ Flow and Transport AMR (ANL-NBS-MD-000001), expected to be available in FY 02. Within these technical bases, the DOE will address NRC comments [points (a) through (e)] presented on the NRC Subissue 2 slide handed out at the January 2001 ENFE technical exchange or provide justification that it is not needed.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
ENFE.2.03	TSPAI	Provide the technical basis for FEP 1.2.06.00 (Hydrothermal Activity), addressing points (a) through (e) of NRC Subissue 2 slide handed out at the January 2001 ENFE technical exchange. The DOE will provide additional technical bases for the screening of FEP 1.2.06.00 (Hydrothermal Activity), in a future revision of the Features, Events, and Processes in UZ Flow and Transport AMR (ANL-NBS-MD-000001), expected to be available in FY 02. Within these technical bases, the DOE will address NRC comments [points (a) through (e)] presented on the NRC Subissue 2 slide handed out at the January 2001 ENFE technical exchange or provide justification that it is not needed.	Received
ENFE.2.04	ENG1	Provide the technical basis for bounding the trace elements and fluoride for the geochemical environment affecting the drip shield and waste package, including the impact of engineered materials. The DOE will document the concentrations of trace elements and fluoride in waters that could contact the drip shield and waste package in a revision to the Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR (ANL-EBS-MD-000001), which will be available in FY02. In addition, trace elements and fluoride concentrations in introduced materials in the EBS (including cement grout, structural steels, and other materials as appropriate) will be addressed in a revision to the Engineered Barrier System: Physical and Chemical Environment Model AMR (ANL-EBS-MD-000033), expected to be available in FY 02.	Complete
ENFE.2.04	ENG3	Provide the technical basis for bounding the trace elements and fluoride for the geochemical environment affecting the drip shield and waste package, including the impact of engineered materials. The DOE will document the concentrations of trace elements and fluoride in waters that could contact the drip shield and waste package in a revision to the Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR (ANL-EBS-MD-000001), which will be available in FY02. In addition, trace elements and fluoride concentrations in introduced materials in the EBS (including cement grout, structural steels, and other materials as appropriate) will be addressed in a revision to the Engineered Barrier System: Physical and Chemical Environment Model AMR (ANL-EBS-MD-000033), expected to be available in FY 02.	Complete
ENFE.2.05	ENG3	Evaluate data and model uncertainties for specific in-drift geochemical environment submodels used in TSPA calculations and propagate those uncertainties following the approach described in Agreement #5, Subissue 1. The DOE will evaluate data and model uncertainties for specific in-drift geochemical environment submodels used in TSPA calculations and propagate those uncertainties following the approach described in Subissue 1, Agreement #5. The DOE will document the evaluation in an update to the Engineered Barrier System: Physical and Chemical Environment Model AMR (ANL-EBS-MD-000033) (or in another future document), expected to be available in FY 02.	Received
ENFE.2.06	ENG3	Evaluate the impact of the range of local chemistry (e.g., dripping of equilibrated evaporated cement leachate and corrosion products) conditions at the drip shield and waste package considering the chemical divide phenomena that may propagate small uncertainties into large effects. The DOE will evaluate the range of local chemical conditions at the drip shield and waste package (e.g. local variations in water composition associated with cement leaching or the presence of corrosion products), considering potential evaporative concentration and the chemical divide effect whereby small differences in initial composition could cause large differences in brine characteristics. This evaluation will be documented in a revision to the Engineered Barrier System: Physical and Chemical Environment Model AMR (ANL-EBS-MD-000033), expected to be available in FY 02.	Received
ENFE.2.07	ENG3	Identify specific coupling relationships that are included and excluded from TSPA, including Onsager couples, and give technical bases for their inclusion or exclusion. The DOE will identify specific coupling relationships that are included and excluded from TSPA, including Onsager couples, and give the technical basis for inclusion and exclusion. This information will be documented in a revision to the Engineered Barrier System Degradation, Flow, and Transport PMR (TDR-EBS-MD-000006), expected to be available by September 2001.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
ENFE.2.08	ENG3	Provide stronger technical basis for the suppression of individual minerals predicted by equilibrium models. The DOE will provide additional technical basis for suppression of individual minerals predicted by equilibrium models, in a revision to the Engineered Barrier System: Physical and Chemical Environment Model AMR (ANL-EBS-MD-000033), expected to be available in FY02.	Complete
ENFE.2.09	ENG3	Provide the In-Drift Precipitates/Salts Analysis AMR, Rev. 00, ICN 02, including (1) the major anionic (e.g., fluoride or chloride) and cationic species, and (2) additional technical basis for the low relative humidity model. The DOE will provide the In-Drift Precipitates/Salts Analysis AMR (ANL-EBS-MD-000045), Rev. 00, ICN 02, including the major anionic (e.g., fluoride or chloride) and cationic species, in January 2001. The DOE will provide to the NRC an update to the In-Drift Precipitates/Salts Analysis AMR (ANL-EBS-MD-000045) that will provide additional technical bases for the low relative humidity model, expected to be available in FY 02.	Complete
ENFE.2.10	ENG3	Provide additional information about the range of composition of waters that could contact the drip shield or waste package, including whether such waters are of the bicarbonate or chloride-sulfate type. The DOE will describe the range of bulk composition for waters that could affect corrosion of the drip shield or waste package outer barrier, in a revision to the Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR (ANL-EBS-MD-000001), expected to be	Received
ENFE.2.11	ENG3	Provide the technical basis for the current treatment of the kinetics of chemical processes in the in-drift geochemical models. This basis should address data in the figure on page 16 of the G.Gdowski Subissue 2 presentation with appropriate treatment of time as related to abstractions used in TSPA. The DOE will provide additional technical basis for the treatment of precipitation-dissolution kinetics by the in-drift geochemical models, in a revision to the Engineered Barrier System: Physical and Chemical Environment Model AMR (ANL-EBS-MD-000033), expected to be available in FY02. The technical basis will include reaction progress simulation for laboratory evaporative concentration tests, and will include appropriate treatment of time as related to the residence times associated with the abstractions used to represent in-drift processes in TSPA.	Complete
ENFE.2.12	ENG3	Provide the documentation and analysis of the column crush tuff experiments. The DOE will provide documentation of the results obtained from the crushed tuff hydrothermal column experiment, and of post-test analysis, in new reports specific to the column test, expected to be available by September 2001.	Complete
ENFE.2.13	ENG3	Provide documentation regarding the deposition of dust and its impact on the salt analysis. The DOE will provide documentation of dust sampling in the Exploratory Studies Facility, and analysis of the dust and evaluation of its impact on the chemical environment on the surface of the drip shield and waste package, in a revision to the Engineered Barrier System: Physical and Chemical Environment Model AMR (ANL-EBS-MD-000033), expected to be available in FY02.	Received
ENFE.2.14	ENG1	Provide the analysis of laboratory solutions that have interacted with introduced materials. The DOE will provide additional information about laboratory solutions that have interacted with introduced materials, in a revision to the Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR (ANL-EBS-MD-000001), expected to be available in FY02.	Complete
ENFE.2.14	ENG3	Provide the analysis of laboratory solutions that have interacted with introduced materials. The DOE will provide additional information about laboratory solutions that have interacted with introduced materials, in a revision to the Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR (ANL-EBS-MD-000001), expected to be available in FY02.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
ENFE.2.15	ENG3	Provide the additional data to constrain the interpolative low relative humidity salts model. The data should provide the technical basis as to why the assumption of the presence of sodium nitrate is conservative, when modeling and experimental results indicate the presence of other mineral phases for which the deliquesence point is unknown. The DOE will provide additional information to constrain the low-relative humidity salts model. The information will include the deliquescence behavior of mineral assemblages derived from alternative starting water compositions (including bulk water compositions, and local variations associated with cement leaching or the presence of corrosion products) representing the range of potential water compositions in the emplacement drifts. This information will be documented in a revision to the In-Drift Precipitates/Salts Analysis AMR (ANL-EBS-MD-000045), expected to be available in FY02.	Complete
ENFE.2.16	ENG3	Provide the Drift-Scale Coupled Processes (DST and THC Seepage) Models, Rev. 01, including information supporting both the limited suite mineral model and the more complete extended model. The DOE will provide the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR (MDL-NBS-HS-000001) Rev 01, including information supporting both the limited suite mineral model and the more complete extended model, in March 2001.	Complete
ENFE.2.17	ENG3	Provide documentation of data used to calibrate models and data to support model predictions, and an assessment of data uncertainty (e.g., sampling and analytical), that includes critical analyses of variables that affect the data measurements and their interpretations (e.g., drift-scale thermal test and evaporation tests). The DOE will provide documentation of data used to calibrate models and data to support model predictions, and an assessment of data uncertainty (e.g., sampling and analytical) in the area of water and gas chemistry from the drift-scale thermal tests and evaporation tests. This documentation will be provided in revisions to the following AMRs: Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier (ANL-EBS-MD-000001), Engineered Barrier System: Physical and Chemical Environment Model (ANL-EBS-MD-000033), and Drift-Scale Coupled Processes (DST and THC Seepage) Models (MDL-NBS-HS-000001), or other documents as appropriate. All documents or revisions are expected to be available in FY 02.	Received
ENFE.2.18	ENG3	The NRC and DOE agreed the following documents would be provided with the schedule indicated: Engineered Barrier System: Physical and Chemical Environment Model (ANL-EBS-MD-000033) Rev. 01: FY 02; Multiscale Thermohydrologic Model (ANL-EBS-MD-000049) Rev. 00, ICN 01: January 2001;Abstraction of Drift-Scale Coupled Processes (ANL-NBS-HS-000029) Rev 01: September 2001; Environment on the Surfaces of the Drip Shield and the Waste Package Outer Barrier (ANL-EBS-MD-000001) Rev. 00, ICN 01: January 2001; Waste Package Degradation PMR (TDR-WIS-MD-000002) Rev. 00, ICN 01: January 2001; Engineered Barrier System Degradation, Flow, and Transport PMR (TDR-EBS-MD-000006) Rev. 01: September 2001; Near Field Environment PMR (TDR-NBS-MD-000001) Rev. 00, ICN 02: January 2001 and Rev. 01: September 2001; Hydrogen Induced Cracking of Drip Shield (ANL-EBS-MD-000006) Rev. 00, ICN 01: January 2001; Drift Degradation Analysis (ANL-EBS-MD-000027) Rev. 01: January 2001; Design Analysis for the Ex-Container Components, ANL-XCS-ME-000001 Rev. 00: January 2001; Longevity of Emplacement Drift Ground Support Materials (ANL-EBS-GE-000003) Rev. 01: January 2001; Stress Corrosion Cracking of the Drip Shield, the Waste Package Outer Barrier, and the Stainless Steel Structural Material AMR (ANL-EBS-MD-000005) Rev. 00, ICN 01: January 2001; In-Drift Microbial Communities (ANL-EBS-MD-000038) Rev. 00, ICN 01: January 2001; Physical and Chemical Environmental Abstraction Model (ANL-EBS-MD-000046) Rev. 00, ICN 01: January 2001; Unsaturated Zone Flow and Transport Model PMR (TDR-NBS-HS-000002) Rev. 01: September 2001; General Corrosion and Localized Corrosion of the Drip Shield (ANL-EBS-MD-000004) Rev. 00: January 2001; Water Distribution and Removal Model (ANL-EBS-MD-000032) Rev. 01: January 2001.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
ENFE.3.01	ENG1	The NRC and DOE agreed the following documents would be provided in February 2001: WAPDEG Analysis of Waste Package and Drip Shield Degradation AMR (ANL-EBS-PA-000001) Rev 00 ICN 01; Near Field Environment PMR (TDR-NBS-MD-000001) Rev 00 ICN 03; Summary of In-Package Chemistry for Waste Forms AMR (ANL-EBS-MD-000050) Rev 01; Calculation of General Corrosion Rate of Drip Shield and Waste Package Outer Barrier to Support WAPDEG Analysis (CAL-EBS-PA-000002) Rev 01; Abstraction of Models for Stainless Steel Structural Material Degradation (ANL-EBS-PA-000005) Rev 00; In-Package Chemistry Abstraction AMR (ANL-EBS-MD-000037) Rev 01; Total System Performance Assessment for the Site Recommendation (TDR-WIS-PA-000001) Rev 00; Waste Form Colloid-Associated Concentrations Limits: Abstraction and Summary AMR (ANL-WIS-MD-000012) Rev 00 ICN 01	Complete
ENFE.3.01	ENG3	The NRC and DOE agreed the following documents would be provided in February 2001: WAPDEG Analysis of Waste Package and Drip Shield Degradation AMR (ANL-EBS-PA-000001) Rev 00 ICN 01; Near Field Environment PMR (TDR-NBS-MD-000001) Rev 00 ICN 03; Summary of In-Package Chemistry for Waste Forms AMR (ANL-EBS-MD-000050) Rev 01; Calculation of General Corrosion Rate of Drip Shield and Waste Package Outer Barrier to Support WAPDEG Analysis (CAL-EBS-PA-000002) Rev 01; Abstraction of Models for Stainless Steel Structural Material Degradation (ANL-EBS-PA-000005) Rev 00; In-Package Chemistry Abstraction AMR (ANL-EBS-MD-000037) Rev 01; Total System Performance Assessment for the Site Recommendation (TDR-WIS-PA-000001) Rev 00; Waste Form Colloid-Associated Concentrations Limits: Abstraction and Summary AMR (ANL-WIS-MD-000012) Rev 00 ICN 01	Complete
ENFE.3.02	ENG3	Provide the thermodynamic database and the report associated with the database. The DOE will provide the thermodynamic data base [Input Transmittal for Thermodynamic Data Input Files for Geochemical Calculations (MO0009THRMODYN.001)] and Data Qualification Report for the Thermodynamic Data File, DATA0.ympR0 for Geochemical Code EQ 3/6 (TDR-EBS-MD-000012) to the NRC in February 2001.	Complete
ENFE.3.03	ENG3	Provide analyses to verify that bulk-scale chemical processes dominate the in-package chemical environment. The DOE will provide analyses justifying the use of bulk chemistry as opposed to local chemistry for solubility and waste form degradation models. These analyses will be documented in an update to the Miscellaneous Waste-Form FEPs AMR (ANL-WIS-MD-000009) or in an update to the Summary of In-Package Chemistry for Waste Forms AMR (ANL-EBS-MD-000050), expected to be available in FY 02.	Received
ENFE.3.03	ENG4	Provide analyses to verify that bulk-scale chemical processes dominate the in-package chemical environment. The DOE will provide analyses justifying the use of bulk chemistry as opposed to local chemistry for solubility and waste form degradation models. These analyses will be documented in an update to the Miscellaneous Waste-Form FEPs AMR (ANL-WIS-MD-000009) or in an update to the Summary of In-Package Chemistry for Waste Forms AMR (ANL-EBS-MD-000050), expected to be available in FY 02.	Received
ENFE.3.04	ENG4	Complete validation of in-package chemistry models. Agreement #5 for CLST subissue 3 addresses testing plans. Model validation based on this testing and further analysis will be documented in an update to the Summary of In-Package Chemistry for Waste Forms AMR (ANL-EBS-MD-000050), expected to be available in FY 02.	Received
ENFE.3.05	UZ3	Provide the technical basis for selection of radionuclides that are released via reversible and irreversible attachment to colloids for different waste forms in the TSPA. The technical bases for the selection of radionuclides released via reversible and irreversible attachments to colloids for different waste forms is provided in section 3.5.6.1 of the Total System Performance Assessment (TSPA) Model for Site Recommendation (MDL-WIS-PA-000002) Rev 00. This document will be provided to the NRC in January 2001.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
ENFE.3.05	ENG3	Provide the technical basis for selection of radionuclides that are released via reversible and irreversible attachment to colloids for different waste forms in the TSPA. The technical bases for the selection of radionuclides released via reversible and irreversible attachments to colloids for different waste forms is provided in section 3.5.6.1 of the Total System Performance Assessment (TSPA) Model for Site Recommendation (MDL-WIS-PA-000002) Rev 00. This document will be provided to the NRC in January 2001.	Received
ENFE.3.05	ENG4	Provide the technical basis for selection of radionuclides that are released via reversible and irreversible attachment to colloids for different waste forms in the TSPA. The technical bases for the selection of radionuclides released via reversible and irreversible attachments to colloids for different waste forms is provided in section 3.5.6.1 of the Total System Performance Assessment (TSPA) Model for Site Recommendation (MDL-WIS-PA-000002) Rev 00. This document will be provided to the NRC in January 2001.	Received
ENFE.4.01	ENG3	Provide the executable version of the most recently qualified version of TOUGHREACT. The DOE will provide the executable TOUGHREACT Rev 2.2 to the NRC by February 2001, subject to the NRC obtaining any applicable agreement for usage of the software.	Complete
ENFE.4.02	ENG3	Provide the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR, Rev. 01 and 02. The DOE will provide the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR (MDL-NBS-HS-000001) Rev 01 to the NRC in March 2001. The DOE will provide the Drift-Scale Coupled Processes (DST and THC Seepage) Models AMR Rev 02 to the NRC in FY 02.	Received
ENFE.4.03	ENG3	Provide the technical bases for screening out coupled THC effects on radionuclide transport properties and colloids. The DOE will provide the technical bases for screening out coupled THC effects on radionuclide transport properties and colloids in a new AMR or in a revision to an existing AMR, expected to be available in FY 02.	Received
ENFE.4.03	TSPAI	Provide the technical bases for screening out coupled THC effects on radionuclide transport properties and colloids. The DOE will provide the technical bases for screening out coupled THC effects on radionuclide transport properties and colloids in a new AMR or in a revision to an existing AMR, expected to be available in FY 02.	Received
ENFE.4.04	ENG3	Provide the technical basis for excluding entrained colloids in the analysis of FEP 2.2.10.06.00 (Thermo-Chemical Alteration) or an alternative FEP. The DOE will provide the technical basis for screening entrained colloids in the analysis of FEP 2.2.10.06.00 in a future revision of the Features, Events, and Processes in UZ Flow and Transport AMR (ANL-NBS-MD-000001), expected to be available in FY 02.	Received
ENFE.4.04	TSPAI	Provide the technical basis for excluding entrained colloids in the analysis of FEP 2.2.10.06.00 (Thermo-Chemical Alteration) or an alternative FEP. The DOE will provide the technical basis for screening entrained colloids in the analysis of FEP 2.2.10.06.00 in a future revision of the Features, Events, and Processes in UZ Flow and Transport AMR (ANL-NBS-MD-000001), expected to be available in FY 02.	Received
ENFE.4.05	TSPAI	Provide the screening criteria for the radionuclides selected for PA. Provide the technical basis for selection of radionuclides that are transported via colloids in the TSPA. The screening criteria for radionuclides selected for TSPA are contained in the AMR Inventory Abstraction (ANL-WIS-MD-000006) Rev 00, ICN 01. The DOE is documenting identification of radionuclides transported via colloids for TSPA in the AMR Colloid-Associated Concentration Limits: Abstraction and Summary (ANL-WIS-MD-000012) Rev 0, in the Total System Performance Assessment for the Site Recommendation (TDR-WIS-PA-000001) Rev 00 ICN 01, and in the Total System Performance Assessment (TSPA) Model for Site Recommendation (MDL-WIS-PA-000002) Rev 00. These documents will be available to the NRC in January 2001.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
ENFE.4.06	TSPAI	Provide documentation to demonstrate suitability of the bounding values used for colloid transport through the perturbed near-field environment. For example, consider sensitivity analyses to investigate the effects of varying colloid sorption parameters (Kc) on repository performance. The DOE will evaluate the suitability of the colloid transport model under perturbed conditions as discussed in agreement #3 for this subissue. As part of this work, the DOE will consider sensitivity analyses to investigate the effects of varying colloid sorption parameters (Kc) on repository performance. The DOE will also provide the TSPA-SR (TDR-WIS-PA-000001) Rev 00 ICN 01 in January 2001. The TSPA-SR includes sensitivity studies in the form of barrier degradation and parameter sensitivity analyses that investigate the effect of sorption and colloid parameters on repository performance.	Received
ENFE.4.06	ENG4	Provide documentation to demonstrate suitability of the bounding values used for colloid transport through the perturbed near-field environment. For example, consider sensitivity analyses to investigate the effects of varying colloid sorption parameters (Kc) on repository performance. The DOE will evaluate the suitability of the colloid transport model under perturbed conditions as discussed in agreement #3 for this subissue. As part of this work, the DOE will consider sensitivity analyses to investigate the effects of varying colloid sorption parameters (Kc) on repository performance. The DOE will also provide the TSPA-SR (TDR-WIS-PA-000001) Rev 00 ICN 01 in January 2001. The TSPA-SR includes sensitivity studies in the form of barrier degradation and parameter sensitivity analyses that investigate the effect of sorption and colloid parameters on repository performance.	Received
ENFE.4.07	TSPAI	Provide updated FEPs AMRs with additional technical bases for those FEPs previously identified by the NRC in Rev. 03 of the ENFE IRSR as inadequately screened. In Rev 03 of the ENFE IRSR, the NRC identified 17 FEPs associated with Subissue 1 for which no screening arguments were identified in the FEPs data base, screening arguments were inconsistent with other project documents, or inadequate exclusion arguments were provided. The lack of screening arguments has been addressed in Rev 00 of the FEPs data base and Rev 00 of the supporting AMRs. Current revisions (or ICNs) of the FEPs AMRs, scheduled for completion in January 2001, will partially address the remaining NRC comments. Consideration of the remaining NRC comments will be provided in subsequent FEPs AMR revisions, expected to be available as periodic revisions, the entirety of which will be available prior to license application.	Complete
ENFE.4.08	TSPAI	Provide the FEPs database. The DOE will provide the FEPs data base to the NRC during March 2001.	Complete
ENFE.5.01	TSPAI	Provide Revision 1 to the Topical Report. DOE will provide the Disposal Criticality Analysis Methodology Topical Report, Revision 01, to NRC during January 2001.	Received
ENFE.5.01	ENG3	Provide Revision 1 to the Topical Report. DOE will provide the Disposal Criticality Analysis Methodology Topical Report, Revision 01, to NRC during January 2001.	Received
ENFE.5.02	TSPAI	Provide the updated FEPs database. DOE stated that it would provide the FEPs AMRs and the FEPs database to NRC during January 2001.	Complete
ENFE.5.03	ENG1	Provide the applicable list of validation reports and their schedules for external criticality. DOE stated that the geochemical model validation reports for “Geochemistry Model Validation Report: Degradation and Release” and “Geochemistry Model Validation Report: Material Accumulation” are expected to be available during 2001. The remainder of the reports are expected to be available during FY2002 subject to the results of detailed planning and scheduling. DOE understands that these reports are required to be provided prior to LA. A list of model validation reports was provided during the technical exchange and is included as an attachment to the meeting summary.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
GEN.1.01	ENG4	For NRC comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 37, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126, DOE will address the concern in the documentation for the specific KTI agreement identified in the DOE response (Attachment 2). The schedule and document source will be the same as the specific KTI agreement.	Partly Received
GEN.1.01	UZ2	For NRC comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 37, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126, DOE will address the concern in the documentation for the specific KTI agreement identified in the DOE response (Attachment 2). The schedule and document source will be the same as the specific KTI agreement.	Partly Received
GEN.1.01	SZ1	For NRC comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 37, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126, DOE will address the concern in the documentation for the specific KTI agreement identified in the DOE response (Attachment 2). The schedule and document source will be the same as the specific KTI agreement.	Partly Received
GEN.1.01	UZ3	For NRC comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 37, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126, DOE will address the concern in the documentation for the specific KTI agreement identified in the DOE response (Attachment 2). The schedule and document source will be the same as the specific KTI agreement.	Partly Received
GEN.1.01	ENG3	For NRC comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 37, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126, DOE will address the concern in the documentation for the specific KTI agreement identified in the DOE response (Attachment 2). The schedule and document source will be the same as the specific KTI agreement.	Partly Received
GEN.1.01	ENG2	For NRC comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 37, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126, DOE will address the concern in the documentation for the specific KTI agreement identified in the DOE response (Attachment 2). The schedule and document source will be the same as the specific KTI agreement.	Partly Received
GEN.1.01	ENG1	For NRC comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 37, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126, DOE will address the concern in the documentation for the specific KTI agreement identified in the DOE response (Attachment 2). The schedule and document source will be the same as the specific KTI agreement.	Partly Received
GEN.1.01	SZ2	For NRC comments 3, 5, 8, 9, 10, 12, 13, 15, 16, 18, 21, 24, 27, 36, 37, 41, 42, 45, 46, 50, 56, 64, 69, 75, 78, 81, 82, 83, 93, 95, 96, 97, 98, 102, 103, 104, 106, 109, 110, 111, 113, 116, 118, 119, 120, 122, 123, 124, and 126, DOE will address the concern in the documentation for the specific KTI agreement identified in the DOE response (Attachment 2). The schedule and document source will be the same as the specific KTI agreement.	Partly Received
IA.1.01	TSPAI	In addition to DOE's licensing case, include for Site Recommendation and License Application, for information purposes, the results of a single point sensitivity analysis for extrusive and intrusive igneous processes at 10E-7. DOE agreed that the analysis will be included in TSPA-SR Rev. 0 and will be available to the NRC in November 2000.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
IA.1.01	DIRECT1	In addition to DOE's licensing case, include for Site Recommendation and License Application, for information purposes, the results of a single point sensitivity analysis for extrusive and intrusive igneous processes at 10E-7. DOE agreed that the analysis will be included in TSPA-SR Rev. 0 and will be available to the NRC in November 2000.	Complete
IA.1.02	DIRECT1	Examine new aeromagnetic data for potential buried igneous features (see U.S. Geological Survey, Open-File Report 00-188, Online Version 1.0), and evaluate the effect on the probability estimate. If the data survey specifications are not adequate for this use, this action is not required. DOE agreed and will document the results of the evaluation in an update to the AMR, Characterize Framework for Igneous Activity at Yucca Mountain, Nevada (ANL-MGR-GS-000001), expected to be available in FY 2003.	Received
IA.1.02	TSPAI	Examine new aeromagnetic data for potential buried igneous features (see U.S. Geological Survey, Open-File Report 00-188, Online Version 1.0), and evaluate the effect on the probability estimate. If the data survey specifications are not adequate for this use, this action is not required. DOE agreed and will document the results of the evaluation in an update to the AMR, Characterize Framework for Igneous Activity at Yucca Mountain, Nevada (ANL-MGR-GS-000001), expected to be available in FY 2003.	Received
IA.2.01	DIRECT2	Re-examine the ASHPLUME Code to confirm that particle density is appropriately changed when waste particles are incorporated into the ash. (Eruptive AC-4) DOE agreed and will correct the description in the ICN to AMR, Igneous Consequences Modeling for TSPA-SR [ANL-WIS-MD-000017] as needed to address the concern. This will be available to the NRC in January 2001.	Complete
IA.2.02	DIRECT2	Document results of sensitivity studies for particle size, consistent with (1) above. (Eruptive AC-4) DOE agreed and will document the waste particle size sensitivity study in a calculation document. This will be available to the NRC in FY2002.	Complete
IA.2.03	DIRECT2	Document how the tephra volumes from analog volcanos represent the likely range of tephra volumes from Yucca Mountain Region (YMR) volcanos. (Eruptive AC-1) DOE agreed and will document the basis for determining the range of tephra volumes that is likely from possible future volcanoes in the YMR in the Eruptive Processes AMR (ANL-MGR-GS-000002). This will be available to the NRC in FY2002.	Received
IA.2.04	DIRECT2	Document that the ASHPLUME model, as used in the DOE performance assessment, has been compared with an analog igneous system. (Eruptive AC-2) DOE agreed and will complete calculation CAL-WIS-MD-000011 that will document a comparison of the ASHPLUME code results to observed data from the 1995 Cerro Negro eruption. This will be available to the NRC in January 2001. DOE will consider Cerro Negro as an analog and document that in the Eruptive Processes AMR (ANL-MGR-GS-000002). This will be available to the NRC in FY2002.	Complete
IA.2.05	DIRECT1	Document how the current approach to calculating the number of waste packages intersected by conduits addresses potential effects of conduit elongation along a drift. (Eruptive AC-3) DOE agreed and will document the way in which the change in geometry of the repository drifts affects the number of waste packages incorporated into the volcanic conduit. Possible consequences of conduit elongation parallel to drifts will be documented in TSPA-SR Rev. 1, available to the NRC in June 2001.	Complete
IA.2.06	DOSE3	Develop a linkage between soil removal rate used in TSPA and surface remobilization processes characteristics of the Yucca Mountain region (which includes additions and deletions to the system). (Eruptive AC-5) DOE agreed and will document its approach to include uncertainty related to surface-redistribution processes in TSPA-SR, Rev. 0. DOE will revisit the approach in TSPA-SR, Rev. 1. This documentation will be available to the NRC in June 2001.	Complete
IA.2.06	DOSE2	Develop a linkage between soil removal rate used in TSPA and surface remobilization processes characteristics of the Yucca Mountain region (which includes additions and deletions to the system). (Eruptive AC-5) DOE agreed and will document its approach to include uncertainty related to surface-redistribution processes in TSPA-SR, Rev. 0. DOE will revisit the approach in TSPA-SR, Rev. 1. This documentation will be available to the NRC in June 2001.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
IA.2.07	DOSE3	Document the basis for airborne particle concentrations used in TSPA in Rev. 1 to the Input Values for External and Inhalation Radiation Exposure AMR. (Eruptive AC-5) DOE agreed and will provide documentation for the input values in the Input Parameter Values for External and Inhalation Radiation Exposure Analysis AMR [ANL-MGR-MD-000001] Rev. 1. This will be available to NRC in January 2001.	Complete
IA.2.07	DOSE2	Document the basis for airborne particle concentrations used in TSPA in Rev. 1 to the Input Values for External and Inhalation Radiation Exposure AMR. (Eruptive AC-5) DOE agreed and will provide documentation for the input values in the Input Parameter Values for External and Inhalation Radiation Exposure Analysis AMR [ANL-MGR-MD-000001] Rev. 1. This will be available to NRC in January 2001.	Complete
IA.2.08	DOSE2	Provide additional justification on the reasonableness of the assumption that the inhalation of particles in the 10-100 micron range is treated as additional soil ingestion, or change the BDCFs to reflect ICRP-30. (Eruptive AC-5) DOE agreed and will review how 10-100 micron particles are considered in the model for the eruptive scenario. The results will be documented in Input Parameter Values for External and Inhalation Radiation Exposure Analysis AMR [ANL-MGR-MD-000001] Rev. 1. This will be available to the NRC in January 2001.	Complete
IA.2.08	DOSE3	Provide additional justification on the reasonableness of the assumption that the inhalation of particles in the 10-100 micron range is treated as additional soil ingestion, or change the BDCFs to reflect ICRP-30. (Eruptive AC-5) DOE agreed and will review how 10-100 micron particles are considered in the model for the eruptive scenario. The results will be documented in Input Parameter Values for External and Inhalation Radiation Exposure Analysis AMR [ANL-MGR-MD-000001] Rev. 1. This will be available to the NRC in January 2001.	Complete
IA.2.09	DIRECT2	Use the appropriate wind speeds for the various heights of eruption columns being modeled. (Eruptive AC-5) DOE agreed and will evaluate the wind speed data appropriate for the height of the eruptive columns being modeled. This will be documented in a calculation document. This will be available to the NRC in FY2002.	Received
IA.2.10	ENG2	Document the ICNs to the Igneous Consequences AMR and the Dike Propagation AMR regarding the calculation of the number of waste packages hit by the intrusion. Include in these or other documents (1) the intermediate results of the releases from Zone 1 and 2, separately, and (2) the evaluation of thermal and mechanical effects, as well as shock, in assessing the degree of waste package damage in Zone 1 and 2. (Intrusive AC 4) DOE agreed and will provide ICN 1 of the following AMRs: Igneous Consequences Modeling for TSPA-SR AMR [ANL-WIS-MD-000017], the Dike Propagation Near Drifts AMR [ANL-WIS-MD-000015], the Characterize Framework for Igneous Activity at Yucca Mountain, Nevada AMR [ANL-MGR-GS-000001], and the Calculation Number of Waste Packages Hit by Igneous Intrusion [CAL-WIS-PA-000001]. This will be available to the NRC in January 2001. DOE will provide the results showing the relative contributions of releases from Zones 1 and 2 in a calculation document. This will be available to the NRC in FY2002. DOE will provide the evaluation of thermal mechanical effects on waste package damage in Zones 1 and 2 in ICN 1 of the Dike Propagation Near Drifts AMR [ANL-WIS-MD-000015]. This will be available to the NRC in January 2001.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
IA.2.10	DIRECT1	Document the ICNs to the Igneous Consequences AMR and the Dike Propagation AMR regarding the calculation of the number of waste packages hit by the intrusion. Include in these or other documents (1) the intermediate results of the releases from Zone 1 and 2, separately, and (2) the evaluation of thermal and mechanical effects, as well as shock, in assessing the degree of waste package damage in Zone 1 and 2. (Intrusive AC 4) DOE agreed and will provide ICN 1 of the following AMRs: Igneous Consequences Modeling for TSPA-SR AMR [ANL-WIS-MD-000017], the Dike Propagation Near Drifts AMR [ANL-WIS-MD-000015], the Characterize Framework for Igneous Activity at Yucca Mountain, Nevada AMR [ANL-MGR-GS-000001], and the Calculation Number of Waste Packages Hit by Igneous Intrusion [CAL-WIS-PA-000001]. This will be available to the NRC in January 2001. DOE will provide the results showing the relative contributions of releases from Zones 1 and 2 in a calculation document. This will be available to the NRC in FY2002. DOE will provide the evaluation of thermal mechanical effects on waste package damage in Zones 1 and 2 in ICN 1 of the Dike Propagation Near Drifts AMR [ANL-WIS-MD-000015]. This will be available to the NRC in January 2001.	Complete
IA.2.11	DOSE2	Provide an analysis that shows the relationship between any static measurements used in the TSPA and expected types and durations of surface disturbing activities associated with the habits and lifestyles of the critical group. DOE will provide an analysis that shows the relationship between any static measurements used in the TSPA and expected types and durations of surface disturbing activities associated with the habits and lifestyles of the critical group in a subsequent revision to the AMR Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) or equivalent document. This will be available to the NRC in FY02.	Need Additional Information
IA.2.11	DOSE3	Provide an analysis that shows the relationship between any static measurements used in the TSPA and expected types and durations of surface disturbing activities associated with the habits and lifestyles of the critical group. DOE will provide an analysis that shows the relationship between any static measurements used in the TSPA and expected types and durations of surface disturbing activities associated with the habits and lifestyles of the critical group in a subsequent revision to the AMR Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) or equivalent document. This will be available to the NRC in FY02.	Need Additional Information
IA.2.12	DOSE2	Provide clarifying information on how PM10 measurements have been extrapolated to TSP concentrations. This should include consideration of the difference in behavior between PM10 and TSP particulates under both static and disturbed conditions. DOE will provide clarifying information on how PM10 measurements have been extrapolated to TSP concentrations. This will include consideration of the difference in behavior between PM10 and TSP particulates under both static and disturbed conditions in a subsequent revision to the AMR Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) or equivalent document. This will be available to the NRC in FY02.	Complete
IA.2.12	DOSE3	Provide clarifying information on how PM10 measurements have been extrapolated to TSP concentrations. This should include consideration of the difference in behavior between PM10 and TSP particulates under both static and disturbed conditions. DOE will provide clarifying information on how PM10 measurements have been extrapolated to TSP concentrations. This will include consideration of the difference in behavior between PM10 and TSP particulates under both static and disturbed conditions in a subsequent revision to the AMR Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) or equivalent document. This will be available to the NRC in FY02.	Complete
IA.2.13	DOSE2	Provide the justification that sampling of range of transition period BDCFs is necessarily conservative in evaluating long-term remobilization processes. DOE will provide the justification that sampling of range of transition period BDCFs is necessarily conservative in evaluating long-term remobilization processes in a subsequent revision to the AMR Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) or equivalent document. This will be available to the NRC in FY02.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
IA.2.13	DOSE3	Provide the justification that sampling of range of transition period BDCFs is necessarily conservative in evaluating long-term remobilization processes. DOE will provide the justification that sampling of range of transition period BDCFs is necessarily conservative in evaluating long-term remobilization processes in a subsequent revision to the AMR Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) or equivalent document. This will be available to the NRC in FY02.	Complete
IA.2.14	DOSE2	Provide information clarifying the method used in TSPA to calculate how deposit thickness effects the average mass load over the transition period. DOE will provide information clarifying the method used in TSPA to calculate how deposit thickness effects the average mass load over the transition period in a subsequent revision to the AMR Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) or equivalent document. This will be available to the NRC in FY02.	Complete
IA.2.14	DOSE3	Provide information clarifying the method used in TSPA to calculate how deposit thickness effects the average mass load over the transition period. DOE will provide information clarifying the method used in TSPA to calculate how deposit thickness effects the average mass load over the transition period in a subsequent revision to the AMR Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) or equivalent document. This will be available to the NRC in FY02.	Complete
IA.2.15	DOSE2	Clarify that external exposure from HLW-contaminated ash, in addition to inhalation and ingestion, was considered in the TSPA. Include in this clarification the consideration of external exposure during indoor occupancy times, or provide basis for dwelling shielding from outdoor gamma emitters. DOE will clarify that external exposure from HLW-contaminated ash, in addition to inhalation and ingestion, was considered in the TSPA. DOE will include in this clarification the consideration of external exposure during indoor occupancy times, or provide basis for dwelling shielding from outdoor gamma emitters in a subsequent revision to the AMR Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) or equivalent document. This will be available to the NRC in FY02.	Complete
IA.2.15	DOSE3	Clarify that external exposure from HLW-contaminated ash, in addition to inhalation and ingestion, was considered in the TSPA. Include in this clarification the consideration of external exposure during indoor occupancy times, or provide basis for dwelling shielding from outdoor gamma emitters. DOE will clarify that external exposure from HLW-contaminated ash, in addition to inhalation and ingestion, was considered in the TSPA. DOE will include in this clarification the consideration of external exposure during indoor occupancy times, or provide basis for dwelling shielding from outdoor gamma emitters in a subsequent revision to the AMR Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) or equivalent document. This will be available to the NRC in FY02.	Complete
IA.2.16	DOSE2	Document that neglecting the effects of climate change on disruptive event BDCFs is conservative. DOE will document that neglecting the effects of climate change on disruptive event BDCFs is conservative in a subsequent revision to the AMRs Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) and Disruptive Event Biosphere Dose Conversion Factor Analysis (ANL-MGR-MD-000003) or equivalent document. This will be available to the NRC in FY02.	Complete
IA.2.16	DOSE3	Document that neglecting the effects of climate change on disruptive event BDCFs is conservative. DOE will document that neglecting the effects of climate change on disruptive event BDCFs is conservative in a subsequent revision to the AMRs Input Parameter Values for External and Inhalation Radiation Exposure Analysis (ANL-MGR-MD-000001) and Disruptive Event Biosphere Dose Conversion Factor Analysis (ANL-MGR-MD-000003) or equivalent document. This will be available to the NRC in FY02.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
IA.2.17	DOSE2	DOE will evaluate conclusions that the risk effects (i.e., effective annual dose) of eolian and fluvial remobilization are bounded by conservative modeling assumptions in the TSPA-SR, Rev 00, ICN1. DOE will examine rates of eolian and fluvial mobilization off slopes, rates of transport in Fortymile Wash, and rates of deposition or removal at proposed critical group location. DOE will evaluate changes in grain size caused by these processes for effects on airborne particle concentrations. DOE will also evaluate the inherent assumption in the mass loading model that the concentration of radionuclides on soil in the air is equivalent to the concentration of radionuclides on soil on the ground does not underestimate dose (i.e., radionuclides important to dose do not preferentially attach to smaller particles). DOE will provide the justification for the range of transition BDCFs sampled. DOE will document the results of investigations in the AMR, Eruptive Processes and Soil Redistribution ANL-MGR-GS-000002, expected to be available in fiscal year 2003 and in the AMR, Input Parameter Values for External and Inhalation Radiation Exposure Analysis, ANL-MGR-MD-000001, available FY 2003, or another appropriate technical document.	Received
IA.2.17	DOSE3	DOE will evaluate conclusions that the risk effects (i.e., effective annual dose) of eolian and fluvial remobilization are bounded by conservative modeling assumptions in the TSPA-SR, Rev 00, ICN1. DOE will examine rates of eolian and fluvial mobilization off slopes, rates of transport in Fortymile Wash, and rates of deposition or removal at proposed critical group location. DOE will evaluate changes in grain size caused by these processes for effects on airborne particle concentrations. DOE will also evaluate the inherent assumption in the mass loading model that the concentration of radionuclides on soil in the air is equivalent to the concentration of radionuclides on soil on the ground does not underestimate dose (i.e., radionuclides important to dose do not preferentially attach to smaller particles). DOE will provide the justification for the range of transition BDCFs sampled. DOE will document the results of investigations in the AMR, Eruptive Processes and Soil Redistribution ANL-MGR-GS-000002, expected to be available in fiscal year 2003 and in the AMR, Input Parameter Values for External and Inhalation Radiation Exposure Analysis, ANL-MGR-MD-000001, available FY 2003, or another appropriate technical document.	Received
IA.2.18	DIRECT1	DOE will evaluate how the presence of repository structures may affect magma ascent, conduit localization, and evolution of the conduit and flow system. The evaluation will include the potential effects of topography and stress, strain response on existing or new geologic structures resulting from thermal loading of HLW, in addition to a range of physical conditions appropriate for the duration of igneous events. DOE will also evaluate how the presence of engineered repository structures in the LA design (e.g., drifts, waste packages, backfill, etc.) could affect magma flow processes for the duration of an igneous event. The evaluation will include the mechanical strength and durability of natural or engineered barriers that could restrict magma flow within intersected drifts. The results of this investigation will be documented in an update to the AMR, Dike Propagation and Interaction with Drifts, ANL-WIS-MD-000015, expected to be available in FY 2003, or another appropriate technical document.	Received
IA.2.18	ENG2	DOE will evaluate how the presence of repository structures may affect magma ascent, conduit localization, and evolution of the conduit and flow system. The evaluation will include the potential effects of topography and stress, strain response on existing or new geologic structures resulting from thermal loading of HLW, in addition to a range of physical conditions appropriate for the duration of igneous events. DOE will also evaluate how the presence of engineered repository structures in the LA design (e.g., drifts, waste packages, backfill, etc.) could affect magma flow processes for the duration of an igneous event. The evaluation will include the mechanical strength and durability of natural or engineered barriers that could restrict magma flow within intersected drifts. The results of this investigation will be documented in an update to the AMR, Dike Propagation and Interaction with Drifts, ANL-WIS-MD-000015, expected to be available in FY 2003, or another appropriate technical document.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
IA.2.19	DIRECT1	DOE will evaluate waste package response to stresses from thermal and mechanical effects associated with exposure to basaltic magma, considering the results of evaluations attendant to IA Agreement 2.18. As currently planned, the evaluation, if implemented, would include (1) appropriate at-condition strength properties and magma flow paths, for duration of an igneous event; and (2) aging effects on materials strength properties when exposed to basaltic magmatic conditions for the duration of an igneous event, which will include the potential effects of subsequent seismically induced stresses on substantially intact waste packages. DOE will also evaluate the response of Zone 3 waste packages, or waste packages covered by backfill or rockfall, if exposed to magmatic gases at conditions appropriate for an igneous event, considering the results of evaluations attendant to IA Agreement 2.18. If models take credit for engineered barriers providing delay in radionuclide release, DOE will evaluate barrier performance for the duration of the hypothetical igneous event. The results of this investigation would be documented in an update to the technical product Waste Package Behavior in Magma CAL-EBS-ME-000002, which would be available by the end of FY 2003, or another appropriate technical document.	Received
IA.2.19	ENG2	DOE will evaluate waste package response to stresses from thermal and mechanical effects associated with exposure to basaltic magma, considering the results of evaluations attendant to IA Agreement 2.18. As currently planned, the evaluation, if implemented, would include (1) appropriate at-condition strength properties and magma flow paths, for duration of an igneous event; and (2) aging effects on materials strength properties when exposed to basaltic magmatic conditions for the duration of an igneous event, which will include the potential effects of subsequent seismically induced stresses on substantially intact waste packages. DOE will also evaluate the response of Zone 3 waste packages, or waste packages covered by backfill or rockfall, if exposed to magmatic gases at conditions appropriate for an igneous event, considering the results of evaluations attendant to IA Agreement 2.18. If models take credit for engineered barriers providing delay in radionuclide release, DOE will evaluate barrier performance for the duration of the hypothetical igneous event. The results of this investigation would be documented in an update to the technical product Waste Package Behavior in Magma CAL-EBS-ME-000002, which would be available by the end of FY 2003, or another appropriate technical document.	Received
IA.2.20	DIRECT1	DOE will evaluate how ascent and flow of basaltic magma through repository structures could result in processes that might incorporate HLW, considering the results of evaluations attendant to IA Agreements 2.18 and 2.19. As currently planned, the evaluation, if implemented, would include the potential for HLW incorporation along reasonable potential flow paths that could develop during an igneous event. The evaluation would also include the physical and chemical response of HLW and cladding after heating and potential disruption of waste package and contents, for waste packages remaining in drifts. The evaluation would examine effects that may result in increased solubility potential relative to undisturbed HLW forms. The results of this investigation would be documented in a new AMR to document the waste form response to magmatic conditions, which is expected to be available by the end of FY 2003. DOE will describe the method of HLW incorporation used in DOE models, including consideration of particle aggregation and the effect on waste transport. If models take credit for engineered barriers providing delay in radionuclide release, DOE will evaluate barrier performance for the duration of the hypothetical igneous event. This will be documented in an update to the igneous consequences AMR, ANL-WIS-MD-000017, which is expected to be available in FY 2003, or another appropriate technical document.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
IA.2.20	ENG2	DOE will evaluate how ascent and flow of basaltic magma through repository structures could result in processes that might incorporate HLW, considering the results of evaluations attendant to IA Agreements 2.18 and 2.19. As currently planned, the evaluation, if implemented, would include the potential for HLW incorporation along reasonable potential flow paths that could develop during an igneous event. The evaluation would also include the physical and chemical response of HLW and cladding after heating and potential disruption of waste package and contents, for waste packages remaining in drifts. The evaluation would examine effects that may result in increased solubility potential relative to undisturbed HLW forms. The results of this investigation would be documented in a new AMR to document the waste form response to magmatic conditions, which is expected to be available by the end of FY 2003. DOE will describe the method of HLW incorporation used in DOE models, including consideration of particle aggregation and the effect on waste transport. If models take credit for engineered barriers providing delay in radionuclide release, DOE will evaluate barrier performance for the duration of the hypothetical igneous event. This will be documented in an update to the igneous consequences AMR, ANL-WIS-MD-000017, which is expected to be available in FY 2003, or another appropriate technical document.	Received
IA.2.20	DIRECT2	DOE will evaluate how ascent and flow of basaltic magma through repository structures could result in processes that might incorporate HLW, considering the results of evaluations attendant to IA Agreements 2.18 and 2.19. As currently planned, the evaluation, if implemented, would include the potential for HLW incorporation along reasonable potential flow paths that could develop during an igneous event. The evaluation would also include the physical and chemical response of HLW and cladding after heating and potential disruption of waste package and contents, for waste packages remaining in drifts. The evaluation would examine effects that may result in increased solubility potential relative to undisturbed HLW forms. The results of this investigation would be documented in a new AMR to document the waste form response to magmatic conditions, which is expected to be available by the end of FY 2003. DOE will describe the method of HLW incorporation used in DOE models, including consideration of particle aggregation and the effect on waste transport. If models take credit for engineered barriers providing delay in radionuclide release, DOE will evaluate barrier performance for the duration of the hypothetical igneous event. This will be documented in an update to the igneous consequences AMR, ANL-WIS-MD-000017, which is expected to be available in FY 2003, or another appropriate technical document.	Received
RDTME.2.01	PRE	Provide Topical Report 3, Preclosure Seismic Design Inputs for a Geologic Repository at Yucca Mountain. Consistent with SDS Subissue 2, Agreement 2, the DOE will provide Seismic Topical Report 3, Preclosure Seismic Design Inputs for a Geologic Repository at Yucca Mountain, expected to be available to the NRC in January 2002.	Received
RDTME.2.02	PRE	Provide the substantive technical content of Topical Report 3. The DOE will provide the preliminary seismic design input data sets used in Site Recommendation design analyses to the NRC by April 2001. The DOE will provide the draft final seismic design inputs for license application via an Appendix 7 meeting after calculations are complete prior to delivery of Seismic Topical Report 3.	Received
RDTME.3.01	PRE	Provide the technical basis for the range of relative humidities, as well as the potential occurrence of localized liquid phase water, and resulting affects on ground support systems. The DOE will provide the technical basis for the range of relative humidity and temperature, and the potential effects of localized liquid phase water on ground support systems, during the forced ventilation preclosure period, in the Longevity of Emplacement Drift Ground Support Materials, ANL-EBS-GE-000003 Rev 01, and revision 1 of the Ventilation Model, ANL-EBS-MD-000030, analysis and model reports. These are expected to be available to NRC in September and March 2001, respectively.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
RDTME.3.02	PRE	Provide the critical combinations of in-situ, thermal, and seismic stresses, together with their technical bases, and their impacts on ground support performance. The DOE will examine the critical combinations of in-situ, thermal, and seismic stresses, together with their technical bases and their impacts on preclosure ground support performance. These results will be documented in a revision to the Ground Control for Emplacement Drifts for SR, ANL-EBS-GE-000002 (or other document) supporting any potential license application. This is expected to be available to NRC in FY 2003.	Received
RDTME.3.03	ENG2	Provide the Seismic Design Inputs AMR and the Preclosure Seismic Design Inputs for a Geologic Repository at Yucca Mountain, Seismic Topical Report 3. Consistent with SDS Subissue 2, Agreement 2, the DOE will provide the Seismic Design Inputs analysis and model report and Preclosure Seismic Design Inputs for a Geologic Repository at Yucca Mountain, Seismic Topical Report 3. These documents are expected to be available to NRC in January 2002.	Received
RDTME.3.03	PRE	Provide the Seismic Design Inputs AMR and the Preclosure Seismic Design Inputs for a Geologic Repository at Yucca Mountain, Seismic Topical Report 3. Consistent with SDS Subissue 2, Agreement 2, the DOE will provide the Seismic Design Inputs analysis and model report and Preclosure Seismic Design Inputs for a Geologic Repository at Yucca Mountain, Seismic Topical Report 3. These documents are expected to be available to NRC in January 2002.	Received
RDTME.3.04	PRE	Provide in the Design Parameter Analysis Report (or some other document) site-specific properties of the host rock, as a minimum those included in the NRC handout, together with the spatial and temporal variations and uncertainties in such properties, as an update to the information contained in the March 1997 Yucca Mountain Site Geotechnical Report. The DOE will: (1) evaluate the adequacy of the currently available measured and derived data to support the potential repository licensing case and identify areas where available data may warrant additional field measurements or testing to reduce uncertainty. DOE will provide a design parameters analysis report (or other document) that will include the results of these evaluations, expected to be available to NRC in FY 2002; and (2) acquire data and/or perform additional analyses as necessary to respond to the needs identified in 1 above. The DOE will provide these results prior to any potential license application.	Received
RDTME.3.05	PRE	Provide the Rock Mass Classification Analysis (or some other document) including the technical basis for accounting for the effects of lithophysae. The DOE will provide a rock mass classification analysis (or other document), including the technical basis for accounting for the effects of lithophysae, expected to be available to NRC in FY 2002.	Received
RDTME.3.06	PRE	Provide the design sensitivity and uncertainty analyses of the rock support system. The DOE will prepare a scoping analysis to determine the significance of the input parameters for review by NRC staff by August 2002. Once an agreed set of significant parameters has been determined by the DOE and the NRC staff, the DOE will prepare an analysis of the sensitivity and uncertainty of the preclosure rock support system to design parameters in a revision to the Ground Control for Emplacement Drifts for SR, ANL-EBS-GE-000002 (or other document) supporting any potential license application. This is expected to be available to NRC in FY 2003.	Received
RDTME.3.07	PRE	The DOE should account for the effect of sustained loading on intact rock strength or provide justification for not accounting for it. The DOE will assess the effects of sustained loading on intact rock strength. The DOE will provide the results of this assessment in a design parameters analysis report (or other document), expected to be available to NRC in FY 2002.	Received
RDTME.3.08	PRE	Provide the design sensitivity and uncertainty analyses of the fracture pattern (with respect to Subissue 3, Component 1). The DOE will provide sensitivity and uncertainty analysis of fracture patterns (based on observed orientation, spacing, trace length, etc) on the preclosure ground control system design in a revision to the Ground Control for Emplacement Drifts for SR, ANL-EBS-GE-000002 (or other document) supporting any potential license application. This is expected to be available to NRC in FY 2003.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
RDTME.3.09	PRE	Provide appropriate analysis that shows that rock movements in the invert are either controlled or otherwise remain within the range acceptable to provide for retrieval and other necessary operations within the deposal drifts. DOE will provide appropriate analysis that shows rock movements in the floor of the emplacement drift are within the range acceptable for preclosure operations. The analysis results will be provided in a revision to the Ground Control for Emplacement Drifts for SR, ANL-EBS-GE-000002 (or other document) supporting any potential license application. This is expected to be available to NRC in FY 2003.	Received
RDTME.3.10	PRE	Provide technical basis for the assessment that two-dimensional modeling for emplacement drifts is considered to be adequate, considering the fact that neither the in-situ stress field nor the principle fracture orientation are parallel or perpendicular to emplacement drift orientation. The DOE will provide the technical bases for the modeling methods used in ground control analysis in a revision to the Ground Control for Emplacement Drifts for SR, ANL-EBS-GE-000002 (or other document) supporting any potential license application. This is expected to be available to NRC in FY 2003.	Received
RDTME.3.11	PRE	Provide continuum and discontinuum analyses of ground support system performance that take into account long-term degradation of rockmass and joint strength properties. The DOE will justify the preclosure ground support system design (including the effects of long term degradation of rock mass and joint strength properties) in a revision to the Ground Control for Emplacement Drifts for SR, ANL-EBS-GE-000002 (or other document) supporting any potential license application. This is expected to be available to NRC in FY 2003.	Received
RDTME.3.12	PRE	Provide dynamic analyses (discontinuum approach) of ground support system performance using site specific ground motion time history as input. The DOE will provide appropriate analyses to include dynamic analyses (discontinuum approach) of preclosure ground support systems, using site specific ground motion time histories as input, in a revision to the Ground Control for Emplacement Drifts for SR, ANL-EBS-GE-000002 (or other document) supporting any potential license application. This is expected to be available to NRC in FY 2003.	Received
RDTME.3.13	PRE	Provide technical justification for boundary conditions used for continuum and discontinuum modeling used for underground facility design. The DOE will provide the technical justification for boundary conditions used in modeling for preclosure ground control analyses in a revision to the Ground Control for Emplacement Drifts for SR, ANL-EBS-GE-000002 (or other document) supporting any potential license application. This is expected to be available to NRC in FY 2003.	Received
RDTME.3.14	UZ2	Provide the results of the ventilation modeling being conducted at the University of Nevada-Reno (Multi-Flux code) and validation testing at the Atlas Facility (validation of the ventilation model based on the ANSYS code), including: 1) the technical bases for the adequacy of discretization used in these models and 2) the technical bases for the applicability of the modeling results to prediction of heat removal from the repository. The DOE will provide the results of the ventilation tests in a update to the Ventilation Model, ANL-EBS-MD-000030, analysis and model report including: 1) the technical bases for the adequacy of discretization used in these models and 2) the technical bases for the applicability of the modeling results to prediction of heat removal from the repository. This is expected to be available to NRC in FY 2002.	Received
RDTME.3.14	PRE	Provide the results of the ventilation modeling being conducted at the University of Nevada-Reno (Multi-Flux code) and validation testing at the Atlas Facility (validation of the ventilation model based on the ANSYS code), including: 1) the technical bases for the adequacy of discretization used in these models and 2) the technical bases for the applicability of the modeling results to prediction of heat removal from the repository. The DOE will provide the results of the ventilation tests in a update to the Ventilation Model, ANL-EBS-MD-000030, analysis and model report including: 1) the technical bases for the adequacy of discretization used in these models and 2) the technical bases for the applicability of the modeling results to prediction of heat removal from the repository. This is expected to be available to NRC in FY 2002.	Received

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RDTME.3.15	ENG2	Provide field data and analysis of rock bridges between rock joints that are treated as cohesion in DRKBA modeling together with a technical basis for how a reduction in cohesion adequately accounts for thermal effects. The DOE will provide clarification of the approach and technical basis for how reduction in cohesion adequately accounts for thermal effects, including any additional applicable supporting data and analyses. Additionally, the adequacy of the cohesion reduction approach will be verified according to the approach described in Subissue 3, Agreement 19, of the Repository Design and Thermal-Mechanical Effects Technical Exchange. This will be documented in a revision to the Drift Degradation Analysis, ANL-EBS-MD-000027, expected to be available to NRC in FY 2003.	Received
RDTME.3.16	ENG2	Provide a technical basis for the DOE position that the method used to model joint planes as circular discs does not under-represent the smaller trace-length fractures. The DOE will analyze the available small trace-length fracture data from the Exploratory Studies Facility and Enhanced Characterization of the Repository Block, including their effect on block development. This will be documented in a revision to the Drift Degradation Analysis, ANL-EBS-MD-000027, expected to be available to NRC in FY 2003.	Received
RDTME.3.17	ENG2	Provide the technical basis for effective maximum rock size including consideration of the effect of variation of the joint dip angle. The DOE will provide the technical basis for effective maximum rock size including consideration of the effect of variation of the joint dip angle. This will be documented in revisions to the Drift Degradation Analysis, ANL-EBS-MD-000027, and the Rockfall on Drip Shield, CAL-EBS-ME-000001, expected to be available to NRC in FY 2003.	Received
RDTME.3.18	ENG1	Provide a technical basis for a stress measure that can be used as the equivalent uniaxial stress for assessing the susceptibility of the various engineered barrier system materials to stress corrosion cracking (SCC). The proposed stress measure must be consistent and compatible with the methods proposed by the DOE to assess SCC of the containers in WAPDEG and in accordance with the agreements reached at the CLST Technical Exchange. The DOE will include a detailed discussion of the stress measure used to determine nucleation of stress corrosion cracks in the calculations performed to evaluate waste package barriers and the drip shield against stress corrosion cracking criterion. DOE will include these descriptions in future revisions of the following: Design Analysis for UCF Waste Packages, ANL-UDC-MD-000001, Design Analysis for the Defense High-Level Waste Disposal Container, ANL-DDC-ME-000001, Design Analysis for the Naval SNF Waste Package, ANL-UDC-ME-000001, and Design Analysis for the Ex-Container Components, ANL-XCS-ME-000001. The stresses reported in these documents will be used in WAPDEG and will be consistent with the agreements and associated schedule made at the Container Life and Source Term Technical Exchange (Subissue 1, Agreement 14, Subissue 6, Agreement 1).	Received
RDTME.3.18	ENG2	Provide a technical basis for a stress measure that can be used as the equivalent uniaxial stress for assessing the susceptibility of the various engineered barrier system materials to stress corrosion cracking (SCC). The proposed stress measure must be consistent and compatible with the methods proposed by the DOE to assess SCC of the containers in WAPDEG and in accordance with the agreements reached at the CLST Technical Exchange. The DOE will include a detailed discussion of the stress measure used to determine nucleation of stress corrosion cracks in the calculations performed to evaluate waste package barriers and the drip shield against stress corrosion cracking criterion. DOE will include these descriptions in future revisions of the following: Design Analysis for UCF Waste Packages, ANL-UDC-MD-000001, Design Analysis for the Defense High-Level Waste Disposal Container, ANL-DDC-ME-000001, Design Analysis for the Naval SNF Waste Package, ANL-UDC-ME-000001, and Design Analysis for the Ex-Container Components, ANL-XCS-ME-000001. The stresses reported in these documents will be used in WAPDEG and will be consistent with the agreements and associated schedule made at the Container Life and Source Term Technical Exchange (Subissue 1, Agreement 14, Subissue 6, Agreement 1).	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
RDTME.3.19	ENG2	The acceptability of the process models that determine whether rockfall can be screened out from performance assessment abstractions needs to be substantiated by the DOE by doing the following: (1) provide revised DRKBA analyses using appropriate range of strength properties for rock joints from the Design Analysis Parameters Report, accounting for their long-term degradation; (2) provide an analysis of block sizes based on the full distribution of joint trace length data from the Fracture Geometry Analysis Report for the Stratigraphic Units of the Repository Host Horizon, including small joints trace lengths; (3) verify the results of the revised DRKBA analyses using: (a) appropriate boundary conditions for thermal and seismic loading; (b) critical fracture patterns from the DRKBA Monte Carlo simulations (at least two patterns for each rock unit); (c) thermal and mechanical properties for rock blocks and joints from the Design Analysis Parameters Report; (d) long-term degradation of rock block and joint strength parameters; and (e) site-specific groundmotion time histories appropriate for post-closure period; provide a detailed documentation of the analyses results; and (4) in view of the uncertainties related to the rockfall analyses and the importance of the outcome of the analyses to the performance of the repository, evaluate the impacts of rockfall in performance assessment calculations. DOE believes that the Drift Degradation Analysis is consistent with current understanding of the Yucca Mountain site and the level of detail of the design to date. As understanding of the site and the design evolve, DOE will: (1) provide revised DRKBA analyses using appropriate range of strength properties for rock joints from a design parameters analysis report (or other document), accounting for their long-term degradation; (2) provide an analysis of block sizes based on the full distribution of joint trace length data from the Fracture Geometry Analysis for the Stratigraphic Units of the Repository Host Horizon, ANL-EBS-GE-000006, supplemented by available small joint trace length data; (3) verify the results of the revised DRKBA analyses using: (a) appropriate boundary conditions for thermal and seismic loading; (b) critical fracture patterns from the DRKBA Monte Carlo simulations (at least two patterns for each rock unit); (c) thermal and mechanical properties for rock blocks and joints from a design parameters analysis report (or other document); (d) long-term degradation of joint strength parameters; and (e) site-specific ground motion time histories appropriate for post-closure period. This will be documented in a revision to the Drift Degradation Analysis, ANL-EBS-MD-000027, expected to be available to NRC in FY 2003. Based on the results of the analyses above and subsequent drip shield calculation revisions, DOE will reconsider the screening decision for inclusion or exclusion of rockfall in performance assessment analysis. Any changes to screening decisions will be documented in analyses prior to any potential license application.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
RDTME.3.19	TSPAI	The acceptability of the process models that determine whether rockfall can be screened out from performance assessment abstractions needs to be substantiated by the DOE by doing the following: (1) provide revised DRKBA analyses using appropriate range of strength properties for rock joints from the Design Analysis Parameters Report, accounting for their long-term degradation; (2) provide an analysis of block sizes based on the full distribution of joint trace length data from the Fracture Geometry Analysis Report for the Stratigraphic Units of the Repository Host Horizon, including small joints trace lengths; (3) verify the results of the revised DRKBA analyses using: (a) appropriate boundary conditions for thermal and seismic loading; (b) critical fracture patterns from the DRKBA Monte Carlo simulations (at least two patterns for each rock unit); (c) thermal and mechanical properties for rock blocks and joints from the Design Analysis Parameters Report; (d) long-term degradation of rock block and joint strength parameters; and (e) site-specific groundmotion time histories appropriate for post-closure period; provide a detailed documentation of the analyses results; and (4) in view of the uncertainties related to the rockfall analyses and the importance of the outcome of the analyses to the performance of the repository, evaluate the impacts of rockfall in performance assessment calculations. DOE believes that the Drift Degradation Analysis is consistent with current understanding of the Yucca Mountain site and the level of detail of the design to date. As understanding of the site and the design evolve, DOE will: (1) provide revised DRKBA analyses using appropriate range of strength properties for rock joints from a design parameters analysis report (or other document), accounting for their long-term degradation; (2) provide an analysis of block sizes based on the full distribution of joint trace length data from the Fracture Geometry Analysis for the Stratigraphic Units of the Repository Host Horizon, ANL-EBS-GE-000006, supplemented by available small joint trace length data; (3) verify the results of the revised DRKBA analyses using: (a) appropriate boundary conditions for thermal and seismic loading; (b) critical fracture patterns from the DRKBA Monte Carlo simulations (at least two patterns for each rock unit); (c) thermal and mechanical properties for rock blocks and joints from a design parameters analysis report (or other document); (d) long-term degradation of joint strength parameters; and (e) site-specific ground motion time histories appropriate for post-closure period. This will be documented in a revision to the Drift Degradation Analysis, ANL-EBS-MD-000027, expected to be available to NRC in FY 2003. Based on the results of the analyses above and subsequent drip shield calculation revisions, DOE will reconsider the screening decision for inclusion or exclusion of rockfall in performance assessment analysis. Any changes to screening decisions will be documented in analyses prior to any potential license application.	Received
RDTME.3.20	UZ2	Provide the sensitivity analyses including the effects of boundary conditions, coefficient of thermal expansion, fracture distributions, rock mass and fracture properties, and drift degradation (from Subissue 3, Component 3, Slide 39). The DOE will provide sensitivity analyses of thermal-mechanical effects on fracture permeability, including the effects of boundary conditions, coefficient of thermal expansion, fracture distributions, rock mass and fracture properties, and drift degradation. This will be provided consistent with site data and integrated with appropriate models in a future revision to the Coupled Thermal Hydrologic Mechanical Effects on Permeability, ANL-NBS-HS-000037, and is expected to be available to NRC in FY 2003.	Received
RDTME.3.20	ENG3	Provide the sensitivity analyses including the effects of boundary conditions, coefficient of thermal expansion, fracture distributions, rock mass and fracture properties, and drift degradation (from Subissue 3, Component 3, Slide 39). The DOE will provide sensitivity analyses of thermal-mechanical effects on fracture permeability, including the effects of boundary conditions, coefficient of thermal expansion, fracture distributions, rock mass and fracture properties, and drift degradation. This will be provided consistent with site data and integrated with appropriate models in a future revision to the Coupled Thermal Hydrologic Mechanical Effects on Permeability, ANL-NBS-HS-000037, and is expected to be available to NRC in FY 2003.	Received
RDTME.3.21	UZ2	Provide the results of additional validation analysis of field tests (from Subissue 3, Component 3, Slide 39). The DOE will provide the results of additional validation analysis of field tests related to the thermal-mechanical effects on fracture permeability in a future revision to the Coupled Thermal Hydrologic Mechanical Effects on Permeability, ANL-NBS-HS-000037, and is expected to be available to NRC in FY 2003.	Received

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RDTME.3.21	ENG3	Provide the results of additional validation analysis of field tests (from Subissue 3, Component 3, Slide 39). The DOE will provide the results of additional validation analysis of field tests related to the thermal-mechanical effects on fracture permeability in a future revision to the Coupled Thermal Hydrologic Mechanical Effects on Permeability, ANL-NBS-HS-000037, and is expected to be available to NRC in FY 2003.	Received
RT.1.01	UZ2	Provide the basis for the proportion of fracture flow through the Calico Hills non-welded vitric. DOE will revise the AMR UZ Flow Models and Submodels and the AMR Calibrated Properties Model to provide the technical basis for the proportion of fracture flow through the Calico Hills Nonwelded Vitric. These reports will be available to the NRC in FY 2002. In addition, the field data description will be documented in the AMR In Situ Field Testing of Processes in FY 2002.	Received
RT.1.01	UZ3	Provide the basis for the proportion of fracture flow through the Calico Hills non-welded vitric. DOE will revise the AMR UZ Flow Models and Submodels and the AMR Calibrated Properties Model to provide the technical basis for the proportion of fracture flow through the Calico Hills Nonwelded Vitric. These reports will be available to the NRC in FY 2002. In addition, the field data description will be documented in the AMR In Situ Field Testing of Processes in FY 2002.	Received
RT.1.02	UZ3	Provide analog radionuclide data from the tracer tests for Calico Hills at Busted Butte and from similar analog and radionuclide data (if available) from test blocks from Busted Butte. DOE will provide data from tracers used at Busted Butte and data from (AECL) test blocks from Busted Butte in an update to the AMR In Situ Field Testing of Processes in FY 2002.	Received
RT.1.02	SZ2	Provide analog radionuclide data from the tracer tests for Calico Hills at Busted Butte and from similar analog and radionuclide data (if available) from test blocks from Busted Butte. DOE will provide data from tracers used at Busted Butte and data from (AECL) test blocks from Busted Butte in an update to the AMR In Situ Field Testing of Processes in FY 2002.	Received
RT.1.03	UZ3	Provide the screening criteria for the radionuclides selected for PA. Provide the technical basis for selection of the radionuclides that are transported via colloids in the TSPA. The screening criteria for radionuclides selected for TSPA are contained in the AMR Inventory Abstraction. DOE is documenting identification of radionuclides transported via colloids for TSPA in the AMR Waste Form Colloid-Associated Concentration Limits: Abstraction and Summary, in the TSPA-SR Technical Report, and in the TSPA-SR Model Document. These documents will be available to the NRC in January 2001.	Received
RT.1.03	SZ2	Provide the screening criteria for the radionuclides selected for PA. Provide the technical basis for selection of the radionuclides that are transported via colloids in the TSPA. The screening criteria for radionuclides selected for TSPA are contained in the AMR Inventory Abstraction. DOE is documenting identification of radionuclides transported via colloids for TSPA in the AMR Waste Form Colloid-Associated Concentration Limits: Abstraction and Summary, in the TSPA-SR Technical Report, and in the TSPA-SR Model Document. These documents will be available to the NRC in January 2001.	Received
RT.1.03	TSPAI	Provide the screening criteria for the radionuclides selected for PA. Provide the technical basis for selection of the radionuclides that are transported via colloids in the TSPA. The screening criteria for radionuclides selected for TSPA are contained in the AMR Inventory Abstraction. DOE is documenting identification of radionuclides transported via colloids for TSPA in the AMR Waste Form Colloid-Associated Concentration Limits: Abstraction and Summary, in the TSPA-SR Technical Report, and in the TSPA-SR Model Document. These documents will be available to the NRC in January 2001.	Received
RT.1.04	UZ3	Provide sensitivity studies on Kd for plutonium, uranium, and protactinium to evaluate the adequacy of the data. DOE will analyze column test data to determine whether, under the flow rates pertinent to the Yucca Mountain flow system, plutonium sorption kinetics are important to performance. If they are found to be important, DOE will also perform sensitivity analyses for uranium, protactinium, and plutonium to evaluate the adequacy of KD data. The results of this work will be documented in an update to the AMR Unsaturated Zone and Saturated Zone Transport Properties available to the NRC in FY 2002.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
RT.1.04	SZ2	Provide sensitivity studies on Kd for plutonium, uranium, and protactinium to evaluate the adequacy of the data. DOE will analyze column test data to determine whether, under the flow rates pertinent to the Yucca Mountain flow system, plutonium sorption kinetics are important to performance. If they are found to be important, DOE will also perform sensitivity analyses for uranium, protactinium, and plutonium to evaluate the adequacy of KD data. The results of this work will be documented in an update to the AMR Unsaturated Zone and Saturated Zone Transport Properties available to the NRC in FY 2002.	Complete
RT.1.05	SZ1	Provide additional documentation to explain how transport parameters used for performance assessment were derived in a manner consistent with NUREG-1563, as applicable. Consistent with the less structured approach for informal expert judgment acknowledged in NUREG-1563 guidance and consistent with DOE procedure AP-3.10Q, DOE will document how it derived the transport parameter distributions for performance assessment, in a report expected to be available in FY 2002.	Received
RT.1.05	SZ2	Provide additional documentation to explain how transport parameters used for performance assessment were derived in a manner consistent with NUREG-1563, as applicable. Consistent with the less structured approach for informal expert judgment acknowledged in NUREG-1563 guidance and consistent with DOE procedure AP-3.10Q, DOE will document how it derived the transport parameter distributions for performance assessment, in a report expected to be available in FY 2002.	Received
RT.1.05	UZ3	Provide additional documentation to explain how transport parameters used for performance assessment were derived in a manner consistent with NUREG-1563, as applicable. Consistent with the less structured approach for informal expert judgment acknowledged in NUREG-1563 guidance and consistent with DOE procedure AP-3.10Q, DOE will document how it derived the transport parameter distributions for performance assessment, in a report expected to be available in FY 2002.	Received
RT.2.01	SZ1	Provide further justification for the range of effective porosity in alluvium, considering possible effects of contrasts in hydrologic properties of layers observed in wells along potential flow paths. DOE will use data obtained from the Nye County Drilling Program, available geophysical data, aeromagnetic data, and results from the Alluvium Testing Complex testing to justify the range of effective porosity in alluvium, considering possible effects of contrasts in hydrologic properties of layers observed in wells along potential flowpaths. The justification will be provided in the Alluvial Testing Complex AMR due in FY 2003.	Complete
RT.2.01	SZ2	Provide further justification for the range of effective porosity in alluvium, considering possible effects of contrasts in hydrologic properties of layers observed in wells along potential flow paths. DOE will use data obtained from the Nye County Drilling Program, available geophysical data, aeromagnetic data, and results from the Alluvium Testing Complex testing to justify the range of effective porosity in alluvium, considering possible effects of contrasts in hydrologic properties of layers observed in wells along potential flowpaths. The justification will be provided in the Alluvial Testing Complex AMR due in FY 2003.	Complete
RT.2.02	SZ1	The DOE should demonstrate that TSPA captures the spatial variability of parameters affecting radionuclide transport in alluvium. DOE will demonstrate that TSPA captures the variability of parameters affecting radionuclide transport in alluvium. This information will be provided in the TSPA-LA document due in FY 2003.	Received
RT.2.02	SZ2	The DOE should demonstrate that TSPA captures the spatial variability of parameters affecting radionuclide transport in alluvium. DOE will demonstrate that TSPA captures the variability of parameters affecting radionuclide transport in alluvium. This information will be provided in the TSPA-LA document due in FY 2003.	Received
RT.2.02	TSPAI	The DOE should demonstrate that TSPA captures the spatial variability of parameters affecting radionuclide transport in alluvium. DOE will demonstrate that TSPA captures the variability of parameters affecting radionuclide transport in alluvium. This information will be provided in the TSPA-LA document due in FY 2003.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
RT.2.03	SZ2	Provide a detailed testing plan for alluvial testing (the ATC and Nye County Drilling Program) to reduce uncertainty (for example, the plan should give details about hydraulic and tracer tests at the well 19 complex and it should also identify locations for alluvium complex testing wells and tests and logging to be performed). NRC will review the plan and provide comments, if any, for DOE's consideration. In support and preparation for the October/November 2000 Saturated Zone meeting, DOE provided work plans for the Alluvium Testing Complex and the Nye County Drilling Program (FWP-SBD-99-002, Alluvial Tracer Testing Field Work Package, and FWP-SBD-99-001, Nye County Early Warning Drilling Program, Phase II and Alluvial Testing Complex Drilling). DOE will provide test plans of the style of the Alcove 8 plan as they become available. The plan will be amended to include laboratory testing. In addition, the NRC On Site Representative attends DOE/Nye County planning meetings and is made aware of all plans and updates to plans as they are made.	Complete
RT.2.03	SZ1	Provide a detailed testing plan for alluvial testing (the ATC and Nye County Drilling Program) to reduce uncertainty (for example, the plan should give details about hydraulic and tracer tests at the well 19 complex and it should also identify locations for alluvium complex testing wells and tests and logging to be performed). NRC will review the plan and provide comments, if any, for DOE's consideration. In support and preparation for the October/November 2000 Saturated Zone meeting, DOE provided work plans for the Alluvium Testing Complex and the Nye County Drilling Program (FWP-SBD-99-002, Alluvial Tracer Testing Field Work Package, and FWP-SBD-99-001, Nye County Early Warning Drilling Program, Phase II and Alluvial Testing Complex Drilling). DOE will provide test plans of the style of the Alcove 8 plan as they become available. The plan will be amended to include laboratory testing. In addition, the NRC On Site Representative attends DOE/Nye County planning meetings and is made aware of all plans and updates to plans as they are made.	Complete
RT.2.04	SZ1	The NRC needs DOE to document the pre-test predictions for the ATC. DOE will document pretest predictions for the Alluvial Testing Complex in the SZ In Situ Testing AMR available in October 2001.	Complete
RT.2.04	SZ2	The NRC needs DOE to document the pre-test predictions for the ATC. DOE will document pretest predictions for the Alluvial Testing Complex in the SZ In Situ Testing AMR available in October 2001.	Complete
RT.2.05	SZ2	Provide the laboratory testing plan for laboratory radionuclide transport studies. NRC will review the plan and provide comments, if any, for DOE's consideration. In support and preparation for the October/November 2000 Saturated Zone meeting, DOE provided work plans for the Alluvium Testing Complex and the Nye County Drilling Program (FWP-SBD-99-002, Alluvial Tracer Testing Field Work Package, and FWP-SBD-99-001, Nye County Early Warning Drilling Program, Phase II and Alluvial Testing Complex Drilling). DOE will provide test plans of the style of the Alcove 8 plan as they become available. The plan will be amended to include laboratory testing. In addition, the NRC On Site Representative attends DOE/Nye County planning meetings and is made aware of all plans and updates to plans as they are made.	Complete
RT.2.06	SZ2	If credit is taken for retardation in alluvium, the DOE should conduct Kd testing for radionuclides important to performance using alluvium samples and water compositions that are representative of the full range of lithologies and water chemistries present within the expected flow paths (or consider alternatives such as testing with less disturbed samples, use of samples from more accessible analog sites (e.g., 40-mile Wash), detailed process level modeling, or other means). DOE will conduct Kd experiments on alluvium using samples from the suite of samples obtained from the existing drilling program; or, DOE will consider supplementing the samples available for testing from the alternatives presented by the NRC. This information will be documented in an update to the SZ In Situ Testing AMR, available in FY 2003. Kd parameter distributions for TSPA will consider the uncertainties that arise from the experimental methods and measurements.	Complete
RT.2.07	SZ2	Provide the testing results for the alluvial and laboratory testing. DOE will provide testing results for the alluvial field and laboratory testing in an update to the SZ In Situ Testing AMR available in FY 2003.	Complete

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RT.2.08	SZ1	Provide additional information to further justify the uncertainty distribution of flow path lengths in the alluvium. This information currently resides in the Uncertainty Distribution for Stochastic Parameters AMR. DOE will provide additional information, to include Nye County data as available, to further justify the uncertainty distribution of flowpath lengths in alluvium in updates to the Uncertainty Distribution for Stochastic Parameters AMR and to the Saturated Zone Flow and Transport PMR, both expected to be available in FY 2002.	Complete
RT.2.09	SZ1	Provide the hydro-stratigraphic cross-sections that include the Nye County data. DOE will provide the hydrostratigraphic cross sections in an update to the Hydrogeologic Framework Model for The Saturated Zone Site-Scale Flow and Transport Model AMR expected to be available during FY 2002, subject to availability of Nye County data.	Received
RT.2.10	TSPAI	Provide additional documentation to explain how transport parameters used for PA were derived in a manner consistent with NUREG-1563, as applicable. Consistent with the less structured approach for informal expert judgment acknowledged in NUREG-1563 guidance and consistent with AP-3.10Q, DOE will document how it derived the transport distributions for performance assessment, in a report expected to be available in FY 2002.	Received
RT.2.10	UZ3	Provide additional documentation to explain how transport parameters used for PA were derived in a manner consistent with NUREG-1563, as applicable. Consistent with the less structured approach for informal expert judgment acknowledged in NUREG-1563 guidance and consistent with AP-3.10Q, DOE will document how it derived the transport distributions for performance assessment, in a report expected to be available in FY 2002.	Received
RT.2.10	SZ2	Provide additional documentation to explain how transport parameters used for PA were derived in a manner consistent with NUREG-1563, as applicable. Consistent with the less structured approach for informal expert judgment acknowledged in NUREG-1563 guidance and consistent with AP-3.10Q, DOE will document how it derived the transport distributions for performance assessment, in a report expected to be available in FY 2002.	Received
RT.2.11	SZ1	Provide the updated UZ Flow and Transport and the SZ Flow and Transport FEPs AMRs. DOE will provide updates to the AMRs Features, Events, and Processes in UZ Flow and Transport and Features, Events, and Processes in SZ Flow and Transport, both available in January 2001.	Complete
RT.2.11	TSPAI	Provide the updated UZ Flow and Transport and the SZ Flow and Transport FEPs AMRs. DOE will provide updates to the AMRs Features, Events, and Processes in UZ Flow and Transport and Features, Events, and Processes in SZ Flow and Transport, both available in January 2001.	Complete
RT.3.01	UZ3	For transport through fault zones below the repository, provide the technical basis for parameters/distributions (consider obtaining additional information, for example, the sampling of wells WT-1 and WT-2), or show the parameters are not important to performance. DOE will provide a technical basis for the importance to performance of transport through fault zones below the repository. This information will be provided in an update to the AMR Radionuclide Transport Models Under Ambient Conditions available to the NRC in FY 2002. If such transport is found to be important to performance, DOE will provide the technical basis for the parameters/distributions used in FY 2002. DOE will consider obtaining additional information.	Received
RT.3.01	SZ1	For transport through fault zones below the repository, provide the technical basis for parameters/distributions (consider obtaining additional information, for example, the sampling of wells WT-1 and WT-2), or show the parameters are not important to performance. DOE will provide a technical basis for the importance to performance of transport through fault zones below the repository. This information will be provided in an update to the AMR Radionuclide Transport Models Under Ambient Conditions available to the NRC in FY 2002. If such transport is found to be important to performance, DOE will provide the technical basis for the parameters/distributions used in FY 2002. DOE will consider obtaining additional information.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
RT.3.02	UZ2	Provide the analysis of geochemical data used for support of the flow field below the repository. DOE will provide the analysis of geochemical data used for support of the fluid flow patterns in the AMR UZ Flow Models and Submodels, available to the NRC in FY 2002.	Received
RT.3.02	UZ3	Provide the analysis of geochemical data used for support of the flow field below the repository. DOE will provide the analysis of geochemical data used for support of the fluid flow patterns in the AMR UZ Flow Models and Submodels, available to the NRC in FY 2002.	Received
RT.3.03	SZ1	Provide additional information to further justify the uncertainty distribution of flow path lengths in the tuff. This information currently resides in the Uncertainty Distribution for Stochastic Parameters AMR. DOE will provide additional information, to include Nye County data as available, to further justify the uncertainty distribution of flowpath lengths from the tuff at the water table through the alluvium at the compliance boundary in updates to the Uncertainty Distribution for Stochastic Parameters AMR and to the Saturated Zone Flow and Transport Process Model Report, both expected to be available in FY 2002.	Complete
RT.3.04	UZ3	Provide sensitivity studies for the relative importance of the hydrogeological units beneath the repository for transport of radionuclides important to performance. DOE will provide a sensitivity study to fully evaluate the relative importance of the different units below the repository that could be used to prioritize data collection, testing, and analysis. This study will be documented in an update to the AMR Radionuclide Transport Models Under Ambient Conditions available to the NRC in FY 2002.	Received
RT.3.05	UZ3	Provide the documentation for the Alcove 8/Niche 3 testing and predictive modeling for the unsaturated zone. DOE will provide documentation for the Alcove 8 / Niche 3 testing and predictive modeling for the unsaturated zone in updates to the AMRs In Situ Field Testing of Processes and Radionuclide Transport Models Under Ambient Conditions, both available to the NRC in FY 2002.	Received
RT.3.05	UZ2	Provide the documentation for the Alcove 8/Niche 3 testing and predictive modeling for the unsaturated zone. DOE will provide documentation for the Alcove 8 / Niche 3 testing and predictive modeling for the unsaturated zone in updates to the AMRs In Situ Field Testing of Processes and Radionuclide Transport Models Under Ambient Conditions, both available to the NRC in FY 2002.	Received
RT.3.06	UZ2	The NRC needs DOE to document the pre-test predictions for the Alcove 8/Niche 3 work. DOE responded that pre-test predictions for Alcove 8 Niche 3 work will be provided to NRC via letter report (Brocoum to Greeves) by mid-January 2001.	Complete
RT.3.06	UZ3	The NRC needs DOE to document the pre-test predictions for the Alcove 8/Niche 3 work. DOE responded that pre-test predictions for Alcove 8 Niche 3 work will be provided to NRC via letter report (Brocoum to Greeves) by mid-January 2001.	Complete
RT.3.07	SZ2	Provide sensitivity studies to test the importance of colloid transport parameters and models to performance for UZ and SZ. Consider techniques to test colloid transport in the Alcove 8/Niche 3 test (for example, microspheres). DOE will perform sensitivity studies as the basis for consideration of the importance of colloid transport parameters and models to performance for the unsaturated and saturated zones and will document the results in updates to appropriate AMRs, and in the TSPA-LA document, all to be available in FY 2003. DOE will evaluate techniques to test colloidal transport in Alcove 8 / Niche 3 and provide a response to the NRC in February 2001.	Received
RT.3.07	UZ3	Provide sensitivity studies to test the importance of colloid transport parameters and models to performance for UZ and SZ. Consider techniques to test colloid transport in the Alcove 8/Niche 3 test (for example, microspheres). DOE will perform sensitivity studies as the basis for consideration of the importance of colloid transport parameters and models to performance for the unsaturated and saturated zones and will document the results in updates to appropriate AMRs, and in the TSPA-LA document, all to be available in FY 2003. DOE will evaluate techniques to test colloidal transport in Alcove 8 / Niche 3 and provide a response to the NRC in February 2001.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
RT.3.08	SZ2	Provide justification that microspheres can be used as analogs for colloids (for example, equivalent ranges in size, charge, etc.). DOE will provide documentation in the C-Wells AMR to provide additional justification that microspheres can be used as analogs for colloids. The C-Wells AMR will be available to the NRC in October 2001.	Received
RT.3.08	UZ3	Provide justification that microspheres can be used as analogs for colloids (for example, equivalent ranges in size, charge, etc.). DOE will provide documentation in the C-Wells AMR to provide additional justification that microspheres can be used as analogs for colloids. The C-Wells AMR will be available to the NRC in October 2001.	Received
RT.3.09	SZ2	Provide the documentation for the C-wells testing. Use the field test data or provide justification that the data from the laboratory tests is consistent with the data from the field tests. DOE will provide the C-Wells test documentation and will either use the test data or provide a justified reconciliation of the lab and field test data in the C-Wells AMR available in October 2001.	Complete
RT.3.10	UZ3	Provide analog radionuclide data from the tracer tests for Calico Hills at Busted Butte and from similar analog and radionuclide data (if available) from test blocks from Busted Butte. DOE will provide data from analog tracers used at Busted Butte and data from (AECL) test blocks from Busted Butte in an update to the AMR In Situ Field Testing of Processes in FY 2002.	Received
RT.4.01	SZ2	Provide Revision 1 to the Topical Report. DOE will provide the Disposal Criticality Analysis Methodology Topical Report, Revision 01, to NRC during January 2001.	Received
RT.4.01	UZ3	Provide Revision 1 to the Topical Report. DOE will provide the Disposal Criticality Analysis Methodology Topical Report, Revision 01, to NRC during January 2001.	Received
RT.4.01	TSPAI	Provide Revision 1 to the Topical Report. DOE will provide the Disposal Criticality Analysis Methodology Topical Report, Revision 01, to NRC during January 2001.	Received
RT.4.02	TSPAI	Provide the updated FEPs database. DOE stated that it would provide the FEPs AMRs and the FEPs database to NRC during January 2001.	Complete
RT.4.03	ENG3	Provide the applicable list of validation reports and their schedules for external criticality. DOE stated that the geochemical model validation reports for “Geochemistry Model Validation Report: Degradation and Release” and “Geochemistry Model Validation Report: Material Accumulation” are expected to be available during 2001. The remainder of the reports are expected to be available during FY2002 subject to the results of detailed planning and scheduling. DOE understands that these reports are required to be provided prior to LA. A list of model validation reports was provided during the technical exchange and is included as an attachment to the meeting summary.	Received
RT.4.03	SZ2	Provide the applicable list of validation reports and their schedules for external criticality. DOE stated that the geochemical model validation reports for “Geochemistry Model Validation Report: Degradation and Release” and “Geochemistry Model Validation Report: Material Accumulation” are expected to be available during 2001. The remainder of the reports are expected to be available during FY2002 subject to the results of detailed planning and scheduling. DOE understands that these reports are required to be provided prior to LA. A list of model validation reports was provided during the technical exchange and is included as an attachment to the meeting summary.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
RT.4.03	UZ3	Provide the applicable list of validation reports and their schedules for external criticality. DOE stated that the geochemical model validation reports for “Geochemistry Model Validation Report: Degradation and Release” and “Geochemistry Model Validation Report: Material Accumulation” are expected to be available during 2001. The remainder of the reports are expected to be available during FY2002 subject to the results of detailed planning and scheduling. DOE understands that these reports are required to be provided prior to LA. A list of model validation reports was provided during the technical exchange and is included as an attachment to the meeting summary.	Received
SDS.1.01	TSPAI	Provide the updated FEPs: Disruptive Events AMR. DOE will provide the updated FEPs AMR to the NRC. Expected availability is January 2001.	Complete
SDS.1.02	ENG2	Consistent with proposed 10 CFR Part 63, the NRC believes the use of the mean is appropriate, however, DOE may use any statistic as long as it is consistent with site data and technically defensible. DOE will either provide technical justification for use of median values or another statistical measure, such as the mean, or will evaluate and implement an alternative approach. The DOE-proposed approach and its basis will be provided to NRC prior to September 2001. The approach will be implemented prior to any potential LA.	Complete
SDS.2.01	ENG2	Regarding ground motion, provide documentation, or point the NRC to the documentation on the expert elicitation process, regarding the feedback to the subject matter experts following the elicitation of their respective judgements. DOE will provide documentation demonstrating the adequacy of the elicitation feedback process by December 2000.	Received
SDS.2.02	TSPAI	Provide the updated FEPs: Disruptive Events AMR, the Seismic Design Input Report, and the update to the Seismic Topical Report. DOE will provide the updated FEPs AMR to NRC. Expected availability is January 2001. DOE will provide STR 3 to the NRC for their review. Expected availability is January 2002. The Seismic Design Inputs Report is expected to be available to the NRC by September 2001.	Received
SDS.2.02	PRE	Provide the updated FEPs: Disruptive Events AMR, the Seismic Design Input Report, and the update to the Seismic Topical Report. DOE will provide the updated FEPs AMR to NRC. Expected availability is January 2001. DOE will provide STR 3 to the NRC for their review. Expected availability is January 2002. The Seismic Design Inputs Report is expected to be available to the NRC by September 2001.	Received
SDS.2.03	ENG2	Consistent with proposed 10 CFR Part 63, the NRC believes the use of the mean is appropriate, however, DOE may use any statistic as long as it is consistent with site data and technically defensible. DOE will either provide technical justification for use of median values or another statistical measure, such as the mean, or will evaluate and implement an alternative approach. The DOE-proposed approach and its basis will be provided to NRC prior to September 2001. The approach will be implemented prior to any potential LA.	Complete
SDS.2.04	ENG2	The approach to evaluate seismic risk, including the assessment of seismic fragility and evaluation of event sequences is not clear to the NRC, provide additional information. DOE believes the approach contained in the FEPs AMR will be sufficient to support the Site Recommendation. The updated FEPs AMR is expected to be available in January 2001.	Received
SDS.3.01	UZ2	The ECRB long-term test and the Alcove 8 Niche 3 test need to be “fractured-informed” (i.e., observation of seepage needs to be related to observed fracture patterns). Provide documentation which discusses this aspect. DOE responded that for the passive test, any observed seepage will be related to full periphery maps and other fracture data in testing documentation. The documentation will be available by any potential LA. For Niche 3, fracture characterization is complete and a 3-D representation will be included in testing documentation. The documentation will be available August 2001.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
SDS.3.01	UZ3	The ECRB long-term test and the Alcove 8 Niche 3 test need to be "fractured-informed" (i.e., observation of seepage needs to be related to observed fracture patterns). Provide documentation which discusses this aspect. DOE responded that for the passive test, any observed seepage will be related to full periphery maps and other fracture data in testing documentation. The documentation will be available by any potential LA. For Niche 3, fracture characterization is complete and a 3-D representation will be included in testing documentation. The documentation will be available August 2001.	Received
SDS.3.02	UZ3	The NRC needs DOE to document the pre-test predictions for the Alcove 8 Niche 3 work. DOE responded that pre-test predictions for Alcove 8 Niche 3 work will be provided to NRC via letter report (Brocoum to Greeves) by mid-January 2001.	Complete
SDS.3.02	UZ2	The NRC needs DOE to document the pre-test predictions for the Alcove 8 Niche 3 work. DOE responded that pre-test predictions for Alcove 8 Niche 3 work will be provided to NRC via letter report (Brocoum to Greeves) by mid-January 2001.	Complete
SDS.3.03	ENG3	The NRC needs to review the Fracture Geometry Analysis for the Stratigraphic Units of the Repository Host Horizon AMR. The NRC will provide feedback and proposed agreements to DOE, if needed, by December 2000.	Received
SDS.3.04	UZ2	The NRC needs DOE to document the discussion of excavation-induced fractures. DOE responded that observations of excavation-induced fractures will be documented in a report or AMR revision by June 2001.	Complete
SDS.3.04	ENG2	The NRC needs DOE to document the discussion of excavation-induced fractures. DOE responded that observations of excavation-induced fractures will be documented in a report or AMR revision by June 2001.	Complete
SDS.3.04	ENG3	The NRC needs DOE to document the discussion of excavation-induced fractures. DOE responded that observations of excavation-induced fractures will be documented in a report or AMR revision by June 2001.	Complete
SDS.3.04	PRE	The NRC needs DOE to document the discussion of excavation-induced fractures. DOE responded that observations of excavation-induced fractures will be documented in a report or AMR revision by June 2001.	Complete
TEF.1.01	TSPAI	Provide the FEPs AMRs relating to TEF. The DOE will provide the following updated FEPs AMRs related to thermal effects on flow to the NRC: Disruptive Events FEPs (ANL-NBS-MD-000005) Rev 00 ICN 01; Features, Events, and Processes: System Level (ANL-WIS-MD-000019) Rev 00; Features, Events, and Processes in UZ Flow and Transport (ANL-NBS-MD-000001) Rev 01; Features, Events, and Processes in SZ Flow and Transport (ANL-NBS-MD-000002) Rev 01; Features, Events, and Processes in Thermal Hydrology and Coupled Processes (ANL-NBS-MD-000004) Rev 00 ICN 01; Miscellaneous Waste Form FEPs (ANL-WIS-MD-000009) Rev 00 ICN 01; and Engineered Barrier System Features, Events, and Processes (ANL-WIS-PA-000002) Rev 01. Expected availability: January 2001.	Complete
TEF.1.01	ENG3	Provide the FEPs AMRs relating to TEF. The DOE will provide the following updated FEPs AMRs related to thermal effects on flow to the NRC: Disruptive Events FEPs (ANL-NBS-MD-000005) Rev 00 ICN 01; Features, Events, and Processes: System Level (ANL-WIS-MD-000019) Rev 00; Features, Events, and Processes in UZ Flow and Transport (ANL-NBS-MD-000001) Rev 01; Features, Events, and Processes in SZ Flow and Transport (ANL-NBS-MD-000002) Rev 01; Features, Events, and Processes in Thermal Hydrology and Coupled Processes (ANL-NBS-MD-000004) Rev 00 ICN 01; Miscellaneous Waste Form FEPs (ANL-WIS-MD-000009) Rev 00 ICN 01; and Engineered Barrier System Features, Events, and Processes (ANL-WIS-PA-000002) Rev 01. Expected availability: January 2001.	Complete
TEF.1.02	TSPAI	Provide the FEPs database. The DOE will provide the FEPs data base to the NRC during March 2001.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
TEF.2.01	UZ2	Consider measuring losses of mass and energy through the bulkhead of the drift-scale test (DST) and provide the technical basis for any decision or method decided upon (include the intended use of the results of the DST such as verifying assumptions in FEP exclusion arguments or providing support for TSPA models. The DOE should analyze uncertainty in the fate of thermally mobilized water in the DST and evaluate the effect this uncertainty has on conclusions drawn from the DST results. The DOE's position is that measuring mass and energy losses through the bulkhead of the DST is not necessary for the intended use of the DST results. The DST results are intended for validation of models of thermally-driven coupled processes in the rock, and measurements are not directly incorporated into TSPA models. Results of the last two years of data support the validation of DST coupled-process models and the current treatment of mass and energy loss through the bulkhead. The DOE will provide the NRC a white paper on the technical basis for the DOE's understanding of heat and mass losses through the bulkhead and their effects on the results by April 2001. This white paper will include the DOE's technical basis for its decision regarding measurements of heat and mass losses through the DST bulkhead. This white paper will address uncertainty in the fate of thermally mobilized water in the DST and also the effect this uncertainty has on conclusions drawn from the DST results. The NRC will provide comments on this white paper. The DOE will provide analyses of the effects of this uncertainty on the uses of the DST in response to NRC comments.	Complete
TEF.2.01	ENG3	Consider measuring losses of mass and energy through the bulkhead of the drift-scale test (DST) and provide the technical basis for any decision or method decided upon (include the intended use of the results of the DST such as verifying assumptions in FEP exclusion arguments or providing support for TSPA models. The DOE should analyze uncertainty in the fate of thermally mobilized water in the DST and evaluate the effect this uncertainty has on conclusions drawn from the DST results. The DOE's position is that measuring mass and energy losses through the bulkhead of the DST is not necessary for the intended use of the DST results. The DST results are intended for validation of models of thermally-driven coupled processes in the rock, and measurements are not directly incorporated into TSPA models. Results of the last two years of data support the validation of DST coupled-process models and the current treatment of mass and energy loss through the bulkhead. The DOE will provide the NRC a white paper on the technical basis for the DOE's understanding of heat and mass losses through the bulkhead and their effects on the results by April 2001. This white paper will include the DOE's technical basis for its decision regarding measurements of heat and mass losses through the DST bulkhead. This white paper will address uncertainty in the fate of thermally mobilized water in the DST and also the effect this uncertainty has on conclusions drawn from the DST results. The NRC will provide comments on this white paper. The DOE will provide analyses of the effects of this uncertainty on the uses of the DST in response to NRC comments.	Complete
TEF.2.02	ENG3	Provide the location and access to the Multi-Scale Thermohydrologic Model input and output files. The output files are in the Technical Data Management System. The DTNs are LL000509112312.003, LL000509012312.002, and LL000509212312.004. The input files are located in the Project records system. The document identification number is MOL.20000706.0396. The DOE will provide the requested information to the NRC in January 2001.	Complete
TEF.2.03	ENG1	Provide the following references: Multi-Scale Thermohydrologic Model AMR, ICN 01; Abstraction of Near Field Environment Drift Thermodynamic and Percolation Flux AMR, ICN 01; Engineered Barrier System Degradation Flow and Transport PMR, Rev. 01; and Near Field Environment PMR, ICN 03. DOE will provide to the NRC the following documents: Multi-Scale Thermohydrologic Model AMR (ANL-EBS-MD-00049) Rev 00 ICN 01 (January 2001); Abstraction of Near-Field Environment Drift Thermodynamic and Percolation Flux AMR (ANL-EBS-HS-000003) Rev 00 ICN 01 (January 2001); Engineered Barrier System Degradation, Flow and Transport PMR (TDR-EBS-MD-000006) Rev 01 (September 2001); Near-Field Environment PMR (TDR-NBS-MD-000001) Rev 00 ICN 03 (January 2001)	Complete
TEF.2.04	ENG1	Provide the Multi-Scale Thermohydrologic Model AMR, Rev. 01. The DOE will provide the Multi-Scale Thermohydrologic Model AMR (ANL-EBS-MD-00049) Rev 01 to the NRC. Expected availability is FY 02.	Received

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TEF.2.05	ENG3	Represent the cold-trap effect in the appropriate models or provide the technical basis for exclusion of it in the various scale models (mountain, drift, etc.) considering effects on TEF and other abstraction/models (chemistry). See page 11 of the Open Item (OI) 2 presentation. The DOE will represent the “cold-trap” effect in the Multi-Scale Thermohydrologic Model AMR (ANL-EBS-MD-00049) Rev 01, expected to be available in FY 02. This report will provide technical support for inclusion or exclusion of the cold-trap effect in the various scale models. The analysis will consider thermal effects on flow and the in-drift geochemical	Received
TEF.2.06	ENG3	Provide the detailed test plan for Phase III of the ventilation test, and consider NRC comments, if any. The DOE will provide a detailed test plan for the Phase III ventilation test in March 2001. The NRC comments will be provided no later than two weeks after receipt of the test plan, and will be considered by the DOE prior to test initiation.	Complete
TEF.2.06	PRE	Provide the detailed test plan for Phase III of the ventilation test, and consider NRC comments, if any. The DOE will provide a detailed test plan for the Phase III ventilation test in March 2001. The NRC comments will be provided no later than two weeks after receipt of the test plan, and will be considered by the DOE prior to test initiation.	Complete
TEF.2.06	UZ2	Provide the detailed test plan for Phase III of the ventilation test, and consider NRC comments, if any. The DOE will provide a detailed test plan for the Phase III ventilation test in March 2001. The NRC comments will be provided no later than two weeks after receipt of the test plan, and will be considered by the DOE prior to test initiation.	Complete
TEF.2.07	ENG3	Provide the Ventilation Model AMR, Rev. 01 and the Pre-Test Predictions for Ventilation Test Calculation, Rev. 00. The DOE will provide the Ventilation Model AMR (ANL-EBS-MD-000030) Rev 01 to the NRC in March 2001. Note that ventilation test data will not be incorporated in the AMR until FY02. The DOE will provide the Pre-test Predictions for Ventilation Tests (CAL-EBS-MD-000013) Rev 00 to the NRC in February 2001. Test results will be provided in an update to the Ventilation Model AMR (ANL-EBS-MD-000030) in FY 02.	Received
TEF.2.07	PRE	Provide the Ventilation Model AMR, Rev. 01 and the Pre-Test Predictions for Ventilation Test Calculation, Rev. 00. The DOE will provide the Ventilation Model AMR (ANL-EBS-MD-000030) Rev 01 to the NRC in March 2001. Note that ventilation test data will not be incorporated in the AMR until FY02. The DOE will provide the Pre-test Predictions for Ventilation Tests (CAL-EBS-MD-000013) Rev 00 to the NRC in February 2001. Test results will be provided in an update to the Ventilation Model AMR (ANL-EBS-MD-000030) in FY 02.	Received
TEF.2.07	UZ2	Provide the Ventilation Model AMR, Rev. 01 and the Pre-Test Predictions for Ventilation Test Calculation, Rev. 00. The DOE will provide the Ventilation Model AMR (ANL-EBS-MD-000030) Rev 01 to the NRC in March 2001. Note that ventilation test data will not be incorporated in the AMR until FY02. The DOE will provide the Pre-test Predictions for Ventilation Tests (CAL-EBS-MD-000013) Rev 00 to the NRC in February 2001. Test results will be provided in an update to the Ventilation Model AMR (ANL-EBS-MD-000030) in FY 02.	Received
TEF.2.08	ENG3	Provide the Mountain Scale Coupled Processes AMR, or an other appropriate AMR, documenting the results of the outlined items on page 20 of the OI 7 presentation (considering the NRC suggestion to compare model results to the O.M. Phillips analytical solution documented in Water Resources Research, 1996). The DOE will provide the updated Mountain-Scale Coupled Processes Model AMR (MDL-NBS-HS-000007) Rev 01 to the NRC in FY 02, documenting the results of the outlined items on page 20 of DOE’s Open Item 7 presentation at this meeting. The DOE will consider the NRC suggestion of comparing the numerical model results to the O.M. Phillips analytical solution documented in WRR (1996).	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
TEF.2.08	UZ2	Provide the Mountain Scale Coupled Processes AMR, or an other appropriate AMR, documenting the results of the outlined items on page 20 of the OI 7 presentation (considering the NRC suggestion to compare model results to the O.M. Phillips analytical solution documented in Water Resources Research, 1996). The DOE will provide the updated Mountain-Scale Coupled Processes Model AMR (MDL-NBS-HS-000007) Rev 01 to the NRC in FY 02, documenting the results of the outlined items on page 20 of DOE's Open Item 7 presentation at this meeting. The DOE will consider the NRC suggestion of comparing the numerical model results to the O.M. Phillips analytical solution documented in WRR (1996).	Complete
TEF.2.09	ENG1	Provide the Multi-Scale Thermohydrologic Model AMR, ICN 03. The DOE will provide the Multi-Scale Thermohydrologic Model AMR (ANL-EBS-MD-00049) Rev 00 ICN 03 to the NRC. Expected availability July 2001.	Complete
TEF.2.10	UZ2	Represent the full variability/uncertainty in the results of the TEF simulations in the abstraction of thermodynamic variables to other models, or provide technical basis that a reduced representation is appropriate (considering risk significance). The DOE will discuss this issue during the TSPAI technical exchange tentatively scheduled for April 2001.	Received
TEF.2.10	ENG3	Represent the full variability/uncertainty in the results of the TEF simulations in the abstraction of thermodynamic variables to other models, or provide technical basis that a reduced representation is appropriate (considering risk significance). The DOE will discuss this issue during the TSPAI technical exchange tentatively scheduled for April 2001.	Received
TEF.2.11	ENG3	Provide the Calibrated Properties AMR, incorporating uncertainty from all significant sources. The DOE will provide an updated Calibrated Properties Model AMR (MDL-NBS-HS-000003) Rev 01 that incorporates uncertainty from significant sources to the NRC in FY 02.	Received
TEF.2.11	UZ2	Provide the Calibrated Properties AMR, incorporating uncertainty from all significant sources. The DOE will provide an updated Calibrated Properties Model AMR (MDL-NBS-HS-000003) Rev 01 that incorporates uncertainty from significant sources to the NRC in FY 02.	Received
TEF.2.12	UZ2	Provide the Unsaturated Zone Flow and Transport PMR, Rev. 00, ICN 02, documenting the resolution of issues on page 5 of the OI 8 presentation. The DOE will provide the Unsaturated Zone Flow and Transport PMR (TDR-NBS-HS-000002) Rev 00 ICN 02 to the NRC in February 2001. It should be noted, however, that not all of the items listed on page 5 of the DOE's Open Item 8 presentation at this meeting are included in that revision. The DOE will include all the items listed on page 5 of the DOE's Open Item 8 presentation in Revision 02 of the Unsaturated Zone Flow and Transport PMR, scheduled to be available in FY 02.	Received
TEF.2.12	UZ3	Provide the Unsaturated Zone Flow and Transport PMR, Rev. 00, ICN 02, documenting the resolution of issues on page 5 of the OI 8 presentation. The DOE will provide the Unsaturated Zone Flow and Transport PMR (TDR-NBS-HS-000002) Rev 00 ICN 02 to the NRC in February 2001. It should be noted, however, that not all of the items listed on page 5 of the DOE's Open Item 8 presentation at this meeting are included in that revision. The DOE will include all the items listed on page 5 of the DOE's Open Item 8 presentation in Revision 02 of the Unsaturated Zone Flow and Transport PMR, scheduled to be available in FY 02.	Received
TEF.2.13	UZ3	Provide the Conceptual and Numerical Models for Unsaturated Zone Flow and Transport AMR, Rev. 01 and the Analysis of Hydrologic Properties Data AMR, Rev. 01. The DOE will provide updates to the Conceptual and Numerical Models for UZ Flow and Transport (MDL-NBS-HS-000005) Rev 01 and the Analysis of Hydrologic Properties Data (ANL-NBS-HS-000002) Rev 01 AMRs to the NRC. Scheduled availability is FY 02.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TEF.2.13	UZ2	Provide the Conceptual and Numerical Models for Unsaturated Zone Flow and Transport AMR, Rev. 01 and the Analysis of Hydrologic Properties Data AMR, Rev. 01. The DOE will provide updates to the Conceptual and Numerical Models for UZ Flow and Transport (MDL-NBS-HS-000005) Rev 01 and the Analysis of Hydrologic Properties Data (ANL-NBS-HS-000002) Rev 01 AMRs to the NRC. Scheduled availability is FY 02.	Received
TSPAI.1.01	TSPAI	Provide enhanced descriptive treatment for presenting barrier capabilities in their final approach for demonstrating multiple barriers. Provide discussion of the capabilities of individual barriers, in light of existing parameter uncertainty (e.g., in barrier and system characteristics) and model uncertainty. DOE will provide enhanced descriptive treatment for presenting barrier capabilities in the final approach for demonstrating multiple barriers. DOE will also provide discussion of the capabilities of individual barriers, in light of existing parameter uncertainty (e.g., in barrier and system characteristics) and model uncertainty. The information will be documented in TSPA Methods and Assumptions document, expected to be available to NRC in FY 2002, for any potential license application.	Complete
TSPAI.1.02	TSPAI	Provide a discussion of the following in documentation of barrier capabilities and the corresponding technical bases: (1) parameter uncertainty, (2) model uncertainty (i.e., the effect of viable alternative conceptual models), (3) spatial and temporal variability in the performance of the barriers, (4) independent and interdependent capabilities of the barriers (e.g., including a differentiation of the capabilities of barriers performing similar functions), and (5) barrier effectiveness with regard to individual radionuclides. Analyze and document barrier capabilities, in light of existing data and analyses of the performance of the repository system. DOE will provide a discussion of the following in documentation of barrier capabilities and the corresponding technical bases: (1) parameter uncertainty, (2) model uncertainty (i.e., the effect of viable alternative conceptual models), (3) spatial and temporal variability in the performance of the barriers, (4) independent and interdependent capabilities of the barriers (e.g., including a differentiation of the capabilities of barriers performing similar functions), and (5) barrier effectiveness with regard to individual radionuclides. DOE will also analyze and document barrier capabilities, in light of existing data and analyses of the performance of the repository system. The information will be documented in TSPA for any potential license application expected to be available in FY 2003.	Received
TSPAI.2.01	SZ2	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.01	DOSE3	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.01	DOSE2	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.01	DOSE1	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.01	UZ3	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received

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TSPAI.2.01	TSPAI	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.01	SZ1	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.01	ENG4	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.01	ENG3	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.01	ENG1	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.01	UZ2	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.01	UZ1	Provide clarification of the screening arguments, as summarized in Attachment 2. See Comment # 5, 7, 8, 9, 10, 13, 18, 19 (Part 5), 21, 32, 41, 47, 50, 53, 58, 67, J-5, J-16, and J-18. DOE will clarify the screening arguments, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	SZ2	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	TSPAI	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	DOSE3	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received

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TSPAI.2.02	DOSE2	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	DOSE1	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	DIRECT1	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	SZ1	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	UZ2	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	UZ1	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	ENG4	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received

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TSPAI.2.02	ENG3	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	ENG2	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	ENG1	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	UZ3	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.02	DIRECT2	Provide the technical basis for the screening argument, as summarized in Attachment 2. See Comment # 3, 4, 11, 12, 19 (Parts 1, 2, and 6), 25, 26, 29, 34, 35, 36, 37, 38, 39, 42, 43, 44, 48, 49, 51, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 68, 69, 70, 78, 79, J-1, J-2, J-3, J-4, J-7, J-8, J-9, J-10, J-11, J-12, J-13, J-14, J-15, J-17, J-20, J-21, J-22, J-23, J-24, J-25, J-26, and J-27. DOE will provide the technical basis for the screening argument, as summarized in Attachment 2, for the highlighted FEPs. The technical basis will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.03	DOSE1	Add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. See Comment 19 (Part 7 and 8), 20, and J-6. DOE will add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. The FEPs will be added to the appropriate FEPs AMRs and the AMRs will be provided to the NRC in FY03.	Received
TSPAI.2.03	TSPAI	Add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. See Comment 19 (Part 7 and 8), 20, and J-6. DOE will add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. The FEPs will be added to the appropriate FEPs AMRs and the AMRs will be provided to the NRC in FY03.	Received
TSPAI.2.03	SZ2	Add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. See Comment 19 (Part 7 and 8), 20, and J-6. DOE will add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. The FEPs will be added to the appropriate FEPs AMRs and the AMRs will be provided to the NRC in FY03.	Received
TSPAI.2.03	SZ1	Add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. See Comment 19 (Part 7 and 8), 20, and J-6. DOE will add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. The FEPs will be added to the appropriate FEPs AMRs and the AMRs will be provided to the NRC in FY03.	Received

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TSPAI.2.03	UZ3	Add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. See Comment 19 (Part 7 and 8), 20, and J-6. DOE will add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. The FEPs will be added to the appropriate FEPs AMRs and the AMRs will be provided to the NRC in FY03.	Received
TSPAI.2.03	DOSE3	Add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. See Comment 19 (Part 7 and 8), 20, and J-6. DOE will add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. The FEPs will be added to the appropriate FEPs AMRs and the AMRs will be provided to the NRC in FY03.	Received
TSPAI.2.03	DOSE2	Add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. See Comment 19 (Part 7 and 8), 20, and J-6. DOE will add the FEPs highlighted in Attachment 2 to the appropriate FEPs AMRs. The FEPs will be added to the appropriate FEPs AMRs and the AMRs will be provided to the NRC in FY03.	Received
TSPAI.2.04	DOSE3	Provide a clarification of the description of the primary FEP. See Comments 24, 31, and 33. DOE will clarify the description of the primary FEPs, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.04	TSPAI	Provide a clarification of the description of the primary FEP. See Comments 24, 31, and 33. DOE will clarify the description of the primary FEPs, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.04	ENG2	Provide a clarification of the description of the primary FEP. See Comments 24, 31, and 33. DOE will clarify the description of the primary FEPs, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received
TSPAI.2.04	ENG1	Provide a clarification of the description of the primary FEP. See Comments 24, 31, and 33. DOE will clarify the description of the primary FEPs, as summarized in Attachment 2, for the highlighted FEPs. The clarifications will be provided in the referenced FEPs AMR and will be provided to the NRC in FY03.	Received

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TSPAI.2.05	TSPAI	It is not clear to the NRC that the current list of FEPs (i.e., the list of FEPs documented in TDR-WIS-MD-000003, 00/01) is sufficiently comprehensive or exhibits the necessary attribute of being auditable (e.g., transparent and traceable). As discussed in the two TSPAI technical exchanges, there are unclear aspects of the approach that DOE plans to use to develop the necessary documentation of those features, events, and processes that they have considered. Accordingly, to provide additional confidence that the DOE will provide NRC with: (1) auditable documentation of what has been considered by the DOE, (2) the technical basis for excluding FEPs, and (3) an indication of the way in which included FEPs have been incorporated in the performance assessment; DOE will provide NRC with a detailed plan (the Enhanced FEP Plan) for comment. In the Enhanced FEP Plan, DOE will address the following items: (1) the approach used to develop a pre-screening set of FEPs (i.e., the documentation of those things that DOE considered and which the DOE would use to provide support for a potential license application), (2) the guidance on the level-of-detail that DOE will use for redefining FEPs during the enhanced FEP process, (3) the form that the pre-screening list of FEPs will take (e.g., list, database, other descriptions), (4) the approach DOE would use for the ongoing evaluation of FEPs (e.g., how to address potentially new FEPs), (5) the approach that DOE would use to evaluate and update the existing scope and description of FEPs, (6) the approach that DOE would use to improve the consistency in the level of detail among FEPs, (7) how the DOE would evaluate the results of its efforts to update the existing scope and definition of FEPs, (8) how the Enhanced FEP process would support assertions that the resulting set of FEPs will be sufficiently comprehensive (e.g., represents a wide range of both beneficial and potential adverse effects on performance) to reflect clearly what DOE has considered, (9) how DOE would indicate their disposition of included FEPs in the performance assessment, (10) the role and definition of the different hierarchical levels used to document the information (e.g., “components of FEPs” and “modeling issues”), (11) how the hierarchical levels used to document the information would be used within DOE’s enhanced FEP process, (12) how the Enhanced FEP Plan would result in documentation that facilitates auditing (i.e., lead to a process that is transparent and traceable), (13) DOE’s plans for using configuration management controls to identify FEP dependencies on ongoing work and design changes. DOE will provide the Enhanced Plan to NRC by March 2002.	Complete
TSPAI.2.06	TSPAI	Provide justification for the approach to: (1) the level of detail used to define FEPs; (2) the degree of consistency among FEPs; and (3) comprehensiveness of the set of FEPs initially considered (i.e., before screening). DOE proposes to meet with NRC periodically to provide assessments of the DOE’s progress, once it has initiated the Enhanced FEP process, and on changes to the approach documented in the Enhanced FEP Plan. During these progress meetings DOE agrees to provide a justification for their approach to: (1) the level of detail used to define FEPs; (2) the degree of consistency among FEPs; and (3) comprehensiveness of the pre-screening set of FEPs.	Complete
TSPAI.2.07	TSPAI	Provide results of the implementation of the Enhanced FEP Plan (e.g., the revised FEP descriptions, screening arguments, the mapping of FEPs to TSPA keywords, and a searchable index of FEP components), in updates to the FEP AMR documents and the FEP Database. DOE agrees to provide the results of their implementation of the Enhanced FEP Plan (e.g., the revised FEP descriptions, screening arguments, improved database navigation through, for example, the mapping of FEPs to TSPA keywords, a searchable index of FEP components, etc.), information requested in updates to the FEP documents and the FEP Database (or other suitable documents) in FY03.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.01	TSPAI	Propagate significant sources of uncertainty into projections of waste package and drip shield performance included in future performance assessments. Specific sources of uncertainty that should be propagated (or strong technical basis provided as to why it is insignificant) include: (1) the uncertainty from measured crevice and weight-loss samples general corrosion rates and the statistical differences between the populations, (2) the uncertainty from alternative explanations for the decrease in corrosion rates with time (such as silica coatings that alter the reactive surface area), (3) the uncertainty from utilizing a limited number of samples to define the correction for silica precipitation, (4) the confidence in the upper limit of corrosion rates resulting from the limited sample size, and (5) the uncertainty from alternative statistical representations of the population of empirical general corrosion rates. The technical basis for sources of uncertainty will be established upon completion of existing agreement items CLST 1.4, 1.5, 1.6, and 1.7. DOE will then propagate significant sources of uncertainty into projections of waste package and drip shield performance included in future performance assessments. This technical basis will be documented in a future revision of the General and Localized Corrosion of Waste Package Outer Barrier AMR (ANL-EBS-MD-000003) expected to be available consistent with the scope and schedules for the specified CLST agreements. The results of the AMR analyses will be propagated into future TSPA analyses for any potential license application.	Received
TSPAI.3.01	ENG1	Propagate significant sources of uncertainty into projections of waste package and drip shield performance included in future performance assessments. Specific sources of uncertainty that should be propagated (or strong technical basis provided as to why it is insignificant) include: (1) the uncertainty from measured crevice and weight-loss samples general corrosion rates and the statistical differences between the populations, (2) the uncertainty from alternative explanations for the decrease in corrosion rates with time (such as silica coatings that alter the reactive surface area), (3) the uncertainty from utilizing a limited number of samples to define the correction for silica precipitation, (4) the confidence in the upper limit of corrosion rates resulting from the limited sample size, and (5) the uncertainty from alternative statistical representations of the population of empirical general corrosion rates. The technical basis for sources of uncertainty will be established upon completion of existing agreement items CLST 1.4, 1.5, 1.6, and 1.7. DOE will then propagate significant sources of uncertainty into projections of waste package and drip shield performance included in future performance assessments. This technical basis will be documented in a future revision of the General and Localized Corrosion of Waste Package Outer Barrier AMR (ANL-EBS-MD-000003) expected to be available consistent with the scope and schedules for the specified CLST agreements. The results of the AMR analyses will be propagated into future TSPA analyses for any potential license application.	Received
TSPAI.3.02	TSPAI	Provide the technical basis for resampling the general corrosion rates and the quantification of the impact of resampling of general corrosion rates in revised documentation (ENG1.1.1). DOE will provide the technical basis for resampling the general corrosion rates and the quantification of the impact of resampling of general corrosion rates in an update to the WAPDEG Analysis of Waste Package and Drip Shield Degradation AMR (ANL-EBS-PA-000001). This AMR is expected to be available to NRC in FY 2003.	Complete
TSPAI.3.02	ENG1	Provide the technical basis for resampling the general corrosion rates and the quantification of the impact of resampling of general corrosion rates in revised documentation (ENG1.1.1). DOE will provide the technical basis for resampling the general corrosion rates and the quantification of the impact of resampling of general corrosion rates in an update to the WAPDEG Analysis of Waste Package and Drip Shield Degradation AMR (ANL-EBS-PA-000001). This AMR is expected to be available to NRC in FY 2003.	Complete
TSPAI.3.03	TSPAI	Provide the technical basis for crack arrest and plugging of crack openings (including the impact of oxide wedging and stress redistribution) in assessing the impact of SCC of the drip shield and waste package in revised documentation (ENG1.1.2 and ENG1.4.1). DOE will provide the technical basis for crack arrest and plugging of crack openings (including the impact of oxide wedging and stress redistribution) in assessing the stress corrosion cracking of the drip shield and waste package in an update to the Stress Corrosion Cracking of the Drip Shield, Waste Package Outer Barrier, and the Stainless Steel Structural Material AMR (ANL-EBS-MD-000005) in accordance with the scope and schedule for existing agreement item CLST 1.12.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.03	ENG1	Provide the technical basis for crack arrest and plugging of crack openings (including the impact of oxide wedging and stress redistribution) in assessing the impact of SCC of the drip shield and waste package in revised documentation (ENG1.1.2 and ENG1.4.1). DOE will provide the technical basis for crack arrest and plugging of crack openings (including the impact of oxide wedging and stress redistribution) in assessing the stress corrosion cracking of the drip shield and waste package in an update to the Stress Corrosion Cracking of the Drip Shield, Waste Package Outer Barrier, and the Stainless Steel Structural Material AMR (ANL-EBS-MD-000005) in accordance with the scope and schedule for existing agreement item CLST 1.12.	Received
TSPAI.3.04	TSPAI	Provide the technical basis that the representation of the variation of general corrosion rates (if a significant portion is "lack of knowledge" uncertainty) does not result in risk dilution of projected dose responses (ENG1.3.3). DOE will provide the technical basis that the representation of the variation of general corrosion rates results in reasonably conservative projected dose rates. The technical basis will be documented in an update to the WAPDEG Analysis of Waste Package and Drip Shield Degradation AMR (ANL-EBS-PA-000001). This AMR is expected to be available to NRC in FY 2003. These results will be incorporated into future TSPA documentation for any potential license application.	Received
TSPAI.3.04	ENG1	Provide the technical basis that the representation of the variation of general corrosion rates (if a significant portion is "lack of knowledge" uncertainty) does not result in risk dilution of projected dose responses (ENG1.3.3). DOE will provide the technical basis that the representation of the variation of general corrosion rates results in reasonably conservative projected dose rates. The technical basis will be documented in an update to the WAPDEG Analysis of Waste Package and Drip Shield Degradation AMR (ANL-EBS-PA-000001). This AMR is expected to be available to NRC in FY 2003. These results will be incorporated into future TSPA documentation for any potential license application.	Received
TSPAI.3.05	ENG1	Provide the technical basis for the representation of uncertainty/variability in the general corrosion rates in revised documentation. This technical basis should provide a detailed discussion and analyses to allow independent reviewers the ability to interpret the representations of 100% uncertainty, 100% variability, and any intermediate representations in the DOE model (ENG1.3.6). DOE will provide the technical basis for the representation of uncertainty/variability in the general corrosion rates. This technical basis will include the results of 100% uncertainty, 100% variability, and selected intermediate representations used in the DOE model. These results will be documented in an update to the WAPDEG Analysis of Waste Package and Drip Shield Degradation AMR (ANL-EBS-PA-000001) or other document. This AMR is expected to be available to NRC in FY 2003.	Received
TSPAI.3.05	TSPAI	Provide the technical basis for the representation of uncertainty/variability in the general corrosion rates in revised documentation. This technical basis should provide a detailed discussion and analyses to allow independent reviewers the ability to interpret the representations of 100% uncertainty, 100% variability, and any intermediate representations in the DOE model (ENG1.3.6). DOE will provide the technical basis for the representation of uncertainty/variability in the general corrosion rates. This technical basis will include the results of 100% uncertainty, 100% variability, and selected intermediate representations used in the DOE model. These results will be documented in an update to the WAPDEG Analysis of Waste Package and Drip Shield Degradation AMR (ANL-EBS-PA-000001) or other document. This AMR is expected to be available to NRC in FY 2003.	Received
TSPAI.3.06	ENG2	Provide the technical basis for the methodology used to implement the effects of seismic effects on cladding in revised documentation. DOE will demonstrate that the methodology used to represent the seismic effects of cladding does not result in an underestimation of risk in the regulatory timeframe (ENG2.1.1). DOE will provide the technical basis for the methodology used to implement the effects of seismic effects on cladding in revised documentation. DOE will demonstrate that the methodology used to represent the seismic effects of cladding does not result in an underestimation of risk in the regulatory timeframe in TSPA-LA. The documentation is expected to be available to NRC in FY 2003.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.06	TSPAI	Provide the technical basis for the methodology used to implement the effects of seismic effects on cladding in revised documentation. DOE will demonstrate that the methodology used to represent the seismic effects of cladding does not result in an underestimation of risk in the regulatory timeframe (ENG2.1.1). DOE will provide the technical basis for the methodology used to implement the effects of seismic effects on cladding in revised documentation. DOE will demonstrate that the methodology used to represent the seismic effects of cladding does not result in an underestimation of risk in the regulatory timeframe in TSPA-LA. The documentation is expected to be available to NRC in FY 2003.	Received
TSPAI.3.07	TSPAI	Provide technical basis for representation of or the neglect of dripping from rockbolts in the ECRB in performance assessment, including the impacts on hydrology, chemistry, and other impacted models. Appropriate consideration will be given to the uncertainties in the source of the moisture, and how those uncertainties impact other models (ENG3.1.1). DOE will provide technical basis for determination of future sources of water in the ECRB, will evaluate the possibility of preferential dripping from engineered materials, and will give appropriate consideration to the uncertainties of the water sources, as well as their potential impact on other models. The work done to date as well as the additional work will be documented in the AMR on In-Situ Field Testing Processes (ANL-NBS-HS-000005) or other documents. This AMR will be available to NRC in FY 2003. DOE will evaluate the role of condensation as a source of water and any impacts of this on hydrologic and chemical conitions in the drift, and DOE will document this work. The effects of condensation will be included in TSPA if found to be potentially important to performance.	Received
TSPAI.3.07	ENG3	Provide technical basis for representation of or the neglect of dripping from rockbolts in the ECRB in performance assessment, including the impacts on hydrology, chemistry, and other impacted models. Appropriate consideration will be given to the uncertainties in the source of the moisture, and how those uncertainties impact other models (ENG3.1.1). DOE will provide technical basis for determination of future sources of water in the ECRB, will evaluate the possibility of preferential dripping from engineered materials, and will give appropriate consideration to the uncertainties of the water sources, as well as their potential impact on other models. The work done to date as well as the additional work will be documented in the AMR on In-Situ Field Testing Processes (ANL-NBS-HS-000005) or other documents. This AMR will be available to NRC in FY 2003. DOE will evaluate the role of condensation as a source of water and any impacts of this on hydrologic and chemical conitions in the drift, and DOE will document this work. The effects of condensation will be included in TSPA if found to be potentially important to performance.	Received
TSPAI.3.07	UZ2	Provide technical basis for representation of or the neglect of dripping from rockbolts in the ECRB in performance assessment, including the impacts on hydrology, chemistry, and other impacted models. Appropriate consideration will be given to the uncertainties in the source of the moisture, and how those uncertainties impact other models (ENG3.1.1). DOE will provide technical basis for determination of future sources of water in the ECRB, will evaluate the possibility of preferential dripping from engineered materials, and will give appropriate consideration to the uncertainties of the water sources, as well as their potential impact on other models. The work done to date as well as the additional work will be documented in the AMR on In-Situ Field Testing Processes (ANL-NBS-HS-000005) or other documents. This AMR will be available to NRC in FY 2003. DOE will evaluate the role of condensation as a source of water and any impacts of this on hydrologic and chemical conitions in the drift, and DOE will document this work. The effects of condensation will be included in TSPA if found to be potentially important to performance.	Received
TSPAI.3.08	TSPAI	Provide the technical basis (quantification) for the abstraction of in-package chemistry and it's implementation into the TSPA which will demonstrate that the utilization of the weighted-moving-average methodology will not result in an underestimation of risk (ENG3.1.3). DOE will provide the technical basis (quantification) for the abstraction of in-package chemistry and its implementation into the TSPA, which will demonstrate that the implementation methodology will not result in an underestimation of risk. The technical basis will be documented in TSPA-LA and is expected to be available in FY 2003.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.08	ENG3	Provide the technical basis (quantification) for the abstraction of in-package chemistry and it's implementation into the TSPA which will demonstrate that the utilization of the weighted-moving-average methodology will not result in an underestimation of risk (ENG3.1.3). DOE will provide the technical basis (quantification) for the abstraction of in-package chemistry and its implementation into the TSPA, which will demonstrate that the implementation methodology will not result in an underestimation of risk. The technical basis will be documented in TSPA-LA and is expected to be available in FY 2003.	Received
TSPAI.3.09	TSPAI	Provide the documentation that presents the representation of uncertainty and variability in the near-field environment abstractions in the TSPA (ENG3.1.4). DOE will present the representation of uncertainty and variability in water and gas chemistry entering the drift in the near-field environment abstractions for the TSPA. This will be documented in the Abstraction of Drift-Scale Coupled Processes (ANL-NBS-HS-000029) or other document expected to be available in FY 2003.	Received
TSPAI.3.09	ENG3	Provide the documentation that presents the representation of uncertainty and variability in the near-field environment abstractions in the TSPA (ENG3.1.4). DOE will present the representation of uncertainty and variability in water and gas chemistry entering the drift in the near-field environment abstractions for the TSPA. This will be documented in the Abstraction of Drift-Scale Coupled Processes (ANL-NBS-HS-000029) or other document expected to be available in FY 2003.	Received
TSPAI.3.10	ENG3	Provide the documentation of the integrated analyses and comprehensive uncertainty analyses related to the Physical and Chemical Environmental Abstraction Model (ENG3.1.5). DOE will provide the documentation of the integrated analyses and comprehensive uncertainty analyses related to the EBS physical and chemical environment in documentation associated with TSPA for any potential license application. The documentation is expected to be available to NRC in FY 2003.	Received
TSPAI.3.10	TSPAI	Provide the documentation of the integrated analyses and comprehensive uncertainty analyses related to the Physical and Chemical Environmental Abstraction Model (ENG3.1.5). DOE will provide the documentation of the integrated analyses and comprehensive uncertainty analyses related to the EBS physical and chemical environment in documentation associated with TSPA for any potential license application. The documentation is expected to be available to NRC in FY 2003.	Received
TSPAI.3.11	TSPAI	DOE should account for appropriate integration between the 3D UZ flow model, the MSTH model, and the drift seepage model. In particular, DOE should ensure that relevant spatial distributions are propagated appropriately between the UZ flow model, the thermohydrology model, and the seepage model (ENG3.1.6). DOE will compare the infiltration flux used for the infiltration bins with the 3D Unsaturated Zone flow model and the multi-scale thermohydrologic (MSTH) model results. The technical basis for any approximations in the spatial distribution of flow rates involved in this abstraction will be provided in Abstraction of NFE Drift Thermodynamic Environment and Percolation Flow AMR (ANL-EBS-HS-000003) or other suitable document. In particular, DOE will ensure that the MSTH model output to the seepage abstraction (or any other model that may provide percolation flux to the seepage abstraction) does not lead to underestimation of seepage. This AMR is expected to be available to NRC in FY 2003.	Received
TSPAI.3.11	ENG3	DOE should account for appropriate integration between the 3D UZ flow model, the MSTH model, and the drift seepage model. In particular, DOE should ensure that relevant spatial distributions are propagated appropriately between the UZ flow model, the thermohydrology model, and the seepage model (ENG3.1.6). DOE will compare the infiltration flux used for the infiltration bins with the 3D Unsaturated Zone flow model and the multi-scale thermohydrologic (MSTH) model results. The technical basis for any approximations in the spatial distribution of flow rates involved in this abstraction will be provided in Abstraction of NFE Drift Thermodynamic Environment and Percolation Flow AMR (ANL-EBS-HS-000003) or other suitable document. In particular, DOE will ensure that the MSTH model output to the seepage abstraction (or any other model that may provide percolation flux to the seepage abstraction) does not lead to underestimation of seepage. This AMR is expected to be available to NRC in FY 2003.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.11	UZ2	DOE should account for appropriate integration between the 3D UZ flow model, the MSTH model, and the drift seepage model. In particular, DOE should ensure that relevant spatial distributions are propagated appropriately between the UZ flow model, the thermohydrology model, and the seepage model (ENG3.1.6). DOE will compare the infiltration flux used for the infiltration bins with the 3D Unsaturated Zone flow model and the multi-scale thermohydrologic (MSTH) model results. The technical basis for any approximations in the spatial distribution of flow rates involved in this abstraction will be provided in Abstraction of NFE Drift Thermodynamic Environment and Percolation Flow AMR (ANL-EBS-HS-000003) or other suitable document. In particular, DOE will ensure that the MSTH model output to the seepage abstraction (or any other model that may provide percolation flux to the seepage abstraction) does not lead to underestimation of seepage. This AMR is expected to be available to NRC in FY 2003.	Received
TSPAI.3.12	ENG3	DOE should complete testing of corrosion in the chemical environments predicted by the model or provide technical basis why it is not needed (ENG3.1.8). DOE will conduct testing of corrosion in the credible range of chemical environments predicted by the model in accordance with the scope and schedule for existing agreements CLST 1.4 and 1.6 or provide a technical basis why it is not needed.	Received
TSPAI.3.12	TSPAI	DOE should complete testing of corrosion in the chemical environments predicted by the model or provide technical basis why it is not needed (ENG3.1.8). DOE will conduct testing of corrosion in the credible range of chemical environments predicted by the model in accordance with the scope and schedule for existing agreements CLST 1.4 and 1.6 or provide a technical basis why it is not needed.	Received
TSPAI.3.13	ENG3	Provide a comparison of the environments for corrosion predicted in the models, to the testing environments used to define empirical corrosion rates in revised documentation (ENG3.2.1). DOE will provide a comparison of the environments for corrosion predicted in the models, to the testing environments utilized to define empirical corrosion rates in revised documentation consistent with the scope and schedule for existing agreement item CLST 1.1.	Complete
TSPAI.3.13	TSPAI	Provide a comparison of the environments for corrosion predicted in the models, to the testing environments used to define empirical corrosion rates in revised documentation (ENG3.2.1). DOE will provide a comparison of the environments for corrosion predicted in the models, to the testing environments utilized to define empirical corrosion rates in revised documentation consistent with the scope and schedule for existing agreement item CLST 1.1.	Complete
TSPAI.3.14	TSPAI	DOE should account for the full range of environmental conditions for the in-package chemistry model (ENG4.1.1). DOE will update the in-package chemistry model to account for scenarios and their associated uncertainties required by TSPA. This will be documented in the In-Package Chemistry AMR (ANL-EBS-MD-000056) expected to be available to NRC in FY 2003.	Received
TSPAI.3.14	ENG4	DOE should account for the full range of environmental conditions for the in-package chemistry model (ENG4.1.1). DOE will update the in-package chemistry model to account for scenarios and their associated uncertainties required by TSPA. This will be documented in the In-Package Chemistry AMR (ANL-EBS-MD-000056) expected to be available to NRC in FY 2003.	Received
TSPAI.3.15	TSPAI	Define a reference EQ3/6 database for the Yucca Mountain Project. DOE will provide documentation of all deviations from the reference database and justification for those deviations used by different geochemical modeling activities (ENG4.1.2). DOE will define a reference EQ3/6 database for the Yucca Mountain Project. DOE will provide documentation of all the deviations from the reference database and justification for those deviations used by different geochemical modeling activities. The database will be available in FY 2003.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.15	ENG4	Define a reference EQ3/6 database for the Yucca Mountain Project. DOE will provide documentation of all deviations from the reference database and justification for those deviations used by different geochemical modeling activities (ENG4.1.2). DOE will define a reference EQ3/6 database for the Yucca Mountain Project. DOE will provide documentation of all the deviations from the reference database and justification for those deviations used by different geochemical modeling activities. The database will be available in FY 2003.	Complete
TSPAI.3.16	TSPAI	DOE should include the possibility of localized flow pathways in the engineered barrier system in TSPA calculations, including the influence of introduced materials on water and gas chemistry on these preferential flow pathways (ENG4.1.6). DOE will evaluate the effect of localized flow pathways on water and gas chemistry in the engineered barrier system as input to TSPA calculations, including the influence of introduced materials on these preferential flow pathways consistent with existing agreements ENFE 2.4, 2.5, and 2.6. This will be documented in an update to the Physical and Chemical Environment Model AMR (ANL-EBS-MD-000033) or other suitable document. This AMR is expected to be available to NRC in FY 2003.	Received
TSPAI.3.16	ENG4	DOE should include the possibility of localized flow pathways in the engineered barrier system in TSPA calculations, including the influence of introduced materials on water and gas chemistry on these preferential flow pathways (ENG4.1.6). DOE will evaluate the effect of localized flow pathways on water and gas chemistry in the engineered barrier system as input to TSPA calculations, including the influence of introduced materials on these preferential flow pathways consistent with existing agreements ENFE 2.4, 2.5, and 2.6. This will be documented in an update to the Physical and Chemical Environment Model AMR (ANL-EBS-MD-000033) or other suitable document. This AMR is expected to be available to NRC in FY 2003.	Received
TSPAI.3.17	TSPAI	Provide an uncertainty analysis of the diffusion coefficient governing transport of dissolved and colloidal radionuclides through the invert. The analysis should include uncertainty in the modeled invert saturation (ENG4.4.1). DOE will provide an uncertainty analysis of the diffusion coefficient governing transport of dissolved and colloidal radionuclides through the invert. The analysis will include uncertainty in the modeled invert saturation. The uncertainty analysis will be documented in the EBS Radionuclide Transport Abstraction AMR (ANL-WIS-PA-000001) expected to be available to NRC in FY 2003.	Received
TSPAI.3.17	ENG4	Provide an uncertainty analysis of the diffusion coefficient governing transport of dissolved and colloidal radionuclides through the invert. The analysis should include uncertainty in the modeled invert saturation (ENG4.4.1). DOE will provide an uncertainty analysis of the diffusion coefficient governing transport of dissolved and colloidal radionuclides through the invert. The analysis will include uncertainty in the modeled invert saturation. The uncertainty analysis will be documented in the EBS Radionuclide Transport Abstraction AMR (ANL-WIS-PA-000001) expected to be available to NRC in FY 2003.	Received
TSPAI.3.18	TSPAI	Provide a technical basis that the water-balance plug-flow model adequately represents the non-linear flow processes represented by Richard's equation, particularly over the repository where there is thin soil (UZ1.2.1). DOE will provide a technical basis that the water-balance plug-flow model adequately represents the non-linear flow processes represented by Richard's equation, particularly over the repository where there is thin soil. The technical basis will be documented in an update to the Simulation of Net Infiltration for Modern and Potential Future Climates AMR (ANL-NBS-HS-000032). The AMR is expected to be	Received
TSPAI.3.18	UZ1	Provide a technical basis that the water-balance plug-flow model adequately represents the non-linear flow processes represented by Richard's equation, particularly over the repository where there is thin soil (UZ1.2.1). DOE will provide a technical basis that the water-balance plug-flow model adequately represents the non-linear flow processes represented by Richard's equation, particularly over the repository where there is thin soil. The technical basis will be documented in an update to the Simulation of Net Infiltration for Modern and Potential Future Climates AMR (ANL-NBS-HS-000032). The AMR is expected to be	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.19	TSPAI	DOE will provide justification for the use of its evapotranspiration model, and defend the use of the analog site temperature data (UZ1.3.1). DOE will provide justification for the use of the evapotranspiration model, and justify the use of the analog site temperature data. The justification will be documented in an update to the Simulation of Net Infiltration for Modern and Potential Future Climates AMR (ANL-NBS-HS-000032) and the Future Climate Analysis AMR (ANL-NBS-GS-000008). The AMRs are expected to be available to NRC in FY 2003.	Received
TSPAI.3.19	UZ1	DOE will provide justification for the use of its evapotranspiration model, and defend the use of the analog site temperature data (UZ1.3.1). DOE will provide justification for the use of the evapotranspiration model, and justify the use of the analog site temperature data. The justification will be documented in an update to the Simulation of Net Infiltration for Modern and Potential Future Climates AMR (ANL-NBS-HS-000032) and the Future Climate Analysis AMR (ANL-NBS-GS-000008). The AMRs are expected to be available to NRC in FY 2003.	Received
TSPAI.3.20	TSPAI	Provide access to data supporting the synthetic meteorologic records (4JA.s01 and Area12.s01) (UZ1.3.2). DOE will provide data supporting the synthetic meteorologic records (specifically, data files 4JA.s01 and Area12.s01). These data files will be provided to NRC September 2001.	Complete
TSPAI.3.20	UZ1	Provide access to data supporting the synthetic meteorologic records (4JA.s01 and Area12.s01) (UZ1.3.2). DOE will provide data supporting the synthetic meteorologic records (specifically, data files 4JA.s01 and Area12.s01). These data files will be provided to NRC September 2001.	Complete
TSPAI.3.21	TSPAI	Demonstrate that effects of near surface lateral flow on the spatial variability of net infiltration are appropriately considered (UZ1.5.1). DOE will demonstrate that effects of near surface lateral flow on the spatial variability of net infiltration are appropriately considered in an update to the Simulation of Net Infiltration for Modern and Potential Future Climates AMR (ANL-NBS-HS-000032) and UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006). These AMRs are expected to be available to NRC	Received
TSPAI.3.21	UZ1	Demonstrate that effects of near surface lateral flow on the spatial variability of net infiltration are appropriately considered (UZ1.5.1). DOE will demonstrate that effects of near surface lateral flow on the spatial variability of net infiltration are appropriately considered in an update to the Simulation of Net Infiltration for Modern and Potential Future Climates AMR (ANL-NBS-HS-000032) and UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006). These AMRs are expected to be available to NRC	Received
TSPAI.3.22	TSPAI	Provide an assessment or discussion of the uncertainty involved with using a hydrologic property set obtained by calibrating a model on current climate conditions and using that model to forecast flow for future climate conditions (UZ2.3.1). DOE will provide an assessment or discussion of the uncertainty involved with using a hydrologic property set obtained by calibrating a model on current climate conditions and using that model to forecast flow for future climate conditions. This assessment will be documented in the UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006) expected to be available to NRC in FY 2003.	Received
TSPAI.3.22	UZ2	Provide an assessment or discussion of the uncertainty involved with using a hydrologic property set obtained by calibrating a model on current climate conditions and using that model to forecast flow for future climate conditions (UZ2.3.1). DOE will provide an assessment or discussion of the uncertainty involved with using a hydrologic property set obtained by calibrating a model on current climate conditions and using that model to forecast flow for future climate conditions. This assessment will be documented in the UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006) expected to be available to NRC in FY 2003.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.23	TSPAI	DOE should evaluate spatial heterogeneity of hydrologic properties within hydrostratigraphic units and the effect this heterogeneity has on model results of unsaturated flow, seepage into the drifts and transport. DOE should also provide a technical basis for the assessment that bomb-pulse Cl-36 data found below the Paint Brush tuff can be linked to a negligible amount of fast flowing water (UZ2.3.2). DOE will evaluate spatial heterogeneity of hydrologic properties within hydrostratigraphic units and the effect this heterogeneity has on model results of unsaturated flow, seepage into the drifts and transport. This evaluation will be documented in the UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006), Radionuclide Transport Models under Ambient Conditions (MDL-NBS-HS-000008) and Seepage Models for PA Including Drift Collapse AMR (MDL-NBS-HS-000002) expected to be available to NRC in FY 2003. DOE will also provide a technical basis for the assessment that bomb-pulse Cl36 data found below the PTn can be linked to a negligible amount of fast flowing water. The technical basis will be documented in the UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006) expected to be available to NRC in FY 2003.	Complete
TSPAI.3.23	UZ2	DOE should evaluate spatial heterogeneity of hydrologic properties within hydrostratigraphic units and the effect this heterogeneity has on model results of unsaturated flow, seepage into the drifts and transport. DOE should also provide a technical basis for the assessment that bomb-pulse Cl-36 data found below the Paint Brush tuff can be linked to a negligible amount of fast flowing water (UZ2.3.2). DOE will evaluate spatial heterogeneity of hydrologic properties within hydrostratigraphic units and the effect this heterogeneity has on model results of unsaturated flow, seepage into the drifts and transport. This evaluation will be documented in the UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006), Radionuclide Transport Models under Ambient Conditions (MDL-NBS-HS-000008) and Seepage Models for PA Including Drift Collapse AMR (MDL-NBS-HS-000002) expected to be available to NRC in FY 2003. DOE will also provide a technical basis for the assessment that bomb-pulse Cl36 data found below the PTn can be linked to a negligible amount of fast flowing water. The technical basis will be documented in the UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006) expected to be available to NRC in FY 2003.	Complete
TSPAI.3.24	TSPAI	Provide the analysis of geochemical and hydrological data (water content, water potential, and temperature) used for support of the flow field below the repository, particularly in the Calico Hills, Prow Pass, and Bullfrog hydrostratigraphic layers. Demonstrate that potential bypassing of matrix flow pathways below the area of the proposed repository, as opposed to the entire site-scale model area, is adequately incorporated for performance assessment, or provide supporting analyses that the uncertainties are adequately included in the TSPA (UZ2.3.3). DOE will provide an analysis of available geochemical and hydrological data (water content, water potential, and temperature) used for support of the flow field below the repository, particularly in the Calico Hills, Prow Pass, and Bullfrog hydrostratigraphic layers. The analyses will demonstrate that potential bypassing of matrix flow pathways below the area of the proposed repository, as opposed to the entire site-scale model area, is adequately incorporated for performance assessment, or provide supporting analyses that the uncertainties are adequately included in the TSPA. These analyses will be documented in the UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006), In-Situ Field Testing of Processes AMR (ANL-NBS-HS-000005), and Calibrated Properties Model AMR (MDL-NBS-HS-000003) expected to be available to NRC in FY 2003.	Received
TSPAI.3.24	UZ2	Provide the analysis of geochemical and hydrological data (water content, water potential, and temperature) used for support of the flow field below the repository, particularly in the Calico Hills, Prow Pass, and Bullfrog hydrostratigraphic layers. Demonstrate that potential bypassing of matrix flow pathways below the area of the proposed repository, as opposed to the entire site-scale model area, is adequately incorporated for performance assessment, or provide supporting analyses that the uncertainties are adequately included in the TSPA (UZ2.3.3). DOE will provide an analysis of available geochemical and hydrological data (water content, water potential, and temperature) used for support of the flow field below the repository, particularly in the Calico Hills, Prow Pass, and Bullfrog hydrostratigraphic layers. The analyses will demonstrate that potential bypassing of matrix flow pathways below the area of the proposed repository, as opposed to the entire site-scale model area, is adequately incorporated for performance assessment, or provide supporting analyses that the uncertainties are adequately included in the TSPA. These analyses will be documented in the UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006), In-Situ Field Testing of Processes AMR (ANL-NBS-HS-000005), and Calibrated Properties Model AMR (MDL-NBS-HS-000003) expected to be available to NRC in FY 2003.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.25	UZ2	DOE should use the Passive Cross Drift Hydrologic test, the Alcove 8 - Niche 3 tests, the Niche 5 test, and other test data to either provide additional confidence in or a basis for revising the TSPA seepage abstraction and associated parameter values (e.g., flow focusing factor, van Genuchten alpha for fracture continuum, etc.), or a provide technical basis for not using it (UZ2.3.4). DOE will utilize field test data (e.g., the Passive Cross Drift Hydrologic test, the Alcove 8 - Niche 3 tests, the Niche 5 test, and other test data) to either provide additional confidence in or a basis for revising the TSPA seepage abstraction and associated parameter values (e.g., flow focusing factor, van Genuchten alpha for fracture continuum, etc.), or provide technical basis for not using it. This will be documented in Seepage Calibration Model and Seepage Testing Data AMR (MDL-NBS-HS-000004) expected to be available to NRC in FY 2003.	Complete
TSPAI.3.25	TSPAI	DOE should use the Passive Cross Drift Hydrologic test, the Alcove 8 - Niche 3 tests, the Niche 5 test, and other test data to either provide additional confidence in or a basis for revising the TSPA seepage abstraction and associated parameter values (e.g., flow focusing factor, van Genuchten alpha for fracture continuum, etc.), or a provide technical basis for not using it (UZ2.3.4). DOE will utilize field test data (e.g., the Passive Cross Drift Hydrologic test, the Alcove 8 - Niche 3 tests, the Niche 5 test, and other test data) to either provide additional confidence in or a basis for revising the TSPA seepage abstraction and associated parameter values (e.g., flow focusing factor, van Genuchten alpha for fracture continuum, etc.), or provide technical basis for not using it. This will be documented in Seepage Calibration Model and Seepage Testing Data AMR (MDL-NBS-HS-000004) expected to be available to NRC in FY 2003.	Complete
TSPAI.3.26	TSPAI	Calibrate the UZ flow model using the most recent data on saturations and water potentials, and clearly document the sources of calibration data and data collection methods (UZ2.3.5). DOE will calibrate the UZ flow model using the most recent data on saturations and water potentials, and document the sources of calibration data and data collection methods. The results will be documented in the Calibrated Properties Model AMR (MDL-NBS-HS-000003) expected to be available to NRC in FY 2003.	Received
TSPAI.3.26	UZ2	Calibrate the UZ flow model using the most recent data on saturations and water potentials, and clearly document the sources of calibration data and data collection methods (UZ2.3.5). DOE will calibrate the UZ flow model using the most recent data on saturations and water potentials, and document the sources of calibration data and data collection methods. The results will be documented in the Calibrated Properties Model AMR (MDL-NBS-HS-000003) expected to be available to NRC in FY 2003.	Received
TSPAI.3.27	TSPAI	Provide an overview of water flow rates used in the UZ model above and below the repository, in the MSTHM, in the seepage abstraction, and in the in-drift flow path models, to ensure appropriate integration between the various models (UZ2.TT.3). DOE will provide an overview of water flow rates used in the UZ model above and below the repository, in the Multi-Scale Thermohydrologic Model (MSTHM), in the seepage abstraction, and in the in drift flow path models, to ensure appropriate integration between the various models. This will be documented in the TSPA for any potential license application expected to be available to NRC in FY 2003.	Received
TSPAI.3.27	UZ2	Provide an overview of water flow rates used in the UZ model above and below the repository, in the MSTHM, in the seepage abstraction, and in the in-drift flow path models, to ensure appropriate integration between the various models (UZ2.TT.3). DOE will provide an overview of water flow rates used in the UZ model above and below the repository, in the Multi-Scale Thermohydrologic Model (MSTHM), in the seepage abstraction, and in the in drift flow path models, to ensure appropriate integration between the various models. This will be documented in the TSPA for any potential license application expected to be available to NRC in FY 2003.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.28	TSPAI	DOE needs to provide independent lines of evidence to provide additional confidence in the use of the active-fracture continuum concept in the transport model (UZ3.5.1). DOE will provide independent lines of evidence to provide additional confidence in the use of the active fracture continuum concept in the transport model. This will be documented in Radionuclide Transport Models under Ambient Conditions AMR (MDL-NBS-HS-000008) and UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006) expected to be available to NRC in FY 2003.	Received
TSPAI.3.28	UZ3	DOE needs to provide independent lines of evidence to provide additional confidence in the use of the active-fracture continuum concept in the transport model (UZ3.5.1). DOE will provide independent lines of evidence to provide additional confidence in the use of the active fracture continuum concept in the transport model. This will be documented in Radionuclide Transport Models under Ambient Conditions AMR (MDL-NBS-HS-000008) and UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006) expected to be available to NRC in FY 2003.	Received
TSPAI.3.29	TSPAI	Provide verification that the integration of the active fracture model with matrix diffusion in the transport model is properly implemented in the TSPA abstraction (UZ3.TT.3). DOE will provide verification that the integration of the active fracture model with matrix diffusion in the transport model is properly implemented in the TSPA abstraction. This verification will be documented in the Particle Tracking Model and Abstraction of Transport Processes (ANL-NBS-HS-000026) expected to be available to NRC in FY 2003.	Received
TSPAI.3.29	UZ3	Provide verification that the integration of the active fracture model with matrix diffusion in the transport model is properly implemented in the TSPA abstraction (UZ3.TT.3). DOE will provide verification that the integration of the active fracture model with matrix diffusion in the transport model is properly implemented in the TSPA abstraction. This verification will be documented in the Particle Tracking Model and Abstraction of Transport Processes (ANL-NBS-HS-000026) expected to be available to NRC in FY 2003.	Received
TSPAI.3.30	TSPAI	Provide the technical basis for the contrasting concentrations of colloids available for reversible attachment in the engineered barrier system and the saturated zone. Sensitivity analyses planned in response to RT Agreement 3.07 should address the effect of colloid concentration on Kc. Update, as necessary, the Kc parameter as new data become available from the Yucca Mountain region (SZ2.3.1). DOE will provide the technical basis for the contrasting concentrations of colloids available for reversible attachment in the engineered barrier system and the saturated zone. The sensitivity analyses planned in response to RT Agreement 3.07 will address the effect of colloid concentration on the Kc parameter. The technical basis will be documented in the Waste Form Colloid Associated Concentration Limits: Abstractions and Summary (ANL-WIS-MD-000012) in FY 2003. The Kc parameter will be updated as new data become available from the Yucca Mountain region in the Uncertainty Distribution for Stochastic Parameters AMR (ANL-NBS-MD-000011) in FY2003.	Received
TSPAI.3.30	SZ2	Provide the technical basis for the contrasting concentrations of colloids available for reversible attachment in the engineered barrier system and the saturated zone. Sensitivity analyses planned in response to RT Agreement 3.07 should address the effect of colloid concentration on Kc. Update, as necessary, the Kc parameter as new data become available from the Yucca Mountain region (SZ2.3.1). DOE will provide the technical basis for the contrasting concentrations of colloids available for reversible attachment in the engineered barrier system and the saturated zone. The sensitivity analyses planned in response to RT Agreement 3.07 will address the effect of colloid concentration on the Kc parameter. The technical basis will be documented in the Waste Form Colloid Associated Concentration Limits: Abstractions and Summary (ANL-WIS-MD-000012) in FY 2003. The Kc parameter will be updated as new data become available from the Yucca Mountain region in the Uncertainty Distribution for Stochastic Parameters AMR (ANL-NBS-MD-000011) in FY2003.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.31	TSPAI	Evaluate the effects of temporal changes in saturated zone chemistry on radionuclide concentrations (SZ2.3.2). DOE will reexamine the FEPs, currently included in the performance assessment, that may lead to temporal changes in saturated zone hydrochemistry. If the DOE determines that these FEPs can be excluded, the results will be documented in the FEP Saturated Zone Flow and Transport AMR (ANL-NBS-MD-000002) in FY 2003. If the DOE determines that these FEPs cannot be excluded from the performance assessment, the DOE will evaluate the effects of temporal changes in the saturated zone chemistry on radionuclide concentrations and will document this evaluation in above mentioned AMR.	Received
TSPAI.3.31	SZ2	Evaluate the effects of temporal changes in saturated zone chemistry on radionuclide concentrations (SZ2.3.2). DOE will reexamine the FEPs, currently included in the performance assessment, that may lead to temporal changes in saturated zone hydrochemistry. If the DOE determines that these FEPs can be excluded, the results will be documented in the FEP Saturated Zone Flow and Transport AMR (ANL-NBS-MD-000002) in FY 2003. If the DOE determines that these FEPs cannot be excluded from the performance assessment, the DOE will evaluate the effects of temporal changes in the saturated zone chemistry on radionuclide concentrations and will document this evaluation in above mentioned AMR.	Received
TSPAI.3.32	TSPAI	Provide the technical basis that the representation of uncertainty in the saturated zone as essentially all lack-of-knowledge uncertainty (as opposed to real sample variability) does not result in an underestimation of risk when propagated to the performance assessment (SZ2.4.1). DOE will provide the technical basis that the representation of uncertainty (i.e., lack-of-knowledge uncertainty) in the saturated zone does not result in an underestimation of risk when propagated to the performance assessment. A deterministic case from Saturated Zone Flow Patterns and Analyses AMR (ANL-NBS-HS-000038) will be compared to TSPA analyses. The comparison will be documented in the TSPA for any potential license application expected to be available to NRC in FY 2003.	Received
TSPAI.3.32	SZ2	Provide the technical basis that the representation of uncertainty in the saturated zone as essentially all lack-of-knowledge uncertainty (as opposed to real sample variability) does not result in an underestimation of risk when propagated to the performance assessment (SZ2.4.1). DOE will provide the technical basis that the representation of uncertainty (i.e., lack-of-knowledge uncertainty) in the saturated zone does not result in an underestimation of risk when propagated to the performance assessment. A deterministic case from Saturated Zone Flow Patterns and Analyses AMR (ANL-NBS-HS-000038) will be compared to TSPA analyses. The comparison will be documented in the TSPA for any potential license application expected to be available to NRC in FY 2003.	Received
TSPAI.3.33	TSPAI	Provide justification that the Kd values used for radionuclides in the soil in Amargosa valley based on the results of a literature review are realistic or conservative for actual conditions at the receptor location (DOSE2.2.1). DOE will provide justification that the Kd values used for radionuclides in the soil in Amargosa Valley are realistic or conservative for actual conditions at the receptor location. The justification will be provided in Evaluate Soil/Radionuclide Removal by Erosion and Leaching AMR (ANL-NBS-MD-000009) or other document expected to be available to NRC in FY 2003.	Complete
TSPAI.3.33	DOSE2	Provide justification that the Kd values used for radionuclides in the soil in Amargosa valley based on the results of a literature review are realistic or conservative for actual conditions at the receptor location (DOSE2.2.1). DOE will provide justification that the Kd values used for radionuclides in the soil in Amargosa Valley are realistic or conservative for actual conditions at the receptor location. The justification will be provided in Evaluate Soil/Radionuclide Removal by Erosion and Leaching AMR (ANL-NBS-MD-000009) or other document expected to be available to NRC in FY 2003.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.34	TSPAI	For the Radionuclides that dominate the TSPA dose, provide the technical basis for selection of Radionuclide or element specific biosphere parameters that are important in the BDCF calculations (e.g. soil to plant transfer factors) (DOSE3.2.1). For the radionuclides that dominate the TSPA dose, DOE will provide the technical basis for selection of radionuclide or element specific biosphere parameters (except for Kds which are addressed in TSPAI 3.33) that are important in the BDCF calculations (e.g. soil to plant transfer factors). The technical basis will be documented in the Transfer Coefficient Analysis AMR (ANL-MGR-MD-000008) or other document and is expected to be available to NRC in FY 2003.	Complete
TSPAI.3.34	DOSE3	For the Radionuclides that dominate the TSPA dose, provide the technical basis for selection of Radionuclide or element specific biosphere parameters that are important in the BDCF calculations (e.g. soil to plant transfer factors) (DOSE3.2.1). For the radionuclides that dominate the TSPA dose, DOE will provide the technical basis for selection of radionuclide or element specific biosphere parameters (except for Kds which are addressed in TSPAI 3.33) that are important in the BDCF calculations (e.g. soil to plant transfer factors). The technical basis will be documented in the Transfer Coefficient Analysis AMR (ANL-MGR-MD-000008) or other document and is expected to be available to NRC in FY 2003.	Complete
TSPAI.3.35	DOSE3	Provide additional justification to support that the assumed crop interception fraction is appropriate for all radionuclides considered and does not result in underestimations of dose. Discussions should address the impacts of electrostatic charge and particle size on the interception fraction for all radionuclides considered in the TSPA (DOSE3.2.5). DOE will provide additional justification to support that the assumed crop interception fraction is appropriate for all radionuclides that dominate the TSPA dose and does not result in underestimations of dose. The justification will include the impacts of electrostatic charge and particle size on the interception fraction. This justification will be documented in Identification of Ingestion Exposure Parameters (ANL-MGR-MD-000006) or other document expected to be available to NRC in FY 2003.	Complete
TSPAI.3.35	TSPAI	Provide additional justification to support that the assumed crop interception fraction is appropriate for all radionuclides considered and does not result in underestimations of dose. Discussions should address the impacts of electrostatic charge and particle size on the interception fraction for all radionuclides considered in the TSPA (DOSE3.2.5). DOE will provide additional justification to support that the assumed crop interception fraction is appropriate for all radionuclides that dominate the TSPA dose and does not result in underestimations of dose. The justification will include the impacts of electrostatic charge and particle size on the interception fraction. This justification will be documented in Identification of Ingestion Exposure Parameters (ANL-MGR-MD-000006) or other document expected to be available to NRC in FY 2003.	Complete
TSPAI.3.36	DOSE3	Document the methodology that will be used to incorporate the uncertainty in soil leaching factors into the TSPA analysis, if that uncertainty is found to be important to the results of the performance assessment (DOSE3.3.1). DOE will document the methodology used to incorporate the uncertainty in soil leaching factors into the TSPA analysis. This will be documented in Nominal Performance Biosphere Dose Conversion Factor Analysis AMR (ANL-MGR-MD-000009), Disruptive Event Biosphere Dose Conversion Factor Analysis (ANL-MGR-MD-000003) or other document expected to be available to NRC in FY 2003.	Complete
TSPAI.3.36	TSPAI	Document the methodology that will be used to incorporate the uncertainty in soil leaching factors into the TSPA analysis, if that uncertainty is found to be important to the results of the performance assessment (DOSE3.3.1). DOE will document the methodology used to incorporate the uncertainty in soil leaching factors into the TSPA analysis. This will be documented in Nominal Performance Biosphere Dose Conversion Factor Analysis AMR (ANL-MGR-MD-000009), Disruptive Event Biosphere Dose Conversion Factor Analysis (ANL-MGR-MD-000003) or other document expected to be available to NRC in FY 2003.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
TSPAI.3.37	TSPAI	Provide a quantitative analysis that the sampling method including the correlations to NP used by the TSPA code to abstract the GENII-S process model code adequately represent the uncerrtainty and variability and correlations for the biosphere process model (DOSE3.4.1). DOE will provide a quantitative analysis that the sampling method including the correlations between BDCFs utilized by the TSPA code to abstract the GENII-S process model data adequately represent the uncertainty and variability and correlations for the biosphere process model. This will be documented in Nominal Performance Biosphere Dose Conversion Factor Analysis AMR (ANL-MGR-MD-000009), Disruptive Event Biosphere Dose Conversion Factor Analysis (ANL-MGR-MD-000003) or other document expected to be available to NRC in FY 2003. Results of these analyses will be documented in the TSPA for any potential license application expected to be available to NRC in FY 2003.	Received
TSPAI.3.37	DOSE3	Provide a quantitative analysis that the sampling method including the correlations to NP used by the TSPA code to abstract the GENII-S process model code adequately represent the uncerrtainty and variability and correlations for the biosphere process model (DOSE3.4.1). DOE will provide a quantitative analysis that the sampling method including the correlations between BDCFs utilized by the TSPA code to abstract the GENII-S process model data adequately represent the uncertainty and variability and correlations for the biosphere process model. This will be documented in Nominal Performance Biosphere Dose Conversion Factor Analysis AMR (ANL-MGR-MD-000009), Disruptive Event Biosphere Dose Conversion Factor Analysis (ANL-MGR-MD-000003) or other document expected to be available to NRC in FY 2003. Results of these analyses will be documented in the TSPA for any potential license application expected to be available to NRC in FY 2003.	Received
TSPAI.3.38	TSPAI	DOE will develop guidance in the model abstraction process that can be adhered to by all model developers so that (1) the abstraction process, (2) the selection of conservatism in components, and (3) representation of uncertainty are systematic across the TSPA model. DOE will evaluate and define approaches to deal with: (1) evaluating non-linear models as to what their most conservative settings may be if conservatism is being used to address uncertainty, and (2) trying to utilize human intuition in a complex system. In addition, DOE will consider adding these items to the internal/external reviewer's checklists to ensure proper implementation of the improved methodology (TSPA0002). DOE will develop written guidance in the model abstraction process for model developers so that (1) the abstraction process, (2) the selection of conservatism in components, and (3) representation of uncertainty, are systematic across the TSPA model. These guidelines will address: (1) evaluation of non-linear models when conservatism is being utilized to address uncertainty, and (2) utilization of decisions based on technical judgement in a complex system. These guidelines will be developed, implemented, and be made available to the NRC in FY 2002.	Need Additional Information
TSPAI.3.39	TSPAI	In future performance assessments, DOE should document the simplifications used for abstractions per TSPAI.3.38 activities. Justification will be provided to show that the simplifications appropriately represent the necessary processes and appropriately propagate process model uncertainties. Comparisons of output from process models to performance assessment abstractions will be provided, with the level of detail in the comparisons commensurate with any reduction in propagated uncertainty and the risk significance of the model (TSPA0003). DOE will document the simplifications utilized for abstractions per TSPAI.3.38 activities for all future performance assessments. Justification will be provided to show that the simplifications appropriately represent the necessary processes and appropriately propagate process model uncertainties. Comparisons of output from process models to performance assessment abstractions will be provided, with the level of detail in the comparisons commensurate with any reduction in propagated uncertainty and the risk significance of the model. The documentation of the information will be provided in abstraction AMRs in FY 2003.	Need Additional Information

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TSPAI.3.40	TSPAI	DOE will implement effective controls to ensure that the abstractions defined in the AMR's are consistently propagated into the TSPA, or ensure that the TSPA documentation describes any differences. Specific examples of needed revisions (if still applicable) include: (1) the implementation of flux splitting in the TSPA model, (2) the propagation of thermohydrology uncertainty/variability into the WAPDEG corrosion model calculations, and (3) the implementation of the in-package chemistry abstraction. DOE will implement program improvements to ensure that the abstractions defined in the AMRs are consistently propagated into the TSPA, or ensure that the TSPA documentation describes any differences. Program improvements may include, for example, upgrades to work plans, procedural upgrades, preparation of desktop guides, worker training, increased review and oversight. The program improvements will be implemented and be made available to the NRC during FY 2002.	Complete
TSPAI.3.41	TSPAI	To provide support for the mathematical representation of data uncertainty in the TSPA, the DOE will provide technical basis for the data distributions used in the TSPA. An example of how this may be accomplished is the representation on a figure or chart of the data plotted as an empirical distribution and the probability distribution assigned to fit these data. DOE will provide the technical basis for the data distributions utilized in the TSPA to provide support for the mathematical representation of data uncertainty in the TSPA. The documentation of the technical basis will be incorporated in documentation associated with TSPA for any potential license application. The documentation is expected to be available to NRC in FY 2003.	Need Additional Information
TSPAI.3.42	TSPAI	DOE should provide a sensitivity analysis on the potentially abrupt changes in colloid concentrations due to shifts in modeled pH and ionic strength across uncertain stability boundaries. This analysis may be combined with plans to address ENFE Agreement 4.06 and RT Agreement 3.07. DOE will complete sensitivity analyses to investigate the effects of varying colloid concentration due to shifts in model predicted pH and ionic strength across uncertain stability boundaries. These analyses will be documented in TSPA for any potential license application expected to be available to NRC in FY 2003.	Received
TSPAI.3.42	ENG4	DOE should provide a sensitivity analysis on the potentially abrupt changes in colloid concentrations due to shifts in modeled pH and ionic strength across uncertain stability boundaries. This analysis may be combined with plans to address ENFE Agreement 4.06 and RT Agreement 3.07. DOE will complete sensitivity analyses to investigate the effects of varying colloid concentration due to shifts in model predicted pH and ionic strength across uncertain stability boundaries. These analyses will be documented in TSPA for any potential license application expected to be available to NRC in FY 2003.	Received
TSPAI.4.01	TSPAI	DOE will document the methodology that will be used to incorporate alternative conceptual models into the performance assessment. The methodology will ensure that the representation of alternative conceptual models in the TSPA does not result in an underestimation of risk. DOE will document the guidance given to process-level experts for the treatment of alternative models. The implementation of the methodology will be sufficient to allow a clear understanding of the potential effect of alternative conceptual models and their associated uncertainties on the performance assessment. The methodology will be documented in the TSPA-LA methods and assumptions document in FY02. The results will be documented in the appropriate AMRs or the TSPA for any potential license application in FY 2003.	Need Additional Information
TSPAI.4.02	TSPAI	DOE will provide the documentation that supports the representation of distribution coefficients (Kd's) in the performance assessment as uncorrelated is consistent with the physical processes and does not result in an underestimation of risk. This will be documented in the TSPA for any potential license application in FY03.	Complete
TSPAI.4.03	TSPAI	DOE will document the method that will be used to demonstrate that the overall results of the TSPA are stable. DOE will provide documentation that submodels (including submodels used to develop input parameters and transfer functions) are also numerically stable. DOE will address in the method the stability of the results with respect to the number of realizations. DOE will describe in the method the statistical measures that will be used to support the argument of stability. The method will be documented in TSPA LA Methods and Assumptions Document in FY02. The results of the analyses will be provided in the TSPA (or other appropriate documentation) for any potential license application in FY 2003.	Partly Received

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TSPAI.4.04	TSPAI	DOE will conduct appropriate analyses and provide documentation that demonstrates the results of the performance assessment are stable with respect to discretization (e.g. spatial and temporal) of the TSPA model. This will be documented in the TSPA for any potential license application in FY 2003.	Received
TSPAI.4.05	TSPAI	DOE will document the process used to develop confidence in the TSPA models (e.g., steps similar to those described in NUREG-1636). The detailed process is currently documented in the model development procedures that are being evaluated for process improvement in response to the model validation corrective action report CAR-BSC-01-C-001. The upgraded model validation procedures will be available for NRC review in FY 2002.	Complete
TSPAI.4.06	TSPAI	DOE will document the implementation of the process for model confidence building and demonstrate compliance with model confidence criteria in accordance with the applicable procedures. This will be documented in the respective AMR revisions and made available to NRC in FY 2003.	Received
TSPAI.4.07	TSPAI	DOE's software qualification requirements are currently documented in procedure AP SI.1Q which is under review for process improvement as part of software CAR-BSC-01-C-002. During its review of AP SI.1Q, DOE will consider: 1) the procedure it would follow to conduct a systematic and uniform verification — all areas of a code analyzed at a consistent level, 2) the process it would follow to ensure correct implementation of algorithms, and 3) the process it would follow for the full disclosure of calculations and results. DOE will document compliance with the improved process in the verification documentation required by AP SI.1Q. Software qualification record packages for the affected programs will be available for NRC review in FY 2003.	Complete
USFIC.3.01	UZ1	Provide the documentation sources and schedule for the Monte Carlo method for analyzing infiltration. DOE will provide the schedule and identify documents expected to contain the results of the Monte Carlo analyses in February 2002.	Received
USFIC.3.02	UZ1	Provide justification for the parameters in Table 4-1 of the Analysis of Infiltration Uncertainty AMR (for example, bedrock permeability in the infiltration model needs to be reconciled with the Alcove 1 results/observations. Also, provide documentation (source, locations, tests, test results) for the Alcove 1 and Pagany Wash tests. DOE will provide justification and documentation in a Monte Carlo analyses document. The information will be available in February 2002.	Received

Agreement	Related ISIs	NRC/DOE Agreement	Status
USFIC.4.01	UZ2	The ongoing and planned testing are a reasonable approach for a licensing application with the following comments: (i) consider a mass balance of water for alcove 8/Niche 3 cross over test; (ii) monitor evaporation during all testing; (iii) provide the documentation of the test plan for the Passive Cross Drift Hydrologic test; (iv) provide the NRC with any Cross Drift seepage predictions that may have been made for the Passive Cross Drift Hydrologic test; (v) provide documentation of the results obtained and the analysis for the Passive Cross Drift Hydrologic test. This documentation should include the analysis of water samples collected during entries into the Cross Drift (determination whether the water comes from seepage or condensation); (vi) provide documentation of the results obtained and the analysis for the Alcove 7 test. This documentation should include the analysis of water samples collected during entries into Alcove 7 (determination whether the water comes from seepage or condensation); (vii) provide the documentation of the test plan for the Niche 5 test; (viii) provide documentation of the results obtained and the analysis for the Niche 5 test; (ix) provide documentation of the results obtained and the analysis for the Systematic Hydrologic Characterization test; (x) provide documentation of the results obtained and the analysis for the Niche 4 test; and (xi) provide documentation of the results obtained from the calcite filling test. Include interpretation of the observed calcite deposits found mostly at the bottom of the lithophysal cavities. DOE stated that: (1) a mass balance of water for the Alcove 8/Niche 3 test has been considered, but is not feasible due to the size of the collection system that would be required. A collection system to obtain a mass balance is being developed for the Niche 5 test (i); (2) evaporation will be monitored for all tests where evaporation is a relevant process (ii); (3) test plans for Niche 5 and the Cross Drift Hydrologic tests are expected to be available to NRC FY 2002 (iii, vii); (4) the Cross Drift seepage predictions will be documented in the Seepage Calibration Model and Seepage Testing Data AMR (MDL-NBS-HS-000004) expected to be available to NRC by FY 2003 (iv); (5) DOE will document the results for the tests identified above (except calcite filling observations) in the In-Situ Field Testing of Processes AMR (ANL-NBS-HS-000005) expected to be available to NRC in FY 2003 (v), (vi), (viii),(ix),(x); (6) results of the calcite filling observations will be documented in Analysis of Geochemical Data for the Unsaturated Zone (ANL-NBS-HS-000017) and the UZ Flow Models and Submodels (MDL-NBS-HS-000006) expected to be available to NRC FY 2003 (xi).	Complete
USFIC.4.01	UZ3	The ongoing and planned testing are a reasonable approach for a licensing application with the following comments: (i) consider a mass balance of water for alcove 8/Niche 3 cross over test; (ii) monitor evaporation during all testing; (iii) provide the documentation of the test plan for the Passive Cross Drift Hydrologic test; (iv) provide the NRC with any Cross Drift seepage predictions that may have been made for the Passive Cross Drift Hydrologic test; (v) provide documentation of the results obtained and the analysis for the Passive Cross Drift Hydrologic test. This documentation should include the analysis of water samples collected during entries into the Cross Drift (determination whether the water comes from seepage or condensation); (vi) provide documentation of the results obtained and the analysis for the Alcove 7 test. This documentation should include the analysis of water samples collected during entries into Alcove 7 (determination whether the water comes from seepage or condensation); (vii) provide the documentation of the test plan for the Niche 5 test; (viii) provide documentation of the results obtained and the analysis for the Niche 5 test; (ix) provide documentation of the results obtained and the analysis for the Systematic Hydrologic Characterization test; (x) provide documentation of the results obtained and the analysis for the Niche 4 test; and (xi) provide documentation of the results obtained from the calcite filling test. Include interpretation of the observed calcite deposits found mostly at the bottom of the lithophysal cavities. DOE stated that: (1) a mass balance of water for the Alcove 8/Niche 3 test has been considered, but is not feasible due to the size of the collection system that would be required. A collection system to obtain a mass balance is being developed for the Niche 5 test (i); (2) evaporation will be monitored for all tests where evaporation is a relevant process (ii); (3) test plans for Niche 5 and the Cross Drift Hydrologic tests are expected to be available to NRC FY 2002 (iii, vii); (4) the Cross Drift seepage predictions will be documented in the Seepage Calibration Model and Seepage Testing Data AMR (MDL-NBS-HS-000004) expected to be available to NRC by FY 2003 (iv); (5) DOE will document the results for the tests identified above (except calcite filling observations) in the In-Situ Field Testing of Processes AMR (ANL-NBS-HS-000005) expected to be available to NRC in FY 2003 (v), (vi), (viii),(ix),(x); (6) results of the calcite filling observations will be documented in Analysis of Geochemical Data for the Unsaturated Zone (ANL-NBS-HS-000017) and the UZ Flow Models and Submodels (MDL-NBS-HS-000006) expected to be available to NRC FY 2003 (xi).	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
USFIC.4.02	UZ2	Include the effect of the low-flow regime processes (e.g., film flow) in DOE's seepage fraction and seepage flow, or justify that it is not needed. DOE will include the effect of the low-flow regime processes (e.g., film flow) in the seepage fraction and seepage flow, or justify that it is not needed. These studies will be documented in Seepage Models for PA Including Drift Collapse AMR (MDL-NBS-HS-000002) expected to be available to NRC in FY 2003.	Complete
USFIC.4.03	UZ2	When conducting seepage studies, consider smaller scale tunnel irregularities in drift collapse or justify that it is not needed. When conducting seepage studies, DOE will consider smaller scale tunnel irregularities in drift collapse or justify that it is not needed. These studies will be documented in Seepage Models for PA Including Drift Collapse AMR (MDL-NBS-HS-000002) expected to be available to NRC in FY 2003.	Complete
USFIC.4.04	UZ2	Provide final documentation for the effectiveness of the PTn to dampen episodic flow, including reconciling the differences in chloride-36 studies. DOE will provide final documentation for the effectiveness of the PTn to dampen episodic flow, including reconciling the differences in chlorine-36 studies These studies will be documented in UZ Flow Models and Submodels AMR (MDL-NBS-HS-000006) expected to be available to NRC in FY 2003.	Received
USFIC.4.05	UZ2	Provide the analysis of geochemical data used for support of the flow field below the repository.	Complete
USFIC.4.06	UZ2	Provide documentation of the results obtained from the Comparison of Continuum and Discrete Fracture Network Models modeling study. Alternatively, provide justification of the continuum approach at the scale of the seepage model grid (formerly June 20 letter, item xiii). DOE will provide documentation of the results obtained from the Comparison of Continuum and Discrete Fracture Network Models modeling study or provide justification of the continuum approach at the scale of the seepage model grid. This will be documented in Seepage Calibration Model and Seepage Testing Data AMR (MDL-NBS-HS-000004) or other suitable document expected to be available to NRC in FY 2003.	Complete
USFIC.4.07	UZ2	Provide documentation of the results obtained from the Natural Analogs modeling study. The study was to apply conceptual models and numerical approaches developed from Yucca Mountain to natural analog sites with observations of seepage into drifts, drift stability, radionuclide transport, geothermal effects, and preservation of artifacts. DOE will provide documentation of the results obtained from the Natural Analogs modeling study. The study was to apply conceptual models and numerical approaches developed from Yucca Mountain to natural analog sites with observations of seepage into drifts, drift stability, radionuclide transport, geothermal effects, and preservation of artifacts. This will be documented in the Natural Analogs for the Unsaturated Zone AMR (ANL-NBS-HS-000007) expected to be available to NRC FY 2002.	Complete
USFIC.5.01	SZ1	The NRC believes that the incorporation of horizontal anisotropy in the site scale model should be reevaluated to ensure that a reasonable range for uncertainty is captured. The data from the C-wells testing should provide a technical basis for an improved range. As part of the C-wells report, DOE should include an analysis of horizontal anisotropy for wells that responded to the long-term tests. Results should be included for the tuffs in the calibrated site scale model. DOE will provide the results of the requested analyses in C-wells report(s) in October 2001, and will carry the results forward to the site-scale model, as appropriate.	Complete
USFIC.5.02	SZ1	Provide the update to the SZ PMR, considering the updated regional flow model. A revision to the Saturated Zone Flow and Transport PMR is expected to be available and will reflect the updated United States Geological Survey (USGS) Regional Groundwater Flow Model in FY 2002, subject to receipt of the model report from the USGS (reference item 9).	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
USFIC.5.03	SZ1	DOE's outline for collecting data in the alluvium appears reasonable but lacks detail. Provide a detailed testing plan for alluvial testing to reduce uncertainty (for example, the plan should give details about hydraulic and tracer tests at the well 19 complex and it should also identify locations for alluvium complex testing wells and tests and logging to be performed). NRC will review the plan and provide comments, if any, for DOE's consideration. In support and preparation for this meeting, DOE provided work plans for the Alluvium Testing Complex and the Nye County Drilling Program (FWP-SBD-99-002, Alluvial Tracer Testing Field Work Package, and FWP-SBD-99-001, Nye County Early Warning Drilling Program, Phase II and Alluvial Testing Complex Drilling). DOE will provide test plans of the style of the Alcove 8 plan as they become available. In addition, the NRC On Site Representative attends DOE/Nye County planning meetings and is made aware of all plans and updates to plans as they are made.	Complete
USFIC.5.03	SZ2	DOE's outline for collecting data in the alluvium appears reasonable but lacks detail. Provide a detailed testing plan for alluvial testing to reduce uncertainty (for example, the plan should give details about hydraulic and tracer tests at the well 19 complex and it should also identify locations for alluvium complex testing wells and tests and logging to be performed). NRC will review the plan and provide comments, if any, for DOE's consideration. In support and preparation for this meeting, DOE provided work plans for the Alluvium Testing Complex and the Nye County Drilling Program (FWP-SBD-99-002, Alluvial Tracer Testing Field Work Package, and FWP-SBD-99-001, Nye County Early Warning Drilling Program, Phase II and Alluvial Testing Complex Drilling). DOE will provide test plans of the style of the Alcove 8 plan as they become available. In addition, the NRC On Site Representative attends DOE/Nye County planning meetings and is made aware of all plans and updates to plans as they are made.	Complete
USFIC.5.04	SZ1	Provide additional information to further justify the uncertainty distribution of flow path lengths in the alluvium. This information currently resides in the Uncertainty Distribution for Stochastic Parameters AMR. DOE will provide additional information, to include Nye County data as available, to further justify the uncertainty distribution of flowpath lengths in alluvium in updates to the Uncertainty Distribution for Stochastic Parameters AMR and to the Saturated Zone Flow and Transport PMR, both expected to be available in FY 2002.	Complete
USFIC.5.05	SZ1	Provide the hydro-stratigraphic cross-sections that include the Nye County data. DOE will provide the hydrostratigraphic cross sections in an update to the Hydrogeologic Framework Model for the Saturated Zone Site-Scale Flow and Transport Model AMR expected to be available during FY 2002, subject to availability of the Nye County data.	Received
USFIC.5.06	SZ1	Provide a technical basis for residence time (for example, using C-14 dating on organic carbon in groundwater from both the tuffs and alluvium). DOE will provide technical basis for residence time in an update to the Geochemical and Isotopic Constraints on Groundwater Flow Directions, Mixing, and Recharge at Yucca Mountain, Nevada AMR during FY 2002.	Complete
USFIC.5.07	SZ1	Provide all the data from SD-6 and WT-24. Some of this data currently resides in the Technical Data Management System, which is available to the NRC and CNWRA staff. DOE will include any additional data from SD-6 and WT-24 in the Technical Data Management System in February 2001.	Complete
USFIC.5.08	SZ1	Taking into account the Nye County information, provide the updated potentiometric data and map for the regional aquifer, and an analysis of vertical hydraulic gradients within the site scale model. DOE will provide an updated potentiometric map and supporting data for the uppermost aquifer in an update to the Water-Level Data Analysis for the Saturated Zone Site-Scale Flow and Transport Model AMR expected to be available in October 2001, subject to receipt of data from the Nye County program. Analysis of vertical hydraulic gradients will be addressed in the site-scale model and will be provided in the Calibration of the Site-Scale Saturated Zone Flow Model AMR expected to be available during FY 2002.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
USFIC.5.09	SZ1	Provide additional information in an updated AMR or other document for both the regional and site scale model (for example, grid construction, horizontal and vertical view of the model grid, boundary conditions, input data sets, model output, and the process of model calibration). The updated USGS Regional Groundwater Flow Model is a USGS Product, not a Yucca Mountain Site Characterization Project product. It is anticipated that this document will be available in September 2001. DOE believes that the requested information is now available in the current version of the Calibration of the Site-Scale Saturated Zone Flow Model AMR and will be carried forward in future AMR revisions.	Complete
USFIC.5.10	SZ1	Provide in updated documentation of the HFM that the noted discontinuity at the interface between the GFM and the HFM does not impact the evaluation of repository performance. DOE will evaluate the impact of the discontinuity between the Geologic Framework Model and the Hydrogeologic Framework Model on the assessment of repository performance and will provide the results in an update to the Hydrogeologic Framework Model for the Saturated-Zone Site-Scale Flow and Transport Model AMR during FY 2002.	Complete
USFIC.5.11	SZ1	In order to test an alternative conceptual flow model for Yucca Mountain, run the SZ flow and transport code assuming a north-south barrier along the Solitario Canyon fault whose effect diminishes with depth or provide justification not to. DOE will run the saturated zone flow and transport model assuming the specified barrier and will provide the results in an update to the Calibration of the Site-Scale Saturated Zone Flow Model AMR expected to be available during FY 2002.	Complete
USFIC.5.12	SZ1	Provide additional supporting arguments for the Site-Scale Saturated Zone Flow model validation or use a calibrated model that has gone through confidence building measures. The model has been calibrated and partially validated in accordance with AP 3.10Q, which is consistent with NUREG-1636. Additional confidence-building activities will be reported in a subsequent update to the Calibration of the Site-Scale Saturated Zone Flow Model AMR, expected to be available during FY 2002.	Complete
USFIC.5.13	SZ1	Provide the evaluation of the ongoing fluid inclusion studies (for example, UNLV, State of Nevada, and USGS). DOE's consideration of the fluid inclusion studies will be documented in an update to the Saturated Zone Flow and Transport PMR expected to be available in FY 2002, subject to availability of the studies.	Complete
USFIC.5.14	TSPAI	Provide the updated SZ FEPs AMR. DOE will provide the updated Features, Events, and Processes in Saturated Zone Flow and Transport AMR in February 2001.	Complete
USFIC.5.14	SZ1	Provide the updated SZ FEPs AMR. DOE will provide the updated Features, Events, and Processes in Saturated Zone Flow and Transport AMR in February 2001.	Complete
USFIC.6.01	UZ3	The DOE will provide the final sensitivity analysis on matrix diffusion (for UZ) in the TSPA-SR, Rev. 0. Due date: December 2000. The saturated zone information will be available in TSPA-SR, Rev.1, expected to be available in June 2001.	Complete
USFIC.6.02	UZ3	The DOE will provide the final detailed testing plan for Alcove 8. The testing plan will be provided by August 28, 2000. The NRC staff will provide comments, if any, no later than two weeks after receiving the testing plan.	Complete
USFIC.6.03	UZ3	The DOE will complete the Alcove 8 testing, taking into consideration the NRC staff comments, if any, and document the results in a DOE-approved AMR, due date: May 2001.	Received
USFIC.6.04	SZ2	Provide the documentation for the C-wells testing. Use the field test data or provide justification that the data from the laboratory tests is consistent with the data from the field tests. DOE will provide the C-wells test documentation and will either use the test data or provide a justified reconciliation of the lab and field test data in C-wells document(s) in October 2001.	Complete

Agreement	Related ISIs	NRC/DOE Agreement	Status
USFIC.6.04	SZ1	Provide the documentation for the C-wells testing. Use the field test data or provide justification that the data from the laboratory tests is consistent with the data from the field tests. DOE will provide the C-wells test documentation and will either use the test data or provide a justified reconciliation of the lab and field test data in C-wells document(s) in October 2001.	Complete

APPENDIX B

NRC COMMENTS ON FEATURES, EVENTS, AND PROCESSES, INCLUDING DOE AND NRC AGREEMENTS

This appendix summarizes previous U.S. Nuclear Regulatory Commission (NRC) comments on the U.S. Department of Energy (DOE) consideration of features, events, and processes in a series of technical exchanges held in 2001. DOE is in the process of updating its screening of features, events, and processes, but the update was not available at the time of this report. The evaluation, based on available information, is presented in the form of a table (Table B–1) with the following fields:

Comment An explanation of issues identified by NRC staff at the 2001 Technical Exchanges.

DOE response to 2001 technical exchanges
Comments were discussed with DOE at the DOE and NRC Technical Exchanges on May 15–17 and August 6–10, 2001. Agreements on items related to Igneous Activity were reached at the September 5, 2001, DOE and NRC Technical Exchange (Reamer, 2001a,b). The language agreed upon by DOE and NRC at the 2001 technical exchanges is provided here for reference.

Table B–1. NRC Comments on Features, Events, and ProcessesIncluding, DOE and NRC Agreements

Integrated Subissue	Technical Exchange	Comment	DOE Responses to 2001 Technical Exchanges
Direct1	75	Various features, events, and processes that could potentially influence the evolution of an igneous event intersecting the repository have not been identified as being relevant for disruptive events. These include 1.1.02.00.00 (Excavation/Construction) changes to the rock around the repository from excavation and construction could affect dike/repository interactions and influence how a dike behaves near the surface. Additionally, repository features such as ventilation shafts could provide a path to the surface that would bypass the repository. 1.1.04.01.00 (Incomplete Closure) if the design of the repository includes a seal at the end of the drifts strong enough to contain magma that is relied on for performance calculations, failure to complete these seals could affect repository performance. 2.1.03.12.00 [Canister Failure (Long-Term)] for intrusive volcanism, credit is taken for the waste packages remaining mostly intact other than an end cap breach following magma interactions. The only waste package failure mechanism investigated to take this credit is internal gas pressure buildup. Other waste package failure mechanisms such as differential expansion of the inner and outer waste packages and phase changes in Alloy 22 from the long-term exposure to elevated temperatures are not considered. 2.1.07.02.00 (Mechanical Degradation or Collapse of Drift) could affect magma-repository interactions and affect the dose as a result of an igneous event. 2.3.01.00.00 (Topography and Morphology) the topography may affect dike propagation near the surface; dike propagation probably should be discussed as part of this feature, event, and process.	The following agreements reached at the September 5, 2001, DOE and NRC Technical Exchange (Reamer, 2001c) address the NRC comments: 1.1.02.00.00 (Excavation/Construction)—Igneous Activity Subissue 2, Agreement 18 1.1.04.01.00 (Incomplete Closure)—Igneous Activity Subissue 2, Agreement 18 2.1.03.12.00 [Canister Failure (Long-Term)]—Igneous Activity Subissue 2, Agreement 19 2.1.07.02.00 (Mechanical Degradation or Collapse of Drift)—Igneous Activity Subissue 2, Agreement 18 2.3.01.00.00 (Topography and Morphology)—Igneous Activity Subissue 2, Agreement 18 Igneous Activity Subissue 2, Agreement 18: DOE will evaluate how the presence of repository structures may affect magma ascent, conduit localization, and evolution of the conduit and flow system. The evaluation will include the potential effects of topography and stress, strain response on existing or new geologic structures resulting from thermal loading of high-level waste, and a range of physical conditions appropriate for the duration of igneous events. DOE will also evaluate how the presence of engineered repository structures in the license application design (e.g., drifts, waste packages, and backfill) could affect magma flow processes for the duration of an igneous event. The evaluation will include the mechanical strength and durability of natural or engineered barriers that could restrict magma flow within intersected drifts. The results of this investigation will be documented in an update to the Analysis Model Report titled Dike Propagation and Interaction with Drifts, ANL–WIS–MD–000015, expected to be available in fiscal year 2003, or another appropriate technical document. Igneous Activity Subissue 2, Agreement 19: DOE will evaluate waste package response to stresses from thermal and mechanical effects associated with exposure to basaltic magma, considering the results of evaluations attendant to Igneous Activity Subissue 2, Agreement 18. As currently planned, the evaluation, if implemented, would include (i) appropriate at-condition strength properties and magma flow paths, for duration of an igneous event; and (ii) aging effects on materials strength properties when exposed to basaltic magmatic conditions for the duration of an igneous event, which will include the potential effects of subsequent seismically induced stresses on substantially intact waste packages. DOE will also evaluate the response of Zone 3 waste packages, or waste packages covered by backfill or rockfall, if exposed to magmatic gases at conditions appropriate for an igneous event, considering the results of evaluations attendant to Igneous Activity Subissue 2, Agreement 18. If models take credit for engineered barriers providing delay in radionuclide release, DOE will evaluate barrier performance for the duration of the hypothetical igneous event. The results

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
			of this investigation would be documented in an update to the technical product Waste Package Behavior in Magma, CA–EBS–ME–000002, which would be available by the end of fiscal year 2003, or another appropriate technical document.
Direct1 Dose2	IA-1	2.3.02.02.00 (Radionuclide Accumulation in Soil) is included for irrigation deposition only; however, this screening argument is too limited because it excludes transport of volcanic ash from other areas to the critical group location (CRWMS M&O, 2001a). DOE indicated that redistribution will be accounted for by conservatively assuming that the wind is blowing toward the critical group and maintaining a high mass load in years after the event. DOE has not provided a demonstration that these conservatisms actually bound the effects of redistribution. Similar comment applies to the following items: 2.3.02.03.00 (Soil and Sediment Transport). In the screening argument, it is claimed that 100-percent south-blowing wind direction assumption accounts for aeolian and fluvial transport processes. Additional technical basis for this statement should be provided. 2.3.13.02.00 (Biosphere Transport) excludes transport in surface water. 2.3.11.02.00 (Surface Runoff and Flooding) 2.3.01.00.00 (Topography and Morphology). The effect of this item on redistribution of radionuclides after an igneous event should be considered.	Igneous Activity Subissue 2, Agreement 17 addresses the NRC comments. DOE will evaluate conclusions that the risk effects (i.e., effective annual dose) of eolian and fluvial remobilization are bounded by conservative modeling assumptions in the document Total System Performance Assessment for Site Recommendation, Rev. 00, ICN1. DOE will examine rates of eolian and fluvial mobilization off slopes, rates of transport in Fortymile Wash, and rates of deposition or removal at the proposed critical group location. DOE will evaluate changes in grain size caused by these processes for effects on airborne particle concentrations. DOE will also evaluate the inherent assumption in the mass loading model that the concentration of radionuclides on soil in the air is equivalent to the concentration of radionuclides on soil on the ground does not underestimate dose (i.e., radionuclides important to dose do not preferentially attach to smaller particles). DOE will document the results of investigations in the Analysis Model Report titled Eruptive Processes and Soil Redistribution, ANL–MGR–GS–000002, expected to be available in fiscal year 2003 and in the Analysis Model Report titled Input Parameter Values for External and Inhalation Radiation Exposure Analysis, ANL–MGR–MD–000001, to be available in fiscal year 2003, or another appropriate technical document.
Dose1 Dose2 Dose3	17	DOE selected a subset of the full list of features, events, and processes as applicable for biosphere screening in CRWMS M&O (2001a). Some entries potentially applicable to biosphere dose conversion factor calculations (that should be considered for screening) have not been included in the scope of the document (CRWMS M&O, 2001a). These include 2.3.11.04.00 (Groundwater Discharge to Surface) 1.3.07.02.00 (Water Table Rise) 3.2.10.00.00 (Atmospheric Transport of Contaminants) 1.2.04.01.00 (Igneous Activity) 2.2.08.01.00 (Groundwater Chemistry/Composition in Unsaturated Zone and Saturated Zone) (i.e., chemical species can impact dose coefficient selection) 2.2.08.11.00 (Distribution and Release of Nuclides from the Geosphere) 3.1.01.01.00 (Radioactive Decay and Ingrowth) 1.2.04.07.00 (Ash Fall).	DOE will provide a technical basis in the Evaluation of the Applicability of Biosphere-Related Features, Events, and Processes, ANL–MGR–MD–000011, to address the NRC comments for 2.3.11.04.00 (Groundwater Discharge to Surface), 1.3.07.02.00 (Water Table Rise), and 2.2.08.11.00 (Distribution and Release of Nuclides from the Geosphere). No further action is required for 3.2.10.00.00 (Atmospheric Transport of Contaminants) and 1.2.04.01.00 (Igneous Activity). DOE agreed to provide clarification of the screening argument in the Evaluation of the Applicability of Biosphere-Related Features, Events, and Processes, ANL–MGR–MD–000011, for 2.2.08.01.00 (Groundwater Chemistry/Composition in Unsaturated Zone and Saturated Zone), to address the NRC comment. DOE will add links to the Evaluation of the Applicability of Biosphere-Related Features, Events, and Processes, ANL–MGR–MD–000011, for 3.1.01.01.00 (Radioactive Decay and Ingrowth) and 1.2.04.07.00 (Ashfall), to address the NRC comment.
ENG1 ENG4 UZ3	57	1.1.02.03.00 (Undesirable Materials Left) is screened out on the basis of low consequences (CRWMS M&O, 2001b). Although a report cited by the DOE (CRWMS M&O, 1995) provides an analysis of appropriate upper bounds on materials introduced into the repository, no analysis has been conducted to determine if the current design will meet these limits. DOE should provide	DOE agreed to provide the technical basis for the screening argument in the Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, to address the NRC comment. The technical basis involves use of the Waste Isolation Evaluation: Tracers, Fluids, and Materials, and Excavation Methods for Use in the Package 2C

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		additional technical basis for the effect of introduced materials on water chemistry.	Exploratory Studies Facility Construction, BABE00000–01717–2200–00007, Rev. 04. As part of Container Life and Source Term Subissue 1, Agreement 1, DOE also agreed to provide additional justification on the effect of introduced materials on water chemistry in a revision to the analysis and model report, Environment on the Surfaces of the Drip Shield and Waste Package Outer Barrier AMR, ANL–EBS–MD–000001, before license application.
UZ2	68	1.2.02.01.00 (Fractures) Is screened as included for seepage and is screened as excluded on the basis of low consequence for permanent effects (CRWMS M&O, 2001c). Generation of new fractures and reactivation of preexisting fractures may significantly change the flow and transport paths. Newly formed and reactivated fractures typically result from thermal, seismic, or tectonic events. Thermally induced changes in stress may result in permeability changes between drifts that could act to divert flow toward drifts. See also comment on 2.2.06.01.00 [Changes in Stress (Due to Thermal, Seismic, or Tectonic Effects) Change Porosity and Permeability of Rock].	The thermal-mechanical effects on rock properties are addressed by an existing DOE and NRC agreement (Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 20 and 21). The FEPs in Thermal Hydrology and Coupled Processes, ANL–NBS–MD–000004, will be revised on completion to meet this agreement.
ENG2 UZ2 SZ1	J-25	1.2.02.02.00 (Faulting). Changes of fault characteristics have been screened as excluded on the basis of low consequence (CRWMS M&O, 2000b); formation of new faults has been excluded on the basis of low probability. 1.2.02.03.00 (Fault Movement Shears Waste Container) has been excluded on the basis of low probability. 1.2.03.02.00 (Seismic Vibration Causes Container Failure) has been excluded on the basis of low consequence (CRWMS M&O, 2000a). In these items, the DOE screening argument relies, in large part, on the median values of fault displacements and ground motions for postclosure (less than 10^{-6}/year), rather than the mean values. The staff consider that the mean more reliably incorporates uncertainty and is a more reasonable and prudent statistical measure than the median. DOE should provide additional technical basis for this approach. DOE agreed to address this concern in a forthcoming Request for Additional Information.	This issue is addressed by existing agreements between DOE and NRC (Structural Deformation and Seismicity Subissue 1 Agreement 2) and an NRC letter dated August 3, 2001 (Reamer, 2001d). Features, Events, and Processes: Screening for Disruptive Events, ANL–WIS–MD–000005, will be revised on completion of this work.
ENG2	J-26	The screening argument for 1.2.02.03.00 (Fault Movement Shears Waste Container) is based, in part, on specific setback distances that will be used by DOE in the repository design (CRWMS M&O, 2000a). The setback distances are a function of fault displacement magnitudes. Thus, the setback values used in the design may need to be reassessed after the displacement issue is resolved.	This issue is addressed by existing agreements between DOE and NRC (Structural Deformation and Seismicity Subissue 1 Agreement 2) and an NRC letter dated August 3, 2001 (Reamer, 2001d). Features, Events, and Processes: Screening for Disruptive Events, ANL–WIS–MD–000005, will be revised on completion of this work.
ENG2 UZ2 SZ1	J-27	1.2.03.01.00 (Seismic Activity) was screened as excluded on the basis of low consequence of effects on such components as the drip shield and waste package and included with regard to effects on cladding (CRWMS M&O, 2000a). The distributions for ground-motion parameters were developed using the Probabilistic Seismic Hazard Assessment Expert	This issue is addressed by existing agreements between DOE and NRC (Structural Deformation and Seismicity Subissue 2 Agreement 1) and an NRC letter dated August 3, 2001. Features, Events, and Processes: Screening for Disruptive Events, ANL–WIS–MD–000005, will be revised on completion of this work.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		Elicitation. Additional technical basis on the use of expert judgment should be provided.	
ENG2	78	1.2.03.02.00 (Seismic Vibration Causes Container Failure) features, events, and processes have been excluded from consideration in the total system performance assessment code (CRWMS M&O, 2000a, 2001d). The screening argument cites preliminary seismic analyses of the drip shield and waste package as the basis for this screening decision (CRWMS M&O, 2000b). It is not clear whether the appropriate combinations of dead loads (caused by drift collapse, fallen rock blocks, or both), rock block impacts, and seismic excitation were considered. Moreover, the ability of these loads to initiate cracks, propagate preexisting cracks, or both may not have been adequately addressed. In addition, DOE has not demonstrated that the drip shield, pallet, and waste package will respond in a purely elastic manner when subjected to the aforementioned loading conditions. The screening argument for 1.2.03.02.00 (Seismic Vibration Causes Container Failure) also states "… it does not appear credible that the drip shield would be breached, because the drip shield has been designed to withstand up to a 6-MT rockfall" based on the rockfall on drip shield analyses performed by DOE (CRWMS M&O, 2000c). DOE, however, did not provide a description of the technical basis that the drip shield has, in fact, been designed to withstand 6-MT rock blocks {see the comments on 2.1.07.01.00 [Rockfall (Large Block)], 2.1.07.02.00 (Mechanical Degradation or Collapse of Drift), and 2.1.07.05.00 (Creeping of Metallic Materials in the Engineered Barrier Subsystem) for additional discussion relevant to rockfall and seismic analyses}. See also comment on 1.2.02.02.00 (Faulting).	Existing agreements from the Container Life and Source Term Subissue 2, Agreements 2 and 8; Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 17 and 19; and Structural Deformation and Seismicity Subissue 1, Agreement 2, and Subissue 2, Agreement 3, address related work. DOE agreed to provide clarification of the screening argument in FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, and Features, Events, and Processes: Screening for Disruptive Events, ANL–WIS–MD–000005, to address the NRC comment.
UZ3 Direct1	J-22	1.2.04.02.00 (Igneous Activity Causes Changes to Rock Properties) is screened as excluded from the radionuclide transport in the unsaturated zone abstraction, on the basis of low consequence (CRWMS M&O, 2000d, 2001e).Natural analogs (CRWMS M&O, 2000e) suggest alteration time scales of thousands of years (Ratcliff, et al., 1994) and alteration scales of tens of meters. Furthermore, modeling studies of the effects of silica redistribution on fracture porosity and permeability (CRWMS M&O, 2000e) have yielded conflicting results (Matyskiela, 1997). Additional clarification should be provided. Probability may also be an aspect to use in developing screening arguments for 1.2.04.02.00 (Igneous Activity Causes Changes to Rock Properties) provided probability is consistent with the probabilities used for the igneous disruptive scenario.	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1 Agreement 4, Subissue 4 Agreements 3 and 4, and Radionuclide Transport Subissue 1 Agreement 5). Features, Events, and Processes in Unsaturated Zone Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work.
SZ1 Dose1 Dose2	8	1.2.04.07.00 (Ash Fall). DOE assumes that ash fall blankets the region between the repository and the compliance boundary (CRWMS M&O, 2000b). Radionuclides associated with ash fall are then assumed to be transported instantaneously into the saturated zone. DOE presented only the case for uniform distribution. Parameter values and models used in the ash fall analysis are not clear. Some parameters used in the model are not well documented and other parameters, such as the number of waste packages that fail, are not viewed as conservative.	DOE agreed to provide clarification of the screening argument in the Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, to address the NRC comment.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		DOE should provide additional bases for the choice of models and parameters used to screen this item.	
Dose1 Dose2	J-24	1.2.04.07.00 (Ash Fall). The screening argument in CRWMS M&O (2000f) for ash fall impacting the saturated zone [i.e., secondary 1.2.04.07.01 (Soil Leaching Following Ash Fall)] includes a three order-of-magnitude error in calculation of the concentration of radionuclides in the well water. Although conservative assumptions are used in the analysis, the error found in Table 6-1 would cause the calculated dose to be 0.161Sv[16.1 rem], instead of 1.61×10^{-2} [1.61×10^{-4}], and would not support a low-consequence screening argument.	DOE agreed to provide the technical basis for the screening argument in Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, screening argument, to address the NRC comment.
SZ2 ENG3	4	1.2.06.00.00 (Hydrothermal Activity). [Saturated Zone]: In CRWMS M&O (2001f), this item is excluded on the basis of low consequence. For saturated zone transport, the adopted K_d distributions account for possible lithologic changes and thermal effects, with reference to CRWMS M&O (2000g). However, the latter document does not provide a clear technical basis that the K_ds were derived in such a fashion. In addition, though the screening argument is based on low consequence, there is a reference at the conclusion of the supplemental discussion to the low probability of hydrothermal activity (CRWMS M&O, 2001f). This also relates to the geothermal gradient in 2.2.10.13.00 [Density-Driven Groundwater Flow (Thermal)]. DOE should provide a stronger technical basis for the assertion that possible hydrothermal effects on K_d values are accounted for in the total system performance assessment. [Unsaturated Zone]: This item is excluded in the unsaturated zone on the basis of low consequence and low probability (CRWMS M&O, 2000h). DOE should provide a sufficient technical basis for models explaining elevated temperatures in the unsaturated zone that adequately address the timing and mode of formation of Type B faults, which record elevated temperatures.	[Saturated Zone]: This issue is addressed by existing DOE and NRC agreements (Radionuclide Transport Subissue 1, Agreement 5, and Subissue 2, Agreement 10). Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, will be updated as necessary to reflect the results of these existing agreements. [Unsaturated Zone]: As part of the Evolution of the Near-Field Environment Subissue 2, Agreement 3, DOE agreed to provide additional technical bases for the screening of 1.2.06.00 (Hydrothermal Activity), addressing points discussed at the January 2001 Evolution of the Near-Field Environment Technical Exchange (Reamer, 2001c). DOE agreed to revise the screening argument in a future revision of Features, Events, and Processes in UZ Flow and Transport AMR, (ANL–NBS–MD–000001), expected to be available in fiscal year 2002.
UZ2	J-23	1.2.06.00.00 (Hydrothermal Activity). Excluded on the basis of low consequence for basaltic magmatism and low probability for silicic magmatism (CRWMS M&O, 2001e). A consistent approach for the screening arguments is needed. The screening argument is considered incomplete because (i) past hydrothermal activity in the Yucca Mountain region is not clearly related to basaltic igneous activity and (ii) probability screening arguments in CRWMS M&O (2001e) are incomplete with respect to silicic magmatism. In addition, DOE cites unpublished studies by the U.S. Geological Survey and the University of Nevada, Las Vegas that reportedly demonstrates hydrothermal activity was a site characteristic until about 2 million years ago. Additional unpublished work by Dublyanski and others, however, does not support this conclusion. None of the unpublished work, however, has supported the conclusion that the likelihood of hydrothermal activity at Yucca Mountain during the next 10,000 years is clearly <1:10,000. Absent a clear linkage to the consequences of basaltic igneous activity, or a demonstrated technical basis for probability values below 1 in 10,000 in 10,000 years, DOE should provide	This issue is addressed by existing DOE/NRC agreements (Radionuclide Transport Subissue 1 Agreement 5 and Subissue 2 Agreement 10). Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, will be updated as necessary to reflect the results of these existing agreements.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		additional technical basis to screen 1.2.06.00.00 (Hydrothermal Activity) from further consideration.	
UZ1 Dose2 Dose3	J-16	1.2.07.01.00 (Erosion/Denudation) is screened as excluded on the basis of low consequence (CRWMS M&O, 2001d). The rationale for exclusion from the unsaturated zone on the basis of low consequence is incomplete. DOE should consider onset and extent of erosion caused by construction and characterization activities at the ground surface and the long-term effects on shallow infiltration.	DOE agreed to provide clarification of the screening argument in Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, to address the NRC comment.
UZ1	J-17	1.2.10.02.00 (Hydrologic Response to Igneous Activity). Excluded based on low consequence (CRWMS M&O, 2001e). Argument to exclude focuses on intrusive events. It should be noted that extrusive events could increase shallow infiltration for the repository in two ways: (i) lava flow would modify or dam a wash overlying the repository and (ii) volcanic fragment and ash layer, which would be highly permeable, may act to trap infiltrating water, shield it from evaporation, and reduce transpiration—all leading to increased shallow infiltration across the repository. There are no data to support or exclude the temporal extent of increased shallow infiltration, though this could be bounded from decades to thousands of years.	DOE agreed to provide the technical basis for the screening argument in Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, screening argument, to address the NRC comment.
UZ1	J-18	1.3.04.00.00 (Periglacial Effects). Excluded by low probability (CRWMS M&O, 2001e). Although other periglacial processes will not likely occur at Yucca Mountain, the freeze/thaw process is currently active. Freeze/thaw mechanical erosion will likely increase as the climate cools, however. The magnitude of erosion will not likely be significant even during the cooler climate condition. The screening argument should be clarified to acknowledge the current freeze/thaw process.	DOE agreed to provide clarification of the screening argument in Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, to address the NRC comment.
SZ1 SZ2 Dose1 Dose3	11	1.3.07.01.00 (Drought/Water Table Decline). According to information in CRWMS M&O (2001f), this item is excluded because of low consequence. DOE states " ... a lower water table could result in less travel through the alluvial aquifer and as a result, less sorption and retardation of the contaminant plume." However, no evidence is presented that precludes a water table decline. Current flow models assume that ground water flow through the saturated alluvium is relatively shallow. As water tables decline, how will flow through the alluvium be affected? Is it possible that a larger component of flow will be through the deep carbonate system? Will the upward gradient observed at some locations be affected? Are there distinct pathways that are dependent on elevation of the water table? It is likely that the transport times will stay the same or increase from water table decline, however, the exclusion argument provided seems insufficient. DOE should provide additional technical justification to exclude 1.3.07.01.00 (Drought/Water Table Decline).	This issue is addressed by existing DOE and NRC agreements (Radionuclide Transport Subissue 2, Agreement 8, and Unsaturated and Saturated Flow Under Isothermal Conditions Subissue 5, Agreement 4). Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, will be updated as necessary to reflect the results of these existing agreements and to clarify the screening argument.
SZ2	7	1.4.06.01.00 (Altered Soil or Surface Water Chemistry). This item is excluded on the basis of low probability (CRWMS M&O, 2001e), but it is not addressed as part of the scope of document ANL–NBS–MD–000002 (CRWMS M&O, 2000f). The probability argument is not supported by a calculation or estimate. This item is	DOE agreed to provide clarification of the screening argument in Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, to address the NRC comments. The analysis and model report will also address the aggregate effects of 1.4.06.01.00 (Altered

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		possibly relevant for the Integrated Subissue Radionuclide Transport in the Saturated Zone because of possible changes in ground water chemistry.	Soil or Surface Water Chemistry) on the unsaturated and saturated zones.
Dose3 Dose1	18	The biosphere analysis and model report on features, events, and processes (CRWMS M&O, 2001a) indicates that any future changes in 1.4.07.01.00 (Water Management Activities) can be excluded based on 10 CFR Part 63. This item includes well pumping from an aquifer as a water management activity. The conclusion that changes to water management activities may be excluded is not supported by the regulation. 10 CFR Part 63 indicates the behaviors and characteristics of the farming community are to be consistent with current conditions of the region surrounding the Yucca Mountain site and that climate evolution shall be consistent with the geologic record. As the climate becomes wetter and cooler, the farming community may pump less water out of the aquifer, consistent with sites analogous to the predicted future climate of Yucca Mountain. This reduction in pumping would not be considered a change in the behavior or characteristics of the critical group because the community would still be raising similar crops using similar farming methods.	DOE agreed to provide clarification of the screening argument in Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, to address the NRC comment.
ENG1	48	2.1.01.04.00 (Spatial Heterogeneity of Emplaced Waste) is screened as excluded on the basis of low consequence (CRWMS M&O, 2000i). Waste placed in Yucca Mountain will have physical, chemical, and radiological properties that will vary. The effect of spatial heterogeneity of the waste on repository-scale response is excluded based on low consequence, however, the heterogeneity within a waste package is implicitly included in the evaluation of in-package temperature used to determine perforation of the commercial spent nuclear fuel cladding. Spatial variability that may affect degradation of engineering barriers, such as conditions leading to crevice corrosion versus passive corrosion of an outer container, is not considered in this feature-event-process.	Spatial variability that may affect degradation of the waste package will be addressed as part of the resolution of an existing agreement (Container Life and Source Term Subissue 1, Agreement 1). The scope of the agreement includes evaluation of the range of chemical environments on the waste package.
ENG 4	50	2.1.02.13.00 (General Corrosion of Cladding). Excluded based on low probability of occurrence (CRWMS M&O, 2000j). Although general corrosion of cladding could expose large areas of irradiated fuel matrix and produce hydrides, it is argued that this corrosion is a slow process. The arguments are based on extrapolation to low temperatures at test data obtained at temperatures above 250 ˚C [482 ˚F] and in measurements of oxide thickness from specific fuel rods after reactor operation and exposure to water in reactor pool storage.	DOE agreed to provide clarification of the screening argument in Clad Degradation Features, Events, and Processes Analysis and Model Report, ANL–WIS–MD–000008, to address the NRC comment.
ENG4	51	2.1.02.14.00 (Microbially Induced Corrosion of Cladding). Included as part of localized corrosion model on the basis that microbial activity may induce local pH decreases and the local acidic environment may produce multiple penetrations of the cladding (CRWMS M&O, 2000j). It is stated, however, that microbially induced corrosion resulting from sulfide produced by sulfate-reducing bacteria and organic acid-producing bacteria is not expected to occur, because of resistance of zirconium to these species. The arguments are poorly worded stating that microbially induced corrosion is not expected to occur (not probable or credible) because microbial activity is screened out at the scale of the repository model as a significant bulk process.	This issue is addressed by an existing DOE and NRC agreement (Container Life and Source Term Subissue 3, Agreement 7). DOE agreed to provide clarification of the screening argument in Clad Degradation—FEPs Screening Arguments, ANL–WIS–MD–000008, Analysis and Model Report to address the NRC comment. The new cladding local corrosion model will reference In-Drift Microbial Communities Analysis and Model Report, ANL–EBS–MD–000038, which includes discussion of iron oxidizing bacteria. Clad Degradation—FEPs Screening Arguments, ANL–WIS–MD–000008, Analysis and Model Report will be revised to be consistent with

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		The argument of local acidic pH such as might be caused by microbial activity resulting in localized corrosion of cladding contradicts experimental evidence showing that zirconium alloys are resistant to corrosion in reducing and oxidizing acids. In addition, the argument contradicts other DOE arguments to screen out pitting corrosion by chloride anions {see 2.1.02.16.00 [Localized Corrosion (Pitting) of Cladding]}. DOE screening arguments for inclusion or exclusion should be consistent with screening decisions for related entries [see 2.1.02.15.00 (Acid Corrosion of Cladding from Radiolysis)]. A third group of bacteria iron oxidizers should also be considered in the analysis (NRC, 2001).	the updated Summary–Abstraction Analysis and Model Report.
ENG4	49	2.1.02.15.00 (Acid Corrosion of Cladding from Radiolysis). Included as part of the localized corrosion model on the basis that formation of HNO_3 and H_2O_2 ions [sic] by radiolysis can enhance corrosion of cladding (CRWMS M&O, 2000j). It is stated, however, that zirconium has excellent corrosion resistance to HNO_3 and concentrated H_2O_2. The arguments are poorly worded, stating that radiolysis is not expected to occur until waste package failure; then, the gamma dose will be too low to produce sufficient HNO_3 and H_2O_2 to promote general corrosion, however, localized corrosion could be possible. The argument of local acidic pH such as might result from microbial activity causing localized corrosion of cladding contradicts experimental evidence showing that zirconium alloys are resistant to corrosion in reducing and oxidizing acids. In addition, the argument contradicts other DOE arguments to screen out pitting corrosion by chloride anions {see 2.1.02.16.00 [Localized Corrosion (Pitting) of Cladding]}. In the Basis for Screening, undue consideration is given to alkaline conditions arising from the concrete liner, whereas the possibility of acidic conditions (pH< 2) is not discussed.	Radiolysis is addressed by an existing DOE and NRC agreement (Container Life and Source Term Subissue 3, Agreement 7). DOE agreed to provide clarification of the screening argument in Clad Degradation—FEPs Screening Arguments, ANL–WIS–MD–000008, to address the NRC comment.
ENG4	47	2.1.02.17.00 [Localized Corrosion (Crevice Corrosion) of Cladding]. Excluded based on low probability of occurrence (CRWMS M&O, 2000j). Experimental evidence is cited to indicate that crevice corrosion has not been observed in zirconium alloys exposed to chloride solutions, including NRC and CNWRA results. There is a need to develop a better understanding of localized corrosion of zirconium alloys before confirming this conclusion because the data are limited. In the report, Clad Degradation—Local Corrosion of Zirconium and Its Alloys Under Repository Conditions (CRWMS M&O, 2000k). It is noted that crevice corrosion may occur in the presence of fluoride ions.	DOE agreed to provide clarification of the screening argument in Clad Degradation—FEPs Screening Arguments, ANL–WIS–MD–000008, to address the NRC comment using data relevant to the proposed repository. In addition, Container Life and Source Term Subissue 3, Agreement 7, also addresses part of the concern.
ENG4	41	2.1.02.20.00 (Pressurization from Helium Production Causes Cladding Failure). Included as a process of internal gas pressure buildup that increases the cladding stress contributing to delayed hydride cracking and strain (creep) failures (CRWMS M&O, 2000j). The wording could be more precise in the text where it is stated that helium production from alpha decay is the main source of pressure buildup.	DOE agreed to provide clarification of the screening argument in Clad Degradation—FEPs Screening Arguments, ANL–WIS–MD–000008, to address the NRC comment.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
ENG4	53	2.1.02.22.00 (Hydride Embrittlement of Cladding). Excluded based on low probability of occurrence (CRWMS M&O, 2000j). The DOE screening argument states that the in-package environment and cladding stresses are not conducive to hydride cracking. The NRC staff believe that reorientation of preexisting hydride and embrittlement depends on temperature in addition to the required stresses. Clarification is needed on the cladding temperature and stress distributions used in the analysis. Several of the secondary features, events, and processes related to various processes leading to hydrogen entry into the cladding are listed next. 2.1.02.22.01 [Hydride Embrittlement from Zirconium Corrosion (of Cladding)]. Excluded because of low probability of occurrence because the hydrogen pickup as a result of cladding corrosion is low, because of the low corrosion rate, and because of the relatively small pickup fraction. The experimental hydrogen pickup fraction is provided, and it is argued the corrosion rate is low. The conclusion DOE reached regarding failure of cladding as a result of hydrogen pickup from general corrosion is acceptable. The screening arguments, however, can be justified better using quantitative arguments for the corrosion rate during disposal conditions. 2.1.02.22.02 [Hydride Embrittlement from Waste Package Corrosion and Hydrogen Absorption (of Cladding)]. Excluded because of the low probability of occurrence because the hydrogen generated by corrosion of waste packages and waste package internals and present as a molecule in gas or dissolved in water is not directly absorbed by the cladding. It is argued, on the basis of experimental data, that hydrogen absorption occurred through the reaction with water and not from the dissolved molecular hydrogen. The conclusion DOE reached regarding failure of cladding as a result of absorption of hydrogen gas generated by corrosion of waste package materials is acceptable. The screening arguments, however, can be better organized. 2.1.02.22.03 (Hydride Embrittlement from Galvanic Corrosion of Waste Package Contacting Cladding). Excluded because of the low probability of occurrence because corrosion of waste package internals will not result in hydriding of cladding. It is argued, using some experimental data as bases, that galvanic coupling to carbon steel will not be conducive to hydrogen charging because corrosion products will interrupt the electrical contact. It is claimed also that the nickel content both in Zircaloy-2 and -4 is not sufficient to induce the necessary hydrogen charging. The conclusion DOE reached regarding failure of cladding as a result of hydrogen entry from galvanic coupling with internal components of the waste packages is, in general, acceptable. The screening arguments, however, could be better supported by more relevant experimental data. 2.1.02.22.04 [Delayed Hydride Cracking (of Cladding)]. Excluded because of the low probability of occurrence. The analysis is based on the use of calculated values for the distribution of the stress intensity factor, which is compared with the threshold stress intensity for	DOE agreed to provide clarification of the screening argument in Clad Degradation—FEPs Screening Arguments, ANL–WIS–MD–000008, to address the NRC comments.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		irradiated Zircaloy-2. The DOE analysis of delayed hydride cracking is based on material properties of cladding containing mostly circumferential hydrides. DOE should provide cladding temperatures and stress distributions and demonstrate these are insufficient to cause hydride reorientation. 2.1.02.22.05 [Hydride Reorientation (of Cladding)]. Excluded because of the low probability of occurrence, since tested fuel rods did not exhibit hydride reorientation at stresses higher than those expected at the repository temperatures. It is argued, in addition, that with hydride reorientation, stresses will be insufficient for hydride embrittlement and cladding failure. Therefore, hydride reorientation has not been included in the model abstraction for cladding degradation. DOE agreed to provide updated documentation on the distribution of cladding temperatures and hoop stresses, which are critical parameters needed to evaluate the propensity to hydride reorientation and embrittlement [see 2.1.02.22.00 (Hydride Embrittlement of Cladding)]. 2.1.02.22.06 [Hydride Axial Migration (of Cladding)]. Excluded based on low probability because it is unlikely that sufficient hydrogen can be moved to the cooler ends of the fuel rods because of a lack of large temperature gradients in the waste packages. Based on studies for storage up to 90 years, it is concluded that the temperature gradients are not sufficient to induce redistribution of hydrides. The screening arguments, however, should include the combined effects of stress and temperature.	
ENG1 ENG2 ENG3	34	2.1.03.02.00 (Stress Corrosion Cracking of Waste Containers). Screened as included for waste package and as excluded for drip shield on the basis of low consequence (CRWMS M&O, 2001d). The screening argument states ... Source of stress for cracks is due to cold work stress and cracks caused by rockfall. However, these cracks tend to be tight (i.e., small crack opening displacement) and fill with corrosion products and carbonate minerals. These corrosion products will limit water transport through the drip shield and, thus, not contribute significantly to the overall radionuclide release rate from the underlying failed waste packages ... . Additional technical bases for the screening argument for the drip shield should be provided. Simplified DOE calculations indicate cracks will take considerable time to fill with corrosion products (Stress Corrosion Cracking of the Drip Shield, the Waste Package Outer Barrier, and the Stainless Steel Structural Material, ANL–EBS–MD–000005). Cracks that develop in the drip shield may propagate, open up, or both when subjected to subsequent loads caused by rockfall/drift collapse, seismic excitation, or both allowing significant ground water infiltration through the drip shield.	This issue is contained in existing DOE and NRC agreement (Container Life and Source Term Subissue 2, Agreement 8). DOE will update FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, screening argument on completion of the agreement.
ENG1 ENG2 ENG3	30	2.1.03.05.00 (Microbially Mediated Corrosion of Waste Container). Screened as included for waste package and as excluded for drip shield on the basis of low consequence (CRWMS M&O, 2001d). Quantitative data on microbially influenced corrosion of drip shield	This issue is addressed by an existing agreement (Container Life and Source Term Subissue 2, Agreement 8). No additional DOE action is required.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)

Integrated Subissue	Technical Exchange	Comment	DOE Responses to 2001 Technical Exchanges
		materials such as Titanium Grades 7 and 16 are not available from the literature. If microbially influenced corrosion of the drip shield occurs, it would not have an effect on dose. Accelerated corrosion rates of the drip shield have been evaluated and do not affect dose (CRWMS M&O, 2000l).	
ENG1 ENG2 ENG3	35	2.1.03.08.00 (Juvenile and Early Failure of Waste Containers). Screened as included for manufacturing and welding defects in waste container degradation analysis and as excluded for manufacturing defects in drip shield degradation analysis and early failure of the waste package and drip shield from improper quality control during emplacement (CRWMS M&O, 2001d). The screening argument states Manufacturing defects in the drip shield are excluded from TSPA analysis based on low consequence to the expected annual dose rate. The basis for this assessment is that slap-down analysis of a 21-pressurized water reactor waste packages resulted in stresses in the waste package material of less than 90 percent of the ultimate tensile strength. The impact energy associated with the emplacement error is substantially less than that expected in a vertical tip-over. According to DOE, emplacement errors are not expected to result in any damage. The results of the slap-down analysis are cited as the screening analyses of several features, events, and processes. Technical basis for damage reported in the slap-down analyses should be expanded. Although the impact energy of emplacement errors may be substantially less than that experienced in the slap-down analyses, a proper assessment of the extent of waste package damage as a result of emplacement errors should be performed.	Manufacturing defects associated with the drip shield will be addressed during the resolution of an existing agreement item for the waste package (Container Life and Source Term Subissue 2, Agreement 7). FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, will be updated to reflect the results of this agreement. Mechanical integrity of the drip shield will be addressed during resolution of an existing agreement item for the waste package (Container Life and Source Term Subissue 2, Agreement 6). FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, will be updated to reflect the results of this agreement. Rockfall effects on the drip shield will be addressed during the resolution of an existing agreement item for the waste package (Container Life and Source Term Subissue 2, Agreement 8). FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, will be updated to reflect the results of this agreement. FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, will be revised to address damage from improper quality control and emplacement of the drip shield. The criteria for damage to the waste package during emplacement will be addressed by administrative procedures for emplacement operations to be developed before operation of the facility.
ENG2	J-1	2.1.03.11.00 (Container Form) has been excluded from consideration in the total system performance assessment code (CRWMS M&O, 2001d). DOE has not addressed the varying clearance between the drip shield and different waste package designs and the concomitant effects this clearance may have on the consequences of rock block impacts, seismic excitation, or both.	This issue is addressed by existing agreements between DOE and NRC (Container Life and Source Term Subissue 2 Agreement 8). FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, will be revised on completion of this work.
UZ1 UZ2	J-19	2.1.05.01.00 (Seal Physical Properties). Excluded based on low consequence (CRWMS M&O, 2001e). It is difficult to assess this item solely based on the screening argument provided. The assessment can be performed once the actual design (ventilation tunnel locations) is released, backfill is described, and the analysis of runoff and flooding is incorporated into the screening argument. 2.1.05.02.00 (Groundwater Flow and Radionuclide Transport in Seals) and 2.1.05.03.00 (Seal Degradation). Excluded based on low consequence, using screening argument for 2.1.05.01.00 (Seal Physical Properties). The adequacy of the screening argument cannot be assessed until the actual design (ventilation tunnel locations) is released, backfill is described, and the analysis of runoff and flooding is incorporated into the screening arguments.	DOE stated it would adopt more rigorous configuration controls as the design advances. These controls will identify features, events, and processes screening arguments that could potentially change when design changes occur.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
ENG3 ENG4 UZ3	J-3	2.1.06.01.00 (Degradation of Cementitious Materials in Drift). The effects of degradation of cementitious materials on seepage chemistry are excluded on the basis of low consequence (CRWMS M&O, 2001b). DOE gives its bases its for exclusion in 2.1.09.01.00 (Properties of the Potential Carrier Plume in the Waste and Engineered Barrier Subsystem) (CRWMS M&O 2001b) stating that chemical models show a negligible effect of grout associated with rock bolts. NRC raised questions about these models pertaining to the treatment of evaporation and the chemical divide phenomenon [Evolution of the Near-Field Environment Technical Exchange (Reamer, 2001e). Concerns about grout chemical effects are related to recent observations of dripping from rock bolt holes in the sealed cross drift test. DOE should provide additional technical basis for screening chemical effects of cementitious materials in the drift. Because degradation products may affect water chemistry, and, therefore, radionuclide sorption behavior, the effect of this database entry on radionuclide transport in the unsaturated zone should be evaluated also. Currently, this entry is not addressed for the unsaturated zone (CRWMS M&O, 2001e). Radionuclide Transport Subissue 1, Agreement 5, and Subissue 2, Agreement 10, concern the technical bases for transport parameter uncertainty distributions.	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 2 Agreements 6, 10, and 14, and Radionuclide Transport Subissue 1 Agreement 5). Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, will be revised on completion of this work.
ENG2 UZ3	J-2 J-4	2.1.06.05.00 (Degradation of Invert and Pedestal) has been screened as excluded on the basis of low consequence (CRWMS M&O, 2001b). [Comment 1]: Rock block impact orientations with the waste package will be affected by degradation of the invert. Comment 2.1.07.01.00 [Rockfall (large block)] stated angled rock block impacts near the closure lid weld may have undesirable consequences. Furthermore, stability of the waste package during seismic excitation will be affected by a degraded invert foundation. Corrosion of the steel pallet components should be considered when evaluating stability of the waste package on its supporting pallet on a degraded invert foundation. [Comment 2]: Invert degradation is excluded on the basis of low consequence (CRWMS M&O, 2001b). The argument that changes to diffusive properties of the invert will be negligible to dose is not supported by demonstration (by sensitivity analyses) of the significant effect of diffusive release through the invert during the first 20,000 years (CRWMS M&O, 2000m, Volume II, Section 3.3). The sensitivity shown in the Repository Safety Strategy also applies to the first 10,000 years. The screening argument contradicts this information. The screening argument should directly address possible effects of degradation on invert diffusive properties.	[Comment 1]: This issue is addressed by existing agreements between DOE and NRC (Container Life and Source Term Subissue 2 Agreement 8). Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, will be revised on completion of this work. [Comment 2]: DOE agreed to provide the technical basis for the screening argument in Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, to address the NRC comment.
ENG1	39	2.1.06.06.00 (Effects and Degradation of Drip Shield). Excluded based on low consequence (CRWMS M&O, 2001d). The drip shield is an important component of the engineered barrier system, and its function and degradation are explicitly considered in the total system performance assessment. The degradation of the drip shield from corrosion processes is considered directly in the model abstraction for waste package	The ability of the additional loading combinations to initiate, propagate, or both preexisting cracks is being addressed in existing agreements (Container Life and Source Term Subissue 2, Agreements 8 and 9). DOE agreed to provide the technical basis for the screening argument in FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, to address the NRC comment.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		degradation, whereas remaining aspects of drip shield behavior are considered as part of the engineered barrier system analysis. For the secondary feature-event-process 2.1.06.06.01 (Oxygen Embrittlement of Ti Drip Shield), DOE argues that oxygen embrittlement is explicitly considered in the screening argument, but no discussion is provided. It is noted that this issue is most relevant to mechanical failure of the drip shield, which is discussed in 2.1.07.01.00 (Rockfall) and 2.1.07.02.00 (Mechanical Degradation or Drift Collapse). Although physical and chemical degradation processes have been included in the total system performance assessment, their effects on the ability of the drip shield to withstand dead loads (caused by drift collapse, fallen rock blocks, or both), rock block impacts, and seismic excitation are not accounted for in the screening arguments (CRWMS M&O, 2001b,d). CRWMS M&O (2000n) states the impact of rockfall on the degraded drip shield has been screened as excluded until more detailed structural response calculations for the drip shield under various rock loads are available.	
ENG1	29	2.1.06.07.00 (Effects at Material Interfaces) is screened as excluded on the basis of low consequence (CRWMS M&O, 2001d). The basic chemical processes that occur at phase boundaries (principally liquid/solid) are included in other features, events, and processes. Solid/solid contact occurs or could occur between the drip shield and the invert, backfill, or both, (if included in the Yucca Mountain project design) between the waste package and the invert, backfill, or both, (if included in the Yucca Mountain project design) between the pedestal and the waste package, drip shield, or both, and between the waste form and any other engineered barrier system component materials. Because these materials are all relatively inert, no significant solid/solid interaction mechanisms have been identified relative to the basic seepage water-induced corrosion of the engineered barrier system components and, hence, this feature-event-process is excluded on the basis of low consequence. However, interfaces between solid phases in contact with an aqueous phase can accelerate degradation processes such as crevice corrosion of the waste package or galvanic coupling of the drip shield to steel components [see screening arguments 2.1.03.01.00 (Corrosion of Waste Containers) and 2.1.03.04.00 (Hydride Cracking of Waste Containers and Drip Shields)].	This issue is addressed by an existing agreement (Container Life and Source Term Subissue 6, Agreement 1). DOE agreed to provide clarification of the screening argument in FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, as necessary, on completion of the agreement item.
ENG2 ENG4	79	2.1.07.01.00 [Rockfall (Large Block)]. [Disruptive Event & Waste Package]: The effects of 2.1.07.01.00 [Rockfall (Large Block)] on the drip shield and waste package have been screened as excluded (CRWMS M&O, 2000a, 2001b,d). The Drift Degradation Analysis and Model Report (CRWMS M&O, 2000o) indicates that thermal loading, seismicity, and time-dependent mechanical degradation of the host rock would have minor effects on the integrity of the drifts through the entire period of regulatory concern. The NRC staff at the DOE and NRC Repository Design and Thermal-Mechanical Effects Technical Exchange (Reamer, 2001f) identified several deficiencies [see the comments on 2.1.07.02.00 (Mechanical Degradation or Collapse of Drift) for additional discussion pertaining to the DOE rockfall analyses].	Existing agreements from Repository Design and Thermal Mechanical Effects agreements (Subissue 3, Agreements 17 and 19) and Container Life and Source Term (Subissue 2, Agreements 2, 3, and 8) address related work. DOE agreed to provide clarification of the screening argument in FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, and Features, Events, and Processes: Screening for Disruptive Events, ANL–WIS–MD–000005, to address the NRC comment.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)

Integrated Subissue	Technical Exchange	Comment	DOE Responses to 2001 Technical Exchanges
		As noted at the Container Life and Source Term and Repository Design and Thermal-Mechanical Effects Technical Exchanges (Reamer, 2001f), the rockfall on drip shield analyses (CRWMS M&O, 2000c) did not consider (i) temperature effects on mechanical material behavior, (ii) seismic motion of the supporting invert, (iii) point load impacts, (iv) appropriate material failure criteria, (v) material degradation processes, (vi) multiple rock block impacts, or (vii) boundary conditions that account for the potential interactions between the drip shield and gantry rails. Consequently, DOE has not provided sufficient information to demonstrate that the drip shield has been designed to withstand 6-, 10-, or 13-MT rock-block impacts. Because the framework for the invert is constructed from carbon steel, the potential degradation may affect orientation of the waste packages during time. In other words, the invert floor cannot be expected to keep the waste packages in a horizontal position for the entire regulatory period. As a result, rock-block impacts on the waste package may occur at angles not perpendicular to the waste package longitudinal axis. Angled rock-block impacts near the closure lid welds may have significantly different results than nonangled impacts. [Cladding]: Mechanical failure of cladding from rockfall is excluded based on low probability because rockfall on an intact waste package will not cause rod failure (CRWMS M&O, 2000j). The main screening argument is based on an intact waste package. The discussion is confusing because arguments based on the presence of backfill are also used in quantitative estimates. The screening arguments should be improved on the basis of appropriate calculations.	
ENG1 ENG2 ENG3	77	2.1.07.02.00 (Mechanical Degradation or Collapse of Drift) has been screened as excluded (CRWMS M&O, 2000a, 2001b) based on CRWMS M&O (2000o), which indicates that the emplacement drifts would essentially maintain their integrity through the period of regulatory concern. The current state of knowledge on unsupported openings in fractured rock indicates most drifts are likely to collapse soon after cessation of maintenance. This opinion is consistent with the conclusion of the DOE expert panel on drift stability* and recent analyses of the behavior of unsupported drifts in fractured rock during seismic loading from an earthquake (Hsiung, et al., 2001). Drift collapse could have implications on temperature, chemistry, seepage into drifts, and drip shield performance. DOE agreed to revise the Drift Degradation Analysis as part of Repository Design and Thermal-Mechanical Effects Agreements 3.17 and 3.19 [DOE and NRC Technical Exchange on Repository Design and Thermal-Mechanical Effects, February 6–8, 2001 (Reamer, 2001f)].	No additional DOE action is required. Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 17 and 19, address concern on drift collapse.
ENG1 ENG2 ENG3	37	2.1.07.05.00 (Creeping of Metallic Materials in the Engineered Barrier Subsystem) has been excluded from consideration in the total-system performance assessment code (CRWMS M&O, 2001b,d). Although DOE correctly points out in the screening argument (CRWMS M&O, 2001d) "… the deformation of many titanium alloys loaded to yield point does not increase with time" (American Society for Metals International, 1990), it still does not specifically address the potential for creeping of titanium Grades 7 and 24. For example, some titanium alloys have been shown to creep at room temperatures (Ankem, et al., 1994). Creeping of the titanium drip shield subjected to dead loads caused by	Treatment of creep of the drip shield will be addressed as part of an existing agreement related to drip shield rockfall analyses (Container Life and Source Term Subissue 2, Agreement 8). DOE agreed to provide the technical basis for the screening argument in FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, to address the NRC comment.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		fallen rock blocks, drift collapse, or both could significantly reduce the clearance between the drip shield and waste package during time. As a result, the drip shield may cause substantial damage to the waste package during its dynamic response to subsequent seismic loads. In addition, creeping could potentially cause separation of the individual drip shield units.	
ENG1 ENG2 ENG4	56	2.1.07.06.00 (Floor Buckling) has been screened as excluded in (CRWMS M&O, 2001b) and EBS Radionuclide Transport Abstraction Analyses and Model Report (CRWMS M&O, 2000n) based on analyses documented in Repository Ground Support Analysis for Viability Assessment (CRWMS M&O, 1998a), which indicate that floor heave from thermal-mechanical effects would not exceed approximately 10 mm [0.391 in]. However, to address concerns raised by the NRC staff about appropriateness of the thermal-mechanical properties used in DOE calculations (such as the analyses cited previously), DOE agreed to revise its assessment of floor buckling [Repository Design and Thermal-Mechanical Effects Agreement 3.9 (Reamer, 2001f). Note the screening argument relies on analyses that DOE agreed to address outstanding NRC concerns in Repository Design and Thermal-Mechanical Effects Agreements 3.2–3.13 (Reamer, 2001f)].	This issue is addressed by existing DOE and NRC agreements (Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 2–13). DOE agreed to include the analysis of floor buckling for postclosure conditions, consistent with the site-specific parameters and loading conditions used to satisfy Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 2–13. Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, will be revised to include this information.
UZ2	59	2.1.08.04.00 (Cold Traps) is screened as excluded on the basis of low consequence (CRWMS M&O, 2001b). Emplacement of waste in the drifts creates thermal gradients within the repository that may result in condensation forming on the roof of the drifts or elsewhere in the engineered barrier system, leading to enhanced dripping on the drip shields, waste packages, or exposed waste material. The DOE Multiscale Thermohydrologic Model does not account for mass transport along the length of drifts. The only Multiscale Thermohydrologic Model submodel that includes thermal hydrology (i.e., mass transport) is a cross section of a drift, so it accounts for potential condensation only along the radial axis.	This issue is addressed by an existing DOE and NRC agreement (Thermal Effects on Flow Subissue 2, Agreement 5). Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, will be revised on completion of this agreement.
ENG1 ENG3	42	2.1.08.07.00 (Pathways for Unsaturated Flow and Transport in the Waste and Engineered Barrier Subsystem) evaluates unsaturated flow and radionuclide transport that may occur along preferential pathways in the waste and engineered barrier system (CRWMS M&O, 2000i). DOE indicates that preferential pathways are already included via " … a series of linked one-dimensional flowpaths and mixing cells through the engineered barrier system, drip shield, waste package, and into the invert" (CRWMS M&O, 2000i). Water has been observed to drip preferentially along grouted rock bolts in the enhanced characterization of the repository block, (e.g., demonstrating that introduced materials can influence the location of preferred flow pathways). Interactions with engineered materials, such as cementitious and metallic components, can have a significant effect on evolved water and gas compositions. Because the description of 2.1.08.07.00 (Pathways for Unsaturated Flow and Transport in the Waste and Engineered Barrier Subsystem) states "Physical and chemical properties of the engineered barrier system and waste form, in both intact and degraded states, should be considered in evaluating [preferential] pathways … ", the screening arguments should be based on an evaluation of these topics.	This issue is addressed by an existing DOE and NRC agreement (Evolution of the Near-Field Environment Subissue 2, Agreements 6, 10, and 14). Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, will be updated on completion of these agreement items.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
ENG3	54	2.1.09.02.00 (Interaction with Corrosion Products) is excluded in the engineered barrier system (except for colloid-related effects) on the basis of low consequence (CRWMS M&O, 2001b). As noted in the DOE and NRC Technical Exchange on Evolution of the Near-Field Environment (Reamer, 2001e), changes in seepage water chemistry resulting from interactions with engineered materials and their corrosion products were not adequately addressed in CRWMS M&O (2000p). Water has been observed to drip preferentially along grouted rock bolts in the enhanced characterization of the repository block, (e.g., demonstrating that introduced materials can influence the location of preferred flow pathways). Seepage waters that have interacted with engineered materials and their corrosion products can have a significant effect on evolved water and gas compositions.	This issue is addressed by an existing DOE and NRC agreement (Evolution of the Near-Field Environment Subissue 2, Agreements 6, 10, and 14). Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, will be updated on completion of these agreement items.
ENG1	36	2.1.09.03.00 (Volume Increase of Corrosion Products) is screened as excluded on the basis of low consequence (CRWMS M&O, 2001d). The presence of waste package corrosion products with higher molar volume than the uncorroded material that may change the stress state in the material being corroded is excluded in the case of the waste package based on low consequence. These products, however, may have an effect on corrosion processes such as stress corrosion cracking of the outer container, after its initial breaching, that may affect radionuclide release [see 2.1.03.07.00 (Mechanical Impact on the Waste Container and Drip Shield)]. The possibility of additional sources of stress arising from the formation of corrosion products should be evaluated in regard to stress corrosion cracking. See comment for 2.1.11.05.00 (Differing Thermal Expansion of Repository Components).	DOE agreed to provide the technical basis for the screening argument in FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, to address the NRC comment.
ENG1	55	2.1.09.07.00 (Reaction Kinetics in Waste and Engineered Barrier Subsystem). [Engineered Barrier Subsystem]: Item is screened as excluded on the basis of low consequence (CRWMS M&O, 2001b). Consideration of chemical reactions, such as radionuclide dissolution/precipitation reactions and reactions controlling the reduction-oxidation state is included by considering reaction kinetics in the in-package equilibrium model, however, reaction kinetics are excluded based on low consequence for the engineered barrier system. But these processes may affect composition of the near-field environment, particularly trace elements. The effect on corrosion of container materials could be indirect and should be considered. [Waste Form Miscellaneous]: Item is screened as excluded on the basis of low consequence (CRWMS M&O, 2000i). Additional technical bases should be provided to demonstrate that the combination of transport processes and reaction kinetics in the engineered barrier system will not adversely impact performance by altering the composition of water contacting the drip shield and waste package.	This issue is addressed by an existing DOE and NRC agreement (Evolution of the Near-Field Environment Subissue 2, Agreements 5, 8, 11, and 12). Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, will be updated on completion of these agreement items.
UZ2	63	2.1.09.12.00 [Rind (Altered Zone) Formation in Waste, Engineered Barrier Subsystem, and Adjacent Rock]. The thermal-hydrological-chemical model is screened as included, and the thermal-hydrological model, effects on transport is screened as excluded on the basis of low consequence (CRWMS M&O, 2001c).	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1, Agreement 3). FEPs in Thermal Hydrology and Coupled Processes, ANL–NBS–MD–000004, will be revised on completion, to meet this agreement.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		Thermal-chemical processes alter the rock forming the drift walls mineralogically. These alterations have hydrological, thermal, and mineralogical properties different from the current country rock.	
ENG4 UZ3 SZ2	5	2.1.09.21.00 (Suspension of Particles Larger Than Colloids). CRWMS M&O (2001f) states these particles will be included and treated as colloids. 2.1.09.21.00 (Suspension of Particles Larger Than Colloids) is not addressed in CRWMS M&O (2001e), however, and is noted as excluded in two other model components in the Yucca Mountain FEP Database (CRWMS M&O, 2001g). It is not clear how the effects of particles are included with colloids. The integration of 2.1.09.21.00 (Suspension of Particles Larger Than Colloids) across the engineered barrier system, unsaturated zone, and saturated zone should be clarified.	DOE agreed to provide clarification for the screening argument in Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, to address the NRC comment.
ENG4 UZ3	J-5	2.1.09.21.00 (Suspensions of Particles Larger than Colloids) is screened excluded from the engineered barrier system transport and waste form release abstractions (CRWMS M&O, 2000q, 2001e). Exclusion is based on the assumption that although particles may be transported through fractures in the unsaturated zone, low ground water velocities through the saturated zone would lead to particle settling (CRWMS M&O, 2000q), suggesting inconsistency in the screening analysis. Without quantitative measures of particle size, pore size, ground water velocity, and chemical variability, however, these qualitative assertions are difficult to evaluate. Because DOE includes colloid formation features, events, and processes in its screening analysis, and because of the large amounts of iron particles that may be introduced in the engineered barrier system, particle transport through the engineered barrier system into the unsaturated zone is plausible.	DOE agreed to provide clarification of the screening argument in Waste Form Colloid-Associated Concentration Limits: Abstraction and Summary ANL–WIS–MD–000012, to address the NRC comment.
UZ2	65	2.1.11.02.00 (Nonuniform Heat Distribution/Edge Effects in Repository). The thermal-hydrological and thermal-hydrological-chemical aspects are screened as included and the (thermal-mechanical effects) are screened as excluded on the basis of low consequence (CRWMS M&O, 2001c). Temperature in homogeneities in the repository lead to localized accumulation of moisture. Uneven heating and cooling at repository edges lead to nonuniform thermal effects during both the thermal peak and the cool-down periods.	Repository-wide, nonuniform heating effects are the subject of existing DOE and NRC agreements (Thermal Effects on Flow Subissue 2, Agreement 5, and Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 20 and 21). FEPs in Thermal Hydrology and Coupled Processes, ANL–NBS–MD–000004, will be revised on completion of this agreement. Thermal-Hydrological-Mechanical continuum modeling will address nonuniform effects at a mountain scale. This information will be provided in Coupled Thermal-Hydrological-Mechanical Effects on Permeability Analysis and Model Report, ANL–NBS–HS–000037.
ENG1 ENG2	38	2.1.11.05.00 (Differing Thermal Expansion of Repository Components) has been excluded from consideration in the total-system performance assessment code (CRWMS M&O, 2001b,d). The technical basis for excluding differing thermal expansion effects on repository performance is not comprehensive. For example, the screening arguments (CRWMS M&O, 2001d) do not address the limited clearance between the inner and outer barriers of the waste package in the axial direction, which may be as small as 2 mm [0.0787 in] according to design drawings (CRWMS M&O, 2000s). In addition, the differential thermal expansion between various invert components and the drift wall (to which they are attached) was not addressed.	DOE agreed to provide the technical basis for the screening argument in FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, to address the NRC comment.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		2.1.11.05.00 (Differing Thermal Expansion of Repository Components) is excluded on the basis of low consequence (CRWMS M&O, 2001b,d). Peak temperature of waste packages with 0.5-m [19.68-in] spacing and 50-year ventilation is 278 ˚C [532.4 ˚F] with backfill and 176 ˚C [348.8 ˚F] without backfill. The screening argument is that the temperature differential between the inner type 316NG barrier and the outer Alloy 22 barrier is 5C˚ [41 ˚F] with a corresponding strain of 2.15 × 10^{-5}. This calculation is performed using the difference between the thermal expansion coefficients for Type 316NG stainless steel and Alloy 22 using the maximum expected temperature difference between the waste package barriers. There will be at least a 1-mm [0.0394-in] gap between the barriers, and no thermal stresses are predicted. Calculations should use a temperature of the waste package rather than the difference between waste package barriers. The clearance between the inner type 316NG barrier and the outer Alloy 22 barrier is 0 to 4 mm [0.1575 in] as specified in the waste package design and fabrication process report (CRWMS M&O, 2000r). It is implicit that this clearance is specified at ambient temperature [i.e., 25 ˚C (77 ˚F)] because (i) no temperature is specified and (ii) the Alloy 22 waste package outer barrier will be heated to 371 ˚C [700 ˚F] for inner 316NG barrier cylinder installation. Using a temperature of 186 ˚C [366.8 ˚F], the calculated strain is 7.99 × 10^{-4}. For a waste package with clearance gaps of 1 mm [0.0394 in] or less at 25 ˚C [77 ˚F], thermal stresses will occur as a result of the differences in thermal expansion.	
ENG3	60	The exclusion of 2.1.12.01.00 (Gas Generation) and 2.1.12.05.00 (Gas Generation from Concrete) in CRWMS M&O (2000i, 2001b) should have additional technical bases to justify the characterization of chemical environments in the engineered barrier system in terms of bulk water and gas compositions. The possibility of local heterogeneity in gas composition in the drift, altering the chemistry of the drip shield/waste package environment and adversely impacting repository performance, should be explored. Local variations in the efficiency of advection/diffusion processes, relative to reaction rates, should be evaluated.	This issue is partially addressed by an existing DOE and NRC agreement (Evolution of the Near-Field Environment Subissue 2, Agreement 6). DOE agreed to provide the technical basis for the screening argument in Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, to address the NRC comment.
ENG1 ENG3 ENG4	32	2.1.13.01.00 (Radiolysis) is excluded based on low consequence (CRWMS M&O, 2000i, 2001d). [Waste Package]: Alpha, beta, gamma, and neutron irradiations of air saturated water can cause changes in chemical conditions (Eh, pH, and concentration of reactive radicals) and positive shifts in corrosion potential from the formation of hydrogen peroxide. DOE, on the bases of experimental work, concluded that radiolysis will not lead to localized corrosion of Alloy 22. Additional work, however, is necessary to complete the evaluation of the critical potentials related to localized corrosion of Alloy 22. [Waste Form Miscellaneous]: Screening argument considers only radiolysis of water to produce hydrogen and oxidants. No consideration of the formation of nitric acid resulting from radiolysis in presence of air. Spent nuclear fuel is expected to have higher dissolution rates at lower pH, thus, ignoring nitric acid may underestimate radionuclide release. Potential production of nitric	DOE agreed to provide additional information on critical potentials for localized corrosion at the DOE and NRC Container Life and Source Term Technical Exchange (Schlueter, 2000). DOE agreed to provide clarification of the screening argument in FEPs Screening of Processes and Issues in Drip Shield and Waste Package Degradation, ANL–EBS–PA–000002, to address the NRC comment.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		acid from radiolysis of N_2 in air should be considered. DOE should consider potential effect of acid environments on the corrosion of Alloy 22 and titanium.	
ENG4 UZ3 SZ2	74	2.1.14.01.00 (Criticality in Waste and Engineered Barrier Subsystem) was preliminarily excluded in the document (CRWMS M&O, 2000t) based on low probability. A preliminary screening status was assigned because the criticality calculations were not complete for DOE spent nuclear fuel after igneous intrusion and near-field and far-field criticality of all waste types following igneous disruption. The excluded screening analysis should provide additional technical basis on the calculation of the probability for criticality are addressed. Because the probability of criticality depends on the presence of a breach of the waste package barriers, most of the discussion of criticality probability is focused on the probability of waste package failure. DOE referenced the document, Probability of Criticality in 10,000 Years (CRWMS M&O, 2000u), for addressing the criticality probability from early failure by stress corrosion cracking, waste package damage after igneous intrusion, and seismic events. DOE referenced the screening argument for rockfall [2.1.07.01 (Rockfall)] for screening damage to the waste package and drip shield from seismically induced rockfall. In general, DOE should address the concerns raised on the waste package and mechanical disruption related features, events, and processes, and the issues raised at the Container Life and Source Term Technical Exchange (Schlueter, 2000) before it can conclude there is no waste package breach before 10,000 years. The concerns on the probability calculation in the document, Probability of Criticality in 10,000 Years (CRWMS M&O, 2000u) are • The conclusion of waste package failure probability of 2.7 x 10^{-11} from stress corrosion cracking, based on the equation in Section 6.1.1, is contrary to the total system performance assessment results that indicate the first waste package failure, using the upper-bound curve, from stress corrosion cracking at approximately 10,000 years. • The screening argument for 1.2.03.02.00 (Seismic Vibration Causes Container Failure) fails to consider the appropriate combinations of dead loads (caused by drift collapse, fallen rock blocks, or both), rock block impact, and seismic excitation or the ability of these loads to initiate cracks, propagate preexisting cracks, or both. • The screening argument for seismic events does not consider the indirect effects, such as causing dents, which could aid in the collection and channeling of water, or tilting the waste packages, which would result in greater height of the water within the waste package. Seismic shaking, combined with a sloped waste package, may also allow materials to accumulate at one end of a waste package to form a more reactive geometry. • The screening argument for seismically induced rockfall damaging the drip shield and waste package includes several deficiencies as documented in the staff review of the Drift Degradation Analysis and Model Report (CRWMS M&O 2000o) and 2.1.07.01.00 [Rockfall (Large Block)]. Other concerns related to the impact of rockfall on the waste package are	The current criticality agreements encompass NRC comments. The following entries are also considered closed-pending in light of existing criticality agreements: 2.1.14.02.00 (Criticality *In Situ*, Nominal Configuration, Top Breach) 2.1.14.03.00 (Criticality *In Situ*, Waste Package Internal Structures Degrade Faster Than Waste Form, Top Breach) 2.1.14.04.00 (Criticality *In Situ*, Waste Package Internal Structures Degrade at Same Rate as Waste Form, Top Breach) 2.1.14.05.00 (Criticality *In Situ*, Waste Package Internal Structures Degrade Slower Than Waste Form, Top Breach) 2.1.14.06.00 (Criticality *In Situ*, Waste Form Degrades in Place and Swells, Top Breach) 2.1.14.07.00 (Criticality *In Situ*, Bottom Breach Allows Flow Through Waste Package, Fissile Material Collects at Bottom of Waste Package) 2.1.14.08.00 (Criticality *In Situ*, Bottom Breach Allows Flow Through Waste Package, 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) 2.2.14.01.00 (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 Topopah Springs Basal Vitrophyre) 2.2.14.04.00 (Far-Field Criticality, Precipitation Caused by Hydrothermal Upwell or Redox Front in the Saturated Zone) 2.2.14.05.00 (Far-Field Criticality, Precipitation in Perched Water Above Topopah Springs Basal Vitrophyre) 2.2.14.06.00 (Far-Field Criticality, Precipitation in Fractures of Topopah Springs Welded 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 B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		reflected in the comments on the related features, events, and processes. • The calculation of the criticality probability does not fully consider mechanisms that could result in accelerated degradation of the fuel during an igneous event, such as burning Zircaloy or creep of the fuel at high temperatures. • The analysis of damage to DOE Zone 2 waste packages (CRWMS M&O, 2000u) fails to consider long-term exposure to high temperatures changing the microstructure of Alloy 22 and reducing the mechanical strength of the material (e.g., Rebak, et al., 2000) or the differences in thermal expansion between the inner barrier type 316NG stainless steel and the outer barrier Alloy 22 causing significant hoop-stress on waste package walls, in addition to the internal pressurization effects analyzed in CRWMS M&O (2000u). Analyses in CRWMS M&O (2000u) also do not consider potentially adverse chemical reactions, such as sulfidation reactions, in response to magmatic degassing or contact with basaltic magma. These processes could cause a more significant breach than the 10-cm^2 [1.55-in^2] hole currently assumed for waste packages located in DOE Zone 2 during basaltic igneous events. • The calculation does not consider any changes to drift by the magma, such as magma solidifying in the lower part of the drift, causing ponding above and around the waste package, or fractures forming in the cooled magma, that may provide preferential pathways to the waste package. Finally, the unsaturated flow may be modified by the presence of 1,170 ˚C [2,138 ˚F] magma so current parameters may no longer be valid. • The criticality probability document is inconsistent when discussing the water content of the magma in Section 5.3.2. The text indicates the magma would consist of a conservative 5-wt% water content, but Table 5-1 lists the water content as only 0.05 wt%. The computer files provided with the document that contained the actual calculations used a more realistic water content of 1.6 percent. A water content of 5 wt% would clearly be conservative, but justification should be provided if a lower water content is used in the calculations.	
UZ2	69	2.2.01.01.00 (Excavation and Construction-Related Changes in the Adjacent Host Rock). Initial effects on seepage are screened as included, and permanent thermal-hydrological-chemical and thermal-mechanical effects are screened as excluded on the basis of low consequence (CRWMS M&O, 2001c). Stress relief leading to dilation of joints and fractures is expected in an axial zone of up to one diameter-width surrounding the tunnels.	Thermal-mechanical effects on rock properties are addressed by an existing DOE and NRC agreement (Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 20 and 21). FEPs in Thermal Hydrology and Coupled Processes, ANL–NBS–MD–000004, will be revised on completion of this agreement.
ENG2 UZ2	62	2.2.01.02.00 (Thermal and Other Waste and Engineered Barrier Subsystem-Related Changes in the Adjacent Host Rock) is screened as excluded on the basis of low consequence (thermal-mechanical effects) and low probability (thermal-hydrological-chemical and backfill effects) (CRWMS M&O, 2001c). Changes in host rock properties result from thermal effects or other factors related to emplacement of the waste and engineered barrier system, such as mechanical or chemical effects of backfill. Properties that may be affected include rock strength, fracture spacing and	Thermal-mechanical effects on fractures will be addressed by existing agreements between DOE and NRC (Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 20 and 21). FEPs in Thermal Hydrology and Coupled Processes, ANL–NBS–MD–000004, will be revised on completion of this agreement. Long-term degradation of the host rock is addressed by existing agreements between DOE and NRC (Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 11 and 19).

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		block size, and hydrologic properties such as permeability. The screening argument did not consider mechanical degradation of the rock mass, such as fracture-wall rock alteration owing to long-term exposure to heat, moisture, and atmospheric conditions. Such degradation might increase the severity of mechanical failure (Ofoegbu, 2000). DOE agreed to reevaluate its assessment of long-term mechanical degradation(Reamer, 2001f) The DOE should account for long-term mechanical degradation of the host rock mass in the assessment of drift degradation, rockfall, and changes in hydrological properties and their effects on repository performance.	DOE will provide an improved technical basis for 2.2.01.02.00 (Thermal and Other Waste and Engineered Barrier Subsystem-Related Changes in the Adjacent Host Rock) by performing a postclosure drift deformation analysis that incorporates postclosure loads and rock properties using relevant information from existing agreements (Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 2–13). Engineered Barrier Subsystem Features, Events, and Processes, ANL–WIS–PA–000002, will be revised to include this information.
UZ2 ENG3	66	2.2.06.01.00 [Changes in Stress (Due to Thermal, Seismic, or Tectonic Effects), Change Porosity, and Permeability of Rock] is screened as excluded on the basis of low consequence and low probability (for one secondary entry) (CRWMS M&O, 2001b). Even small changes in the fracture openings cause large changes in permeability. The rock deforms according to the rock stress field. Changes in the ground water flow and in the temperature field will change the stress acting on the rock, which will, in turn, change the ground water flow. 2.2.06.01.00 [Change in Stress (Due to Thermal, Seismic, or Tectonic Effects), Change Porosity, and Permeability of Rock] is excluded as having low consequence to dose (CRWMS M&O, 2000a). However, the DOE analyses used to support the screening argument (CRWMS M&O, 2000v) did not consider water-flux diversion toward a drift from the adjacent pillar caused by increased aperture of subhorizontal fractures in the pillar from thermal-mechanical response. Such flux diversion would cause increased water flow to the drifts.	Thermal-mechanical effects on rock properties are addressed by an existing DOE and NRC agreement (Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 20 and 21). FEPs in Thermal Hydrology and Coupled Processes, ANL–NBS–MD–000004, and the Features, Events, and Processes: Screening for Disruptive Events, ANL–WIS–MD–000005, will be revised on completion of this agreement.
UZ2	J-20	2.2.07.05.00 (Flow and Transport in the Unsaturated Zone from Episodic Infiltration). Excluded based on low consequence (CRWMS M&O, 2001e). Screening argument asserts that episodic infiltration is expected to be attenuated by flow in the paintbrush nonwelded tuff layer such that unsaturated zone flow beneath this layer is effectively steady-state. Analyses to support this assertion, however, have only considered episodic infiltration with an average of 5 mm/yr [0.197 in/yr] infiltration flux. Area-average infiltration flux over the proposed repository horizon at Yucca Mountain is expected to exceed 20 mm/yr [0.787 in/yr] during future wetter climate conditions.	This issue is addressed by existing agreements between DOE and NRC (Unsaturated and Saturated Flow Under Isothermal Conditions Subissue 4 Agreement 4). Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work.
UZ3 SZ1 SZ2	J-6	2.2.07.15.00 (Advection and Dispersion). As defined, this item does not apply to the unsaturated zone and is not discussed in CRWMS M&O (2001e). Given that advection and dispersion are key components of the DOE radionuclide transport in the unsaturated zone model abstraction, the definition of 2.2.07.15.00 (Advection and Dispersion) should be extended to include these aspects (advection and dispersion) in the unsaturated zone.	DOE will add this features, events, processes to Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, and present the DOE discussion in the screening argument.
UZ2	USFIC-1	2.2.07.18.00 (Film Flow into Drifts) is screened as included on the basis of low consequence (low film flow rates). Higher film flow rates into drifts are considered included (CRWMS M&O, 2001e). Technical bases for the screening argument for 2.2.07.18.00 (Film Flow into Drifts) will derive from work needed to satisfy the	At the Unsaturated and Saturated Flow Under Isothermal Conditions DOE and NRC Technical Exchange (Reamer, 2000), DOE agreed to include the effect of the low-flow regime processes (e.g., film flow) in the DOE seepage fraction and seepage flow, or justify that it is not needed (Subissue 4, Agreement 2). No additional work is

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		Unsaturated and Saturated Flow Under Isothermal Conditions Subissue 4, Agreement 2.	required to derive the technical basis for the screening argument for 2.2.07.18.00 (Film Flow into Drifts).
UZ3	J-7	2.2.08.01.00 (Groundwater Chemistry/Composition in Unsaturated Zone and Saturated Zone) is excluded. DOE included the current ambient ground water conditions in the Total System Performance Assessment–Site Recommendation abstraction of radionuclide transport in the unsaturated zone, but has excluded future changes (CRWMS M&O, 2000w, 2001e). DOE asserts that thermal effects on chemistry are minimal, but assertion focuses mainly on the effects of dissolution and precipitation on hydrologic properties. The screening argument refers to a model of thermal-chemical effects on seepage water chemistry at the drift wall (CRWMS M&O, 2000x). Because modeled effects fell within the range of variation included in total system performance assessment, it is asserted that effects farther from the drift would be smaller, based on an unverified assumption (CRWMS M&O, 2001e). This argument does not address chemical changes below the repository, which are likely to be more significant than changes above, because of interactions with the engineered barrier system and waste materials. Even so, predicted changes in key geochemical parameters (pH and total carbon) in seepage water are large enough to have an effect on sorption coefficients. Without the details on how expert judgment was used to derive the Total System Performance Assessment–Site Recommendation sorption parameters, it is not clear how the effects of changes in the ambient chemistry system are incorporated into the transport calculations.	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1 Agreement 4, and Subissue 4 Agreements 3 and 4, Radionuclide Transport Subissue 1 Agreement 5, and Subissue 2 Agreement 10). Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work.
UZ3 SZ2	J-8	2.2.08.02.00 (Radionuclide Transport Occurs in a Carrier Plume in Geosphere) is excluded from the Total System Performance Assessment–Site Recommendation abstraction of radionuclide transport in the unsaturated zone on the basis of low consequence (CRWMS M&O, 2000d, 2001e). The key assumption (CRWMS M&O, 2001e; Assumption 11) is that results from the near-field thermal-hydrological-chemical coupled processes model (CRWMS M&O, 2000x) can be used to bound the effects of similar coupled processes on far-field flow and transport. This assumption has not yet been verified. Because the screening argument for this item is focused primarily on thermal effects on the chemistry of seepage water entering the emplacement drifts, it does not appear to include other potential effects (colloids, interactions with waste forms, and engineered barrier system materials). Also, 2.1.09.01.00 (Properties of a Carrier Plume in the Engineered Barrier Subsystem) is included in the process model report (CRWMS M&O, 2001b, 2000y), suggesting that radionuclide transport in a carrier plume should be included in transport beyond the engineered barrier system.	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1 Agreement 4, and Subissue 4 Agreements 3 and 4, and Radionuclide Transport Subissue 1 Agreement 5). Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work.
UZ2 UZ3	J-9	2.2.08.03.00 [Geochemical Interactions in Geosphere (Dissolution, Precipitation, Weathering) and Effects on Radionuclide Transport] is excluded (CRWMS M&O, 2000d, 2001e) from the Total System Performance Assessment–Site Recommendation abstraction of radionuclide transport in the unsaturated zone on the basis of low consequence. The key assumption (CRWMS M&O, 2001e; Assumption 11) is that results from the near-field thermal-hydrological-chemical coupled processes model (CRWMS M&O, 2000x) can be used to bound the effects of similar coupled	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1 Agreements 4 and 7, and Subissue 2 Agreement 6). Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		processes on far-field flow and transport. This assumption has not yet been verified. Predicted mineralogical changes (CRWMS M&O, 2000x) in response to the thermal effects of the repository are small (calcite only). Predicted changes in porosity and permeability are also small. Transport through fractures is conservatively modeled in the Total System Performance Assessment–Site Recommendation, assuming no retardation. The screening argument, however, only addresses changes in seepage water chemistry. It does not address the possibility of reduced (or enhanced) matrix diffusion through precipitation and dissolution. Diffusion into the matrix and sorption on matrix minerals can be an important retardation mechanism. The effect of small-volume changes on fracture armoring and diffusion into the matrix may be important. The current screening arguments will depend, in part, on the demonstration of Assumption 11 that far-field changes to radionuclide transport in the unsaturated zone will be less than the calculated near-field changes (CRWMS M&O, 2001e). Effects on flow are excluded based on low consequence. Problems with modeling of drift-scale coupled processes (CRWMS M&O, 2000x) used to support this screening argument have been raised by NRC. The DOE has agreed to provide additional technical basis for the screening argument (Reamer, 2001e).	
UZ3	J-10	2.2.08.06.00 (Complexation in Geosphere) is excluded. DOE included the effects of ambient condition complexation in the Total System Performance Assessment–Site Recommendation abstraction of radionuclide transport in the unsaturated zone, but has excluded future changes (CRWMS M&O, 2000d, 2001e). The effects of complexation are "implicitly included in the radionuclide sorption coefficients," but there is no clear technical basis regarding the effects of organics or other ligands provided in establishing the K_d distributions (CRWMS M&O 2001e). Experimental results reported in Triay, et al. (1997) that form much of the basis for the sorption coefficient distributions only address the effects of organics on neptunium and plutonium sorption. The analysis and model report (CRWMS M&O, 2000w) does not provide additional information on the effect of organics on other radionuclides. The current process models do not address the effects of complexation on transport parameters, and the exclusion of changes to complex formation does not have sufficient support. In addition, the screening argument refers to modeling results on repository effects on seepage chemistry, which may not be relevant to transport conditions below the repository (CRWMS M&O, 2001e).	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1 Agreement 4, and Subissue 4 Agreements 3 and 4, and Radionuclide Transport Subissue 1 Agreement 5). Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work.
Dose2 Dose3	20	The Yucca Mountain Project Database (CRWMS, 2001g) does not indicate that 2.2.08.07.00 (Radionuclide Solubility Limits in the Geosphere) is relevant to the biosphere. This item is relevant for limiting the quantity of radioactive material that can leach radionuclides out of the soil or tephra deposit in the biosphere compared with the quantity of radionuclides that would be predicted to leach out of the deposit using only leach rate limits.	DOE will add this item to Evaluation of the Applicability of Biosphere-Related Features, Events, and Processes, ANL–MGR–MD–000011, and present the DOE discussion in the screening argument.
UZ3	J-11	2.2.08.07.00 (Radionuclide Solubility Limits in the Geosphere) is excluded from the Total System Performance Assessment–Site Recommendation abstraction of radionuclide transport in the unsaturated	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 4 Agreement 3). Features, Events, and Processes in UZ Flow and Transport,

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		zone on the basis of low consequence (CRWMS M&O, 2000d, 2001e). The DOE screening argument assumes that radionuclide solubility limits in the geosphere may be different and indicates that radionuclide solubility limits in the geosphere are conservatively ignored with respect to solubility reduction in the far field (CRWMS M&O, 2000d). The possibility of increasing solubility limits, however, should also be considered. Solubility limits in the geosphere will be determined by interaction between the contaminant plume and the host rock.	ANL–NBS–MD–000001, will be revised on completion of this work.
UZ3 SZ2	J-12	2.2.10.01.00 (Repository-Induced Thermal Effects in Geosphere) is excluded from the Total System Performance Assessment–Site Recommendation abstraction of radionuclide transport in the unsaturated zone on the basis of low consequence (CRWMS M&O, 2000d, 2001e). The screening argument is only partially supported by near-field thermal-chemical modeling for a limited number of hydrochemical constituents and minerals (CRWMS M&O, 2000x) and is not directly related to the effects on radionuclide transport. The exclusion of 2.2.10.01.00 (Repository-Induced Thermal Effects in Geosphere) will depend, in part, on the verification of Assumption 11 that far-field changes to radionuclide transport in the unsaturated zone will be less than the calculated near-field changes (CRWMS M&O, 2001e).	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1 Agreement 4, and Subissue 4 Agreements 3 and 4, and Radionuclide Transport Subissue 1 Agreement 5). Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work.
SZ1	13	2.2.10.02.00 (Thermal Convection Cell Develops in Saturated Zone) is screened as excluded on the basis of low consequence (CRWMS M&O, 2000b). DOE indicates that temperatures at the water table are expected to approach 80 °C [176 °F]. DOE further points out the resulting concern is that thermally driven water flow in the upper tuff aquifer could increase ground water velocities relative to the system without heat sources. Additional justification for exclusion should be provided.	DOE agreed to provide clarification of the screening argument in Features, Events, and Processes in Saturated Zone Flow and Transport, ANL–NBS–MD–000002, to address the NRC comment.
UZ2 SZ1 SZ2	3	2.2.10.03.00 (Natural Geothermal Effects). It is stated that natural geothermal effects are included because the current geothermal gradient is addressed in the saturated zone flow and transport model (CRWMS M&O, 2001f). This discussion, however, does not address the potential for spatial and temporal variations in that gradient, which is part of the description of 2.2.10.03.00 (Natural Geothermal Effects). Resolution of this issue is necessary to address changes in the geothermal gradient in 2.2.10.13.00 [Density-Driven Groundwater Flow (Thermal)].	This issue is addressed by an existing DOE and NRC agreement (Unsaturated and Saturated Flow Under Isothermal Conditions Subissue 5, Agreement 13). Features, Events, and Processes in Saturated Zone Flow and Transport, ANL–NBS–MD–000002, will be updated, as necessary, to reflect the results of this existing agreement.
ENG2 ENG3 UZ2	70	2.2.10.04.00 (Thermal-Mechanical Alteration of Fractures Near Repository) is screened excluded on the basis of low consequence (CRWMS M&O, 2000h, 2001c). See discussion in 2.2.06.01.00 [Changes in Stress (Due to Thermal, Seismic, or Tectonic Effects), Change Porosity, and Permeability of Rock]. Heat from the waste causes thermal expansion of the surrounding rock, generating compressive stresses near the drifts and extensional stresses away from them. The zone of compression migrates with time.	The thermal-mechanical effects on rock properties are addressed by an existing DOE and NRC agreement (Repository Design and Thermal-Mechanical Effects Subissue 3, Agreements 20 and 21). FEPs in Thermal Hydrology and Coupled Processes, ANL–NBS–MD–000004, will be revised on completion of this work.
UZ2	67	2.2.10.05.00 (Thermal-Mechanical Alteration of Rocks Above and Below the Repository) is screened as excluded on the basis of low consequence (CRWMS M&O, 2001c). Thermal-mechanical compression at the repository produces tension-fracturing in the paintbrush nonwelded tuff and other units above the repository. These fractures alter unsaturated zone flow between	DOE planned to analyze the effects of thermal-hydrological-mechanical coupled processes with regard to drainage in the pillars and flow in the vicinity of the drifts and thermal-hydrological/thermal-hydrological-chemical/thermal-hydrological-mechanical analyses to quantify uncertainties in the thermal seepage model. In addition, thermal-hydrological-mechanical continuum

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		the surface and the repository. Extreme fracturing may propagate to the surface, affecting infiltration. Thermal fracturing in rocks below the repository affects flow and radionuclide transport to the saturated zone.	modeling will address thermal- mechanical effects in rocks above and below the repository at a mountain scale in an update to the Coupled Thermal-Hydrological-Mechanical Effects on Permeability Analysis and Model Report, ANL–NBS–HS–000037. DOE will clarify the screening arguments in the FEPs in Thermal Hydrology and Coupled Processes, ANL–NBS–MD–000004, on completion of this agreement.
ENG3 UZ2 UZ3 SZ1 SZ2 UZ3	64 9	2.2.10.06.00 [Thermal-Chemical Alteration (Solubility Speciation, Phase Changes, and Precipitation/Dissolution)] [Near-Field Environment]: Screened as excluded on the basis of low consequence (CRWMS M&O, 2001c). Changes in the ground water temperature in the farfield, if significant, may change the solubility and speciation of certain radionuclides. This change could have the effect of altering radionuclide transport processes. Relevant processes include volume effects associated with silica phase changes, precipitation and dissolution of fracture-filling minerals (including silica and calcite), and alteration of zeolites and other minerals to clays. [Saturated Zone]: Screened as excluded on the basis of low consequence (CRWMS M&O, 2001f) with reference to the screening argument for 2.2.07.10.00 (Condensation Zone Forms Around Drifts) in (CRWMS M&O, 2001e). The argument that repository thermal effects on saturated zone radionuclide transport will be minimal is based on a to-be-verified assumption (CRWMS M&O, 2001e). There is no explicit technical basis presented that rock alteration or temperature effects on geochemical properties and processes will negligibly affect saturated zone transport. In addition, it is asserted in CRWMS M&O (2001f) that any such effects would be within the bounds of uncertainty ranges established for transport properties such as K_d. However, the relevant analysis and model report (CRWMS M&O, 2000w) does not provide a clear technical basis that this is the case. DOE should provide additional technical justification for exclusion. Same comment applies to 2.2.10.08.00 (Thermal-Chemical Alteration of the Saturated Zone). [Unsaturated Zone]: DOE has not provided the technical basis for excluding entrained colloids in the analysis of 2.2.10.06.00 [Thermo-Chemical Alteration (Solubility Speciation, Phase Changes, and Precipitation/Dissolution)] or an alternative database entry (CRWMS M&O, 2001e). DOE has not considered possible entrainment of colloids and particulates in convecting/advecting boiling fluids or by otherwise vigorous water movement in the drift.	[Near-Field Environment]: This issue is addressed by an existing agreement between DOE and NRC (Evolution of the Near-Field Environment Subissue 1, Agreement 3). FEPs in Thermal Hydrology and Coupled Processes, ANL–NBS–MD–000004, will be revised on completion of this work. [Saturated Zone]: DOE agreed to provide clarification of the screening argument in Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, to address the NRC comment. [Unsaturated Zone]: At the Evolution of the Near-Field Environment Technical Exchange, DOE agreed to provide the technical basis for excluding entrained colloids in the analysis of 2.2.10.06.00 (Thermal-Chemical Alteration) or an alternative features, events, and processes (Evolution of the Near-Field Environment Subissue 1, Agreement 6). DOE will provide the technical basis for screening entrained colloids in the analysis of 2.2.10.06.00 (Thermal-Chemical Alteration) in a future revision of Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000001, expected to be available in fiscal year 2002.
UZ3	J-13	2.2.10.06.00 [Thermal-Chemical Alteration (Solubility, Speciation, Phase Changes, Precipitation/Dissolution)] is excluded from the Total System Performance Assessment–Site Recommendation abstraction of radionuclide transport in the unsaturated zone on the basis of low consequence (CRWMS M&O, 2000d, 2001e). Thermal effects on chemistry at the mountain scale are expected to be low, based on near-field coupled thermal-hydrological-chemical models that indicate the thermal effects of the repository result in only small changes in major hydrochemical constituents and limited changes in mineralogy, however, model results in the cited report (CRWMS M&O, 2000x) only	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1 Agreement 4, and Subissue 4 Agreements 3 and 4, and Radionuclide Transport Subissue 1 Agreement 5). Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		consider a few components in hydrochemistry important to container life (e.g., pH, total carbon, and calcium). The model is limited to calcite precipitation/dissolution and addresses only seepage water chemistry. Thermal-chemical effects on transport beneath the repository, which could reflect the influence of the engineered barrier system and waste form materials, are not considered. In addition, although the assumption that far-field changes are likely to be less than near-field changes is reasonable, it has not been verified (CRWMS M&O, 2001e). The technical basis should be strengthened to demonstrate low consequence. The evaluation of this exclusion will depend in part on the verification of Assumption 11 that far-field changes to radionuclide transport in the unsaturated zone will be less than the calculated near-field changes (CRWMS M&O, 2001e).	
UZ2 UZ3	J-14	2.2.10.07.00 (Thermal-Chemical Alteration of the Calico Hills Unit) is excluded from the Total System Performance Assessment–Site Recommendation abstraction of radionuclide transport in the unsaturated zone on the basis of low consequence (CRWMS M&O, 2001e). The screening argument is based on the prediction of small changes in aqueous geochemistry and mineralogy in response to coupled thermal-hydrological-chemical processes in the near field (CRWMS M&O, 2000x). Thermal-chemical changes in the far field, including the Calico Hills unit, will be even less significant (CRWMS M&O, 2001e; Assumption 11). The screening argument indicates that temperatures in the zeolite-bearing Calico Hills unit, will not be high enough to cause significant zeolite alteration. Final evaluation of this exclusion will depend, in part, on the verification of Assumption 11 that far-field changes to radionuclide transport in the unsaturated zone will be less than the calculated near-field changes (CRWMS M&O, 2001e). Alteration of the uppermost nonwelded layers below the repository could significantly reduce the fraction of matrix flow below the repository. Nonwelded vitric horizons, either basal Topopah Springs vitrophyre or the uppermost Calico Hills unit, cover nearly half the repository. In the southwestern portion of the repository footprint, the nonwelded, nonaltered tuffs lie as little as 45 m [147.64 ft] below the repository. The screening argument (CRWMS M&O, 2001e) includes the assertion that temperatures in the Calico Hills unit will remain below 70 ˚C [158 ˚F], which is not high enough to cause significant zeolite alteration. According to the cited reference, however, it appears temperatures can exceed 70 ˚C [158 ˚F] {up to 85 ˚C [185 ˚F]} is estimated from figures in the cited section of CRWMS M&O, 2000z} where the nonwelded, nonaltered tuff is closest to the repository.	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1 Agreement 4, and Subissue 4 Agreements 3 and 4, and Radionuclide Transport Subissue 1 Agreement 5). Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work. DOE also stated that alteration of vitric rock has not been addressed and will need to be included in the overall thermal-hydrological-chemical analyses.
SZ1 SZ2	9	2.2.10.08.00 (Thermal-Chemical Alteration of the Saturated Zone). See comment on 2.2.10.06.00 [Thermal-Chemical alteration (solubility speciacion, phase changes, precipitation/dissolution)].	See comment on 2.2.10.06.00 [Thermal-Chemical Alteration (solubility speciacion, phase changes, precipitation/dissolution)].
UZ2 UZ3	J-15	2.2.10.09.00 (Thermal-Chemical Alteration of the Topopah Spring Basal Vitrophyre) is excluded from the Total System Performance Assessment–Site Recommendation abstraction of radionuclide transport in the unsaturated zone on the basis of low consequence (CRWMS M&O, 2000d, 2001e). The screening argument is based on predicting small changes in aqueous geochemistry and mineralogy in	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1 Agreement 4, and Subissue 4 Agreements 3 and 4, and Radionuclide Transport Subissue 1 Agreement 5). Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
		response to coupled thermal-hydrological-chemical processes in the near field (CRWMS M&O, 2000x). Thermal-chemical changes in the far field, including the Topopah Spring basal vitrophyre, are expected to be even less significant (CRWMS M&O, 2001e). Although the assumption that far-field changes are likely to be less than near-field changes (Assumption 11) is reasonable, this assumption has not been verified (CRWMS M&O, 2001e). It is important to note that the near-field analyses (CRWMS M&O, 2000x) focus on seepage chemistry and how it might affect container life, rather than considering thermal effects on radionuclide transport. The technical basis should be strengthened to demonstrate low consequence to radionuclide transport. Alteration of the uppermost nonwelded layers below the repository could significantly reduce the fraction of matrix flow below the repository. Nonwelded vitric horizons, either basal Topopah Spring vitrophyre or the uppermost Calico Hills unit, cover nearly half the repository. In the southwestern portion of the repository footprint, the nonwelded, nonaltered tuffs lie as little as 45 m [147.64 ft] below the repository. The screening argument for 2.2.10.07.00 (CRWMS M&O, 2001e) includes the assertion that temperatures in the Calico Hills unit will remain below 70˚C [158 ˚F] which is not high enough to cause significant zeolite alteration. According to the cited reference, however, it appears temperatures can exceed 70˚C [158 ˚F] {up to 85˚C [185 ˚F] is estimated from figures in the cited section of CRWMS M&O (2000z)} where the nonwelded, nonaltered tuff is closest to the repository. Temperatures would be higher in the overlying Topopah Spring basal vitrophyre than in Calico Hills.	
UZ1 UZ2	61	2.2.10.12.00 (Geosphere Dryout Due to Waste Heat). It is necessary to develop a screening argument for this item as part of the scope of the analysis and model report (CRWMS M&O, 2001e). Elevated thermal effects on shallow infiltration from changes in soil water content were not addressed for 2.2.10.12.00 (Geosphere Dryout Due to Waste Heat). The DOE study of a natural thermal gradient on Yucca Mountain addresses this item (CRWMS M&O, 1998b). 2.2.10.12.00 (Geosphere Dryout Due to Waste Heat) is screened as included in CRWMS M&O (2001c) for issues related to the near-field environment, but does not address the effects on infiltration.	DOE agreed to provide the technical basis for the screening argument in Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, to address the NRC comment.
UZ2 SZ1 SZ2	12	2.2.10.13.00 [Density-Driven Groundwater Flow (Thermal)]. The analysis and model report (CRWMS M&O, 2001f) addresses this item in two parts: repository-induced effects (excluded, low consequence) and natural geothermal effects (included). Natural effects are included only to the extent that the natural geothermal gradient is applied in the saturated zone flow and transport model. However, changes in thermal gradients are excluded on the basis of low consequence, with reference to 1.2.06.00.00 (Hydrothermal Activity) and 1.2.10.02.00 (Hydrologic Response to Igneous Activity) (CRWMS M&O, 2001f). A clear technical basis is not provided for these items that all possible changes in thermal gradients will be localized. The screening argument for 1.2.06.00.00 (Hydrothermal Activity) focuses on geochemical effects (see separate entry), whereas 1.2.10.02.00 (Hydrologic Response to Igneous Activity) is focused on highly localized igneous intrusions. How these arguments apply to 2.2.10.13.00 [Density-Driven Groundwater Flow (Thermal)] is not entirely clear.	This issue is addressed by an existing DOE and NRC agreement (Unsaturated and Saturated Flow Under Isothermal Conditions Subissue 5, Agreement 13). Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, will be updated to clarify the screening argument and to reflect the results of this existing agreement.

Table B–1. NRC Comments on Features, Events, and Processes Including, DOE and NRC Agreements (continued)			
Integrated Subissue	**Technical Exchange**	**Comment**	**DOE Responses to 2001 Technical Exchanges**
UZ2	J-21	2.2.11.02.00 (Gas Pressure Effects) is excluded based on low consequence and low probability (CRWMS M&O, 2001e). Consistency is needed in the screening arguments. Buildup of water vapor pressure within rock matrix blocks from waste heat has not been considered. Gas pressure can build up within matrix blocks that have low permeability. This condition can increase the boiling point and keep water in the liquid phase at higher temperatures. Flashing to vapor as liquid water leaves the matrix block can result in mineral deposition that can later affect flow pathways.	This issue is addressed by existing agreements between DOE and NRC (Evolution of the Near-Field Environment Subissue 1 Agreements 5 and 7, and Subissue 4 Agreement 3). Features, Events, and Processes in UZ Flow and Transport, ANL–NBS–MD–000001, will be revised on completion of this work.
SZ1 SZ2 Dose1 Dose2 Dose3	10	2.3.11.04.00 (Groundwater Discharge to Surface) is excluded on the basis of low consequence (CRWMS M&O, 2001f). Modeling shows that spring discharge within the 20-km [12.4-mi] radius is not likely, yet past discharges occurred within the 20-km [12.4-mi] radius (e.g., paleospring deposits at 9S and 1S). See discussion of 1.3.07.02.00 (Water Table Rise). Additional technical justification should be provided to fully exclude 2.3.11.04.00 (Groundwater Discharge to Surface).	DOE agreed to provide clarification of the screening argument in Features, Events, and Processes in SZ Flow and Transport, ANL–NBS–MD–000002, to address the NRC comment.
Dose3 Dose2	21	2.3.13.01.00 (Biosphere Characteristics) screening argument indicates the Yucca Mountain region lacks permanent surface water (CRWMS M&O, 2001a). It is not clear this statement is consistent with the geologic record of past climate change in the area.	DOE agreed to provide clarification of the screening argument in Evaluation of the Applicability of Biosphere-Related Features, Events, and Processes (FEP), ANL–MGR–MD–000011, to address the NRC comment.
Dose3	24	2.3.13.02.00 (Biosphere Transport) contains only two secondary entries related to surface water, gas, and biogeochemical transport processes (CRWMS M&O, 2001a). The Yucca Mountain Project feature, event, and process description and the originator description are different and question whether the focus is transport processes, alterations during transport, or both.	DOE agreed to clarify the description of the primary features, events, and processes in Evaluation of the Applicability of Biosphere-Related Features, Events, and Processes (FEP), ANL–MGR–MD–000011, to address the NRC comment.
Dose3	25	2.4.07.00.00 (Dwellings) includes a secondary entry, household cooling, which has an inappropriate screening argument (CRWMS M&O, 2001a). The screening argument indicates that because use of an evaporative cooler would only increase inhalation and direct exposure pathways, and these pathways are only minor contributors to the current dose conversion factors, the use of evaporative coolers can be screened. However, the direct exposure and inhalation dose from evaporative coolers is the result of significantly different processes than the direct exposure and inhalation dose from radionuclides deposited on soils and, hence, could have a more significant dose impact.	DOE agreed to provide the technical basis for the screening argument in Evaluation of the Applicability of Biosphere-Related Features, Events, and Processes (FEP), ANL–MGR–MD–000011, to address the NRC comment.
Dose3 Dose2 Direct2	26	The analysis and model report (CRWMS M&O, 2001a) states that 3.3.08.00.00 (Radon and Daughter Exposure) is screened as excluded on the basis the parent radionuclide (Th-230) will not reach the critical group in 10,000 years in the basecase scenario (CRWMS M&O, 2000aa, 2001a). This rationale, however, does not apply to the direct release scenario, where transport times are much shorter.	DOE agreed to provide the technical basis for the screening argument in Evaluation of the Applicability of Biosphere-Related Features, Events, and Processes (FEP), ANL–MGR–MD–000011, to address the NRC comment.

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CRWMS M&O—Civilian Radioactive Waste Management System Management and Operating Contractor
DOE—U.S. Department of Energy
FEPs—features, events, and processes
NRC—U.S. Nuclear Regulatory Commission
SZ—saturated zone
TSPA—total system performance assessment
UZ—unsaturated zone

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