

PROGRESS REPORT #12

APPENDIX A

**Matrix Mapping the SCP to the Annotated Outline
and Requirements Documents**

APPENDIX A

Because of the changes reflected in the Program Plan and because of increasing site and engineering knowledge, some aspects of the detailed program outlined in the Site Characterization Plan (SCP) have changed. In Chapters 1 through 7, the SCP described the site and summarized repository and waste package designs. In Chapter 8, Section 8.3.1 described site testing plans, while programs for repository (Section 8.3.2), seals (Section 8.3.3), and waste package (Section 8.3.4) were presented in terms of approaches to meeting design requirements, site information needed for design, and the design activities to be performed to develop the design basis. Performance assessment approaches for preclosure and postclosure evaluations were presented in Section 8.3.5, and site information needed and activities to be conducted were also described. The Site Characterization Program Baseline represents a subset of information extracted from the SCP that has undergone controlled revisions since 1988. Similarly, study plans provide expansions of test plans in Section 8.3.1 and have been systematically revised, with changes documented in the Site Characterization Program Baseline and summarized in previous progress reports.

To better describe and document the changes currently occurring in the program, Table 1 was compiled to map the general content of the SCP to the requirements or planning documents that provide the basis for the current program, as well as to appropriate sections of the Annotated Outline for the License Application where the information will be presented. The level of detail provided in this table reflects the status of the design and performance assessment programs, which are currently being reviewed and refocused as new strategies resulting from the Program Plan are implemented. Also lending itself to a more generalized treatment is the site descriptive material that was contained in Chapters 1-5 of the SCP. This information will be fully reflected in upcoming revisions to Section 3.1 of the License Application Annotated Outline.

Changes to the objectives of site studies, as well as to the activity structure within studies, have previously been documented in both the Site Characterization Program Baseline and the Site Design and Test Requirements Document. Currently, the Site Design and Test Requirements Document is the single document presenting the current study plan objectives for the program. Table 2 presents a compilation of ongoing changes and modifications to site program studies and activities since the SCP was issued. This matrix identifies where studies and activities have been combined, deleted, or modified. Some changes shown in Table 2 have not been formally completed, but are included in this compilation for completeness.

Under the Program Plan, the site characterization program initially focuses on the scientific investigations and engineering activities needed to support a Technical Site Suitability evaluation in 1998. Thus, the activities conducted through 1998 emphasize improved understanding of hydrologic processes and expanded knowledge about the geologic framework of the site. If the site appears suitable, the focus of site characterization will shift to acquiring additional site characterization data to support advanced waste package and repository design activities and developing the analyses needed to determine overall site suitability in 2000. Similarly, this information, together with that used to support the 1998 Technical Site Suitability evaluation, will serve as the basis for a license application in 2001.

PROGRESS REPORT #12

Consistent with the Program Plan, major reliance will be placed on containment by the engineered barriers for the 2001 application, while additional data obtained between 2001 and 2008 will improve confidence in performance of natural barriers. This underlying strategy provides the rationale for some of the changes in sequencing and scope of design, performance assessment, and site studies and activities.

Although many site investigations needed to evaluate suitability will be continued to support the licensing process, several will be completed, or nearly so, when the Technical Site Suitability evaluation is made in 1998. The results of these investigations will be incorporated into the license application annotated outline. Data collection, engineering activities, and analyses conducted after the 1998 evaluation will focus on the primary objective of submitting a successful License Application to the U.S. Nuclear Regulatory Commission (NRC) in 2001.

Additional information regarding long-term performance will be provided in the phases after the initial license application. The initial license application for construction authorization will be followed later by an updated application for a license to receive and possess spent nuclear fuel and high-level waste in about 2008, and a final application for a license amendment to close the repository. Additional applications for license amendments to permit changes in design or operating conditions may be submitted as needed.

Repository and waste package design information and plans are under development with Advanced Conceptual Design activities providing some information. The focus in repository design has been to ensure that interfaces to the Exploratory Studies Facility (ESF) are adequately defined and developed. For regulatory control, the Civilian Radioactive Waste Management System Requirements Document establishes the technical requirements for the entire program (including waste acceptance, storage, and transportation). The Mined Geologic Disposal System Requirements Document is the controlling document for the Yucca Mountain Site Characterization Project. It defines the Program-level requirements for designing the repository, the engineered barrier system, the ESF, and surface-based testing facilities.

The next level is Project documentation, which establishes design requirements and specifications for the repository, for the facilities at the site to support site characterization, and for the engineered barrier system. These design requirements documents are the Repository Design Requirements Document, the Site Design and Test Requirements Document, and the Engineered Barrier Design Requirements Document.

Under the Site Design and Test Requirements Document, are more specific documents for controlling the site characterization activities. These documents address the ESF and the facilities supporting surface-based testing. The Exploratory Studies Facility Design Requirements Document describes the functions to be performed by and the design requirements for facilities, underground openings, utilities, and services of the ESF. The Surface-Based Testing Facilities Requirements Document identifies requirements for facilities needed to support sampling and testing to be carried out from the ground surface.

PROGRESS REPORT #12

In Sections 8.3.2 through 8.3.5, the SCP described approaches that would be taken to demonstrate compliance with design and performance requirements (issue resolution strategies) for each major 10 CFR Part 60 requirement. These approaches were expected to be revised as site knowledge increased and results from performance assessment and modeling activities became available. Similarly, implementing the Program Plan is likely to result in the need to revise some of these approaches. The process of resolving Site Characterization Analysis open items results in important feedback from NRC staff and potential revisions to original plans, for example for the proposed approach for meeting the requirement for substantially complete containment by the waste package. Similarly, focused interactions with NRC staff on topics, such as the approach to defining and calculating ground-water travel time, have provided the basis for improving the approaches described in the SCP. To date, the general changes to the approaches have been summarized in appropriate sections of progress reports. The Department of Energy is currently considering whether changes to approaches for demonstrating compliance have become substantive enough to warrant more-detailed documentation to serve as supporting references for future progress reports.

PROGRESS REPORT #12

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Table 1. Matrix of SCP Chapters and Sections

SCP Chapter/Section	LA AO ^a Section	Requirements Document or Planning Document	Comments
1 - Geology	3.1, 3.1.1, 3.1.1.1, 3.1.1.2, 3.1.1.3	Not applicable	The Annotated Outline for the License Application will update the site descriptive materials presented in Chapters 1-5 of the SCP
2 - Geoengineering	3.1.1.2.7	Not applicable	Same as 1
3 - Hydrology	3.1.2, 3.1.2.1, 3.1.2.2, 3.1.2.3	Not applicable	Same as 1
4 - Geochemistry	3.1.3, 3.1.3.1, 3.1.3.2	Not applicable	Same as 1
5 - Climate	3.1.4, 3.1.4.1, 3.1.4.2, 3.1.4.3	Not applicable	Same as 1
6 - Conceptual Design of a Repository	4.0, 4.1, 7.0	<p>Site Characterization Program Baseline (SCPB)</p> <p>Initial Summary Report for Advanced Conceptual Design (ACD)</p> <p>Repository Design Requirements Document (RDRD)</p>	<p>Revision 14 of the SCPB will substantially change the scope of the document; this revision will describe the conceptual design of the repository at a summary level of detail</p> <p>See Chapters 7 and 8 in the Summary Report for ACD</p> <p>Contains design basis requirements</p>

Table 1. Matrix of SCP Chapters and Sections

SCP Chapter/Section	LA AO ^a Section	Requirements Document or Planning Document	Comments
6 - Conceptual Design of a Repository (continued)		Controlled Design Assumptions (CDA)	The CDA documents management decisions and/or assumptions, based on best available information or engineering judgment, and provides references to plans and schedules to substantiate the assumptions; appropriate assumptions are also listed in the RDRD as requirements with a "to be verified" (TBV) designation
7 - Waste Package	4.1, 5.1	SCPB Initial Summary Report for ACD Engineered Barrier Design Requirements Document (EBDRD) CDA	Revision 14 of the SCPB will substantially change the scope of the document; this revision will describe the conceptual design of the waste package at a summary level of detail See Chapter 6 of ACD Summary Report Contains design basis requirements The appropriate assumptions from this document are also listed in the EBDRD as requirements with a TBV designation
8 - Site Characterization Program			
8.0 - Introduction		Program Plan Vol. 2	Introductory material updated in Program Plan
8.1 - Rationale		SCPB Program Plan, Vol 2	Summary information on Rationale for Site Characterization Program and general approach to issue resolution remains applicable and will be updated as appropriate

Table 1. Matrix of SCP Chapters and Sections

SCP Chapter/Section	LA AO^a Section	Requirements Document or Planning Document	Comments
8.2 - Issues		SCPB Program Plan, Vol 2	Summary information on Issues-based approach remains applicable and will be updated as appropriate
8.3 - Planned Tests, Analyses, and Studies	1.6	Site Design and Test Requirements Document (SDTRD)	SDTRD provides study plan objectives for site program
8.3.1 - Site Program	1.6	SDTRD	SDTRD provides study plan objectives for site program; See Table A-2 for compilation of changes to studies and activities
8.3.2 - Repository Program	4.1, 4.2, 4.3, 4.4, 4.5, 7.0	RDRD EBDRD	Sections 3.2 and 3.7 of the RDRD and EBDRD capture the repository requirements; revisions to SCP repository design activities occur as the design program moves forward and are/will be documented in this and future Progress Reports
8.3.3 - Seal Program	4.1.2, 4.3	RDRD EBDRD	Sections 3.7 of the RDRD and 3.2 of the EBDRD capture the seal requirements; revisions to SCP seal design activities will occur as the design program moves forward and will be documented in future Progress Reports
8.3.4 - Waste Package	4.1, 5.0, 5.1.1, 5.2	EBDRD	Section 3.7 of the EBDRD captures the waste package requirements; revisions to SCP waste package design activities occur as the design program moves forward and are/will be documented in this and future Progress Reports

Table 1. Matrix of SCP Chapters and Sections

SCP Chapter/Section	LA AO ^a Section	Requirements Document or Planning Document	Comments
8.3.5 - Performance Assessment Program: Preclosure	2.5, 4.1, 4.2, 4.3, 4.4, 4.5, 5.1, 5.2, 6.0, 7.0	RDRD EBDRD	Sections 3.2 of the RDRD and EBDRD cover preclosure performance assessment requirements; revisions to SCP preclosure performance assessment activities will occur to support the interim site suitability milestone for Radiological Safety and repository design activities, and are/will be documented in this and future Progress Reports
8.4 - Planned Site Preparation Activities		ESFDR, SCPB	SCPB Rev. 14 will provide a summary level description of the Exploratory Facilities Design and document interfaces to the Geologic Repository Operation Area
8.5 - Milestones, Decision Points, and Schedule		Program Plan Vol. 2	Detailed schedules and milestones for Program Plan activities for Fiscal Year 1996 and out-years are under development; Annual Plans and Technical Implementation Plans are tools that are being used to document detailed planning basis for site characterization, design, and performance assessment activities in support of Program Plan
8.6 - Quality Assurance Program	10.2	Quality Assurance Requirements Document (QARD)	The QARD and the procedures that implement it have replaced the Quality Assurance Plan that served as the basis for Section 8.6
8.7 - Decontamination and Decommissioning	4.1.1.11, 4.1.2.6, 4.1.3.9	RDRD, ESFDR	Requirements for decommissioning are captured in RDRD and ESFDR

a License Application Annotated Outline

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity		Comments	SDTRD^a Section	LA AO^b Section	PR^c Section
8.3	Planned Tests, Analyses, and Studies	N/A			N/A
8.3.1	Site Program	N/A	3.2.1.1	1.6	Ch. 3
8.3.1.1	Program: Site Overview	N/A			N/A
8.3.1.2	Program: Geohydrology	N/A	3.2.1.2	3.1.2	3.1
8.3.1.2.1	Investigation: Studies to Provide a Description of the Regional Hydrologic System	N/A	3.2.1.2.A		N/A
8.3.1.2.1.1	Study: Characterization of the Meteorology for Regional Hydrology	Ongoing	3.2.1.2.A.1	3.1.4, 3.1.4.1	3.1.1
8.3.1.2.1.2	Study: Characterization of Runoff and Streamflow	Ongoing	3.2.1.2.A.2	3.1.2.1, 3.1.2.1.1	3.1.2
8.3.1.2.1.3	Study: Characterization of the Regional Ground-Water Flow System	Ongoing	3.2.1.2.A.3	3.1.2.2	3.1.3
8.3.1.2.1.4	Study: Regional Hydrologic System Synthesis and Modeling	Ongoing	3.2.1.2.A.4	3.1.2.2	3.1.4
8.3.1.2.2	Investigation: Studies to Provide a Description of the Unsaturated Zone Hydrologic System at the Site	N/A	3.2.1.2.B		N/A

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD^a Section	LA AO^b Section	PR^c Section
8.3.1.2.2.1 Study: Characterization of Unsaturated-Zone Infiltration	Ongoing	3.2.1.2.B.1	3.1.2.3	3.1.5
8.3.1.2.2.2 Study: Water Movement Test	Ongoing	3.2.1.2.B.2	3.1.2.3	3.1.6
8.3.1.2.2.3 Study: Characterization of Percolation in the Unsaturated-Zone Surface-Based Study	Ongoing	3.2.1.2.B.3	3.1.2.3	3.1.7
8.3.1.2.2.4 Study: Characterization of the Yucca Mountain Percolation in the Unsaturated Zone in the Exploratory Studies Facility	Ongoing Act. 8.3.1.2.2.4.6 - Tests transferred to other activities. Testing in the Calico Hills Formation will be part of other ESF test activities. Act. 8.3.1.2.2.4.9 - Deleted. Testing is no longer planned in an exploratory <u>shaft</u> . This activity comprised tests specific to a shaft.	3.2.1.2.B.4	3.1.2.3	3.1.8

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity		Comments	SDTRD^a Section	LA AO^b Section	PR^c Section
8.3.1.2.2.5	Study: Diffusion Tests in the Exploratory Studies Facility	Ongoing	3.2.1.2.B.5	3.1.2.3	3.1.9
8.3.1.2.2.6	Study: Characterization of Gaseous-Phase Movement in the Unsaturated Zone	Ongoing	3.2.1.2.B.6	3.1.2.3	3.1.10
8.3.1.2.2.7	Study: Hydrochemical Characterization of the Unsaturated Zone	Ongoing	3.2.1.2.B.7	3.1.2.3	3.1.11
8.3.1.2.2.8	Study: Fluid Flow in Unsaturated, Fractured Rock	Ongoing	3.2.1.2.B.8	3.1.2.3	3.1.12
8.3.1.2.2.9	Study: Site Unsaturated-Zone Modeling and Synthesis	Ongoing	3.2.1.2.B.9	3.1.2.3	3.1.13
8.3.1.2.3	Investigation: Studies to Provide a Description of the Saturated Zone Hydrologic System at the Site	N/A	3.2.1.2.C	3.1.2.3	N/A
8.3.1.2.3.1	Study: Characterization of the Site Saturated-Zone Ground-Water Flow System	Ongoing	3.2.1.2.C.1	3.1.2.3	3.1.14
8.3.1.2.3.2	Study: Characterization of the Saturated-Zone Hydrochemistry	Ongoing	3.2.1.2.C.2	3.1.2.3	3.1.15

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.2.3.3 Study: Saturated-Zone Hydrologic System Synthesis and Modeling	Ongoing	3.2.1.2.C.3	3.1.2.3	3.1.16
8.3.1.3 Program: Geochemistry	N/A	3.2.1.3	3.1.3	3.2
8.3.1.3.1 Investigation: Studies to Provide the Information on Water Chemistry Within the Potential Emplacement Horizon and Along Potential Flow Paths	N/A	3.2.1.3.A		N/A
8.3.1.3.1.1 Study: Ground-Water Chemistry Model	Ongoing	3.2.1.3.A.1	3.1.3.2	3.2.1
8.3.1.3.2 Investigation: Studies to Provide the Information on Mineralogy, Petrology, and Rock Chemistry Within the Potential Emplacement Horizon and Along potential Flow Paths	N/A	3.2.1.3.B		N/A
8.3.1.3.2.1 Study: Mineralogy, Petrology, and Chemistry of Transport Pathways	Ongoing	3.2.1.3.B.1	3.1.3.2	3.2.2
8.3.1.3.2.2 Study: History of Mineralogical and Geochemical Alteration of Yucca Mountain	Ongoing	3.2.1.3.B.2	3.1.3.2	3.2.3
8.3.1.3.3 Investigation: Studies to Provide the Information Required on Stability of Minerals and Glasses	N/A	3.2.1.3.C		N/A

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.3.3.1 Study: Natural Analog of Hydrothermal Systems in Tuff	This study is no longer planned. This study is not site characterization work, would not substitute for site-specific data, and has utility only in reducing uncertainties in EQ3/6 applications. Overlaps work planned in Studies 8.3.4.2.4.1 and 8.3.1.20.1.1	3.2.1.3.C.1	3.1.3.2	3.2.4
8.3.1.3.3.2 Study: Kinetics and Thermodynamics of Mineral Evolution	Ongoing	3.2.1.3.C.2	3.1.3.2	3.2.5
8.3.1.3.3.3 Study: Conceptual Model of Mineral Evolution	Work scope of this study has been combined with Study 8.3.1.3.3.2	3.2.1.3.C.3	3.1.3.2	3.2.6
8.3.1.3.4 Investigation: Studies to Provide the Information Required on Radionuclide Retardation by Sorption Processes Along Flow Paths to the Accessible Environment	N/A	3.2.1.3.D		N/A
8.3.1.3.4.1 Study: Batch Sorption Studies	Ongoing Incorporates Study 8.3.1.3.4.3	3.2.1.3.D.1	3.1.3.2	3.2.7
8.3.1.3.4.2 Study: Biological Sorption and Transport	Ongoing	3.2.1.3.D.2	3.1.3.2	3.2.8
8.3.1.3.4.3 Study: Development of Sorption Models	Work scope of this study has been combined with Study 8.3.1.3.4.1	3.2.1.3.D.3	3.1.3.2	3.2.9

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD^a Section	LA AO^b Section	PR^c Section
8.3.1.3.5 Investigation: Studies to Provide the Information Required on Radionuclide Retardation by Precipitation Processes Along Flow Paths to the Accessible Environment	N/A	3.2.1.3.E		N/A
8.3.1.3.5.1 Study: Dissolved Species Concentration Limits	Ongoing	3.2.1.3.E.1	3.1.3.2	3.2.10
8.3.1.3.5.2 Study: Colloid Behavior	Out-Year	3.2.1.3.E.2	3.1.3.2	3.2.11
8.3.1.3.6 Investigation: Studies to Provide the Information Required on Radionuclide Retardation by Dispersive, Diffusive, and Advective Processes Along Flow Paths to the Accessible Environment	N/A	3.2.1.3.F		N/A
8.3.1.3.6.1 Study: Dynamic Transport Column Experiments	Ongoing	3.2.1.3.F.1	3.1.3.2	3.2.12
8.3.1.3.6.2 Study: Diffusion	Ongoing	3.2.1.3.F.2	3.1.3.2	3.2.13

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity		Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.3.7	Investigation: Studies to Provide the Information Required on Radionuclide Retardation by all Processes Along Flow Paths to the Accessible Environment	N/A	3.2.1.3.G		N/A
8.3.1.3.7.1	Study: Retardation Sensitivity Analysis	Ongoing	3.2.1.3.G.1	3.1.3.2	3.2.14
8.3.1.3.7.2	Study: Demonstration of Applicability of Laboratory Data to Repository Transport Calculations	Ongoing	3.2.1.3.G.2	3.1.3.2	3.2.15
8.3.1.3.8	Investigation: Studies to Provide the Information Required on Retardation of Gaseous Radionuclides Along Flow Paths to the Accessible Environment	N/A	3.2.1.3.H		N/A
8.3.1.3.8.1	Study: Gaseous Radionuclide Transport Calculations and Measurements	This study is no longer planned. Already covered under Study 8.3.1.2.2.6 and Act. 8.3.1.3.7.1.3 Awaiting EPA Section 801 Rulemaking	3.2.1.3.H.1		3.2.16
8.3.1.4	Program: Rock Characteristics	N/A	3.2.1.4		3.3
8.3.1.4.1	Investigation: Development of an Integrated Drilling Program and Integration of Geophysical Activities	N/A	3.2.1.4.A		N/A
8.3.1.4.1.1	Activity: Development of an Integrated Drilling Program	This study is no longer planned.	3.2.1.4.A.1.a		3.3.1

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity		Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.4.1.2	Activity: Integration of Geophysical Activities	Ongoing	3.2.1.4.A.1.b		3.3.2
8.3.1.4.2	Investigation: Geologic Framework of the Yucca mountain Site	N/A	3.2.1.4.B		N/A
8.3.1.4.2.1	Study: Characterization of the Vertical and Lateral Distribution of Stratigraphic Units Within the Site Area	Ongoing	3.2.1.4.B.1	3.1.1.2.2	3.3.3
8.3.1.4.2.2	Study: Characterization of the Structural Features Within the Site Area	Ongoing	3.2.1.4.B.2	3.1.1.2.3	3.3.4
8.3.1.4.2.3	Study: Three-Dimensional Geologic Model	Ongoing	3.2.1.4.B.3	3.1.1.2	3.3.5
8.3.1.4.3	Investigation: Development of Three-Dimensional Models of Rock Characteristics at the Repository Site	N/A	3.2.1.4.C		N/A
8.3.1.4.3.1	Study: Systematic Acquisition of Site-Specific Subsurface Information	Ongoing	3.2.1.4.C.1	3.1.1, 3.1.1.2.7	3.3.6
8.3.1.4.3.2	Study: Three-Dimensional Rock Characteristics Models	Ongoing	3.2.1.4.C.2	3.1, 3.1.1	3.3.7
8.3.1.5	Program: Climate	N/A	3.2.1.5		3.4
8.3.1.5.1	Investigation: Studies to Provide the Information Required on Nature and Rates of Change in Climatic Conditions to Predict Future Climates	N/A	3.2.1.5.A	3.1.4.3	N/A

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity		Comments	SDTRD^a Section	LA AO^b Section	PR^c Section
8.3.1.5.1.1	Study: Characterization of Modern Regional Climate	Ongoing	3.2.1.5.A.1	3.1.4.1	3.4.1
8.3.1.5.1.2	Study: Paleoclimate Study: Lake, Playa, and Marsh Deposits	Ongoing	3.2.1.5.A.2	3.1.1.2.2.5, 3.1.2.3.10	3.4.2
8.3.1.5.1.3	Study: Climatic Implications of Terrestrial Paleocology	Ongoing	3.2.1.5.A.3	3.1.4.2	3.4.3
8.3.1.5.1.4	Study: Analysis of the Paleoenvironmental History of the Yucca Mountain Region	Ongoing	3.2.1.5.A.4		3.4.4
8.3.1.5.1.5	Study: Paleoclimate-Paleoenvironmental Synthesis	Planned for FY 1995	3.2.1.5.A.5	3.1.2.2.7	3.4.5
8.3.1.5.1.6	Study: Characterization of the Future Regional Climate and Environments	Ongoing	3.2.1.5.A.6	3.1.4.3	3.4.6
8.3.1.5.2	Investigation: Studies to Provide the Information Required on Potential Effects of Future Climatic Conditions on Hydrologic Characteristics	N/A	3.2.1.5.B		N/A
8.3.1.5.2.1	Study: Characterization of the Quaternary Regional Hydrology	Ongoing	3.2.1.5.B.1	3.1.2.2.7, 3.1.2.3.10, 3.1.4.2	3.4.7

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity		Comments	SDTRD^a Section	LA AO^b Section	PR^c Section
8.3.1.5.2.2	Study: Characterization of the Future Regional Hydrology Due to Climate Changes	Out-Year	3.2.1.5.B.2	3.1.4.3	3.4.8
8.3.1.6	Program: Erosion	This work is completed. Any additional work will be performed under Study 8.3.1.5.1.4.	3.2.1.6	3.1.1.2.1	3.5
8.3.1.7	Program: Rock Dissolution	N/A	3.2.1.7		N/A
8.3.1.8	Program: Postclosure Tectonics	N/A	3.2.1.8		3.6
8.3.1.8.1	Investigation: Studies to Provide the Information Required on Direct Releases Resulting from Volcanic Activity	N/A	3.2.1.8.A		N/A
8.3.1.8.1.1	Study: Probability of Magmatic Disruption of the Repository	Ongoing	3.2.1.8.A.1	3.1.1.2, 3.1.1.3	3.6.1
8.3.1.8.1.2	Study: Physical Processes of Magmatism and Effects on the Repository	Ongoing	3.2.1.8.A.2	3.1.1.3, 4.5	3.6.2

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SCP Program/Investigation/Study/Activity		Comments	SDTRD^a Section	LA AO^b Section	PR^c Section
8.3.1.8.2	Investigation: Studies to Provide the Information Required on Rupture of Waste Packages due to Tectonic Events	N/A	3.2.1.8.B		N/A
8.3.1.8.2.1	Study: Tectonic Effects: Evaluations of Changes in the Natural and Engineered Barrier Systems Resulting from Tectonic Processes and Events	Ongoing Incorporates Investigations 8.3.1.8.3 & 8.3.1.8.4 and Study 8.3.1.8.5.3	3.2.1.8.B.1	3.1.1.3, 5.2.2, 6.2.2	3.6.3
8.3.1.8.3	Investigation: Studies to Provide the Information Required on Changes in Unsaturated and Saturated Zone Hydrology due to Tectonic Events	N/A	3.2.1.8.C		N/A
8.3.1.8.3.1	Study: Analysis of the Effects of Tectonic Processes and Events on Average Percolation Flux Rates Over the Repository	Work scope of this study has been combined with Study 8.3.1.8.2.1	3.2.1.8.C.1	6.2.2	3.6.4
8.3.1.8.3.2	Study: Analysis of the Effects of Tectonic Processes and Events on Changes in Water-Table Elevation	Work scope of this study has been combined with Study 8.3.1.8.2.1	3.2.1.8.C.2	3.1.1.3, 6.3, 6.3.2	3.6.5
8.3.1.8.3.3	Study: Analysis of the Effects of Tectonic Processes and Events on Local Fracture Permeability and Effective Porosity	Work scope of this study has been combined with Study 8.3.1.8.2.1	3.2.1.8.C.3	3.1.1.3	3.6.6
8.3.1.8.4	Investigation: Studies to Provide the Information Required on Changes in Rock Geochemical Properties Resulting from Tectonic Events	N/A	3.2.1.8.D		N/A

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.8.4.1 Study: Analysis of the Effects of Tectonic Processes and Events on Rock Geochemical Properties	Work scope of this study has been combined with Study 8.3.1.8.2.1	3.2.1.8.D.1	3.1.3	3.6.7
8.3.1.8.5 Investigation: Studies to Provide the Information Required by the Analysis and Assessment Investigations of the Tectonics Program	N/A	3.2.1.8.E		N/A
8.3.1.8.5.1 Study: Characterization of Volcanic Features	Ongoing	3.2.1.8.E.1	3.1.1.1.3.2, 3.1.1.2.3.5	3.6.8
8.3.1.8.5.2 Study: Characterization of Igneous Intrusive Features	Ongoing Act. 8.3.1.5.2.1 - Deleted. The technique yields results too ambiguous and too general to be useful. Act. 8.3.1.5.2.2 - Data will be collected under Study 8.3.1.8.1.2.	3.2.1.8.E.2	3.1.1.2	3.6.9
8.3.1.8.5.3 Study: Investigation of Folds in Miocene and Younger Rocks of the Region	Unfunded This study relies on available data, no unique data to be acquired by this study. Work scope transferred to Study 8.3.1.8.2.1	3.2.1.8.E.3	3.1.1.2.3	3.6.10
8.3.1.9 Program: Human Interference	N/A	3.2.1.9		3.7

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.9.1 Investigation: Studies to Provide the Information Required on Natural Phenomena and Human Activities that might Degrade Surface Markers and Monuments	N/A	3.2.1.9.A		N/A
8.3.1.9.1.1 Study: An Evaluation of Natural Processes that Could Affect the Long-Term Survivability of the Surface Marker System at Yucca Mountain	Ongoing No Study Plan. No unique data to be acquired by this study. Data will come from Studies 8.3.1.8.1.2, 8.3.1.8.2.1, 8.3.1.5.1.4 & Erosion Topical Report.	3.2.1.9.A.1	7.10	3.7.1
8.3.1.9.2 Investigation: Studies to Provide the Information Required on Present and Future Value of Energy, Mineral, Land, and Ground-Water Resources	N/A	3.2.1.9.B		N/A
8.3.1.9.2.1 Study: Natural Resource Assessment of Yucca Mountain, Nye County, Nevada	Ongoing	3.2.1.9.B.1	3.1.1.1.5, 3.1.1.2.5	3.7.2
8.3.1.9.2.2 Study: Water Resource Assessment of Yucca Mountain, Nevada	Ongoing	3.2.1.9.B.2	3.1.2.1.7, 3.1.2.1.8, 3.1.2.2.8	3.7.3
8.3.1.9.3 Investigation: Studies to Provide the Information Required on Potential Effects of Exploiting Natural Resources on Hydrologic, Geochemical, and Rock Characteristics	N/A	3.2.1.9.C		N/A

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.9.3.1 Study: Evaluation of Data Needed to Support an Assessment of the Likelihood of Future Inadvertent Human Intrusion at Yucca Mountain as a Result of Exploration and/or Extraction of Natural Resources	Ongoing No study plan. No unique data to be acquired by this study. Study 8.3.1.9.2.1 will be a major direct input to this study.	3.2.1.9.C.1	3.1.1.1.5	3.7.4
8.3.1.9.3.2 Study: An Evaluation of the Potential Effects of Exploration for, or Extraction of, Natural Resources on the Hydrologic Characteristics at Yucca Mountain	Out-Year No study plan. No unique data to be acquired by this study. Study 8.3.1.9.2.2 will supply inputs to computer modeling and bounds for sensitivity analysis.	3.2.1.9.C.2	3.1.2.1.8, 3.1.1.1.5, 3.1.1.2.5	3.7.5
8.3.1.10 Program: Population Density and Distribution	N/A	3.2.1.10	9.2	N/A
8.3.1.11 Program: Land Ownership and Mineral Rights	N/A	3.2.1.11	9., 9.1	N/A
8.3.1.12 Program: Meteorology	N/A	3.2.1.12		3.8
8.3.1.12.1 Investigation: Studies to Provide Data on Regional Meteorological Conditions	N/A	3.2.1.12.A		N/A

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.12.1.1 Study: Characterization of the Regional Meteorological Conditions	To begin in FY 1995 No study plan. Material intended for inclusion in this study plan was combined with other studies in the Scientific Investigation Implementation Plan.	3.2.1.12.A.1	3.1.4.1	3.8.1
8.3.1.12.1.2 Study: Plan for Synthesis of Yucca Mountain Site Characterization Project Meteorological Monitoring	The work scope of this study was combined with other studies in the Scientific Investigation Implementation Plan for Study 8.3.1.12.1.1.	3.2.1.12.A.2	3.1.4.1	3.8.2
8.3.1.12.2 Investigation: Studies to Provide Data on Atmospheric and Meteorological Phenomena at Potential Locations of Surface Facilities	N/A	3.2.1.12.B		N/A
8.3.1.12.2.1 Study: Meteorological Data Collection at the Yucca Mountain Site	Ongoing	3.2.1.12.B.1	3.1.4.1.2, 3.1.4.1.3	3.8.3
8.3.1.12.3 Investigation: Studies to Provide Data on the Location of Population Centers Relative to Wind Patterns in the General Region of the Site	Ongoing The work scope of this investigation was combined with other studies in the Scientific Investigation Implementation Plan for Study 8.3.1.12.1.1.	3.2.1.12.C	4.2.1.27, 4.5.1.3, 7.2.4, 7.2.5	3.8.4

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.12.4 Investigation: Studies to Provide Data on Potential Extreme Weather Phenomena and Their Recurrence Intervals	N/A	3.2.1.12.D	3.1.4.1.1, 3.1.4.1.3, 4.1.1, 4.1.1.9, 4.1.3.3	N/A
8.3.1.12.4.1 Study: Characterize the Potential Extreme Weather Phenomena and Their Recurrence Intervals	The work scope of this study was combined with other studies in the Scientific Investigation Implementation Plan for Study 8.3.1.12.1.1.	3.2.1.12.D.1	3.1.4.1	3.8.5
8.3.1.13 Program: Offsite Installations	N/A	3.2.1.13	4.2, 4.3, 4.4	3.9
8.3.1.13.1 Investigation: Determination of Nearby Industrial, Transportation, and Military Installations and Operations (Nuclear and Nonnuclear)		3.2.1.13.A		N/A
8.3.1.13.1.1 Activity: Identify Near-Site Activities		3.2.1.13.A.1.a	4.3, 4.4	N/A
8.3.1.13.1.2 Activity: Characterize Nuclear Fuel Cycle Facilities in the Area		3.2.1.13.A.1.b	4.3, 4.4	N/A
8.3.1.13.1.3 Activity: Characterize all Nuclear Facilities not Associated with the Nuclear Fuel Cycle near the Yucca Mountain Site		3.2.1.13.A.1.c	4.3, 4.4	N/A
8.3.1.13.2 Investigation: Potential Impacts of Nearby Installations and Operations		3.2.1.13.B	4.3, 4.4	N/A

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.13.2.1 Activity: Evaluate Near-Site Activities		3.2.1.13.B.1.a	4.3, 4.4, 7.2	N/A
8.3.1.13.2.2 Activity: Evaluation of the impact of Nuclear Fuel Cycle Operations Near the Yucca Mountain Site and Las Vegas		3.2.1.13.B.1.b	4.3, 4.4	N/A
8.3.1.13.2.3 Activity: Evaluate the impact of all Nuclear Facilities not Associated with the Nuclear Fuel Cycle Near the Yucca Mountain Site		3.2.1.13.B.1.c	4.3, 4.4, 7.2	N/A
8.3.1.13.2.4 Activity: Evaluate the impact of Ground Motion from Nuclear Testing Activities at the Nevada Test Site		3.2.1.13.B.1.d	3.1.1.2.4, 6.2.2	N/A
8.3.1.14 Program: Surface Characteristics	N/A	3.2.1.14		3.10
8.3.1.14.1 Investigation: Studies to Provide the Topographic Characteristics of Potential Locations of Surface Facilities	N/A	3.2.1.14.A		N/A
8.3.1.14.2 Investigation: Studies to Provide Soil and Rock Properties of Potential Locations of Surface Facilities	N/A	3.2.1.14.B	3.1.1.2.7	N/A
8.3.1.14.2.1 Study: Exploration Program	Ongoing	3.2.1.14.B.1	3.1.1.2.7, 4.1.1	3.10.1
8.3.1.14.2.2 Study: Laboratory Tests and Material Property Measurements	Ongoing	3.2.1.14.B.2	3.1.1.2.7, 4.1.1	3.10.2
8.3.1.14.2.3 Study: Field Tests and Characterization Measurements	Ongoing	3.2.1.14.B.3	3.1.1.2.7, 4.1.2, 4.1.3	3.10.3

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity		Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.15	Program: Thermal and Mechanical Rock Properties	N/A	3.2.1.15		3.11
8.3.1.15.1	Investigation: Studies to Provide the Required Information for Spatial Distribution of Thermal and Mechanical Properties	N/A	3.2.1.15.A		N/A
8.3.1.15.1.1	Study: Laboratory Thermal Properties	Ongoing	3.2.1.15.A.1	3.1.1.2.7	3.11.1
8.3.1.15.1.2	Study: Laboratory Thermal Expansion Testing	Ongoing	3.2.1.15.A.2	3.1.1.2.7	3.11.2
8.3.1.15.1.3	Study: Laboratory Determination of Mechanical Properties of Intact Rock	Ongoing	3.2.1.15.A.3	3.1.1.2.7	3.11.3
8.3.1.15.1.4	Study: Laboratory Determination of the Mechanical Properties of Fractures	Ongoing	3.2.1.15.A.4	3.1.1.2.7	3.11.4
8.3.1.15.1.5	Study: Excavation Investigations	Ongoing	3.2.1.15.A.5	3.1.1.2.7	3.11.5
8.3.1.15.1.6	Study: In Situ Thermomechanical Properties	Ongoing	3.2.1.15.A.6	3.1.1.2.7	3.11.6
8.3.1.15.1.7	Study: In Situ Mechanical Properties	Ongoing	3.2.1.15.A.7	3.1.1.2.7	3.11.7
8.3.1.15.1.8	Study: In Situ Design Verification	Ongoing Incorporates scope of work from Act. 8.3.1.15.2.1.2	3.2.1.15.A.8	3.1.1.2.7	3.11.8
8.3.1.15.2	Investigation: Studies to Provide the Required Information for Spatial Distribution of Ambient Stress and Thermal Conditions	N/A	3.2.1.15.B		N/A

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.15.2.1 Study: Characterization of the Site Ambient Stress Conditions	No study plan. Act. 8.3.1.15.2.1.1 - Deleted Proposed techniques would be redundant with other planned approaches. Act. 8.3.1.15.2.1.2 - Transferred to Study 8.3.1.15.1.8.	3.2.1.15.B.1	3.1.1.2.7	3.11.9
8.3.1.15.2.2 Study: Characterization of the Site Ambient Thermal Conditions	Ongoing	3.2.1.15.B.2	3.1.1.2.7	3.11.10
8.3.1.16 Program: Preclosure Hydrology	N/A	3.2.1.16		3.12
8.3.1.16.1 Investigation: Flood Recurrence Intervals and Levels at Potential Locations of Surface Facilities	N/A	3.2.1.16.A	3.1.2.1.4, 3.1.2.1.5, 4.1	N/A
8.3.1.16.1.1 Study: Characterization of Flood Potential of the Yucca Mountain Site	Ongoing	3.2.1.16.A.1	3.1.2.1.5	3.12.1
8.3.1.16.2 Investigation: Location of Adequate Water Supplies	N/A	3.2.1.16.B		N/A
8.3.1.16.2.1 Study: Location of Adequate Water Supply for Construction, Operation, Closure, and Decommissioning of a Mined Geologic Disposal System at Yucca Mountain, Nevada	Out-Year No study plan. Activities do not require a study plan, will be based on data gathered in other studies.	3.2.1.16.B.1	3.1.2.2.8, 3.1.2.2.9, 3.1.2.3.9, 4.1.1.6	3.12.2
8.3.1.16.3 Investigation: Ground-Water Conditions within and above the Potential Host Rock	N/A	3.2.1.16.C		N/A

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.16.3.1 Study: Determination of the Preclosure Hydrologic Conditions of the Unsaturated Zone at Yucca Mountain, Nevada	Unfunded	3.2.1.16.C.1	3.1.2.3.4	3.12.3
8.3.1.17 Program: Preclosure Tectonics	N/A	3.2.1.17		3.13
8.3.1.17.1 Investigation: Studies to Provide the Required Information on Volcanic Activity that could Affect Repository Design or Performance	N/A	3.2.1.17.A		N/A
8.3.1.17.1.1 Study: Potential for Ash Fall at the Site	No study plan. All activities rely on data from other studies.	3.2.1.17.A.1	3.1.1.2.3.5, 3.1.1.3	3.13.1
8.3.1.17.2 Investigation: Studies to Provide the Required Information on Fault Displacement that could Affect Repository Design or Performance	N/A	3.2.1.17.B		N/A
8.3.1.17.2.1 Study: Faulting Potential at the Repository	No study plan. Combined with Study 8.3.1.17.3.6	3.2.1.17.B.1	3.1.1.2.3, 3.1.1.3	3.13.2
8.3.1.17.3 Investigation: Studies to Provide the Required Information on Vibratory Ground Motion that could Affect Repository Design or Performance	N/A	3.2.1.17.C		N/A

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.17.3.1 Study: Relevant Earthquake Sources	Ongoing	3.2.1.17.C.1	3.1.1.1.4, 3.1.1.2.4	3.13.3
8.3.1.17.3.2 Study: Underground Nuclear Explosion Sources	No study plan. All activities rely on available data. This work is essentially complete	3.2.1.17.C.2	3.1.1.2.4	3.13.4
8.3.1.17.3.3 Study: Ground Motion from Regional Earthquakes and Underground Nuclear Explosions	Ongoing	3.2.1.17.C.3	3.1.1.2.4	3.13.5
8.3.1.17.3.4 Study: Effects of Local Site Geology on Surface and Subsurface Motions	This work is completed.	3.2.1.17.C.4	3.1.1.2.4	3.13.6
8.3.1.17.3.5 Study: Ground Motion at the Site from Controlling Seismic Events	Out-Year	3.2.1.17.C.5	3.1.1.2.4	3.13.7

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.17.3.6 Study: Probabilistic Seismic Hazards Analyses	Ongoing	3.2.1.17.C.6	3.1.1.2.4, 3.1.1.2.4.3	3.13.8
8.3.1.17.4 Investigation: Preclosure Tectonics Data Collection and Analysis	N/A	3.2.1.17.D		N/A
8.3.1.17.4.1 Study: Historical and Current Seismicity	Ongoing	3.2.1.17.D.1	3.1.1.1.4	3.13.9
8.3.1.17.4.2 Study: Location and Recency of Faulting Near the Prospective Surface Facilities	Ongoing Act. 8.3.1.17.4.2.1 is completed	3.2.1.17.D.2	3.1.1.2.3, 3.1.1.2.4	3.13.10
8.3.1.17.4.3 Study: Quaternary Faulting Within 100 km of Yucca Mountain, Including the Walker Lane	Ongoing	3.2.1.17.D.3	3.1.1.1.3, 3.1.1.1.4	3.13.11
8.3.1.17.4.4 Study: Quaternary Faulting Proximal to the Site Within Northeast-Trending Fault Zones	Ongoing Act. 8.3.1.17.4.4.3 - Transferred to Study 8.3.1.17.4.6.	3.2.1.17.D.4	3.1.1.1.3, 3.1.1.2.3	3.13.12
8.3.1.17.4.5 Study: Detachment Faults at or Proximal to Yucca Mountain	Ongoing	3.2.1.17.D.5	3.1.1.1.3, 3.1.1.2.3	3.13.13
8.3.1.17.4.6 Study: Quaternary Faulting Within the Site Area	Ongoing	3.2.1.17.D.6	3.1.1.2.3.2, 3.1.1.2.4	3.13.14

Table 2. Matrix of SCP Programs, Investigations, Studies, and Activities

SCP Program/Investigation/Study/Activity	Comments	SDTRD ^a Section	LA AO ^b Section	PR ^c Section
8.3.1.17.4.7 Study: Subsurface Geometry and Concealed Extensions of Quaternary Faults at Yucca Mountain	No study plan. Work scope transferred to Studies 8.3.1.4.2.1 & 8.3.1.17.3.6	3.2.1.17.D.7	3.1.1.2.3	3.13.15
8.3.1.17.4.8 Study: Stress Field Within and Proximal to the Site Area	Out-Year	3.2.1.17.D.8	3.1.1.2.4, 3.3.1.2.3	3.13.16
8.3.1.17.4.9 Study: Tectonic Geomorphology of the Yucca Mountain Region	No study plan. Work scope transferred to Studies 8.3.1.5.1.4, 8.3.1.17.4.3, and 8.3.1.17.4.12	3.2.1.17.D.9		3.13.17
8.3.1.17.4.10 Study: Geodetic Leveling	Ongoing	3.2.1.17.D.10	3.1.1.1.3, 3.1.1.2.3	3.13.18
8.3.1.17.4.11 Study: Characterization of Regional Lateral Crustal Movement	No study plan. Work scope transferred to Study 8.3.1.17.4.10	3.2.1.17.D.11	3.1.1.1.3, 3.1.1.2.3	3.13.19
8.3.1.17.4.12 Study: Tectonic Models and Synthesis	Ongoing	3.2.1.17.D.12	3.1.1.2.4, 3.1.1.3	3.13.20

- a Site Design and Test Requirements Document
- b License Application Annotated Outline
- c Progress Report

PROGRESS REPORT #12

APPENDIX B

Site Characterization Program Baseline History

Site Characterization Program Baseline History (Page 1 of 2)

Revision	Issued	Revisions
0	2/22/91	Initial Issue
1	4/5/91	Updated information related to the Exploratory Studies Facility. Incorporated changes to program planning resulting from the "Exploratory Studies Facility Alternatives Study: Final Report."
2	10/2/91	Revised plans for testing in Site Characterization Plan Section 8.3.1.14. Consolidated all of the anticipated studies under Investigation 8.3.1.14 into one Study Plan (8.3.1.14.2).
3	2/7/92	Changes to the objectives of Activities 1 and 4 in Study Plan 8.3.1.2.1.4 and Activity 4 in Study Plan 8.3.1.2.3.2. Added three drillholes to Study Plan 8.3.1.2.3.1. Deleted requirement for tagging surface dust suppression water with chemical tracer.
4	3/13/92	Incorporated changes in the objectives of Activities 1 and 3 in Study Plan 8.3.1.2.3.2.
5	7/15/92	Corrected references to integration of geophysical activities.
6	7/15/92	Updated Section 8.4 to be consistent with current Exploratory Studies Facility concept.
7	7/15/92	Deleted Activity 8.3.1.4.2.1.6 to eliminate redundancy.
8	9/24/92	Reorganized waste package near-field environment program.
9	10/2/92	Changed scope of the Site Characterization Program Baseline to delete activity descriptions that are controlled in the study plans; placed parameter tables in separate controlled document; removed hypothesis testing tables and analyses supporting test control from the Site Characterization Program Baseline. Changes made to Activities 8.3.1.2.2.4.6, 8.3.1.5.2.1.2, 8.3.1.5.2.2.1, 8.3.1.5.2.2.2, 8.3.1.5.2.2.3; changes made to Studies 8.3.1.3.7.2, 8.3.1.8.1.1, 8.3.1.8.1.2, 1.10.4.3; and changes made to Investigation 8.3.1.7.1.
10	1/14/93	Documented changes made to Study 8.3.1.2.2.4; Activities 8.3.1.8.5.2.2, 8.3.1.15.2.2, 8.3.1.17.4.3.2, 8.3.1.17.4.4.3; and Section 8.3.5.13.

B-1

PROGRESS REPORT #12

Site Characterization Program Baseline History (Page 2 of 2)

Revision	Issued	Revisions
11	8/3/94	Revised Investigation 8.3.1.8.2. Revised the objectives of Activities 8.3.1.8.5.2.1, 8.3.1.8.5.2.3, and 8.3.1.17.3.1. Documented editorial changes to Section 8.4.
12	1/20/95	Revised the objectives of Studies 8.3.1.5.1.6 and 8.3.1.15.1.5. Revised 8.4 in response to NRC comments and revised ESF/Repository interface drawings described in CR 94/035M2.

PROGRESS REPORT #12

APPENDIX C

Interim Evaluations in the Site Suitability Evaluation Process

Interim Evaluations in the Site Suitability Evaluation Process (Page 1 of 3)

Interim Evaluation Completion Date	Technical Basis Report	Higher-Level Finding Regulatory Assessment	Guideline Reference
Surface Processes (FY 1995)	Available information on erosion, surface characteristics, and hydrology	Postclosure Erosion Qualifying Condition and Disqualifying Condition Preclosure Surface Characteristics Qualifying Condition Preclosure Hydrology Qualifying Condition and Disqualifying Conditions	§960.4-2-5 §960.5-2-8 §960.5-2-10
Tectonics (FY 1997)	Existing information on faulting, seismicity and volcanology; seismic design bases	Preclosure Tectonics Qualifying Condition and Disqualifying Condition Postclosure Tectonics Disqualifying Condition	§960.5-2-11 §960.4-2-7
Preclosure Radiological Safety (FY 1997)	Available information on population density and distribution, site ownership and control, meteorology, offsite installations and operations; repository design concepts; dose assessment calculations	Preclosure radiologic safety system guideline Qualifying Condition Population Density and Distribution Qualifying Condition and Disqualifying Condition Site Ownership and Control Qualifying Condition Meteorology Qualifying Condition Offsite Installations and Operations Qualifying Condition and Disqualifying Condition	§960.5-1(a) §960.5-2-1 §960.5-2-2 §960.5-2-3 §960.5-2-4

C-1

PROGRESS REPORT #12

Interim Evaluations in the Site Suitability Evaluation Process (Page 2 of 3)

Interim Evaluation Completion Date	Technical Basis Report	Higher-Level Finding Regulatory Assessment	Guideline Reference
<p>Geochemistry and Rock Characteristics (FY 1997)</p>	<p>Available information on rock and mineral distribution, mineral alteration history, ground-water chemistry, sorption characteristics, rock mechanical properties, and natural resources; repository design concepts</p>	<p>Postclosure Human Interference Disqualifying conditions</p> <p>Preclosure rock characteristics Qualifying and Disqualifying Condition</p> <p>The postclosure qualifying conditions for geochemistry, rock characteristics, and human interference will be considered under the regulatory assessment for Total System Performance Assessment</p>	<p>§960.4-2-2</p> <p>§960.4-2-3</p> <p>§960.4-2-8</p> <p>§960.5-2-9</p>
<p>Reasonably Available Technology (FY 1997)</p>	<p>Preceding technical basis reports for surface characteristics, rock characteristics, hydrology, and tectonics; repository design concepts</p>	<p>Preclosure Systems guideline for ease and cost of siting, construction, operations, and closure Qualifying Condition</p>	<p>§960.5-2-8, 5-2-9, 5-2-10, and 5-2-11</p>
<p>Geohydrology and Transport (FY 1998)</p>	<p>Potential climate change impacts on radionuclide transport, geochemistry impacts on radionuclide transport, ground-water travel time along radionuclide transport pathways</p>	<p>Postclosure Geohydrology Disqualifying Condition</p>	<p>§960.4-2-4</p> <p>§960.4-2-3</p> <p>§960.4-2-1</p>

C-2

PROGRESS REPORT #12

Interim Evaluations in the Site Suitability Evaluation Process (Page 3 of 3)

Interim Evaluation Completion Date	Technical Basis Report	Higher-Level Finding Regulatory Assessment	Guideline Reference
Total System Performance Assessment (FY 1998)	Total System Performance Assessment - 1997 and the preceding technical basis documents for geohydrology, geochemistry, rock characteristics, climate, and tectonics; waste package and repository design concepts	Postclosure System Guideline Qualifying Condition: System and Subsystem Requirements of 10 CFR Part 60 and 40 CFR Part 191 Postclosure Qualifying Conditions for Geohydrology, Geochemistry, Rock Characteristics, Climate, Human Interference, and Tectonics	§960.4-1 §960.4-2-1 §960.4-2-2 §960.4-2-3 §960.4-2-4 §960.4-2-7
Technical Site Suitability Evaluation (FY 1998)	Collation of preceding technical basis documents	Technical Site Suitability Determination; collation of preceding regulatory assessments	Not a 10 CFR Part 960 Requirement
Prepare Site Recommendation Report and Affirm Previous Findings (FY 2000)	Environmental, socioeconomic and transportation technical basis from Final Environmental Impact Statement: All preceding technical basis documents and current data and analyses	Preclosure Environmental Quality Systems Guideline Qualifying Condition Environmental Quality Qualifying and Disqualifying Condition Socioeconomic Qualifying and Disqualifying Conditions Transportation Qualifying Condition Site Recommendation Report	§960.5-1-2 §960.5-2-5 §960.5-2-6 §960.5-2-7 §960.3-2-4

C-3

PROGRESS REPORT #12

PROGRESS REPORT #12

APPENDIX D

Interactions with the U.S. Nuclear Regulatory Commission and Other Organizations

Interactions with the U.S. Nuclear Regulatory Commission and Other Organizations (Page 1 of 5)

Organization	Date	Type	Location	Subject/Purpose
NRC	10/7/94	Technical Meeting	Washington, D.C. and Las Vegas, NV (Videoconference)	Discussion of NRC concerns related to the Extreme Erosion Topical Report and Seismic Topical Report I (probabilistic seismic hazard assessment).
NRC	11/1/94	Management Meeting	Rockville, MD	DOE response to NRC concerns related to ESF design control and QA.
NRC	11/7/94	Technical Meeting	Las Vegas, NV	Bi-monthly discussion of the status of ESF design and construction activities.
NRC	11/8-9/94	Technical Exchange	Las Vegas, NV	Discussion of the DOE field heater experiments associated with coupled thermal-hydrologic-mechanical-chemical processes
NRC	11/9/94	Site Visit	Yucca Mountain, NV	Tour of the Fran Ridge Large Block Test.
NRC	11/29/94	Technical Exchange	Denver, CO	Discussion of ground-water flow mechanisms in the unsaturated zone.
NRC	11/30/94 - 12/1/94	Technical Exchange	Denver, CO	Discussion of site data, modeling, and regulatory aspects of the ground-water travel time requirement.
NRC	12/2/94	Management Meeting	Washington, D.C. and Las Vegas, NV (Videoconference)	NRC comments on the DOE Five-Year Plan and the Program Approach.
NRC	12/6/94	Management Meeting	Washington, D.C. and Las Vegas, NV (Videoconference)	Bi-monthly discussion of management issues, including topical report annotated outlines and transmittals of information to NRC.

D-1

PROGRESS REPORT #12

Interactions with the U.S. Nuclear Regulatory Commission and Other Organizations (Page 2 of 5)

Organization	Date	Type	Location	Subject/Purpose
NRC	12/7/94	Technical Exchange	Rockville, MD	DOE presentations on the status of waste package design and materials testing, and discussion of the substantially complete containment requirement.
NRC	1/17/95	Management Meeting	Washington, D.C. and Las Vegas, NV (Videoconference)	Discussion of the DOE waste isolation and containment strategy as reflected in the Program Approach.
NRC	1/19/95	Site Visit	Yucca Mountain, NV	Tour of the site for the NRC Nuclear Safety Research Review Committee on Waste.
NRC	1/24/95	Technical Meeting	Rockville, MD	Bi-monthly discussion of the status of ESF design and construction activities.
NRC	1/26/95	Technical Exchange	Washington, D.C. and Las Vegas, NV (Videoconference)	Discussion of NRC concerns related to Seismic Topical Report I and the annotated outline for Seismic Topical Report II (seismic design methodology).
NRC	2/8/95	Management Meeting	Washington, D.C. and Las Vegas, NV (Videoconference)	Bi-monthly discussion of management issues, including the NRC policy on harassment and intimidation.
NRC	3/20/95	Technical Meeting	Washington, D.C. and Las Vegas, NV (Videoconference)	Bi-monthly discussion of the status of ESF design and construction activities.
NRC	3/29/95	Technical Exchange	Washington, D.C. and Las Vegas, NV (Videoconference)	Discussion of the DOE calculational approach to pre-waste emplacement ground-water travel time.

D-2

PROGRESS REPORT #12

Interactions with the U.S. Nuclear Regulatory Commission and Other Organizations (Page 3 of 5)

Organization	Date	Type	Location	Subject/Purpose
ACNW	10/18-19/94	68th Meeting	Las Vegas, NV	Discussion of pneumatic testing, electronic data transfer, the impact of the Program Approach on saturated and unsaturated zone activities, and the Waste Isolation Pilot Plant system prioritization approach.
ACNW	10/20/94	Site Visit	Yucca Mountain, NV	Tour of field activities associated with the hydrology program.
ACNW	10/21/94	Working Group	Las Vegas, NV	Discussion of uses and limitations of ground-water dating methods.
ACNW	11/10/94	69th Meeting	Las Vegas, NV	Discussions with the Director of the NRC Division of Waste Management and a meeting with NRC; topics included NRC research activities and the impact of the DOE Program Approach.
ACNW	1/18-19/95	70th Meeting	Rockville, MD	Discussion of the NRC materials research program, rock mechanics, and the draft NRC Probabilistic Risk Assessment Policy and Implementation Plan; discussions with the Director of the NRC Division of Waste Management.

D-3

PROGRESS REPORT #12

Interactions with the U.S. Nuclear Regulatory Commission and Other Organizations (Page 4 of 5)

Organization	Date	Type	Location	Subject/Purpose
ACNW	2/21-22/95	71st Meeting	Rockville, MD	Discussions with the Director of the NRC Division of Waste Management on ground-water travel time and key technical uncertainties; discussions with the Director of the NRC Office of Research on the "hot" repository concept and the multi-purpose canister; discussion of proposed EPA standards for land disposal of low-level waste, model validation, and guidelines for the Licensing Support System.
ACNW	3/15-16/95	72nd Meeting	Rockville, MD	Presentations by DOE on the waste containment strategy in the Program Approach and on the Engineered Barrier System; presentations by NRC, the State of Nevada, and ACNW consultants on ground-water travel time.
NWTRB	10/12/94	Fall Full Board Meeting	Las Vegas, NV	Discussion of three main areas related to site suitability: the process by which DOE will assess site suitability; the main technical site-suitability issues at Yucca Mountain and DOE priorities regarding exploration, testing, and data collection; and the roles assigned to natural and engineered barriers.

D-4

PROGRESS REPORT #12

Interactions with the U.S. Nuclear Regulatory Commission and Other Organizations (Page 5 of 5)

Organization	Date	Type	Location	Subject/Purpose
NWTRB	11/17-18/94	Combined Meeting of Structural Geology and Geoengineering Panel and Hydrogeology and Geochemistry Panel	Washington, D.C.	Discussion of several areas related to thermal management of a high-level waste repository, including alternative thermal management strategies, <i>in situ</i> thermal testing needs, performance analysis, and the DOE process for making a thermal management decision.
NWTRB	1/10-11/95	Winter Full Board Meeting	Beatty, NV	Discussions included the DOE environmental monitoring program at Yucca Mountain; the DOE strategy for developing the Environmental Impact Statements for the multi-purpose canister and for the repository; the integration of the repository Environmental Impact Statement with Yucca Mountain site characterization studies; the DOE socioeconomic program; and the DOE waste isolation strategy development.

PROGRESS REPORT #12

APPENDIX E

Status of NRC Site Characterization Analysis Open Items

Status of Site Characterization Analysis Open Items (Page 1 of 27)

Item ID	Item Description	Status	Action Description
Objection 1	Adequacy of Title I design control process.	Closed 11/2/92	NRC letter lifting Objection 1. NRC considers this objection closed.
Objection 2	Acceptability of DOE Quality Assurance Program.	Closed 11/2/92	NRC letter lifting Objection 2. NRC considers this objection closed.
Comment 1	A systematic, iterative approach to identify and collect data during site characterization to support a license application not demonstrated to be in place.		Submit a supplemental response to the NRC. This response will be used to close Comments 10, 18, 49, and 60.
Comment 2	Performance Assessment: Confidence in performance.		Submit a supplemental response to the NRC.
Comment 3	Reliance on expert judgment to supply licensing information.		Supplemental response submitted to the NRC on 7/12/93. Awaiting NRC concurrence.
Comment 4	Rationale for the testing needs; integration of testing with design and performance assessment needs.		Develop parametric calculations to refine parameter goals. Develop plans for collecting all necessary data. Supply NRC with the information in semiannual progress reports. Submit a supplemental response to the NRC.
Comment 5	Waste Package: Interpretation of substantially complete containment.	Closed 7/11/94	NRC Evaluation of DOE response. NRC considers this comment closed.
Comment 6	Performance Assessment: Hypothesis Testing Table and alternative conceptual models.		Submit a supplemental response to the NRC.
Comment 7	Use of expert judgment versus peer review.		Supplemental response submitted to the NRC on 7/12/93. Awaiting NRC concurrence.

E-1

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 2 of 27)

Item ID	Item Description	Status	Action Description
Comment 8	Alternative Tectonic Models.		Study Plan 8.3.1.17.4.12, Rev. 1 "Tectonic Models and Synthesis" needs to be completed and approved. Submit a supplemental response to the NRC.
Comment 9	Use of expert judgment during the development of Hypothesis Testing Table.		Submit a supplemental response to the NRC.
Comment 10	Assessment of significance of site hydrologic characteristics.		Resolve concerns in Comment 1. Resolution of Comment 1 will address the cross-issues for this comment.
Comment 11	No hypothesis on the thermal effects of waste emplacement in the hydrologic environments presented.		Submit a supplemental response to the NRC.
Comment 12	Porous flow in the Calico Hills unit.	Closed 11/2/92	NRC letter lifting Objection 1. NRC considers this comment closed.
Comment 13	Surface Hydrology: Surface water gaging station locations and the natural infiltration measurements.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 14	Hydrologic properties of the tuffaceous beds of the Calico Hills nonwelded unit.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 15	Solitario Canyon horizontal borehole activity is inadequate to discriminate between the hypotheses that faults are barriers to fluid flow in non-welded tuff units or faults are conduits for liquid-water flow.	Closed 9/15/94	NRC evaluation of SP 8.3.1.2.2.4. NRC considers this comment closed.

E-2

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 3 of 27)

Item ID	Item Description	Status	Action Description
Comment 16	Characterization of the hydrologic properties of the Calico Hills unit.	Closed 11/2/92	NRC letter lifting Objection 1. NRC considers this comment closed.
Comment 17	Multi-purpose borehole testing near the shafts.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 18	Initial hydrologic modeling studies are not supported by planned studies.		Resolve concerns in Comment 1. Resolution of Comment 1 will address cross-issues for this comment.
Comment 19	Saturated Zone: Work is not adequate for saturated zone characterization.		Develop and submit plan to define sufficient testing of the saturated zone. Submit a supplemental response to the NRC.
Comment 20	Saturated Zone: Potentiometric surface will not adequately be defined.		Submit a supplemental response to the NRC.
Comment 21	Saturated Zone: Tc-199 and I-129 are not included to be characterized in the ground water flow and radionuclide analysis background concentrations.		Supplemental response submitted to the NRC on 1/7/93. Awaiting NRC concurrence.
Comment 22	Saturated Zone: Hydrochemical samples.		Supplemental response submitted to the NRC on 1/7/93. Awaiting NRC concurrence.
Comment 23	Unsaturated Zone: Evaluation of radionuclide concentrations on fracture surfaces.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 24	Approaches are not sufficient for determining reliable thermodynamic properties.		Receive Study Plan from Los Alamos National Laboratory.

E-3

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 4 of 27)

Item ID	Item Description	Status	Action Description
Comment 25	Waste Package: Rationale on additional testing on waste and interactions between and among radionuclides on sorption.		Submit Study Plan 8.3.4.2.4.1 "Characterization of Chemical and Mineralogical Changes in Post-Emplacement Environment" to NRC. Submit a supplemental response to the NRC.
Comment 26	Sorption Batch Studies.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 27	Batch Sorption Measurements.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 28	Sorption on Particulates and Colloids.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 29	Biological Sorption and Transport.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 30	Solubility Modeling.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 31	Some parameters and conditions under fracture flow are not planned and need to be determined.		Submit a supplemental response to the NRC.
Comment 32	Rock characteristics program: Geophysical integration is insufficient.		Geophysical Integration Group needs to develop a plan to implement integration. Submit a supplemental response to the NRC.
Comment 33	Engineering rock parameters are not adequately integrated to develop 3-D rock characteristics models.		Study Plan 8.3.1.4.3.1 "Systematic Acquisition of Site Specific Data" submitted to the NRC on 1/11/93. Prepare Study Plan 8.3.1.4.2.3 "Three-Dimensional Geologic Modeling" and submit to the NRC. Submit a supplemental response to the NRC.

E-4

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 5 of 27)

Item ID	Item Description	Status	Action Description
Comment 34	Drilling Program: It is unclear how data from various drill holes will be used in support of various studies, how uncertainties in core retrieval and data analyses will be handled, and how the large volume of existing information will be used to plan the drilling program.		Submit a supplemental response to the NRC.
Comment 35	Adequacy of lithological, structural, and drifting activities to characterize the site.	Closed 11/2/92	NRC letter lifting Objection 1. NRC considers this comment closed.
Comment 36	Rationale for investigation 8.3.1.4.2 may not be accurate for the perimeter drift defining lower concentrations of faults.		Supplemental response submitted to the NRC on 6/16/94. Awaiting NRC concurrence.
Comment 37	Identification of blast fractures.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 38	Characterization of faults in the subsurface.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 39	Systematic Drilling Program: No assessment is provided to support the estimated maximum range of statistical correlation for porosity and air permeability.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.

Status of Site Characterization Analysis Open Items (Page 6 of 27)

Item ID	Item Description	Status	Action Description
Comment 40	Systematic Drilling Program: Spacing of the 30 sample borehole pairs in a range of up to 10,000 feet may represent a lower bound for geostatistical analysis.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 41	Systematic Drilling Program: Tight clustering of sample locations SD-8 and SD-12 has not been justified.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 42	Adequacy of evaluation of escarpment retreat.		Supplemental response submitted to the NRC on 7/23/92. Awaiting NRC concurrence.
Comment 43	Adequacy of numerical goals in erosion, post-closure tectonics, and pre-closure tectonics performance assessment tables.	Closed 2/17/95	Ltr. Bell to Milner, "NRC Review of the DOE Responses to Site Characterization Analysis Comments 42 and 43."
Comment 44	Waste Package: Overall goal is not consistent with substantially complete containment.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 45	Volcanic rate calculations independent of underlying volcanic-tectonic processes.		Supplemental response submitted to the NRC on 7/12/93. Awaiting NRC concurrence.
Comment 46	Postclosure Tectonics.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 47	Waste Package: Relationship of postclosure tectonics to the waste package and the EBS requirements.		Supplemental response submitted to the NRC on 6/9/93. Awaiting NRC concurrence.

Status of Site Characterization Analysis Open Items (Page 7 of 27)

Item ID	Item Description	Status	Action Description
Comment 48	Use of fault slip rates on the repository facilities are not conservative.		Prepare and issue topical report "Seismic Design Criteria" in accordance with the Seismic Hazards Issue Resolution Group's Issue Resolution Action Plan. Submit a supplemental response to the NRC.
Comment 49	Volcanism: Results from investigations on basaltic volcanism may fail to meet overall system performance.	Closed 9/14/94	NRC evaluation of SP 8.3.1.8.1.2. NRC considers this comment closed.
Comment 50	Effects of faulting may be underestimated.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers the comment closed.
Comment 51	Adequacy of Geophysics program to determine deep and shallow crustal features.		Geophysical Integration group needs to develop a plan to implement integration.
Comment 52	Use of Geophysics to identify volcanic/igneous features.		Completed assessment by independent consultant of planned and potential geophysical studies that contribute to resolution of volcanism issue. Consultant's preliminary findings were submitted to the NRC on site representative. Submit a supplemental response to the NRC.
Comment 53	Adequacy of natural resource assessment; consideration of ore deposition models.		Supplemental response submitted to the NRC on 2/5/93 in SP 8.3.1.9.2.1. NRC Ltr. 2/18/94 Holonich to Shelor partially closing SCA Comment 53. Awaiting NRC concurrence.
Comment 54	Inconsistencies in Site Characterization Plan Chapter 8.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.

E-7

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 8 of 27)

Item ID	Item Description	Status	Action Description
Comment 55	Adequacy of geostatistical approach to geomechanical and thermal properties.		The review of Performance Allocations for Activity 8.3.1.15 "Rock Characteristics Program" needs to be completed. Submit a supplemental response to the NRC.
Comment 56	Validation of models for mechanical and thermal properties.		Submitted SP 8.3.1.15.1.5, Rev. 1 "Excavation Investigations," to NRC on 5/5/94. Submit 8.3.1.15.1.6 "In Situ Thermomechanical Properties," and 8.3.1.15.1.7, "In Situ Mechanical Properties" to the NRC. The Review of Performance Allocations for Activity 8.3.1.15 "Rock Characteristics Program" needs to be completed. Submit a supplemental response to the NRC.
Comment 57	Design verification does not consider alternative methods of excavation.	Closed 11/2/92	NRC letter lifting Objection 1. NRC considers comment closed.
Comment 58	Descriptions in the in situ design verification section do not include tests to verify design reports.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 59	Description of tectonic and igneous events do not allow for determination of actual investigations to be conducted, and sequencing of activities.		Submit a supplemental response to the NRC.
Comment 60	Performance Assessment: Adequacy of preclosure design and performance goals and characterization parameters.		Resolve concerns in Comment 1. Resolution of Comment 1 will address cross-issues of this comment.

Status of Site Characterization Analysis Open Items (Page 9 of 27)

Item ID	Item Description	Status	Action Description
Comment 61	Assumption that future faulting will follow previous faulting.		Submit a supplemental response to the NRC.
Comment 62	The studies of faulting at the surface facilities do not indicate how DOE is proposing to use standoff distances.		Submit a supplemental response to the NRC.
Comment 63	Use of pre-existing and unavailable information for the preclosure tectonics program and the surface facilities.		Submit a supplemental response to the NRC which will describe where in the study plan and the "Test and Evaluation Plan" the concerns of the NRC are addressed.
Comment 64	Adequacy of faults study for design and performance.		Submit a supplemental response to the NRC.
Comment 65	Use of domains to define areas of faulting potential.	Closed 7/31/91	NRC evaluation of DOE response. NRC considers this comment closed.
Comment 66	Release via a single event 10,000 year cumulative slip earthquake.		Complete detailed study to show the facility can conservatively withstand an event exceeding the design basis ground motion. Submit a supplemental response to the NRC.
Comment 67	Data on earthquakes having a cutoff of a magnitude 5.5 may not be sufficient to support an evaluation of the effects of site geology on surface and subsurface motion.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 68	Adequacy of treatment on detachment faulting affects.		Prepare Study Plan 8.3.1.17.4.12, Rev. 1 "Tectonic Models and Synthesis" and submit to the NRC. Submit a supplemental response to the NRC.

E-9

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 10 of 27)

Item ID	Item Description	Status	Action Description
Comment 69	Synthesis of data on the northwest trending faulting.		Prepare Study Plan 8.3.1.17.4.12 "Tectonic Models and Synthesis" and submit to the NRC. Submit supplemental response to the NRC.
Comment 70	Blast control procedures are less important to post-closure performance are not justified.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 71	Adequacy of technologies in assessing faulting for construction, operation, and closure.		Submit a supplemental response to the NRC.
Comment 72	Adequacy of the seal program.	Closed 11/2/92	NRC letter lifting Objection 1. NRC considers this comment closed.
Comment 73	Performance Assessment: Adequacy of required backfill hydraulic conductivity.		Resume work on the seals program investigation. Prepare the study plan for the measurement of the hydraulic conductivity (there is no numeric designator for this SP yet). Submit a supplemental response to the NRC.
Comment 74	Testing of Seal Components: No indication is given as to whether and when the testing to evaluate the behavior of selected sealing components under in situ test conditions will be initiated.		Prepare Study Plan 8.3.3.2.2.3 "In Situ Testing of Seal Components." Submit a supplemental response to the NRC.
Comment 75	Definition of and inconsistent use of geologic setting.	Closed 12/30/93	NRC Evaluation of DOE Responses. NRC considers this comment closed.

E-10

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 11 of 27)

Item ID	Item Description	Status	Action Description
Comment 76	NRC reviews cannot be relied on as peer reviews.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 77	Adequacy of considerations of retrieval operations in evaluating the effects of credible accidents on radiological exposure.		Evaluate the effects of credible accidents on radiological exposures during retrieval operation of the Advanced Conceptual Design. Submit a supplemental response to the NRC.
Comment 78	10 CFR Part 20 requirements need to be considered for postclosure.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 79	Waste Package: Adequacy of waste package corrosion tests for the repository.		Complete the reviews and revisions of Study Plan 8.3.4.2.4.1 "Characterization of Chemical and Mineralogical Changes in the Post Emplacement Environment" and submit to the NRC. The Lawrence Livermore National Laboratory report, "Metal Barrier Selection and Testing," LLNL SIP CM-01, Rev. 2 was submitted to the NRC on 1/31/95. Submit a supplemental response to the NRC.
Comment 80	Performance goals consistent with interpretation and intent of substantially complete containment.	Closed 3/7/95	NRC Evaluation of supplemental response. NRC considers this item closed.
Comment 81	Waste Package: Adequacy of program in stress corrosion cracking behavior of waste packages.		The metals barriers scientific investigation plan was submitted to the NRC on 1/31/95. Evaluation of the extended dry concept with drift emplacement needs to be completed which may make this concern moot. The metals barrier scientific investigation must be initiated and preliminary results released. Submit a supplemental response to the NRC.

E-11

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 12 of 27)

Item ID	Item Description	Status	Action Description
Comment 82	Waste Package: There is an inadequate discussion on how the waste package performance may be verified at the time of license application.		Prepare Study Plan 8.3.4.2.4.4 "Engineered Barrier System Field Test" and submit to the NRC. Submit a supplemental response to the NRC.
Comment 83	The term "uniform corrosion" is misleading.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 84	Issue resolution strategy and testing package for the waste package and Engineering Barrier System do not take into account the full range of likely natural conditions that might affect performance of the barrier.		Consider the effect of unanticipated processes and events on the overall system in the ongoing issue resolution process. Submit a supplemental response to the NRC.
Comment 85	Performance Assessment: Temporal changes in the state of stress due to corrosion of the container is not accounted for.		The metals barriers scientific investigation plan to be completed. Evaluation of the extended dry concept with drift emplacement needs to be completed which may make this concern moot. The metals barrier scientific investigation must be initiated and preliminary results released. Submit a supplemental response to the NRC.
Comment 86	Waste Package: Degradation modes of copper-based alloys do not appear to agree with scientific literature.		Complete the degradation modes surveys for candidate materials and test plans for promising materials. Submit a supplemental response to the NRC.

Status of Site Characterization Analysis Open Items (Page 13 of 27)

Item ID	Item Description	Status	Action Description
Comment 87	Waste Package: Adequacy of effects of dissimilar metal contacts causing corrosion.		Advance the waste package design which will narrow the waste package option down to three designs. Describe the use of data from galvanic testing in the waste package design plan. Submit a supplemental response to the NRC.
Comment 88	Waste Package: Assumption of reduced uncertainties because of the unsaturated zone.		The Lawrence Livermore National Laboratory scientific investigation SIP-CM-01 (Rev. 1), "Metal Barrier Selection and Testing" was submitted to the NRC on 1/31/95.
Comment 89	Waste Package: Construction materials may change the local pH and affect the corrosion of the metal containers and the leach rates of radionuclides from the glass.		Prepare Study Plan 8.3.4.2.4.5 "Manmade Materials" and submit to the NRC. Submit a supplemental response to the NRC.
Comment 90	Waste Package: Consideration of varying oxygen concentrations on the corrosion of metal containers.		Provide details on how the effects of oxygen on the waste package will be considered. These details will be described in the metal barriers investigation plan. Complete evaluation of the drift emplacement alternative. This alternative would make this concern moot. Submit a supplemental response to the NRC.
Comment 91	Waste Package/Performance Assessment: Consideration of alternative canisters for C-14 releases.		Evaluate and describe performance of alternative waste package designs to be considered in Advanced Conceptual Design. Review the new Environmental Protection Agency standards when they become available. Alternative waste package scenarios need to be developed. A robust design may make this concern moot. Submit a supplemental response to the NRC.

Status of Site Characterization Analysis Open Items (Page 14 of 27)

Item ID	Item Description	Status	Action Description
Comment 92	Disturbed Zone: Boundary definition does not include properties affected by heat generated by waste emplacement.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers the comment closed.
Comment 93	Performance Assessment: Will the site meet the performance objective for prewaste emplacement.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 94	Performance Assessment: Assumption about features, events, processes related to the hydraulic systems in the modeling strategy.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 95	Performance Assessment: Logic used to develop and screen scenarios and its implementation appear to be deficient.		Supplemental Response submitted to the NRC on 5/27/93. Awaiting NRC concurrence.
Comment 96	Adequacy of the use of Kd for modeling heterogeneous medium.		Study Plans 8.3.1.3.4.1 "Sorption Study" and 8.3.1.3.4.3 "Development of Sorption Models" were submitted to the NRC on 8/26/94; Study Plan 8.3.1.3.5.1 "Dissolved Species Concentration Limit" was submitted to the NRC on 9/17/93. Submit a supplemental response to the NRC.
Comment 97	Adequacy of evidence to eliminate iodine as an important radionuclide.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.

E-14

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 15 of 27)

Item ID	Item Description	Status	Action Description
Comment 98	Performance Assessment: Appropriateness of weighting Complementary Cumulative Distribution Functions by expert judgment.		Continue the development of the alternative conceptual models. Address the Complementary Cumulative Distribution Functions through the iterative TSPA process. Prepare and provide the NRC with documentation on the TSPA and sensitivity studies (related to schedule in Comment 9). Submit a supplemental response to the NRC.
Comment 99	Performance Assessment: Quantification of all releases.		DOE/NRC Technical Exchange on Scenarios and Complementary Cumulative Distribution Functions.
Comment 100	Performance Assessment: Adequacy of considerations of faulting release scenarios.	Closed 2/8/93	NRC evaluation of DOE responses. The NRC considers this comment closed.
Comment 101	Performance Assessment: Appropriateness of equation used to estimate the partial performance for the 4th scenario class involving release along the water pathway.		Supplemental response submitted to the NRC on 10/11/94. Awaiting NRC concurrence.
Comment 102	Performance Assessment: Adequacy of Ross sequences in comparison to the hydrologic flow model.		Submit a supplemental response to the NRC.
Comment 103	Performance Assessment: Ross sequences address anticipated conditions and not scenarios.		Submit a supplemental response to the NRC.

Status of Site Characterization Analysis Open Items (Page 16 of 27)

Item ID	Item Description	Status	Action Description
Comment 104	Performance Assessment: Ross sequences address spent fuel but not vitrified waste form.	Closed 2/8/93	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 105	Performance Assessment: Rationale for elimination of scenarios.		Supplemental response submitted to the NRC on 5/27/93. Awaiting NRC concurrence.
Comment 106	Performance Assessment: Missing coupling term for calculation of liquid phase radionuclide transport.	Closed 2/8/93	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 107	Performance Assessment: Awaiting time in calculation is OK but care needs to be taken in the empirical Complementary Cumulative Distribution Functions in approximating.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 108	Performance Assessment: Use of the Estimated Partial Performance Measures to screen scenarios and establish goals.	Closed 2/8/93	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 109	Performance Assessment: Adequacy of treatment of coupling time between matrix and fracture flow in hypothesis testing tables.		Continue Total System Performance Analysis activity which will continue to analyze the coupling times for the transfer of radionuclides between matrix and fracture flow. Submit a supplemental response to the NRC.
Comment 110	Performance Assessment: Adequacy of dealing with human intrusion in the Complementary Cumulative Distribution Function.	Closed 2/8/93	NRC evaluation of DOE responses. NRC considers this comment closed.

Status of Site Characterization Analysis Open Items (Page 17 of 27)

Item ID	Item Description	Status	Action Description
Comment 111	Inconsistencies exist in the Site Characterization Plan on Total System Performance.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 112	Adequate discussion of state variables as constants or as random variables.	Closed 2/8/93	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 113	Consistency of definition of Complementary Cumulative Distribution Function and the unit step function.	Closed 2/8/93	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 114	The term "independent" is used instead of "mutually exclusive."	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 115	Adequacy of expanding of Complementary Cumulative Distribution Function in terms of scenario classes.		Submitted a supplemental response to the NRC on 5/27/93. Awaiting NRC concurrence.
Comment 116	Individual exposures via potable water may need to be expanded.		Issuance by the Environmental Protection Agency of a new standard (40 CFR 191) for individual exposure standards per the Energy Policy Act of 1992. Revise issue resolution strategy for Site Characterization Plan Issue 1.2. Prepare additional response to NRC. Submit revised issue resolution strategy and response to NRC.

E-17

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 18 of 27)

Item ID	Item Description	Status	Action Description
Comment 117	Individual exposure rate of C-14 may need to consider advective and diffusive flow rates.		Submit a supplemental response to the NRC.
Comment 118	The monitoring and testing activities should include long-term in situ and long-term waste package activities.		Determine testing requirements after site characteristics have advanced far enough to define the performance program. Submit a supplemental response to the NRC.
Comment 119	Performance Confirmation: The information presented is insufficient to determine if the confirmation program meets the requirements of 10 CFR 60.		Conduct NRC/DOE interaction on the performance confirmation program. Prepare Study Plan 8.3.3.2.2.3 "In Situ Testing of Seal Components" and then submit to the NRC for acceptance. Prepare Study Plan 8.3.1.15.1.6 "In Situ Thermo-mechanical Properties" and submit to the NRC. Prepare Study Plan 8.3.4.2.4.4 "Engineered Barrier Field Tests" and submit to the NRC. Submit a supplemental response to the NRC.
Comment 120	Model and computer code validation studies.		Prepare and provide to the NRC the model and computer code validation strategy. Submit a supplemental response to the NRC.
Comment 121	Exploratory Shaft Facility: Adequacy of seismic design of Exploratory Shaft Facility.		Exploratory Studies Facility Design Requirements submitted on 9/9/94.
Comment 122	Demonstration and acceptability of the dry coring method.		Supplemental response submitted to the NRC on 3/30/94. Awaiting NRC concurrence.
Comment 123	Assessment of effects of ventilation on the Exploratory Shaft Facility.	Closed 6/21/94	NRC evaluation of DOE responses. NRC considers this comment closed.

Status of Site Characterization Analysis Open Items (Page 19 of 27)

Item ID	Item Description	Status	Action Description
Comment 124	Potential causes for a reduction in the drainage capacity.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 125	Existing data used in the licensing process needs to be qualified.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 126	Items covered by 10 CFR Part 60 (G) are incomplete.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 127	Design Acceptability Analysis.	Closed 11/2/92	NRC letter lifting Objection 1. NRC considers this comment closed.
Comment 128	Requirements applicable to the Exploratory Shaft Facility.	Closed 11/2/92	NRC letter lifting Objection 1. NRC considers this comment closed.
Comment 129	Design Acceptability Analysis and the Exploratory Studies Facility Design Requirements do not consider 10 CFR 60 requirements.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 130	Only 22 of fifty-two (52) requirements applicable to the Exploratory Shaft Facility were focused on in the Title I design. The rigor and completeness of the Design Acceptability Analysis are questioned.		Prepare a supplemental response after the ESFDR document is issued. The response will identify where in the ESFDR document the 29 requirements are addressed and discuss how the 30th requirement is addressed by the SCP.
Comment 131	Design Acceptability Analysis.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Comment 132	Design Acceptability Analysis.	Closed 11/2/92	NRC letter lifting Objection 1. NRC considers this comment closed.

Status of Site Characterization Analysis Open Items (Page 20 of 27)

Item ID	Item Description	Status	Action Description
Comment 133	Design Acceptability Analysis.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this comment closed.
Question 1	Integration of mapping efforts.	Closed 12/30/93	NRC evaluation of DOE responses. NRC considers this question closed.
Question 2	Performance Assessment: Relation between mechanical and hydraulic apertures.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 3	Repository Design: Rationale used for selecting the total repository area is not presented.		Supplemental response submitted to the NRC on 5/17/94. Awaiting NRC concurrence.
Question 4	Adequacy of temperature logging to evaluate anomalously low heat flow.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 5	Adequacy of vertical boreholes for evaluation of faults and fractures.		Submitted supplemental response to the NRC on 6/16/94. Awaiting NRC concurrence.
Question 6	Meaning of statement in last paragraph page 8.3.1-75.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 7	Face mapping of exploratory drifts restricted to areas of anomolous conditions.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 8	Rock Properties: Level of detail and uncertainty in 3D model.		Submitted Study Plan 8.3.1.4.3.1 "Systematic Acquisition of Site-Specific Subsurface Information" to the NRC for review on 1/19/93. Submit Study Plan 8.3.1.4.3.2 "Three-Dimensional Rock Characteristics Models" to the NRC for review. Submit a supplemental response to the NRC.

Status of Site Characterization Analysis Open Items (Page 21 of 27)

Item ID	Item Description	Status	Action Description
Question 9	Systematic Drilling Program: Adequacy of sampling same sequences for rock properties.		Submitted Study Plan 8.3.1.4.3.1 "Systematic Acquisition of Site-Specific Subsurface Information" to the NRC for review on 1/19/93. Submit a supplemental response to the NRC.
Question 10	How will 3D block model account for variability in the block?	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 11	Rationale to start drilling prior to approval of study plans.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 12	Rationale for exclusion of lunar crater basaltic field as natural analog.		Submitted supplemental response to the NRC on 6/9/93. Awaiting NRC concurrence.
Question 13	Basis for statements made about the migration, structural boundaries, and stage of volcanism.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 14	Natural Resources: Adequacy of evaluation of previous mining and drilling leases.	Closed 2/18/94	NRC evaluation of DOE responses. NRC considers this question closed.
Question 15	Resource exploration and mineral resource potential.	Closed 2/18/94	NRC evaluation of DOE responses. NRC considers this question closed.
Question 16	Methods for determining the impact of ground motion from underground nuclear explosions.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 17	Rock Properties: Activities to investigate effects on	Closed 4/21/93	NRC evaluation of DOE responses. NRC considers this question closed.
Question 18	Allowable movements on joints related to rock mass strength.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.

E-21

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 22 of 27)

Item ID	Item Description	Status	Action Description
Question 19	Side Looking Airborne Radar (SLAR).	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 20	Repository Design: Discussion of vertical or horizontal emplacement.		Supplemental response submitted to the NRC on 6/16/94. Awaiting NRC concurrence.
Question 21	Process to assure the parameters for performance goal C2 (radiation shielding of rock) is comprehensive enough and expected values realistic.		Further develop the advanced conceptual design. Submit a supplemental response to the NRC.
Question 22	Parameters related to repository construction and operation.		Supplemental response submitted to the NRC on 3/30/94. Awaiting NRC concurrence.
Question 23	Computer code verification and validation.		Submit a supplemental response to the NRC.
Question 24	Justification that the shaft liner does not provide structural support for the formation.	Closed 7/31/94	NRC evaluation of DOE responses. NRC considers this question closed.
Question 25	Heterogeneous air flow characteristics for seal program.		Supplemental response submitted to the NRC on 4/13/93. Awaiting NRC concurrence.
Question 26	Inconsistency between tentative Design Goals and Design Performance Goals.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 27	Storage capacity at base of shaft for attaining the tentative design goals.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.

E-22

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 23 of 27)

Item ID	Item Description	Status	Action Description
Question 28	ES-1 penetration of the Calico Hills Unit: Impacts of the current sealing program and issue resolution strategy 4.4.		Prepare seal design concepts (Sandia National Laboratories). Conduct performance assessment of seal program. Submit a supplemental response to the NRC.
Question 29	Justification that references sited present results representative of conditions at Yucca Mountain.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 30	Waste Package: Water quality as related to waste package design.		The metal barriers scientific investigation plan was submitted to the NRC on 1/31/95. Complete evaluation of the drift emplacement alternative needs. Submit a supplemental response to the NRC.
Question 31	Waste Package: Integrity of spent fuel cladding.		Supplemental response submitted to the NRC on 9/16/92. Awaiting NRC concurrence.
Question 32	Waste package: Container "similarity" for borosilicate glass waste vs. spent fuel.		Advance the waste package design and narrow the waste package options down to three designs. Submit a supplemental response to the NRC.
Question 33	Waste Package: Emplacement hole drainage concerns.		Evaluate water-vapor interface, crevice corrosion, and galvanic corrosion testing in the metal barriers scientific investigation plan during Advanced Conceptual Design. Complete evaluation of the drift emplacement alternative. This alternative would make this concern moot. Submit a supplemental response to the NRC.
Question 34	Waste Package/ Performance Assessment: Meaning of undetected defective closures.		Submit a supplemental response to the NRC.

E-23

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 24 of 27)

Item ID	Item Description	Status	Action Description
Question 35	Waste Package: Acceptance criteria for helium leak results.	Closed 11/8/94	NRC Staff evaluation of Supplemental response. NRC considers this item closed.
Question 36	Waste Package: Contact of canisters with corrosive elements during shipping and handling.		Advance the waste package design and narrow options down to three designs. Submit a supplemental response which will further address the issue of eliminating corrosion elements during manufacture of the container to the NRC.
Question 37	Waste package: Basis for 10-cm of free fall for canister and contents.	Closed 3/7/95	NRC evaluation of DOE responses. NRC considers this question closed.
Question 38	What is the basis for the 1-mm thinning criterion for waste package scratching.		Submitted a supplemental response to the NRC on 7/12/93. Awaiting NRC concurrence.
Question 39	Waste Package: Defining "unusual process history" of canister.		Advance the design of the waste package. Submit a supplemental response to the NRC.
Question 40	Waste Package: Basis for factor of 2 on borehole liner in comparison to container material.		Study effects of water containing liner corrosion products on degradation of the container in accordance with the metal barriers scientific investigation plan. Submit a supplemental response to the NRC.
Question 41	Repository: Consideration of 10 CFR 60.132 (a) in resolution of Issue 2.4.		Conduct engineering studies to evaluate the waste throughput requirements. Submit a supplemental response to the NRC.
Question 42	Repository: Assumption of stability of vertical emplacement hole.		Advance the Advanced Conceptual Design. Drift emplacement may make this comment moot. Submit a supplemental response to the NRC.

E-24

PROGRESS REPORT #12

Status of Site Characterization Analysis Open Items (Page 25 of 27)

Item ID	Item Description	Status	Action Description
Question 43	Waste Package: Anticipated operational occurrences considered part of normal conditions on the preclosure design and analysis.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 44	Waste Package/Performance Assessment: Basis for assumed numbers of breached assemblies or canisters.		Provide information on failures of waste forms in multiple locations. Prepare and provide the NRC with documentation on the Total System Performance Assessment. Advance the Advanced Conceptual Design and narrow options to two candidate designs. Submit a supplemental response to the NRC.
Question 45	Waste Package: Investigation of particulate source terms, retention factors, and plate-out of waste package during accident conditions.		NRC requested preliminary MGDS/ESF postclosure safety analysis for review. Supplemental response submitted to the NRC on 7/1/94. Awaiting NRC concurrence.
Question 46	Waste Package: Basis for stricter containment of long half-life isotopes.	Closed 7/11/94	NRC evaluation of DOE response. NRC considers this question closed
Question 47	Waste Package: Assumption on breached waste containers.	Closed 3/7/95	NRC Evaluation of DOE Response. NRC Considers this question closed.
Question 48	Waste Package: Selection of peer review panel on waste package.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 49	Waste Package: Effects of low temperature oxidation on containers.		Advance the design of the waste package to three options. The metal barriers scientific investigation plan was submitted to the NRC on 1/31/95. Submit a supplemental response to the NRC.

Status of Site Characterization Analysis Open Items (Page 26 of 27)

Item ID	Item Description	Status	Action Description
Question 50	Waste Package: Assumption that stress propagation results in corrosion.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 51	Design second research criteria for accepting waste from Idaho National Engineering Laboratory and Hanford.	Closed 11/8/94	NRC evaluation of DOE responses. NRC considers this question closed.
Question 52	Waste Package: Leaching properties specification will require the producer to control leaching characteristics of the glass waste.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 53	Waste Package: Specification of cooling rate of the glass waste.	Closed 3/7/95	NRC Evaluation of DOE Response. NRC considers this question closed.
Question 54	Waste Package: Release rates of radionuclides from spent fuels.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 55	Exploratory Shaft Facility: Interference at the Exploratory Shaft Facility by waste storage tanks, septic field, and waste water lagoon.		Submit a supplemental response to the NRC.
Question 56	Basis for 5 cm of fault displacement in waste package environment.		Supplemental response submitted to the NRC on 5/17/94. Awaiting NRC concurrence.
Question 57	Effects of drilling multipurpose boreholes.		Supplemental response submitted to the NRC on 3/24/93. Awaiting NRC concurrence.
Question 58	Flexibility of the Exploratory Shaft Facility design to accommodate in situ testing of the waste package, if required.		Supplemental response submitted to the NRC on 3/24/93. Awaiting NRC concurrence.

Status of Site Characterization Analysis Open Items (Page 27 of 27)

Item ID	Item Description	Status	Action Description
Question 59	Basis for length of in situ thermal tests.		Prepare Study Plan 8.3.1.15.1.6 "In Situ Thermomechanical Properties" and submit to NRC. Submit a supplemental response to the NRC.
Question 60	Exploratory Shaft Facility: Timing of Exploratory Shaft Facility radial borehole test.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.
Question 61	Exploratory Shaft Facility: Accommodation of design changes during Exploratory Shaft Facility construction.	Closed 11/2/92	NRC letter lifting Objection 1. NRC considers this question closed.
Question 62	Repository: Basis for 500 feet of separation from Exploratory Shaft Facility and waste emplacement panel.		Submit a supplemental response to the NRC.
Question 63	Certifying Training Attendance Record reviewers were not principal investigators.	Closed 7/31/91	NRC evaluation of DOE responses. NRC considers this question closed.

PROGRESS REPORT #12

APPENDIX F

Change Control Board Actions

PROGRESS REPORT #12

Change Control Board Actions

Requirements and Reports Changes

Title	Change Description	Status
Repository Surface Design Report	Changes report delivery from 9/29/94 to 10/31/95	Closed
ESF Design Requirements Document (YMP/CM-0019) Rev. 1, ICN 1	Incorporates design requirements for the integrated data and control system	Closed
Waste Package Conceptual Design Report	Revises report delivery from 12/23/94 to 3/31/95	Closed
Site Design & Test Requirements Document	Revises titles and objectives in five sections	Open
Technical Baseline	Streamlines Project Technical Baseline including deletion of four obsolete requirements documents.	Open
Site Characterization Program Baseline	Restructures Site Characterization Program Baseline including the removal of test objectives duplicated in Site Design & Test Requirements Document and updates of design summary.	Open

PROGRESS REPORT #12

Change Control Board Actions

Surface-Based Testing Changes (Page 1 of 2)

Title	Change Description	Status
Geophysical Surveys	Adds Job Package JP94-12 into the Change Control Board Register for drilling deep seismic shot holes.	Closed
Exile Hill Booster Pump	Adds Job Package JP94-24 to Change Control Board Register	Closed
Borehole USW NRG-77a	Adds Job Package JP94-03 to Change Control Board Register	Closed
Borehole USW NRG-6	Adds Job Package JP94-19 to Change Control Board Register	Closed
Work Breakdown Structure Element 1.2.5.7	Opens new Work Breakdown Structure element for site activities evaluation and review	Closed
Rock Valley Trenches and Test Pits	Add Job Package JP94-10 to Change Control Board Register	Closed
Studies 8.3.1.5.6 & 8.3.1.15.1.5	Revise testing objectives in studies for future regional climates and environments, and excavation investigations, respectively. Makes editorial changes to Section 8.4 that respond to NRC comments. Incorporate six revised ESF/Repository Interface Drawings as described in Change Request 94/035M2.	Closed
Borehole UE-25 UZ-16	Adds Job Package JP95-13 for initial instrumentation for borehole UE-25 UZ#16	Closed
Crater Flat Tectonics	Adds Job Package JP95-16 to the Change Control Board Register	Open
Borehole USW SD-12	Adds Job Package JP94-04 to the Change Control Board Register	Open

PROGRESS REPORT #12

Change Control Board Actions

Surface-Based Testing Changes (Page 2 of 2)

Title	Change Description	Status
Work Breakdown Structure Elements 1.2.3.5.3.1 & 1.3.5.3.5	Funds new USW UZ-7a borehole, reduces work scope of current USW UZ-7 borehole, and funds work on USW UZ-4 and USW UZ-5	Open
Borehole USW UZ-5	Adds Job Package JP95-11 to Change Control Board Register	Open
Borehole USW UZ-7a	Adds Job Package JP95-15 to Change Control Board Register	Open

PROGRESS REPORT #12

Change Control Board Actions

Exploratory Studies Facility Changes (Page 1 of 2)

Title	Change Description	Status
ESF North Ramp Station	Adds new Job Package JP94-16 to Change Control Board Register for station 0+60 to 28+15.5	Closed
ESF Electrical Duct Bank Drawings	Revises 10 1B drawings to remove TBVs and incorporated Field Change Requests	Closed
ESF Muck Storage Area	Adds Job Package JP95-3 to the Change Control Board Register	Closed
ESF Package 1A Specifications	Revises Specifications YMP-025-1-SP09 and YMP-025-1-SP10	Open
Medium Voltage Switchgear Specification	Revises specification to incorporate five Field Change Requests and remove one TBV	Closed
ESF Surface Drawing	Revises Drawing Index to remove TBV and include information from another drawing	Closed
Surface Muck Handling System	Adds Job Package JP95-09 to the Change Control Board Register	Closed
ESF Package 1A	Revises four electrical duckbank drawings	Open
ESF Package 1B Electrical Drawings	Revise 33 electrical drawings to remove TBVs and incorporate Field Change Requests	Open
M&O Electrical Specifications	Revises 14 M&O electrical specifications to incorporate Field Change Requests and remove TBVs	Open
ESF Package 1A Electrical System	Deletes 20 electrical drawings regarding obsolete electrical system	Open
ESF Package 1A Water Supply & Distribution System	Revises the Table of Contents to make eight sections of YMP-025-1-SP07 specifications obsolete and incorporates two Field Change Requests	Open

PROGRESS REPORT #12

Change Control Board Actions

Exploratory Studies Facility Changes (Page 2 of 2)

Title	Change Description	Status
ESF Division Specification	Revises specifications for temporary surface construction facilities and material/handling equipment, sections -1500 and -1600, respectively.	Open
ESF Package 1A Drawings	Revises 28 drawings to show reference to approved baselined drawings.	Open
ESF Package 1B drawings	Revises nine drawings to remove TBVs and incorporate new scope of work from baselined Package 1D.	Open
ESF Specifications	Revises six civil specifications, including removal of TBVs, incorporation of Field Change Requests, and removal of Q-control in two sections of specification.	Open
ESF Package 1A Topsoil & Rock Storage Area	Revises YMP-025-1-SP04 specifications.	Open
ESF Specifications	Revises 10 subsurface electrical specifications.	Open
ESF Conveyor Foundation	Increases cost estimate for segment of conveyor foundation package by \$180K, from \$264K to \$440K.	Open
ESF Cost Estimate for Surface Preparation Design Package 1D	Reduces ESF Cost Baseline Estimate presented in Chapter 14 of the ESF Technical Baseline by \$1.9 million, from \$6,245,049 Title I estimate to \$4,333,100 Title II estimate. This includes muck storage area, standby power, and tunnel ventilation power.	Open
ESF Packages 1A, 1B and 2A	Transfers ESF design packages from Level 2 Change Control Board control to Level 3 Change Control Board control.	Open

PROGRESS REPORT #12

APPENDIX G

Study Plan Status

Study Plan Status (Page 1 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.1.2.1.1	Characterization of the Meteorology for Regional Hydrology	6/26/90	3/13/91	10/21/91	12/10/91
8.3.1.2.1.2	Characterization of Runoff and Streamflow	3/27/89	8/21/90	5/14/91	4/12/91
8.3.1.2.1.3	Characterization of the Regional Ground-Water Flow System	3/1/90	1/18/91	10/4/91	3/19/93
8.3.1.2.1.4	Regional Hydrologic System Synthesis and Modeling	6/6/90	12/18/91	5/6/92	1/29/93
8.3.1.2.2.1	Characterization of Unsaturated-Zone Infiltration	3/9/90	1/18/91	5/31/91	
8.3.1.2.2.2, R0	Water Movement Test	9/23/87	11/9/89	4/8/93	
8.3.1.2.2.2, R1	Water Movement Test	10/17/91	2/10/93	4/8/93	
8.3.1.2.2.3	Characterization of Percolation in the Unsaturated Zone-Surface-Based Study	8/12/88	4/8/91	3/26/92	
8.3.1.2.2.4	Characterization of the Yucca Mountain Unsaturated Zone in the Exploratory Studies Facility (.4, .5, .7, .8, .9)	9/9/87	1/9/89	3/5/93	
8.3.1.2.2.4, R1	Characterization of the Yucca Mountain Unsaturated Zone in the Exploratory Studies Facility (.4, .5, .7, .8)	12/4/92	1/14/93	3/5/93	
8.3.1.2.2.4, R2	Characterization of the Yucca Mountain Unsaturated Zone in the Exploratory Studies Facility (.10)	3/16/93	6/2/94	9/15/94	
8.3.1.2.2.4, R3	Characterization of the Yucca Mountain Unsaturated Zone in the Exploratory Studies Facility (.1, .2)	4/29/94			

G-1

PROGRESS REPORT #12

Study Plan Status (Page 2 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.1.2.2.5	Diffusion Tests in the Exploratory Studies Facility	11/1/88	4/22/92	1/19/93	11/1/93
8.3.1.2.2.6	Characterization of Gaseous-Phase Movement in the Unsaturated Zone	6/12/89	6/11/91	10/7/91	5/1/92
8.3.1.2.2.6, R1	Characterization of Gaseous-Phase Movement in the Unsaturated Zone	4/6/93	9/30/93		
8.3.1.2.2.7	Hydrochemical Characterization of the Unsaturated Zone	10/24/88	9/18/90	5/1/92	12/28/92
8.3.1.2.2.7, R1	Hydrochemical Characterization of the Unsaturated Zone	12/1/92	9/9/93	1/26/94	
8.3.1.2.2.8	Fluid Flow in Unsaturated, Fractured Rock	9/7/90	8/12/92	1/28/93	
8.3.1.2.2.8, R1	Fluid Flow in Unsaturated, Fractured Rock	12/1/92	12/17/93	8/23/94	
8.3.1.2.2.9	Site Unsaturated-Zone Modeling and Synthesis	1/25/91	7/1/93	11/8/93	
8.3.1.2.3.1.1-6	Characterization of the Site Saturated-Zone Ground-Water Flow System	5/31/89	2/13/91	12/6/91	
8.3.1.2.3.1.7	Characterization of the Site Saturated-Zone Ground-Water Flow System	2/8/88	2/22/90	12/6/91	
8.3.1.2.3.2	Characterization of the Saturated-Zone Hydrochemistry	3/28/90	4/22/92	1/4/93	
8.3.1.2.3.3	Saturated-Zone Hydrologic System Synthesis and Modeling	9/4/90	1/14/93	6/16/93	
8.3.1.3.1.1	Ground-Water Chemistry Model	3/15/91	5/4/94		

G-2

PROGRESS REPORT #12

Study Plan Status (Page 3 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.1.3.2.1	Mineralogy, Petrology, and Chemistry of Transport Pathway	1/22/88	6/13/89	8/20/90	12/28/92
8.3.1.3.2.2	History of Mineralogical and Geochemical Alteration of Yucca Mountain	3/28/88	12/18/91	4/27/92	1/24/94
8.3.1.3.3.1	Natural Analog of Hydrothermal Systems in Tuff	No Study Plan to be Developed			
8.3.1.3.3.2	Kinetics and Thermodynamics of Mineral Evolution	3/25/94			
8.3.1.3.3.3	Conceptual Model of Mineral Evolution				
8.3.1.3.4.1	Batch Sorption Studies	10/28/92	8/4/94		
8.3.1.3.4.2	Biological Sorption and Transport	12/12/88	11/25/92	3/25/93	
8.3.1.3.4.3	Development of Sorption Models	10/28/92	8/4/94		
8.3.1.3.5.1/2	Dissolved Species Concentration Limits and Colloid Behavior	9/7/90	9/9/93		
8.3.1.3.6.1	Dynamic Transport Column Experiments	3/10/93			
8.3.1.3.6.2	Diffusion	7/24/89	8/6/93	1/19/94	
8.3.1.3.7.1	Retardation Sensitivity Analysis	12/14/88	8/11/92	1/19/93	
8.3.1.3.7.2	Demonstration of Applicability of Laboratory Data to Repository Transport Calculations	Out Year – Under Development			
8.3.1.3.8.1	Gaseous Radionuclide Transport Calculations and Measurements	No Study Plan to be Developed			

G-3

PROGRESS REPORT #12

Study Plan Status (Page 4 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.1.4.2.1	Characterization of the Vertical and Lateral Distribution of Stratigraphic Units Within the Site Area	4/12/90	6/9/92	12/14/92	
8.3.1.4.2.2	Characterization of the Structural Features Within the Site Area	9/4/87	2/3/89	2/8/93	
8.3.1.4.2.2, R1	Characterization of the Structural Features Within the Site Area (.3, .5)	2/27/90	4/22/92	2/8/93	
8.3.1.4.2.2, R2	Characterization of the Structural Features Within the Site Area (.3, .5)	11/18/92	12/22/92	2/8/93	2/11/94
8.3.1.4.2.3	Three-Dimensional Geologic Model	2/13/95			
8.3.1.4.3.1	Systematic Acquisition of Site-Specific Subsurface Information	3/27/90	12/8/92	7/19/93	
8.3.1.4.3.2	Three-Dimensional Rock Characteristics Models	5/4/94			
8.3.1.5.1.1	Characterization of Modern Regional Climate	6/24/93	7/25/94		
8.3.1.5.1.2	Paleoclimate Study: Lake, Playa, and Marsh Deposits	10/25/90	10/31/91	4/27/92	1/24/94
8.3.1.5.1.3	Climatic Implications of Terrestrial Paleoecology	2/11/91	1/17/92	8/27/92	1/24/94
8.3.1.5.1.4	Analysis of the Paleoenvironmental History of the Yucca Mountain Region	3/30/90	5/29/91	12/06/91	1/11/93
8.3.1.5.1.5	Paleoclimate-Paleoenvironmental Synthesis	2/2/95			
8.3.1.5.1.6	Characterization of the Future Regional Climate and Environments	12/29/93	6/15/94	10/18/94	

G-4

PROGRESS REPORT #12

Study Plan Status (Page 5 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.1.5.2.1	Characterization of the Quaternary Regional Hydrology (.3, .4, .5)	1/26/88	6/8/89	11/24/89	4/9/91
8.3.1.5.2.1, R2	Characterization of the Quaternary Regional Hydrology (.1)	9/25/90	11/10/92	6/24/93	11/1/93
8.3.1.5.2.2	Characterization of Future Regional Hydrology Due to Climate Changes	1/16/91	11/10/92	4/5/93	11/1/93
8.3.1.6.1.1	Distribution and Characteristics of Present and Past Erosion	No Study Plans to be Developed			
8.3.1.6.2.1	Influence of Future Climatic Conditions on Locations and Rates of Erosion				
8.3.1.6.3.1	Evaluation of the Effects of Future Tectonic Activity on Erosion at Yucca Mountain				
8.3.1.6.4.1	Development of a Topical Report on the Effects of Erosion				
8.3.1.8.1.1	Probability of Magmatic Disruption of the Repository	3/29/89	9/19/90	10/5/91	8/8/91
8.3.1.8.1.2	Physical Processes of Magmatism and Effects on the Repository	10/21/92	9/21/93	9/14/94	

G-5

PROGRESS REPORT #12

Study Plan Status (Page 6 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.1.8.2.1	Analysis of Waste Package Rupture Due to Tectonic Processes and Events	12/15/89	11/16/92	11/19/93	
8.3.1.8.2.1, R1	Tectonic Effects: Evaluations of Changes in the Natural and Engineered Barrier Systems Resulting from Tectonic Processes and Events	2/18/94			
8.3.1.8.3.1	Analysis of the Effects of Tectonic Processes and Events on Average Percolation Flux Rates Over the Repository	These Studies Have Been Combined Into 8.3.1.8.2.1 R1			
8.3.1.8.3.2	Analysis of the Effects of Tectonic Processes and Events on Changes in Water-Table Elevation				
8.3.1.8.3.3	Analysis of the Effects of Tectonic Processes and Events on Local Fracture Permeability and Effective Porosity				
8.3.1.8.4.1	Analysis of the Effects of Tectonic Processes and Events on Rock Geochemical Properties				
8.3.1.8.5.1	Characterization of Volcanic Features	12/14/88	4/18/90	8/20/90	2/21/91
8.3.1.8.5.2	Characterization of Igneous Intrusive Features	10/13/92	3/7/94	8/22/94	
8.3.1.8.5.3	Investigation of Folds in Miocene and Younger Rocks of the Region	No Study Plans to be Developed			
8.3.1.9.1.1	An Evaluation of Natural Processes that Could Affect the Long-Term Survivability of the Surface Marker System at Yucca Mountain				

G-6

PROGRESS REPORT #12

Study Plan Status (Page 7 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.1.9.2.1	Natural Resource Assessment of Yucca Mountain, Nye County, Nevada	7/13/90	11/6/92	3/16/93	2/11/94
8.3.1.9.2.2	Water Resource Assessment of Yucca Mountain, Nevada	10/6/89	8/26/91	5/4/92	12/28/92
8.3.1.9.3.1	Evaluation of Data Needed to Support an Assessment of the Likelihood of Future Inadvertent Human Intrusion at Yucca Mountain as a Result of Exploration and/or Extraction of Natural Resources	No Study Plans to be Developed			
8.3.1.9.3.2	An Evaluation of the Potential Effects of Exploration for, or Extraction of, Natural Resources on the Hydrologic Characteristics at Yucca Mountain				
8.3.1.12.2.1	Meteorological Data Collection at the Yucca Mountain Site	9/28/90	3/20/91	11/12/91	12/2/91
8.3.1.12.2.1, R1	Meteorological Data Collection at the Yucca Mountain Site	3/31/92	8/9/93		
8.3.1.14.2	Studies to Provide Soil/Rock Properties of Potential Locations of Surface/Subsurface Facilities	7/15/91	10/01/91	1/24/92	4/6/92
8.3.1.15.1.1	Laboratory Thermal Properties	3/17/88	10/21/90	8/22/94	
8.3.1.15.1.1, R1	Laboratory Thermal Properties	11/3/92	8/27/93	8/22/94	

G-7

PROGRESS REPORT #12

Study Plan Status (Page 8 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.1.15.1.2	Laboratory Thermal Expansion Testing	12/1/88	8/21/90	8/22/94	
8.3.1.15.1.2, R1	Laboratory Thermal Expansion Testing	11/3/92	8/27/93	8/22/94	
8.3.1.15.1.3	Laboratory Determination of Mechanical Properties of Intact Rock	2/8/88	5/21/91	Deferred	
8.3.1.15.1.3, R1	Laboratory Determination of Mechanical Properties of Intact Rock	7/19/93			
8.3.1.15.1.4	Laboratory Determination of the Mechanical Properties of Fractures	10/23/91	12/14/94		
8.3.1.15.1.5	Excavation Investigations	3/26/87	1/09/89	8/19/94	
8.3.1.15.1.5, R1	Excavation Investigations	3/18/93	4/22/94	8/19/94	
8.3.1.15.1.6	In Situ Thermomechanical Properties	Out Year – Under Development			
8.3.1.15.1.7	In Situ Mechanical Properties				
8.3.1.15.1.8	In Situ Design Verification	3/20/90	2/3/93	4/15/93	11/1/93
8.3.1.15.2.1	Characterization of the Site Ambient Stress Conditions (.2)	9/22/87	1/11/89	Deferred	
8.3.1.15.2.1, R.1	Characterization of the Site Ambient Stress Conditions (.1)				
8.3.1.15.2.2	Characterization of the Site Ambient Thermal Conditions	10/13/92	6/23/94		
8.3.1.16.1.1	Characterization of Flood Potential of the Yucca Mountain Site	3/30/89	9/17/90	5/8/91	1/22/91

G-8

PROGRESS REPORT #12

Study Plan Status (Page 9 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.1.16.2.1	Location of Adequate Water Supply for Construction, Operation, Closure, and Decommissioning of a Mined Geologic Disposal System at Yucca Mountain, Nevada	No Study Plan to be Developed			
8.3.1.16.3.1	Determination of the Preclosure Hydrologic Conditions of the Unsaturated Zone at Yucca Mountain, Nevada	Out Year – Under Development			
8.3.1.17.1.1	Potential for Ash Fall at the Site	No Study Plans to be Developed			
8.3.1.17.2.1	Faulting Potential at the Repository				
8.3.1.17.3.1	Relevant Earthquake Sources	8/1/90	12/18/91	5/18/92	1/13/93
8.3.1.17.3.1, R1	Relevant Earthquake Sources	2/18/94			
8.3.1.17.3.2	Underground Nuclear Explosion Sources	Out Year – Under Development			
8.3.1.17.3.3.1	Ground Motion from Regional Earthquakes	4/21/94			
8.3.1.17.3.3.2	Ground Motion from Underground Nuclear Explosions	2/2/94	9/6/94	12/22/94	
8.3.1.17.3.4	Effects of Local Site Geology on Surface and Subsurface Motions	7/6/90	11/14/91	6/8/92	1/11/93
8.3.1.17.3.5	Ground Motion at the Site from Controlling Seismic Events	10/4/90	7/9/93	11/2/93	
8.3.1.17.3.6	Probabilistic Seismic Hazards Analyses	10/17/94			
8.3.1.17.4.1	Historical and Current Seismicity	10/17/89	9/17/90	5/14/91	11/1/93
8.3.1.17.4.1, R1	Historical and Current Seismicity	11/16/93	11/9/94	2/17/95	

G-9

PROGRESS REPORT #12

Study Plan Status (Page 10 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.1.17.4.2	Location and Recency of Faulting Near the Prospective Surface Facilities	12/6/88	5/22/89	11/24/89	5/29/90
8.3.1.17.4.3	Quaternary Faulting Within 100 km of Yucca Mountain, Including the Walker Lane	3/25/92	1/21/93	9/2/93	3/3/94
8.3.1.17.4.4	Quaternary Faulting Proximal to the Site Within Northeast-Trending Fault Zones	8/3/92	3/18/93	9/2/93	
8.3.1.17.4.5	Detachment Faults at or Proximal to Yucca Mountain	5/1/90	7/20/92	2/1/93	1/24/94
8.3.1.17.4.6	Quaternary Faulting Within the Site Area	10/14/88	1/23/91	10/3/91	1/13/93
8.3.1.17.4.7	Subsurface Geometry and Concealed Extensions of Quaternary Faults at Yucca Mountain	No Study Plan to be Developed			
8.3.1.17.4.8	Stress Field Within and Proximal to the Site Area	2/27/95			
8.3.1.17.4.9	Tectonic Geomorphology of the Yucca Mountain Region	No Study Plan to be Developed			
8.3.1.17.4.10	Geodetic Leveling	3/30/90	1/18/91	10/4/91	2/1/93
8.3.1.17.4.11	Characterization of Regional Lateral Crustal Movement	No Study Plan to be Developed			
8.3.1.17.4.12	Tectonic Models and Synthesis	4/30/93	11/18/94	2/6/95	
8.3.1.20.1.1	Characterization of the Altered Zone	1/30/95			
8.3.3.2.2.1	Seal Material Properties Development	Out Year – Under Development			
8.3.3.2.2.3	In Situ Testing of Seal Components	9/16/94			

G-10

PROGRESS REPORT #12

Study Plan Status (Page 11 of 11)

Study Plan Number	Study Plan Title	Submitted to YMSCO ^a	Approved by YMSCO ^b	Reviewed by NRC ^c	Reviewed by NV ^d
8.3.4.2.4.1	Characterization of the Chemical and Mineral Changes in the Postemplacement Environment	8/8/94			
8.3.4.2.4.2	Hydrological Properties of Waste Package Environment	12/20/93	2/27/95		
8.3.4.2.4.2, R1	Hydrological Properties of Waste Package Environment	2/28/95			
8.3.4.2.4.3	Characterization of the Geomechanical Attributes for the Waste Package Environment	6/28/89	12/11/92	4/21/93	
8.3.4.2.4.4	Engineered Barrier System Field Tests	7/9/93			
8.3.4.2.4.5	Effects of Man-Made Materials on Water Chemistry	4/28/94			

- ^a Submitted to YMSCO and under review.
- ^b Completed YMSCO review.
- ^c Completed NRC initial review with no objections.
- ^d Received comments from State of Nevada.

PROGRESS REPORT #12

APPENDIX H

Glossary

PROGRESS REPORT #12

GLOSSARY

Accessible environment means the atmosphere, the land surface, surface water, oceans, and the portion of the lithosphere that is outside the controlled area.

Barrier means any material or structure that prevents or substantially delays the movement of water or radionuclides.

Boiling water reactor (BWR) means a nuclear reactor system that uses boiling water in the primary cooling system. Steam from the primary cooling system turns turbines to generate electricity.

Borehole means a hole made with a drill, auger, or other tools for exploring strata in search of minerals, supplying water for blasting, emplacing waste, proving the position of old workings or faults, or releasing accumulations of gas or water. Boreholes include core holes, dry-well-monitoring holes, waste-emplacment boreholes, and test holes for geophysical or ground-water characterization.

Closure means final backfilling of the remaining open operational areas of the underground facility and boreholes after the termination of waste emplacement, culminating in the sealing of shafts.

Confinement as it pertains to radioactivity, means the retention of radioactive material within some specified bounds. Confinement differs from containment in that there is no absolute physical barrier in the former.

Containment means the confinement of radioactive waste within a designated boundary.

Controlled area means a surface location, to be marked by suitable monuments, extending horizontally no more than 10 kilometers in any direction from the outer boundary of the underground facility, and the underlying subsurface, which area has been committed to use as a geologic repository and from which incompatible activities would be prohibited before and after permanent closure.

Degradation means the general lowering of the surface of the land by erosive processes, especially by the removal of material by flowing water.

Disposal means the emplacement in a repository of high-level radioactive waste, spent nuclear fuel, or other highly radioactive material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste, and the isolation of such waste from the accessible environment.

Drift means a horizontal or nearly horizontal, mined passageway.

PROGRESS REPORT #12

Emplacement means the act of placing waste containers in prepared positions. For the proposed repository at Yucca Mountain, two methods are currently being considered: emplacement of a single waste container in a shallow vertical borehole in the floor of the emplacement drift or emplacement of multiple waste containers in long horizontal boreholes in the wall of the drift.

Engineered barrier system means the manmade components of a disposal system designed to prevent the release of radionuclides from the underground facility or into the geohydrologic setting. Such term includes the radioactive-waste form, radioactive-waste canisters, materials placed over and around such canisters, any other components of the waste package, and barriers used to seal penetrations in and into the underground facility.

Environmental impact statement means the document required by Section 102(2)(C) of the National Environmental Policy Act of 1969. Sections 114(a) and 114(f) of the Nuclear Waste Policy Act of 1982 include certain limitations on the National Environmental Policy Act requirements as they apply to the preparation of an environmental impact statement for the development of a repository at a characterized site.

Exploratory studies facility means a facility constructed for the purpose of performing underground studies during site characterization.

Fault means a fracture or a zone of fractures along which there has been displacement of the sides relative to one another parallel to the fracture or zone of fractures.

Flow path means the theoretical line that ground water follows in moving from a recharge area to a discharge area.

Flux means the ratio of the volume of fluid per unit area per unit time. Also known as specific discharge.

Geologic repository means a system, requiring licensing by the NRC, that is intended to be used, or may be used, for the disposal of radioactive waste in excavated geologic media. A geologic repository includes (1) the geologic-repository operations area and (2) the portion of the geologic setting that provides isolation of the radioactive waste and is located within the controlled area.

Ground-water flux means the rate of ground-water flow per unit area of porous or fractured media measured perpendicular to the direction of flow.

Ground-water travel time means the time required for a unit volume of ground water to travel between two locations. The travel time is the length of the flow path divided by the velocity, where velocity is the average ground-water flux passing through the cross-sectional area of the geologic medium through which flow occurs, perpendicular to the flow direction, divided by the effective porosity along the flow path. If discrete segments of the flow path have different hydrologic properties, the total travel time will be the sum of the travel times for each discrete segment.

PROGRESS REPORT #12

Guidelines means Part 960 of Title 10 of the Code of Federal Regulations—General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories.

High-level radioactive waste means (1) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (2) other highly radioactive material that the Nuclear Regulatory Commission, consistent with existing law, determines by rule requires permanent isolation.

Issue means a question relating to the performance of the mined geologic disposal system that must be resolved to demonstrate compliance with the applicable Federal regulations (including 10 CFR Part 60, 10 CFR Part 960, 40 CFR Part 191, and 10 CFR Part 20). See Section 8.1.1.

Isolation means inhibiting the transport of radioactive material so that the amounts and concentrations of this material entering the accessible environment will be kept within prescribed limits.

License application means an application for a license from the U.S. Nuclear Regulatory Commission to construct a repository.

Mined geologic disposal system (MGDS) means a system, requiring licensing by the U.S. Nuclear Regulatory Commission, that is used for the disposal of high-level radioactive waste in excavated geologic media. It is synonymous with "geologic repository."

Multibarrier system means a system of natural and engineered barriers, operating independently or relatively independently, that acts to contain and isolate the waste.

Multipurpose canister means a sealed, metallic container holding multiple spent nuclear fuel assemblies in a dry, inert environment and overpacked separately and uniquely for the various system elements of storage, transportation, and disposal.

National Environmental Policy Act means the Federal statute that is the national charter for protection of the environment. The Act is implemented by procedures issued by the Council on Environmental Quality. These procedures ensure that environmental information is available to public officials and citizens before Federal decisions are made and before Federal actions are taken. The National Environmental Policy Act of 1969 appears at 42 USC 4321 et seq.

Natural barrier means the physical, mechanical, chemical, and hydrologic characteristics of the geologic environment that individually and collectively act to minimize or preclude radionuclide transport.

Natural system means a host rock suitable for repository construction and waste emplacement and the surrounding rock formations. It includes natural barriers that provide containment and isolation by limiting radionuclide transport through the geohydrologic

PROGRESS REPORT #12

environment to the biosphere and provide conditions that will minimize the potential for human interference in the future.

Notice of intent means a notice published in the Federal Register that an environmental impact statement will be prepared and considered by a Federal agency. The notice is required by the National Environmental Policy Act implementing procedures. The notice must describe the proposed action and possible alternatives; describe the agency's proposed scoping process including whether, when, and where any scoping meeting will be held; and state the name of an agency official who can answer questions about the proposed action and the environmental impact statement.

Nuclear Waste Policy Act means the Nuclear Waste Policy Act of 1982, as amended, 42 USC 10101, et seq.

Overpack means a structural component used to hold and protect a multi-purpose canister so that the combination meets the Nuclear Regulatory Commission requirements for its application. There are several types of overpacks: (1) for transportation under 10 CFR Part 71; (2) for transfer under 10 CFR Part 72; (3) for storage under 10 CFR Part 72; and (4) for disposal under 10 CFR Part 60. An overpack is designed for its particular use in conjunction with a multi-purpose canister.

Perched ground water means unconfined ground water separated from an underlying body of ground water by an unsaturated zone. Its water table is a perched water table. Perched ground water is held up by a perching bed whose permeability is so low that water percolating downward through it is not able to bring water in the underlying unsaturated zone above atmospheric pressure.

Performance assessment means any analysis that predicts the behavior of a system or system component under a given set of constant and/or transient conditions. Performance assessments will include estimates of the effects of uncertainties in data and modeling.

Postclosure means the period of time after the closure of the geologic repository.

Preclosure means the period of time before and during the closure of the geologic repository.

Pressurized water reactor (PWR) means a reactor system that uses pressurized water in the primary cooling system. Steam formed in a secondary cooling system is used to turn turbines to generate electricity.

Pre-waste-emplacment means before the authorization of repository construction by the Nuclear Regulatory Commission.

Radioactive waste or "waste" means high-level radioactive waste and other radioactive materials, including spent nuclear fuel, that are received for emplacement in a geologic repository.

PROGRESS REPORT #12

Repository construction means all excavation and mining activities associated with the construction of shafts, shaft stations, rooms, and necessary openings in the underground facility, preparatory to radioactive-waste emplacement, as well as the construction of necessary surface facilities, but excluding site-characterization activities.

Saturated zone means that part of the Earth's crust beneath the water table in which all voids, large and small, are ideally filled with water under pressure greater than atmospheric.

Seismic means pertaining to, characteristic of, or produced by earthquakes or earth vibrations.

Site means a potentially acceptable site or a candidate site, as appropriate, until such time as the controlled area has been established, at which time the site and the controlled area are the same.

Site characterization means activities, whether in the laboratory or in the field, undertaken to establish the geologic conditions and the ranges of the parameters of a candidate site relevant to the location of a repository, including borings, surface excavations, excavations of exploratory shafts, limited subsurface lateral excavations and borings, and in situ testing needed to evaluate the suitability of a candidate site for the location of a repository, but not including preliminary borings and geophysical testing needed to assess whether site characterization should be undertaken.

Sorption is a term including both adsorption and absorption, and means the binding, on a microscopic scale, of one substance to another, such as by adsorption or ion exchange. In this document, the word is especially used for the sorption of dissolved radionuclides onto aquifer solids or waste-package materials by means of close-range chemical or physical forces.

Spent nuclear fuel means fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing.

Stakeholders means individuals or organizations who have an important, ongoing interest in the service and service quality of the Office of Civilian Radioactive Waste Management.

Stoichiometry means (1) the application of the laws of definite proportions and of the conservation of matter and energy to chemical activity; (2) the quantitative relationship between constituents in a chemical reaction.

Substantially complete containment means (1) by virtue of the intrinsic properties and design of the waste package components subjected to the range of conditions anticipated in the underground facility, 80 percent or more of the waste packages will retain all their radioactivity for a containment period of 1,000 years after permanent closure of the repository; (2) at any time during the containment period, at least 99 percent of the radioactivity resulting from the original waste emplaced in the underground facility will be retained within the set of waste packages; (3) any releases from the waste packages that occur during the containment period should be gradual such that releases from the engineered

PROGRESS REPORT #12

barrier system in any year during this period should not exceed one part in 100,000 of the total inventory of radionuclide activity present in the geologic repository system in that year.

Surface facilities means repository support facilities within the restricted area.

Systems engineering systemically applies science and engineering principles to control a complex total system development effort for the purpose of achieving an optimum balance of all system elements. It is a process that transforms and integrates operational needs and requirements into a description of system requirements to maintain the overall system effectiveness.

Thermal loading means the application of heat to a system, and is usually measured in terms of watt density. The thermal loading for a repository is the watts per acre produced by the radioactive waste in the active disposal area.

Unsaturated zone means the zone between the land surface and the water table. Generally, water in this zone is under less than atmospheric pressure, and some of the voids may contain air or other gases at atmospheric pressure. Beneath flooded areas or in perched water bodies, the water pressure locally may be greater than atmospheric.

Waste package means the waste form and any containers, shielding, packing, and other sorbent materials immediately surrounding an individual waste container.

10 CFR Part 60 means the Nuclear Regulatory Commission regulation, titled "Disposal of High-Level Radioactive Waste in Geologic Repositories," that sets forth technical requirements governing development of a permanent geologic repository for spent nuclear fuel and high-level radioactive waste.

10 CFR Part 960 means the Department of Energy regulation, titled "General Guidelines for the Recommendation of Sites for Nuclear Waste Repositories," that establishes guidelines to compare sites and select a site for recommendation to the President for development of a geologic repository.

PROGRESS REPORT #12

APPENDIX I

References

PROGRESS REPORT #12

REFERENCES

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APPENDIX J

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PROGRESS REPORT #12

APPENDIX K

Acronyms, Abbreviations, and Symbols

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Acronyms, Abbreviations, and Symbols

CRWMS	Civilian Radioactive Waste Management System
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ESF	Exploratory Studies Facility
FY	fiscal year
LBL	Lawrence Berkeley Laboratory
LLNL	Lawrence Livermore National Laboratory
Los Alamos	Los Alamos National Laboratory
M&O	Civilian Radioactive Waste Management System Management and Operating Contractor
NRC	U.S. Nuclear Regulatory Commission
OCRWM	Office of Civilian Radioactive Waste Management
Project	Yucca Mountain Site Characterization Project
QA	quality assurance
SCP	Site Characterization Plan
SNL	Sandia National Laboratories
USGS	U.S. Geological Survey
YMP	Yucca Mountain Site Characterization Project
YMSCO	Yucca Mountain Site Characterization Office

Scientific/Engineering Terms and Units

BP	before present
darcy	= $10^{-12}m^2$ (permeability)
gpm	gallons per minute
ka	kiloannum (thousand years ago)
Ma	megannum (million years ago)
pH	negative log of hydrogen ion concentration (acidity/alkalinity)
ppb	parts per billion
ppm	parts per million

PROGRESS REPORT #12

Acronyms, Abbreviations, and Symbols (Continued)

Borehole Letter Designators

c	Hydrologic test hole
G	Geologic
GA	Geologic angle "exploratory hole"
GU	Geologic unsaturated zone
h	Horizontal drilled hole
H	Hydrologic Research Facility holes
J	Jackass Flats (water wells)
N	Neutron hole
NRG	North Ramp Geologic hole
p	Paleozoic or pre-Tertiary hole
RF	Repository Surface Facility hole
SD	Systematic Drilling hole
SRG	South Ramp Geologic hole
UE	Underground Exploratory
USW	Underground southern (Nevada) waste hole
UZ	Unsaturated zone hole
UZN	Unsaturated zone neutron hole
V	Volcanic hole
VH	Volcanic/hydrologic hole
WT	Water table hole

Thermomechanical Stratigraphic Designators

CHn	Calico Hills nonwelded
PTn	Paintbrush nonwelded
TCw	Tiva Canyon welded
TSw1	Topopah Spring densely welded devitrified lithophysal-rich tuff
TSw2	Topopah Spring densely welded devitrified lithophysal-poor tuff
TSw3	Topopah Spring basal vitrophyre

Trench Designators

BMT	Bare Mountain Trench
CF	Crater Flat
GDF	Ghost Dance fault
MWV	Midway Valley
NRT	North Ramp Trench
SCR	Stagecoach Road
SCF	Solitario Canyon fault

Pavement Designators

ARP-1	Antler Ridge Pavement 1
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PROGRESS REPORT #12

Acronyms, Abbreviations, and Symbols (Continued)

Metal Designators

ASTM	American Society for Testing and Materials
UNS	Unified Numbering System for Metals and Alloys

Metric Units

°C	degree Celsius
cm ³	cubic centimeters
cm	centimeter (= 10 ⁻² m or 2.54 inches)
d	day
g	gram (= 0.3527 ounce)
h	hour
ha	hectare (= 2.48 acres)
Hz	hertz (cycles per second)
J	joule (Newton-meter)
°K	degree Kelvin
kg	kilogram (= 10 ³ grams or 2.2046 pounds)
km	kilometer (= 10 ³ m or 0.6213 mile)
L	liter (= 0.2641 gallon)
MTU	metric tons of uranium equivalent
MTIHM	metric tons of initial heavy metal
m	meter (= 3.2808 feet)
mg	milligram (= 10 ⁻³ g)
mgal	milligalileo
mL	milliliter (= 10 ⁻³ L)
mm	millimeter (= 10 ⁻³ m)
µm	micrometer (= 10 ⁻⁶ m)
nm	nanometer (= 10 ⁻⁹ m)
nT	nanotesla
Pa	pascal (also, MPa = megapascal, kPa = kilopascal)
S	siemens
s	second
V	volt
W	watt
kWh	kilowatt-hour
MWh	megawatt-hour
MWd	megawatt-day
GWd	gigawatt-day

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