



Department of Energy

Washington, DC 20585

MAY 1 1989

John J. Linehan, Director  
Repository Licensing and Quality  
Assurance Directorate  
Division of High-Level  
Waste Management  
Office of Nuclear Material  
Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dear Mr. Linehan:

During the October 1988 meeting concerning the Exploratory Shaft Facility (ESF) Open Items, 56 ESF open items were identified and plans for their resolution were discussed. Enclosure 1 includes the 45 of these 56 items (open items 6-50) which were to be addressed in the Site Characterization Plan (SCP) and the specific sections of the SCP that contain the information that we believe is sufficient to resolve the open items. Therefore, we consider these open items closed.

Enclosure 1 also includes open items 1 and 2 which are partially addressed by the cited sections of the SCP. For completeness, open items 3, 4, 5 and 51 through 56 which are not addressed in the SCP are included on the list in the enclosure.

If you have any questions or comments concerning the information contained in the enclosure or in the referenced documentation, please contact myself or Edward Regnier of my staff at 586-4590.

Sincerely,

Gordon Appel, Chief  
Licensing Branch  
Office of Civilian Radioactive  
Waste Management

Enclosure: As stated

cc: K. Stablein, NRC  
R. Loux, State of Nevada  
C. Johnson, State of Nevada  
D. Bechtel, Clark County, NV  
S. Bradhurst, Nye County, NV  
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Item No.	Relationship to Old Item No.	Statement of Open Item	Partial Listing of Documents for Closure
<u>ESF DESIGN CONTROL PROCESS</u>			
1.	67	DOE should demonstrate that it has in place and is implementing an overall systematic design and approval process for the ESF that (i) considers 10 CFR 60 requirements including those for QA, (ii) recognizes uncertainties associated with site characterization activities, (iii) recognizes the need for feedback and interaction among participants responsible for design, scientific tests, performance assessment, construction and operation, and (iv) considers operational impacts on tests and space requirements to avoid test interferences.	<p>SCP 8.4.2.1 (Rationale for planned testing)</p> <p>SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)</p> <p>SCP 8.4.2.3.3.1 (Design and interface control)</p> <p>SCP 8.4.2.3.6.1 (Potential for interference between tests)</p> <p>SCP 8.4.2.3.6.2 (Potential for construction and operations interference with testing)</p> <p>SCP 8.4.2.3.6.4 (Design flexibility)</p> <p>DOE-NV Yucca Mountain Project ESF Title I Design Control Process Review Report, January 19, 1989.</p> <p>ESF Subsystem Design Requirements Document.</p> <p>Generic Requirements for a Mined Geologic Disposal System, Appendix E.</p> <p>Nevada Nuclear Waste Storage Investigations QA Plan 88-9 QA Surveillance Reports.</p> <p>Technical Assessment Review Reports.</p>
2.	19 20 21 22 62 68	DOE should provide the basis for assignment of quality levels to ESF design, construction, data collection during construction, the liner, rock structure, and the dewatering system. Also, provide a schedule for completion of ESF construction and testing QA procedures. (Note: Q-list for the ESF is QA open item 9 as identified in the meeting summary for the 7/7/88 DOE-NRC meeting on QA open items. This open item and QA open item 9 each need to be addressed individually.)	<p>SCP 8.3.2.2 (Issue resolution strategy for Issue 1.11: Have the characteristics and configurations of the repository and repository engineering barriers been adequately established?)</p> <p>SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4: Are the technologies of repository construction, operation, and decommissioning adequately established?)</p> <p>SCP 8.4.3.2.5 (Summary of potential impacts to the site from site characterization activities)</p> <p>SCP 8.6.4.2.2 (Preliminary quality activities list)</p> <p>ESF Subsystems Design Requirements Document.</p> <p>Nevada Nuclear Waste Storage Investigation QA Plan 88-9.</p> <p>Project Office Implementation Procedures for NUREG-1318.</p> <p>QMP-02-06, Assignment of Quality Assurance Levels.</p> <p>SAND84-2461 (SCP-Conceptual Design Report).</p>

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3.	126	DOE should demonstrate that the ESF design process has provided for systematic review and consideration of 10 CFR 60 requirements in the development of the ESF design and for verification that those requirements have in fact been incorporated into the design.	DOE-NV Yucca Mountain Project ESF Title I Design Control Process Review Report, January 19, 1989. Yucca Mountain Project Exploratory Shaft Facility (ESF) Title I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Locations - Review Record Memorandum, February 3, 1989. QA Surveillance Reports.
4.	127	DOE should identify the specific entity responsible for ensuring that 10 CFR 60 requirements are reviewed and considered in the development of the ESF design and then for verifying that those requirements have in fact been incorporated into the design.	Technical Oversight Group Report, "Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility", December, 1988.
5.	128	DOE should describe its design control process to assure that items and activities potentially important to safety or waste isolation for the design and construction of the exploratory shaft facility are identified as Quality Level I. The description should include both criteria and methods to be used. It should also address plans for determining what previous data and analyses are needed to support Quality Level I items or activities and how DOE plans to validate these.	Project Office Implementation Procedures for NUREG-1318.

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<u>ESF Performance Analysis</u>			
6.	52 56 59 70 100	<p>The CDSCP does not include sufficient and consistent conceptual design information on the proposed ESF. This does not allow the evaluation of the potential interference of proposed investigations with each other and the interference of construction operations in the two shafts and long drifts with these investigations.</p> <p>Also, demonstrate that there will be minimal interference</p> <ul style="list-style-type: none"> <li>- between the two exploratory shafts</li> <li>- between adjacent subsurface tests; and</li> <li>- between construction and testing activities.</li> </ul>	<p>SCP 8.4.3.2.1.2 (Ground-water flow in matrix and fractures (Item 10, Boduarsson et al 1988))</p> <p>SCP 8.4.2.2.2 (Controls of surface-based testing)</p> <p>SCP 8.4.2.2.2.3 (Basis for surface-based testing construction controls)</p> <p>SCP 8.4.2.2.3 (Surface-based test interference)</p> <p>SCP 8.4.2.3.1 (ESF testing operations, constraints and zones of influence)</p> <p>SCP 8.4.2.3.3.2 (General arrangement of surface facilities)</p> <p>SCP 8.4.2.3.3.3 (General arrangement of ES-1 &amp; ES-2)</p> <p>SCP 8.4.2.3.3.4 (General arrangement of main test level &amp; exploratory drifts)</p> <p>SCP 8.4.2.3.4.4 (Exploratory Shaft facility underground construction and operations)</p> <p>SCP 8.4.2.3.5 (General description of underground support systems)</p> <p>SCP 8.4.2.3.6.1 (Potential for interference between tests)</p> <p>SCP 8.4.2.3.6.2 (Construction to test interference)</p> <p>SCP 8.4.3.2.1.3 (Redistribution of water retained in the unsaturated zone ) (Item 1, West (1988), Item 3, Eaton and Peterson (1988))</p> <p>SCP 8.4.3.2.3.2 (Analysis of in situ experiments (Item 1, Costin and Bauer (1988))</p>

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7.	1 51 57 71	The CDSCP does not sufficiently consider the potentially adverse impacts resulting from the proposed locations of ES-1, ES-2 other shafts and ramp portals in areas which may be susceptible to surface water infiltration, sheet flow, and lateral and vertical erosion (Refs. 1 and 2). For the proposed locations, there is a possibility of (a) potentially significant and unmitigable long-term adverse impacts on the waste isolation capability of the site and/or (b) affecting the ability to adequately characterize the site. Also, provide an analysis of the potential effects of construction, erosion, flooding, and increase in shaft diameter on long term repository performance.	<p>SCP 8.4.2 (Description and location of characterization operations)</p> <p>SCP 8.4.2.3.3 (General arrangement of ES-1 and ES-2)</p> <p>SCP 8.4.2.3.3.1 (Rationale for ESF location)</p> <p>SCP 8.4.2.3.6.3 (Integration of the ESF with repository design)</p> <p>SCP 8.4.3 (Potential impacts of characterization activities on postclosure performance objectives)</p> <p>SCP 8.4.3.1.1 (General approach to performance assessment)</p> <p>SCP 8.4.3.1.2 (Approach to assess the potential impacts of site char. activities)</p> <p>SCP 8.4.3.2 (Summary of supporting technical analyses and data)</p> <p>SCP 8.4.3.2 (Supporting technical analyses and data)</p> <p>SCP 8.4.3.2.1 (Hydrologic analyses and data)</p> <p>SCP 8.4.3.2.4 (Design features that may contribute to performance)</p> <p>SCP 8.4.3.3 (Potential impacts of site char. activities on postclosure performance)</p> <p>SCP 8.4.3.3.1 (Impacts on total-system releases)</p> <p>SCP 8.4.3.3.2 (Impact on waste package containment)</p> <p>SCP 8.4.3.3.3 (Impacts on EBS release)</p> <p>SCP 8.4.3.3.4 (Impacts on GWTT)</p> <p>SANDB5-0598 ES Performance Analysis Report</p>

Shaft Location

8.	29	Within the boundaries, the DOE needs to establish the properties, characteristics, and sample sizes that can be used in the evaluation of "representativeness." A method for analyzing the data also needs to be established.	SCP 8.4.2.1.5 (Representativeness of planned testing)
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9.	102	<p>The extent of site exploration described in the CDSCP indicates that the DOE plans to explore only a small portion of the underground repository block through underground testing and drifting. Substantially more drifting may be necessary to reduce uncertainties about the presence of faults and other geologic and hydrologic conditions. In the CDSCP no exploratory drift is planned to cross the main waste storage area to the southern portions of the block, which based upon existing information appears to contain more faults and fractures than other parts of the block. Borehole penetrations into the main waste storage area (boreholes from the surface, horizontal core drilling or other means) may not provide the representative information needed to construct a reliable three-dimensional geologic model of the repository block and evaluate ranges of parameters that could affect repository performance.</p>	<p>SCP 8.3.1.2.2.3.2 (Site vertical borehole studies)                      SCP 8.3.1.4.3.1.1 (Systematic drilling program)                      SCP 8.4.2.1.5 (Representativeness of planned testing)                      SCP 8.4.2.1.5.1 (Relation between surface-based testing in the ESF )                      SCP 8.4.2.1.5.2 (Respresentativeness of the ESF locations)                      SCP 8.4.2.1.5.5 (Need for drifting to the southern part of the repository block)                      SCP 8.4.2.3.3 (Description of ESF)</p>

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<u>Performance Assessment</u>			
10.	73	The CDSCP (Section 8.4.1.1 states that current plans call for drilling approximately 300 to 350 shallow holes (50 to 150 ft. deep), and 45 to 80 exploratory holes (presumably deep). Several trenches are also planned to be excavated for site characterization. In addition, Section 8.4.2.5.1 includes a summary of proposed numerous activities that would involve drilling from or very close to ES-1. The individual, the cumulative and the synergistic effects of these holes have not been considered in the evaluation of the potential impacts of exploratory shaft construction and testing on the waste isolation integrity of the site (Section 8.4.2.6, and supporting references, in particular Fernandez et al., 1987; Case and Kelsall, 1987).	<p>SCP 8.3.2.5.5 (Reference preclosure repository design)</p> <p>SCP 8.4.2 (Description and location of characterization operations)</p> <p>SCP 8.4.2.2 (Surface-based activities)</p> <p>SCP 8.4.2.2.2.3 (Basis for surface-based testing construction controls)</p> <p>SCP 8.4.2.3 (Subsurface-based activities)</p> <p>SCP 8.4.3 (Potential impacts of site characterization activities on postclosure performance objectives)</p> <p>SCP 8.4.3.2 (Supporting technical analyses and data)</p> <p>SCP 8.4.3.2.5.1 (Evaluation of potential impacts to the site from surface activities for current site conditions)</p> <p>SCP 8.4.3.2.5.2 (Evaluation of potential impacts to the site from drilling activities for current site conditions)</p> <p>SCP 8.4.3.3.1.2 (Evaluation of impacts on total-system releases)</p>
11.	84	Geomechanical analyses do not consider the effects of emplaced support components or the effect of elevated temperature on the support system components. The description of far field analysis in the CDSCP does not address potential for thermally induced movement along faults or fractures.	SCP 8.3.2.1.4.1 (Geomechanical analyses)
12.	88	The description of far field analysis in the CDSCP does not address potential for thermally induced movement along faults or fractures.	SCP 8.3.2.2.6 (Information need 1.11.6: Repository thermal loading and predicted thermal and thermo-mechanical response of the host rock)

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13.	96	<p>It is stated in the second paragraph on pg. 8.3.3.2-24 that "more conservatism has been added by the selection of the design-basis performance goals to be substantially less than the maximum allowable values." Although this is true immediately after closure, the two curves (Fig. 8.3.3.2-3) do converge relatively rapidly. Although no time scale is included, it can be inferred from Fernandez et al, 1987, Fig. 3-2, that the breakpoint in the Design Basis Performance Goals is at about 1000 years. Beyond that point the two curves are so close together as to leave very little safety margin.</p>	<p>SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established?)</p>
14.	85	<p>The first section of the next to last paragraph on pg. 8.3.2.2-55 expresses the anticipation that contingency measures might strongly emphasize constructibility based on semi-empirical rock mass classifications. These classifications bear no direct relation to the primary long-term repository performance requirements of containment and isolation. It is not clear, therefore, whether the selected criteria are appropriate for guiding emplacement decisions, and, specifically to perform system performance studies for off-normal conditions, as proposed in the first sentence of the last paragraph on pg. 8.3.2.2-55.</p>	<p>SCP 8.3.2.2.3 (Information need 1.11.3: Design constraints for orientation, geometry, layout, and depth of the underground facility that contribute to waste containment and isolation including flexibility to accommodate site-specific conditions)</p>

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15.	91	The last tentative goal on pg. 8.3.2.5-21 indicates that high confidence is needed that ES-1 shafts will terminate no less than 15- m above ground-water table. It does not appear that this goal is reached under the present ES-1 design.	SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4: Are the technologies of repository construction, operation, closure, and decommissioning adequately established for the resolution of the performance issues?) SCP 8.4.2.2.3.3 (ESF shafts arrangement)
<u>Seals</u>			
16.	8 58 101	Identify construction procedures that will be used to minimize damage to the rock mass excavated.	SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations) SCP 8.4.2.3.3.2 (Integrated data system description) SCP 8.4.3.2.3 (Thermal/mechanical analyses and data) SAND85-0598 Fernandez et al. (1988) ES Performance Analyses
17.	54 103	Discuss how the DOE would recognize the possible need for remedial measures to maintain postclosure isolation capabilities potentially altered by penetrated targeted geological/hydrological features. Plans should also be provided for the remedial actions that may be required to lower the adverse impacts of penetrating the target features.	SCP 6.2.8.6 (Options for sealing a discrete fault or fracture zone in an access or emplacement drift - vertical emplacement.) SCP 8.5.2.3.4.4 (Description of ESF underground construction and operations)  SAND84-1895 Fernandez et al. (1987) Technical Basis for Sealing SAND84-2461 (Section 5.1.3 of the Conceptual Design Report)
18.	2	Describe how the selected excavation technique and shaft design accounts for limitations and uncertainties in long term sealing considerations.	SCP 8.4.2.3.3.3 (General arrangement of ES-1 and ES-2) SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations) SCP 8.4.3.2.4 (Design features that may contribute to performance) SCP 8.4.3.3 (Potential impacts of SC activities on postclosure performance)

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19.	3	Provide design specifications for the shaft construction and show how they deal with the factors affecting sealing.	Title I Drawings and Specifications Package SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.4.2.3.4.4 (ESF underground construction and operations) SCP 8.4.2.3.6.1 (Potential for interference between tests) SCP 8.4.2.3.6.2 (Potential for construction and operations interference with testing) SCP 8.4.3.2.1.2 (Ground-water flow in matrix and fractures) SCP 8.4.3.2.1.3 (Redistribution of water retained in the unsaturated zone) SCP 8.4.3.2.3.2 (Analysis of in situ experiments)
20.	4 10 11 92 121	Describe the design, materials, durability, placement methods, and long-term performance of seals. Describe tests to be done, in both the laboratory and field environments to determine their long-term durability and their compatibility, both chemical and physical, to the host rock environment. This information, particularly concerning in situ seal testing, is necessary to evaluate effects of seal testing activities on the ability of the site to meet performance objectives (10 CFR 60.112 and 10 CFR 60.113). In addition, the start date of in situ seal testing should be chosen such that sufficient data for evaluating the license application will be available at the time of submittal of the application.	SCP 6.2.8 (Seal designs) SCP 6.2.8.2 (Shaft/ramp seal emplacement) SCP 6.2.8.4 (Borehole seal emplacement) SCP 8.3.3.1.2 (Seal components) SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established?) SCP 8.3.3.2.2 (Information Need 1.12.2: Materials and characteristics of seals for shafts, drifts and boreholes) SCP 8.3.3.2.2.3 (In situ testing of seals and components) SCP 8.3.3.2.3 (Information Need 1.12.3: Placement method for seals for shafts, drifts, and boreholes) SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.4.3.3.1 (Impact on total system releases)  SAND85-0598 Fernandez et al. (1988) ES Performance Analyses SAND84-1895 Fernandez et al. (1987) Technical Basis Report SAND84-2641 SCP-CDR
21.	5	Discuss the selected locations of any planned explorations or testing to be performed along the length of the shaft. Include discussion of data on sealing characteristics to be gathered and the limitations and uncertainties associated with the data.	SCP 8.3.3.2.2.3 (In situ testing of seals and components) SCP 8.4.2.3.1 (ESF Testing, operations, layout constraints, and zones of influence)
22.	12	Describe remedial methods to be used if sealing methods are not adequate.	SCP 8.3.3.1 (Overview of the seal program)

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23.	15	Describe test and inspection procedures to be used after sealing of the shaft to assess the results of the sealing effort in controlling adverse effects.	SCP 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone-- surface-based studies)
24.	44 94	A decision and its implications on whether the DOE will remove the liner at permanent closure or use it as part of the long term sealing system has not been determined. Justification should be provided for the course of action considered appropriate.	SCP 6.2.8.2 (Shaft and ramp seal emplacement) SCP 8.3.3.1 (Overview of the Seal Program) SCP 8.3.3.2.2 (Information Need 1.12.2: Materials and characteristics of seals for shafts, drifts, and boreholes.) SCP 8.4.3.2.3 (Thermal/mechanical analyses and data) SCP 8.4.3.2.4 (Design features that may contribute to performance) SAND85-0598 Fernandez et al. (1988) ES Performance Analyses
25.	9	Identify liner construction and placement technique. Include such information as: liner type, liner material testing and placement of liner. This information needs to be fully considered in application of any permanent sealing program.	SCP 6.2.8 (Seals) SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.134 and (b) provide information for the resolution of the performance issues?) SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations) SAND85-0598 Fernandez et al. (1988) ES Performance Analyses
26.	93	The CDSCP states that "The lack of aquifer above the waste emplacement horizon at the Yucca Mountain site, makes it unnecessary to install either permanent or temporary shaft or ramp seal components at the time of access construction." No evidence or substantiation is presented for the statement that neither operational nor permanent seals will be required.	SCP 8.3.3.1 (Overview of seal program) SCP 8.3.1.2.2.4.9 (Multipurpose borehole testing near the exploratory shaft) SCP 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone-surface based study,)

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27.	95	<p>The statement near the end of the next to the last paragraph on pg. 8.3.3.1-4 that "boreholes that are upgradient or long distances from the repository may not require sealing" appears to be driven largely by the considerations of vertical downward flow in the pre-repository rock environment, and does not represent a conservative sealing approach.</p>	<p>SCP 8.3.3.1 (Overview of the seal program)                      SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.134 and (b) provide information for the resolution of the performance issues?)                      SCP 8.4.1.3 (Concepts of unsaturated-zone flow and their application to Yucca Mountain)                      SCP 8.4.2.2 (Surface-based activities)                      SCP 8.6.4.2 (Quality assurance during site characterization)</p>
28.	97	<p>It is unclear whether a reasonably conservative design approach has been used to determine required backfill hydraulic conductivity.</p>	<p>SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established to (a) show compliance with the postclosure design criteria of 10 CFR 60.134 and (b) provide information for the resolution of the performance issues?)                      SCP 8.3.3.2.1 (Information Need 1.12.1: site, waste package and underground facility information needed for design of seals and their placement methods)                      SCP 8.3.3.2.2.3 (Information Need 1.12.3: Placement method for seals for shafts, drifts, and boreholes)</p> <p>SANDB5-0598 ES Performance Analysis                      SANDB4-1895 Technical Basis for Seals</p>
29.	120	<p>There are many inconsistencies in this section when compared with the details given in other sections of the CDSCP and reference documents. What are the potential impacts of such inconsistencies?</p>	<p>SCP 8.3.3.2 (Issue resolution strategy for Issue 1.12: Have the characteristics and configurations of the shaft and borehole seals been adequately established?)</p>

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<u>Testing</u>			
30.	17	<p>Describe test plans and procedures used to obtain adequate data on site characteristics that can be measured either directly or indirectly during construction of the exploratory shaft. For example:</p> <ul style="list-style-type: none"> <li>o Geologic mapping and rock mass characterization of the shaft walls</li> <li>o Measurements of rates and quantities of groundwater inflow and collection of groundwater samples for testing</li> <li>o Measurements of overbreakage during blasting</li> <li>o Rock mechanics testing of samples obtained during drill and blast operations</li> </ul>	<p>SCP 8.3.1.15.1.1 (Evaluation of thermal properties)            SCP 8.3.1.15.1.2 (Laboratory thermal expansion testing)            SCP 8.3.1.15.1.3 (Laboratory determination of the mechanical properties of intact rock)            SCP 8.3.1.15.1.4 (Laboratory determination of the mechanical properties of fractures)            SCP 8.3.1.15.1.8.1 (Evaluation of mining methods)            SCP 8.3.1.15.2.1 (Characterization of the ambient stress conditions; and related study plan)            SCP 8.3.1.2.2.2 (Water movement tests; and related study plan)            SCP 8.3.1.2.2.3 (Surface based study of percolation)            SCP 8.3.1.2.2.3.1 Matrix hydrologic properties testing)            SCP 8.3.1.2.2.4 (Unsaturated zone percolation)            SCP 8.3.1.2.2.4.4 (Radial borehole tests in the ESF)            SCP 8.3.1.2.2.4.5 (Excavation effects test in the ESF)            SCP 8.3.1.2.2.4.7 (Perched water test in ESF)            SCP 8.3.1.2.2.4.8 (Hydrochemistry tests in the ESF)            SCP 8.3.1.2.2.4.9 (Multi-purpose boreholes)            SCP 8.3.1.4.2.2 (Characterization of structural features within the area; and related study plan)            SCP 8.3.1.15.1.5 (Study: Excavation Investigations; and Related Study Plan)            SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)            SCP 8.4.2.3.4.4 (Description of ESF underground construction            SCP 8.4.2.3.6 (Evaluation of ESF layout and operations) and operations)</p>

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31.	34	During the DOE presentation on the rationale for selection of the site for the exploratory shaft, the DOE stated that the site chosen is representative of the repository block but indicated that discussion of the question of representativeness would be deferred. The NRC staff agrees that this should be an agenda item for a future meeting.	SCP 8.4.2.1.5 (Representativeness of planned testing)
32.	36	The DOE delineated the underground layout of the exploratory shaft and drifts and stated that underground testing considerations heavily influenced the layout. The NRC cannot assess the adequacy of the planned tests and hence the testing layout until the test plans are provided prior to the NNWSI/NRC ESTP meeting.	SCP 8.3.1.15 (Overview of thermal and mechanical rock properties program) SCP 8.3.1.2 (Overview of the geohydrology program) SCP 8.3.1.3 (Overview of the geochemistry program) SCP 8.3.1.5 (Overview of the climate program) SCP 8.3.4.2.4 (Information need 1.10.4: Postemplacement near-field environment) SCP 8.4.2.1 (Rationale for planned testing) SCP 8.4.2.3.3.3 (ES general arrangement) SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence) SCP 8.4.2.3.3.4 (Main test level general arrangement) SCP 8.4.2.3.6 (Evaluation of ESF layout and operations)
33.	104	In several activity descriptions, it is proposed that air coring will be used to drill holes to be used for permeability testing (e.g., Infiltration test, pg. 8.4-52; bulk permeability test, pg. 8.4-53; radial borehole tests, pg. 8.4-53; Calico Hills tests, pg. 8.4-54; diffusion tests, pg. 8.4-54. Aside from the potential technical difficulties associated with the feasibility of drilling such holes, this raises questions about the reliability of the permeability values thus obtained.	SCP 8.3.1.2.2.3.2 (Site vertical borehole studies) SCP 8.4.2.3 (Subsurface-based activities) SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence) SCP 8.4.2.2.2.3 (Basis for surface-based testing construction controls)

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34.	107	Does this program include all drilling or only surface based drilling?	<p>SCP 8.3.1.4.1 (Integrated Drilling Program and integrated geophysical activities)</p> <p>SCP 8.4.2.3.1 (Exploratory shaft facility testing, operations, layout, constraints, and zones of influence)</p> <p>SCP 8.4.2.3.3 (Description of ESF)</p> <p>SCP 8.4.3.2.1 (Hydrologic analyses and data)</p> <p>SCP 8.4.3.2.2 (Geochemical analyses and data)</p> <p>SCP 8.4.3.2.3 (Thermal/mechanical analyses and data)</p>
35.	45	A discussion of sealing materials and placement method and timing for exploratory boreholes from the ES will be provided in a future meeting on repository design.	<p>SCR 6.2.8.4 (Borehole seal emplacement)</p> <p>SCP 8.3.3.1 (Overview of the seal program)</p> <p>SCP 8.3.3.1.2 (Seal components)</p> <p>SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)</p> <p>SCP 8.4.2.3.3 (Description of ESF)</p>
36.	46	The testing program to characterize perched water zones will be discussed at the ESTP meeting.	<p>SCP 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone - Surface Based Studies)</p> <p>SCP 8.3.1.2.2.4.7 (Perched water test in ESF)</p> <p>SCP 8.3.1.2.2.4.9 (Multi-purpose borehole)</p> <p>SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)</p>
37.	74	CDSCP's approach to characterizing the complex three-dimensional nature of fracture systems in the repository block appears to rely on fractal analysis of outcrop exposures and geologic mapping of ES-1, drifts and boreholes (excluding floors and working faces). Also the CDSCP limits the objectives of fracture network studies to providing fracture analyses to supporting hydrologic modeling. The approach and objective to characterization described in the CDSCP may not lead to sufficient descriptions of the fracture networks.	<p>SCP 8.3.1.2.2.3 (Characterization of percolation in the unsaturated zone--surface based study)</p> <p>SCP 8.3.1.2.2.3.2 (Site vertical borehole studies)</p> <p>SCP 8.3.1.4.1.2 (Integration of geophysical studies)</p> <p>SCP 8.3.1.4.2.2 (Characterization of structural features in the site area)</p> <p>SCP 8.3.1.4.2.2.1 (Geologic mapping of zonal features in the Paintbrush Tuff)</p> <p>SCP 8.3.1.4.2.2.2 (Surface-fracture network studies)</p> <p>SCP 8.3.1.4.2.2.3 (Characterization of percolation in the unsaturated zone--surface based study)</p> <p>SCP 8.3.1.3.2.2.4 (Geologic mapping of exploratory shaft and drifts)</p> <p>SCP 8.3.1.4.2.2.5 (Seismic tomography / vertical seismic profiling)</p> <p>SCP 8.3.1.4.3.1.1 (Systematic drilling program)</p>

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Item No.	Relationship to Old Item No.	Statement of Open Item	Documents for Closure
38.	113	Why is there no link (other than that indicated in Figure 8.3.2.1-1) established between this plan and Issue 1.12-Repository Sealing?	<p>SCP 8.3.2.2 (Issue resolution strategy for Issue 1.11: Have the characteristics and configurations of the repository and repository barriers been adequately established?)</p> <p>SCP 8.3.2.2.3 (Information need 1.11.3: Design concepts for orientation, geometry, layout, and depth of underground facility that contribute to waste containment and isolation including flexibility to accommodate site-specific conditions.)</p> <p>SCP 8.3.3.2 (Seal characteristics)</p>
39.	117	Use of mechanical excavation is considered not feasible in some parts of the document and plausible in other parts. The next to last paragraph on pg. 8.3.2.4-28 mentions the possibility that mechanical excavation may be used. Does this contradict other implications in the CDSCP (e.g., pg. 8.3.2.2-70) that mechanical excavation is not feasible?	<p>SCP 8.3.2.2 (Issue resolution strategy for Issue 1.11: Have the characteristics and configurations of the repository and repository barriers been adequately established?)</p> <p>SCP 8.3.2.2.5 (Design constraints to limit excavation-induced changes in rock mass permeability)</p> <p>SCP 8.4.2.3.4.4 (Description of ESF underground construction and operations)</p>
40.	77	Section 8.3.1.15 does not present a clear testing rationale. Thermal and mechanical properties to be determined are not related to specific individual tests.	<p>SCP 8.3.1.15 (Overview of the thermal and mechanical rock properties program)</p>
41.	78	The testing program laid out in Section 8.3.1.15 is deficient in several respects. In some cases, important information that could be gained in testing is not identified. Also, some proposed tests are ill-defined, and others may not be able to provide required information.	<p>SCP 8.3.1.15 (Overview of the thermal and mechanical rock properties program)</p> <p>SCP 8.3.1.15.1.6.2 (Canister-scale heater experiment)</p> <p>SCP 8.3.2.1.4.1 (Geomechanical analysis)</p> <p>SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)</p>

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Item No.	Relationship to Old Item No.	Statement of Open Item	Documents for Closure
42.	79	<p>The discussion and use of statistics in this chapter is not clear. A statistical approach has been suggested to determine numbers of tests required to determine various rock properties, but the approach suggested is confusing and apparently overlooks several considerations that should be factors into such an approach. Also, needed confidences of "low," "medium," or "high" have been assigned without explaining the basis for such assignments. Bases for assigning the needed confidence of low, medium or high are not discussed.</p>	<p>SCP 8.3.1.15 (Overview of thermal and mechanical rock properties)                      SCP 8.3.1.15.1 (Investigation: Study on spatial distribution of thermal and mechanical properties)                      SCP 8.1.2.2 (Performance Allocation)</p>
43.	80	<p>In order to examine the margin of safety engineered into the stability of emplacement holes from the standpoint of retrievability, the canister-scale heater experiment needs to be run beyond the average design heat load. The CDSCP does not include provisions for such testing. Also, no mention is made of testing of lined versus unlined holes, backfilled holes, etc.</p>	<p>SCP 8.3.1.15.1.6.2 (Canister-scale heater experiment)</p>
44.	81	<p>This experiment is one of the more important rock mechanics experiments proposed yet, virtually no detail is given regarding it. There seems to be a lack of integration between this experiment and the modeling activities and design.</p>	<p>SCP 8.3.1.15.1.6.5 (Heated room experiment)                      SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)                      SCP 8.3.5.20 (Analytical techniques requiring development)</p>

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Item No.	Relationship to Old Item No.	Statement of Open Item	Documents for Closure
45.	82	<p>Plate-load tests do not necessarily provide a means of determining in-situ (i.e., undisturbed) rock mass deformational properties. Data obtained from such tests may be useful in assessing spatial variability, effects of different excavation, procedure, etc. is part of the overall program to characterize deformational relations of the rock mass adjacent to underground openings but may not be useful in thermomechanical calculations.</p>	<p>SCP 8.3.1.15.1.7.1 (Plate loading tests) SCP 8.4.2.3.1 (ESF testing operations, layout constraints and zones of influence)</p>
46.	72	<p>The rationale for the specification of information needs does not appear to ensure completeness of those information needs. Furthermore, the integration of testing with design and performance assessment appears to be lacking.</p>	<p>SCP 8.2 (Issues to be resolved and information required during site characterization) SCP 8.3 (Planned tests, analyses, and studies) SCP 8.3.2.5 (Issue resolution strategy for Issue 4.4: Are the technologies of repository construction, operation, closure, and decommissioning adequately established for the resolution of performance issues?) SCP 8.4.3 (Potential impacts of site characterization activities on postclosure performance objectives)</p> <p>SANDB4-2461 (SCP-CDR) SANDB6-1250 (Sensitivity analyses)</p>
47.	75	<p>The required integration of site-specific subsurface information with repository design is not considered in this section (e.g., not even among the qualifying factors listed in the next to last paragraph on pg. 8.3.1.4-90.</p>	<p>SCP 8.3.1.4.1 (Investigation: Development of an integrated drilling program and integration of geophysical data) SCP 8.3.1.4.1.1 (Development of an integrated drilling program) SCP 8.3.1.4.3.1.1 (Systematic drilling program) SCP 8.4.2.2.2 (Description of locations, operations, and construction controls for surface based activities)</p>

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Item No.	Relationship to Old Item No.	Statement of Open Item	Documents for Closure
48.	105	The performance confirmation program has not been sufficiently well defined, and appropriate details are not included in the CDSCP. The discussion concerning confirmation, Issue 1.7, has not presented the strategy or a plan to meet the requirements set forth in Subpart F of 10 CFR 60 part 60.	<p>SCP 8.3.5.16 (Issue resolution strategy for Issue 1.7: Will the performance-confirmation meet the requirements of 10 CFR 60.137?)</p> <p>SCP 8.4.2.3.6.3 (Integration of the exploratory shaft facility with the repository design)</p> <p>SCP 8.4.2.3.6.4 (Design flexibility)</p>
49.	109	What role, if any, will the data presented in Chapter 2 play in the proposed model development and in scoping the amount of planned site specific in situ testing?	<p>SCP 8.3.1.4.3 (Development of 3-D models of rock characteristics at the repository site)</p> <p>SCP 8.3.1.15.1 (Studies to provide the required information for spatial distribution of thermal and mechanical properties)</p>
50.	99	Plans should be made to correlate persistence of geologic features from ES-1 to ES-2 which might provide preferential pathways and to develop a photographic record of ES-2 for possible future use.	<p>SCP 8.3.1.4.2.2 (Characterization of structural features within the site area)</p> <p>SCP 8.3.1.4.2.2.4 (Geologic mapping of the exploratory shaft and drifts)</p> <p>SCP 8.4.2.3 (Subsurface-based test interference)</p> <p>SCP 8.4.2.3.1 (ESF testing operations, layout constraints, and zones of influence)</p>

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Item No.	Relationship to Old Item No.	Statement of Open Item	Partial Listing of Documents for Closure
<u>Design and Construction</u>			
51.	7	Identify the acceptance criteria for construction of the exploratory shaft.	Title II Specifications
52.	47	The design specifications and acceptance criteria for the shaft construction including construction controls, test blasting, and overbreak control will be provided to the NRC when available.	Title II Specifications DOE approved construction contractors procedures
53.	13	Describe test and inspection procedures to be used during excavation (e.g., plumbness of hole, rock mass disturbance etc.) to determine acceptability of the shaft as constructed.	Title II Specifications DOE approved construction contractors procedures
54.	14	Describe test and inspection procedures to be used during shaft liner construction.	Title II Specifications DOE approved construction contractors procedures
55.	16	Describe plans to document the above construction activities.	Title II Specifications Title III Reports
56.	61	The DOE will provide the technical analysis supporting the proposed size of the exploratory drifts by June 1, 1987.	Draft Letter Report titled "Proposed Alternative Configuration for the ESF Exploratory Drifts," Revision 2 Transmittal letter Skousen to Lahoti, dated 7/12/88. No. NN1.880712.0006.