Department of Energy
Washington, DC 20585

MAR 03 1992

Mr. Joseph J. Holonich, Director
Repository Licensing and Quality Assurance
Project Directorate
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Holonich:

The U.S. Department of Energy (DOE) provided the U.S. Nuclear Regulatory Commission (NRC) with the Calico Hills Risk/Benefit Analysis (CHRBA) on January 25, 1991, and the final draft of the Exploratory Studies Facility Alternative Studies (ESFAS) Final Report on July 18, 1991. As noted in the NRC letter to DOE dated September 4, 1991, the transmittal letters for these documents did not indicate whether they were intended to address any SCA open items. This letter provides the information requested in the NRC September 4, 1991, letter. This letter also transmits the published ESFAS Final Report, enclosure (1), with no substantial changes from the final draft.

In the NRC September 4, 1991, letter, the NRC stated "SCA Objection 1 on ESF design and design control was not identified as having been addressed in either document, even though in DOE's responses to the SCA open items (DOE letter of December 14, 1990), both documents are mentioned as containing material responsive to SCA Objection 1." NRC requested that DOE "...specify which open items are addressed, where the material intended to address each open item may be found within a given document, and how each open item is addressed by that material."

Enclosure (2) quotes the relevant SCA open items (portions of Objection 1, Comments 12, 16, 34, 35, 57, 72, 127, 128, 130, 132 and Question 28) and cites where and explains how the documents address them. This information updates and completes the responses for each of the open items identified above, the original versions of which were furnished to NRC in the DOE December 14, 1990, letter.

Additionally, in Question 61 of the SCA, NRC asked how changes will be made during the design and construction of the ESF. The project procedures that will be used to control such changes were

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Ltr. Encl.

ADD: Charlotte Abrams

identified in the letter DOE sent to NRC on November 26, 1991, for resolution of Objection 1 (see page 2 of attachment 2 of enclosure 1 in that letter). In NRC's July 31, 1991, letter, which contained the evaluation of the original DOE response to SCA Question 61, NRC requested the specific reference to the Architect/Engineer's procedures. This reference is PP-03-17, "Configuration Change Control". With this information, DOE considers Question 61 closed.

DOE considers that the November 26, 1991, letter and the additional documentation presented herein completely closes Objection 1 and the comments and questions enumerated above, including Question 61.

If you have any questions, please contact Priscilla Bunton at (202) 586-8365.

John P. Roberts
Acting Associate Director for
Systems and Compliance
Office of Civilian Radioactive
Waste Management

Enclosures:
(1) Exploratory Studies Facility Alternative Study: Final Report, Sand91-0025, September, 1991 (3 copies)
(2) CHRBA/ESFAS Documentation and SCA Open Items

cc: w/o enclosure (1):
C. Gertz, YMPO
R. Loux, State of Nevada
K. Whipple, Lincoln County, NV
M. Baughman, Lincoln County, NV
J. Bingham, Clark County, NV
D. Bechtel, Clark County, NV
S. Bradhurst, Nye County, NV
B. Raper, Nye County, NV
P. Niedzielski-Eichner, Nye County, NV
R. Campbell, Inyo County, CA
R. Michener, Inyo County, CA
G. Derby, Lander County, NV
P. Goicoechea, Eureka, NV
C. Schank, Churchill County, NV
C. Jackson, Mineral County, NV
F. Sperry, White Pine County, NV
L. Vaughan, Esmeralda County, NV
K. Hooks, NRC

Recvd. w/ Ltr 3/3/98

SCA OPEN ITEMS
NRC OPEN ITEMS ADDRESSED BY THE DOE QUALITY ASSURANCE PROGRAM

1. *Open Item - SCA Objection 1, page 4-1*:

> "The exploratory shaft facility (ESF) is intended to become an integral part of the repository if the site is found acceptable. However, the SCP and its references do not demonstrate the adequacy of the ESF Title I design control process, and the adequacy of the ESF Title I design which is the basis for the SCP."

Where the open item is addressed by the Quality Assurance Program:

Yucca Mountain Site Characterization Administrative Procedures, Volume 2 of 3, Yucca Mountain Site Characterization Project Office Quality Management Procedures.

How the open item is addressed by the Quality Assurance Program:

The Title I design control process conforms to a quality assurance program that was accepted by the NRC. Surveillances and audits, which the NRC may observe, ensure that the process continues to conform. The next page lists surveillances and audits of the design control process that have transpired since the SCA was issued.

Disposition: DOE now considers this item closed.

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Surveillances of Design Process Completed in Fiscal Years 1990 and 1991

References	Participant	Subject
YMP-SR-90-022	Holmes and Narver	Development of Design Package #1
YMP-SR-91-010	Technical and Management Support Services	Calico Hills Risk Benefit Analysis
YMP-SR-91-017	Technical and Management Support Services	Appendix J to the ESF Design Requirements Document
		SCP Baseline Document
		Associated training and review record packages
YMP-SR-91-018	Yucca Mountain Site Characterization Project Office	System Requirements System Description
		Repository Design Requirements
		SCP Baseline Document
		Associated change control, records, and personnel training
YMP-SR-91-026	YMPO/Raytheon Services Nevada	Design Process and associated personnel training and records

Audits of Design Process Completed in Fiscal Years 1990 and 1991

References	Participant
90-07	Fenix and Scisson Nevada
90-I-01	Yucca Mountain Site Characterization Project Office
91-04	Raytheon Services Nevada
91-I-01	Yucca Mountain Site Characterization Project Office

SCA OPEN ITEMS
NRC OPEN ITEMS ADDRESSED BY THE
CALICO HILLS RISK/BENEFIT ANALYSIS (CHRBA)

1. ***Open Item - SCA Objection 1, Page 4-3, Recommendations, second bullet***:

> "The Title II design should ensure ... that the number of shafts and their locations in the final repository contribute to reduce uncertainty with respect to waste isolation."

Where the open item is addressed by the CHRBA:

Pages 2.4-10 through 2.4-31, 2.5.2.2-1 through 2.5.2.2-4, and 2.5.2.5-1 through 2.5.2.5-13.

How the open item is addressed by the CHRBA:

The CHRBA specifically evaluated ESF/repository accesses and the impact that different configurations would have on the waste isolation capabilities of the different strategies. Initially 24 strategies were identified based upon six possible locations, two possible definitions for extent and two possible states for ESF connection/integration. The 24 strategies were reduced to 12 strategies due to infeasibility of integration and elimination of options which would require additional penetrations through the repository block.

A final grouping from 12 to 8 strategies was performed based upon the perceived most important factors in scoring, i.e., how would different options score on waste isolation and test utility. The evaluation process included: (1) whether north/central/south location, inside/outside, and limited/extensive are significant choices with respect to waste isolation and test utility; and (2) whether the options that appear to provide the best waste isolation or the best test utility are significantly better than medial combinations combining both aspects.

These final 8 strategies were then evaluated via analysis utilizing several objectives. The highest level objective was "Appropriate Site Characterization." That objective included the quality of the characterization itself, its impact on waste isolation, and the programmatic aspects of the CHn characterization decision.

Disposition: DOE now considers this item closed.

2. *Open item - SCA Objection 1, Page 4-3, Basis, first bullet from the top*:

> "Potential impacts of long-term performance confirmation testing on ESF design have not been addressed (see Comment 119)." (This item is also addressed and closed by the ESFAS.)

Where the open item is addressed by the CHRBA:

Pages 2.5.2.5-1 through 2.5.2.5-13.

How the open item is addressed by the CHRBA:

The eight strategies for characterizing the Calico Hills unit were scored against a set of characterization issues. The strategies were broken down according to which site characteristics would be investigated, and the degree of characterization. The site characteristics were further correlated to the confidence issues. Among the confidence issues, the CHRBA sought to "maximize the benefit of site characterization to performance confirmation" (Page 2.5.2.5-12).

Disposition: DOE now considers this item closed.

3. *Open Items*

SCA Objection 1, Page 4-3, Basis, third bullet from the top:

> "The subsurface drifting and exploration planned in the SCP have not been shown to be sufficient to yield the data needed for repository design and site suitability demonstration at license application."

SCA Comment 35, Page 4-36:

> "The program of drifting in the north, combined with systematic drilling and feature sampling drilling, appears unlikely to provide the lithologic and structural information necessary to adequately investigate potentially adverse conditions at the site or insure that observations made and data collected will be representative of conditions and processes throughout the repository block. Also, it has not been demonstrated that the proposed site characterization plan provides for a sufficient amount of underground drifting to collect data necessary for designing the repository and analyzing repository performance."

SCA Comment 35, Page 4-37, Recommendations, first bullet:

> "Demonstrate that from a scientific perspective, the program of drifting in the northern part of the repository combined with the systematic drilling and feature sampling program will provide the information necessary to ensure that conditions and processes encountered are representative of conditions and processes throughout the site and that potentially adverse conditions will be adequately investigated."

SCA Comment 35, Page 4-37, Recommendations, second bullet:

> "Demonstrate that the planned site characterization will provide sufficient data for designing the repository and analyzing the repository performance."

SCA Comment 35, Page 4-37, Recommendations, third bullet:

> "Compare and evaluate the benefits and disadvantages between more extensive drifting during site characterization (including supplemental horizontal core drilling) and the surface-based systematic drilling program with respect to the data derived and effects on repository performance. In the event that additional drifting is determined to be necessary by DOE, SCP updates should discuss the bases that will be used to determine the extent and direction of the drifting."

(The above items are also addressed and closed by the ESFAS.)

Where the open items are addressed by the CHRBA:

Pages 2.4-10 through 2.4-31, 2.5.2.4-1 through 2.5.2.4-9, and 2.7-1 through 2.7-4.

How the open items are addressed by the CHRBA:

The underground excavations will now comprise 76,000 feet of drifts as opposed to 10,000 feet that was reported in the SCP. Of this, approximately 12,000 feet would provide access to major geologic features within the Calico Hills unit (Section 2.4, strategies 2 and 5). These features include the Solitario Canyon Fault, Ghost Dance Fault, Drill Hole Wash, Imbricate normal fault zone to the east, and the vitric-zeolitic facies transition.

The CHRBA recommended extensive drifting because it would yield data that would instill scientific confidence (Section 2.5.2.4.3) and discourage regulatory delays (Page 2.5.2.2-4). Admittedly, DOE cannot guarantee that the data we anticipate now will wholly defend a potential license application submitted ten or more

years from now. Between now and potential repository licensing, the scope of site characterization could change through possible changes in 10 CFR 60 and, in particular, 40 CFR 191. However, we currently believe that the increased drifting will provide access to additional geologic features and formations which will enable collection of adequate data to support site characterization activities.

Disposition: DOE now considers these items closed.

4. ***Open Item - SCA Comment 12, Page 4-19, Recommendation***:

> "Activities should be developed to test the hypothesis that liquid-water flow in the Calico Hills unit is restricted to the rock matrix and the hypothesis that matrix properties of the altered Calico Hills nonwelded zeolitized unit are probably largely isotropic, because chemical alteration can be expected to destroy preferred orientations of rock properties. Testing the hypothesis that the matrix of the altered Calico Hills nonwelded zeolitized unit is largely isotropic, by using multiple well tests in the saturated zone, should be considered."

Where the open item is addressed by the CHRBA:

As noted in our original response, "alternatives for testing of the Calico Hills unit are currently being considered in a risk/benefit analysis. The recommendations of this team are planned to be forthcoming." Alternative strategies for testing are addressed in Table 2.3-9 (Pages 2.3-18 through 2.3-21) and pages 2.4-16 through 2.4-17 of the CHRBA. Conclusions and recommendations are discussed on Pages 2.7-1 through 2.7-5.

How the open item is addressed by the CHRBA:

The proposed tests are expected to provide information on variations of hydrologic properties and processes with scale, validation of models for flow and transport, and monitoring of in situ conditions. The underground testing strategies proposed in the CHRBA are for specific test strategies in the CHn, some of which may be combined with surface based test activities. Site characterization activities as listed in Table 2.3-9 (pages 2.3-18 through 2.3-21), when executed within CHn, will test the hypotheses for liquid-water flow in the CHn.

Disposition: DOE now considers this item closed.

5. ***Open Item - SCA Comment 16, Page 4-22, Recommendation***:

"Provide a complete plan to adequately characterize the hydrologic properties of the Calico Hills unit."

Where the open item is addressed by the CHRBA:

As noted in our original response, "a Calico Hills Risk/Benefit Analysis study has held several meetings to score these alternate methods of studying the Calico Hills. The recommendations of this committee will soon be presented to DOE/HQ for approval." The CHRBA was formally submitted to the NRC on January 25, 1991. The recommendations and conclusions are found in Section 2.7, Pages 2.7-1 through 2.7-5 of the CHRBA.

How the open item is addressed by the CHRBA:

Site characterization activities as listed in Table 2.3-9 (pages 2.3-18 through 2.3-21), when executed within CHn, will characterize the hydrologic properties of the CHn.

The CHRBA recommendations for characterization of the CHn provide as complete of an analysis of the options for characterizing CHn as is possible at this time. 10 CFR 60.17 states that "the site characterization plan shall contain -- (a) a general plan for site characterization activities to be conducted at the area to be characterized, which general plan shall include: ...2(iii) Plans for any investigation activities that may affect the capability of such area to isolate high-level radioactive waste;...(emphasis added)" Further details of the characterization activities to address the hydrologic properties of the Calico Hills member will be available as Title II design progresses and as in situ characterization is performed. Test planning will be coordinated with Title II design and in situ characterization activities. Updates of progress will be reported semiannually in accordance with 10 CFR 60.18(g).

Disposition: DOE now considers this item closed.

6. ***Open Item - SCA, Comment 34, Page 4-36, Recommendation, third bullet***:

"Angled drillholes should be considered as a means to identify and characterize vertical/near vertical features."

Where the open item is addressed by the CHRBA:

As noted in our original response, "in addition, angled drill holes are being considered as an option in the Calico Hills Risk/Benefit Analysis ..." Angled drill holes have been

considered in the CHRBA as noted in Section 2.2.4, pages 2.2-13 through 2.2-15, and Section 2.3, Pages 2.3-1 through 2.3-10, including Tables 2.3-1 through 2.3-8.

How the open item is addressed by the CHRBA:

The CHRBA considered using angled drill holes as one available technique for characterizing CHn. In the CHRBA, various techniques were rated on their expected ability to provide needed information about the characteristics of CHn. These ratings were used as guidance for composing various characterization strategies from the available techniques. DOE will continue to consider angled drill holes, as appropriate, when composing site characterization strategies.

Disposition: DOE now considers this item closed.

7. ***Open item - SCA Comment 127, page 4-96, Recommendations, first bullet***:

> "DOE should reconsider whether the design process, which appears to have overlooked key information about the suitability of exploratory shaft locations, is adequate to assure that the shafts will not adversely impact waste isolation."

Where the open item is addressed by the CHRBA:

Pages 2.4-1 through 2.4-31, 2.5.1.2-1 through 2.5.1.2-14, 2.6.1.6-1 through 2.6.1.6-37, and 2.6.1.8-1 through 2.6.1.8-13.

How the open item is addressed by the CHRBA:

The CHRBA considered 24 locations from which shafts and/or ramps would access the Calico Hills (Figure 2.4-1). The options were screened, simplified and sorted into eight strategies for characterizing the Calico Hills unit (Section 2.4). Each strategy was then assessed for its impact on waste isolation. The CHRBA concluded that " ... expected aqueous releases from the total system will likely be well below the regulatory standard whether or not the CHn unit is characterized." (Page 2.6.2.8-1).

Disposition: DOE now considers this item closed.

SCA OPEN ITEMS
NRC OPEN ITEMS ADDRESSED BY THE
EXPLORATORY STUDIES FACILITY ALTERNATIVES STUDY (ESFAS)

1. *Open Item - SCA Objection 1, page 4-1, Basis, first bullet, item a*:

> "In planning the underground test facility, the overall performance confirmation testing program and the need for starting certain performance confirmation tests (e.g., waste package testing) as early as practicable during site characterization should be considered."

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.2, page 2-32
Section 5.2.1, page 5-7
Section 6.2.2, page 6-7
Section 6.3.3, page 6-9
Appendix 4A, Section 3.1.4, page 4A-7 and Table 3, pages 4A-13 through 4A-16
Appendix 5C, pages 5C-44 through 5C-149

In Volume 2:
Section 7.2.4, page 7-10, Item 12
Appendix B, pages B-12 through B-30

How the open item is addressed by the ESFAS:

The ESFAS considered several features recommended by the NRC and/or NWTRB which were incorporated into the various options. As noted in the influence diagram showing the most significant factors in the ESFAS (ESFAS Volume 2, Page 7-6), site suitability testing played a major role in decision analysis. The scoring results from the Expert Panel on Programmatic Viability clearly indicate that these panel members believe such tests to be important. The scoring results also show that early tests for site suitability were important to the DOE Management Panel, the Expert Panel on Programmatic Viability, and the Expert Panel on Regulatory Considerations.

Although it is presently DOE's policy that there will not be in situ high level waste (HLW) testing in the ESF, the ESFAS evaluated options for their ability to be flexible to accommodate such testing, should DOE's policy change. The ESFAS results provide the basis for a new ESF configuration that could more easily accommodate such testing than the base case.

Disposition: DOE now considers this item closed.

2. ***Open Item - SCA Objection 1, Page 4-1, Basis, first bullet, Item b***:

> "The design of the ESF should take into account the need for preliminary information from in situ seal testing to be available in the License Application submittal."

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.2, page 2-31 & 32
Section 5.2, pages 5-7 through 5-50
Section 6.5, page 6-16, Table 6-8
Appendix 5C, page 5C-102

In Volume 2:
Appendix B, Section B.1.9, pages B-42 through B-56

How the open item is addressed by the ESFAS:

The ESFAS specifically addressed this concern in scoring the 34 options. The Engineered Barrier System (EBS) is a major feature as indicated on influence diagrams including Postclosure Health Effects (Figures B-12 & B-13, Volume 2). The design and effectiveness of the EBS which includes seals was a major consideration in the scoring of options for postclosure health impacts. In situ seal testing and the EBS are included in the suite of 35 tests planned for the ESF. These tests and the impact of the configurations on the ability to conduct each test were evaluated as part of the ESFAS. This evaluation compared each option and provided justification on test data sheets for their ranking with respect to the base case option. The summary evaluations are included in Volume 1 of the ESFAS as Table 5-8. It is expected that preliminary information from in situ seal testing will be available at the time of License Application submittal.

Information available to the Expert Panel members for the ESFAS included a report titled "Technical Basis for Performance Goals, Design Requirements and Material Recommendations for the NNWSI Repository Sealing Program", SAND84-1895, March 1987. This report concluded that only limited sealing measures are required to properly isolate the radioactive waste in the repository. Nevertheless, a broad range of sealing design options and associated hydrologic design requirements are proposed to provide a greater degree of assurance that the hydrologic performance goals can be met, even if unanticipated hydrologic flows enter the waste disposal area. This position is based upon site suitability data presently available.

Seal testing is currently identified as a late test as noted on pages 5-8 and 5-9 of Volume 1 of the ESFAS. Should DOE decide to perform in situ seal testing earlier than currently planned, the ESF Main Test Level (MTL) layout will now contain additional space to accommodate such testing.

Disposition: DOE now considers this item closed.

3. ***Open Item - SCA Objection 1, page 4-1, Basis, second bullet, item d***.

> "The Design Acceptability Analysis (DAA) undertaken by DOE in response to NRC concerns for evaluating the acceptability of the ESF Title I design did not consider certain concerns critical to NRC acceptance of DAA conclusions. The following are some examples:
> ...d. Of the 22 requirements that were considered quantitatively, some inadequacies have been identified. For example, in considering the regulatory requirements related to alternatives to major design features important to waste isolation (60.21(c)(1)(ii)(D), the analysis presented was limited and incomplete. As a result, comparative evaluation of alternatives to the major design features was limited to comparative evaluation of five alternative ESF locations. Hence other comparative evaluations such as the number of man-made openings were not considered. (Comment 132)"

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.2, page 2-33
Section 2.3, pages 2-40 & 41
Section 6.0, pages 6-1 through 6-17

In Volume 2:
Appendix B, Section B.1.9, pages B-43 through B-56

How the open item is addressed by the ESFAS:

The requirement to analyze alternatives to major design features that are important to waste isolation (10 CFR 60.21(c)(1)(ii)(D)) was addressed in the ESFAS. This study examined 34 ESF/repository configurations, each with variations in major design features (e.g., number, location and type of accesses, location of MTL, excavation method, etc.). Options 1 through 17 would systematically characterize the shallow strata (e.g. Topopah Springs) and then the deep strata (Calico Hills). Conversely, options 18 through 34 would give first priority to the Calico Hills strata. The intent is to assess the validity of earlier forecasts of Yucca Mountain's suitability. The Calico Hills strata plays a major role in determining suitability of the

site, and if unfavorable data was identified during early testing, the site may be found unsuitable. From these alternatives, DOE management selected one ESF design. The study also identified major design features that, if incorporated into a given option, could result in that option having better overall performance.

The design process calls for performance assessment analyses to support the design in an interactive manner. The role of major design features in waste isolation is but one aspect of the Title II design process that will continually be evaluated via performance assessment.

Disposition: DOE now considers this item closed.

4. ***Open item - SCA Objection 1, page 4-2, item b:***

> "The zones of influence presented for thermal tests are based on short test durations. Thermal tests such as the canister-scale heater experiment, heated block test, and heated room experiments are planned to run for relatively short durations (30 months, 100 days, 36 months). The staff considers that longer durations will very likely be necessary. The need to obtain additional site characterization data beyond the planned time periods may result in larger zones of influence."

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.2, page 2-36
Section 6.3.3, page 6.9
Appendix 4A, Section 3.1.4, page 4A-7

In Volume 2:
page 1-5
Section 7.2.4, pages 7-5 through 7-11

How the open item is addressed by the ESFAS:

The ESFAS specifically considered this concern when evaluating and ranking the 34 ESF options. The revised design provides more MTL space and greater separation of tests than the ESF design identified in the SCP, thereby decreasing the potential for test interferences.

This concern will be appropriately considered during the Title II design. Test Planning Packages, compiled under Administrative Procedure (AP) 5.32Q, "Test Planning and Implementation Requirements", address test durations as a potential constraint or impact.

Disposition: DOE now considers this item closed.

5. ***Open item - SCA Objection 1, page 4-2, item h***:

> "The space designated for tests within the underground test area layout is very likely to be inadequate. DOE assumes that all the space within the dedicated test area may be or is usable. This is unlikely to be the case. For example, some areas may not be suited for use because of faults, lithophysal content, breccia, etc. In addition, offsets from waste emplacement areas (30 m) and from proposed multipurpose boreholes (two drift diameters) may further reduce the available test area."

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.2, page 2-39
Section 6.2, page 6-8
Section 6.3.3, page 6-9
Section 6.4, pages 6-12 & 13
Appendix 4A, Section 3.1.4, page 4A-7

In Volume 2:
page 1-5
Section 7.2.4, pages 7-5 through 7-11

How the open item is addressed by the ESFAS:

The options that were developed for evaluation in the ESFAS included a range of configurations in response to a list of major design features. Additional design features were considered by the expert panels to be of importance to ESF/repository option screening. In addition to these features, additional features were included as a result of guidance. This guidance was developed in response to NRC and NWTRB concerns.

One of these additional features was increasing the size of the dedicated MTL to avoid interferences in testing. This feature was included in the options to permit all tests, including extended duration tests and any future performance confirmation tests, to be separated by sufficient distance to avoid any test-to-test or construction-to-test interference. This feature is represented under Characterization Testing in Table 6-3 (Volume 1) and as item 11c on Table 6-5, Identification of Favorable Features in Highly Rated Options. As noted in the option scoring, options which included increased MTL area generally scored better.

Disposition: DOE now considers this item closed.

6. ***Open item - SCA Objection 1, Page 4-3, first bullet from the top***:

> "Potential impacts of long-term performance confirmation testing (for the waste package) on ESF design have not been addressed (see Comment 119)." (This item is also addressed and closed by the CHRBA.)

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.2, page 2-32
Section 5.2.1, pages 5-7, 5-50 and Table 5-8

In Volume 2:
Section B.1.7, pages B-30 through B-34
Section B.1.8, pages B-34 through B-37

How the open item is addressed by the ESFAS:

The ESFAS considered the impacts of long-term performance confirmation testing on ESF design in several places in the study. Most notable are the influence diagrams for Likelihood of Construction/Operation Approval (Figure B-7) and Factors That Influence the Likelihood of Retrieval (Figure B-8). A major concern noted in SCA Comment 119 is the ability to perform waste package testing and the reporting of results therefrom. As noted in these influence diagrams, waste package testing was a discriminating feature that was considered during individual option scoring. In addition, to be able to perform an adequate suite of characterization and confirmation tests, the MTL for a particular option must be large enough and configured properly to be able to accommodate such testing. From the scoring results, it is noted that those options with a larger MTL scored better overall.

Disposition: DOE now considers this item closed.

7. ***Open Items***

SCA Objection 1, Page 4-3, Basis, third bullet from the top:

> "The subsurface drifting and exploration planned in the SCP have not been shown to be sufficient to yield the data needed for repository design and site suitability demonstration at license application."

SCA Comment 35, Page 4-36:

> "The program of drifting in the north, combined with systematic drilling and feature sampling drilling, appears unlikely to provide the lithologic and

structural information necessary to adequately investigate potentially adverse conditions at the site or insure that observations made and data collected will be representative of conditions and processes throughout the repository block. Also, it has not been demonstrated that the proposed site characterization plan provides for a sufficient amount of underground drifting to collect data necessary for designing the repository and analyzing repository performance."

SCA Comment 35, Page 4-37, Recommendations, first bullet:

"Demonstrate that from a scientific perspective, the program of drifting in the northern part of the repository combined with the systematic drilling and feature sampling program will provide the information necessary to ensure that conditions and processes encountered are representative of conditions and processes throughout the site and that potentially adverse conditions will be adequately investigated."

SCA Comment 35, Page 4-37, Recommendations, second bullet:

"Demonstrate that the planned site characterization will provide sufficient data for designing the repository and analyzing the repository performance."

SCA Comment 35, Page 4-37, Recommendations, third bullet:

"Compare and evaluate the benefits and disadvantages between more extensive drifting during site characterization (including supplemental horizontal core drilling) and the surface-based systematic drilling program with respect to the data derived and effects on repository performance. In the event that additional drifting is determined to be necessary by DOE, SCP updates should discuss the bases that will be used to determine the extent and direction of the drifting."

(These open items are also addressed and closed by the CHRBA.)

Where the open items are addressed by the ESFAS:

In Volume 1:
Section 2.2, pages 2-31 & 32
Section 4, pages 4-1 through 4-22
Section 5, pages 5-1 through 5-59

In Volume 2:
Appendix B, pages B-12 through B-29

How the open items are addressed by the ESFAS:

The ESFAS evaluated a range of options for various parameters, including the representativeness of the drifting program. The most highly ranked option (Option 30) was one that offered a significantly greater amount of subsurface drifting that the ESF design presented in the SCP.

Beyond the present configuration, the extent of the necessary subsurface exploration will be addressed in phases. To that end, DOE has prepared a plan (Plan for Phased Approach to ESF Design Development and Implementation, YMP/91-13, February, 1991) for a phased execution of the ESF design, construction, and test activities. With a phased approach, DOE considers the most recent data as underground exploration proceeds. The nature of the data dictates the scope of future exploration.

Disposition: DOE now considers these items closed.

8. ***Open item - SCA Comment 57, page 4-52, Recommendation***:

> "Studies relating to design verification do not consider investigating the effects of underground excavation in the tuff using alternate excavation methods.
>
> Recommendation
>
> Alternate methods of excavation should be evaluated and results provided in SCP updates."

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 1.3, pages 1-4 through 1-10
Section 4.2.4, page 4-4
Section 6.2.1, page 6-6
Appendix 3B, pages 3B-1 through 3B-5
Appendix 4A, Section 3.1.3, page 4A-7

In Volume 2:
page 7-8, paragraph 5

How the open item is addressed by the ESFAS:

As noted in our original response, mechanical excavation methods factored heavily in the ESFAS which was in progress at the time. Updates of this activity have been provided approximately every six months in the Yucca Mountain Project Site Characterization Progress Report. Mechanized mining techniques were evaluated when ranking the various alternatives considered in the ESFAS. It is generally recognized that mechanized mining methods (as

opposed to drill-and-blast methods) would minimize mechanical and/or chemical effects on the surrounding rock. Consequently, the overall ranking clearly indicates that options using mechanical excavation techniques rank higher.

Although the current generation of roadheaders does not present a viable option for drifting, some newer design mobile miners may prove applicable for this purpose. Repository design configurations which use mechanized mining techniques will be evaluated. The drill and blast mining technique may be used when mechanized mining is inappropriate.

Disposition: DOE now considers this item closed.

9. ***Open Item - SCA Comment 72, page 4-72, Recommendations***:

> "In view of the limited data available at this time, it would be prudent for DOE to assume that seals will be needed until and unless it can be shown that seals will not be required to meet the repository performance objectives. It is not clear in the SCP that this is the assumption under which the sealing program is going to proceed.
>
> Recommendations
>
> DOE should plan its sealing program on the basis that seals will be needed until and unless it can be demonstrated otherwise.
>
> The SCP updates should evaluate the need for temporary and permanent seals for accesses based on conditions inherent at each location of proposed shafts and ramps."

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.2, pages 2-31 & 32
Section 5.2, pages 5-7 through 5-50
Section 6.5, page 6.5, Table 6-8
Appendix 5C, page 5C-102

In Volume 2:
Appendix B, Section B.1.9, pages B-42 through B-56

How the open item is addressed by the ESFAS:

As noted in our original response, the ESFAS would identify a defensible basis for the design and construction of the ESF at the Yucca Mountain Site.

See the response to SCA Objection 1, page 4-1 (ESFAS item 2 above).

Disposition: DOE now considers this item closed.

10. *Open Items*

SCA Comment 127, page 4-96, Recommendations, second bullet:

> "DOE should address apparent conflicts between the design criteria specified (i.e., set-back of 100 feet from faults) in Bertram (1984) and Nark and others (1988) and the presence of a possible fault near the exploratory shafts as suggested by the geophysical testing (Smith and Robs, 1982)."

SCA Comment 127, page 4-96, Recommendations, third bullet:

> " The present shaft locations should be re-evaluated based on an assessment of available technical data."

SCA Comment 127, page 4-96, Recommendations, fourth bullet:

> "Consider conducting further tests (e.g., geophysical testing and trenching) in the vicinity of the proposed shafts to verify features and conditions that exist in that area."

Where the open items are addressed by the ESFAS:

In Volume 1:
Section 4.0, pages 4-1 through 4-22
Section 5.0, pages 5-1 through 5-59

How the open items are addressed by the ESFAS:

The ESFAS evaluated many different types of ESF accesses in development of the final set of options. Each option and its type of access was evaluated for compliance with regulatory and design requirements. Along with the types of accesses, location was also considered. These two major design features were only a subset of the many design features evaluated. The design criteria specified in the referenced reports (shaft set-back of 100 feet from faults) was developed using a two shaft design concept. THe ESFAS evaluated several configurations utilizing shafts, ramps, and shaft/ramp combinations. The favored option (Option 30) utilizes a two ramp configuration. Therefore, the conflict in the design criteria is not considered directly applicable to this option. In addition, the presence of a possible fault near a ramp is of less concern because of the expected perpendicular orientation of the ramp with respect to a potential fault. Any major geophysical anomaly (i.e. major

fault) encountered during ramp construction will be evaluated for its impact upon the ESF design.

Additionally, DOE has prepared a plan (Plan for Phased Approach to ESF Design Development and Implementation, YMP/91-13) for a phased execution of the ESF design, construction, and test activities. This approach will provide DOE with the most current and representative data concerning potential geophysical anomalies. The nature of the data will dictate the scope of future exploration.

Disposition: DOE now considers these items closed.

11. ***SCA Comment 128, page 4-97, Recommendation***:

> "Design criteria corresponding to the applicable 10 CFR 60 requirements, not considered in the Design Acceptability Analysis, should be developed and used for the Title II design."

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.3, page 2-40
Appendix 2C, pages 2C-1 through 2C-37
Appendix 4A, Section 3.3, pages 4A-10 & 11

How the open item is addressed by the ESFAS:

As noted in the original response, the process of determining the application of 10 CFR 60 requirements to the ESF design was being performed and would be considered in the ESFAS. All 10 CFR 60 requirements were considered during the performance of the ESFAS and will continue to be considered during Title II design.

To arrive at the final set of options which were evaluated using decision analysis techniques, a large set of initial options were generated from an historical perspective. These options were combined with new options which comprised the total set of options. The total set of options were screened based on their ability to meet regulatory and testing requirements. Those options which were unable to satisfy the regulatory and testing requirements were disqualified.

In preparing the ESFAS, all 10 CFR 60 requirements were considered, but only a subset of the requirements could discriminate one option from another. The final set of options were scored against the base option as to how well they would perform with respect to those requirements from 10 CFR 60 and other testing requirements that were considered to be discriminatory.

Disposition: DOE now considers this item closed.

12. ***Open item - SCA Comment 130, page 4-99, Recommendation***:

"The SDRD used in Title II design should consider all applicable 10 CFR 60 requirements."

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.3, page 2-40
Appendix 2C, pages 2C-1 through 2C-37
Appendix 4A, Section 3.3, pages 4A-10 & 11

How the open item is addressed by the ESFAS:

See response #11.

Disposition: DOE now considers this item closed.

13. ***Open item - SCA Comment 132, page 4-101***:

"The requirements of 10 CFR 60.21(c)(1)(ii)(D) [i.e., consideration of major design features], in particular, have not been adequately addressed in evaluating the acceptability of ESF Title I design.

Recommendation:

The Title I design should be expanded to fully address the 10 CFR 60.21 requirements."

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.2, page 2-33
Section 2.3, pages 40 & 41
Section 6, pages 6-1 through 6-17
Appendix B, Section B.1.7.2, pages B-32 & 33

In Volume 2:
Appendix B, Section B.1.9, pages B-43 through B-56

How the open item is addressed by the ESFAS:

See response #3.

The ESFAS considered major design features in every aspect of the study. Major design features were used in classifying historical option, developing new options, discriminating between the final set of options and in scoring by many of the Expert Panels. The

role of major design features and consideration for 10 CFR 60.21(c)(1)(ii)(D) is noted on the influence diagrams in Volume 2 of the ESFAS. This is most notable in two particular influence diagrams, Postclosure Health Effects (Figure B-13) and Likelihood of Construction and/or Operation Approval (Figure B-7).

Disposition: DOE now considers this item closed.

14. ***Open item - SCA Question 28, page 4-114, Recommendation***:

> "If a decision is made to penetrate the Calico Hills unit, an analysis of the impact on the sealing program should be presented in SCP updates. Corresponding changes for the sealing program and Issue Strategy 4.4 should be included."

Where the open item is addressed by the ESFAS:

In Volume 1:
Section 2.2, page 2-31 & 32
Section 5.2, pages 5-7 through 5-50
Section 6.5, page 6.5, Table 6-8
Appendix 5C, page 5C-102

In Volume 2:
Appendix B, Section B.1.9, pages B-42 through B-56

How the open item is addressed by the ESFAS:

As noted in the original response to this question, the materials investigation portion of the repository sealing program has always considered the evaluation of a seal in the Calico Hills unit. The need for and the feasibility of placing seals in the underground facility and the ramps and shaft will continue to be evaluated. Furthermore, the effects of sealing were evaluated as part of the CHRBA and were integrated with the ESFAS.

Also, see responses #1, 2, and 3 in the ESFAS and response #5 in the CHRBA section.

Disposition: DOE now considers this item closed.