YUCCA MOUNTAIN PROJECT

EXPLORATORY SHAFT FACILITY (ESF) TITLE I DESIGN ACCEPTABILITY ANALYSIS AND COMPARATIVE EVALUATION OF ALTERNATIVE ESF LOCATIONS

REVIEW RECORD MEMORANDUM

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Review Record Memorandum Approval	Signature & Date
Jerry L. King (Chairperson)	2/3/89
Richard C. Lee (Secretary)	2/3/89
Robert A. Levich (DOE Project Office Representative)	02/03/89

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NOTE

The following documents were added to the Review Record Memorandum after the cover page was signed:

1. Closed-out Standard Deficiency Reports and Observations (Appendix C)

2. Closed-out Document Review Sheets for the TAR Plan (Appendix B-4)

Jerry L. King 2/8/89

Jerry L. King, TAR Chairperson

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EXECUTIVE SUMMARY

The purpose of this Technical Assessment Review (TAR) was twofold: (1) to perform a Design Acceptability Analysis (DAA) to address documented concerns of the U.S. Nuclear Regulatory Commission (NRC) regarding the design control process used to develop the Title I Exploratory Shaft Facility (ESF) Design; and (2) to evaluate alternative exploratory shaft locations with respect to differences in waste isolation potential and in potential adverse effects of shaft sinking, and to assess what influence, if any, these differences might have had on the selection of the preferred shaft location, had they been an explicit consideration in the location selection process. The DAA responds to a suggestion made by the NRC staff at a meeting with the U.S. Department of Energy (DOE) in November 1988 regarding one acceptable approach for demonstrating the acceptability of the ESF Title I Design.

The TAR was conducted as a Quality Assurance (QA) Level I activity in accordance with the Yucca Mountain Project QA Plan, NNWSI/88-9. The implementing procedure was Quality Management Procedure (QMP)-02-08, Rev. 0, "Technical Assessment Review." During the TAR, two QA surveillances were jointly conducted by DOE Office of Civilian Radioactive Waste Management Quality Assurance and Yucca Mountain Project Quality Assurance. An NRC observer was present at both surveillances. An observer from the State of Nevada was present at the second surveillance.

The ESF Title I Design was assessed by the TAR Team with respect to design criteria that were developed for applicable 10 CFR Part 60 regulatory requirements related to three major concerns: (1) maintaining the long-term waste isolation capability of the site, (2) not compromising the ability to characterize the site, and (3) obtaining data that are representative of site behavior. These concerns are referred to here as NRC Concerns 1, 2, and 3. For applicable 10 CFR Part 60 requirements that are not related to Concerns 1, 2, or 3, the potential impact on Title I Design was assessed qualitatively, without generating detailed design criteria. (Design criteria for all applicable 10 CFR Part 60 requirements are being generated by DOE as a prerequisite to the start of Title II Design.)

Three subcommittees were formed to accomplish different parts of the TAR. Subcommittee 1 developed design criteria and used the criteria to assess the adequacy of the ESF Title I Design. Subcommittee 2 assessed the appropriateness of data used in the Title I Design and how uncertainties were considered. Subcommittee 3 conducted a comparative evaluation of exploratory shaft locations.

The charge of TAR Subcommittee 1 included: (1) assessment of how the ESF Subsystem Design Requirements Document (SDRD) used in Title I Design addresses applicable requirements from 10 CFR Part 60 that are related to Concerns 1, 2, or 3; (2) development of a list of DAA criteria from these 10 CFR Part 60 requirements and comparison of this list to the ESF Title I SDRD; and (3) assessment of the ESF Title I Design with respect to the list of DAA criteria developed.

For the assessment of the SDRD, a list of requirements from 10 CFR Part 60 that are applicable to the ESF was taken from a report, entitled "Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain

Exploratory Shaft Facility," prepared for the DOE by the Technical Oversight Group. The 46 applicable requirements from that report were further subdivided into 52 requirements. Of these, 22 were determined to be related to NRC Concerns 1, 2, or 3 and are here called the DAA-related Part 60 requirements. The subcommittee found these requirements to be only partially reflected in the SDRD. This was expected because the SDRD was developed to specify subsystem functions rather than regulatory requirements.

Subcommittee 1 developed approximately 300 DAA criteria to address the DAA-related Part 60 requirements; a portion of these are individual criteria applied redundantly to different physical features of the ESF. The subcommittee compared the DAA criteria to the performance criteria, constraints, and assumptions in the ESF Title I SDRD and found that the majority of the DAA criteria were explicitly or partially addressed.

Subcommittee 1 then assessed the adequacy of the ESF Title I Design with respect to the DAA-related criteria and developed conclusions and recommendations for actions, as appropriate. Recommended actions include additional technical analyses, planning in preparation for decisions that must be made during construction, and further definition of the testing program. The subcommittee found that most of the DAA criteria for Concern 1 (waste isolation) were treated adequately in the ESF Title I Design or supporting documentation, and that those criteria that were not treated adequately can be addressed by Title II Design activities or in the associated preparatory activities. All of the DAA criteria for Concerns 2 and 3 were judged to be adequately addressed in the Title I Design, although some were not addressed directly. This was considered to be acceptable for a preliminary design.

Subcommittee 2 reviewed the use of data and parameter values in reports that document the design, and in performance analyses that address NRC Concerns 1, 2 or 3. The subcommittee identified and performed more than 50 reviews of reports which were used in a prominent manner in Site Characterization Plan (SCP) Section 8.4 (Planned Site Preparation Activities), in support of the Title I Design. Each report was reviewed by at least one subcommittee member, considering data appropriateness, conceptual models, analytical methods, data uncertainty, and how the report was used in Section 8.4. The reviewers identified various problems with these reports, in some cases recommending new calculations or consultation with the authors of Section 8.4. Several revisions to the SCP are recommended, with an indication that they can be appropriately addressed in semiannual progress reports. A number of recommendations are also made for additional analyses during or in association with Title II Design. The subcommittee identified no problems in the design and performance evaluations that would significantly impact the ESF Title I Design.

The impact on ESF Title I Design of applicable 10 CFR Part 60 requirements that are not related to NRC Concerns 1, 2 or 3 was assessed qualitatively, without developing detailed design criteria. These other requirements pertain to preclosure radiological safety, waste retrievability, QA, performance confirmation, and procedural requirements. This assessment found that development and application of detailed design and performance criteria for these other requirements can be addressed in Title II Design activities with low risk of design changes that would require significant changes to the schedule, configuration, or technical approach for ESF-related site characterization activities.

The comparative evaluation of alternative exploratory shaft locations comprised three tasks.

In the first task, Subcommittee 3 compared and contrasted the five alternative exploratory shaft locations that were originally considered by the DOE, with respect to waste isolation potential. Seven natural characteristics of the alternative locations were used as surrogates for waste isolation potential in lieu of a complex assessment of total system performance under normal and disturbed conditions, which would require site-specific information yet to be obtained. Based on analysis of the surrogate characteristics, the subcommittee concluded that, for currently expected conditions, differences in waste isolation potential between the alternative shaft locations are not significant because the conditions at all locations would allow the postclosure performance requirements to be met by a wide margin. Differences in waste isolation potential might be significant under certain conditions, namely, widespread high-flux conditions (currently considered to be unlikely) or local high-flux conditions that are caused by subsurface lateral diversion or spatially variable pulses of surface infiltration. In either of these cases, alternative shaft locations in the northeast part of the repository block (including the current location) would be more likely to have groundwater flow times from the repository horizon to the water table of less than 10,000 yr, in the local zones of concentrated flux. Under these conditions, other natural barriers, including geochemical retardation, flow times in the saturated zone, and longer flow times outside the zones of flux concentration, would probably combine to provide adequate waste isolation capability for the overall site.

The second task of Subcommittee 3 was to assess the impact of shaft construction on waste isolation potential at each alternative location. The subcommittee concluded that the presence of a shaft at any of the locations considered would not be expected to significantly affect the waste isolation capability of an associated repository.

The third task of Subcommittee 3 was to compare the waste isolation potential of the five alternative shaft locations to that of the overall site. A comparison of surrogate conditions suggests that the current shaft location may have a lower potential for isolating waste than other possible shaft locations and may, therefore, be the most suited for acquisition of data that will allow for a conservative representation of overall site properties.

Based on the comparative evaluation, Subcommittee 3 concluded that consideration of waste isolation potential in the shaft location selection process would not have changed the choice of the current location and may have strengthened the scientific basis for choosing the current location.

In summary, the ESF Title I Design was found to be acceptable with respect to applicable requirements of 10 CFR Part 60, given that the Title I Design is preliminary and that Title II Design will be completed before shaft sinking commences. The DAA criteria developed for the assessment of the ESF Title I Design should be considered for inclusion in the ESF SDRD for

Title II Design. Additional analyses during or in association with Title II Design are recommended. Minor problems were identified in the SCP that can be addressed in semiannual progress reports. Waste isolation potential does not appear to be a discriminating factor between alternative exploratory shaft locations and, had it been explicitly considered, would not have affected the selection of the preferred shaft location. Based on the findings of the TAR, it is expected that no changes to the ESF Title I Design will be required that would require significant modification to the schedule, configuration, or technical approach for site characterization activities as described in the SCP.

Chapter 1

INTRODUCTION

1.1 PURPOSE AND MOTIVATION

The purpose of the TAR is twofold: (1) to assess the acceptability of the ESF Title I Design with respect to applicable requirements of 10 CFR Part 60, and (2) to evaluate alternative exploratory shaft locations from the perspective of the capabilities of those locations, with and without an exploratory shaft present, to provide for waste isolation and containment, and assess whether these capabilities would have affected the preferred shaft locations had they been explicitly considered in the location selection process. This review is intended to meet the applicable requirements of the Yucca Mountain Project Quality Assurance Plan, NNWSI/88-9, for a Quality Assurance (QA) Level I activity.

The DAA is intended to address concerns of the NRC staff regarding the design control process that was used to develop the ESF Title I Design. In a meeting with representatives of the DOE on November 3, 1988, the NRC staff suggested a DAA as one acceptable approach to demonstrating the acceptability of the ESF Title I Design. (Minutes of this meeting are included in Appendix B-2.) The comparative evaluation of shaft locations is intended to provide the NRC staff with additional information about alternative locations that were considered by the DOE. The TAR is fundamentally an assessment of the adequacy of ESF Title I Design as a basis for planning of ESF-related site characterization activities.

The principal product of the TAR, this Review Record Memorandum (RRM), documents the various design and performance analyses which relate to the regulatory acceptability of ESF Title I Design; in addition, it provides the results and conclusions of the TAR. The RRM should facilitate NRC review of ESF Title I Design by providing a "road map" to the supporting documentation.

The TAR implemented Steps 2 and 3 of a November 17, 1988, memorandum from Stephan H. Kale, Acting Director for Facilities Siting and Development, Office of Civilian Radioactive Waste Management (OCRWM), to Carl P. Gertz, Project Manager, Yucca Mountain Project Office (Project Office). The TAR was conducted in accordance with a December 8, 1988, letter from Gertz to Kale, which outlined the Project Office strategy for responding to the NRC concerns regarding the ESF Title I Design control process. The referenced memorandum and letter are included in Appendix F.

1.2 SCOPE

1.2.1 DESIGN ACCEPTABILITY ANALYSIS

The ESF Title I Design was assessed by the TAR Team with respect to design criteria that were developed for applicable 10 CFR Part 60 regulatory requirements related to three major concerns: (1) maintaining the long-term waste isolation capability of the site, (2) not compromising the ability to characterize the site, and (3) obtaining data that are representative of site behavior. These concerns are referred to here as NRC Concerns 1, 2, and 3.

For applicable 10 CFR Part 60 requirements that are not related to Concerns 1, 2, or 3, the potential impact on Title I Design was assessed qualitatively, without generating detailed design criteria. (Design criteria for all applicable 10 CFR Part 60 requirements are being generated by the DOE as a prerequisite to the start of Title II Design.)

Specifically, the scope of the DAA includes:

1. TAR Part I, Element 1: Assessment of coverage by the SDRD of the Subset of 10 CFR Part 60 requirements related to waste isolation, ability to characterize the site, and data representativeness.

2. TAR Part I, Element 2: Identification of design interfaces and assessment of SDRD design/performance criteria for the subset of 10 CFR Part 60 requirements.

3. TAR Part I, Element 3: Assessment of adequacy of ESF Title I Design against criteria developed for DAA.

4. TAR Part I, Element 4: Assessment of appropriateness of data used in ESF Title I Design and how data uncertainties were considered.

5. TAR Part I, Element 5: Summarization of recommendations and proposed corrective measures.

6. TAR Part I, Element 6: Qualitative assessment of the impact on ESF Title I Design of other applicable 10 CFR Part 60 requirements.

The DAA is summarized in Chapter 2 and detailed in Appendix I.

1.2.2 COMPARATIVE EVALUATION OF SHAFT LOCATIONS

The comparative evaluation of shaft locations, for alternative locations which were specifically considered earlier, is intended to identify (1) any significant differences in the potential to isolate or contain wastes, with and without an exploratory shaft present; and (2) what influence, if any, these differences might have had on the selection of the preferred shaft location, had the differences been an explicit consideration in the location selection process. The alternative locations considered earlier are five locations documented in Bertram (1984). The evaluation also compares the waste isolation potential of the alternative exploratory shaft locations to the waste isolation potential of the overall site. The evaluation considers current site conditions, expected changes in current conditions over the next 10,000 yr, and alternative conceptual models of conditions at the site.

Specifically, the scope of the comparative evaluation includes:

1. TAR Part II, Element 1: Compilation of information germane to waste isolation for each alternative location; identification of differences between locations in their potential for providing waste isolation, assuming an exploratory shaft is not present; and evaluation of the influence any differences might have had on the preferred shaft location.

2. TAR Part II, Element 2: Evaluation of potentially adverse effects that an exploratory shaft might have on the isolation capability of a repository associated with each location, considering the information developed in the previous step; and evaluation of the influence these potential effects might have had on the preferred exploratory shaft locations.

3. TAR Part II, Element 3: Comparison of the waste isolation potential of the five alternative exploratory shaft locations with the isolation potential of other possible exploratory shaft locations within the conceptual perimeter drift boundary of the repository.

Illustrative groundwater-travel-time calculations were originally envisioned to support the assessment of the waste isolation potential of alternative exploratory shaft locations (see QALAS, Appendix C-1), and preliminary calculations were performed. These were judged, however, to be too immature to include in the RRM.

The comparative evaluation of alternative exploratory shaft locations is summarized in Chapter 3 and detailed in Appendices J and K.

1.3 CONDUCT OF TAR

1.3.1 QA LEVELS AND CONTROLLING PROCEDURE

Per agreement with the NRC and in accordance with Yucca Mountain Project Quality Management Procedure (QMP)-02-06, Rev. 0, "Assignment of Quality Assurance Levels," the TAR was established as a Quality Level I activity. The rationale for this assignment is that portions of the ESF may be important to waste isolation or important to safety, although this has yet to be determined. The TAR was conducted under QMP-02-08, Rev. 0, "Technical Assessment Review," which conforms to NNWSI/88-9, Section III (5.0), "Technical Reviews."

1.3.2 TAR PLAN

A plan for the conduct of the TAR was developed and comments on a preliminary draft of the TAR Plan were solicited from the NRC staff and the State of Nevada. These comments were considered in developing the final TAR Plan and written responses to the State of Nevada and NRC comments were developed; the comments and responses are provided in Appendix B-5.

In accordance with QMP-02-08, Rev. 0, the TAR was initiated with the issuance of a TAR Notice by the Project Office. A version of the TAR Plan, considered to be final at the time, was appended to the TAR Notice (Appendix B-1) and served to document the scope and purpose of the TAR. Through a QA surveillance, it was determined that, as a document that prescribes activities affecting quality, NNWSI/88-9, Rev. 2 (Section VI), requires that the TAR Plan be subject to document control. As a remedial action to a Project Office Standard Deficiency Report (Appendix C-6), the draft TAR Plan which accompanied the TAR Notice was reviewed under QMP-06-03, Rev. 1, "Document Review/Acceptance/Approval;" revised; and issued as a controlled document per

QMP-06-02, Rev. 1, "Document Control." The final TAR Plan reflects the actual conduct of the TAR; a copy of the final Plan is provided in Appendix B-2. Comments and responses from the QMP-06-03 review of the draft TAR Plan are provided in Appendix B-4.

1.3.3 TAR PARTICIPANTS

A TAR Committee, responsible for administration of the TAR, was formed in accordance with the TAR Plan. The TAR Chairperson, a Project Office Representative (DOE Branch Chief), the TAR Secretary, a QA Specialist, and a Technical Specialist comprised the TAR Committee. The TAR Chairperson (Jerry L. King) was responsible for coordinating the review process and other specific duties as specified in QMP-02-08. The Project Office Representative (Robert A. Levich) was responsible for ensuring that all actions taken by the TAR Committee were in accord with Project Office policy. The TAR Secretary (Richard C. Lee) documented the activities of the TAR Team and compiled the RRM. The QA Specialist (John Jardine) provided advice and counsel regarding QA aspects of the TAR. The Technical Specialist (Ernest Hardin) provided technical assistance as needed to the TAR Chairperson. The TAR Secretary and the Technical Specialist also participated as technical members of the TAR Team.

The TAR Team comprised 27 individuals (excluding the TAR Chairperson and Project Office Representative), each of whom was qualified to function as one or more of the following: Mining Engineer, Performance Assessment/Evaluation Specialist, Geotechnical Engineer, Geologist, Geochemist, Geophysicist, Hydrologist/Hydrogeologist, and Regulatory Specialist. Per QMP-02-08, the TAR Chairperson established minimum qualifications for education, experience, and independence needed by TAR Team members to fulfill the technical disciplines required to accomplish the scope and purpose of the review. The independence criteria established were that TAR Team members could not have been principal contributors to ESF Title I Design or the version of the SDRD which was used for ESF Title I Design. The minimum criteria established for each technical discipline were as listed in the TAR Plan and are documented in Appendix C-3.

Three subcommittees were formed to accomplish different parts of the TAR. Subcommittee 1 developed design criteria and used them to assess the adequacy of the Title I ESF Design. Subcommittee 2 assessed the appropriateness of data used in the Title I Design and how uncertainties were considered. Subcommittee 3 conducted a comparative evaluation of exploratory shaft locations.

Personnel participating in the TAR, their respective organizations, technical disciplines, and subcommittee assignments are listed in Appendix H.

1.3.4 APPROACH TO DEVELOPING COMMENTS, CONCLUSIONS, AND RECOMMENDATIONS

Each subcommittee developed an appropriate methodology for generating and documenting its review comments, conclusions, and recommendations relative to the nature of the subcommittee's particular task. In Subcommittees 1 and 2, individual team members reviewed particular aspects of the ESF Title I Design or particular supporting analyses or calculations, respectively, depending on the subject matter and the team member's area(s) of expertise. Summaries and overall conclusions were concurred on by subgroups of each subcommittee. Subcommittee 3 worked in groups and utilized a consensus approach to developing conclusions and recommendations. There were no unresolved differing professional opinions among subcommittee members. Details of the review processes employed by each of the three subcommittees are provided in Chapters 2 and 3 and supporting appendices.

Recommendations were documented on TAR Comment Record forms, which are reproduced here in Appendix G. These forms were provided to the Project Office for distribution to the Technical Project Officers (TPOs), who are responsible for resolutions. As resolutions are obtained and documented on the forms, supplements to the RRM will be produced and retained as a QA record (QMP-02-08, Rev. 0, Section 5.5.6).

1.3.5 REFERENCE VERIFICATION

References cited in the RRM were checked to ensure that the specifics of each citation (author, date, page numbers, etc.) are correct and that each citation appropriately characterizes specific content of the referenced document. Documentation of reference verification is being retained as a QA record in accordance with QMP-17-01, Rev. 0. (See Section 1.4.3.)

1.4 RECORDS

1.4.1 QA-RELATED RECORDS IN THE RRM

QA-related records associated with the TAR comprise Appendix C. These records include the following:

- QA Level Assignment Sheet (QALAS).
- The TAR Team Selection Record, which documents the functions involved in the review and the names of qualified individuals selected to be on the TAR Team (not all of whom actually participated; see Appendix H for a list of participating Team members).
- Letters from each Team member's employer certifying that the member meets the minimum qualification requirements established for the review.
- Questionnaires documenting, for each Team member, authorship of reports on ESF Title I Design, participation in reviews of reports on ESF Title I Design, authorship of sections of the SCP related to ESF Title I Design, and participation in committee reviews of ESF Title I Design.
- Records of each Team member's training in QMP-02-08 and the TAR Plan.
- Standard Deficiency Reports (SDRs) and Observations resulting from QA surveillances of the TAR.

1.4.2 OTHER RECORDS IN THE RRM

Meeting minutes, including presentation materials and attendance lists, are included in Appendix D.

Appendix E lists documents in the original TAR Package (per the final TAR Plan); documents added to the TAR Package, including the reports reviewed by Subcommittee 2; and resource documents that were used in support of the TAR. The TAR Package is the collection of documents that provided the design or design-supporting information that was assessed by the TAR Team members.

Correspondence relating to the TAR is provided in Appendix F.

1.4.3 QA RECORDS

Per QMP-02-08, Rev. 0, the TAR Package and the RRM are being retained as QA records in accordance with QMP-17-01, Rev. 0, "Record Source and Record User Responsibilities." As stated above, documentation of reference verification is also being retained as a QA record.

Chapter 2

SUMMARY OF PART I OF THE TECHNICAL ASSESSMENT REVIEW - DESIGN ACCEPTABILITY ANALYSIS

2.1 PART 1 - ELEMENT 1: ASSESSMENT OF 10 CFR PART 60 REQUIREMENTS IN THE YUCCA MOUNTAIN PROJECT SUBSYSTEM DESIGN REQUIREMENTS DOCUMENT (SDRD)

The objective of this element as described in the TAR Plan was to assess how completely the Functional Requirements from the December 1987 SDRD addressed the requirements from 10 CFR Part 60 that are relevant to the ESF and to the three major (NRC) concerns (#1, #2, and #3).

The requirements from Part 60 that were considered were taken from a list of 10 CFR Part 60 requirements applicable to the ESF, which was developed by a group under DOE/Headquarters (HQ) direction ("Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility - Technical Oversight Group Report," December 1988). To facilitate the review and development of criteria, the 46 applicable requirements identified in the above report were further subdivided into 52 requirements. Each of these requirements were evaluated with regard to how they related, if at all, to NRC Concerns 1, 2, and 3. This was based on the subcommittee members' knowledge of the Part 60 requirements and the ESF design. It was the collective judgement of the subcommittee that 22 of the 52 requirements were relevant to NRC Concerns 1, 2, and 3. Several requirements were determined to be related to more than one of these three concerns. This defined the focus for the work under Elements 1, 2, and 3 of Part I. The other 30 requirements were outside the scope of this Technical Assessment Review and hence were not considered further. These requirements, which are discussed in Element 6 of Part I, addressed the areas of preclosure radiological safety, retrievability, types of tests to be conducted during performance confirmation, the QA program, and procedural requirements.

The 22 relevant Part 60 requirements were compared with the SDRD Functional Requirements. Table I-1 of Appendix I is a compilation of the applicable requirements from Part 60, and the corresponding SDRD Functional Requirements identified by the TAR subgroup. The table lists all of the applicable Part 60 requirements and major concerns (#1, #2, and/or #3) discussed above, and quotes applicable Functional Requirements from the SDRD. The phrase "none applicable" appears wherever no Functional Requirements could be associated with a particular Part 60 requirement. As Table I-1 indicates, 18 SDRD Functional Requirements were identified as addressing to some extent (mostly indirectly or generally) 10 of the 22 relevant Part 60 requirements.

As defined in the SDRD Section 1.2.6, Functional Requirements are definitions of what the subsystems must accomplish. They are derived from a functional analysis of the total system and of the contribution of each subsystem. This is a systems engineering principle rather than a regulatory analysis approach. As such, it is understandable that all of the relevant Part 60 requirements would not be addressed by the SDRD Functional Requirements. Part 60 requirements are often more appropriately addressed by the SDRD Performance Criteria and Constraints. Table I-2 is an addendum to the Functional Requirements table discussed above; it quotes the Performance Criteria, Constraints, and Assumptions from the SDRD that also relate to the relevant Part 60 requirements. Some of these are quite specific, but they address the Part 60 requirements more effectively than the Functional Requirements, for example the additional design criteria of 60.133. Table I-2 points out that the SDRD Performance Criteria, Constraints, and Assumptions address, to some extent, 20 of the relevant Part 60 requirements.

In summary, the SDRD Functional Requirements tend more effectively to address Concern #2 (ability to characterize the site) than Concern #1 (impacts on waste isolation) by providing more complete and specific information. The postclosure performance Concern #1 is certainly intrinsic to many provisions in the design, but is addressed only generally in the SDRD. Concern #3 (representative data) is generally not addressed, except for general Functional Requirements that relate to 60.15. When taken as a whole (i.e., Functional Requirements, Performance Criteria, Constraints, and Assumptions), the SDRD addresses to varying degrees 21 of the 22 relevant Part 60 requirements. Only the requirement for evaluation of alternative design features important to waste isolation (60.21(c)(1)(ii)(D)) was not addressed.

2.2 PART I - ELEMENT 2: EVALUATION OF PERFORMANCE/DESIGN CRITERIA IN CURRENT TITLE I ESF DESIGN REQUIREMENTS

As indicated in the TAR Plan, the objective of Element 2 of Part I was to identify the performance criteria and constraints relevant to NRC Concerns 1, 2, and 3, that are or are not included in current ESF Title I Design Requirements. In order to accomplish this objective, a set of criteria pertaining to NRC Concerns 1, 2, and 3 was developed. The subcommittee assigned responsibility for developing this criteria list followed a multi-step process.

The process began with the 22 10 CFR Part 60 requirements determined under Element 1 to be relevant to NRC Concerns 1, 2, and 3. The subcommittee then identified, for each of the 22 requirements, the interfaces to testing, performance assessment, site, and repository design considerations. The significance of these interfaces is that aspects related to them would need to be considered in the development and implementation of the criteria. The next step in the process was to identify for each of the relevant Part 60 requirements the ESF physical system elements for which criteria were to be developed. These system elements are the same as the nine elements of the ESF Physical System Description specified in the SDRD:

1. ESF Site
2. Utilities
3. Surface Facilities
4. First Shaft
5. Second Shaft
6. Underground Excavations
7. Underground Utility Systems
8. Underground Tests
9. ESF Decommissioning Strategy

The correlation between the relevant Part 60 requirements, NRC concerns, interfaces, and ESF physical system elements is depicted in a matrix contained in Appendix I-3.

The subcommittee then developed a list of criteria pertaining to each of the Part 60 requirements for each of the ESF physical system elements (see Appendix I-3). In developing the criteria, the subcommittee used the following information sources:

1. Information developed during the repository conceptual design and preparation of the performance allocation tables in the SCP.

2. A preliminary draft of the SDRD being developed for Title II design.

3. The professional judgment of the subcommittee members based on their knowledge of the ESF system functions and the Part 60 requirements.

These criteria were compared to the Performance Criteria, Constraints, and Assumptions contained in the SDRD used in Title I Design ("Exploratory Shaft Facility Subsystem Design Requirements Document - Yucca Mountain

Site," NVO-309, December 18, 1987, including Engineering Change Requests 1-32). Of the 282 criteria developed, 93 were explicitly addressed, 127 were partially addressed, and 63 were not addressed in the SDRD. The documentation of this evaluation is contained in Appendix I-4.

2.3 PART I - ELEMENT 3: ASSESSMENT OF ADEQUACY OF ESF TITLE I DESIGN AGAINST THE DESIGN/PERFORMANCE CRITERIA

2.3.1 INTRODUCTION

The adequacy of the ESF Title I Design was assessed in the activities under Element 3 of Part I of this Technical Assessment Review; the subcommittee members are identified in Appendix H. More specifically, the 100 percent ESF Title I Design was reviewed to determine if the requirements, criteria, constraints, and interfaces identified in other TAR activities (see elements 1 and 2 of Part I) as being material to NRC Concerns 1, 2, and 3 are adequately reflected in the design or in existing assessments of ESF design adequacy. Section 2.3 documents the approach used to complete the review and summarizes the results of the review. The design met most of the criteria adequately; however, recommendations were developed where the adequacy was uncertain.

The members of Subcommittee 1 performed the design adequacy assessment; subcommittee members are identified in Appendix H. Generally, one member of the subcommittee was assigned to review the design against each of the individual criteria developed as part of this TAR (the discussion of the development of the criteria is in Appendix I-3). Individual reviewers were assigned to review each of the criteria developed. A separate team was assembled to verify that the references were properly and accurately cited in the review. The assignments for the individual reviews were made in discussions among the subcommittee members, with committee members aware that, if they felt unqualified to judge the adequacy of the design relative to a specific criterion, they could ask that the criterion be reassigned. This process led to the realization that additional personnel were needed to assist in the review; as a result, Keith Kersch, Bruce Crowe, Larry Costin, and Charles Voss were added to Subcommittee 1. As indicated in Appendix H, those who evaluated the design were qualified to function as geochemists, geotechnical engineers, geologists, geophysicists, mining engineers, regulatory specialists, or performance assessment specialists. It was decided among subcommittee members that the reviews would provide the following information for each of the criteria:

1. Whether the criterion had been addressed in ESF Title I Design.
2. Rationale.
3. Adequacy of treatment.
4. Recommendations and corrective measures.
5. Name, signature, and organization of reviewer.
6. Date.

In documenting the reviews, the reviewers found it more convenient in many cases to describe an assessment related to several criteria in a single write-up. This was often done because numerous criteria were similar (in several cases identical) for various subsystems or because related criteria applied to the same design features. An example of using a single write-up for multiple criteria is the description of the drainage plan that is related to the control of water from the first and second shafts, the underground excavations, and the underground testing. Additionally, most of the requirements for the first and second shafts are identical, so they are often treated in a single write-up. The assessments of the ESF Title I Design made for each of the criteria are provided in Section I-5 of Appendix I.

The remainder of Section 2.3 is divided into three subsections. Each subsection contains a summary of the reviews related to one of the three principal NRC concerns. Section 2.3.2 provides a summary of the assessment of the adequacy of the ESF Title I Design against criteria related to assuring that the long-term waste isolation capability of the site will not be compromised. Section 2.3.3 provides a summary of the assessment related to assuring that the ability to characterize the site will not be compromised. Section 2.3.4 contains a summary of the assessment related to assuring that the ESF site characterization activities will provide representative data. In each of the summaries, the general approach taken to evaluate the criteria is described, the types of concerns and related design features that could impact the evaluations are identified, and the adequacy assessments are summarized.

2.3.2 ADEQUACY OF TREATMENT OF CRITERIA PERTAINING TO LIMITING THE IMPACT OF ESF CONSTRUCTION AND OPERATION ON WASTE ISOLATION (NRC CONCERN #1)

During discussions about the development of the specific criteria to address the regulations, a general philosophy concerning how the evaluation of the Title I Design with respect to the criteria would be used to address NRC Concern #1 was developed. Generally, this approach involves recognition that the two most basic requirements related to NRC Concern 1 are (1) that site characterization be conducted to limit adverse effects on long-term performance of the geologic repository to the extent practical [60.15(d)(1)], and (2) that the performance characterization program be implemented so that it will not adversely affect the ability of the natural and engineered elements of the geologic repository to meet the performance objectives [60.140(d)(1)]. To show compliance with these two basic requirements, it is necessary to evaluate the ESF activities (construction, operation, and testing) to demonstrate that there are minimal and acceptable impacts on the ability of the site to comply with the postclosure performance objectives in 60.112, 60.113(a)(1)(ii)(A), and 60.113(a)(1)(ii)(B). The philosophy used in evaluating each of the ESF postclosure performance objectives was to (1) directly evaluate whether the site characterization activities associated with the ESF can be expected to significantly impact the ability of the site and engineered features to meet the postclosure performance objectives, and (2) evaluate whether the ESF activities would impact the ability to meet numerous additional related criteria in 10 CFR Part 60 that, if satisfied, will likely contribute to meeting the performance objectives. A table (Figure 2.3-1) was prepared to illustrate this philosophy. This table shows how the lower level requirements related to the ESF roll up into the higher requirements of 10 CFR 60.112, 60.113(a)(1)(ii)(A), and 60.113(a)(1)(ii)(B), then to 60.15(d)(1) and 60.140(d)(1).

It is believed that this "rollup" approach is consistent with the intent of the requirements in 10 CFR Part 60. The additional design criteria of 10 CFR Part 60, as originally proposed, required the design of the repository to accommodate potential interaction between the waste, the underground facility, and the site, as well as specified requirements related to the method of construction. The notice of the proposed rule (Federal Register

	60.15d1 EVALUATION			60.15d1 EVALUATION			60.140d1 EVALUATION		
	ESF CONST / OPS IMPACTS			TESTING IMPACTS			TESTING IMPACTS		
	TOTAL SYSTEMS 60.112	W.PKG LIFE .113a1iiA	RELEASE RATE .113a1iiB	TOTAL SYSTEMS 60.112	W.PKG LIFE .113a1iiA	RELEASE RATE .113a1iiB	TOTAL SYSTEMS 60.112	W.PKG LIFE .113a1iiA	RELEASE RATE .113a1iiB
SITE	.130 .133a2 .133d .133f								
SURF UTILS	.133a2 .133d								
1ST & 2ND SHAFT	.15d3 .21c1iiD .130 .133a1 .133a2 .133d .133e2 .133f .133h .133i								
U.G. EXCAV	.15d3 .21c1iiD .130 .133a1 .133a2 .133b .133d .133e2 .133f .133h .133i	.15d3 .21c1iiD .130 .133a1 .133a2 .133b .133d .133e2 .133f .133h .133i	.15d3 .21c1iiD .130 .133a1 .133a2 .133b .133d .133e2 .133f .133h .133i				.137	.137	.137
UG UTILS	.130 .133a2 .133d	.130 .133a2 .133d	.130 .133a2 .133d						
UG TESTS				.15d3 .74 .130 .133d .133i	.15d3 .74 .130 .133d .133i	.15d3 .74 .130 .133d .133i	.74 .130 .133d .133i .137	.74 .130 .133d .133i .137	.74 .130 .133d .133i .137
DECOMM	.133h	.133h	.133h						

Fig. 2.3-1. Matrix of Criteria developed under other Requirements of 10 CFR Part 60 considered in the evaluation of the Requirements of 60.15(d)(1), 60.112, 60.113(a)(1)(ii)(A), 60.113(a)(1)(ii)(B), and 60.140(d)(1).

Vol. 46, No. 130, July 8, 1981) stated that the Commission believed such requirements were necessary to ensure that the ability of the repository to contain and isolate the wastes would not be compromised by the construction of the repository. The proposed criteria were thought to represent a common practice based on experience, which has shown that such items need to be regulated. Additionally, in response to comments on the proposed rule (NUREG 0804), the Commission defended the inclusion of specific requirements and noted they consider it appropriate to include reasonable generic requirements that, if satisfied, will ordinarily contribute to meeting the release standards.

It should be noted that a design that incorporates the features identified in the related design criteria of 10 CFR Part 60 is not automatically assured either of being in compliance with the performance objectives of 10 CFR Part 60 or of not impacting the ability of the site to comply with the performance objectives. However, the design criteria of 10 CFR Part 60 encompass virtually all options open to a designer to ensure that a design does not impact the ability of the site to meet the performance objectives and, where possible, enhances the ability of the site to meet the performance objectives.

As indicated for paragraph 60.112 in the roll-up table (Figure 2.3-1), the criteria used for considering the potential impacts of performance confirmation testing are similar to the criteria applied to site characterization testing. The only differences identified are in the application of 60.15(d)(3) and 60.137 to site characterization and performance confirmation, respectively. No separation of the performance confirmation testing requirements from construction and operations criteria was considered necessary at the time since no construction and activities related only to performance confirmation activities that are not part of ESF construction are identified. The conclusion is reached in the TAR that the treatment of performance confirmation concerns is generally considered adequate in the ESF Title I Design, based on availability of space in the ESF dedicated test area for future testing; flexibility to develop additional excavations; and the assumptions that future testing will be similar to planned testing with respect to potential impacts on waste isolation and that controls will be maintained to require that impacts on performance will be evaluated prior to conducting such testing.

It is clearly recognized by the TAR reviewers and by the authors of SCP Section 8.4 that the evaluations of the potential impacts of site characterization activities on postclosure performance are based on the current conceptual models for processes believed to be appropriate for Yucca Mountain. Furthermore, it is noted that the likelihood and consequences of most of the related scenarios and the validity of the current (and alternate) models can be established only after site characterization has provided the necessary information. With this appropriate recognition of the uncertainties associated with the site behavior that need to be reduced by site characterization, and with recognition of the anticipated level of detail expected in the ESF Title I Design, the TAR review of the ESF Title I Design was conducted.

The reviewers generally sought to determine if the Title I Design consciously incorporates design features specifically intended to assist the site in complying with the performance objectives and the related specific criteria. The reviewers also sought to recognize appropriate components of the repository system to be relied on for performance. These components were then considered in the evaluation of the impacts of ESF construction, operation, and testing on the site properties and conditions that could, in turn, lead to significant impacts in the ability of the site to meet the performance objectives. These features in the ESF Title I Design comprise both physical items, including aspects of the configuration, and control of activities. The evaluations of the impacts that the design could have on the ability of the site to comply with the performance objectives are largely abstracted from Section 8.4.3 of the SCP. In these assessments, the issue resolution strategies presented in the SCP are used to identify the system elements and performance measures relied upon to demonstrate that the performance objectives have been met. The potential impacts of the site characterization activities on the performance measures of the system elements are evaluated. Many of the data, calculations, and analyses supporting the assessments in SCP Section 8.4 were also reviewed as part of this TAR. The results of that evaluation bear on the assessment of adequacy of the ESF Title I Design, and are summarized in Section 2.4.4.

Evaluations of the ESF Title I Design indicate that a number of design features were specifically embodied in the design both to assist the site in complying with the engineered barrier system release rate performance objective and to limit impacts to the site properties and conditions that could, in turn, lead to significant impacts in the ability of the site to meet the performance objectives. These design features include separation of the ESF tests from potential emplacement drifts; control of drainage directions; control of water use, including recovery and disposal of waste water; blasting control; capability for liner removal; separation of surface-based exploratory boreholes from planned ESF drifts; having no waste storage in any ESF drifts; and avoiding impoundment of surface water. Additionally, many features that are not part of the ESF but are part of the repository (for example, the air gap planned between waste packages and the emplacement borehole walls or the seals planned for installation during decommissioning) are planned to assist the site in complying with the postclosure performance objectives. The TAR evaluations and those in SCP Section 8.4 conclude that the ESF is designed with features that will enhance the capability of the site and engineered features to meet the performance objectives.

For the total system release performance objective, the components to be relied on for meeting the objective vary with the release scenario class. However, the unsaturated zone at Yucca Mountain (as discussed in Section 8.4.1.3 of the SCP) is the primary repository system element that the DOE expects to rely on to mitigate deleterious effects of many of the events, processes and features related to performance. The system elements relied upon for waste package containment and for the engineered barrier system release performance objectives are the engineered environment of the waste package, the waste container, and the waste form. In general, the primary manner in which site characterization activities could affect postclosure performance would be by altering the hydrologic or environment at Yucca Mountain. The evaluations made in Section 8.4.3.3 focus on changes to the hydrologic environment and how performance might be affected by changes to the amount of flux, the direction of flux, or the site conditions, or by the creation of a new pathway. Changes to the geochemical, geological, thermal, and mechanical environments are also considered as appropriate; the significance of most of these changes, however, lies primarily in their potential effects on the hydrologic environment.

Related to the ability to meet the total systems release objective, the potential impact to performance from ESF activities has been evaluated under assumptions of the occurrence of the nominal scenario; changes resulting from likely processes and events and changes resulting from disruptive scenarios were also considered. The principal focus of the evaluations was on the potential for increased ground-water flux and the potential for penetrations resulting from site characterization activities to function as preferential pathways for liquid movement. The potential impacts to the site from underground construction of exploratory shaft facility drifts and testing alcoves are evaluated in Section 8.4.3.2.5.4 of the SCP. The analyses discussed in SCP Section 8.4.3.2.1 indicate that water introduced to the rock formations from underground construction will change the saturation of the rock only slightly. This change will generally be limited to approximately 10 m from the opening. The initial changes to saturation will be transient because equilibration is expected to occur within several months. The changes to saturation will generally be transient and will not significantly increase either the percolation flux at the repository horizon or the value of the unsaturated hydraulic conductivity. The fraction of volume excavated within the ESF is small and is also not expected to significantly alter the flow field, or percolation flux, around the excavated opening; the effects of ventilation may further reduce the transient effects to flux and hydraulic conductivity caused by introducing water to the rock formations.

Hydrologic disturbances from ESF testing activities could potentially impact site performance by increasing the water flux at the repository horizon or by changing the hydrologic properties of the unsaturated zone. The currently identified tests will not introduce a significant amount of water to the unsaturated zone, and the water used in these tests will not result in permanent changes.

Changes in geochemistry could potentially affect the site, primarily by altering the environment near waste emplacement. West (1988) did not identify any interactions between fluids and materials used during construction that would have a significant, permanent impact on the site. The design of the ESF prudently places controls on fluids and materials. The construction of the underground drifts and testing alcoves will cause some small permanent changes to the rock near the excavated openings. Because of the distance between the openings and emplaced waste, however, these geochemical changes are not expected to significantly alter the environment in the waste emplacement areas.

The potential geochemical impact from chemicals introduced during testing should be a very local effect near the test. These changes should not affect the environment near waste packages, the capability of the tuff to retard transport of radionuclides, or the ground-water flux at the repository horizon.

The underground drifts and testing alcoves within the ESF will be permanent features, but are not expected to function as preferential pathways for either liquid or gaseous radionuclides. The mechanical disturbances to fracture apertures and hydraulic conductivity from ESF construction (due to stress relief, blast damage, etc.) are generally expected to be contained within 1 to 2 diameters of the penetrations. The changes in hydraulic conductivity around the drifts are expected to be increased by less than a factor of 2 at distances greater than approximately 5 meters from the wall. Changes to the site from introducing fluids and materials are expected to be generally transient and insignificant. The permanent changes are not expected to significantly impact the hydrologic, geochemical, and thermal/ mechanical conditions of the site.

The quantities, types, and locations of the fluids and materials used, the lateral separation of the ESF penetrations from the waste emplacement areas, the location of the shaft entrances to limit the potential for water inflow, the drainage plan for the ESF, the controls planned for limiting the excavation-induced changes in permeability, and the plans for sealing the shafts and exploratory boreholes also contribute to the conclusion that the performance of the ESF activities as planned is not expected to preclude the capability of the site to meet the performance objective for the total systems release of radionuclides to the accessible environment. Furthermore, in the absence of further site characterization and analysis, site characterization activities related to the ESF are also not expected to affect significantly either the frequency of occurrence or the magnitude of the disruptive scenarios that may reasonably be postulated to occur within the 10,000-year period of performance.

The system elements relied upon for waste package container performance and limiting the radionuclide releases from the engineered barrier system are the engineered environment of the waste package, the waste container, and the waste form. The three performance measures for the engineered environment of the waste package are (1) quantity of liquid water that can contact the container, (2) quality of liquid water that can contact the container, and (3) rock-induced load on the waste package. In SCP Section 8.4.3.2.5, it is concluded that constructing the ESF will not affect the ground-water flux at the repository horizon or create preferential pathways for liquid water flow. This conclusion is based generally on the quantities of water planned for use, the amount of water expected to be left in the formation, the separation of the ESF from waste emplacement areas, and the expected local effect of the water left in the formation. Hence, the construction of the ESF should not increase the amount of water that contacts containers. The potential geochemical disturbances (SCP Section 8.4.3.2.5) from fluids and materials introduced during site characterization are expected to be local and not transported far from the source. In addition, construction controls on the amount and use of chemicals will also decrease potential geochemical disturbances to the site. Because of the relatively short distance the fluids would likely penetrate the rock wall, and the approximately 30 m lateral distance from the ESF to the closest waste emplacement area, it is concluded to be unlikely that the quality of water contacting the waste container or waste form will change as a result of ESF activities. The 30 m standoff from the ESF drifts to waste emplacement areas makes it unlikely that significant rock-induced loading of the waste containers would occur as a result of ESF construction, operation, or testing. Since the environment of the container is not expected to be influenced by the ESF activities, it is reasonable to conclude that the waste container and waste form will be unaffected.

Based primarily upon the approaches presented in SCP Section 8.4 and the design features present in the ESF Title I Design, it is generally concluded that the ESF Title I Design is adequate to indicate that the ESF activities are not expected to impact the ability of the site and engineered features to meet the postclosure performance objectives. Additional assurance is provided by the results of the Design Adequacy Assessments relative to the numerous additional design criteria that, if satisfied, will likely contribute to meeting the performance objectives. The results of these additional assessments are summarized below, and the complete write-ups are included in Appendix I-5.

Of the design criteria related to the site and surface utilities, the treatment of only two was found to be inadequate in any way. Of the design criteria related to ES-1 and ES-2, 34 criteria were judged to be adequately addressed with respect to waste isolation impacts, although the degree of adequacy varied. Criteria judged to be adequately addressed included appropriate location of shafts with respect to planned underground construction and operations, fluid control, shaft configuration, construction methods and control of deleterious rock movement, and shaft separation.

In addressing the potential performance-related and waste isolation impacts from underground testing, sixteen of the applicable criteria were considered to have been adequately treated with respect to the Title I Design. These included criteria related to fluids and materials control, thermal and thermomechanical effects of testing, and appropriate location of boreholes. Those criteria that were inadequately addressed are related mostly to procedural controls (e.g., for water use in testing) and the disposal of waste water from underground construction, operations, and testing. The Title I Design contains insufficient information to permit assessment, but it is expected that the ESF Title II Design will contain more detailed specifications of procedures. These concerns are presented in the form of recommendations in Section 2.5.

Of the criteria considered for the underground excavation, underground utilities, and decommissioning, only five were considered to be inadequately addressed. Three of the five findings of inadequacy relate to the two-drift diameter spacing criterion for underground excavation.

2.3.3 ADEQUACY OF TREATMENT OF CRITERIA PERTAINING TO MAINTAINING THE ABILITY OF THE SITE TO BE CHARACTERIZED (NRC CONCERN #2)

The evaluations of design compliance with those criteria related to 10 CFR Part 60 that address interference concerns between tests and between testing and construction and operations for both planned site characterization testing and any performance confirmation testing that may be required included a review of 75 individual criteria related to eight different subparts of 10 CFR Part 60. The reviewers have concluded that all but one of the criteria have been directly addressed by the design and none of the criteria were deemed not to have been addressed. It could not be determined whether one criterion was or was not addressed (criterion 2.5.8.3, requiring test procedures to include control of water), because not all the test procedures have been written and, thus, it was not possible to completely evaluate the design against this criterion. It was noted in the reviews that features to control the flow of water are included in the design in numerous ways.

The treatment of the addressed criteria by the design was considered to be adequate in most cases, and no judgments of inadequate treatment were made. However, the treatment of several criteria was considered by the reviewers to be less than fully adequate, primarily because insufficient detail (such as surface blast control and water control procedures that are not completely specified) was available to make a comprehensive evaluation. Several recommendations and corrective measures to be implemented in Title II design were identified.

The Title I design evaluation found that the stated criteria were addressed in the design by a variety of physical design features, specified controls on construction methods, and the inclusion of sufficient flexibility in the design to provide the capability to deal with uncertainty in site conditions and to provide for additional characterization or performance confirmation testing as may be required.

The design features of importance in satisfying interference-related criteria included both physical items and control of activities. Specifically, some of the more important features related to limiting interference are:

1. The provision of adequate and reasonable separation between tests and the isolation of testing areas from those used for operations and maintenance and from ongoing construction.

2. Safety features on and the redundancy of underground water systems and utilities, and the siting of the shaft collars above levels that could be affected by the probable maximum flood, all of which contributed to ensuring that the design could control the spread of credible disruptive events that would affect site characterization testing.

3. Ventilation, hoisting, and utilities that were designed with sufficient capacity to accommodate reasonable expansion of the testing program.

4. The provision of sufficient space within the dedicated test area to allow for reasonable expansion of the testing program and/or relocation of tests based on the satisfaction of site acceptance criteria for each test.

5. The separation and isolation of the dedicated test area from the repository to preclude activities in the repository from interfering with planned or future testing in the dedicated test area.

6. Controls on construction methods, such as the use of controlled blasting and the limited and controlled use of water and other fluids and materials, were found to be important to satisfying criteria related to control of water, gas, and other materials so as not to adversely affect the adequacy or reliability of site characterization information. Such controls were also found to be

important in meeting criteria requiring that the design limit the potential for deleterious rock movement and not create preferential pathways for groundwater.

The flexibility of the design, which was discussed and evaluated in detail in SCP Section 8.4.2.3.6.4, was found to be sufficient to satisfy all criteria relating to the ability to expand the testing program, to relocate tests if unsuitable ground conditions are encountered, to allow adjustments where necessary and provide contingency plans to accommodate specific site conditions, and to allow development of new areas as may be required. The design flexibility evaluation considered flexibility in all aspects of the design, including hoisting capacity, underground utilities, ground support, and muck handling.

The adequacy of treatment of the design criteria in the design was found to be lacking only in the criteria relating to performance confirmation testing. This is a result of the lack of definition of the performance confirmation test program at the time of Title I Design. Further, it is not expected that much detail can be given for performance confirmation testing prior to obtaining baseline site characterization data, expected in the next several years.

As part of the Subcommittee 1 evaluations of the ESF Title I Design, a member of the subcommittee (L. Costin) met with a REECO engineer (Bill Grams) to discuss and document possible concerns regarding aspects of the ESF Title I Design. The results of that meeting are documented in a letter from Mr. Costin dated January 31, 1989, a copy of which is included in Appendix F. Three areas of concern were raised by Mr. Grams that are relevant to NRC concern number 2 (ability to adequately characterize the site). The areas of concern are:

1. The limited amount of operational area within the dedicated test area, which could make oeprational support of mining and testing activities difficult.

2. A potential for construction-to-test interference exists in situations where mining and testing may be going on simultaneously and in close proximity.

3. The design does not allow for easy expansion for additional testing within the dedicated test area without possible interference with ongoing testing.

Mr. Grams suggested that his concerns arose because of the preliminary nature of the ESF Title I Design, which did not provide sufficient detail in some areas to allow a complete evaluation. He anticipated that all of his concerns would be fully addressed in the Title II Design. Mr. Costin concluded that the concerns expressed by Mr. Grams had been covered by criteria evaluated in this DAA and did not require alterations of or additions to the criteria developed and evaluated in the DAA.

The first concern is related to sufficient area for equipment storage underground and a disagreement about storing equipment at the surface. An ECR to provide additional area has been submitted for Title II Design. The second concern is specifically related to the Sequential Drift Mining Experiment and the development of new test areas after testing activities had begun. Similar concerns had been raised in the DAA, resulting in a recommendation to develop procedures to allow excavation near test instrumentation; such excavation has been successfully carried out in G-Tunnel. The third area of concern is similar to the second and was likewise addressed in the DAA. Additional detail regarding this matter can be found in Mr. Costin's letter.

2.3.4 ADEQUACY OF TREATMENT OF CRITERIA PERTAINING TO MAINTAINING THE ABILITY OF THE SITE CHARACTERIZATION PROGRAM TO PROVIDE REPRESENTATIVE DATA (NRC CONCERN #3)

Assessment of Title I ESF Design for NRC Concern 3 is summarized in the following statements. The number and depth of shafts and boreholes are consistent with obtaining needed information for site characterization, and controls are in place to maintain this consistency as test plans are further developed. A significant amount of planning is needed to prepare for selection of the main test level breakouts in the two shafts. Test location acceptance criteria need to be developed; once they are, it should be possible to assess whether ESF tests are likely to obtain data that are representative of site conditions and processes within the framework established in Section 8.4 of the SCP.

The choice of testing methods, scope of testing, and schedule of testing were not considered in this assessment; only the locations of planned tests were considered in evaluating whether the ESF (including testing) is likely to provide data that are representative of site conditions and processes. Assessment of the design with respect to maintaining the ability to characterize the site, including evaluations of test-test interference and construction-test interference, was addressed for NRC Concern 2.

Seven separate response forms were produced for Concern 3, addressing 60.15(b), 60.15(d)(2), 60.15(d)(3), 60.74, and 60.133(b). The following is a list of the findings generated.

1. The ESF provides for testing at the candidate waste emplacement horizon. This was checked by referring to documents establishing the basis for the candidate repository horizon. Both shafts will service this level.

2. The elevations of the main test level breakouts in ES-1 and ES-2 are specified in the design, but there is uncertainty associated with the values used. Information obtained prior to construction or during construction will be required to refine the breakout selection. A description of the information needed, and the manner in which it will be obtained, is needed in the design.

3. The number and depth of the shafts is consistent with obtaining needed data for site characterization. This is supported by documentation that establishes the rationale for two shafts and their functions and principal design features.

4. The number and description of boreholes in the ESF is consistent with obtaining representative data for site characterization. This is chiefly because descriptions of each test have been reviewed (e.g., SCP Consultation Draft), because the test locations are constrained by representativeness considerations, and because detailed Study Plans will be reviewed prior to the performance of any test.

5. Detailed information on the location and orientation of boreholes for ESF testing is not provided in the design. The ESF Title I Design is nevertheless adequate with respect to this criterion because it amply provides the means for compliance, and because none of the preliminary information available indicates that the ESF will not comply. A reference configuration for the boreholes drilled from the ESF should be developed and evaluated with respect to intrusion of boreholes into (a) the pillar separating the designated test and waste emplacement areas, and (b) possible waste emplacement areas. The need to obtain representative data should be considered in this evaluation.

6. The appropriateness of the area set aside for future testing in the designated test area cannot be evaluated completely based on currently available information. However, the ESF Title I Design appears to meet this criterion insofar as the areas identified for planned testing and future testing are similar with respect to the limited available information on the variability of rock characteristics at the ESF location.

7. Test location acceptance criteria should be developed during Title II ESF design. Test location criteria are an important part of the DOE strategy for obtaining representative data as delineated in Section 8.4 of the SCP. They are also needed to evaluate the adequacy of flexibility in design of the shafts, underground excavations, and underground utilities, because flexibility is required in part to address representativeness constraints.

2.4 PART I - ELEMENT 4: ASSESSMENT OF APPROPRIATENESS OF DATA USED IN ESF TITLE I DESIGN AND HOW DATA UNCERTAINTIES WERE CONSIDERED.

2.4.1 DESCRIPTION OF TASK

Element 4 of Part I of the TAR focused on the parameters and data used in ESF Title I design and performance analyses which are related to NRC Concerns 1, 2, and 3. Subcommittee II of the TAR team was charged with evaluating the adequacy of the relevant analyses and calculations, including the appropriateness of the data or values used in those calculations. The appropriateness and reasonableness of data and parameters were reviewed with respect to data and parameters included in the Reference Information Base (RIB) and in other sources as appropriate. Subcommittee II was also charged with (1) reviewing how data uncertainties were considered in relevant analyses and calculations and (2) assessing the adequacy of such considerations with regard to NRC Concerns 1, 2, and 3.

2.4.2 DESCRIPTION OF PROCESS USED

An evaluation of the ESF Title I Design Report indicated that the majority of relevant analyses, calculations, and conclusions regarding construction for the ESF Title I design are not found in the Design Report itself, but are located in Section 8.4 of the Site Characterization Plan (SCP). Section 8.4 of the SCP is referenced in the Title I Design Report where an analysis, calculation, or conclusion is discussed. Additional analyses are found in the appendices of the ESF Title I Design Summary Report. To properly evaluate the adequacy of the relevant analyses and calculations, including the appropriateness and reasonableness of the data or values used in those calculations, Section 8.4 of the SCP was reviewed to determine what analyses, calculations, and conclusions are contained within it. The subcommittee used a preliminary list of such analyses and calculations that was compiled by Elmer Klavetter of Sandia National Laboratories (SNL). This list was reviewed for appropriateness and completeness by the subcommittee leader (A. C. Matthusen) and other members of the committee. Several of the references included in the initial list were determined to be inappropriate for inclusion in the review. These references included Sections 8.4.3.2.1.1 and 8.4.3.2.3 of the SCP, because reviews of these sections would duplicate the work being conducted in review of other documents on the list; Khilar et al., 1985, because this document is only referenced as supporting documentation and does not contain data generated in support of the Yucca Mountain Project; Jardine, 1988, Jardine et al., 1988, and DeGabrielle and Wu, in prep., because these reports do not address topics related to the NRC Concerns 1, 2, and 3 that serve as a focus for this review; and Blanford and Osnes, 1987, Zimmerman et al., 1987, and Zimmerman et al., 1987, for reasons described in the memo from Tillerson to Matthusen, included in Appendix I).

Initial subcommittee meetings were held to assess the most effective way of accomplishing the reviews. After discussion and preliminary scoping evaluation of different references in Section 8.4 of the SCP by the subcommittee members, the subcommittee developed the following process to complete the reviews:

1. Reviewing RIB 03.001 and assessing the reasonableness of the parameter values presented within the RIB. This was accomplished in several ways: in some instances the parameters in the RIB were compared to values in data reports that provided experimentally determined values for parameters, and in some instances the data in the RIB were compared to values listed in the data chapters of the SCP (i.e., chapters 1 through 5 which contain summaries of the pertinent data known about the Yucca Mountain site) or to values in the Yucca Mountain Environmental assessment (EA). The use of data from these documents was deemed appropriate as these documents provide a useful summary of the information that is known about the site and that have been gathered regarding site properties, including empirical data,and all of the information in these documents has been heavily reviewed and is based on published documents. In addition, parameter values in the SCP and EA that are from published references have been verified as being accurate by the reference verification process. Finally, in some instances the data in the RIB were evaluated based upon the reviewer's knowledge of the site properties.

2. Noting how and where the reference was used in Section 8.4 of the SCP (e.g., to describe an analysis done in the reference, to support a conclusion, to describe results of an empirical study, etc.).

3. Checking data values used in the referenced document against the suggested preferred values in RIB 3.0.

4. If no values for the parameters were listed in RIB 3.0, then evaluating the parameter values based on comparison to measured values tabulated in the data chapters of the SCP (i.e., chapters 1 through 5 as appropriate; again, this method was deemed acceptable for the same reasons as discussed previously) or the EA, or basing the evaluation on professional judgment when published values were not available.

5. Assessing the appropriateness of both the conceptual models used in the analysis and the analytical methods.

6. Evaluating how data uncertainties were considered in the analyses and whether these considerations were adequate.

7. Evaluating the use of the analyses as to whether or not the analyses have been appropriately used in evaluation of the ES Title I design.

In parts 1, 4, 5, 6, and 7 of the review process, professional judgment was relied upon to make the required determinations. The use of professional judgment in conducting a review is considered appropriate because assignments were made for subcommittee personnel to review documents according to their specific fields of expertise. The reviews were transmitted to the TAR subcommittee leader, and are included in Appendix I.

After the document reviews began, it became apparent that all required fields of expertise were not represented. Whenever a reviewer felt that his/her background was not adequate to review a document and perform the required assessment, the subcommittee leader was advised that other specialties were required to complete a review. To adequately review the required documents, a hydrogeologist with a background in unsaturated zone hydrogeology and a geochemist were qualified and began to review the documents that pertained to these fields. Additional hydrologists were also qualified to allow all of the reviews to be accomplished in a timely manner. Reviews that were done for Subcommittee III on Comparative Analysis of Alternative ESF Locations were also considered for this subcommittee to ascertain data reasonableness.

When the initial reviews were completed, they were read by the subcommittee leader and some of the other subcommittee members. In some instances, further clarification was requested from the reviewer or additional reviews of the same document by other reviewers were deemed appropriate.

A total of fifty-three reviews were done by fifteen reviewers on forty-two reports in support of the assessment and appropriateness of the data used in ESF Title I design. A list of the reports reviewed and the reviewers' names are contained in Table 2.4-1. The individual review for each report is contained in Appendix I. In some cases, multiple reviews of a document were conducted because the subcommittee leader judged that the expertise of several reviewers would be required to provide a thorough review, because the document being reviewed comprised several smaller reports, or because the document was cited in support of several different analyses in Section 8.4 of the SCP. In addition, some reviewers were asked for additional clarification by the subcommittee leader.

2.4.3 SUMMARY OF CONCLUSIONS

The purpose of this section is to provide summaries of the issues raised by the reviewers that may impact one of the five principal concerns: (1) the reasonableness of data in the RIB (version 03.001); (2) the appropriateness of data parameters used in the analyses; (3) the reasonableness of the conceptual models and analytic methods used; (4) the treatment of data uncertainty; and (5) appropriateness of analyses used to support the conclusions reached in Section 8.4 of the SCP.

Summaries of the Subcommittee II reviews are contained in Table 2.4-2. Perusal of this table indicates that with very few exceptions the reasonableness of the data and appropriateness of the data parameters were satisfactory. The conceptual models and analytic methods were considered reasonable without exception. Data uncertainty in the reports was generally treated by: (1) using conservative data; (2) use of dissimilar sets of data that may limit or bound the mean or expected data values; and/or (3) comparing results obtained from more than one conceptual model. According to the reviews, data uncertainty was treated in approximately 70 percent of the reports. In those reports where data uncertainty was not considered, the reviewers felt either that the treatment of uncertainty was not an issue, because the report was not used to support any major conclusions or positions (e.g., Johnson, 1981; Reda, 1986; Ross, 1987; St. John, 1987b; St. John, 1987c; St. John, 1987d; and Weeks, 1987), or where data uncertainty was considered irrelevant to the study, or the study was of a conceptual nature

Table 2.4-1 Summary list of review documents and reviewers (Page 1 of 6)

Review Document	Reviewer(s)
Appendix B.2 of the ESF Title I Design Summary Report, Volume 4B, "Preliminary Evaluation: Three Dimensional Far-Field Analysis for the Exploratory Shaft Facility"	Charles F. Voss
Bauer, S. J., L. S. Costin, and J. F. Holland, 1988. "Preliminary Analyses in Support of In Situ Thermomechanical Investigations," SAND88-2785, Sandia National Laboratories, Albuquerque, NM	Joe R. Tillerson
Bertram, S. G., 1984. "NNWSI Exploratory Shaft Site and Construction Method Recommendation Report," SAND84-1003, Sandia National Laboratories, Albuquerque, NM	Ernest L. Hardin
Birgersson, L., and I. Neretnieks, 1982. "Diffusion in the Matrix of Granitic Rock: Field Test in the Stripa Mine," in Proceedings of the Material Research Society Fifth International Symposium on the Scientific Basis for Nuclear Waste Management, June 7-10, 1982, Berlin, Germany, W. Lutze (ed.)	Paul L. Cloke
Bodvarsson, G. S., A. Niemi, A. Spencer, and M. P. Attanyake, 1988. "Preliminary Calculations of the Effects of Air and Liquid Water-Drilling on Moisture Conditions in Unsaturated Rocks," LBL-25073, Lawrence Berkeley Laboratory, Berkeley, CA	Edward M. Kwicklis, Paul L. Cloke
Buscheck, T. A., and J. J. Nitao, 1988. "Preliminary Scoping Calculations of Hydrothermal Flow in Variably Saturated, Fractured, Welded Tuff During the Engineered Barrier Design Test at the Yucca Mountain Exploratory Shaft Test Site, UCID-21571, Lawrence Livermore National Laboratory, Livermore, CA	Edward M. Kwicklis
Case, J. B., and P. C. Kelsall, 1987. "Modification of Rock Mass Permeability in the Zone Surrounding a Shaft in Fractured, Welded Tuff," SAND86-7001, Sandia National Laboratories, Albuquerque, NM	Charles F. Voss

Table 2.4-1 Summary list of review documents and reviewer (Page 2 of 6)

Review Document	Reviewer(s)
Costin, L. S., and S. J. Bauer, 1988. "Preliminary Analyses of the Excavation Investigation Experiments Proposed for the Exploratory Shaft at Yucca Mountain, Nevada Test Site," SAND87-1575, Sandia National Laboratories, Albuquerque, NM	Joe R. Tillerson
Costin, L. S., and E. P. Chen, 1988. "An Analysis of the G-Tunnel Heated Block Thermomechanical Response Using a Compliant-Joint Rock-Mass Model," SAND87-2699, Sandia National Laboratories, Albuquerque, NM	Joe R. Tillerson
Dudley, A. L., R. R. Peters, J. H. Gauthier, M. L. Wilson, M. S. Tierney, and E. A. Klavetter, 1988. "Total System Performance Assessment Code (TOSPAC) Volume 1: Physical and Mathematical Bases," SAND85-0002, Sandia National Laboratories, Albuquerque, NM	Clifford J. Noronha
Ehgartner, B. L., 1987. "Sensitivity Analyses of Underground Drift Temperature, Stresses, and Safety Factors to Variation in the Rock Mass Properties of Tuff for a Nuclear Waste Repository Located at Yucca Mountain, Nevada," SAND86-1250, Sandia National Laboratories, Albuquerque, NM	Charles F. Voss
Fernandez, J. A., T. E. Hinkebein, and J. B. Case, 1988. "Selected Analyses to Evaluate the Effect of the Exploratory Shafts on Repository Performance at Yucca Mountain," SAND85-0598, Sandia National Laboratories, Albuquerque, NM	Paul L. Cloke, S. G. Doty and J. D. Marvil, Rob Trautz, Keith M. Kersch, Joe Prizio
Hill, J., 1985. "Structural Analysis of the NNWSI Exploratory Shaft, SAND84-2354, Sandia National Laboratories, Albuquerque, NM	Joe R. Tillerson
Hopkins P. L., R. R. Eaton, and S. Sinnock 1987. "Effects of Drift Ventilation on Repository Hydrology and Resulting Solute Transport Implications," SAND86-1571, Sandia National Laboratories, Albuquerque, NM	Keith M. Kersch

Table 2.4-1 Summary list of review documents and reviewers (Page 3 of 6)

Review Document	Reviewer(s)
Hustrulid, W., 1984. "Lining Considerations for a Circular Vertical Shaft in Generic Tuff," SAND83-7068, Sandia National Laboratories, Albuquerque, NM	Charles F. Voss
Johnson, R. L., 1981. "Thermo-Mechanical Scoping Calculations for a High Level Nuclear Waste Repository in Tuff," SAND81-0629, Sandia National Laboratories, Albuquerque, NM	Charles F. Voss
Johnson, R. L., and S. J. Bauer, 1987. "Unit Evaluation at Yucca Mountain, Nevada Test Site: Near-Field Thermal and Mechanical Calculations Using the SANDIA-ADINA Code, SAND83-0030, Sandia National Laboratories, Albuquerque, NM	Joe R. Tillerson
Johnstone, J. K., R. R. Peters, and P. F. Gnirk, 1984. "Unit Evaluation at Yucca Mountain, Nevada Test Site: Summary Report and Recommendation," SAND83-0372, Sandia National Laboratories, Albuquerque, NM	Joe R. Tillerson
Kipp, Jr., K. L., 1987. "Effect of Topography on Gas Flow in Unsaturated Fractured Rock: Numerical Simulation," American Geophysical Union, Geophysical Monograph 42, D. D. Evans and T. J. Nicholson (eds.), pp. 171-176	Ralph Cady, Keith M. Kersch
Kwicklis, E. N., and D. T. Hoxie, 1988. "Numerical Simulation of Liquid-Water Infiltration Into a Fractured Welded Tuff," Workshop IV on Flow and Transport Through Unsaturated Fractured Rock as Related to a High-Level Radioactive Waste Repository, (abs.), University of Arizona, Tucson, AZ	Keith M. Kersch, Ralph Cady
Sinnock, S. (ed.), Y. T. Lin, and M. S. Tierney, 1986. "Preliminary Estimates of Groundwater Travel Time and Radionuclide Transport at the Yucca Mountain Repository Site," SAND85-2701, Sandia National Laboratories, Albuquerque, NM	Clifford J. Noronha

Table 2.4-1 Summary list of review documents and reviewers (Page 4 of 6)

Review Document	Reviewer(s)
Martinez, M. J., 1984. "Capillary-Driven Flow in a Fracture Located in a Porous Medium," SAND84-1697, Sandia National Laboratories, Albuquerque, NM	Keith M. Kersch
Nimick, F. B., L. E. Shepard, and T. E. Blejwas, 1988. "Preliminary Evaluation of the Exploratory Shaft Representativeness for the Yucca Mountain Project," SAND87-1685, Sandia National Laboratories, Albuquerque, NM	Richard C. Lee
Peters, R. R., 1988. "Hydrologic Technical Correspondence in Support of the Site Characterization Plan," Memorandum #3, SAND88-2784, Sandia National Laboratories, Albuquerque, NM	Clifford J. Noronha
Peters, R. R., 1988. "Hydrologic Technical Correspondence in Support of the Site Characterization Plan," Memorandum #4, SAND88-2784, Sandia National Laboratories, Albuquerque, NM	Clifford J. Noronha
Peters, R. R., 1988. "Hydrologic Technical Correspondence in Support of the Site Characterization Plan," Memorandum #5, SAND88-2784, Sandia National Laboratories, Albuquerque, NM	Clifford J. Noronha
Peters, R. R., J. H. Gauthier, and A. L. Dudley, 1986. "The Effect of Percolation Rate on Water-Travel Time in Deep, Partially Saturated Zones," SAND5-0854C, Sandia National Laboratories, Albuquerque, NM	Clifford J. Noronha Edward M. Kwicklis
Peterson, A. C., R. R. Eaton, A. J. Russo, and J. A. Lewin, 1988. "Technical Correspondence in Support of an Evaluation of the Hydrologic Effects of Exploratory Shaft Construction at Yucca Mountain," SAND88-2936, Sandia National Laboratories, Albuquerque, NM	Keith M. Kersch

Table 2.4-1 Summary list of review documents and reviewers (Page 5 of 6)

Review Document	Reviewer(s)
Reda, D. C., 1986. "Influence of Transverse Microfractures on the Imbibition of Water Into Initially Dry Tuffaceous Rock," in Proceedings Symposium on Flow and Transport Through Unsaturated Rock, SAND86-0420C, Sandia National Laboratories, Albuquerque, NM	August C. Matthusen
Reference Information Base, Version 03.001, Issued December, 1987.	Jeffery K. Kimball, Edward M. Kwicklis, Joe R. Tillerson, Charles F. Voss
Ross, B., 1987. "A Survey of Disruption Scenarios for a High-Level-Waste Repository at Yucca Mountain, Nevada," SAND85-7117, Sandia National Laboratories, Albuquerque, NM	August C. Matthusen
St. John, C. M., 1987. "Interaction of Nuclear Waste Panels with Shafts and Access Ramps for a Potential Repository at Yucca Mountain," SAND84-7213, Sandia National Laboratories, Albuquerque, NM	Joe R. Tillerson
St. John, C. M., 1987. "Investigative Study of the Underground Excavations for a Nuclear Waste Repository in Tuff," SAND83-7451, Sandia National Laboratories, Albuquerque, NM	Charles F. Voss
St. John, C. M., 1987. "Reference Thermal and Thermal/Mechanical Analyses of Drifts for Vertical and Horizontal Emplacement of Nuclear Waste in a Repository in Tuff," SAND86-7005, Sandia National Laboratories, Albuquerque, NM	Charles F. Voss
St. John, C. M., 1987. "Thermomechanical Analysis of Underground Excavations in the Vicinity of a Nuclear Waste Isolation Panel," SAND84-7208, Sandia National Laboratories, Albuquerque, NM	Charles F. Voss

Table 2.4-1 Summary list of review documents and reviewers (Page 6 of 6)

Review Document	Reviewer(s)
St. John, C. M., and S. J. Mitchell, 1987. "Investigation of Excavation Stability in a Finite Repository," SAND86-7011, Sandia National Laboratories, Albuquerque, NM	Charles F. Voss
Technical Letter Memorandum RSI(ALO)-0037, "Estimates of Expected Values and Ranges of Temperature, Stress, and Strain Along the Exploratory Shaft at the Yucca Mountain Project," Appendix B.3, Vol. 4B, ESF Title I Design Summary Report	Charles F. Voss
Wang, J. S. Y. and T. N. Narasimhan, 1988. "Hydrologic Modeling of Vertical and Lateral Movement of Partially Saturated Fluid Flow Near a Fault Zone at Yucca Mountain," SAND87-7070, Sandia National Laboratory, Albuquerque, NM	Keith M. Kersch
Water, Waste & Land, Inc., 1986. "Analyses of Observed Flow Between Test Wells USW G-1 and USW UZ-1," Draft NRC Mini Report 6, U.S. Nuclear Regulatory Commission, Washington, DC.	Keith M. Kersh
Weeks, E. P., 1987. "Effects of Topography on Gas Flow in Unsaturated Fractured Rock: Concepts and Observations," American Geophysical Union Geophysical Monograph 42, D.D. Evans, and I.J. Nicholson (eds.), pp. 165-170	Ralph Cady, Keith M. Kersch
West, K. A., 1988. "Nevada Nuclear Waste Storage Investigations Exploratory Shaft Facility Fluids and Materials Evaluation," LA-11398-MS, Los Alamos National Laboratory, Los Alamos, NM	Ralph Cady, Ralph Cady, Paul L. Cloke, S. G. Doty
Zimmerman, R. M., R. A. Bellman Jr., K. L. Mann, D. P. Zerga, M. Fowler, and R. L. Johnson, 1988. "G-Tunnel Welded Tuff Mining Experiment Evaluations," SAND87-1433, Sandia National Laboratories, Albuquerque, NM	Joe R. Tillerson

Table 2.4-2. Summary of DAA Reasonableness Reviews (page 1 of 7)

Report	Data reasonable?	Appropriate method?	Uncertainty treatment	Use of analysis in in Title I Evaluation	Recommendation
ESF Title I Report Appendix B.2	Appropriate	Calculation of temperatures and stresses could be expanded to include the presence of underground openings	Not treated	Ref. in Title I report	Objectives and use of analysis should be clarified if used in support of Title II design
Bauer et al., 1988	Reasonable	Reasonable and adequate	Some uncertainties treated	Appropriately used in SCP 8.4	None
Bertram, 1984	Appropriate	Location selection tends to be non-discriminating with respect to waste isolation concerns	Appropriately treated	Appropriate in SCP 8.4	Site selection should be reviewed with respect to potential impacts on waste isolation performance of the site
Birgersson and Neretnieks, 1982	Inappropriate for Yucca Mountain site	Irrelevant	Irrelevant	Inappropriate	Provide correction in SCP progress reports
Bodvarsson et al., 1988	Reasonable	Appropriate	Uncertainty examined in several ways	Correctly summarized in SCP 8.4.3, but some additional evaluations are warranted	Evaluate re-equilibration time for tuff; numerical simulations did not consider function that may may result in interference
Buscheck and Nitao, 1988	Reasonable	Appropriate	Not considered	Appropriately used in SCP 8.4	No recommendation made
Case and Kelsall, 1987	Reasonable	Reasonable and appropriate	Ranges of expected parameter values considered	Model is reasonable but conservatism appears to be overstated in SCP 8.4.3.2.3.1 but does not impact the overall conclusions reached in Section 8.4.3.3 concerning the effect of the shaft on repository performance. Additional scenario should be considered	Additional fault scenario should be considered in future evaluation

Table 2.4-2. Summary of DAA Reasonableness Reviews (page 2 of 7)

Report	Data reasonable?	Appropriate method?	Uncertainty treatment	Use of analysis in in Title I Evaluation	Recommendation
Costin and Bauer, 1988	Reasonable	Reasonable and appropriate	Appropriately treated in several ways	Appropriately used in SCP	None related to ESF Title I design. Inclusion of some specific stresses-related properties of liner and undergrouund opening support system in Title II RIB
Costin and Chen, 1988	Reasonable properties and use of G-tunnel results for simulation of ESF heated-block test	Reasonable and appropriate	Substantial treatment of uncertainty	Appropriately used in SCP 8.4	None for ESF design, but consider recommendation in ESF experiment design
Dudley et al., 1988	Reasonable except difference noted for CH_nv hydraulic conductivity value compared to EA	Reasonable	Adequately addressed by wide range of parameters	Summarized in SCP 8.4.3.2.1.2	No recommendation made
Ehgartner, 1987	Reasonable	Appropriate	Sensitivity analyses conducted using ranges of properties	SCP Section 8.4.3.2.3.1 mistakes the results of one part of analysis results	Determine impact of mistake in reference on overall conclusions drawn in SCP 8.4.3.3 is requested
Fernandez et al., 1988 Geochemistry	Generally appropriate except for some minor pH-related results	Generally appropriate except for some minor pH-related results	Some qualitative consideration given to uncertainty but no formal sensitivity evaluation done	Appropriately used in SCP 8.4 with results judged to be sufficiently conservative, and in some cases overly conservative	None
Hydrologic and airflow	Reasonable	Appropriate	In general, data uncertainties were considered and conservative approaches taken	In general, conclusions utilized appropriately in judgments of potential impacts of ES or performance	Reviewers suggested in some areas the use of additional or alternate technical approaches or scenarios and indicated that more detail should be provided in future evaluations

Table 2.4-2. Summary of DAA Reasonableness Reviews (page 3 of 7)

Report	Data reasonable?	Appropriate method?	Uncertainty treatment	Use of analysis in in Title I Evaluation	Recommendation
Fernandez et al., 1988 (continued) Hydrologic	Reasonable	Reasonable	Uncertainty addressed by considering very unlikely scenarios and varying rock properties over wide ranges	Appropriately used	No recommendation made
Hill, 1985	Reasonable except that matrix value used for Young's Modulus	Reasonable	Appropriately considered in use of 2-D and 3-D analysis of pillar width and room acceptability shape effects	Appropriately used as one of several analyses that form basis for estimating extent of stress changes	Future evaluations should indicate recognition at rock matrix value used for the elastic modulus; no impact on ESF design since modulus value change is unlikely to change conclusions in report
Hopkins et al., 1987	Reasonable	Reasonable and conservative	Uncertainty addressed by varying flux and humidity in drift	Appropriate	No recommendations made
Hustrulid, 1984	Appropriate criteria consistent with RIB. No significant data inconsistencies	Appropriate	Data uncertainty considered by varying factors in strength criteria and by analyzing multiple liner emplacement scenarios	Reasonably used when considered with another report by Hustrulid	None
Johnson, 1981	Reasonable, rock properties generally within range of RIB	Use of ubiquitous joint model considered conservative	Not considered in this analysis	Results considered conservative	None
Johnson and Bauer, 1987	Reasonable except matrix value used for Young's modulus	Reasonable and appropriate	Effectively treated by using average and limit properties of 2 units and by varying in situ stress	Appropriately used as one of several analyses supporting extent of stress altered zone	When referenced, cognizance of use of matrix value for modulus should be demonstrated

Table 2.4-2. Summary of DAA Reasonableness Reviews (page 4 of 7)

Report	Data reasonable?	Appropriate method?	Uncertainty treatment	Use of analysis in in Title I Evaluation	Recommendation
Johnstone et al., 1984	Reasonable except matrix value used for Young's Modulus	Reasonable	Appropriately considered using average and limit values for 4 units, comparing results with G-tunnel experience, and by utilizing tunnel indexing methods and finite element approaches	Appropriately used in SCP Section 8.4	None
Kipp, 1987	Reasonable except for heat capacity for air	Reasonable	Not considered in this analysis		No recommendation made
Kwicklis and Hoxie, 1988	Reasonable	Conceptual model reasonable and appropriate	Uncertainty considered only relative to fracture aperture variation	Abstract treated verticle infiltration of ponded water. Reference in 8.4 is on invasion of drilling fluid. Inconsistency may not radically effect the results in scoping calculation but expected to significantly impact numeric results	No recommendation made
Lin and Tierney (Sinnock), 1986	Generally reasonable	Appropriate and reasonable	Adequately addressed in wide range of input parameter		None
Martinez, 1984	Reasonable	Appropriate	Addressed by using range of values for saturation and aperture	Appropriately used in SCP 8.4	No recommendation made

Table 2.4-2. Summary of DAA Reasonableness Reviews (page 5 of 7)

Report	Data reasonable?	Appropriate method?	Uncertainty treatment	Use of analysis in in Title I Evaluation	Recommendation
Nimick et al., 1988	Adequate	Appropriate	No consideration of data uncertainty	All uses in SCP 8.4 are consistent with report; author's definition of representativeness should accompany the use of this work	Author's definition of representativeness should accompany reference to it
Peters, 1988 Hydro. analysis #9 (memo 3)	Data values reasonable except for water compressibility value	Appropriate and reasonable	Travel time sensitivity not addressed	Appropriate since conclusions can be easily explained by figures in report	No recommendation made
Seismic and Tectonic (memo 4)	Data values reasonable except for water compressibility value	Appropriate and reasonable	No intent to treat uncertainty in this deterministic analysis	Summarized in SCP Section 8.4.3.2.1.1	No recommendation made
Hydro. Analysis (memo 5)	Reasonable	Appropriate and reasonable	Cases represent two extremes	Summarized in SCP Section 8.4.3.2.1.2	No recommendation made
Peters et al., 1986	Data reasonable except for water compressibility	Appropriate and reasonable, conservatively underestimates travel time	Adequately addressed by using wide range of parameters	8.4 contains accurate summary of conclusions of report	Modify value used for compressibility of water
Peterson et al., 1988	Data are reasonable except that rock compressibility appears too high	Reasonable	Uncertainty addressed by varying amount of water retained in formation		Evaluate rock and fracture compressibility
Reda, 1986	Not applicable to experimental report	Lab and experimental procedures appear reasonable	Not treated directly	Reasonable discussion in SCP 8.4 of water movement through unsatuated zone	No recommendation made
RIB Version 03.001	Reasonable	Not applicable to RIB review	Variation in numerous parameters identified	Generally appropriately used as source for input values used in analyses of Yucca Mountain behavior	Expand RIB substantially for use in ESF Title II design especially with regard to hydrologic parameters. Also the seismic design value for the ESF liner should be based on a peak ground acceleration of 0.3g.

Table 2.4-2. Summary of DAA Reasonableness Reviews (page 6 of 7)

Report	Data reasonable?	Appropriate method?	Uncertainty treatment	Use of analysis in in Title I Evaluation	Recommendation
Ross, 1987	Not applicable to ESF Title I design	Reasonable and appropriate	Not treated	Not cited with regard to ESF design	No recommendation made
St. John, 1987a SAND84-7213	Reasonable	Reasonable and appropriate	Authors recognized some major uncertainties and adequately treated them	Appropriately used in SCP 8.4 except for one incorrect citation	If SCP errata is prepared, correct the citation
St. John, 1987b SAND83-7451	Appropriate	Appropriate	Not considered in report	Briefly summarized in SCP 8.4.3	None
St. John 1987c SAND86-7005	Reasonable	Appropriate	No attempt made to to consider uncertainty associated with data	Briefly summarized in SCP 8.4.3 appropriately and except for one incorrect citation in 8.4.3	Correct the incorrect citation on SCP page 8.4.3-29
St. John, 1987d SAND84-7208	Appropriate but more conservative than RIB values	Appropriate	Did not consider data uncertainty	Briefly summarized in SCP 8.4.3	Correct the incorrect citation on SCP page 8.4.3-29
St. John and Mitchell, 1987	Appropriate	Appropriate	Limited treatment of data uncertainty	Briefly summarized in SCP 8.4.3	Consider postprocessing some more recent results to evaluate potential for joint activation
ESF Title I Report Appendix B.3, RSI (ALO)-0037	Reasonable	Inadequately described in report to allow judgment of analysis method	Ranges of value were simulated for numerous independent variables	Considered most appropriate for very preliminary analysis or benchmarking other models	Clarify objectives and use of results if report is used to support Title II design
Wang and Narasimhan, 1988	Reasonable	Reasonable and consistent with accuracy of data available	Not addressed since this is a conceptual study	Not directly referenced in SCP	Report objectives and information need clarification before use in Title II design
Water, Waste & Land, Inc., 1986	Reasonable	Reasonable	Scoping calculation only	Only used to emphasize need for dry drilling	No recommendation made

Table 2.4-2. Summary of DAA Reasonableness Reviews (page 7 of 7)

Report	Data reasonable?	Appropriate method?	Uncertainty treatment	Use of analysis in in Title I Evaluation	Recommendation
Weeks, 1987	Reasonable	Reasonable	Not addressed but calculations have no input on ESF design	Valid conclusions are drawn in SCP 8.4 from this report	More work needed to determine impact on performance assessment
West, 1988					
Geochemical effects	Appropriate	Appropriate for the most part; where inappropriate other considerations avoid invalidating conclusions	Taken into account by specifying ranges of values	Reasonable conclusions drawn from report in SCP 8.4	Several recommendations related to materials control are provided in the review, also penetration of hydrocarbons test recommended before beginning testing in ESF. Suggested review of report by others with mining water-use expertise
Water	Reasonable and appropriate but technical basis for some water-related parameters is questioned	Reasonable and appropriate considering conservative recommendations	Uncertainties considered by conservative approaches taken in recommendation on water usage	Conclusions utilized appropriately in judgments of potential impacts of the ES on performance	Consider technical concerns during Title II
Zimmerman et al., 1988	Reasonable	Reasonable	Appropriately and adequately treated	Appropriate used in ESF Title I design evaluation in SCP Section 8.4	None

(e.g., Birgersson and Neretnicks, 1982; Kipp, 1987; Nimick et al., 1988; Peters Memo-4, 1988; Wang and Narasimhan, 1988; and Water, Waste & Land, Inc., 1986). There were two reports that appear to require further consideration for data uncertainty and are thus subject to comment disposition: Buscheck and Nitao, 1988; and Peters Memo 3, 1988. Less than half of the forty-two reports reviewed had any recommendations and, of the recommendations given, many were of a minor nature. A summary of the reviewer's recommendations/issues are presented below.

1. In the review of Appendix B.2 of the ESF Title I Design Summary Report, Vol. 4B, "Preliminary Evaluation: Three Dimensional Far-Field Analysis for the Exploratory Shaft Facility," it was recommended that the objectives and use of the analyses be expanded if they are to be used in Title II design.

2. In the review of Bertram (1984) (see also Chapter 3 of this TAR), "NNWSI Exploratory Shaft Site and Construction Method Recommendation Report," the reviewer notes that the methodology used to select potential sites did not consider potential impacts on waste isolation performance.

3. The review of Birgersson and Neretnieks (1982), "Diffusion in the Matrix of Granitic Rock," indicates that the report was inappropriately used to support limited diffusion of the geochemical alteration zone caused by grout emplaced in the ESF. The reviewer suggests that progress reports for the SCP reference the proper document and that alteration due to diffusion from emplacement of grout be re-evaluated prior to emplacing grout in test areas or within 30 meters of the test areas.

4. In review of Bodvarsson et al. (1988), "Preliminary Calculations of the Effects of Air and Liquid Water-Drilling on Moisture Conditions in Unsaturated Rocks," the reviewer (#1) does not disagree with the material in the report or its use in the SCP, but the reviewer does express disagreement with a conclusion drawn in the SCP based on the material presented in Bodvarsson et al. (1988) and other reports. The reviewer notes that it is unclear whether re-equilibration time will be longer or shorter for non-welded tuff than for welded tuff should they be exposed to moisture. The reviewer also notes that numerical simulations did not consider certain factors that may result in interference. It is recommended that the considerations voiced by the reviewer should be evaluated to ascertain whether or not they have been considered previously and if not they should be evaluated in the Title II design.

5. In review of Case and Kelsall (1987), "Modification of Rock Mass Permeability in the Zone Surrounding a Shaft in Fractured, Welded Tuff," the reviewer discovered that the SCP discussion concerning preferential pathways was inconsistent in its treatment of faults intersecting the exploratory shaft. The case where a fault is intersected and identified as such is not considered. The reviewer recommends that the following construction scenario should be considered: if or when the exploratory shaft intersects a fault extending to the repository area, the fault should be evaluated and

the results provided in subsequent SCP Progress Reports. In addition, the appropriateness of including a discussion on the feasibility of sealing such a fault and the criteria for doing so should also be considered.

6. The reviewer of Costin and Bauer (1988), titled "Preliminary Analysis of the Excavation Investigation Experiments Proposed for the Exploratory Shaft at Yucca Mountain, Nevada Test Site," recommends that the following specific parameters be added to the RIB for use in Title II design: (1) concrete properties for materials used in the liner; (2) in situ stress as a function of depth; and (3) properties of the materials planned for use in support systems proposed for the ESF.

7. The review of Ehgartner (1987), "Sensitivity Analysis of Underground Drift Temperature, Stresses, and Safety Factors to Variation on the Rock Mass Properties of Tuff for a Nuclear Waste Repository Located at Yucca Mountain," notes that SCP Section 8.4.3.2.3.1 appears to mistake the results of the analyses. The SCP reports that changes in rock strength and modulus in the Topopah Spring member had a greater effect on factors of safety than other parameters, but in no case was failure of the rock mass predicted. Ehgartner reports that approximately 20 percent of the possible values for the thermal and thermal/mechanical properties result in rock mass safety factors of less than 1. The reviewer recommends that the authors of SCP Section 8.4.3.3 document the extent that the Ehgartner (1987) reference was used to reach conclusions concerning the potential impacts of site characterization activities on the performance objectives for the site. An assessment should be made by the author(s) whether the conclusions reached in 8.4.3.3 are changed in any way as a result of this information.

8. In reviewing Fernandez et al. (1988), "Review of Selected Analyses to Evaluate the Effect of the Exploratory Shafts on Repository Performance at Yucca Mountain," the third reviewer recommended that additional calculations be performed using higher values of the draft pressure. The reviewer speculates that because the effects of gas compressibility and water vapor transport were not included in the calculation, an overestimate of the pneumatic conductivity resulted.

9. The fifth reviewer of the Fernandez et al. (1988) report suggests that shaft-inflow calculations for the flood-inundation scenario should include the effects of potential earth movement at the new ES locations; or, alternatively, the SCP should cite previous studies that include potential topographical changes affecting shaft inflow at the old ES locations as an upper bound case. In addition, the reviewer notes that the report discusses how precipitate formation may affect ESF drainage capabilities, while no similar discussion appears in the SCP. Also, the SCP discusses how the separate issue of siltation might affect ESF drainage, while no corroborating discussion appears in the report.

10. In the review of Hill (1985), "Structural Analysis of the NNWSI Exploratory Shaft," it was noted that a value used for the Young's Modulus was inappropriate for use for a rock mass value (more

appropriate for a matrix value), however the reviewer states that it is unlikely that the value used would significantly impact the predicted stresses and related factors of safety. The reviewer recommends that authors using this report in future evaluations should indicate recognition of the fact that a rock matrix value was used in the simulations for the elastic modulus.

11. Nimick et al. (1988), "Preliminary Evaluation of the Exploratory Shaft Representativeness for the Yucca Mountain Project," evaluates representativness of a variety of parameters that were at issue in the evaluation of the ESF preliminary location. The authors use a very general definition of "representative" for the description of the expected stratigraphic unit thickness, lithophysal abundance, etc. It appears that this broad definition does not appear with the citation in Section 8.4 of the SCP, and consequently the "representative" attributes of specific parameters may have been overstated.

12. The second reviewer of Peters et al. (1986), "The Effect of Percolation Rate on Water-Travel Time in Deep, Partially Saturated Zones," noted that the values used for the compressibility of water was off by about a factor of four. The reviewer notes that this error is irrelevant for the unsaturated zone.

13. In reviewing Peterson et al. (1988), "Technical Correspondence in Support of the Hydrologic Effects of Exploratory Shaft Facility Construction at Yucca Mountain," the reviewer does not disagree with the analytic methods or with the conclusion drawn. However, the reviewer does note several instances in which the data used appear to be inappropriate and one instance where he does not feel qualified to assess the data value. It is recommended that the appropriateness of the rock and rock fracture compressibility values be reevaluated.

14. In review of the Reference Information Base (RIB) Version 03.001, the reviewers found that, in general, the parameter values in the RIB were reasonable for simulating the behavior of the ESF at Yucca Mountain for Title I design. However, it was recommended that in future versions of the RIB, values for hydrologic parameters should be included and that the seismic design value for the ESF liner be based on a peak ground acceleration of 0.3g.

15. The reviewer of St. John (1987) reports, "Reference Thermal and Thermal/Mechanical Analyses of Drifts for Vertical and Horizontal Emplacement of Nuclear Waste in a Repository in Tuff" and "Thermomechanical Analysis of Underground Excavations in the Vicinity of a Nuclear Waste Isolation Panel," found the material reasonable and adequate. However, the reviewer noted that the two citations in the text of the SCP are incorrect. It is recommended that these be corrected either in an errata sheet or in SCP Progress Reports.

16. In the review of St. John and Mitchell (1987), "Investigation of Excavation Stability in a Finite Repository," the reviewer noted some potentially important data that were not used in SCP Section 8.4. The authors note that the joint activation around the access drifts due to both thermomechanical and excavation-induced stresses is very

sensitive to joint orientation. Because joint dislocation can alter the-hydrologic properties of the rock, the reviewer suggests that the thermomechanical investigations be revisited with estimates of joint activation.

17. The reviewer of "Technical Letter Memorandum RSI(ALO)-0037" recommends that the objectives of the report and the use of information contained within should be clarified if the report is to be used in Title II design.

18. The third reviewer of West (1988), "NNWSI ESF Fluids and Materials Evaluation," does not disagree with the data or the adequacy of the report, but the reviewer does supply a list of recommendations. It is recommended that the reviewer's recommendations be evaluated for their impact upon Title II design.

19. The fourth reviewer of West (1988) proposed three principal concerns. The first was that the author did not appear to use conservative values for the percentage of drilling fluid that is expected to be lost to the surroundings. Values as high as 70 percent may be more appropriate than the 10 percent used in the report. The report recommends that minimal-water techniques should be used in the excavation of any underground opening that falls within a spherical radius of 300 feet from the center of the bulk permeability room test. The reviewer recommends that minimal-water techniques should be used throughout the main level, since four locations are planned for the bulk permeability test, and the exact locations are unknown. Finally, the report concludes that hydrocarbons and solvents would only be expected to penetrate a few centimeters; however, this conclusion does not take into account the potential that the fracture system may allow considerably greater penetration.

2.4.4 SUMMARY OF RECOMMENDATIONS RELATED TO SECTION 2.4.3

In the more than fifty reviews performed on data reasonableness and appropriateness in support of Title I design, nearly all of the reports were judged to have used appropriate data and methods. In a majority of the reports, the authors treatment of uncertainty was considered appropriate. There were no issues identified by the reviewers that called into question Title I design.

Of the seventeen issues raised by the reviewers (see Section 2.4.3), there are two primary groupings that seem appropriate for summary purposes. The first group are the issues that may affect Title II design, and the second group are those issues that should be included in the SCP progress reports. Instances where it has been suggested that more detailed evaluations are warranted for Title II design are the following: (1) pathway scenarios should be considered where the shaft may intersect a fault; (2) higher values of pressure differentials are needed in shaft airflow analysis to consider gas compressibility and water vapor transport; (3) the conservatisms relative to percent of drilling fluids expected to be recovered may need reconsideration; (4) the analysis objectives of Appendix B.2 of the ESF Title I report will need considerable expansion; (5) upper bound inundation calculations for the proposed ES-location should be evaluated using impacts of earth movement; and (6) thermomechanical investigations in support of excavation should be reconsidered using estimates of joint activation.

Reviewers have indicated an inappropriate use of documents in SCP Section 8.4: (1) Birgersson and Neretnieks (1982) was used inappropriately to indicate limited diffusion of grout in the ESF; (2) Ehgartner (1987) is incorrectly referenced as indicating no zone of failure occurs near drifts; and (3) a definition of representativeness used by Nimick et al. (1988) is not included in the SCP citation. The issue that Bertram (1984) did not consider the potential impact of waste isolation on performance is not considered significant because that issue is the subject of this TAR.

Subcommittee II recommends that:

1. Specific analysis requests including appropriate treatment of uncertainty, identified previously, should be considered in Title II evaluations.

2. The apparent inappropriate use of the previously discussed SCP references should be considered for clarification or correction in SCP progress reports.

3. Recommendations should be considered in SDRD and RIB development.

2.4.5 Names and Signatures of the Reviewers

The signatures below indicate that the Data Reasonableness Subcommittee member has reviewed the previous summary section (2.4.4), and is satisfied that any issue(s) that may be identified in his or her review (contained in Appendix I-6) is adequately presented in section 2.4.4, and the discussion reflects the reviewer's original intent/concern.

Reviewer Name	Signature	Date
Paul L. Cloke	Paul L. Cloke	2/3/89
Ernest L. Hardin	E L Hardin	2/2/89
Richard C. Lee	Richard C. Lee	2/3/89
August C. Matthusen	August C. Matthusen	2/2/89

2.4.5 Continued

The signature below indicates that the Data Reasonableness Subcommittee member has reviewed the previous summary section (2.4.4), and is satisfied that any issue(s) that may be identified in his or her review (contained in Appendix I) is adequately presented in section 2.4.4, and the discussion reflects the reviewer's original intent/concern.

Reviewer Name	Signature	Date
Ralph Cady	Ralph Cady	7/6/1989

2.4.5 Continued

The signature below indicates that the Data Reasonableness Subcommittee member has reviewed the previous summary section (2.4.4), and is satisfied that any issue(s) that may be identified in his or her review (contained in Appendix I) is adequately presented in section 2.4.4, and the discussion reflects the reviewer's original intent/concern.

Reviewer Name	Signature	Date
Sandra G. Doty	[signature]	2/3/89

2.4.5 Continued

The signature below indicates that the Data Reasonableness Subcommittee member has reviewed the previous summary section (2.4.4), and is satisfied that any issue(s) that may be identified in his or her review (contained in Appendix I) is adequately presented in section 2.4.4, and the discussion reflects the reviewer's original intent/concern.

Reviewer Name	Signature	Date
Keith M. Kersch	Keith M Kersch	2/3/89
Josh Marvil	[illegible]	2/3/89

2.4.5 Continued

The signature below indicates that the Data Reasonableness Subcommittee member has reviewed the previous summary section (2.4.4), and is satisfied that any issue(s) that may be identified in his or her review (contained in Appendix I) is adequately presented in section 2.4.4, and the discussion reflects the reviewer's original intent/concern.

Reviewer Name	Signature	Date
Jeffrey K. Kimball	Jeffrey K Kimball	2/3/89

2.4.5 Continued

The signature below indicates that the Data Reasonableness Subcommittee member has reviewed the previous summary section (2.4.4), and is satisfied that any issue(s) that may be identified in his or her review (contained in Appendix I) is adequately presented in section 2.4.4, and the discussion reflects the reviewer's original intent/concern.

Reviewer Name	Signature	Date
Edward M. Kwicklis	Edward M. Kwicklis	2/3/89

2.4.5 Continued

The signature below indicates that the Data Reasonableness Subcommittee member has reviewed the previous summary section (2.4.4), and is satisfied that any issue(s) that may be identified in his or her review (contained in Appendix I) is adequately presented in section 2.4.4, and the discussion reflects the reviewer's original intent/concern.

Reviewer Name	Signature	Date
Clifford J. Noronha	CJNoronha	3 Feb 89

2.4.5 Continued

The signature below indicates that the Data Reasonableness Subcommittee member has reviewed the previous summary section (2.4.4), and is satisfied that any issue(s) that may be identified in his or her review (contained in Appendix I) is adequately presented in section 2.4.4, and the discussion reflects the reviewer's original intent/concern.

Reviewer Name	Signature	Date
Joseph Prizio	[signature]	3-Feb-89

The signature below indicates that the Data Reasonableness Subcommittee member has reviewed the previous summary section (2.4.4), and is satisfied that any issue(s) that may be identified in his or her review (contained in Appendix I) is adequately presented in section 2.4.4, and the discussion reflects the reviewer's original intent/concern.

Reviewer Name	Signature	Date
Joe R. Tillerson		2/3/89

2.4.5 Continued

The signature below indicates that the Data Reasonableness Subcommittee member has reviewed the previous summary section (2.4.4), and is satisfied that any issue(s) that may be identified in his or her review (contained in Appendix I) is adequately presented in section 2.4.4, and the discussion reflects the reviewer's original intent/concern.

Reviewer Name	Signature	Date
Charles F. Voss	Charles F. Voss	2/3/89

2.5 PART I - ELEMENT 5: SUMMARY OF RECOMMENDATIONS AND CORRECTIVE MEASURES

This section is intended as a general summary of the evaluations, assessments, and reviews comprising the Design Acceptability Analysis (DAA) of Sections 2.1 through 2.4. Also, the section is to identify any deficiencies in the design or the supporting documentation that are so significant as to bring into question the adequacy of the Title I ESF Design. The paragraphs below summarize and discuss the following tasks:

1. Evaluation of the Title I ESF SDRD (Elements 1 and 2).

2. Review of the principal analyses and calculations which support evaluations of the design (Element 4).

3. Assessment of the Title I ESF Design with respect to DAA criteria (Element 3).

The Title I ESF Design was found to be acceptable by the DAA, and is considered to be an appropriate preliminary design basis for conduct of Title II ESF Design. It is believed that implementation of the DAA recommendations can lead to increased confidence in the ESF design. However, the DAA recommendations are unlikely to result in design changes that would require significant modification to the schedule, configuration, or technical approach for site characterization activities as described in the SCP. The recommendations can be implemented during Title II, or before the start of construction, with the exception of revisions to the SDRD which should be implemented in preparation for Title II.

With respect to Element 1, 18 of the Functional Requirements from the ESF SDRD were found to apply to the 10 CFR Part 60 requirements, typically indirectly and in a general or implicit manner. However, as discussed in Section 2.1, the Functional Requirements are the products of a systems engineering analysis rather than a regulatory analysis, so it is not inappropriate for the 10 CFR Part 60 requirements to be partially addressed by the Functional Requirements. (This is a more appropriate role for the Performance Criteria and Constraints in the SDRD.) Accordingly, it is recommended that no specific corrective measures be taken to explicitly reflect the 10 CFR Part 60 requirements in the SDRD Functional Requirements. Nevertheless, there should be a distinguishable link between the Functional Requirements and the Performance Criteria and Constraints.

Regarding Element 2 (Section 2.2), of the 282 DAA criteria developed to reflect the 10 CFR Part 60 requirements pertaining to NRC Concerns 1, 2, and 3, a total of 93 were found to be explicitly addressed by the SDRD Performance Criteria, Constraints, and Assumptions. An additional 127 were partially addressed, and the remaining 63 were not addressed. However, these results cannot be considered a true measure of design adequacy, which was addressed by the design assessment of Element 3. Nevertheless, with respect to the SDRD, it is recommended that the criteria developed under Element 2 [see Appendix I-3] be considered for inclusion in the revision to the SDRD that is ongoing in preparation for Title II design activities. Criteria should also be developed for the other 10 CFR Part 60 requirements (discussed in Section 2.6) not addressed by the DAA criteria, i.e., those 10 CFR Part 60 requirements not directly related to NRC Concerns 1, 2, and 3. In addition, it is recommended that the revised ESF SDRD contain an appendix with a criteria list similar to that in Appendix I-3, but addressing all of the 46 requirements from 10 CFR Part 60 that are applicable to the ESF. This would facilitate evaluation of how the SDRD criteria reflect the 10 CFR Part 60 requirements.

The assessment that the ESF Title I design is adequate is based partly on evaluations of the impacts that the ESF could have on waste isolation, and the ability of the site to meet the postclosure performance objectives. These evaluations are reported, and assessments of the performance impact of the ESF are developed, in Section 8.4.3 of the SCP. More than 50 reviews were performed of reports representing the principal data, calculations, and analyses supporting the assessments in Section 8.4 as part of this DAA (Element 4). The results of these reviews are summarized in Section 2.4.4 above, and are important to the assessment of adequacy of the Title I ESF Design. Briefly, nearly all of the reports reviewed were judged to have used appropriate data and methods. Likewise, the treatment of uncertainty was considered appropriate. There were no issues identified by the reveiwers that questioned the adequacy of the Title I ESF Design. The concerns identified by the reviewers addressed evaluations warranted for Title II Design, and changes to SCP Section 8.4 which can be treated in the semiannual progress reports.

Approximately 28 unique recommendations were produced in Element 3 of the DAA. (Several recommendations are repeated, with different emphasis, for the different NRC Concerns.) The recommendations are based on assessment of the Title I ESF Design by the TAR Subcommittee #1, with respect to the DAA criteria developed by the subcommittee and described in Section 2.2. The majority of recommendations address additional analyses, strategy, or specifications needed in conjunction with Title II ESF Design. Although recommendations have been produced, no corrective action relative to the DAA criteria is required for the Title I ESF Design, which is judged to be an appropriate preliminary design basis for Title II ESF Design.

The Title I design is preliminary and was judged to adequately address, or to provide a sufficient basis for further design related activities to adequately address the DAA criteria. Thus, even where certain DAA criteria are reported to be treated inadequately in the Title I ESF Design, the implications are judged to be such that the criteria can be adequately addressed in Title II ESF Design or related activities.

The lists of recommendations in the following sections are taken from the DAA forms compiled in Appendix I. Like the appendix, these lists are organized according to major Concern 1, 2, or 3, and no ranking of importance is ascribed to the order of presentation. The lists are intended as an inclusive summary of every recommendation in the appendix, and thus a complete report of DAA recommendations. The lists are summarized in Table 2.5-1. For each recommendation, the table describes a juncture during future design, construction, and testing activities when the recommendation, if accepted, should have been implemented according to the judgement of the DAA reviewers. Where a recommendation has different aspects, more than one such juncture may be identified.

Table 2.5-1. Synopsis of Recommendations from DAA of Title I ESF Design (TAR Part 1, Element 3) (page 1 of 4)

	Item	Timing
	RECOMMENDATIONS PERTAINING TO NRC CONCERN #1 (WASTE ISOLATION)	
1.	Construction controls for excavation of main pad	Title II Design
2.	Procedures for controlling water inflow	Title II Design
3.	Procedures to control the use of water in construction, operation, and testing activities	Title II Design
4.	Examine water disposal system	Early Title II Design
5.	Examine detailed testing procedures with respect to waste isolation	Before testing
6.	Address recommendations of the West (1988) report; develop procedures for fluids/materials control and inventory	Title II Design
7.	Evaluate results of microbial studies for effects on waste isolation	Title II Design
8.	Reevaluate acceptability of J-13 water when more information on UZ pore water chemistry is available	Early in Construction
9.	Evaluate the effects of fire on materials and related to testing, relative to waste isolation	Title II Design
10.	Develop and implement QA procedures for identifying items important to waste isolation, and perform comparative evaluations as appropriate	Early Title II Design
11.	Integrate MPBH requirements	Title II SDRD & Title II Design
12.	Sensitivity evaluations	Title II Design
13.	Monitor and survey alignments and locations of boreholes from the underground portion of the ESF	Title II SDRD
14.	Drawings to indicate alignment, location, and extent of boreholes	Title II Design

Table 2.5-1. Synopsis of Recommendations from DAA of Title I ESF Design (TAR Part 1, Element 3) (page 2 of 4)

	Item	Timing
	RECOMMENDATIONS PERTAINING TO NRC CONCERN #1 (WASTE ISOLATION)	
15.	Reinterpret 15-m drift borehole standoff criterion with respect to MPBH and USW G-4	Title II SDRD & Title II Design
16.	Evaluate two-diameter separation criterion for adjacent drifts	Title II Design
17.	Develop specifications to control pressure grouting	Title II Design
18.	Evaluate impact of repository thermal loading on the ES liners	Title II Design
19.	Three-dimensional thermomechanical analysis of the ESF over 10,000 yr	Title II Design
20.	Maintain the capability to extend ES-1 into the Calico Hills unit	Title II SDRD, Early Title II Design, & Title II Design

Table 2.5-1. Synopsis of Recommendations from DAA of Title I ESF Design (TAR Part 1, Element 3) (page 3 of 4)

	Item	Timing
	RECOMMENDATIONS PERTAINING TO NRC CONCERN #2 (WASTE ISOLATION)	
1.	Increase width of pillar between the SE part of MTL and the repository	Title II Design
2.	Complete work in progress, as a basis for controls on water and blasting methods	Title II Design
3.	Develop specific constraints, as needed, on tracers added to water used for construction, testing and operations	Title II Design
4.	Develop methodology for identifying and implementing certain activities to support performance confirmation	Title II Design
5.	Evaluate Waste Package Vertical test location	Title II Design
6.	Controls on excavation methods for construction of the main pad	TitleII Design
7.	Procedures to control the use of water in construction, operation, and testing activities	Title II Design
8.	Examine testing procedures to assess potential for interference or impact on ability to characterize the site	Before Testing
9.	Evaluate two-diameter separation criterion for adjacent drifts	Title II Design
10.	Maintain the capability to extend ES-1 into the Calico Hills unit	Title II SDRD, Early Title II Design, & Title II Design

Table 2.5-1. Synopsis of Recommendations from DAA of Title I ESF Design - (TAR Part 1, Element 3) (page 4 of 4)

	Item	Timing
	RECOMMENDATIONS PERTAINING TO NRC CONCERN #3 (WASTE ISOLATION)	
1.	Document and plan for uncertainty in depths to the ES-1 and ES-2 MTL breakouts	Title II Design
2.	Develop a reference description for the location, alignment, and extent of boreholes in the ESF	Title II Design
3.	Develop test location acceptance criteria for planned ESF tests	Title II Design

2.5.1 LIST OF RECOMMENDATIONS RELATED TO NRC CONCERN #1

1. The design does not specify excavation techniques for controlling overbreak or limiting rock mass damage during excavation of the main pad, particularly the northwest portion. Controls should be imposed on excavation techniques for pad construction as part of the Title II design. In particular, the diameter and length of blast holes, and the types of explosives which may be used, should be specified. Also, a Blasting Plan should be required to be submitted for approval by the controlling official at least four hours prior to each blast, and a vibration monitoring program should be implemented. (Timing: TitleII Design. Re: DAA Criteria 1.1.1.1, 1.6.1.1, 1.9.6.1, and 1.16.1.1)

2. The treatment of procedures planned for use in controlling water inflow is marginally adequate in the current Title I ESF Design description and supporting evaluations. More detail on these requirements, including contingency plans and consideration of borehole packer seals, should be provided in the Title II ESF Design. (Timing: Title II Design. Re: DAA Criteria 1.1.1.1, 1.6.1.1, and 1.12.6.5)

3. The treatment of procedures needed to control the use of water in ESF construction, operation, and testing activities is marginally adequate in the current Title I ESF Design. More detail on the control of the amount and disposition of water used for such activities as blast hole drilling and cleaning of walls for mapping, should be provided in the Title II ESF Design. The use of conventional drilling methods (fluid circulation) versus dry drilling methods for the various boreholes to be drilled from the ESF should be evaluated with respect to waste isolation concerns. (Timing: Title II Design. Re: DAA Criterion 1.6.1.1)

4. The water disposal system (specifically the pond and sewer system) should be carefully examined to determine the impact of the planned location on waste isolation. The distance from the planned water disposal areas at the surface to the repository boundary should be evaluated with respect to postclosure performance. The analysis should be done early enough in Title II design to allow a decision to be made regarding whether or not it is necessary to move the pond and sewer system or to line the pond. (Timing: early Title II Design. Re: DAA Criteria 1.1.1.1, 1.6.1.1, and 1.14.2.1)

5. All detailed testing procedures, particularly for construction phase ESF testing, should be examined with respect to potential impacts on waste isolation performance. (Timing: before testing. Re: DAA Criteria 1.6.1.1, 1.8.6.1, 1.9.6.1, 1.14.8.1, and 1.14.8.7)

6. Recommendations of the West (1988) report should be addressed in further design work. Procedures should also be established for control of all materials entering or leaving the ESF, particularly related to the limitation or the introduction of hydrocarbons, solvents, and chemicals. (Timing: Title II Design. Re: DAA Criteria

1.1.1.1, 1.6.1.1, 1.8.6.1, 1.9.6.1, 1.10.4.4, 1.10.4.5, 1.10.5.4, 1.10.5.5, 1.10.6.5, 1.10.6.6, 1.10.8.1, 1.10.8.2, and 1.10.8.3)

7. The results of future microbial studies should be evaluated in future design documents, to the extent practicable, to assure there will be no long term adverse effects from the introduction of potential growth substrate materials. (Timing: Title II Design. Re: DAA Criteria 1.1.1.1, 1.6.1.1, 1.8.6.1, 1.9.6.1, 1.10.8.2, and 1.10.8.3)

8. Statements in regard to criteria concerning rock water chemistry and the use of J-13 water for the ESF may need to be reevaluated during the earliest stages of construction (i.e., construction of the shafts and main test level) when additional information on the chemistry of UZ pore water is available. (Timing: early in construction. Re: DAA Criteria 1.1.1.1, 1.6.1.1, 1.8.6.1, 1.9.6.1, and 1.10.8.4)

9. Further design analyses should consider the effects of fire involving tests conducted in the underground test areas, on the waste isolation performance of the rock mass. The materials to be used in testing, and the fire protection and suppression systems, should be evaluated with respect to the effects of fire. (Timing: Title II Design. Re: DAA Criteria 1.1.1.1, and 1.12.6.3)

10. QA procedures for identifying items important to waste isolation should be developed and implemented early in Title II ESF Design. Comparative evaluations of alternatives for major design features will be required if the features are found to be important to waste isolation. (Timing: early in Title II Design. Re: DAA Criteria 1.1.1.1, 1.3.4.2, 1.6.1.1, 1.8.6.1, and 1.9.6.1)

11. Requirements relevant to the drilling and testing of boreholes in proximity to the exploratory shafts, particularly with respect to the multiple purpose borehole (MPBH) activity, should be provided in the Title II ESF SDRD. The Title II ESF Design should then accommodate this activity as a result of complying with the SDRD. (Timing: Title II SDRD & Title II Design. Re: DAA Criteria 1.1.1.1, 1.2.8.1, 1.6.1.1, 1.8.6.1, and 1.9.6.1)

12. Analyses planned for Title II design evaluations should include sensitivity evaluations as appropriate to support reevaluation of compliance with criteria and constraints, and modification of design features, if necessary during construction as variable underground conditions are encountered. Also, sensitivity analyses would reinforce statements about the benefit gained from separating testing and waste emplacement areas. (Timing: Title II Design. Re: DAA Criteria 1.1.1.1, 1.2.4.1, 1.2.5.1, 1.6.1.1, and 1.13.6.1)

13. The alignments and locations of boreholes from the underground portion of the ESF should be monitored during construction, surveyed, and the results included on all underground working maps. (Timing: Title II SDRD. Re: DAA Criteria 1.2.6.3, and 1.6.1.1)

14. Title II drawings for the ESF, including test areas, should indicate to-the extent practicable the extent of boreholes to be drilled from the shafts and drifts, to evaluate compliance with criteria pertaining to penetration of the TSw2 unit and separation of testing from waste emplacement areas. In addition, Title II drawings should show the entire layout of the main test level, the location and extent of each existing or planned surface based borehole that penetrates the repository horizon, and the standoff distance required. (Timing: Title II Design. Re: DAA Criteria 1.1.1.1, 1.2.6.1, 1.2.8.2, 1.6.1.1, 1.8.6.1, and 1.9.6.1)

15. The 15-m drift borehole standoff criterion should be interpreted with respect to the MPBHs and borehole USW G-4. Closer proximity of openings to these boreholes may be desirable, and exceptions to the standoff criterion should be considered. Special consideration should be given to the localized drainage within the designated test area, the manner in which the MPBHs minimally penetrate the repository horizon, and the proximity of the MPBHs to the much larger shaft and connecting drift openings. (Timing: Title II SDRD & Title II Design. Re: DAA Criteria 1.1.1.1, 1.2.6.2, 1.6.1.1, and 1.11.6.5)

16. The two-diameter separation criterion for adjacent drifts should be evaluated to assess whether it should apply to short drifts and alcoves, and ESF tests such as the Sequential Drift Mining and Waste Package Vertical tests. The ESF layout should then be changed, if necessary, to comply with the criterion. (Timing: Title II Design. Re: DAA Criteria 1.6.1.1, 1.11.6.6, and 1.15.6.3)

17. Construction specifications should be developed for the Title II ESF Design to indicate where pressure grouting during construction is to be avoided, and to reflect compliance with specific, applicable criteria that pertain to such grouting. (Timing: Title II Design. Re: DAA Criteria 1.1.1.1, 1.4.4.2, and 1.4.5.2)

18. The impact of repository thermal loading on the ES liners should be evaluated, and the analysis should be included in the Title II design. The recommended analyses can be at least partially accomplished by post processing results from published analyses. (Timing: Title II Design. Re: DAA Criteria 1.1.1.1, 1.6.1.1, 1.18.4.1, and 1.18.5.1)

19. A three-dimensional thermomechanical analysis of the ESF should be performed for the Title II design. The analysis should cover time-steps up to 10,000 years after waste emplacement. This analysis should evaluate the extent and nature of changes in the hydrologic conditions around the ESF resulting from thermal and thermomechanical effects of the repository. (Timing: Title II Design. Re: DAA Criteria 1.1.1.1, 1.6.1.1, 1.9.6.1, and 1.18.6.1)

20. Maintain the capability to extend ES-1 into the Calico Hills unit, if it is deemed necessary and prudent. Include specific criteria in the body of the Title II SDRD to address the flexibility requirement, if appropriate. Prepare a risk benefit analysis early

in Title II ESF Design if possible, providing analyses as described in-SCP Section 8.4.2.1.6.1. (Timing: Title II SDRD, early in Title II Design, and Title II Design. Re: DAA Criteria 1.1.1.1, 1.2.4.1, 1.3.4.1, and 1.6.1.1)

2.5.2 LIST OF RECOMMENDATIONS RELATED TO NRC CONCERN #2

1. The pillar between the repository and the southeast margin of the ESF main test level layout should be increased to at least twice the diameter of the larger drift, i.e., to at least 40 feet. (Timing: Title II Design. Re: DAA Criterion 2.7.6.1)

2. Work in progress should be completed, in association with the Title II ESF Design, to establish a basis for determining the controls on water and blasting methods that are needed to limit test-test interference and construction-test interference, and maintain the ability to characterize the site. (Timing: Title II Design. Re: DAA Criteria 2.5.4.1, 2.5.5.1, 2.5.6.1, 2.5.6.4, and 2.5.8.1)

3. The requirements developed in Title II should contain specific constraints, where appropriate, on the types of tracers added to water used for construction, testing and operations. (Timing: Title II Design. Re: DAA Criterion 2.5.6.6)

4. A formalized methodology should be developed for identifying and implementing testing activities that support performance confirmation as required in 10 CFR 60 Subpart F, in particular for obtaining appropriate baseline data relative to the ESF (surface) site including the main pad and underlying bedrock. (Timing: Title II Design. Re: DAA Criterion 2.8.1.1)

5. The location of the Waste Package Vertical test should be reevaluated to ensure that sufficient separation can be maintained, with respect to test requirements, between the test drifts and the proposed repository. (Timing: Title II Design. Re: DAA Criteria 2.4.6.1, and 2.6.6.3)

6. The design does not specify excavation techniques for controlling overbreak or limiting rock mass damage during excavation of the main pad, particularly the northwest portion. Controls may be needed to the extent that they affect the adequacy or reliability of information needed for site characterization. (Timing: Title II Design. Re: DAA Criterion 2.7.1.1)

7. The treatment of procedures needed to control the use of water in ESF construction, operation, and testing activities is marginally adequate in the current Title I ESF Design. More detail on the control of the amount and disposition of water used for such activities as blast hole drilling and cleaning of walls for mapping, should be provided in the Title II ESF Design. (Timing: Title II Design. Re: DAA Criterion 2.5.6.5)

8. All detailed testing procedures, particularly for construction phase ESF testing, should be examined with respect to potential for interference between tests. (Timing: before testing. Re: DAA Criterion 2.5.8.3)

9. The two-diameter separation criterion for adjacent drifts should be evaluated to assess whether it should apply to short drifts and alcoves, and ESF tests such as the Sequential Drift Mining and Waste Package Vertical tests. The potential for deleterious rock movement should be weighed against provision of needed information for site characterization. (Timing: Title II Design. Re: DAA Criterion 2.6.6.3)

10. Maintain the capability to extend ES-1 into the Calico Hills unit, if it is deemed necessary and prudent. Include specific criteria in the body of the Title II SDRD to address the flexibility requirement, if appropriate. Prepare a risk benefit analysis early in Title II ESF Design if possible, providing analyses as described in SCP Section 8.4.2.1.6.1. (Timing: Title II SDRD, early in Title II Design and Title II Design. Re: DAA Criterion 2.4.4.2)

2.5.3 LIST OF RECOMMENDATIONS RELATED TO NRC CONCERN #3

1. Document the nature of the present uncertainty in projected depths to the ES-1 and ES-2 MTL breakouts, define the sensitivity and/or required accuracy of the MTL horizon selection, and state what information will be used for breakout selection in ES-1 and ES-2. Plans for certain contingencies, such as failure of the MPBHs to penetrate to the repository horizon, should be addressed. (Timing: Title II Design. Re: DAA Criteria 3.1.4.2, and 3.1.5.2)

2. Develop a reference description for the location, alignment, and extent of boreholes in the ESF. Compilation is especially appropriate for boreholes located near potential waste emplacement areas, or which may penetrate an intervening pillar. The description is needed to show that waste isolation concerns relative to these boreholes can be met while obtaining needed information for site characterization. (Timing: Title II Design. Re: DAA Criterion 3.3.8.1)

3. Develop test location acceptance criteria for planned ESF tests during Title II ESF Design. If operative criteria are developed, they will tend to show that the respective tests will produce representative data in the context of the strategy presented in SCP Section 8.4.2.1.5. Test location criteria are likely to affect the ESF design, particularly the sequence of drifting and the MTL layout. (Timing: Title II Design. Re: DAA Criteria 3.5.4.1, 3.5.5.1, 3.5.6.1, and 3.5.7.1)

2.6 PART I - ELEMENT 6: QUALITATIVE ASSESSMENT OF IMPACTS ON DESIGN OF OTHER APPLICABLE 10 CFR 60 REQUIREMENTS

For this DAA, detailed design criteria were generated for those 10 CFR Part 60 requirements that were identified as applicable to the ESF, and were related to NRC Concerns 1, 2 and 3. Other 10 CFR Part 60 requirements are identified as applicable to the ESF in the flowdown analysis discussed in Section 2.1, which refers to the flowdown analysis generated by DOE/HQ (re: draft Technical Oversight Group Report "Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility"). These other requirements are considered briefly in this section by evaluating the general impact of omitting them from the DAA on the assessment of the acceptability of the Title I ESF Design. Evaluation of the other requirements is an important check on the applicability of the results of the DAA. It is also important to note that design criteria will be developed (as appropriate) to address these other requirements, as well as requirements imposed by other regulations (e.g., 30 CFR 57), in the ongoing activities related to Title II ESF Design. This section provides rationale for why these "other" requirements can be addressed by these ongoing activities.

The "other" requirements can be categorized as directly related to waste retrievability and radiological safety requirements of paragraph 60.111, or related to miscellaneous topics, some of which are also related to waste retrievability or radiological safety.

2.6.1 OTHER REQUIREMENTS DIRECTLY RELATED TO WASTE RETRIEVABILITY AND PRECLOSURE RADIOLOGICAL SAFETY

Paragraph 60.111(a) requires protection against radiation exposures and releases of radioactive material during the preclosure period of performance. Paragraph 60.111(b) requires that the geologic repository operations area (GROA) be designed to preserve the option of waste retrieval until permanent closure. This section develops a position that the Title I ESF Design and planned construction and testing activities are unlikely to impact repository operations in a manner that could adversely affect compliance with paragraph 60.111. This position then supports the conclusion that there is small likelihood of future changes relative to the Title I Design that would result in significant modification to the schedule, configuration, or technical approach for ESF related site characterization activities.

The zones of influence around in situ tests have been evaluated to assess the potential for test-test interference in the ESF. These analyses (summarized in SCP Section 8.4.2.3) generally show that the zones of influence (including elevated stress and temperature, hydrologic effects, and chemical effects) are substantially limited to the dedicated test area. The analyses give no indication that the ESF tests themselves would adversely affect repository performance with respect to the preclosure performance objectives.

Potential impacts on preclosure radiological safety and waste retrievability from structural failure of underground openings that comprise the ESF, and from surface flooding, are considered below.

2.6.1.1 Impact of Structural Failure

This section discusses the mechanical consequences of rock mass structural failure, and the indirect effect on repository ventilation from failure of one or both shafts or associated drifts.

Structural failure may be defined as deleterious rock movement sufficient to prevent the component from performing its intended function. Examples of potentially disruptive events include seismic ground motion, faulting, equipment collision with drift walls, and unexpected deterioration of ground support components. Such events have some potential to initiate failure of the shaft liners, wall rock, or ground support in shaft-access drifts.

Table 2.6-1 identifies ESF shafts and drifts and their intended use in the repository during the preclosure period. The table also identifies the openings through which waste will be transported. As indicated, the ESF related shafts and drifts will not be used for waste emplacement, nor will waste be transported through drifts constructed for the dedicated ESF test area.

Impact of debris from a concrete liner or drift collapse is unlikely to lead to a radiological release. For the shaft, this conclusion is based primarily on the fact that no radioactive waste is to be handled or transported in the exploratory shafts (Table 2.6-1), and that the loss of intake air to an area in which waste is stored is unlikely to lead to an offsite release of radionuclides. Where waste is transported through the repository access drifts, the waste will be confined to a container that is enclosed in a transfer cask. The waste transfer cask is not yet designed; however, it is estimated that a steel cask with a thickness of about 10 inches would be required to meet shielding requirements (SNL, 1987, Appendix P). Such a massive cask is likely to maintain its integrity during a drift collapse, so that no radioactivity would be released. In addition, the cask will be designed to withstand credible earthquakes, fires, runaway transporters, and accidental drops. Additionally, the reduction in repository ventilation airflow that might result from a drift collapse could be expected to reduce the likelihood of an offsite release.

A potentially adverse consequence due to a structural failure would be dust generated from the concrete liner or rock. Excessive dust might plug the HEPA filters and render radiation detectors inoperable. However, this problem would not be unique to the ESF openings because the ESF contains only a small portion of the drifts that will be used to ventilate the repository. The potential impacts of such dust on the performance of HEPA filters and radiation detectors will be studied as part of repository design activities. It is important to note that structural failure of the exploratory shafts and associated drifts would not prevent the repository ventilation exhaust system from being shut down, which would then reduce or eliminate the potential for offsite release.

Drifts that may be used in transportation of waste, and thus in retrieval, are identified in Table 2.6-1. Waste will neither be transported nor retrieved through the exploratory shafts. Structural failure of the panel access drifts could be accommodated either by restoration of the drifts

Table 2.6-1. Use of ESF shafts and drifts during repository operations

Type of opening	Primary function during preclosure	Transport of waste to/from emplacement drifts	Used for waste emplacement
Shafts			
ES-1, ES-2	Ventilation intake for waste emplacement area	No	No
Drifts			
Upper demonstration breakout room	None	No	No
Dedicated test area	Potential support for performance confirmation testing	No	No
Drill Hole Wash Exploratory Drift	Part of tuff main with possible extension into tuff ramp and ventilation exhaust for development area	No	No
Imbricate Fault Exploratory Drift	Panel access drift and intake airway for waste emplacement area	Yes	No
Ghost Dance Fault Exploratory Drift	Panel access drift and intake airway for waste emplacement area	Yes	No

or by developing alternate routes for waste transport. Retrieval time could be lengthened by restorative measures. However, because the expected time to complete retrieval operations is 14 yr (SCP-CDR, Appendix L-2, SNL 1987) and the time available for retrieval is up to 34 yr based on 60.111(b)(3), sufficient time would be available to restore drifts used for transport or create new routes using existing or newly mined drifts.

Retrieval could be affected by loss of one or both of the shafts, according to the SCP-CDR (SNL, 1987). The SCP-CDR estimates that retrieval operations would rely on approximately 60 percent of the total airflow capacity of the two converted exploratory shafts. However, other openings such as the waste ramp could still provide intake air for retrieval related operations, to maintain flow from mining areas toward retrieval and waste emplacement areas of the repository. Retrieval could be slowed depending on the severity of facility damage and the time required to reinstate ventilation capacity, through shaft repair or replacement. However, the retrieval schedule of 60.111(b)(3) provides sufficient time for such remedial options and hence the ability to retrieve the waste would not be compromised by structural failure of one or both of the exploratory shafts.

2.6.1.2 Impacts of surface flooding

Numerous features of the Title I ESF Design will limit the impact of surface flooding on the waste isolation performance of a repository that includes the ESF. This section summarizes some of the important features. The two exploratory shafts, which are expected to be incorporated into the repository as ventilation intake shafts, are designed to withstand the effects of a probable maximum flood (PMF). The shaft collars will be located above the height of the PMF, the ground surface around the shafts will be graded away from the collars, and additional flood measures will be constructed in the vicinity. Additionally, a sump will be constructed in each shaft below the repository horizon, and any other water entering the ESF openings will tend to reenter the rock mass or drain to the ES-1 sump where it will be pumped to the surface. It is unlikely that surface flooding will adversely affect the ventilation function of the shafts or cause the shafts or shaft access drifts to adversely affect any other part of the repository. Hence it is unlikely that the shafts, drifts, and related facilities will compromise radiological safety and waste retrievability performance as a result of flooding.

2.6.1.3 Conclusions regarding radiological safety and waste retrievability

Based on the above discussion, the Title I ESF Design already incorporates many of the principal features that will be needed to show compliance with detailed criteria addressing 10 CFR Part 60 requirements for radiological safety and waste retrievability. Development of these design and performance criteria will be accomplished by related, ongoing activities in preparation for Title II ESF Design. Although radiological safety and waste retrievability aspects of the Title I Design have not been assessed in the DAA to the same level of detail as for the three major NRC concerns, it is reasonable to expect that, based on the technical discussion above, the ESF design will not be changed significantly by new criteria. Thus there is low likelihood that such new criteria will generate changes to the ESF design that would result in significant modification to the schedule, configuration, or technical approach for ESF related site characterization activities.

2.6.2 MISCELLANEOUS REQUIREMENTS

The 10 CFR Part 60 requirements identified in Part I, Element 1 as applicable to the ESF design (see Section 2.1) included several requirements that were not directly related to paragraph 60.111 or NRC Concerns 1, 2, or 3. Many of these requirements are already addressed by the Title I ESF Design, and some will be evaluated and treated by preparations for Title II Design. It is the goal of this section to show that significant changes in the Title I Design are not expected to result from explicit evaluation and implementation of these requirements.

In the following list, each of the miscellaneous applicable requirements from 10 CFR Part 60 is described briefly, followed by a discussion of potential impacts on the Title I ESF Design.

a) Subsurface exploratory drilling, excavation, and in situ testing before and during construction shall be planned and coordinated with GROA design and construction. [60.15(d)(4)]

Substantial evidence exists to indicate that the Title I ESF Design and design evaluations are coordinated with the design of the GROA as represented by the SCP-CDR (SNL, 1987). The ESF drainage plan, layout, borehole penetrations, controls on fluids and materials, and other aspects of the ESF are examples of design features constrained by the repository interface.

b) Deferral of shaft sinking until NRC comments on the shafts have been considered. [60.16]

The schedule for ESF construction and testing is constrained by the requirement to solicit and consider NRC comments on the shafts.

c) The SAR shall include an analysis of...major design systems, structures, and components (SS/C) to identify those that are important to safety... [60.21(c)(1)(ii)(E)]

The analysis of ESF items important to safety is being performed in preparation for Title II ESF Design. For the reasons presented in Section 2.6.1.1 above, it is not expected that this analysis will result in significant changes to the ESF design. The ESF design already contains provisions, such as those discussed below with reference to 60.131, that contribute to preclosure performance.

d) Maintenance of required construction records, to include specific minimum types of information. [60.72]

The required construction records do not comprise a physical feature of the design; however, the Title I ESF Design, including construction method and sequence, ground support, etc., will allow for adequate information to be collected.

e) Additional design criteria for SS/C important to safety:

(i) ...designed so that natural phenomena and environmental conditions anticipated at the GROA will not interfere with necessary safety functions. [60.131(b)(1)]

The repository related function of the ESF permanent items is reflected in the Title I ESF Design (for nonsafety related items) by the use of lifetime specifications. For reasons discussed in Section 2.6.1.1, it is unlikely that structural failure of these items would result in an offsite release, and thus it is unlikely that the functions of these items will be important to safety. The DAA has considered the lifetime specifications and concluded (with qualification) that they are met by the design. Finally, if these items are found to be important to safety, their design would be reassessed and changes might be required. However, such changes would probably be minor, owing to conservative aspects of the design.

(ii) ...to withstand dynamic effects that could result from equipment failure and similar events and conditions [60.131(b)(2)]

As discussed in section 2.6.1.1, the repository related functions for the ESF permanent items are not likely to be important to safety. Even if they were, the repository related functions conceived for the ESF permanent items do not involve equipment that could fail, producing dynamic effects contributing to offsite release. Similarly, it is unlikely that failures associated with equipment used during site characterization would cause damage to the permanent items that would be significant with respect to their repository related functions.

(iii) ...to perform safety functions during and after credible fires or explosions in the GROA [60.131(b)(3)]

Credible fires or explosions in the GROA would be similar to those in the ESF, for which the DAA has found that the Title I ESF Design includes appropriate controls.

(iv) ...to maintain control of radioactive waste and effluents and to permit prompt termination of operations, and evacuation of personnel during an emergency [60.131(b)(4)(i)]

The likely impact of structural failure on radiological safety is discussed in Section 2.6.1.1. Emergency egress is one of the principal requirements responsible for selection of the two-shaft concept for the ESF. Because the exploratory shafts are designed for emergency egress from the ESF, it is reasonable to expect that the shafts would satisfy a similar requirement for the repository, if necessary.

(v) ...to permit periodic inspection, testing, and maintenance, as necessary [60.131(b)(6)]

Nonpermanent items in the ESF will be removable, for incorporation of the shafts and associated drifts into the repository. Common experience with underground structures suggests that the nature of the ESF permanent items (i.e., shaft liner, underground excavations, ground support, operational seals) is compatible with this requirement.

(vi) The design of the GROA shall...include such provisions for worker protection as may be necessary to provide reasonable assurance that all SS/C's important to safety can perform intended functions [60.131(b)(9)]

If the shafts and associated drifts are determined to be important to safety, the safety function would not necessarily require the presence or intervention of workers in the underground (ESF) openings. If worker safety were a concern, then because of conservatism in the design including the method of excavation and the nature of the other permanent items, the ESF would meet applicable standards, or provide the flexibility to facilitate measures to ensure that such standards can be met. Also, the ESF has been designed to meet applicable Mine Safety and Health Administration (MSHA) regulations, in accordance with criteria and constraints included in the Title I ESF Subsystem Design Requirements Document (SDRD).

f) Performance confirmation requirements:

(i) Start of the performance confirmation program during site characterization and continuation until closure [60.140(b)]

Adequate baseline data will be collected during characterization. Also, applicable tests are planned for site characterization, and will be continued afterward as appropriate.

(ii) Inclusion in the performance confirmation program of in situ monitoring, laboratory and field testing, and in situ experiments, as appropriate [60.140(c)]

Laboratory, in situ, and field tests included in the site characterization program are applicable to performance confirmation.

(iii) A continuing program of surveillance, measurement, testing, and geologic mapping during repository construction and operation to confirm geotechnical and design parameters [60.141(a)]

Measurement programs begun during site characterization are appropriate for performance confirmation, and will be continued as appropriate. The ESF design facilitates this type of testing and observation.

(iv) Monitoring and evaluation of subsurface conditions against design assumptions [60.141(b)]

The data needed to evaluate design assumptions will be collected during site characterization, and will be continued afterward as appropriate.

(v) Measurements of rock deformations and displacement, changes in rock stress and strain, rate and location of water inflow into subsurface areas, changes in groundwater conditions, rock pore water pressures including those along fractures and joints, and the thermal and thermomechanical response of the rock mass as a result of development and operations of the geologic repository [60.141(c)]

Collection of these types of data is planned for the ESF, including tests designed to produce thermal and thermomechanical simulation of repository conditions. The ESF design facilitates the data collection and testing, and continuation of such activities after site characterization as appropriate.

(vi) Comparison of measurements and observations with original design bases and assumptions [60.141(d)]

Planned testing and measurement programs in the ESF will provide data and other information to support evaluation of original design bases and assumptions.

(vii) In situ monitoring of the thermomechanical response of the underground facility until permanent closure [60.141(e)]

Collection of relevant data is planned in the ESF; repository monitoring will be supported by the ESF to the extent practicable.

(viii) Conduct of a program during the early or developmental stages of construction for in situ testing of seals, backfill, and thermal interaction effects [60.142(a)]

Capability to perform such tests has been incorporated in a general way into the ESF layout and other aspects. A program of in situ seals testing in the ESF is planned for site characterization (SCP Study 8.3.3.2.2.3), although detailed test plans are not currently available.

(ix) Initiation of design testing as early as practicable [60.142(b)]

Specific tests and measurement programs which are directly applicable to performance confirmation design testing are planned for the ESF and are fully supported by the ESF design.

(x) Construction of a backfill test section [60.142(c)]

Capability to perform this type of testing has been incorporated in a general way into the ESF layout and other aspects, although specific test plans are not yet available. SCP Study 8.3.3.2.2.3 describes the type of in situ testing of seals and backfill that will be performed in the ESF, and includes a discussion of the state of the art in this type of testing and a process for developing specific tests.

(xi) Establishment of test sections for borehole and shaft seals [60.142(d)]

Flexbility to perform this type of testing is intrinsic to the ESF design, although specific test plans (including the location of testing such as that described in SCP Study 8.3.3.2.2.3) are not available.

(g) Application of a QA program to all SS/C important to safety and to items and activities important to waste isolation [60.151]....such program to be based on the criteria of Appendix B 10 CFR 50 as applicable and additional criteria in 10 CFR 60.151 [60.152].

Implementation of a fully qualified QA program for the Yucca Mountain Project and the ESF is nearing completion. Procedures for identifying and controlling the design of items important to safety, or important to waste isolation, will be implemented prior to Title II ESF Design.

In consideration of the above list and annotations and the ESF Title I ESF Design with supporting documentation, it is evident that the design, construction, and operation of the ESF can reasonably be expected to meet the miscellaneous requirements from 10 CFR Part 60. These requirements will be addressed more explicitly in Title II design after the process of identifying items important to safety and items important to waste isolation is complete.

In summary, it is likely that detailed ESF design and performance criteria for the miscellaneous requirements identified can be developed and implemented in Title II Design, with low likelihood of generating design changes relative to the Title I ESF Design that would result in significant modification to the schedule, configuration, or technical approach for ESF related site characterization activities.

REFERENCES:

SNL, 1987, "Site Characterization Plan Conceptual Design Report," Sandia National Laboratories, Albuquerque, NM, report SAND84-2641.

Concurrence by subcommittee 1 on the content of Sections 2.1, 2.2, 2.3, 2.5, and 2.6.

Joe R Tillerson	Joe R Tillerson	2/2/89
Dermot Ross-Brown	[illegible]	2/2/89
Arch W. Girdley	W. A. Girdley	1/30/89
Miguel A. Lugo	Miguel Lugo	2/1/89
Ernest L. Hardin	E L Hardin	2/1/89
Bruce Crowe	Bruce Crowe	2/2/89
Keith M. Kersch	Keith M Kersch	2/3/89
Michael D. Voegele	Michael Voegele	2/2/89
Larry Costin	[illegible]	2/1/89
Charles Voss	Charles Voss	2/1/89

Chapter 3

SUMMARY OF PART II OF TAR - ASSESSMENT OF ALTERNATIVE EXPLORATORY SHAFT LOCATIONS

To address the NRC's concerns regarding whether the Title I Design for the Exploratory Shaft Facilities (ESFs) is consistent with applicable 10 CFR Part 60 requirements, a comparative evaluation of alternative ESF locations was made. The comparative evaluation is intended to identify any significant differences among alternative locations in their ability to isolate waste, with and without ESFs present; and to determine what influence, if any, these differences might have had on the selection of the shaft location if waste isolation had been a consideration in the location selection process.

The completed analysis is in three elements, in accordance with the TAR Plan. Element 1 is an assessment of significant differences in the waste isolation potential of alternative ESF locations, assuming no ESF present; Element 2 is an assessment of significant differences in waste isolation potential of alternative ESF locations, assuming an ESF is present; and Element 3 compares the variations of certain waste isolation related characteristics relevant for alternative ESF locations throughout the overall site. The summaries provided in this chapter are based on detailed evaluations that are included as Appendix J of this Review Record Memorandum.

The overall conclusions and recommendations based on the comparative evaluation are the following:

1. Differences among the alternative shaft locations for currently expected conditions are not significant to waste isolation. This is because all the locations are expected to have conditions that would allow regulatory requirements to be met by wide margins.

2. Differences among the alternative shaft locations might be significant if future data show that widespread large-flux conditions exist at the repository site (currently considered unlikely) or could result from future disruptions of current conditions. Significant differences might also exist if current or future local concentrations of large flux are caused by subsurface lateral diversion or spatially variable pulses of surface infiltration. In either of these cases, locations toward the northeast would be more likely to have groundwater flow times to the water table less than the period of regulatory concern (10,000 yr) in the local zones of flux concentration. Under these conditions, evaluations of other natural barriers, including geochemical retardation, flow times in the saturated zone, and longer flow times outside the zones of flux concentrations, may be necessary to demonstrate adequate waste isolation capabilities for the overall site.

3. The presence of a shaft at any of the locations is not expected to significantly affect the waste isolation capability of a repository.

4. The current shaft location is the preferred location for characterization. Although the relative differences discussed in conclusions 1

and 2 are judged not significant to the waste isolation capabilities of-the overall site, they suggest that the characteristics of the current location may be less favorable than the characteristics of the other locations. Therefore, the current location is the most suitable for a conservative approach to collecting data to reduce uncertainties associated with the models, assumptions, and processes that affect predictions of waste isolation.

5. The addition of a waste isolation criterion to the set of criteria used in selecting a shaft location would not have changed the selection of the current location, but might have strengthened the scientific basis for choosing it, on the basis of conclusion 4.

6. The DOE should continue to support the current ESF location as the preferred location for the site characterization program, on the basis of conclusions 1 through 5.

3.1 PART II - ELEMENT 1: ASSESSMENT OF SIGNIFICANT DIFFERENCES IN WASTE ISOLATION POTENTIAL OF ALTERNATIVE EXPLORATORY SHAFT LOCATIONS, ASSUMING NO EXPLORATORY SHAFT IS PRESENT

This section reviews the assessment carried out for element 1 of the comparative evaluation. It compares information that is germane to the waste isolation potential of the five preferred alternative shaft locations identified by Bertram (1984), and it evaluates whether any differences identified would have influenced the selection of the ESF location if the differences had been explicitly considered in the selection process. The comparison uses available information to assess the similarities and differences in potential postclosure performance among the five alternative shaft locations. The available information consists primarily of data describing the site characteristics that account for the relative differences in performance.

It should be noted that postclosure performance is a concept that applies to the entire mined geologic disposal system. Therefore, a comparison of the potential influences on performance of certain site characteristics at alternative shaft locations, which represent only a small portion of the entire repository, cannot be used to draw conclusions about the ability of the site as a whole and its engineered features to meet regulatory performance objectives. Also, waste will not be placed in the exploratory shaft or its facilities; therefore, performance may never be associated directly with the ESF locations. In this chapter of the Review Record Memorandum and throughout Appendix J, the term "postclosure performance" is commonly used to refer to the relative groundwater flow time or radionuclide transport time at the alternative locations. This usage assumes that some waste will be placed at the shaft location so characteristics that influence releases from the emplaced wastes or subsequent transport away from the shaft location are of actual concern at these particular locations. In this context, the comparisons could be extended to judge the relative contributions that particular shaft locations might make to the performance of the overall repository system. However, no assessments of postclosure performance of the total system or its subsystems are yet available that would allow direct comparison of the relative contributions of alternative shaft locations to overall system performance. Therefore, a set of site characteristics that are inferred to serve as reasonable surrogates for engineered barrier, site, and total system performance (related to the NRC postclosure performance objectives of 10 CFR Part 60) was established. These surrogates were used to assist in reaching an overall judgment regarding whether any relative differences among performance-influencing factors at alternative shaft locations are significant.

In selecting surrogates, the performance allocation tables of the SCP (DOE, 1988) for Issues 1.1, 1.4, 1.5, and 1.6 and the alternative conceptual model tables for the site characterization programs (Section 8.3.1) were reviewed to determine which site characteristics may influence expected (nominal) postclosure performance. Additionally, disturbed-scenario categories were reviewed to determine whether additional surrogates were needed to evaluate differences among alternative locations for future conditions. The issues listed above are directly associated with the four NRC postclosure performance objectives described in 10 CFR Part 60 (60.112 and 60.113).

The review of the performance allocation and alternative conceptual model tables showed that the most important surrogates for isolation potential are (1) ground water flux in the unsaturated zone (i.e., the quantity of water that moves (per unit time) at and below the repository level), and (2) the mode of movement of this water (i.e., whether the water is moving predominantly in the matrix pores of the rock or predominantly in fractures). The ratio of flux to saturated matrix hydraulic conductivity is an important surrogate characteristic because it is probably a reliable indicator of the predominant mode of groundwater movement. Thus, variations of matrix conductivity among alternative shaft locations are important surrogates to consider in comparing these locations. A set of lower-level surrogates related to flux and matrix conductivity were identified; they include thickness of individual hydrogeologic units with large- and small-conductivity values, the total thickness of the unsaturated zone beneath the repository, the downdip position of alternative locations, the location of geologic structures (faults), and surface topography.

Surrogates related to geochemical characteristics and thermal-mechanical characteristics were also identified. These surrogates included such factors as water and rock chemistry, the distance to the vitric and zeolitic units, and the thickness of these units. In general, these surrogates were judged to be nondiscriminating, except that the thicknesses of the zeolitic units and of the total unsaturated zone beneath the repository were useful for assessing the potential for radionuclide retardation.

Surrogates related to potential disruptive scenarios were developed on the basis of the scenario categories in the SCP (from the performance allocations for such scenarios), which were classified according to potential impacts on barriers of the repository system. The disruptive-scenario classes were each reviewed to determine which of the surrogates for the nominal class applied to the potential disruptive classes, and whether any additional surrogates were needed. Only one other surrogate, overburden thickness, was identified to account for the potential disruptive scenarios.

An understanding of the implications of the selected surrogates is gained by considering their potential variation among the five locations in the context of the complex three-dimensional geometry of the overall Yucca Mountain site. These analyses are summarized here and presented in detail in Chapter 2 of Appendix J.

Insight into the usefulness of the surrogate site characteristics in representing waste isolation capability can be gained by considering the relationships between those characteristics and the flow of groundwater from the repository to the underlying water table. The flow of groundwater is particularly important to waste isolation because it would be the principal mechanism by which radioactive material might leave a repository if the barriers against release were breached. The performance allocation tables in the SCP, as mentioned above, emphasize ground water flux through the unsaturated zone and its mode of movement. Most aspects of the surrogates used to compare alternative shaft locations have direct bearing on one or both of these characteristics of ground water flow. Although the relationships have not yet been fully explored, computer simulations cited in SCP Sections 3.9.2 and 8.4.3.2 have provided some basic understanding.

The range of flow modes that may occur in the unsaturated modes at Yucca Mountain encompasses flow predominately in matrix pores, flow in both matrix pores and fractures, and flow predominantly in fractures. Flow in fractures is considered a less favorable condition than flow in matrix pores, because it is usually faster; the shorter ground water travel times that result from flow in fractures would be less favorable than the longer times resulting from flow in the matrix. For this reason, surrogates that suggest lower likelihoods for flow in fractures are indicators of locations with greater waste isolation potential. Examining the surrogates over the entire range of flow modes is useful because it addresses potential differences among locations under the current conditions, in which matrix flow probably is predominant; under potential disruptive conditions that might increase flux enough to cause significant flow in fractures; and under alternative concepts of flow that describe significant local flow in fractures under current conditions.

If flow is predominantly in the matrix pores, the thicknesses of unsaturated rock units beneath the repository are obvious indicators of performance, because the greater the thickness, the longer the time taken for radionuclides to reach the water table, assuming nearly constant transport velocities. The total thickness of the unsaturated material is, therefore, a primary surrogate for performance under matrix-dominated flow. Among the five locations, however, the differences in this thickness do not appear to be significant with respect to regulatory objectives, because the ground water travel times at all the alternative shaft locations are expected to be much longer than the period of regulatory concern (10,000 yr for the postclosure performance objective of 10 CFR 60.112) (DOE, 1986, Section 6.3.1.1.5). Furthermore, most radionuclides would be retarded, relative to the ground-water flow times, by the minerals in the zeolitic, vitric, and devitrified units, and the transport times for these radionuclides would be even longer.

If the flow occurs partly in the matrix pores and partly in fractures, the surrogates are more likely to discriminate significant differences among the locations. Whether such flow conditions currently exist at the site, either locally or over a wide area, is not known. As a general rule, flow occurs predominantly in the rock matrix when the flux is substantially less than the saturated matrix hydraulic conductivity of the rock. When fluxes are approximately equal to the value of conductivity, flow in fractures is more likely, and both flow modes may occur simultaneously. Some conceptual models and disruptive scenarios include the possibility of these conditions: for example, some models describe increased flux in a downdip direction associated with lateral diversion of the flow at or near unit contacts, and some disruptive scenarios describe episodic, concentrated pulses of infiltration at the surface. If such conditions cause concentrations of flux that are comparable to or exceed the saturated matrix hydraulic conductivity of the rocks along the flow paths, flow in fractures would be likely. The surrogates that most closely indicate the possibility for such conditions to occur are (1) downdip position, which reflects the possibility that lateral flow, if it occurs, may cause greater flux in a downdip direction; (2) locations of faults, which might transmit large concentrations of laterally diverted fluxes downward; and (3) topography, which is assumed to influence the distribution of infiltration.

Even without lateral flow or surface infiltration that concentrates flux, widely distributed flow in fractures may alternate with flow in matrix pores along any particular flow path. Such an alternation can occur when the local saturated hydraulic conductivity exceeds the local flux along some part of the path and is less than the local flux along other parts. The possibility for flow in fractures under such conditions is greater in the units with smaller conductivity (TSw and CHnz). Flow through the matrix pores for an amount of flux up to the value of saturated matrix conductivity is likely even where some water in excess of this value may rapidly move through the fractures. Thus, the most rapid flow times may be associated with only a small portion of the total flux and may not be representative of the predominant contaminant migration pathways. These conditions are likely to occur there when the flux is approximately as large as the mean saturated hydraulic conductivity of those units--a value that currently is estimated to be about 0.5 mm/yr. If flux is near this value, the flow in the large-conductivity units (CHnv, PPw, and BFw) is likely to remain almost exclusively in the matrix pores because most of the volume of these units would have local conductivities that are larger than the flux. The thickness of large-conductivity units is therefore a surrogate that indicates potential for greater performance: locations with the greater thicknesses of these units have the greater potential for waste isolation when flux is approximately the same as the mean value for the saturated hydraulic conductivity of the small-conductivity units.

The conditions under which flow in fractures is initiated or sustained are not well understood. However, the current limited evidence suggests that flow at Yucca Mountain probably is predominantly in matrix pores, at least in the places where the saturation measurements have been made. Nevertheless, it may be assumed that flow simultaneously in matrix pores and fractures is less likely where the flux-to-conductivity ratio is likely to be smaller (i.e., at locations where the large-conductivity units make up the larger fractions of the stratigraphic column). The total thickness of the unsaturated materials beneath the repository horizon is also a useful surrogate under these conditions, because travel time will be longer where the section is thicker, even if some flow is in fractures. This is because where the total section is thicker, a greater thickness of rock with local conductivities greater than the flux is more likely, even in the small-conductivity, presumably thicker, units. Another useful surrogate is the thickness of the zeolitic units, because of their ability to retard radionuclides. These three surrogates are therefore useful for qualitative comparisons among potential shaft locations under plausible conditions of local flow in fractures.

The third flow mode in the range that is feasible at Yucca Mountain--flow predominantly in fractures--would require a concentration of flux that is much greater than the currently estimated average values for the site. Such fluxes might arise from significant lateral diversion followed by flow through fault conduits or from locally restricted pulses of infiltration beneath washes or other areas favorable for infiltration. A likely consequence of such conditions would be full saturation and perched water throughout a significant volume of rock. Neither of these conditions has been observed unambiguously beneath Yucca Mountain. Flow predominantly in fractures, therefore, would occur under models and scenarios that, though plausible--particularly under much wetter climates--are not considered likely. Under such conditions, flow times through the fractures of the small-conductivity units would become so short that they probably would contribute little to the total flow time from the repository to the water table. The flow time through the large-conductivity units probably would remain long, however, because flow in fractures would not be likely to occur in those units unless much larger flux occurred. In comparing locations on the basis of conditions that produce large local flux values, the thickness of the large-conductivity units is again the primary surrogate for waste isolation.

Even though flow predominantly in fractures would shorten groundwater flow times to the water table for the most rapidly moving water, geochemical retardation and parallel flow through matrix pores for fluxes up to the saturated conductivity value would still slow the movement of most radionuclides. This expectation is particularly likely for the large-conductivity units, where flow would probably still be almost exclusively in matrix pores. In the small-conductivity units, the occurrence of flow in fractures might reduce the geochemical retardation for that portion of contaminated water moving through the fractures, unless the contaminants diffuse effectively into the large surface-area pores of the rock matrix. This matrix diffusion process is expected to occur, but its effectiveness has not been well established. Under large-flux conditions, therefore, the retarding capacity of the small-conductivity zeolitic unit (CHnz) is questionable for amounts of water in excess of the transmitting capacity of the matrix pores. Also, flow times and retardation processes (including matrix diffusion) along at least five kilometers of saturated zone flow paths (minimum distance to accessible environment boundary placed five kilometers from the edge of the waste emplacement area) would provide an additional barrier to waste releases. This barrier would not effectively discriminate among the alternative shaft locations. Therefore, for the purposes of this comparative evaluation of locations, the thickness of the large-conductivity units is used as the most reliable discriminating surrogate for retardation capacity, groundwater travel time, and, therefore, waste isolation.

On the basis of the preceding discussion, seven surrogates for isolation potential were identified: (1) thickness of large-conductivity unsaturated units beneath the repository; (2) thickness of total unsaturated rocks beneath the repository; (3) location of faults and whether the shaft locations are more than or less than 100 feet from the faults; (4) topography, and whether the shaft locations occur in flood prone drainage channels, on ridge crests, or along the intervening slopes; (5) the distance downdip from a reference line (the Solitario Canyon Fault); (6) thickness of unsaturated zeolite-dominated units beneath the repository; and (7) thickness of rocks above the repository (overburden). The values of each of these surrogate characteristics at the five alternative shaft locations will be compared in the following paragraphs. The interested reader is referred to Appendix J, which includes maps that show the values for these surrogate characteristics throughout the entire repository area and which provides more detailed discussions of the surrogates and their comparisons.

Thickness of large-conductivity units: The discussion above indicates that the greater the thickness of large-conductivity units, the greater is the isolation potential of an ESF location. This statement is particularly valid for models or scenarios that include potential for flow in fractures, where flux is large relative to the conductivity of the small-conductivity units. The thickness of the large-conductivity units increases along a line extending approximately from the northeast corner of the site to the southwest corner (see Figures 3 through 6, Appendix J); therefore, on this basis, the isolation potential increases from location 1 (highest isolation potential) to location 2 to location 5 to location 3 to location 4 (lowest isolation potential).

Thickness of unsaturated zone: The total thickness of unsaturated rocks beneath the current design elevations of the floors of the repository drifts probably is a surrogate for postclosure performance, if groundwater flow is generally restricted, as expected, to the matrix pores of both small- and large-conductivity units, or if flow alternates between matrix pores and fractures in small-conductivity units. Total thickness increases from northeast to southwest (see Figure 7, Appendix J); therefore, on this basis, the performance potential increases from the northeast to southwest portion of the repository site. This surrogate also correlates with isolation potential under scenarios that may cause the water table to rise, by providing a measure of the distance it must rise to saturate emplaced waste. The relative ranking of the five alternative shaft locations from high to low isolation potential (large to small unsaturated thickness) is: location 2, location 1, location 5, location 4, location 3; though locations 3, 4, and 5 are all within about 10% of the same thickness. This pattern is similar to that established above for thickness of large-conductivity units as a surrogate for performance under fracture-dominated flow models or scenarios, and reflects a general trend of increasing performance potential toward the southwest.

Fault locations: Consideration in this report of fault locations as a surrogate for performance essentially adopts the use of the same characteristic by Bertram (1984). The map in Bertram (1984) showing the locations of faults is considered appropriate to use as a basis for identifying the more likely areas where flux concentrations due to lateral diversion may drain vertically to the water table. However, in this report, only the map of 100-foot setbacks is used, and the area of consideration is extended south of the limit used by Bertram (1984). Using this criterion, all five shaft locations are more than 100 feet from the nearest faults and this factor is nondiscriminating (see Figure 8, Appendix J).

Topography: Topography may influence infiltration patterns at Yucca Mountain. These, in turn, may influence the spatial distribution of flux at the repository depths and below along flow paths toward the water table and, therefore, toward the accessible environment. According to one conceptual model, significant concentrations of infiltration are more likely to occur in drainage channels, along ridge crests, and in localized depressions. If this model is correct, the relative performance potential of the five shaft locations may be classified in terms of this surrogate characteristic as follows: locations 3, 4, and 5 along the lower reaches of drainage channels (relatively low isolation potential); locations 1 and 2 along Yucca Crest (relatively high isolation potential) (see Figure 9, Appendix J).

Downdip distance: The greater the distance downdip, the greater is the potential for build-up or concentration of flux that would be available for vertical percolation. If faults serve as conduits to drain the laterally diverted flux, then the areas downdip from, but adjacent to, the faults may have the lowest flux values. It is assumed for this comparison that the potential for higher, perhaps localized, flux through and below the repository level generally increases eastward, downdip from the Solitario Canyon Fault (see Figure 10, Appendix J). Performance potential is therefore assumed to decrease toward the east. The increase in distance downdip and the corresponding decrease in performance potential ranges in order from location 2 (updip, higher performance potential) to locations 1, 5, 4, and 3 (downdip, lower performance potential).

Thickness of zeolites: Zeolites may provide greater retardation of radionuclide transport than nonzeolitic units. Therefore, performance potential probably correlates with the thickness of the zeolitic units and accordingly is relatively constant across the site with respect to this surrogate (see Figure 11, Appendix J). The performance potential of the five locations range slightly from higher to lower (for this surrogate) as follows: locations 5, 4, 3, 2, and 1, though thicknesses of locations 5, 4, 3, and 2 are all within 10%.

Thickness of overburden: Thickness of overburden serves as a surrogate for performance under scenarios of increased infiltration and associated flux due to climatic change. The thicker the overburden, the longer the time for any increased flux to percolate down to the repository level, where it may contact and corrode waste canisters, eventually breaching them and leading to a release of radionuclides. Therefore, areas of thicker overburden have a better potential for waste isolation under increased-flux scenarios. The five locations range from higher to lower performance potential with respect to this surrogate as follows: location 1, location 5, location 4, location 3, and location 2, though overburden thicknesses at locations 4, 3, and 2 are all within 10% (see Figure 12, Appendix J).

Each of the seven surrogates discussed above are used to rank the alternative shaft locations with respect to their potential for waste isolation (Table 3-1). The rankings represent the relative influence of each of several multiple natural barriers that occur at the locations.

These relative differences should be considered from the perspective of regulatory requirements before conclusions are reached about the most desirable location for the shaft facilities. Criteria for selecting and locating an ESF depend on considerations in addition to relative differences among alternative locations. Such considerations include estimates of the relative contribution of each location to the performance of the overall site and engineered barriers. These contributions should be considered in terms of

Table 3. Relative ranking of each alternative shaft location with respect to surrogate site characteristics for postclosure performance

SURROGATES	Location 1		Location 2		Location 3		Location 4		Location 5	
	Value	Rank[a]	Value	Rank	Value	Rank	Value	Rank	Value	Rank
Thickness of large-conductivity units (ft)	395	1	205	2	81	4	12	5	91	3
Thickness of unsaturated zone below repository (ft)	948	1	688	3[b]	719	3[b]	727	3[b]	792	2
Location of faults[c]	Zone 1	1	Zone 1	1	Zone 1	1	Zone 1	1	Zone 1	1
Topography[d]	Zone 2	2	Zone 2	2	Zone 1	3	Zone 1	3	Zone 1	3
Distance downdip[e] (ft)	5814	2	4904	1	9736	4[b]	9312	4[b]	6835	3
Thickness of zeolites (ft)	332	2	374	1[b]	380	1[b]	382	1[b]	392	1[b]
Thickness of overburden (ft)	948	1	688	3[b]	719	3[b]	727	3[b]	792	2

[a]Lower rank values correspond to greater isolation potential, higher rank values to lesser isolation potential.
[b]Insufficient differences for discrimination; value at a site less than 10% above lowest value in a group of same ranking.
[c]Two zones possible: Zone 1, greater than 100 feet; Zone 2, less than 100 feet.
[d]Three zones possible: Zone 1 - drainage channels; Zone 2 - ridge crests; Zone 3 - steep slopes.
[e]Distance from Solitario Canyon fault to location along contact at base of TSw3.

regulatory requirements and in terms of the uncertainties associated with both the relative differences among the locations and overall estimates of system performance. Judgments of whether any relative differences among locations are significant with respect to waste isolation depend on the collective evaluation of many interacting factors, including those noted above. Relative differences among locations (whether perceived to be large or small) are likely to be insignificant if the overall system performance, including the contributions of the shaft locations, is perceived to be substantially below regulatory requirements.

The differences identified in this chapter for expected conditions are judged to be insignificant for this reason (i.e., because in general each location is expected to meet the regulatory requirements, probably by a wide margin). Differences among the alternative shaft locations might be significant if future data show that widespread large-flux conditions exist at the repository site (currently considered unlikely) or could result from future disruptions of current conditions. Significant differences also might exist if current or future concentrations of large amounts of local flux are caused by subsurface lateral diversion or surface infiltration pulses. In either of these cases, locations toward the northeast would be more likely to have groundwater flow times to the water table less than the period of regulatory concern (10,000 yr) in the local zones of flux concentration; though other natural barriers, including geochemical retardation, flow times in the saturated zone, and longer flow times outside the zones of flux concentrations, would probably combine to provide adequate waste isolation capabilities for the overall site. Thus, if wasteisolation capability had been an explicit criterion for the selection of an ESF location, the criterion would not have discriminated among the five locations in Bertram (1984), because no significant differences in alternative locations exist for the expected low flux conditions. However, for plausible widespread or local large-flux conditions, the differences among the locations might have strengthened the scientific basis for selecting the current location. The reasons for this are discussed in Section 3.4.

In summary, surrogates for performance were developed to evaluate the relative differences among alternative ESF locations. Evaluation of these factors suggests that, although differences probably do exist, the ESF locations do not differ significantly in their ability to meet regulatory requirements under nominal expected conditions. Two relative differences were noted among the locations: (1) the groundwater flow times through the unsaturated rock formations below the Coyote Wash location are probably shorter than the corresponding times at the other locations; and (2) if lateral diversion or infiltration through washes causes the unsaturatedzone groundwater flux to be different at different parts of the repository site, this flux may be larger at the current location (location 4), location 3, and location 5 than at locations 1 and 2 because of the higher likelihood of local zones of fracture flow at the three former locations. Neither of these two differences is expected to have a significant effect on the ability of the site to isolate waste.

3.2 PART II - ELEMENT 2: ASSESSMENT OF SIGNIFICANT DIFFERENCES IN WASTE ISOLATION POTENTIAL OF ALTERNATIVE EXPLORATORY SHAFT LOCATIONS, ASSUMING AN EXPLORATORY SHAFT IS PRESENT

In addition to comparing the waste-isolation capabilities of the five locations for an ESF, the effects that an ESF would have at those locations were also examined; this examination was done in compliance with the preapplication-review requirements of 10 CFR Part 60, paragraphs 60.15(d)(1) and 60.17(a)(2)(iii and iv). In reporting the assessment performed as element 2 of the comparative evaluation, this section reviews the available information on these effects and suggests how such information might have affected the selection if it had been an explicit part of the selection process. The available information is reviewed extensively in SCP, Section 8.4.3. This report is drawn from that review.

Section 8.4.3.2 of the SCP summarizes the technical analyses and data that support the evaluation of these effects. These analyses deal with potential changes to three general sets of properties of the site: hydrologic conditions, geochemical conditions, and the thermal and mechanical properties of the rock. Hydrologic conditions are considered to be especially significant. Therefore, for this report, independent reviews were made of the conclusions drawn in SCP Section 8.4.3 regarding the hydrologic effects of an ESF; the reviews included detailed examinations of analyses performed by Fernandez et al. (1988) and West (1988), upon which many of the conclusions are based (see Appendix K1 through K4). Various technical points were raised by the reviewers, but on the basis of these reviews, the analyses and conclusions regarding the hydrologic effects of an exploratory shaft generally are considered valid and appropriate. As explained in SCP Section 8.4.3, the remaining uncertainties about these effects can be compensated for by design controls.

Analyses of changes to hydrologic conditions caused by site characterization activities (including construction of an ESF) are particularly useful in estimating the three most important potential hydrologic effects: changes in the amount or distribution of ground water flux, changes in the distribution of hydrologic properties, and the associated creation of preferential pathways. Such changes might adversely affect the waste isolation capability of the site if they were widespread or substantial. The summarized analyses suggest that water moving downward from site characterization activities at the ground surface would not appreciably affect saturation levels in the underlying rock at depths greater than about 10 meters below the surface. Water introduced directly to the underground rock will also have little effect; the resulting changes to matrix saturation are expected to be small and limited to the short distances that appreciable amounts of water are expected to travel from the shafts. The studies of fluid movement and of vapor movement suggest that the shafts themselves will not become preferential pathways for the movement of liquid water, water vapor, or air.

Analyses of potential changes to geochemical conditions suggest that none of the materials to be introduced by shaft construction will affect existing chemical conditions, except in the small volumes of rock near the points of introduction.

Analyses of changes in thermal and mechanical properties deal with potential alterations to the rock around the shaft, around the excavations that will be part of the ESF, and near the main pad at the surface. The analyses estimate the changes in rock-mass permeability that would result from excavation of the shaft (including the effects of removing the liner), construction of drifts in the ESF, thermal effects from emplaced waste, and the blasting to be conducted in preparing the main pad. These analyses suggest that the thermal and mechanical effects of the ESF will be confined to the rock near the excavations.

In summary, the effects that would be most important to waste isolation are the three hydrologic effects listed above. None of these effects is expected to cause anything but localized effects on the site. Minor changes in flux could be expected, but only in small zones near the places where water is introduced; less none of these changes is expected to affect more than small volumes of rock. Furthermore, the volumes in which the limited changes might occur are separated from the areas in which waste may eventually be emplaced, and none of the penetrations into the rock is expected to become a preferential pathway for the movement of fluids and vapors.

To determine whether these limited effects would be significant to the waste isolation capability of a repository associated with an ESF, Section 8.4.3.3.1 of the SCP examines the effects under three types of scenarios: (1) the future conditions at the site remain as they are now, (2) expected changes occur, and (3) unlikely disruptive changes occur. The three discussions conclude that the presence of the effects induced by site characterization probably will not significantly affect the ability of the site to meet the regulations governing waste isolation.

The evaluation of waste isolation pays particular attention to the scenario class that includes surface flooding. An analysis directed toward this hypothetical sequence of events assumes that the probable maximum flood occurs in the floor of the wash in which the ESF is located. The probable maximum flood would not fill the wash to a level that would allow water to flow directly into the shaft, even when the level is raised by debris in the flood waters. The analysis therefore assumes that water from the flood enters the backfilled, unlined ESF through fractures in the rock below the flood water. To be conservative, the analysis also assumes that the shaft itself is not sealed, although the shaft design calls for seals that would impede the movement of water through the shaft. Under these conservative assumptions, the amount of water that might enter through fractures assumed to intersect the shaft is shown in the analysis to be well within the drainage capability of the ESF, and, because of the distance between the shaft and emplaced waste, would not contribute to a breach of waste isolation.

In general, the results summarized above are equally applicable to each of the five alternative locations in Bertram (1984). The types of rock that appear at each location are essentially the same; although the thicknesses vary somewhat among the locations, the results of the analyses are not sensitive to variations in thickness within the range that occurs among the locations. Similarly, conclusions drawn from the geochemical, thermal, and mechanical analyses do not depend sensitively on the differences that exist among the rock formations at the five locations.

Because the analyses can be assumed to apply equally well to all five locations, the conclusions about the effects of construction, operations, and testing in the ESF apply to all five locations. Another conclusion that applies to all five locations is that the long-term effects of the shafts probably will not affect the waste isolation capability of the site. Among the estimates of the effects on waste isolation, the analysis of the flooding event probably is the one that is the most dependent on characteristics of the individual locations. The available analyses suggest, however, that little would be gained by using one of the other locations, because no significant effects on waste isolation are to be expected from flooding, even at the current location.

The overall conclusion is that the shafts at any of the five locations are not expected to affect significantly the waste isolation capability of a repository associated with the shafts.

3.3 PART II - ELEMENT 3: ASSESSMENT OF ALTERNATIVE EXPLORATORY SHAFT LOCATIONS COMPARED TO ISOLATION POTENTIAL FOR THE OVERALL SITE SHAFT LOCATIONS

This section reviews the assessment carried out for element 3 of the comparative evaluation. The qualitative criteria established for using each of the surrogates discussed in Section 3.1 are used to compare potential performance across the entire Yucca Mountain site. This section evaluates the trends of the relative range of potential performance across the entire Yucca Mountain site.

The trends of improving performance that are indicated for the five alternative locations considered by Bertram (1984) (see Section 3.1) appear to continue to the southwest. This suggests that locations with the best performance potential occur in the southwestern corner of the repository area, where the unsaturated zone beneath the repository is thickest and characterized by thick large-conductivity, nonwelded or partially welded, nonzeolitic tuffs. Similarly, locations with the least performance potential probably occur toward the northeast, where densely welded and zeolitic, small-conductivity units dominate the unsaturated stratigraphic section beneath the repository. This general northeast-to-southwest trend of improving performance caused by hydrostatigraphic geometry may be accentuated by structural and topographic patterns that could increase the likelihood of vertical drainage of downdip lateral diversion and infiltration pulses due to storm runoff, respectively. These conditions, in turn, could result in greater likelihood of local concentrations of flux and associated zones of shorter flow times toward the northeast.

The five alternative locations considered by Bertram (1984) therefore encompass a limited range of the potential performance differences across the entire Yucca Mountain site. The lower end of the range is well represented by three of the alternative locations, locations 3, 4, and 5, and particularly by location 4 (the current location), but the upper portion of the total range is only represented by location 1, which is just far enough to the south to begin to represent the upper range of site performance. The full range of site performance probably would have been encompassed by alternative shaft locations if Bertram (1984) had not excluded areas south of a line 4,000 feet north of USW H-3. This area to the southwest is where the most favorable site characteristics probably occur.

The results of this evaluation of performance trends across the site should not be interpreted in terms of the potential for the overall Yucca Mountain repository system to meet regulatory requirements. This comparison is intended only to establish any likely trends in isolation potential. It does not estimate the potential for any of the locations or, particularly, the site as a whole to meet regulatory requirements. Although the analyses indicate that differences probably exist among the locations, these differences are significant only under unlikely scenarios or alternative hydrologic models that describe local concentrations of flux. In general, this comparison indicates that the locations on the ridge crest to the west, and especially the southwest, tend to have characteristics that are more favorable for isolation than locations in the washes to the east and northeast. This general northeast-to-southwest trend of improving performance is due mainly to hydrostratigraphic patterns, but it may be accentuated by structural and topographic patterns that could increase the likelihood of vertical drainage of downdip lateral diversion and infiltration pulses, respectively.

3.4 CONCLUSIONS FROM COMPARATIVE EVALUATION OF ALTERNATIVE EXPLORATORY SHAFT LOCATIONS

Comparative evaluations of alternative shaft locations were made to address the NRC's concern regarding whether the ESF Title I Design is consistent with applicable 10 CFR Part 60 requirements for waste isolation. The analyses are summarized in Sections 3.1 through 3.3 of this chapter; they are reported in detail in Appendix J.

Sections 3.1 and 3.3 discuss relative differences among the five alternative shaft locations considered in the location selection process reported by Bertram (1984). The manner in which these relative differences should be used to identify the preferred locations for the shaft depends on several factors, including the following:

- The degree to which the locations compare to the overall regulatory requirements for the site.
- The magnitude of the relative differences in performance influencing characteristics.
- The site processes and conditions that are most critical with respect to the regulatory requirements.
- The likelihood for occurrence of such conditions or processes at alternative locations .
- The ability to characterize these conditions from the shaft facilities.

- o Whether construction or operation of the shaft facilities could cause an otherwise acceptable site to fail to meet the regulatory requirements.

Judgments of whether any relative differences among locations are significant with respect to waste isolation depend on the collective evaluation of all these generalized decision factors. Any conclusions reached in this comparative evaluation should be considered in the perspective of the regulatory requirements. The primary regulatory requirements associated with the comparative evaluation are the broad postclosure performance objectives of 10 CFR Part 60, Subpart E (60.112 and 60.113), and the site characterization requirements of 10 CFR 60, Subpart B (60.15(d)(1) and 60.17(a)(2)(iii)).

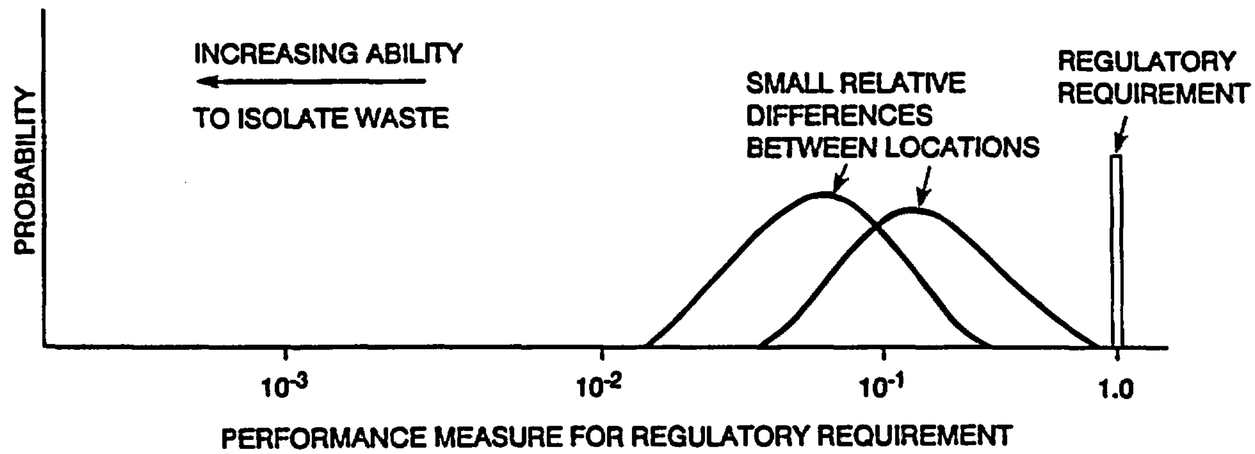
The importance of the generalized decision factors is illustrated in Figure 3-1 by two examples. The figure uses a probability distribution function for a generalized performance measure as an estimate of the ability of two hypothetical locations to isolate waste; it also shows a hypothetical regulatory requirement stated in terms of a value for the performance measure. In one example (Case A), only small differences exist in the estimates of the relative abilities of the alternative locations to isolate wastes, and the absolute estimates are near the regulatory requirements. In the other example (Case B), large differences exist in the relative estimates, but the absolute estimates are far below the regulatory requirements. In both examples, the absolute estimates meet the regulatory requirements.

In Case A, uncertainties in the release estimates are extremely important and the relative differences, though small, may be significant, because both estimates are near the value set by the regulatory requirement. However, the small relative differences must be compared with the estimated uncertainties expressed by the width of the distribution curves shown in Figure 3-1; the overall uncertainty estimates may overwhelm any relative differences. In this example, the location that is less favorable for obtaining the site data that would more conservatively quantify the uncertainties may not be a suitable candidate for an ESF. In the extreme case, that location might not be suitable as part of a repository, if site characterization could cause a small change in the distribution curve that would result in a violation of the requirement. Thus, Case A is an example where relatively small differences may be significant.

In Case B, uncertainties in the release estimates are not significant (in terms of location selection) unless they are extremely large, and the relative differences are not likely to be significant. For this example, both locations are likely to be suitable candidates for an ESF. Thus, Case B is an example where relatively large differences in the ability to isolate waste are likely to be not significant for selecting a location for an ESF.

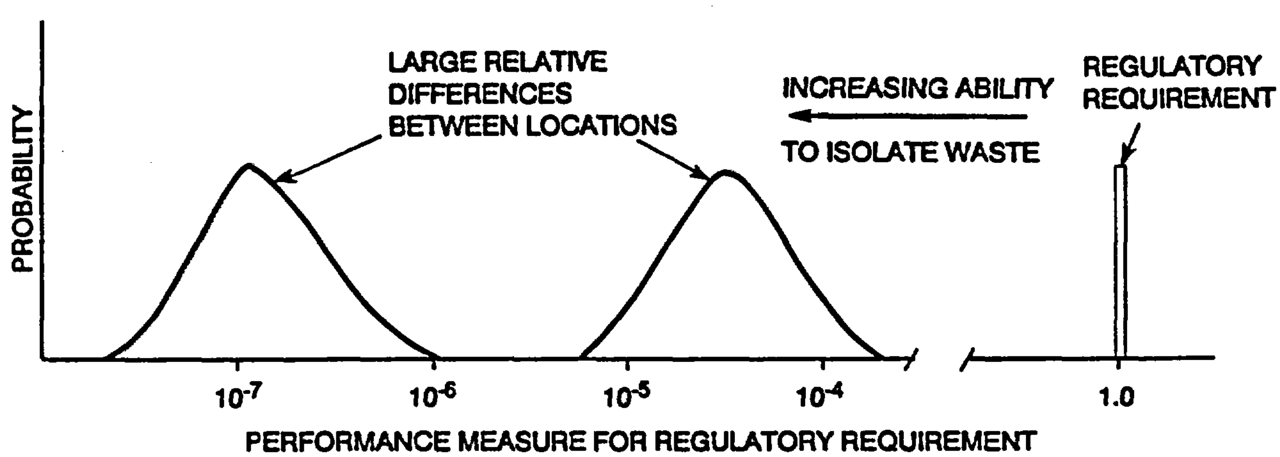
These two examples demonstrate that judgments on alternative locations are dependent on more than the relative differences between locations. In fact, for Case B in Figure 3-1, the less favorable location may be the better location for an ESF, because that location would permit the obtaining of site data that would more conservatively quantify the uncertainties associated with the regulatory requirement.

CASE A



In Case A, uncertainties in release estimates are critical, and the relative differences in alternative locations may be significant, possibly even for small uncertainties. (It is necessary to compare uncertainties to the relative estimates; i.e., the uncertainties may overwhelm the small relative differences.)

CASE B



In Case B, uncertainties in release estimates are not important unless they are extremely large, and the relative differences in alternative locations are not likely to be significant.

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Figure 3-1. Examples of differences in alternative shaft locations and their significance in terms of regulatory requirements.

The evaluation reported in this chapter suggests that the differences among the five alternative shaft locations for expected small-flux conditions are similar to those in Case B of Figure 3-1, except that the identified differences are not necessarily "large." The relative differences identified in this evaluation may be considered relatively or absolutely either small or large, depending on (1) the proper hydrologic model that characterizes the current flow system in the unsaturated zone, and (2) the likelihood of various disruptive scenarios that might locally or pervasively increase flux through the repository level and below. Under current assumptions about expected nominal conditions and models, the differences among the locations, though clearly distinguishable on the basis of current data, are insignificant because absolute performance at all locations probably would greatly exceed regulatory requirements. No evidence exists to indicate that conditions at any of the shaft locations would cause the repository to fail to meet regulatory requirements. The current evidence is not, however, sufficiently reliable to definitively rule out the possibility that conditions, models, or scenarios could lead to increased concentrations of flux and rapid flow through fractures from the repository level to the water table. These conditions, though not considered likely enough or pervasive enough to result in a finding of unsuitability for the Yucca Mountain site, are most likely to occur, if they occur at all, in the region targeted for exploration by the currently designed ESF. Placing the ESF there is prudent because it allows the site characterization program to obtain the data that might be the most negative for site performance.

One of the purposes of this evaluation was to determine the effect that a waste isolation criterion would have had on the selection of an ESF location if it had been part of the original selection process. The evaluation suggests that such a criterion would probably have had little, if any, effect on the final choice. The effect that it would have had depends on how it would have been stated. If it had been stated so as to favor the selection of locations that are likely to meet the waste isolation regulations, it would not have discriminated effectively among the five locations, given that the surrogate characteristics are favorable at all the locations. Such a nondiscriminating statement would have left the selection to the criteria used in Bertram (1984), and the current location would have been selected.

A more useful statement of the criterion would have been a statement that explicitly favored the selection of locations where data could be obtained to address the uncertainties associated with the less favorable site characteristics. As explained in Chapter 1 of Appendix J, some of the criteria actually used in the selection implicitly favored such locations. In principle, an explicit statement of this kind would be useful because such locations are the most worthy of detailed study. As explained above, studies there are prudent because they help to establish lower bounds on the waste isolation capability of the rest of the site, increasing confidence that the rest of the site, where waste would actually be emplaced, would meet the regulatory requirements. This second possible statement of the criterion would have tended to favor the current location. Added to the other criteria used in Bertram (1984), it, like the first statement, would have led to a selection of the current location.

Section 3.2 reviews the analyses that examine the effects of a shaft on the waste isolation capability of a repository associated with the shaft.

These analyses suggest that a shaft is expected to have no significant effects on waste isolation, regardless of its location within the site proposed for development at Yucca Mountain. A selection criterion based on such effects would not have discriminated among the five alternative shaft locations. Therefore, if such a criterion had been among those used in selecting the final location, it would not have affected the choice of the currently proposed location.

The examination described in this report leads to a conclusion that selection criteria explicitly based on waste isolation capability would not have changed the location currently proposed for the exploratory shafts at Yucca Mountain.

The overall conclusions and recommendations based on the comparative evaluation are the following:

1. Differences among the alternative shaft locations for currently expected conditions are not significant to waste isolation. This is because all the locations are expected to have conditions that would allow regulatory requirements to be met by wide margins.

2. Differences among the alternative shaft locations might be significant if future data show that widespread large-flux conditions exist at the repository site (currently considered unlikely) or could result from future disruptions of current conditions. Significant differences might also exist if current or future local concentrations of large flux are caused by subsurface lateral diversion or spatially variable pulses of surface infiltration. In either of these cases, locations toward the northeast would be more likely to have groundwater flow times to the water table less than the period of regulatory concern (10,000 yr) in the local zones of flux concentration. Under these conditions, evaluations of other natural barriers, including geochemical retardation, flow times in the saturated zone, and longer flow times outside the zones of flux concentrations, may be necessary to demonstrate adequate waste isolation capabilities for the overall site.

3. The presence of a shaft at any of the locations is not expected to significantly affect the waste isolation capability of a repository.

4. The current shaft location is the preferred location for characterization. Although the relative differences discussed in conclusions 1 and 2 are judged not significant to the waste isolation capabilities of the overall site, they suggest that the characteristics of the current location may be less favorable than the characteristics of the other locations. Therefore, the current location is the most suitable for a conservative approach to collecting data to reduce uncertainties associated with the models, assumptions, and processes that affect predictions of waste isolation.

5. The addition of a waste isolation criterion to the set of criteria used in selecting a shaft location would not have changed the selection of the current location, but might have strengthened the scientific basis for choosing it, on the basis of conclusion 4.

6. The DOE should continue to support the current ESF location as the preferred location for the site characterization program, on the basis of conclusions 1 through 5.

Concurrence:

Scott Sinnock 2/1/89

S. Sinnock, SNL Date

Felton W. Bingham 2/1/89

F. Bingham, SNL Date

Jeffrey Kimball 2/1/89

J. Kimball, DOE/HQ Date

Scott G. Van Camp 2/1/89

S. Van Camp, Weston Date

William E. Wilson 2-1-89

W. Wilson, USGS Date

REFERENCES

Bertram, S.G., 1984. "NNWSI Exploratory Shaft Site and Construction Method Recommendation Report," SAND84-1003, Sandia National Laboratories, Albuquerque, New Mexico.

Case, J.B. and P.C. Kelsall, 1987. "Modification of Rock Mass Permeability in the Zone Surrounding a Shaft in Fractured, Welded Tuff," SAND86-7001, Sandia National Laboratories, Albuquerque, New Mexico.

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West, K.A., 1988. "Exploratory Shaft Facility Fluids and Materials Evaluation," LA-11398-MS, Los Alamos National Laboratory, Los Alamos, New Mexico.

APPENDIX A

QMP-02-08, Rev. 0

Title	No. QMP-02-08 Rev. 0
TECHNICAL ASSESSMENT REVIEW	Effective Date 08-Aug-1988
	Page 1 of 12

1.0 PURPOSE AND SCOPE

This procedure defines the method to be used and responsibilities for performing Technical Assessment Reviews for the Nevada Nuclear Waste Storage Investigations (NNWSI) Project. The requirements of this procedure may be supplemented with further documented guidance that defines the logistics and methodologies to be used in a review.

2.0 APPLICABILITY

This procedure applies to Technical Assessment Reviews conducted by the Waste Management Project Office (WMPO) for the NNWSI Project. A Technical Assessment Review is one of a set of review methods defined for the NNWSI Project in Section 4.2.5 of the Systems Engineering Management Plan (SEMP). This procedure can be used in meeting the requirements for technical reviews defined in the SEMP and in U.S. Department of Energy (DOE) Order 4700.1, Attachment III-1, Page III-47, Section 2.

3.0 DEFINITIONS

3.1 TECHNICAL ASSESSMENT REVIEW

The Technical Assessment Review is a documented evaluation of technical status, technical progress, or technical merit, in combination or separately. It is performed by qualified individuals other than those who performed the technical work being reviewed, but who may be from the same organization. Technical Assessment Review is a management method that may be used to accomplish such items as the following:

1. Assessing requirements.
2. Determining the degree to which technical work meets requirements.
3. Identifying technical issues in a timely fashion, including interfaces with site and design efforts.
4. Assessing the technical status or technical progress of activities.
5. Providing a basis to accept technical services rendered.

APPROVED BY

Project Manager, T&MSS	WMPO Project Quality Manager	WMPO Project Manager
[signature]	Wendell B. Mansel for J. Blaylock	[signature] for
Date 3 August 1988	Date 08/03/88	Date 8/4/88

6. Defining and directing necessary changes in accordance with WMPO procedures.

3.2 TECHNICAL ASSESSMENT REVIEW NOTICE

The Technical Assessment Review Notice (Figure 1) is issued by the responsible WMPO Branch Chief, or designee, announcing the Technical Assessment Review. The notice provides the following:

1. Technical Assessment Review scope and purpose, identifying areas and items to be assessed, including an indication of the required depth. This may be accomplished in a variety of ways, including the use of questionnaires, checklists, a list of design requirements, or through other suitable means.

2. Date, time, location, and other logistical information for the Technical Assessment Review meeting.

3. Name of the Technical Assessment Review Team Chairperson.

3.3 TECHNICAL ASSESSMENT REVIEW TEAM SELECTION RECORD

3.3.1 The Technical Assessment Review Team Selection Record (Figure 2) is completed, signed, and dated by the Technical Assessment Review Team Chairperson. It identifies the functions involved in the review, and the names of qualified individuals selected to be on the Technical Assessment Review Team. The review team members are assigned the responsibility for reviewing and providing comments, as applicable, for those functions. The review team members must be other than those who performed the technical work, but they may be from the same organization.

3.3.2 The Technical Assessment Review Team Selection Record includes the documentation of the qualifications of the review team members assigned for the various review functions.

3.4 TECHNICAL ASSESSMENT REVIEW PACKAGE

The Technical Assessment Review Package is a collection of documents (e.g., reports, schedules, plans, and drawings) that provides the information to be assessed by the review team members to achieve the established scope and purpose.

3.5 REVIEW RECORD MEMORANDUM

The Review Record Memorandum is a documented summary of the Technical Assessment Review prepared by the Secretary, which includes the following:

1. Scope of the review.
2. Technical Assessment Review Notice.
3. Technical Assessment Review Meeting minutes.
4. Technical Assessment Review Team Selection Record.
5. Technical Assessment Review Comment Records identifying comments and resolutions.
6. List of meeting attendees and, when specified, their Technical Assessment Review responsibilities.
7. Correspondence relating to the Technical Assessment Review.
8. Information presented during the Technical Assessment Review meeting and other information provided to the review team members that was not contained in the original Technical Assessment Review Package or in subsequent additions or modifications to the package.
9. Conclusions and recommendations.

3.6 TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

The Technical Assessment Review Comment Record is a form used to document Technical Assessment Review comments and their resolution (Figures 3 and 4).

3.7 TECHNICAL ASSESSMENT REVIEW DATA PACKAGE

The Technical Assessment Review Package is a set of Quality Assurance (QA) records consisting of the Technical Assessment Review Package and the Review Record Memorandum, including any supplements as described in Section 5.5.6.

4.0 RESPONSIBILITIES

4.1 RESPONSIBLE WMPO BRANCH CHIEF OR DESIGNEE

4.1.1 The responsible WMPO Branch Chief or designee shall plan, schedule, and announce the Technical Assessment Review, designate the Technical Assessment Review Chairperson, and distribute the Review Record Memorandum.

4.1.2 If the responsible WMPO Branch Chief determines that a Project Participant is to be the designee, the responsible WMPO Branch Chief shall document that decision and the designated organization shall prepare and issue the Technical Assessment Review Notice.

4.2 TECHNICAL ASSESSMENT REVIEW CHAIRPERSON

The Technical Assessment Review Chairperson is responsible for the following:

1. Designating the Secretary for the Technical Assessment Review.

2. Determining the technical disciplines to be used to accomplish the scope and purpose of the review.

3. Establishing minimum qualifications (e.g., education, experience, and independence) needed by review team members to fulfill technical disciplines to accomplish the scope and purpose of the review.

4. Obtaining suitable documentation of review team members' qualifications for the various technical disciplines.

5. Ensuring that the documentation of the review team members' qualifications meets the needs of the review.

6. Determining the number of reviewers for the Technical Assessment Review Team.

7. Obtaining information for the review from the appropriate Technical Project Officer (TPO) and others, as appropriate.

8. Coordinating the Technical Assessment Review Team, the meeting, and the review process.

9. Issuing the Review Record Memorandum to the responsible WMPO Branch Chief for distribution.

10. Compiling a data package of the Technical Assessment Review.

4.3 SECRETARY

The Secretary documents the Technical Assessment Review Team activities. Specifically, the Secretary records the meeting minutes, collects comments and resolutions, and prepares the Review Record Memorandum (per Section 3.5).

4.4 TECHNICAL ASSESSMENT REVIEW TEAM MEMBERS

It is the responsibility of the review team members to review and provide comments in their technical area, as designated by the Chairperson, and to participate in the evaluation of proposed resolutions.

5.0 PROCEDURE

5.1 INITIATION OF THE TECHNICAL ASSESSMENT REVIEW

The responsible WMPO Branch Chief or designee plans, scopes, and schedules the Technical Assessment Review and designates the Technical Assessment Review Chairperson. The responsible WMPO Branch Chief or designee also issues the Technical Assessment Review Notice to Quality Assurance, Regulatory Compliance, and others, as appropriate.

5.2 TEAM SELECTION

5.2.1 The Technical Assessment Review Chairperson performs the following:

1. Designating the Secretary for the Technical Assessment Review.

2. Determining the technical disciplines to be used to accomplish the scope and purpose of the review.

3. Establishing minimum qualifications (e.g., education, experience, and independence) needed by review team members to fulfill the technical disciplines to accomplish the scope and purpose of the review.

4. Obtaining suitable documentation of review team members' qualifications for the various technical disciplines, as described in Section 5.2.2

5. Ensuring that the documentation of the review team members' qualifications meets the needs of the review, and signing and dating the Technical Assessment Review Team Selection Record(s).

6. Determining the number of reviewers for the Technical Assessment Review Team.

7. Ensuring that assigned Review Team Members are trained to this procedure and other applicable documents.

5.2.2 The Technical Assessment Review Chairperson requests the following information for each of the review team members: name of the person and a statement that the review team member meets the education, experience, and independence qualifications established for the review. This information is to be provided by the employer of the review team member.

5.2.3 If a review team member's employer is an agency outside of the NNWSI Project, the chairperson is responsible for notifying the agency that the documentation verifying the education, experience, and independence of the review team member must be obtained and retained by that agency. This documentation shall be made available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the DOE. In addition, the agency shall be required to notify the WMPO prior to destruction of this verification documentation.

5.3 TECHNICAL ASSESSMENT REVIEW PACKAGE

The Technical Assessment Review Chairperson obtains the information for the review from the appropriate TPO and others, as appropriate.

5.4 TECHNICAL ASSESSMENT REVIEW

5.4.1 The review team members review the material and document their comments on Technical Assessment Review Comment Records. If a review team member has no comment, this is documented on a Technical Assessment Review Comment Record.

5.4.2 The Secretary records meeting minutes, collects comments and resolutions, and prepares the Review Record Memorandum (per Section 3.5). The Technical Assessment Review Chairperson reviews, signs, and dates the Review Record Memorandum.

5.5 RESOLUTION OF TECHNICAL ASSESSMENT REVIEW COMMENTS

5.5.1 The Technical Assessment Review Chairperson obtains resolutions for the Technical Assessment Review comments from the appropriate TPO.

5.5.2 The Technical Assessment Review Chairperson coordinates the team's evaluation of the resolutions obtained in Section 5.5.1. After deciding the appropriateness of the resolutions, such acknowledgment is documented to the appropriate TPO.

5.5.3 Any unresolved comments are referred by the Chairperson to the appropriate TPO for resolution. (The appropriate TPO is the one who has responsibility for the subject of the unresolved comment.)

5.5.4 The Chairperson, upon submittal of a review comment resolution by the appropriate TPO, shall ensure that the resolution is provided to the review team member and the responsible WMPO Branch Chief.

5.5.5 The review team member who had the unresolved comment shall evaluate the provided comment resolution, and either:

1. Sign and date the review comment resolution (according to the Chairperson's instruction) to indicate agreement, and return it to the Chairperson.

2. If a disagreement exists, attempt to achieve an agreement, (via the Chairperson) with the appropriate TPO. If agreement cannot be reached, provide the documented basis for the disagreement to the Chairperson and request assistance from successively higher levels of management.

5.5.6 The Chairperson may complete the Review Record Memorandum with a documented unresolved comment; however, supplements must be provided to the memorandum as the appeals process is pursued, such that a complete record of the comment is retained as a QA record.

5.6 REVIEW RECORD MEMORANDUM

The Technical Assessment Review Chairperson issues the Review Record Memorandum to the responsible WMPO Branch Chief for distribution to the TPO(s) and others, as appropriate.

5.7 CLOSURE OF RESOLUTION

The responsible WMPO Branch Chief or designee shall ensure that the appropriate TPO satisfies and closes out the commitments made in resolutions to the Technical Assessment Review comments.

5.8 TECHNICAL ASSESSMENT REVIEW DOCUMENTATION

The Technical Assessment Review Chairperson shall (1) compile a data package relative to the Technical Assessment Review that consists of the Technical Assessment Review Package and the Review Record Memorandum (including any supplements as described in Section 5.5.6) and (2) provide for disposition of the data package in accordance with Section 8.0.

6.0 REFERENCES

The latest revisions of the following apply:

NNWSI/88-3, NNWSI Project Systems Engineering Management Plan

DOE Order 4700.1, Project Management System

QMP-17-01, QA Records

7.0 FIGURES

At a minimum, the information needs on the forms shown on the following figures shall be satisfied. This may be accomplished by the use of the form itself or a suitable alternate.

Figure 1, Technical Assessment Review Notice

Figure 2, Technical Assessment Review Team Selection Record

Figure 3, Technical Assessment Review Comment Record

Figure 4, Technical Assessment Review Comment Record Continuation Sheet

8.0 QA RECORDS

The following are QA records and are maintained in accordance with QMP-17-01, QA Records.

1. Technical Assessment Review Package.
2. Review Record Memorandum (including any supplements as described in Section 5.5.6).

TECHNICAL ASSESSMENT REVIEW NOTICE N-QA-010 7/88

To ______________________ Date ____________

Technical Area to be Reviewed ______________________

____

WBS No.: ______________________

Review Date ____________ Location ____________ Time ____________

Technical Assessment Review Chairperson ______________________

Based on review of the qualification documentation, this Technical Assessment Review Chairperson is qualified to execute the responsibilities of QMP-02-08 with respect to the scope and purpose of this Review.

Scope of Technical Assessment Review:

Purpose of Technical Assessment Review:

Signed ______________________

Attachments:

Figure 1. Technical Assessment Review Notice.

TECHNICAL ASSESSMENT REVIEW TEAM SELECTION RECORD N-QA-008 7/88

Technical Assessment Review Subject ______________________

FUNCTION	REPRESENTATIVE
Secretary	

Based on review of the qualification documentation, these representatives cover the functions for this Review and are acceptable as team members to accomplish the scope and purpose of this review.

Signed ______________________

Attachment:

Qualification Documentation

Figure 2. Technical Assessment Review Team Selection Record.

Title	
TECHNICAL ASSESSMENT REVIEW	No. QMP-02-08 Rev. 0 Effective Date 08-Aug-1988 Page 11 of 12

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

N-QA-006
7/88

Technical Assessment Review Subject ______________ Sheet ____ of ____

Reviewer ______________ Organization ______________ Date ______

Comments Resolved By ______________ Organization ______________ Date ______

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Reference Dcmt. No.	Comments	Accept	Reject	Reason	Accept	Reject

Figure 3. Technical Assessment Review Comment Record.

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD CONTINUATION SHEET

N-QA-006
7/88

Technical Assessment Review Subject ____________

Sheet _____ of _____

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Reference Doc't. No.	Comments	Accept	Reject	Reason	Accept	Reject

Figure 4. Technical Assessment Review Comment Record Continuation Sheet.

APPENDIX B

TAR Notice and Plan

APPENDIX B-1

TAR Notice

Department of Energy
Nevada Operations Office
P. O. Box 98518
Las Vegas, NV 89193-8518

WBS # 1.2.6
"QA"

NN1.881212.0075

DEC 12 1988

Carl P. Gertz, Project Manager, YMP, NV

ANNOUNCEMENT OF ACTIONS UNDERWAY BY THE YUCCA MOUNTAIN PROJECT OFFICE (PROJECT OFFICE) IN RESPONSE TO U.S. NUCLEAR REGULATORY COMMISSION (NRC) CONCERNS REGARDING DESIGN CONTROL ISSUES RELATED TO THE EXPLORATORY SHAFT FACILITY (ESF) TITLE I DESIGN (NN1-1989-0633)

References: (1) Letter, Gertz to Distribution, dtd. 10/26/88
(2) Letter, Gertz to Kale, dtd. 12/08/88

At the direction of the Office of Civilian Radioactive Waste Management in response to NRC concerns regarding design control issues related to the ESF, it is urgent that the Project Office begin at once to conduct a Technical Assessment Review of the acceptability of the Title I ESF design control process. The enclosure describes the purpose and scope of the Technical Assessment Review, which will be conducted in accordance with Quality Management Procedure (QMP)-02-08. This transmittal satisfies the requirements of Section 3.2, QMP-02-08, the Technical Assessment Review Notice. This action should be viewed as one component of the the pre-Title II design activities discussed in the letter referenced above.

The Technical Assessment Review will be initiated as soon as possible, and will be completed within 30-45 days after start of the review. Upon completion of the Technical Assessment Review, a management review will be conducted by the Project Office. The management review will include a review of the work performed in preparing the plans, documents, procedures, qualification records for individuals, and the Technical Assessment Review Record memorandum. The management review will ensure that plans are developed to make appropriate modifications to the Title II design process and/or the site testing program as a result of the Technical Assessment Review, if necessary.

The description of the purpose of the Technical Assessment Review, provided in the enclosure, includes a list of the responsible individuals, dates, location, scope of work, instructions to reviewers, reviewer's qualifications, and other pertinent information. You are requested to make arrangements for the staff named in the enclosure to participate in the Technical Assessment Review. As the Yucca Mountain Project designee, Science Applications International Corporation (SAIC) is to conduct the Technical Assessment Review in accordance with this announcement. There will be a kick-off and Quality Assurance training meeting for all members of the Technical Assessment Review Team at the SAIC offices in Las Vegas, Nevada, on December 12-13, 1988, in Room 637, starting at 8:30 a.m. We expect that this task will require a dedicated and heroic effort on the part of all Technical Assessment Review Team members. Current plans are for the entire team to work for 11 straight days through the weekend of December 17-18, 1988, and break for Christmas holidays on the afternoon of December 22, 1988. This schedule should be considered when making travel arrangements.

I have asked that Robert A. Levich, Chief of the Technical Analysis Branch, take the lead in getting this task accomplished. If you have any questions about the details in this letter, please contact him at (702) 794-7946 or FTS 544-7939, or Jerry L. King, of SAIC at (702) 794-7648 or FTS 544-7948.

Robert W Barton
for Maxwell B. Blanchard, Director
Regulatory & Site Evaluation Division
Yucca Mountain Project Office

YMP:RAL-1023

Enclosure:
Technical Assessment Review Plan

cc w/encl:
S. H. Kale, HQ (RW-20) FORS
Ralph Stein, HQ (RW-30) FORS
Lake Barrett, HQ (RW-3) FORS
Ram Lahoti, HQ (RW-223) FORS
S. J. Brocoum, HQ (RW-221) FORS
Jeffrey Kimball, HQ (RW-221) FORS
David Siefken, Weston, Washington, D.C.
M. D. Voegele, SAIC, Las Vegas, NV
S. H. Klein, SAIC, Las Vegas, NV
J. E. Shaler, SAIC, Las Vegas, NV
J. L. Younker, SAIC, Las Vegas, NV
J. L. King, SAIC, Las Vegas, NV
G. K. Beall, SAIC, Las Vegas, NV
M. A. Glora, SAIC, Las Vegas, NV
D. B. Jorgenson, SAIC, Las Vegas, NV
Scott Sinnock, SNL, 6315, Albuquerque, NV
J. E. Stiegler, SNL, 6310, Albuquerque, NV
F. W. Bingham, SNL, 6312, Albuquerque, NM
J. R. Tillerson, SNL, 6314, Albuquerque, NM
R. B. Raup, USGS, Denver, CO
W. E. Wilson, USGS, Denver, CO
William Langer, USGS, Denver, CO
E. L. Wilmot, YMP, NV
L. P. Skousen, YMP, NV
W. R. Dixon, YMP, NV
James Blaylock, YMP, NV
U. S. Clanton, YMP, NV
D. C. Dobson, YMP, NV
W. A. Girdley, YMP, NV
E. H. Petrie, YMP, NV
J. K. Robson, YMP, NV
N. A. Voltura, YMP, NV

TECHNICAL ASSESSMENT REVIEW NOTICE

N-QA-010
7/88

To Distribution Date December 12, 1988

Technical Area to be Reviewed ESF 100% Title I Design

WBS No.: 1.2.6.1.1

Review Date 12/13/88-1/20/89 Location Las Vegas, NV Time

Technical Assessment Review Chairperson Jerry L. King

Based on review of the qualification documentation, this Technical Assessment Review Chairperson is qualified to execute the responsibilities of QMP-02-08 with respect to the scope and purpose of this Review.

Scope of Technical Assessment Review:

Per attached Technical Assessment Review Plan

Purpose of Technical Assessment Review:

Per attached Technical Assessment Review Plan

Signed [signature]
For Maxwell B. Blanchard

Attachments:

Technical Assessment Review Plan

Resume of Jerry King, T. A. R. Chairperson

"ENCLOSURE"

NN1.881212.0077

TECHNICAL ASSESSMENT REVIEW PLAN

EXPLORATORY SHAFT FACILITY (ESF) TITLE-I-DESIGN ACCEPTABILITY ANALYSIS & COMPARATIVE EVALUATION OF ALTERNATIVE ESF LOCATIONS

DECEMBER, 1988/JANUARY 1989

YUCCA MOUNTAIN PROJECT OFFICE
U. S. DEPARTMENT OF ENERGY
LAS VEGAS, NEVADA

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

1.0 PREFACE

1.1 Introduction

In recent interactions with the U. S. Nuclear Regulatory Commission (NRC), the U. S. Department of Energy (DOE) has been asked to furnish information on the Title I design of the Exploratory Shaft Facility (ESF) and the technical requirements of 10 CFR Part 60. Appendix I is a November 14, 1988 letter from the NRC (John J. Linehan, Acting Director of Repository Licensing Project Directorate) to the DOE (Ralph Stein, Acting Associate Director, Office of Systems Integration and Regulations) explaining NRC concerns related to the design control process that was used for the Title I ESF design. To respond to the NRC's concerns, the DOE decided to conduct an independent, internal design acceptability analysis of the ESF Title I design with respect to applicable 10 CFR Part 60 requirements. This analysis is to meet the applicable requirements of the YMP Quality Assurance Plan NV/88-9.

1.2 Quality Management Procedure

This design acceptability analysis is being conducted under Quality Management Procedure (QMP) 02-08, entitled Technical Assessment Review (TAR). QMP 02-08 satisfies the requirements of the Quality Assurance Plan NV/88-9, Section III (Scientific Investigation and Design Control), Paragraph 5.0, (Technical Reviews), and the definitions in Appendix A for verification and technical review.

1.3 Responsible Project Office Designee

By inclusion of this Plan with the Technical Assessment Review Notice, the Yucca Mountain Project Office designates Science Applications International Corporation (SAIC) as the Project participating organization which is responsible for planning, organizing, conducting, documenting, and coordinating the TAR.

2.0 PURPOSE & SCOPE OF THE TECHNICAL ASSESSMENT REVIEW

The TAR will comprise a comparative evaluation of alternative ESF locations, as well as an acceptability analysis of the ESF Title I design. The description below is organized in two parts: Part I addresses all elements of the Title I ESF design acceptability analysis, and Part II focuses on the comparison of alternative locations for the ESF. The TAR will develop review conclusions and recommendations for corrective actions, if it is determined that such actions are necessary as a result of the review.

2.1 Purpose of Technical Assessment Review

The objective of the design acceptability analysis (Part I of the TAR) is to evaluate major elements of ESF Title I design against three general objectives in 10 CFR Part 60: (1) the long-term waste isolation capability of the site will not be compromised; (2) the ability to characterize the site will not be compromised; and (3) the ESF site-characterization activities will provide representative data. The acceptability analysis will address the appropriateness of the data used in the design and how the uncertainties were considered. For any area of the design that is found to be unacceptable, impacts on the overall design will be identified, and recommendations for corrective actions will be developed. The design acceptability analysis is intended to satisfy the objectives of Steps 1, 2, and 5 of Attachment 2 of the 14 November 1988 letter from the NRC to the DOE (Appendix I).

The comparative evaluation of exploratory shaft locations (Part II of the TAR) is intended to identify any significant differences, for alternative locations which were considered, in their ability to isolate or contain wastes, with and without an ESF present, and what influence, if any, these differences might have had on the selection of the preferred shaft location had they had been a consideration in the location-selection process (see Appendix I, NRC letter, Attachment 3). The evaluation will also compare the waste-isolation potential of alternative ESF locations to the waste-isolation potential of the overall site.

2.2 Technical Assessment Review Package & Resource Documents

The Technical Assessment Review Package is a collection of documents that provides the information to be reviewed by the TAR team members to assess the adequacy of the ESF Title I design. Documents in the TAR Package will include but not be limited to: the Generic Requirements Document/Appendix E; the ESF-SDRD, Volumes I and II; the Reference Information Base (RIB); the ESF Design Scope and Planning Document for Title I Design, prepared by Fenix & Scisson; the ESF Title I Scope and Planning Basis Document, prepared by Holmes & Narver; the Homes & Narver ESF Title I Design Basis Document; the Fenix & Scisson ESF Title I Design Basis Document; and the Nuclear Waste Repository in Tuff Subsurface Facility Conceptual Design ESF/Repository Interface Control Drawing Number R07048A, Sheets, 1-15, prepared by Sandia National Laboratories (SNL).

Other documents, such as the draft 10 CFR 60 flowdown report (see section 2.4.1) and section 8.4 of the Site Characterization Plan (SCP), are considered to be resource documents which the TAR team may use without review to support the design acceptability analysis, although identification of deficiencies in resource documents is not precluded. The TAR Secretary will document which resource documents are used, and how they are used, during the course of the review. This documentation and copies of the resource documents will be included in the Review Record Memorandum (see section 4.0).

2.3 Documentation of Conclusions and Recommendations

Conclusions and recommendations for corrective actions resulting from the TAR will be included in the Review Record Memorandum, as described in Section 4.0.

2.4 Scope of Part I of TAR—Design Acceptability Analysis

2.4.1 TAR Part I - Element 1: Assessment of 10 CFR Part 60 Requirements in the Yucca Mountain Project Subsystem Design Requirements Document

The objective of this element is to assess the completeness of coverage of functional requirements listed in the Subsystem Design Requirements Document (SDRD) that are related to the NRC's principal concerns that: (1) the isolation capability of the site will not be compromised, (2) the ability to characterize the site will not be compromised, and (3) ESF site-characterization activities will provide representative data. These concerns are hereinafter referred to simply as NRC concerns 1, 2, and 3.

This assessment will utilize the draft products of an analysis of the flowdown of 10 CFR Part 60 requirements into the Generic Requirements Document, Appendix E. This analysis is being conducted by DOE/HQ under DOE/HQ Quality Implementing Procedure (QIP) 3.2 for technical reviews and is nearly complete. The TAR Team will include a principal author of the 10 CFR 60 flowdown analysis who will apprise the TAR Team of any substantive changes to the draft products of the Part 60 flowdown analysis.

The draft 10 CFR 60 flowdown report identifies the 10 CFR 60 requirements which are applicable to the ESF. The TAR team will use the draft report and ancillary documents as resource documents (see section 2.2) to aid in the identification of those functional requirements which are relevant to the three general concerns described above. The TAR team will then evaluate which of these requirements are and are not reflected in the SDRD.

2.4.2 <u>TAR Part I - Element 2: Evaluation of Performance/Design Criteria in Current Title I ESF Design Requirements</u>

The objective of Element 2 is identify performance/design criteria and constraints, relevant to NRC concerns 1, 2, and 3, which are and are not included in current Title I ESF Design Requirements. This will be accomplished by, first, identifying the ESF design features and interfaces which are relevant to the three NRC concerns. Design features and interfaces to be reviewed are those which are either defined or impacted by siting of the ESF, repository design, ESF testing, surface-based testing, or ESF and repository performance assessments. The TAR team will then review the SDRD and other design documentation to identify existing design/performance criteria and constraints which pertain to the relevant subset of design features and interfaces. Finally, the TAR team will assess the adequacy of these criteria and constraints with respect to NRC concerns 1, 2, and 3 and will identify any additional criteria and constraints which are needed.

2.4.3 <u>TAR Part I - Element 3: Assessment of Adequacy of the Current ESF Title I Design Against Design/Performance Criteria</u>

For Element 3, the TAR team will review the 100 % Title I ESF design to determine if the requirements, criteria, constraints, and interfaces identified in Elements 1 and 2 as being material to NRC concerns 1, 2, and 3 are adequately reflected in the design or in existing assessments of ESF design adequacy. The TAR team will determine whether relevant criteria have been addressed and, if so, the adequacy of the treatment.

2.4.4 <u>TAR Part I - Element 4: Assessment of Appropriateness of Data Used in ESF Title I Design and How Data Uncertainties were Considered</u>

Element 4 of Part I of the TAR will focus on the parameters and data used in ESF Title I design and performance analyses which are related to NRC concerns 1, 2, and 3. The TAR team will evaluate the adequacy of the relevant analyses and calculations, including the appropriateness of the data or values used in those calculations. The appropriateness and reasonableness of data and parameters will be reviewed with respect to data and parameters included in the Reference Information Base (RIB) and in other sources as appropriate. The TAR team will also review how data uncertainties were considered in relevant analyses and calculations and will assess the adequacy of such considerations with regard to the three NRC concerns.

2.4.5 Technical Assessment Review Part I - Element 5: Assessment of Impacts on Design and Recommendations for Corrective Measures

Element 5 of the design acceptability analysis includes the development of a summary of any deficiencies identified in ESF 100% Title I requirements, criteria, constraints, and interfaces; and deficiencies in supporting analyses and calculations, including deficiencies in data values, parameter values, and considerations of data uncertainty. The TAR team will develop recommendations for correcting the deficiencies and will identify, in particular, any deficiencies so significant as to bring into question the adequacy of the ESF Title I design.

2.5 Scope of Part II of Technical Assessment Review: Assessment of Alternative Locations for the Exploratory Shaft Facility

To further address the NRC's concerns regarding the degree to which the ESF Title I design meets applicable 10 CFR 60 requirements, the TAR team will perform a comparative evaluation of alternative ESF locations. The comparative evaluation is intended to identify any significant differences, for alternative locations which were specifically considered earlier, in their potential to isolate or contain wastes, with and without an ESF present, and what influence, if any, these differences might have had on the selection of the preferred shaft location had they had been an explicit consideration in the location-selection process (see Appendix I, NRC letter, Attachment 3). The evaluation will also compare the waste-isolation potential of alternative ESF locations to the waste-isolation potential of the overall site. The evaluation will consider current site conditions, expected changes in current conditions over the next 10,000 years, low-probability disruptive events and processes over the next 10,000 years, and alternative conceptual models of conditions at the site.

2.5.1 TAR Part II - Element 1: Assessment of Significant Differences in Waste-Isolation Potential of Alternative ESF Locations, Assuming No ESF Present

The TAR team will compile, for the five alternative ESF locations considered in the Bertram (1985) document, information which is germane to the potential of each site to isolate waste. This information will be evaluated to determine if significant differences exist between the alternative locations in their potential for providing waste isolation, assuming an ESF is not present. The influence any such differences might have had on selection of the ESF location will then be examined.

2.5.2 TAR Part II - Element 2: Assessment of Significant Differences in Waste-Isolation Potential of Alternative ESF Locations, Assuming ESF is Present

The TAR team will evaluate the five alternative ESF locations in Bertram (1985) for significant differences in their potential to isolate waste, assuming that an ESF has been constructed. Considering the information compiled under Part I, Element 1 for each alternative location, the TAR Team will examine potentially adverse effects that an exploratory shaft might have on the isolation capability of each location and the influence these effects might have had on the selection of the ESF location, had they been explicitly considered.

2.5.3 TAR Part II- Element 3: Assessment of Alternative ESF Locations Compared to Isolation Potential for the Overall Site

The five alternative ESF locations considered in the Bertram (1985) document will be compared with other possible ESF locations within the conceptual perimeter drift boundary of the repository with regard to factors contributing to waste isolation. Parameters such as ground-water travel time, thickness of the unsaturated zone below the repository horizon, thickness of the zeolite units beneath the repository horizon, and the presence of volcanic glass will be considered.

3.0 ORGANIZATION

3.1 Participating Organizations

Organizations participating in the Technical Assessment Review include:

- U. S. Department of Energy/Headquarters (DOE/HQ)
- U. S. Department of Energy/Nevada - Yucca Mountain Project Office (YMPO)
- Roy F. Weston, Inc.
- U. S. Geological Survey (USGS)
- Science Applications International Corporation (SAIC)
- Sandia National Laboratories (SNL)
- Pacific Northwest Laboratories (PNL)

Team members from other organizations may be added during the course of the review if deemed appropriate by the TAR chairperson.

3.2 Technical Assessment Review Committee

The Technical Assessment Review Committee (TARC) is responsible for administration of the TAR. The TARC will include a YMPO Branch Chief, who is responsible for ensuring that all actions taken by the TARC are in accord with YMPO policy. The TAR Chairperson is a member of the TARC and is responsible for coordinating all efforts of the TAR team. The TARC will also include the TAR Secretary, a Quality Assurance specialist, and one or two technical specialists, who will assist the Review Chairperson in conducting the TAR. The following individuals are designated as members of the TARC:

YMPO Branch Chief — Robert Levich
TAR Chairperson: Jerry King
TAR Secretary: Richard Lee
Quality Assurance Specialist: John Jardine (alternate: Keith Schwartztrauber)
Technical Specialist: Ernest Hardin

3.3 Technical Assessment Review Team Selection

The members of the TAR team must be qualified to perform the work required by the TAR and their qualifications must be documented. As set forth in QMP-02-08, the TAR Chairperson is responsible for determining what technical disciplines are needed for the review, establishing the minimum qualifications for team members, and obtaining documentation of these qualifications. Categories for team-member technical disciplines are identified in Table 1. The minimum qualification criteria listed in Table 1 will be used as guidelines by the TAR Chairperson for qualifying individual team members. The actual criteria used may differ somewhat from those listed and will be documented by the TAR Secretary.

Table 1. Categories of TAR team member technical disciplines, and criteria for qualification in each category.

Category	Minimum Criteria for Qualification
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering (or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 3 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.

The TAR Chairperson may add team members in technical disciplines other than those listed in Table 1, if necessary to achieve the scope and purpose of the review.

In addition to being technically qualified, TAR team members must be individuals other than those who performed the technical work being reviewed (QMP-02-08, section 3.1). This independence criterion is interpreted for this TAR to mean that TAR team members must not have been principal contributors to the ESF Title I design or the Subsystem Design Requirements Document which was used for ESF Title I design.

The employer of each member will provide the TAR Chairperson with the following information: name of the person and a statement that the review team member meets the education, experience, and independence qualifications established for that person's role in the TAR (QMP-02-08, section 5.2.2). If a review team member's employer is an agency outside of the Yucca Mountain project, the TAR Chairperson will notify the agency that the documentation verifying the education, experience, and independence of the review team member must be obtained and retained by that agency. This documentation shall be made available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the DOE. In addition, the agency shall be required to notify the YMPO prior to destruction of this verification documentation (QMP-02-08, section 5.2.3).

Documentation of qualifications will be attached to the Technical Assessment Review Team Selection Record (form No. N-QA-016), which is signed and dated by the TAR chairperson to certify that the review team members' qualifications, as described in the documentation provided by each member's employer, meets the needs of the review. The TAR Team Selection record becomes a part of the TAR Record Memorandum.

3.3 Location and Time of Technical Assessment Review

A schedule for the TAR is provided in Section 5.0. TAR team members will attend a workshop on December 12-13, 1988, in Room 637 at the SAIC offices in Las Vegas, NV, located at 101 Convention Center Drive. The workshop will convene at 8:30 a.m. The TAR will formally begin when the Technical Assessment Review Notice (form No. N-QA-010) has been signed by the YMPO Regulatory & Site Evaluation Division Director. It is likely that a number of working sessions will be scheduled in order to complete the TAR on the planned schedule. The TARC Chairman is responsible for determining the need for additional TAR team working sessions and scheduling rooms and logistical support.

4.0 TECHNICAL ASSESSMENT REVIEW PROCESS

4.1 Pre-Review

As noted above, the TAR begins when the responsible YMPO Division Director signs the TAR Notice. Individual TAR team members may start to participate when their technical and independence qualifications have been accepted by the TAR chairperson, as documented on the TAR Team Selection Record, and when they have completed training on QMP-02-08. Training on QMP-02-08 will be via the reading assignment method and will be documented by the TAR chairperson on form No. N-AD-077. The training documentation will be included in the Review Record Memorandum. All pre-review requirements will be completed during the time of the December 12-13 workshop.

4.2 Review Products & Need for an Interim Change Notice

The current version of QMP-02-08 calls for a comment resolution process in which TAR team members provide comments on forms, those forms are sent to the appropriate Technical Project Officer (TPO) for resolutions, which are then accepted or rejected by the TAR team member who provided the comment. In contrast, this TAR will not involve a comment-resolution process. Instead, the TAR will produce conclusions regarding the adequacy of the ESF Title I design and recommendations for actions to be taken to correct any significant deficiencies which are identified during the course of the review. To provide for this deviation from the process described in the current version of QMP-02-08, an Interim Change Notice will be developed and issued which modifies QMP-02-08 to provide the option of providing the type of product that is planned for this TAR. The Interim Change Notice must be in force before the TAR team begins to develop conclusions and recommendations but need not be in force before the TAR commences.

The TAR Secretary will develop the Interim Change Notice and ensure its timely implementation.

4.3 Review Record Memorandum

The TAR Secretary is responsible for compiling the Review Record Memorandum (RRM). The RRM shall include the following:

Scope of the Review
Technical Assessment Review Notice
Technical Assessment Review Meeting minutes
Technical Assessment Review Team Selection Record
Lists of meeting attendees and, when specified, their responsibilities
Correspondence relating to the TAR
Information presented during TAR meetings and other information provided to the review team members that was not contained in the original TAR Package or in subsequent additions or modifications to the package
Documentation of Design Acceptability Analyses
Documentation of ESF-location comparative evaluations
Conclusions regarding the adequacy of the ESF Title I design
Recommendations for corrective actions, if any

The TAR Chairman and the YMPO Branch Chief/TAR representative sign the RRM and issue it to the YMP Office.

The dates for issuance of draft and final RRMs are shown on the schedule in Section 5.0.

5.0 SCHEDULE

Activity/Deliverable	Date
Initial Workshop	December 12-13, 1988
TAR meetings & subcommittee meetings, as necessary	December 14-22, 1988 (no break over weekend)
Adjourn	December 22, 1988, p.m.
Homework	December 23, 1988-January 2, 1989
Re-convene (in Las Vegas)	January 3, 1989
Draft Review Record Memorandum	January 12, 1989
Final Review Record Memorandum	January 20, 1989

APPENDIX I

November 14, 1988, Letter from Linehan to Stein

(Note: Appendix I missing in original document)

JERRY L. KING

EDUCATION

Ph.D., Earth Sciences, Scripps Institution of Oceanography, University of California at San Diego (1981)
B.A., Physics: University of California at San Diego (1973)

WORK SUMMARY

Dr. King has a record of successfully resolving regulatory-technical issues in nuclear facility licensing. As a geophysicist with the U.S. Nuclear Regulatory Commission (NRC), Dr. King authored uncontested seismic safety evaluations for the Seabrook and V. C. Summer nuclear power stations. As a project manager with the Electric Power Research Institute, Dr. King managed key components of a research program to develop probabilistic seismic hazard estimates for nuclear plants in the central and eastern United States. This program successfully averted potentially precipitous NRC actions with respect to the seismic-design adequacy of all commercial nuclear power plants on the Eastern Seaboard. When Dr. King joined Science Applications International Corporation as a senior seismologist, the Yucca Mountain Project lacked a consensus approach to the characterization of tectonic processes and events that might affect the site during the preclosure period. Dr. King co-authored plans for site characterization which have been endorsed by all involved Project participating organizations.

PROFESSIONAL EXPERIENCE

Science Applications International Corporation (SAIC), 1986 to present:

Currently, Dr. King is Manager, Technical Issues Evaluation & Assessment Division (TIEAD), of the Yucca Mountain Project's Technical & Management Support Services (T&MSS) Contractor. As TIEAD Manager, Dr. King is responsible for providing technical support for the development of Project technical positions; analyses of existing and proposed regulatory requirements and guidance and development of licensing strategies; regulatory and public interactions; development of study plans and progress reports; review of technical documents; quality-assurance audits and surveillances; and total-system performance assessment. In particular, Dr. King recently coordinated a cost-benefit analysis of the seismic design basis of surface waste-handling facilities, an analysis and compilation of alternative conceptual models involved in the characterization of the Yucca Mountain site, and an overview description of the site program for the Site Characterization Plan.

Electric Power Research Institute, 1983 to 1986:

As a Project Manager in the Risk Assessment Program, Nuclear Power Division, Dr. King managed a number of research projects to compile a comprehensive

Verified for accuracy by:

Jerry L. King

Date: Oct. 25, 1988

seismological and geophysical database to support tectonic interpretations and assessments of seismic source zones in the central and eastern United States. These products were key components of a nuclear-industry initiative to develop a methodology for estimating probabilistic seismic hazards in this region. This initiative successfully averted potentially precipitous action by the NRC with respect to the seismic-design adequacy of all nuclear power plants on the Eastern Seaboard, which was occasioned by a change in the position of the U.S. Geological Survey regarding the uniqueness of the 1886 Charleston, South Carolina earthquake. Dr. King successfully managed a number of other research projects relating to the assessment of earthquake hazards and the development of seismic design bases. The annual budget of projects managed by Dr. King was approximately $1.7 million.

U.S. Nuclear Regulatory Commission, 1981 to 1983:

As a Geophysicist in the Geosciences Branch of the Office of Nuclear Reactor Regulation, Dr. King reviewed the adequacy of the Seabrook nuclear station's seismic design basis, authored the corresponding section of the staff's Safety Evaluation Report and provided expert testimony to the Advisory Committee on Reactor Safeguards (ACRS). He reviewed the adequacy of a program at the V. C. Summer nuclear power plant to demonstrate differences in earthquake ground motions between the free field and the foundations of nuclear structures. His safety evaluations for the Seabrook and V.C. Summer plants were both uncontested. Dr. King also authored a staff position paper and provided expert testimony to the ACRS on high-frequency soil-structure-interaction effects.

Scripps Institution of Oceanography, 1973-1981:

As a Research Assistant at UCSD's Scripps Institution of Oceanography, Dr. King measured and analyzed seismic site effects at several locations in the USSR, deployed and maintained an array of digital seismic event recorders in Afghanistan as part of an investigation of deep crustal structure, and demonstrated the utility of laboratory models for predicting seismic site effects. Dr. King's research results were published in five refereed-journal articles.

AWARDS, HONORS, PROFESSIONAL AFFILIATIONS, AND CERTIFICATIONS

Member, Earthquake Engineering Research Institute (EERI)
Member, EERI Committee on Younger Members
Member, Seismological Society of America
Member, American Geophysical Union.

ARTICLES, PRESENTATIONS, PUBLICATIONS, AND REPORTS

Modeling the seismic response of sedimentary basins (with J. Brune). Bull. Seism. Soc. Am., 71, 1469-1488, 1981.

Analysis of differential array data from El Centro, USA and Garm, USSR (with B. Tucker). Third Int. Conf. on Microzonation, Seattle, Washington, June

Verified for accuracy by:

Jerry L. King

Date: Oct. 25, 1988

28-July 1, 1982, pp. 611-622.

Estimates of Q in central Asia as a function of frequency and depth using the coda of locally recorded earthquakes (with S. Roecker, B. Tucker and D. Hatzfeld). Bull. Seism. Soc. Am., 72, 129-150, 1982.

Observations of hard-rock site effects (with B. Tucker, D. Hatzfeld and I. Nersesov). Bull. Seism. Soc. Am., 74, 126-13, 1984.

Observed variations of earthquake motion across a sediment-filled valley (with B. Tucker). Bull. Seism. Soc. Am., 74, 137-152, 1984.

Dependence of sediment-filled valley response on input amplitude and valley properties (with B. Tucker). Bull. Seism. Soc. Am., 74, 153-166, 1984.

Using national geophysical data sets to assess earthquake potential in the central and eastern United States (with J.C. Stepp). NOAA Conf. on Pathways and Future Directions for Environmental Data and Information Users, Denver, Colorado, August 19-22, 1984, pp. 319-330.

Interpretation of seismic source zones for seismic hazard calculations (with J.C. Stepp). Proceedings of 12th Water Reactor Safety Research Information Meeting, USNRC, NUREG/CP-0058, Vol. 5, January 1985, pp. 155-166.

Strong Ground Motion Simulation and Earthquake Engineering Applications (coeditor with R.E. Scholl). EERI Report No. 85-02 and EPRI Report No. NP-4299, November 1985.

Some comments on ground-motion aspects of the proposed revised Standard Review Plan. Proceedings of Brookhaven National Laboratory-USNRC Workshop on Soil-Structure Interaction, Bethesda, Maryland, June 16-18, 1986, NUREG/CP-0054, pp. 92-99.

Assessment of seismic hazards at Yucca Mountain (with G.A. Frazier and T.A. Grant). Trans. Am. Nuclear Soc. Annual Meeting, San Diego, California, June 12-16, 1988, pp. 219-220.

Verified for accuracy by:

Jerry L. King

Date: Oct. 25, 1988

APPENDIX B-2

TAR Plan

TECHNICAL ASSESSMENT REVIEW PLAN

EXPLORATORY SHAFT FACILITY (ESF) TITLE-I-DESIGN ACCEPTABILITY ANALYSIS & COMPARATIVE EVALUATION OF ALTERNATIVE ESF LOCATIONS

DECEMBER, 1988/FEBRUARY 1989

YUCCA MOUNTAIN PROJECT OFFICE
U. S. DEPARTMENT OF ENERGY
LAS VEGAS, NEVADA

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1.0 PREFACE

1.1 BACKGROUND

In recent interactions with the U. S. Nuclear Regulatory Commission (NRC), the U. S. Department of Energy (DOE) was asked to furnish information on the Title-I Design of the Exploratory Shaft Facility (ESF) and how it satisfies the technical requirements of 10 CFR Part 60. Appendix I is a November 14, 1988 letter from the NRC to the DOE that transmits minutes of a November 3, 1988 NRC-DOE meeting; these minutes explain the NRC's concerns related to the design control process that was used for the Title-I ESF design. To respond to the NRC's concerns, the DOE decided to conduct an independent, internal design acceptability analysis of the ESF Title-I Design with respect to applicable 10 CFR Part 60 requirements, and, in addition, a comparative evaluation of alternative exploratory shaft locations with respect to waste-isolation potential. Appendix II is a December 1, 1988 letter from the NRC to the DOE that transmits minutes of a November 23, 1988 NRC-DOE meeting on the ESF design acceptability analysis, and Appendix III is a December 15, 1988 letter that transmits minutes of a subsequent NRC-DOE meeting, on December 8, 1988.

A preliminary draft of this Plan was given to the NRC and the State of Nevada at the December 8, 1988 meeting. The NRC and the State both provided written comments on the preliminary draft Plan, which are included here in Appendix IV. Responses to these comments will be provided along with the final results of the review. The NRC and State comments were considered in developing the final Technical Assessment Review Plan.

1.2 QUALITY ASSURANCE

This analysis is to be conducted as a QA-Level-I activity and is to satisfy the requirements of the Yucca Mountain Project (YMP) Quality Assurance Plan (NNWSI/88-9). A Quality Assurance Level Assignment Sheet (QALAS) will be completed to document the assignment of the QA level, following QMP-02-06, Rev. 0. The design acceptability analysis will be conducted under Quality Management Procedure QMP-02-08, Rev. 0, entitled Technical Assessment Review (TAR).

1.3 ROLE OF THE TAR PLAN

The TAR Plan specifies the scope and purpose of the TAR. Flexibility in accomplishing the scope and purpose of the TAR Plan is intended, within the constraints imposed by the controlling procedure, QMP-02-08, Rev. 0. The TAR Chairperson may modify procedural guidance provided by the TAR Plan as circumstances warrant. Any differences between the review process actually followed and that suggested in the Plan will be documented in the Review Record Memorandum (RRM).

1.4 RESPONSIBLE PROJECT OFFICE DESIGNEE

Science Applications International Corporation (SAIC) is the Project participating organization that is responsible for planning, organizing, conducting, documenting, and coordinating the TAR.

2.0 PURPOSE & SCOPE OF THE TECHNICAL ASSESSMENT REVIEW

2.1 PURPOSE OF TECHNICAL ASSESSMENT REVIEW

Part I of the TAR will comprise an acceptability analysis of ESF Title-I Design with respect to applicable 10 CFR 60 requirements. Part II of the TAR will comprise a comparative evaluation of alternative exploratory shaft locations. The TAR will develop conclusions and, if found to be warranted, propose corrective measures.

The objective of the design acceptability analysis (Part I of the TAR) is to evaluate the acceptability of the ESF Title-I Design, considering the requirements of 10 CFR 60. The design acceptability analysis (DAA) will focus on three general objectives in 10 CFR Part 60, namely that: (1) the long-term waste-isolation capability of the site will not be compromised; (2) the ability to characterize the site will not be compromised; and (3) the ESF site-characterization activities will provide representative data. The acceptability analysis will address the appropriateness of the data used in the design and how uncertainties were considered. For any area of the design that is found to be deficient or incomplete, recommendations for corrective measures will be developed.

The DAA will qualitatively evaluate (i.e., without generating detailed design criteria) the acceptability of ESF Title-I Design with respect to those applicable requirements of 10 CFR 60 that are not related to the three general objectives cited above. (Detailed design criteria for all Part 60 requirements are being generated by DOE in another activity as a prerequisite to the start of Title-II Design.) In accord with the NRC-DOE agreement reached at the December 8, 1988 meeting (see Appendix III), this qualitative analysis will evaluate the impact on the Title-I Design of omitting detailed criteria development for an applicable requirement, and will provide a rationale describing why, if the impact was not significant, any design considerations can be delayed until Title-II Design.

The comparative evaluation of exploratory shaft locations (Part II of the TAR) is intended to identify any significant differences, for alternative locations which were considered earlier, in the ability of the location to isolate or contain waste, with and without an exploratory shaft present, and what influence, if any, these differences might have had on the selection of the preferred shaft location, had they had been a consideration in the location-selection process (see Appendix I, NRC letter, Attachment 3). The evaluation will also compare the waste-isolation potential of alternative exploratory shaft locations to the waste-isolation potential of the overall site.

2.2 TECHNICAL ASSESSMENT REVIEW PACKAGE & RESOURCE DOCUMENTS

The Technical Assessment Review Package is a collection of documents that provides the information to be reviewed by the TAR Team members to assess the adequacy of the ESF Title-I Design. Documents in the TAR Package will include but not be limited to: the Title-I ESF Design Report (4 volumes, including drawing package; the Nuclear Waste Repository in Tuff Subsurface Facility Conceptual Design ESF/Repository Interface Control Drawing Number R07048A, Sheets, 1-15, prepared by Sandia National Laboratories (SNL); and the (12/87) ESF Subsystem Design Requirements Document (SDRD), including approved Engineering Change Requests. The data appropriateness review will, as an intermediate step, identify those documents which present data or calculations that support the Title-I ESF Design. These documents (e.g., the Reference Information Base) will be added to the TAR Package and listed in the RRM. Documents to be assessed by the TAR Team may be added to the TAR Package during the course of the review. Any such documents will also be identified in the RRM.

Other documents, such as section 8.4 of the Site Characterization Plan (SCP) and the Technical Oversight Group report, "Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility," are considered to be "resource documents" which the TAR Team may use without review to support the design acceptability analysis, although identification of deficiencies in resource documents is not precluded. The RRM will document which resource documents are used, and how they are used, during the course of the review.

2.3 SCOPE OF PART I OF TAR--DESIGN ACCEPTABILITY ANALYSIS

2.3.1 Part I - Element 1: Assessment of coverage by Subsystem Design Requirements Document (SDRD) of the subset of 10 CFR 60 requirements related to waste isolation, ability to characterize the site, and data representativeness

The objective of this element is to assess the completeness of coverage of requirements listed in the Subsystem Design Requirements Document (SDRD) that are related to the NRC's principal concerns that: (1) the isolation capability of the site will not be compromised, (2) the ability to characterize the site will not be compromised, and (3) ESF site-characterization activities will provide representative data. These concerns are hereinafter referred to simply as NRC Concerns 1, 2, and 3.

This assessment will utilize a draft report by the Technical Oversight Group (TOG), "Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility," which documents an analysis of the flowdown of 10 CFR Part 60 requirements into Appendix E of the Generic Requirements Document. This analysis is being conducted by DOE/HQ under DOE/HQ Quality Implementing Procedure (QIP) 3.2 for technical reviews, is nearly complete, and will be finalized before the TAR closes. The TAR Team will include a principal author of the 10 CFR 60 flowdown analysis who will apprise the TAR Team of any substantive changes to the draft products of the

Part 60 flowdown analysis. The impact of any such changes on the conclusions and recommendations of the TAR will be evaluated before the TAR closes.

The TOG report identifies the 10 CFR 60 requirements that are applicable to the ESF. The TAR Team will use the TOG report as a resource document (see Section 2.2) to aid in the identification of those requirements which are relevant to the three general concerns described above. The TAR Team will then evaluate which of these requirements are and are not reflected in the SDRD.

2.3.2 Part I - Element 2: Identification of design interfaces and assessment of SDRD performance/design criteria for the subset of 10 CFR 60 requirements

The objective of Element 2 is identify performance/design criteria and constraints, relevant to NRC Concerns 1, 2, and 3, which are and are not included in current Title-I ESF Design requirements. This will be accomplished by, first, identifying the ESF design features and interfaces which are relevant to the three NRC concerns. Design features and interfaces to be reviewed are those which are either defined or impacted by siting of the ESF, repository design, ESF testing, surface-based testing, or ESF and repository performance assessments. The TAR team will then review the SDRD and other design documentation to identify existing design/performance criteria and constraints which pertain to the relevant subset of design features and interfaces. Finally, the TAR team will assess the adequacy of these criteria and constraints with respect to NRC Concerns 1, 2, and 3, and will generate any additional criteria and constraints that are needed.

2.3.3 Part I - Element 3: Assessment of adequacy of ESF Title-I Design against criteria developed for Design Acceptability Analysis

For Element 3, the TAR Team will review the Title-I ESF Design to determine if the requirements, criteria, constraints, and interfaces identified in Elements 1 and 2 as being material to NRC Concerns 1, 2, and 3 are adequately reflected in the design or in existing assessments of ESF design adequacy. The TAR Team will determine whether relevant criteria have been addressed and, if so, the adequacy of the treatment.

2.3.4 Part I - Element 4: Assessment of appropriateness of data used in ESF Title-I Design and how data uncertainties were considered

Element 4 of Part I of the TAR will focus on the parameters and data used in ESF Title-I Design and performance analyses that are related to NRC Concerns 1, 2, and 3. The TAR Team will evaluate the adequacy of the relevant analyses and calculations, including the appropriateness of the data or values used in those calculations. The appropriateness and reasonableness of data and parameters will be reviewed with respect to data and parameters included in the Reference Information Base (RIB) and in other sources as appropriate. The TAR Team will also review how data uncertainties were considered in relevant analyses and calculations and will assess the adequacy of such considerations with regard to the three NRC concerns.

2.3.5 Part I - Element 5: Summarization recommendations and proposed corrective measures

Element 5 of the design acceptability analysis includes the development of a summary of existing criteria, constraints, and interfaces that should be modified, and criteria, constraints and interfaces that should be added to the existing ones, to adequately address those applicable 10 CFR 60 requirements that are related to NRC Concerns 1, 2 and 3. Deficiencies identified in supporting analyses and calculations, and additional analyses and calculations that are needed, will also be summarized. In particular, the TAR Team will identify any deficiencies in criteria, constraints, interfaces, or supporting calculations and analyses that are so significant as to bring into question the adequacy of the ESF Title-I Design.

The TAR Team will develop recommendations for corrective measures and document them on Technical Assessment Review Comment Record forms, which will be forwarded to the appropriate Technical Project Officers (TPOs) for resolution.

2.3.6 Part I - Element 6: Qualitative assessment of impacts on design of other applicable 10 CFR 60 requirements

This element of the TAR is a qualitative assessment (i.e., without the generation of detailed design/performance criteria) of the potential impact on Title-I ESF Design of applicable 10 CFR 60 requirments that are not related to NRC Concerns 1, 2, or 3, and the development of a rationale for why the generation of, and evaluation of design against, detailed design/performance criteria can be deferred until Title II Design.

2.4 SCOPE OF PART II OF TECHNICAL ASSESSMENT REVIEW: ASSESSMENT OF ALTERNATIVE LOCATIONS FOR THE EXPLORATORY SHAFT FACILITY

To further address the NRC's concerns regarding the degree to which the ESF Title-I Design meets applicable 10 CFR 60 requirements, the TAR Team will perform a comparative evaluation of alternative exploratory-shaft locations. The comparative evaluation will attempt to identify significant differences in the waste-isolation potential, with and without a shaft present, of alternative shaft locations that were considered earlier and what influence, if any, these differences might have had on the selection of the preferred shaft location, had they had been an explicit consideration in the location-selection process (see Appendix I, NRC letter, Attachment 3). The evaluation will also compare the waste-isolation potential of alternative shaft locations to the waste-isolation potential of the overall site. The evaluation will consider current site conditions, expected changes in current conditions over the next 10,000 years, low-probability disruptive events and processes over the next 10,000 years, and alternative conceptual models of conditions at the site.

2.4.1 TAR Part II - Element 1: Assessment of significant differences in waste-isolation potential of alternative exploratory shaft locations, assuming no exploratory shaft is present

The TAR Team will compile, for the five alternative exploratory shaft locations considered in the Bertram (1984) document, information that is germane to the potential of each site to isolate waste. This information will be evaluated to determine if significant differences exist between the alternative locations in their potential for providing waste isolation, assuming an exploratory shaft is not present. The influence any such differences might have had on selection of the exploratory shaft locations will then be examined.

2.4.2 TAR Part II - Element 2: Assessment of significant differences in waste-isolation potential of alternative exploratory shaft locations, assuming exploratory shaft is present

The TAR Team will evaluate the five alternative exploratory shaft locations in Bertram (1984) for significant differences in their potential to isolate waste, assuming that an exploratory shaft has been constructed. Considering the information compiled under Part II, Element 1 for each alternative location, the TAR Team will examine potentially adverse effects that an exploratory shaft might have on the isolation capability of each location and the influence these effects might have had on the selection of the exploratory shaft locations, had they been explicitly considered.

2.4.3 TAR Part II - Element 3: Assessment of alternative exploratory shaft locations compared to isolation potential for the overall site

The five alternative exploratory shaft locations considered in the Bertram (1985) document will be compared with other possible exploratory shaft locations within the conceptual perimeter drift boundary of the repository with regard to factors contributing to waste isolation. Parameters such as the thickness of the unsaturated zone below the repository horizon, thickness of the zeolite units beneath the repository horizon, and the presence of volcanic glass will be considered.

3.0 ORGANIZATION

3.1 Participating Organizations

Organizations participating in the Technical Assessment Review include:

- U. S. Department of Energy/Headquarters (DOE/HQ)
- U. S. Department of Energy/Nevada - Yucca Mountain Project Office (YMPO)
- Roy F. Weston, Inc. (Weston)
- U. S. Geological Survey (USGS)
- Science Applications International Corporation (SAIC)
- Sandia National Laboratories (SNL)

- o Pacific Northwest Laboratories (PNL)
- o Los Alamos National Laboratory (LANL)
- o U. S. Bureau of Reclamation (Bureau of Rec)

Team members from other organizations may be added during the course of the review by the TAR chairperson. The final list of TAR Team members and their affiliations will be documented in the RRM.

3.2 TECHNICAL ASSESSMENT REVIEW COMMITTEE

The Technical Assessment Review Committee is responsible for administration of the TAR and comprises the TAR Chairperson, a YMPO Representative (Branch Chief), the TAR Secretary, a QA Specialist, and a Technical Specialist. The TAR Chairperson is responsible for coordinating all efforts of the TAR Team. The YMPO Representative is responsible for ensuring that all actions taken by the TAR Committee are in accord with YMPO policy. The TAR Secretary will document the activities of the TAR Team and will compile the TAR Review Record Memorandum. The QA Specialist will provide advice and counsel to the TAR Chairperson regarding the QA aspects of the TAR. The Technical Specialist will provide technical assistance to the Chairperson as needed. TAR Committee members may also participate as TAR reviewers if appropriately trained and qualified.

The following individuals are the designated members of the TAR Committee:

Chairperson:	Jerry L. King
YMPO Representative:	Robert A. Levich
Secretary:	Richard C. Lee
QA Specialist:	John Jardine (alternate: Keith Schwartztrauber)
Technical Specialist:	Ernest Hardin

3.3 TECHNICAL ASSESSMENT REVIEW TEAM SELECTION

Per QMP-02-08, Rev. 0, the TAR Chairperson is responsible for determining what technical disciplines are needed for the review, establishing the minimum qualifications for team members, and obtaining documentation of these qualifications.

Tentative categories for team-member technical disciplines and the corresponding minimum qualification criteria are identified in Table 1.1. The actual criteria used may differ somewhat from those listed and the TAR Chairperson may add team members in technical disciplines other than those listed in Table 1.1, if necessary to achieve the scope and purpose of the review. The qualfication criteria used and the technical disciplines of TAR Team members will be documented in the RRM.

In addition to being technically qualified, TAR Team members must be individuals other than those who performed the technical work being reviewed (QMP-02-08, Rev. 0, Section 3.1). This independence criterion is interpreted for this TAR to mean that TAR Team members must not have been principal

Table 1.1. Categories of TAR Team member technical disciplines, and criteria for qualification in each category.

Category	Minimum Criteria for Qualification
Mining Engineer	Registered Professional in mining engineering (or equivalent specialty); or advanced degree in mining engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Performance Assessment/ Evaluation Specialist	Advanced degree in a technical field (i.e., mathematics, science, or engineering), and 3 years experience applicable to reviewing evaluations of: impact of the ESF on isolation capability of the site, the effect of the ESF on the ability to characterize the site, and the extent to which data obtained in the ESF are representative of the site.
Geotechnical Engineer	Registered professional in geotechnical engineering.(or equivalent specialty); or advanced degree in civil, geological, or geotechnical engineering and 3 years experience applicable to the scope and purpose of this TAR; or an engineering degree and 7 years applicable experience.
Geologist, Geochemist, Geophysicist, or Hydrologist/ Hydrogeologist	Each of these categories requires seven years experience in the particular technical area (i.e., geology, geochemistry, geophysics, or hydrology/hydrogeology) applicable to the scope and purpose of this TAR; or an advanced degree in the particular technical area and 2 years applicable experience.
Regulatory Specialist	Close working knowledge of regulations applicable to ESF design, especially 10 CFR Parts 60 and 960, and 40 CFR Part 191; also, 3 years experience in the application of such regulations in activities supporting the DOE geologic repository program.

contributors to the ESF Title-I Design or the Subsystem Design Requirements Document which was used for ESF Title-I Design. Documentation of TAR-Team-member independence will be provided in the RRM.

The employer of each TAR Team member will provide the TAR Chairperson with the following information: name of the person and a statement that the review team member meets the education, experience, and independence qualifications established for that person's role in the TAR (QMP-02-08, Section 5.2.2). If a review team member's employer is an agency outside of the Yucca Mountain project, the TAR Chairperson will notify the agency that the documentation verifying the education, experience, and independence of the review team member must be obtained and retained by that agency. This documentation shall be made available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the DOE. In addition, the agency shall be required to notify the YMPO prior to destruction of this verification documentation (QMP-02-08, Section 5.2.3).

Documentation of qualifications will be attached to the Technical Assessment Review Team Selection Record (form No. N-QA-016), which is signed and dated by the TAR chairperson to certify that the review team members' qualifications, as described in the documentation provided by each member's employer, meets the needs of the review. The TAR Team Selection record becomes a part of the TAR Review Record Memorandum.

4.0 TECHNICAL ASSESSMENT REVIEW PROCESS

4.1 LOCATION AND TIME OF TECHNICAL ASSESSMENT REVIEW

A tentative schedule for the TAR is provided in Section 5.0. TAR Team members will attend a workshop on December 12-13, 1988, in Room 637 at the SAIC offices in Las Vegas, NV, located at 101 Convention Center Drive. The workshop will convene at 8:30 a.m. It is likely that a number of working sessions will be scheduled in order to complete the TAR on the planned schedule. The TAR Committee Chairperson is responsible for determining the need for additional TAR Team working sessions and scheduling rooms and logistical support.

4.2 INITIATION OF REVIEW

The TAR will begin when the Technical Assessment Review Notice (form No. N-QA-010) has been signed by the YMPO Regulatory & Site Evaluation Division Director. Individual TAR Team members may start to review materials in the TAR Package when their technical and independence qualifications have been accepted by the TAR Chairperson and documented on the TAR Team Selection Record, and when they have completed training on QMP-02-08. Training on QMP-02-08 will be via the reading assignment method and will be documented by the TAR Chairperson on an appropriate form, to be included in the Review Record Memorandum.

4.3 REVIEW PROCEDURES

Detailed procedures for conducting the review and for developing conclusions and recommendations, within the constraints imposed by QMP-02-08, Rev. 0, will be developed by the TAR Chairperson or his designee(s). The review process followed will be detailed in the Review Record Memorandum.

4.4 DOCUMENTATION OF CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations for corrective measures resulting from the TAR will be documented on Form N-QA-006, Technical Assessment Review Comment Record. These forms will be forwarded to the Yucca Mountain Project Office (YMPO) or directly to the appropriate Technical Project Officer (TPO) for resolution of the comments, per Section 5.5 of QMP-02-08, Rev. 0.

4.5 REVIEW RECORD MEMORANDUM

The TAR Secretary is responsible for compiling the Review Record Memorandum (RRM). The RRM shall include, but not be limited to, the following items:

- Quality Assurance Level Assignment Sheet (QALAS)
- Description of purpose and scope of the TAR
- TAR Notice
- TAR Plan
- TAR Team Selection Record
- Documentation of training on QMP-02-08 and other training conducted
- Meeting minutes, with lists of attendees and, when specified, their TAR responsibilities
- Information presented during TAR meetings and other information provided to the review team members that was not contained in the original TAR Package or in subsequent additions or modifications to the package
- Documentation of the design acceptability analyses
- Documentation of comparative evaluation of exploratory shaft locations
- Description of differences, if any, between the TAR Plan and actual conduct of the TAR
- Conclusions regarding the adequacy of the ESF Title-I Design
- Recommendations for corrective measures, if any
- TAR Comment Records identify comments and resolutions
- Correspondence relating to the TAR
- Standard Deficiency Reports (SDRs) and Observations, if any

The TAR Chairman, TAR Secreatry and the YMPO Representative will sign the RRM and issue it to the responsible YMPO Division Director.

5.0 SCHEDULE

Tentative dates for TAR activities and deliverables are as follows:

Activity/Deliverable	Date
Initial Workshop	December 12-13, 1988
TAR meetings & subcommittee meetings, as necessary	December 14-22, 1988 (no break over weekend)
Adjourn	December 22, 1988, p.m.
Homework	December 23, 1988-January 2, 1989
Re-convene (in Las Vegas)	January 3, 1989
Draft Review Record Memorandum	January 12, 1989
Final Review Record Memorandum	January 20, 1989

6.0 REFERENCES

Bertram, S. G., 1984. "NNWSI Exploratory Shaft Site and Construction Method Recommendation Report," SAND84-1003, Sandia National Laboratories, Albuquerque, NM.

APPENDIX I

November 14, 1988, Letter from John J. Linehan to Ralph Stein

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Acvd 11/17/88

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 1 4 1988

Mr. Ralph Stein, Acting Associate Director
Office of Systems Integration and Regulations
Office of Civilian Radioactive Waste Management
U. S. Department of Energy RW-24
Washington, D. C. 20545

Dear Mr. Stein:

The purpose of this letter is to transmit a copy of the meeting minutes prepared by the Nuclear Regulatory Commission (NRC) staff covering the November 3, 1988 meeting on the design control issues associated with the exploratory shaft facility. The minutes, along with supporting attachments, are contained in the enclosure. If you have any additional questions, please contact the NRC project manager for this subject, Mr. Joe Holonich at (301) 492-3403 or FTS 492-3403.

Sincerely,

John J. Linehan

John J. Linehan, Acting Director
Repository Licensing Project Directorate
Division of High-Level Waste Management

Enclosures: As stated

cc: C. Gertz, DOE
R. Loux, State of Nevada
K. Turner, GAO

8802103

ENCLOSURE

On November 3, 1988 members of the Nuclear Regulatory Commission (NRC) staff met with representatives from the Department of Energy (DOE), the State of Nevada, and Nye County, Nevada to discuss the design control on the exploratory shaft facility (ESF). A list of attendees is contained in Attachment 1. During the meeting, the NRC staff identified one acceptable approach DOE could use to demonstrate the adequacy of the current design. The approach was reviewed and revised based on input received from other participants. The final, tentatively agreed upon version is contained in Attachment 2. In addition, DOE presented its approach to evaluating alternative exploratory shaft locations. A copy of this is contained in Attachment 3. The NRC staff noted that it believes that the DOE approach by itself would not be acceptable; however, further staff discussions would be necessary before a final position would be taken.

Joseph J. Holonich 11/14/88

Joseph J. Holonich, Sr. Project Manager
Repository Licensing Project Directorate
Division of High-Level Waste Management
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission

Attachment 1

Attendees

NRC
J. Holonich
J. Kennedy
J. Linehan
K. Stablein
M. Nataraja
D. Gupta
J. Conway

STATE OF NEVADA
C. Johnson

NYE COUNTY
E. Holstein

DOE
E. Wilmont
G. Appel
R. Stein
J. Saltzman
L. Barrett
S. Echols

WESTON
D. Siefken

GENERAL ACCOUNTING OFFICE
K. Turner
E. Nakamura

Attachment 2

Design Acceptability Analysis

In the site characterization plan (SCP), the Department of Energy (DOE) will be providing design information on the exploratory shaft facility (ESF) that was developed without a design control process that met 10 CFR Part 60, Subpart G. Before the staff can comment on the ESF design information presented in the SCP, DOE must first demonstrate that the design meets the applicable 10 CFR Part 60 technical requirements. One acceptable approach to demonstrate the acceptability of the ESF design is outlined below.

Develop and implement a plan that meets the appropriate requirements of 88-9 and addresses Steps 1 and ~~2~~.

Step 1

Provide an analysis for 10 CFR Part 60 requirements which:

(a) identifies all 10 CFR Part 60 requirements that are applicable to the design and construction of the ESF;

(b) evaluates design interfaces; and

(c) generates design criteria based on (a) and (b) or demonstrates how the current design criteria used for the Title I addresses (a) and (b). not option

Step 2

DOE should analyze the current design against the design criteria generated under 1(c). This analysis should demonstrate that the ESF design and construction satisfy the three general objectives in 10 CFR Part 60. These are: (1) the long-term waste isolation capability of the site is not compromised; (2) the ability to characterize the site is not compromised; and (3) the ESF site characterization activities would provide representative data. This analysis should also address the appropriateness of the data used in the design and how the uncertainties were considered. The analysis is not intended to meet NUREG-1298, "Qualification of Existing Data for HLW Repositories," but will demonstrate the reasonableness of the data for the type of analyses being performed.

Step 3

DOE needs to brief NRC on the design control process and quality assurance applied to the ESF Title I design to the degree it was relied upon in the design acceptability analysis as well as the methodology for and status of the design acceptability analysis prior to the SCP.

Step 4

DOE should submit the design acceptability analysis to the staff for review along with the SCP.

Step 5

For any area of the design found unacceptable by DOE during the design acceptability analysis, DOE should identify the impact on the overall design and the DOE actions to correct the deficiency.

Step 6

After the SCP is issued, DOE should independently confirm the design acceptability analysis through an on-site review that is observed by NRC.

Step 7

Based on the results of Step 6, the NRC staff will assess the need for it to conduct a visit to evaluate the QA and technical aspects of the ESF Title I design and the design acceptability analysis.

Step 8

The ability of the staff to comment on the ESF will be dependent on the timeliness and ability of DOE to demonstrate the adequacy of the design and to independently confirm the design acceptability.

Prior to the start of sinking of the ESF, DOE must have a fully qualified QA program, including design control, in place for ESF activities.

III. PERFORM COMPARATIVE EVALUATIONS RELATED TO ALTERNATIVE SHAFT LOCATIONS TO EXAMINE:

- ANY SIGNIFICANT DIFFERENCES IN THE CAPABILITY OF THOSE LOCATIONS TO ISOLATE OR CONTAIN WASTES AND WHAT INFLUENCE, IF ANY, THESE DIFFERENCES MAY HAVE HAD ON THE SELECTION OF THE PREFERRED SHAFT LOCATION IF THEY HAD BEEN AN EXPLICIT PART OF THE SELECTION PROCESS

- ANY SIGNIFICANT ADVERSE EFFECTS THAT A SHAFT MIGHT HAVE ON THE ABILITY OF THE LOCATION TO CONTAIN AND ISOLATE WASTE AND WHAT INFLUENCE, IF ANY, THESE DIFFERENCES MAY HAVE HAD ON THE SELECTION OF THE PREFERRED SHAFT LOCATION IF THEY HAD BEEN AN EXPLICIT PART OF THE SELECTION PROCESS

APPENDIX II

Minutes of the November 23, 1988 NRC-DOE Meeting on ESF Design Acceptability Analysis

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Mr. Ralph Stein, Acting Associate Director
Office of System Integration and Regulations
Office of Civilian Radioactive Waste Management
U. S. Department of Energy RW-24
Washington, D. C. 20545

Dear Mr. Stein:

Subject: Minutes of November 23, 1988 Meeting on the Exploratory Shaft Facility Design Acceptability Analysis

The purpose of this letter is to transmit the minutes on the subject meeting. These minutes were prepared by members of the U. S. Nuclear Regulatory Commission (NRC) staff and representatives of the U. S. Department of Energy (DOE). Based on the DOE information presented at the meeting, the staff has several points, which are given below, that it believes DOE should consider in the exploratory shaft facility (ESF) design acceptability analysis (DAA).

(1) DOE should not rely upon existing ESF design soley at face value.

(2) Although DOE is performing an alternatives analysis of shaft locations per 10 CFR Part 60.21, the NRC staff noted that Part 60.21 deals with major design features; therefore, DOE needs to define the major design features for the ESF and consider alternatives for them.

(3) In its application of quality assurance to the DAA, DOE should perform at a minimum, one surveillance if not an audit.

(4) It is not clear to the staff where Step 1(c) of the DAA agreed upon by NRC and DOE at the November 3, 1988 meeting is contained in the DOE process. In addition, the staff is not sure how the flowdown activities being performed by DOE for requirements from Part 60 to the Code of Federal Regulations Title 10 affect the DAA. Therefore, the staff requested that DOE provide additional explanations at the meeting presently scheduled for December 8, 1988.

The specific details of the meeting are contained in the enclosed minutes. If you have any questions or require additional information, feel free to contact the NRC project manager for the meeting, Joe Holonich, who can be reached at (301) 492-3403 or FTS 492-3403.

Sincerely,

Joseph J. Holonich for

John J. Linehan, Acting Director
Repository Licensing Project Directorate
Division of High-Level Waste Management

cc: C. Gertz, DOE/NV
R. Loux, State of Nevada
K. Turner, GAO
D. Bechtel, Clark County, NV
J. Bradhurst, Nye County, NV
M. Baughman, Lincoln County, NV

B.2-25

12-12-88

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<u>ENCLOSURE</u>

On November 23, 1988, members of the U. S. Nuclear Regulatory Commission (NRC) staff met with representatives from the U. S. Department of Energy (DOE), and the State of Nevada. The purpose of the meeting was to have DOE present an outline of the approach it plans to take to perform a design acceptability analysis (DAA) of the Title I design of the exploratory shaft facility (ESF). Attachment 1 is a list of attendees at the meeting. At the beginning of the meeting, the NRC stated that it would not provide any determination on the acceptability of the process. It did, however, note that where it believed problems existed, the staff would identify this to DOE. The DOE presentation covered two areas of discussion. The first area dealt with the DOE action plan for implementing the DAA, and the second covered the flowdown of requirements from Part 60 to the Code of Federal Regulations, Title 10 (10 CFR, Part 60) into ESF design criteria. Attachments 2 and 3 are copies of the DOE presentations on the DAA implementation and the flowdown activities, respectively.

In its presentation on the DAA, DOE reviewed the process it would use to perform the steps needed to perform the DAA. The steps for the DAA were agreed upon by DOE and the NRC during a November 3, 1988 meeting (letter from John J. Linehan, NRC to Ralph Stein, DOE, dated November 3, 1988). Besides describing how it would meet the particular steps of the DAA, DOE also discussed: (1) the comparative evaluations it would perform to consider alternative shaft locations; (2) identified the applicable elements of quality assurance (QA) that would be applied to the DAA; (3) the procedure it would follow to perform the DAA (a copy is contained in attachment 4); and (4) the plan it would use to document the historical design control process and QA program applied to the ESF design.

During this presentation, the NRC staff identified points that DOE should consider. For the discussion on how the process met the steps identified at the November 3, 1988 meeting, the staff wanted to ensure that DOE realized that the Department had to provide the rationale for deferring actions from Title I to Title II ESF design activities. DOE responded that it agreed with this point. Another point raised by the staff dealt with the independence of the DAA process. The staff wanted DOE to ensure that the DAA was a systematic and rigorous approach that independently showed the acceptability of the ESF Title I design. This included the independence of the people performing the DAA as well as thoroughly considering the existing information used in the DAA at more than face value. This included all of the information germane to the ESF design topics being evaluated. A third point raised by the NRC was the potential for a disconnect between the ESF design information in the Site Characterization Plan (SCP), and the information generated from the DAA. DOE responded that the section of the SCP containing the ESF design information had been expanded to include all of the available design information. In addition, DOE noted that the DAA would be complete and provided to the NRC staff at approximately the same time of the SCP. In the area of comparative evaluations, the staff indicated that it believed that the evaluation should not only look at shaft location as part of the alternatives, but it should also consider the ability to characterize the site and the representativeness of the data after the analysis considered waste isolation.

On the topic of the flowdown of 10 CFR, Part 60 requirements into specific ESF design criteria, the staff did not have any particular comments. However, it did note that it was worried that this flowdown analysis would be not be completed until early 1989, and therefore, would be providing draft information to the DAA process in December 1988.

At the end of the meeting, the staff presented a summary of the points it had raised. These points are given below.

(1) DOE should not rely upon existing ESF design information solely at face value.

(2) Although DOE is performing an alternatives analysis of shaft locations per 10 CFR Part 60.21, the NRC staff stated that Part 60.21 deals with major design features; therefore, DOE needs to define the major design features for the ESF and consider alternatives for them.

(3) In its application of QA to the DAA, DOE should perform at a minimum, one surveillance if not an audit.

(4) It is not clear to the staff where Step 1(c) of the DAA agreed upon by NRC and DOE at the November 3, 1988 meeting is contained in the DOE process. In addition, the staff is not sure how the 10 CFR, Part 60 flowdown activities affect the DAA. Therefore, the staff requested that DOE provide additional explanations at the meeting presently scheduled for December 8, 1988.

DOE stated that it understood the staff points and would provide additional information on items (1) and (4) at the December 8, 1988 meeting. As stated earlier in these minutes, the NRC made no determination on the overall acceptability of the proposed process.

Joseph J. Holonich 12/01/88
Joseph J. Holonich, Sr. Project Manager
Division of High-Level Waste Management
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission

Linda Desell for 12/01/88
Gordon Appel, Chief
Licensing Branch
Office of System Integration and Regulations
Office of Civilian Radioactive Waste Management
U. S. Department of Energy

ATTACHMENT 1

List of Attendees

NRC

J. Holonich
D. Gupta
F. Cameron
J. Linehan
K. Stablein
J. Conway
M. Nataraja

GAO

K. Turner
E. Nakamura

Newman & Holtzinger

S. Brammer

DOE

S. Kale
N. Voltura
G. Appel
R. Lahoti
M. Blanchard

DOE/Weston

S. Dam

State of Nevada

C. Johnson

Attachment 2

DOE Presentation on Design Acceptability Analysis

OVERVIEW OF THE DESIGN ACCEPTABILITY ANALYSIS

DOE-NRC MEETING

NOVEMBER 23, 1988

PRESENTED BY: MAXWELL BLANCHARD

DOE ACTION PLAN FOR ADDRESSING
NRC STEPS 1 - 5: DESIGN ACCEPTABILITY ANALYSIS

ELEMENTS OF DOE ACTION PLAN

- EACH ELEMENT CORRELATES WITH STEPS OR PARTS OF STEPS IN THE NRC LETTER (LINEHAN TO STEIN, NOV. 14, 1988), ATTACHMENTS 2 AND 3.
- APPLICABLE PART OF NNWSI-88-9 FOR THIS ACTIVITY IS SECTION III - DESIGN CONTROL, (WITH SUPPORT FROM OTHER SECTIONS - SEE PAGE 7).
- APPLICABLE QUALITY MANAGEMENT PROCEDURE WITHIN THE YUCCA MOUNTAIN PROJECT OFFICE IS QMP-02-08 TECHNICAL ASSESSMENT REVIEW.
- THE TECHNICAL ASSESSMENT REVIEW WILL PRODUCE THE ACCEPTABILITY ANALYSIS AND COMPARATIVE EVALUATIONS OF THE ESF LOCATION.
- FINAL DOCUMENTATION WILL INCLUDE CONCLUSIONS ABOUT ESF TITLE I DESIGN AND RECOMMENDATIONS FOR CONSIDERATION IN ESF TITLE II DESIGN.

DESIGN ACCEPTABILITY ANALYSIS: NRC STEPS 1 AND 2

ATTACHMENT 2: NRC LETTER	ELEMENTS OF DOE ACTION PLAN	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
Step 1(a)	1a. Identify all 10 CFR Part 60 requirements that are applicable to the design and construction of the ESF.	10 CFR 60 Flowdown Report; Part 60 Compliance Review for 100% Title I; SDRD Compliance Review; and SCP Section 8.4	Summarize 10 CFR 60 Report; develop text on flowdown to the ESF SDRD; Summarize SCP Section 8.4 information on Part 60 applicable requirements.
Step 1(b)	1b. Evaluate design interfaces		
	i. Develop a list of design and physical features/interfaces between ESF design, construction, operation, and siting, repository design, ESF testing and performance assessment.	Requirements Documents, SCP-CDR; list from 1a	Prepare the list of interfaces; prepare a comparative evaluation showing how interfaces were addressed in the SDRD (or other requirements); identify interfaces or criteria not adequately addressed in list.
	ii. Evaluate list of interfaces	Comparison of above list and SDRD criteria	
Step 2. 1st sentence and Step 1(c)	1c. Analyse the current design against the design criteria	100% Title I Design Review Record Memorandum	Evaluate Review Record Memorandum for completeness of treatment relative to 1a and 1b.

DESIGN ACCEPTABILITY ANALYSIS: STEP 2

ATTACHMENT 2: NRC LETTER	ELEMENTS OF DOE ACTION PLAN	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
Step 2. 2nd & 3rd sentences	Step 2. Assess the current design against the design criteria from Step 1(c) to:		
	1) Demonstrate the long term waste isolation capability of the site is not compromised.	Point Paper Response to Objection # 4 & Section 8.4.3 (Impacts on Isolation)	Criteria identified in Step 1 will be evaluated to determine whether a) the criteria are relevant to isolation; b) the criteria were considered; and c) the adequacy of the treatment.
	2) Demonstrate that the ability to characterize the site is not compromised.	Point Paper Responses to Objections 3 & 4 & Section 8.4.	Same as for (1)
	3) Demonstrate that ESF site characterization activities would provide representative data.	Section 8.4.2 (Interference), SAND Reports	Summarize SCP text on representativeness of the characterization program with particular emphasis on the ESF location.
Step 2. 4th & 5th sentences	Evaluate the appropriateness of the data used in the design and how uncertainties were considered.	Reference Information Base and summaries of relevant evaluations and analyses in Sections 8.4.2 (Interference) and 8.4.3 (Impacts on Isolation)	Assess appropriateness of the data used in the calculations supporting the summaries in Section 8.4 of the SCP. Assess the project databases, including but not limited to, the RIB.

DESIGN ACCEPTABILITY ANALYSIS: STEP 3-5

ATTACHMENT 2: NRC LETTER	ELEMENTS OF DOE ACTION PLAN	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
Step 3	Step 3. Compile documentation of design control process and quality assurance relied upon in ESF Title I.	Historical records relevant to Title I ESF design control and quality assurance (See Item 2E on agenda).	Compile all previous records to establish relevancy to ESF Title I design.
Step 4	Step 4. Prepare the Technical Assessment Review Record Memorandum (QMP-02-08); transmittal to the NRC.	Documentation of Technical Assessment Review.	Conduct Technical Assessment Review and prepare report per QMP-02-08, paragraph 3.5.
Step 5	Step 5 Identify deficiencies, if any, in the criteria list or interface list from Steps 1 and 2.	No specific information.	Summarize deficiencies identified in the criteria lists of Steps 1 & 2 and recommend action to DOE Management.

ATTACHMENT 3 - COMPARATIVE EVALUATIONS RELATED TO ALTERNATIVE SHAFT LOCATIONS

ELEMENTS OF DOE ACTION PLAN	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
Prepare comparative evaluation of alternative shaft locations, considering 1) current site conditions; 2) expected changes to these conditions over next 10,000 years; 3) low-probability disruptive events and processes over next 10,000 yrs; and 4) alternative conceptual models of conditions at the site. Evaluation of Bertram report has 3 parts (SAND 84-1003, ESF Site and Construction Method Recommendation Report): 1. Compare alternative locations with one another without ESF present for: a. Significant differences among alternative locations in their potential for waste isolation. b. The influence these differences might have had on selection of ESF location. • 2. Compare alternative locations with one another assuming ESF has been constructed to: a. Examine any adverse effects on isolation. b. Examine the influence these effects might have had on selection of ESF location. • 3. Compare the five alternative locations to the Yucca Mt. site with regard to factors contributing to waste isolation. Consider parameters such as GWTT, thickness of UZ below repository, thickness of zeolite units beneath repository, and presence of volcanic glass.	SCP Chapters 1-4; Section 8.4.3 (Impacts on Isolation); Sinnock & Lin (SNL, 1986)	A qualitative 3-part evaluation will be prepared as described in Column 1.

IN ADDITION TO ATTACHMENT 3 - COMPARATIVE EVALUATIONS RELATED TO ALTERNATIVE SHAFT LOCATIONS

ELEMENTS OF DOE ACTION PLAN	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
Document the acceptability of additional requirements in SDRD for: shaft location shaft diameter second shaft shaft separation testing interferences testing needs	SCP Section 8.4; EA	Prepare a summary of the documentation developed for Section 8.4 of the SCP.

B.2-36

<u>APPLICABILITY OF QAP 88-9, REV. 1, TO DESIGN ACCEPTABILITY ANALYSIS</u>
(ATTACHMENT 2, PARAGRAPH 2 OF NRC LETTER)

- QAP-88-9 NNWSI PROJECT QA PLAN SECTION III, PARAGRAPH 5.0, TECHNICAL REVIEWS
  - SUPPORTED BY: SECTION I, ORGANIZATION
    SECTION II, QA PROGRAM
    SECTION V, INSTRUCTIONS, PROCEDURES & DRAWINGS
    SECTION VI, DOCUMENT CONTROL
    SECTION XVI, CORRECTIVE ACTION
    SECTION XVII, QA RECORDS
    SECTION XVIII, AUDITS/SURVEILLANCES

- QMP-02-08 TECHNICAL ASSESSMENT REVIEW
  - PROJECT OFFICE IMPLEMENTING PROCEDURE

QMP-02-08, TECHNICAL ASSESSMENT REVIEW PROCEDURE

INITIATE
TECHNICAL ASSESSMENT REVIEW

↓

ISSUE
TECHNICAL ASSESSMENT REVIEW
NOTICE

↓

COMPLETE
TECHNICAL ASSESSMENT REVIEW
TEAM SELECTION

↓

PREPARE
TECHNICAL ASSESSMENT REVIEW
PACKAGE

↓

PERFORM
TECHNICAL ASSESSMENT REVIEW

↓

PREPARE
TECHNICAL ASSESSMENT REVIEW
COMMENT RECORD

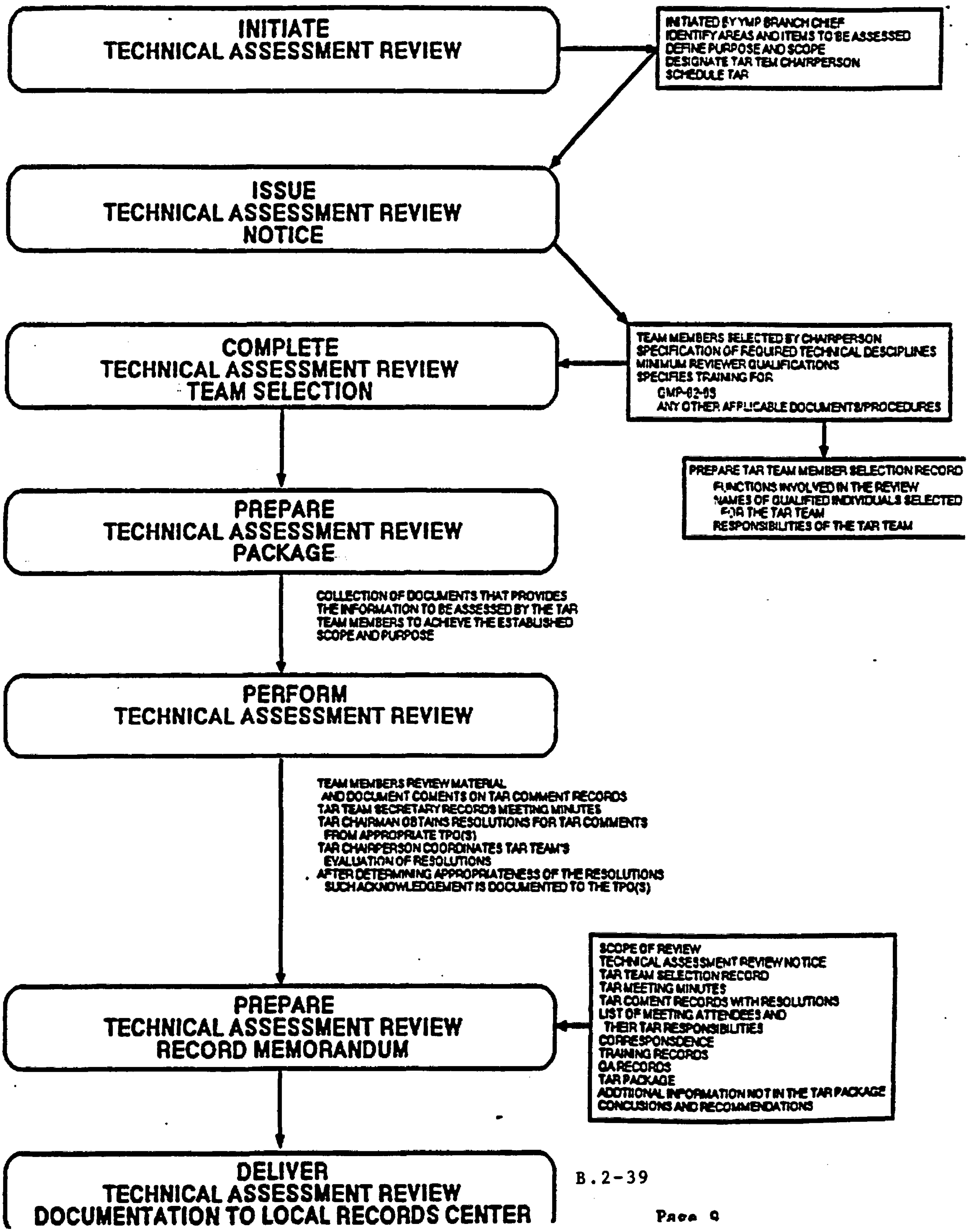
↓

PREPARE
TECHNICAL ASSESSMENT REVIEW
RECORD MEMORANDUM

↓

DELIVER
TECHNICAL ASSESSMENT REVIEW
DOCUMENTATION TO LOCAL RECORDS CENTER

QMP-02-08, TECHNICAL ASSESSMENT REVIEW PROCEDURE



QMP 02-08, SECTION 3.5: TECHNICAL ASSESSMENT REVIEW RECORD MEMORANDUM

1. SCOPE OF THE REVIEW.
2. TECHNICAL ASSESSMENT REVIEW NOTICE.
3. TECHNICAL ASSESSMENT REVIEW MEETING MINUTES
4. TECHNICAL ASSESSMENT REVIEW TEAM SELECTION RECORD.
5. TECHNICAL ASSESSMENT REVIEW COMMENT RECORDS IDENTIFYING COMMENTS AND RESOLUTIONS.
6. LIST OF MEETING ATTENDEES AND, WHEN SPECIFIED, THEIR TECHNICAL ASSESSMENT REVIEW RESPONSIBILITIES.
7. CORRESPONDENCE RELATING TO THE TECHNICAL ASSESSMENT REVIEW.
8. ADDITIONAL INFORMATION
    - DESIGN ACCEPTABILITY ANALYSIS
    - COMPARATIVE EVALUATIONS RELATED TO ALTERNATIVE SHAFT LOCATIONS
    - DOCUMENTATION PACKAGE
9. CONCLUSIONS AND RECOMMENDATIONS.

AGENDA ITEM 2-F: SUMMARY OF ACTION PLAN FOR DOCUMENTATION OF HISTORICAL DESIGN CONTROL PROCESS AND QUALITY ASSURANCE PROGRAM

- PREPARE A PLAN
- IDENTIFY PARTICIPANTS INVOLVED
- DEVELOP SPECIFIC INFORMATION/RECORD REQUIREMENTS FOR:
  - -- RESPONSIBLE ORGANIZATIONS AND INDIVIDUALS
  - -- GOVERNING PLANS AND PROCEDURES
  - -- APPLICABLE QA PROGRAM
  - -- QUALIFICATIONS OF RESPONSIBLE INDIVIDUALS
  - -- RESULTS OF PREVIOUSLY PERFORMED TECHNICAL AND MANAGEMENT ASSESSMENTS
- TRAIN INFORMATION RETRIEVAL PERSONNEL

AGENDA ITEM 2-F: SUMMARY OF ACTION PLAN FOR DOCUMENTATION OF HISTORICAL DESIGN CONTROL PROCESS AND QUALITY ASSURANCE PROGRAM (CONTINUED)

- COMPILE THE INFORMATION/RECORD REQUIREMENTS INTO A REPORT WHICH INCLUDES:
  - PLAN, REPORT, ORGANIZATION RESPONSIBILITIES, INDIVIDUAL TRAINING RECORDS.
  - SPECIFIC TOPICS IN THE REPORT INCLUDE:
    - HIERARCHY OF REQUIREMENTS DEVELOPED
    - IDENTIFICATION OF INTERFACES
    - REPORTS HAVING ANALYSES RELATED TO REQUIREMENTS FOR SHAFT LOCATION, SHAFT DIAMETER, SECOND SHAFT, SHAFT SEPARATION, TESTING INTERFERENCES, AND TESTING NEEDS
    - TITLE I DESIGN DOCUMENTATION
    - THE PROCESS USED TO TRACK 10 CFR 60 REQUIREMENTS INTO THE DESIGN

Attachment 3

DOE Presentation on 10 CFR Part 60 Flowdown

STATUS OF
10 CFR 60 FLOWDOWN
INTO ESF DESIGN REQUIREMENTS DOCUMENTS

DOE-NRC MEETING

NOVEMBER 23, 1988

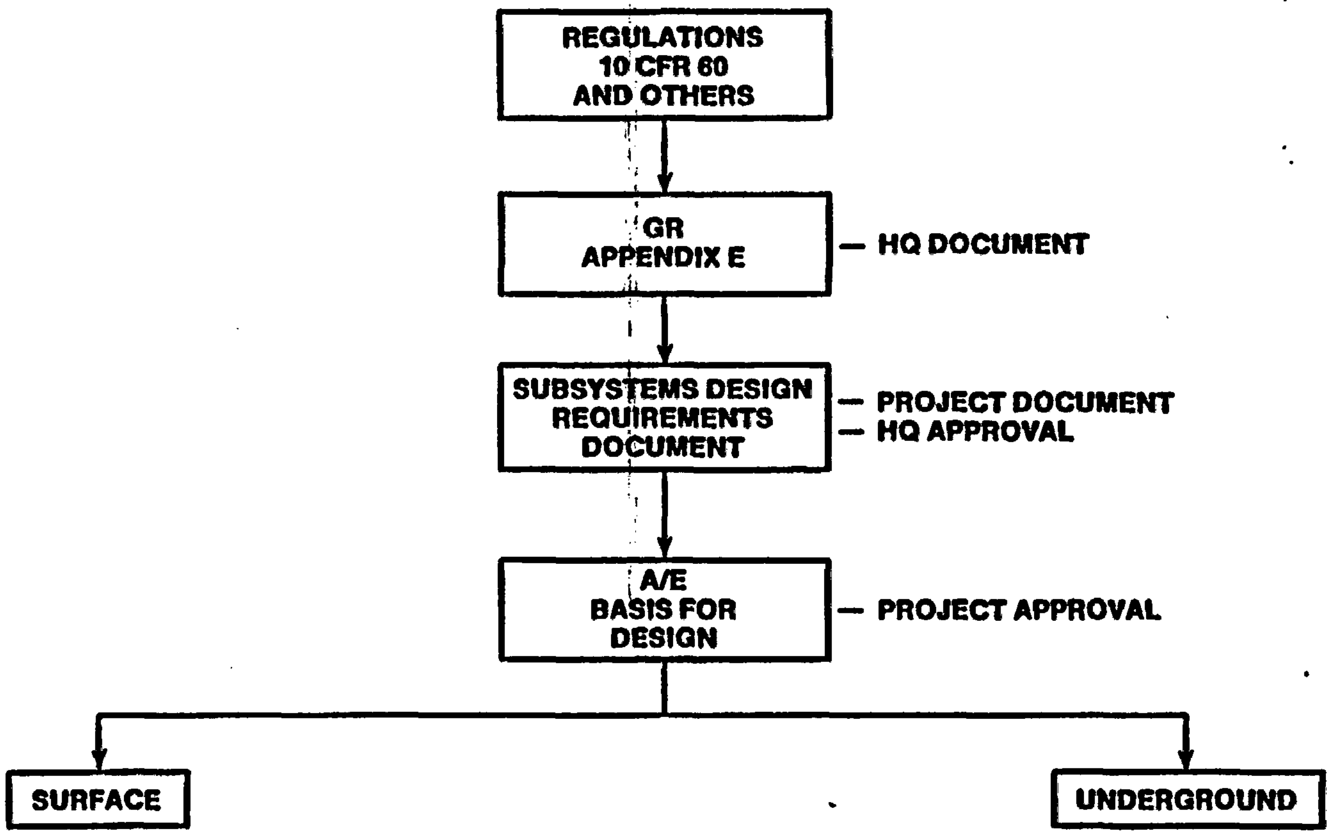
PRESENTED BY: RAM LAHOTI

PURPOSE OF BRIEFING

- TO APPRAISE NRC OF THE STATUS OF DOE EFFORTS CURRENTLY UNDERWAY TO VERIFY THE FLOWDOWN OF 10 CFR 60 REQUIREMENTS INTO THE ESF DESIGN REQUIREMENTS DOCUMENTS, INCLUDING:
  - GENERIC REQUIREMENTS DOCUMENT (GR) APPENDIX E
  - YMPO SDRD
  - A/E BASIS FOR DESIGN

B.2-45

10 CFR 60 REQUIREMENTS FLOWDOWN TO DESIGN DOCUMENTS



B.2-46

B.2-47

BRIEFING INCLUDES

- BACKGROUND INFORMATION
- STATUS OF REQUIREMENTS FLOWDOWN REVIEWS
- FUTURE ACTIONS

B.2-48

BACKGROUND INFORMATION

PURPOSE AND SCOPE OF TECHNICAL REVIEW
(10 CFR 60 TO APPENDIX E)

- PERFORM A COMPREHENSIVE DOCUMENTED REVIEW TO DETERMINE THE APPLICABILITY OF 10 CFR 60 REQUIREMENTS TO THE DESIGN, CONSTRUCTION, AND OPERATION OF THE ESF.
- COMPARE THE APPLICABLE 10 CFR 60 REQUIREMENTS WITH THE GR APPENDIX E.
- DETERMINE THE APPROPRIATE SECTIONS OF APPENDIX E WHERE ADDITIONAL REQUIREMENTS NEED TO BE ADDRESSED.
- DOCUMENT PROPOSED MODIFICATIONS TO APPENDIX E.

REVIEW PROCEDURE
(10 CFR 60 TO APPENDIX E)

- TECHNICAL REVIEW TO ASSURE COMPLIANCE WITH 10 CFR 60 REQUIREMENTS WAS CONDUCTED IN ACCORDANCE WITH 10 CFR 60 SUBPART G.
- TECHNICAL REVIEW WAS CONDUCTED IN ACCORDANCE WITH QUALITY IMPLEMENTING PROCEDURE (QIP) 3.2 "TECHNICAL REVIEWS".
- TECHNICAL REVIEW GROUP (TRG) CONSISTED OF PERSONNEL FROM DOE/HQ AND CONTRACTORS.
- TRG SELECTION WAS BASED ON INDIVIDUALS' QUALIFICATIONS, BACKGROUND, AND EXPERTISE IN THEIR SPECIFIC DISCIPLINES.
- TRG MEMBERS COMPLETED AN INDOCTRINATION AND TRAINING SESSION TO MEET THE REQUIREMENTS OF QIP 2.1 "INDOCTRINATION AND TRAINING" PRIOR TO COMMENCEMENT OF THE REVIEW.

REVIEW PROCESS
(10 CFR 60 TO APPENDIX E)

- TRG MEMBERS MADE INDIVIDUAL DETERMINATIONS AS TO WHICH 10 CFR 60 REQUIREMENTS WERE APPLICABLE TO THE DESIGN, CONSTRUCTION, AND OPERATION OF THE ESF.
- AFTER GROUP DISCUSSIONS, CONSENSUS WAS REACHED AS TO THE APPLICABILITY OF EACH REQUIREMENT, WITH THE APPROPRIATE RATIONALE DOCUMENTED.
- TRG REVIEWED APPENDIX E TO DETERMINE IF THE APPLICABLE REQUIREMENTS WERE ADEQUATELY ADDRESSED.
- FOR REQUIREMENTS NOT ADEQUATELY ADDRESSED, PROPOSED MODIFICATIONS TO THE TEXT WERE PREPARED AND DOCUMENTED.
- SUBMIT TECHNICAL REVIEW REPORT TO OCRWM MANAGEMENT.

PURPOSE AND SCOPE OF TECHNICAL REVIEW
(APPENDIX E TO SDRD AND BASIS FOR DESIGN)

- PREPARE A MARKED-UP DRAFT APPENDIX E INCORPORATING THE CHANGES RECOMMENDED BY THE TRG
- COMPARE THE APPENDIX E MARK-UP WITH THE SDRD AND BASIS FOR DESIGN TO DETERMINE IF THE APPLICABLE 10 CFR 60 REQUIREMENTS WERE ADEQUATELY ADDRESSED.
- DETERMINE THE APPROPRIATE SECTIONS OF THE SDRD WHERE ADDITIONAL REQUIREMENTS NEED TO BE ADDRESSED.
- DOCUMENT PROPOSED MODIFICATIONS TO THE SDRD.
- PROVIDE COMMENTS ON THE BASIS FOR DESIGN TO YMPO FOR CONSIDERATION.

B.2-52

REVIEW PROCEDURE & PROCESS
(APPENDIX E TO SDRD AND BASIS FOR DESIGN)

- REVIEW CONDUCTED IN ACCORDANCE WITH THE SAME QA PROCEDURES AS THE APPENDIX E REVIEW.
- REVIEW PROCESS WAS THE SAME AS THE PROCESS USED FOR APPENDIX E.

B.2-54

STATUS OF REVIEWS

STATUS OF REQUIREMENTS FLOWDOWN REVIEWS

- FLOWDOWN OF 10 CFR 60 REQUIREMENTS INTO GR APPENDIX E
  - REVIEW COMPLETE
  - REPORT IN PREPARATION
- FLOWDOWN OF 10 CFR 60 REQUIREMENTS FROM APPENDIX E TO SDRD
  - REVIEW COMPLETE
  - REPORT IN PREPARATION
- FLOWDOWN OF 10 CFR 60 REQUIREMENTS FROM SDRD TO BASIS FOR DESIGN.
  - REVIEW IN PROGRESS.

B.2-55

FUTURE ACTIONS

B.2-56

FUTURE ACTIONS

- UPON APPROVAL OF RECOMMENDED CHANGES, BASELINE CHANGE PROPOSALS FOR REVISION OF APPENDIX E WILL BE SUBMITTED TO CHANGE CONTROL BOARD.
- UPON APPROVAL OF BASELINE CHANGE PROPOSALS BY THE CHANGE CONTROL BOARD, APPENDIX E WILL BE REVISED
- BASED ON CHANGE CONTROL BOARD APPROVAL, PROJECT WILL INCORPORATE THE CHANGES INTO THE SDRD AND BASIS FOR DESIGN
- ALL ACTIONS ABOVE TO BE COMPLETED TO SUPPORT TITLE II DESIGN.

Attachment 4

DOE Procedure QMP-02-08

"Technical Assessment Review"

WASTE MANAGEMENT PROJECT OFFICE

QUALITY MANAGEMENT PROCEDURE

N-QA-015
12/87

Title	
TECHNICAL ASSESSMENT REVIEW	No. QMP-02-08 Rev. 0
	Effective Date 08-Aug-1988
	Page 1 of 12

CONTROLLED COPY

1.0 PURPOSE AND SCOPE

This procedure defines the method to be used and responsibilities for performing Technical Assessment Reviews for the Nevada Nuclear Waste Storage Investigations (NNWSI) Project. The requirements of this procedure may be supplemented with further documented guidance that defines the logistics and methodologies to be used in a review.

2.0 APPLICABILITY

This procedure applies to Technical Assessment Reviews conducted by the Waste Management Project Office (WMPO) for the NNWSI Project. A Technical Assessment Review is one of a set of review methods defined for the NNWSI Project in Section 4.2.5 of the Systems Engineering Management Plan (SEMP). This procedure can be used in meeting the requirements for technical reviews defined in the SEMP and in U.S. Department of Energy (DOE) Order 4700.1, Attachment III-1, Page III-47, Section 2.

3.0 DEFINITIONS

3.1 TECHNICAL ASSESSMENT REVIEW

The Technical Assessment Review is a documented evaluation of technical status, technical progress, or technical merit, in combination or separately. It is performed by qualified individuals other than those who performed the technical work being reviewed, but who may be from the same organization. Technical Assessment Review is a management method that may be used to accomplish such items as the following:

1. Assessing requirements.

2. Determining the degree to which technical work meets requirements.

3. Identifying technical issues in a timely fashion, including interfaces with site and design efforts.

4. Assessing the technical status or technical progress of activities.

5. Providing a basis to accept technical services rendered.

APPROVED BY

Project Manager, T&MSS	WMPO Project Quality Manager	WMPO Project Manager
[signature]	Wendell B. Mansel for J. Blaylock	[signature]
Date 3 August 1988	Date 08/03/88	Date 8/4/88

6. Defining and directing necessary changes in accordance with WMPO procedures.

3.2 TECHNICAL ASSESSMENT REVIEW NOTICE

The Technical Assessment Review Notice (Figure 1) is issued by the responsible WMPO Branch Chief, or designee, announcing the Technical Assessment Review. The notice provides the following:

1. Technical Assessment Review scope and purpose, identifying areas and items to be assessed, including an indication of the required depth. This may be accomplished in a variety of ways, including the use of questionnaires, checklists, a list of design requirements, or through other suitable means.

2. Date, time, location, and other logistical information for the Technical Assessment Review meeting.

3. Name of the Technical Assessment Review Team Chairperson.

3.3 TECHNICAL ASSESSMENT REVIEW TEAM SELECTION RECORD

3.3.1 The Technical Assessment Review Team Selection Record (Figure 2) is completed, signed, and dated by the Technical Assessment Review Team Chairperson. It identifies the functions involved in the review, and the names of qualified individuals selected to be on the Technical Assessment Review Team. The review team members are assigned the responsibility for reviewing and providing comments, as applicable, for those functions. The review team members must be other than those who performed the technical work, but they may be from the same organization.

3.3.2 The Technical Assessment Review Team Selection Record includes the documentation of the qualifications of the review team members assigned for the various review functions.

3.4 TECHNICAL ASSESSMENT REVIEW PACKAGE

The Technical Assessment Review Package is a collection of documents (e.g., reports, schedules, plans, and drawings) that provides the information to be assessed by the review team members to achieve the established scope and purpose.

3.5 REVIEW RECORD MEMORANDUM

The Review Record Memorandum is a documented summary of the Technical Assessment Review prepared by the Secretary, which includes the following:

1. Scope of the review.
2. Technical Assessment Review Notice.
3. Technical Assessment Review Meeting minutes.
4. Technical Assessment Review Team Selection Record.
5. Technical Assessment Review Comment Records identifying comments and resolutions.
6. List of meeting attendees and, when specified, their Technical Assessment Review responsibilities.
7. Correspondence relating to the Technical Assessment Review.
8. Information presented during the Technical Assessment Review meeting and other information provided to the review team members that was not contained in the original Technical Assessment Review Package or in subsequent additions or modifications to the package.
9. Conclusions and recommendations.

3.6 TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

The Technical Assessment Review Comment Record is a form used to document Technical Assessment Review comments and their resolution (Figures 3 and 4).

3.7 TECHNICAL ASSESSMENT REVIEW DATA PACKAGE

The Technical Assessment Review Package is a set of Quality Assurance (QA) records consisting of the Technical Assessment Review Package and the Review Record Memorandum, including any supplements as described in Section 5.5.6.

4.0 RESPONSIBILITIES

4.1 RESPONSIBLE WMPO BRANCH CHIEF OR DESIGNEE

4.1.1 The responsible WMPO Branch Chief or designee shall plan, schedule, and announce the Technical Assessment Review, designate the Technical Assessment Review Chairperson, and distribute the Review Record Memorandum.

4.1.2 If the responsible WMPO Branch Chief determines that a Project Participant is to be the designee, the responsible WMPO Branch Chief shall document that decision and the designated organization shall prepare and issue the Technical Assessment Review Notice.

4.2 TECHNICAL ASSESSMENT REVIEW CHAIRPERSON

The Technical Assessment Review Chairperson is responsible for the following:

1. Designating the Secretary for the Technical Assessment Review.
2. Determining the technical disciplines to be used to accomplish the scope and purpose of the review.
3. Establishing minimum qualifications (e.g., education, experience, and independence) needed by review team members to fulfill technical disciplines to accomplish the scope and purpose of the review.
4. Obtaining suitable documentation of review team members' qualifications for the various technical disciplines.
5. Ensuring that the documentation of the review team members' qualifications meets the needs of the review.
6. Determining the number of reviewers for the Technical Assessment Review Team.
7. Obtaining information for the review from the appropriate Technical Project Officer (TPO) and others, as appropriate.
8. Coordinating the Technical Assessment Review Team, the meeting, and the review process.
9. Issuing the Review Record Memorandum to the responsible WMPO Branch Chief for distribution.
10. Compiling a data package of the Technical Assessment Review.

4.3 SECRETARY

The Secretary documents the Technical Assessment Review Team activities. Specifically, the Secretary records the meeting minutes, collects comments and resolutions, and prepares the Review Record Memorandum (per Section 3.5).

4.4 TECHNICAL ASSESSMENT REVIEW TEAM MEMBERS

It is the responsibility of the review team members to review and provide comments in their technical area, as designated by the Chairperson, and to participate in the evaluation of proposed resolutions.

5.0 PROCEDURE

5.1 INITIATION OF THE TECHNICAL ASSESSMENT REVIEW

The responsible WMPO Branch Chief or designee plans, scopes, and schedules the Technical Assessment Review and designates the Technical Assessment Review Chairperson. The responsible WMPO Branch Chief or designee also issues the Technical Assessment Review Notice to Quality Assurance, Regulatory Compliance, and others, as appropriate.

5.2 TEAM SELECTION

5.2.1 The Technical Assessment Review Chairperson performs the following:

1. Designating the Secretary for the Technical Assessment Review.

2. Determining the technical disciplines to be used to accomplish the scope and purpose of the review.

3. Establishing minimum qualifications (e.g., education, experience, and independence) needed by review team members to fulfill the technical disciplines to accomplish the scope and purpose of the review.

4. Obtaining suitable documentation of review team members' qualifications for the various technical disciplines, as described in Section 5.2.2

5. Ensuring that the documentation of the review team members' qualifications meets the needs of the review, and signing and dating the Technical Assessment Review Team Selection Record(s).

6. Determining the number of reviewers for the Technical Assessment Review Team.

7. Ensuring that assigned Review Team Members are trained to this procedure and other applicable documents.

5.2.2 The Technical Assessment Review Chairperson requests the following information for each of the review team members: name of the person and a statement that the review team member meets the education, experience, and independence qualifications established for the review. This information is to be provided by the employer of the review team member.

5.2.3 If a review team member's employer is an agency outside of the NNWSI Project, the chairperson is responsible for notifying the agency that the documentation verifying the education, experience, and independence of the review team member must be obtained and retained by that agency. This documentation shall be made available for surveillance and audit by the U.S. Nuclear Regulatory Commission or the DOE. In addition, the agency shall be required to notify the WMPO prior to destruction of this verification documentation.

5.3 TECHNICAL ASSESSMENT REVIEW PACKAGE

The Technical Assessment Review Chairperson obtains the information for the review from the appropriate TPO and others, as appropriate.

5.4 TECHNICAL ASSESSMENT REVIEW

5.4.1 The review team members review the material and document their comments on Technical Assessment Review Comment Records. If a review team member has no comment, this is documented on a Technical Assessment Review Comment Record.

5.4.2 The Secretary records meeting minutes, collects comments and resolutions, and prepares the Review Record Memorandum (per Section 3.5). The Technical Assessment Review Chairperson reviews, signs, and dates the Review Record Memorandum.

5.5 RESOLUTION OF TECHNICAL ASSESSMENT REVIEW COMMENTS

5.5.1 The Technical Assessment Review Chairperson obtains resolutions for the Technical Assessment Review comments from the appropriate TPO.

5.5.2 The Technical Assessment Review Chairperson coordinates the team's evaluation of the resolutions obtained in Section 5.5.1. After deciding the appropriateness of the resolutions, such acknowledgment is documented to the appropriate TPO.

5.5.3 Any unresolved comments are referred by the Chairperson to the appropriate TPO for resolution. (The appropriate TPO is the one who has responsibility for the subject of the unresolved comment.)

5.5.4 The Chairperson, upon submittal of a review comment resolution by the appropriate TPO, shall ensure that the resolution is provided to the review team member and the responsible WMPO Branch Chief.

5.5.5 The review team member who had the unresolved comment shall evaluate the provided comment resolution, and either:

1. Sign and date the review comment resolution (according to the Chairperson's instruction) to indicate agreement, and return it to the Chairperson.

2. If a disagreement exists, attempt to achieve an agreement, (via the Chairperson) with the appropriate TPO. If agreement cannot be reached, provide the documented basis for the disagreement to the Chairperson and request assistance from successively higher levels of management.

5.5.6 The Chairperson may complete the Review Record Memorandum with a documented unresolved comment; however, supplements must be provided to the memorandum as the appeals process is pursued, such that a complete record of the comment is retained as a QA record.

5.6 REVIEW RECORD MEMORANDUM

The Technical Assessment Review Chairperson issues the Review Record Memorandum to the responsible WMPO Branch Chief for distribution to the TPO(s) and others, as appropriate.

5.7 CLOSURE OF RESOLUTION

The responsible WMPO Branch Chief or designee shall ensure that the appropriate TPO satisfies and closes out the commitments made in resolutions to the Technical Assessment Review comments.

5.8 TECHNICAL ASSESSMENT REVIEW DOCUMENTATION

The Technical Assessment Review Chairperson shall (1) compile a data package relative to the Technical Assessment Review that consists of the Technical Assessment Review Package and the Review Record Memorandum (including any supplements as described in Section 5.5.6) and (2) provide for disposition of the data package in accordance with Section 8.0.

6.0 REFERENCES

The latest revisions of the following apply:

NNWSI/88-3, NNWSI Project Systems Engineering Management Plan

DOE Order 4700.1, Project Management System

QMP-17-01, QA Records

7.0. FIGURES

At a minimum, the information needs on the forms shown on the following figures shall be satisfied. This may be accomplished by the use of the form itself or a suitable alternate.

Figure 1, Technical Assessment Review Notice

Figure 2, Technical Assessment Review Team Selection Record

Figure 3, Technical Assessment Review Comment Record

Figure 4, Technical Assessment Review Comment Record Continuation Sheet

8.0 QA RECORDS

The following are QA records and are maintained in accordance with QMP-17-01, QA Records.

1. Technical Assessment Review Package.
2. Review Record Memorandum (including any supplements as described in Section 5.5.6).

TECHNICAL ASSESSMENT REVIEW NOTICE

N-QA-010
7/88

To ______________________ Date __________

Technical Area to be Reviewed ______________________

WBS No.: ______________________

Review Date __________ Location __________ Time __________

Technical Assessment Review Chairperson ______________________

Based on review of the qualification documentation, this Technical Assessment Review Chairperson is qualified to execute the responsibilities of QMP-02-08 with respect to the scope and purpose of this Review.

Scope of Technical Assessment Review:

Purpose of Technical Assessment Review:

Signed ______________________

Attachments:

Figure 1. Technical Assessment Review Notice.

TECHNICAL ASSESSMENT
REVIEW TEAM SELECTION RECORD

N-QA-008
7/88

Technical Assessment Review Subject ______________________________

FUNCTION	REPRESENTATIVE
Secretary	

Based on review of the qualification documentation, these representatives cover the functions for this Review and are acceptable as team members to accomplish the scope and purpose of this review.

Signed ______________________________

Attachment:

Qualification Documentation

Figure 2. Technical Assessment Review Team Selection Record.

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD

N-QA-008
7/88

Sheet ____ of ____

Technical Assessment Review Subject ____________

Reviewer __________ Organization __________ Date ______

Comments Received By __________ Organization __________ Date ______

Item Number	Reference Doc't. No.	REVIEWER'S COMMENTS: Comments	Accept	Reject	RESOLUTION: Reason	REVIEWER'S DISPOSITION: Accept	Reject

Figure 3. Technical Assessment Review Comment Record.

Title	No. QMP-02-08 Rev. 0
TECHNICAL ASSESSMENT REVIEW	Effective Date 08-Aug-1988
	Page 12 of 12

TECHNICAL ASSESSMENT REVIEW COMMENT RECORD CONTINUATION SHEET

N-QA-008
7/88

Technical Assessment Review Subject ______________

Sheet ____ of ____

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION	
Item Number	Reference Doct. No.	Comments	Accept	Reject	Action	Accept	Reject

Figure 4. Technical Assessment Review Comment Record Continuation Sheet.

APPENDIX III

Minutes of the December 8, 1988 NRC-DOE Meeting on ESF Design Acceptability Analysis

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

YMP

DEC 15 1988

Mr. Ralph Stein, Associate Director
Office of Systems Integration and Regulations
Office of Civilian Radioactive Waste Management
U. S. Department of Energy, RW-24
Washington, D. C. 20545

Dear Mr. Stein:

SUBJECT: MINUTES FROM DECEMBER 8, 1988 MEETING ON THE EXPLORATORY SHAFT DESIGN ACCEPTABILITY ANALYSIS

The purpose of this letter is to provide you with a copy of the meeting minutes from the December 8, 1988 exploratory shaft facility (ESF), design acceptability analysis (DAA) meeting. Members of the U. S. Nuclear Regulatory Commission (NRC) staff and representatives from the U. S. Department of Energy (DOE) jointly prepared the minutes.

There are several points the staff raised during the meeting that DOE should know and consider in the DAA. These points are provided in the summary of the minutes. In addition, the staff believes that a clarification of its position on the application of requirements from the Code of Federal Regulations, Title 10, Part 60 (10 CFR Part 60) is needed. During the meeting, DOE informed the staff that it had identified 46 requirements from 10 CFR Part 60 that apply to the ESF. Of these 46, 23 would be considered in the DAA. The 23 being considered were the ones that addressed the three objectives identified in Step 2. of the DAA agreed upon at the November 3, 1988 meeting (John J. Linehan, NRC letter to Ralph Stein, DOE, dated November 14, 1988). This process is not consistent with the NRC understanding of the DAA. The staff understanding is that all 10 CFR Part 60 requirements need to be considered in the DAA analysis discussed in Step 2. In addition, that analysis should demonstrate that the ESF will not violate any of the three objectives identified in Step 2. The staff wants to clarify the point that all 10 CFR Part 60 requirements need to be considered in the DAA. Further discussion of this is given in the enclosure.

If you have any questions on the enclosed minutes, please feel free to contact the NRC project manager for this area, Mr. Joe Holonich who can be reached at (301) 492-3403 or FTS 492-3403.

cc Gertz
cc Wilmot
cc Dobson
Dyer
Crawley
Bjerstedt
Lewis
Blanchard
Skousen
Robison/Tweaters
WP/SAIC
Reiter/SAIC

Sincerely,

John J. Linehan

John J. Linehan, Director
Repository Licensing and Quality Assurance Project Directorate
Division of High-Level Waste Management

cc: C. Gertz, YMPO
R. Loux, St. of NV.
S. Bradhurst, Nye County, N
D. Bechtel, Clark County, N
M. Baugham, Lincoln County, NV.

ENCLOSURE

On December 8, 1988, members of the U. S. Nuclear Regulatory Commission (NRC) staff met with representatives of the U. S. Department of Energy (DOE), its contractors, and the State of Nevada. The purpose of the meeting was to have DOE present preliminary results from several areas of activity associated with the design acceptability analysis (DAA), and to present the status of the overall DAA. Attachment 1 is a list of attendees.

The first presentation by DOE covered the status of the flowdown of requirements, given in the Code of Federal Regulations, Title 10, Part 60 (10 CFR Part 60), into the design requirements documents for the exploratory shaft facility (ESF). This briefing was given as a follow-up to the information presented by DOE at the November 23, 1988 meeting on the DAA. The purpose of the presentation was to provide an update on the status of the DOE efforts currently under way to verify the flowdown of 10 CFR Part 60 requirements into the specific ESF design documents. Relevant ESF design documents included: (1) the Generic Requirements for a Mined Geologic Disposal System (GRD), Appendix E; (2) the Yucca Mountain Project Office (YMPO) Subsystem Design Requirements Document (SDRD); and (3) the Basis for Design used by the architect/engineering firms. Included in the presentation was a summary of the review process that differentiated between those activities being done by the YMPO technical assessment review group and those that were being done by DOE/HQ. DOE also discussed the documentation that would result from the reviews, and presented a table of preliminary review results. The table contained a listing of the applicable 10 CFR Part 60 requirements and identified whether they were addressed in either the GRD, Appendix E and SDRD, or not addressed. Attachment 2 is a copy of the DOE presentation.

Based on the information presented, the NRC staff stated that the results presented in the table appear to cover the major objectives that should be considered. These objectives were: (1) the long-term waste isolation capability of the site is not compromised; (2) the ability to the characterize the site is not compromised; and (3) the ESF site characterization activities will provide representative data. In addition, the staff noted that the requirements identified as applicable should also cover preclosure design considerations, and based on the information presented in the table it appeared that DOE recognized this. Although the staff could not determine the acceptability of the specifics contained in the table, it did identify to DOE four additional 10 CFR Part 60 requirements that should be included on the table. The four additional requirements were: (1) 10 CFR 60.21 (c)(1)(ii)(A); (2) 10 CFR 60.21(c)(1)(ii)(B); (3) 10 CFR 60.131(b)(8); and (4) 60.134.

Next, DOE presented information on the status of its plans for the ESF, Title I DAA and the comparative evaluations related to alternative shaft locations. As part of this discussion, DOE provided a copy of the "Technical Assessment Review Notice," that defines the purpose, scope, and process for the technical assessment review (TAR) of the ESF, Title I design and the comparative evaluation of shaft locations. Attachment 3 is a copy of the presentation, and Attachment 4 is a copy of the TAR notice.

Part of this DOE presentation was a discussion on the preliminary results of what 10 CFR Part 60 requirements, identified by the flowdown analysis discussed above, need to be considered in the DAA. In this discussion, DOE stated that it intended to consider only those 10 CFR Part 60 requirements that are necessary to meet the three major objectives discussed in the previous paragraph. In response to this information, the staff noted that its position was that DOE had to consider all of the applicable 10 CFR Part 60 requirements in the DAA. DOE further stated that this consideration could be an evaluation of the impact on the Title I design of omitting an applicable requirement, and a rationale describing why, if the impact was not significant, any design considerations could be delayed until Title II design. The staff agreed with DOE that this was acceptable. A copy of the DOE presentation on the review of flowdown requirements is given in Attachment 5.

The final presentation made by DOE covered the appropriateness of the data used in the design analysis and the consideration of uncertainties. DOE described its approach for determining the appropriateness, considering uncertainties, and determining the adequacy of the evaluations. The staff did not see any major difficulties with the proposed approach; however, the staff did not perform a detailed review.

At the end of the meeting, the NRC staff presented its summary of the points that DOE needed to consider. The points are presented below and are categorized based on the particular presentation.

<u>Status and Results of Flowdown Requirements</u>

(1) DOE should consider the application of four additional requirements to the results table (Attachment 2, Pages 15 through 17).

(2) The staff does not consider the information on page 10 of the presentation in Attachment 2 anything more than a preliminary assessment.

(3) Some of the applicable 10 CFR Part 60 requirements are not being addressed by DOE in the DAA. The staff position is that all applicable 10 CFR Part 60 requirements need to be considered per Step 1 (a) of the process outlined at the November 3, 1988 meeting. The fact that a requirement does not address any of the three major objectives, does not preclude DOE from including it in the DAA. The staff agrees that if DOE finds that in considering these requirements, a deficiency is identified, DOE can assess the impact on the ESF, Title I design, and delay any action until Title II design by providing appropriate rationale.

(4) DOE needs to provide the rationale for identifying which of the three major design objectives are addressed by 10 CFR Part 60 requirements. (How are the "X's" placed in the columns in the table in Attachment 3, Backup Material, Pages 1 through 3).

(5) The staff would like to see a matrix similar to the one given on page E-34 of the GRD. This matrix should not only include all of the applicable requirements from 10 CFR Part 60, but should also identify all of the work breakdown structures to which the requirements apply.

(6) The staff reiterated the point that 10 CFR Part 60.21 deals with the need to consider alternatives analysis for major design features of the ESF not just the shaft location. This point was raised at the November 23, 1988 meeting (John J. Linehan, NRC letter to Ralph Stein, DOE dated December 2, 1988.

TAR Notice

(1) In the TAR notice, DOE includes the minutes from the November 3, 1988 meeting. The staff was concerned that DOE did not include the November 23, 1988 meeting minutes and minutes for this meeting (December 8, 1988) in the TAR Notice. Both of these subsequent meetings help to better define the issues. Placing just the one set of minutes in the TAR could result in confusion.

With respect to the matrix requested by the staff in item (5) in the "Status and Results of Flowdown Requirements," DOE noted that it was generated after all the other previous work had been completed. The table itself was not input to the design process, it just summarizes the design criteria. In addition, DOE stated that this matrix would be generated in a separate design control process not the DAA. The staff noted that this was acceptable.

For its closing remarks, DOE requested that the staff review the TAR notice and provide any feedback it could. The NRC committed to review the document and identify any concerns it may have by the middle of the week of December 12, 1988. DOE also stated that it believed that NRC could see that the process being used and products being generated were being accomplished under the appropriate controls of the "Nevada Nuclear Waste Storage Investigation Quality Assurance Plan." Finally, DOE noted that it had hoped to receive feedback from the NRC on the completeness of the DOE list of 10 CFR Part 60 requirements, and the approach of relating these requirements to the three major objectives. DOE stated that the meeting achieved this.

The State of Nevada had no closing comments, noting that the NRC staff had captured all of its concerns.

Joseph J. Holonich 12/15/88
Joseph J. Holonich
Repository Licensing Project Directorate
Division of High-Level Waste
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission

Gordon Appel 12/15/88
Gordon Appel, Chief
Licensing Branch
Office of Systems Integration and Regulations
Office of Civilian Radioactive Waste Management
U. S. Department of Energy

ATTACHMENT 1

List of Attendees

NRC

J. Holonich
D. Gupta
J. Kennedy
J. Linehan
K. Stablein
J. Conway
R. Weller
T. Verma
R. Natarja
F. Ross
K. McConnell
R. Ballard*

DOE

R. Stein*
R. Lahoti
M. Blanchard
G. Appel
T. Petrie
M. Frei
S. Kale
R. Lark
C. Bradley

State of Nevada

C. Johnson

DOE/Weston

S. Dam

General Accounting Office

K. Turner
E. Nakamura

USGS/DOE

R. Wallace

Advisory Committee on Nuclear Waste

O. Merril

Newman & Holtzinger

K. Unnerstall

* Did not stay the entire meeting.

NNI.881219.0081

ATTACHMENT 2

Presentation on the Status of Flowdown Analysis

STATUS OF 10 CFR 60 FLOWDOWN INTO ESF DESIGN REQUIREMENTS DOCUMENTS

DOE/NRC MEETING

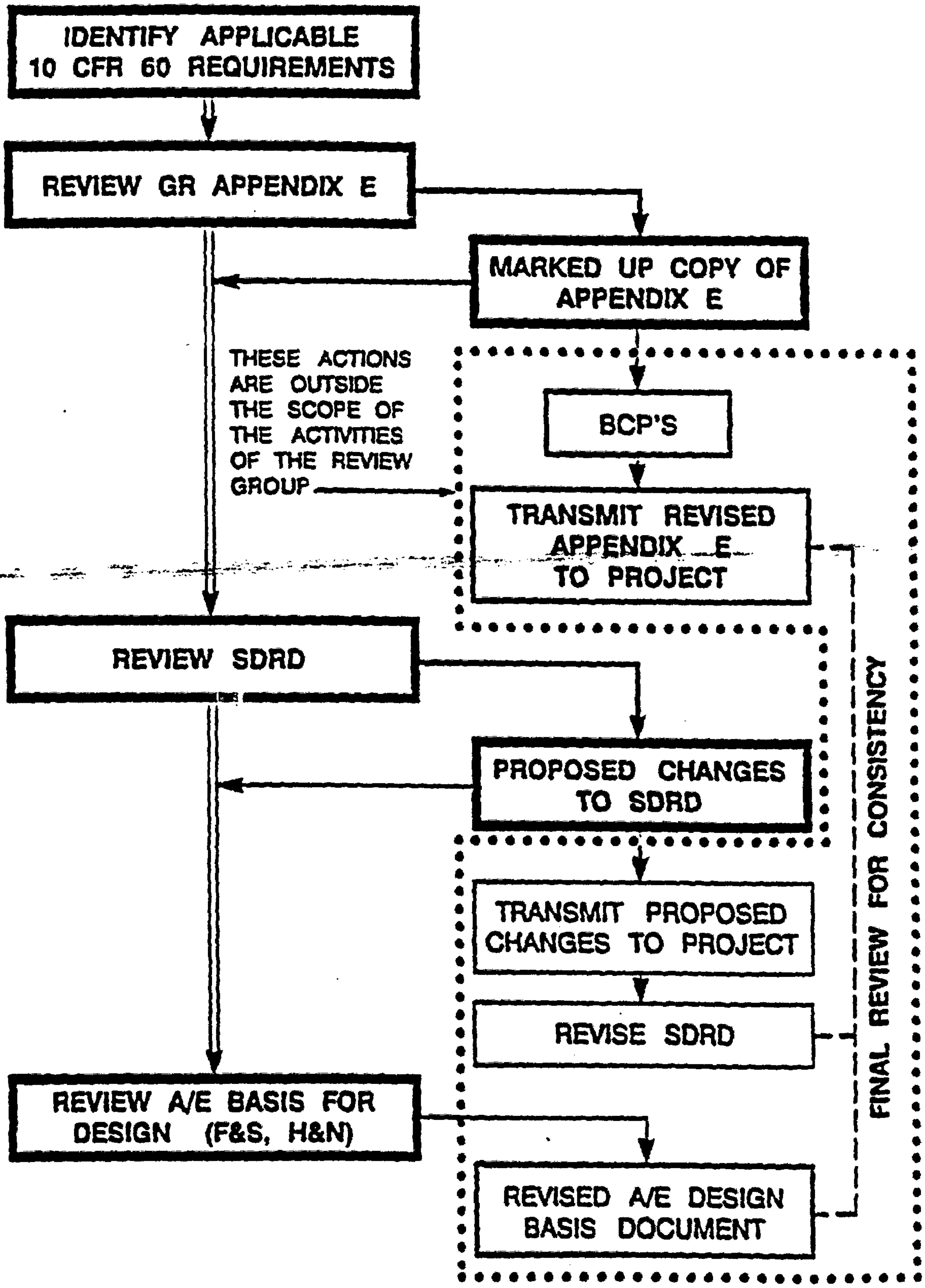
DECEMBER 8, 1988

PURPOSE OF BRIEFING

- TO PROVIDE AN UPDATED STATUS OF DOE EFFORTS CURRENTLY UNDER WAY TO VERIFY THE FLOWDOWN OF 10 CFR 60 REQUIREMENTS INTO THE ESF DESIGN REQUIREMENTS DOCUMENTS, INCLUDING:
  - GR APPENDIX E
  - YUCCA MOUNTAIN PROJECT OFFICE SDRD
  - A/E BASIS FOR DESIGN
- THIS IS A FOLLOW-UP TO THE NOVEMBER 23, 1988 DOE/NRC MEETING

B.2-79

SUMMARY OF REVIEW PROCESS



NRCFLWBPHOD.A25/12 6 88 2

REVIEW PROCEDURE

- REVIEW MEETS THE 10 CFR 60 SUBPART G QA REQUIREMENTS
- QUALITY IMPLEMENTING PROCEDURE (QIP) 3.2 "TECHNICAL REVIEWS" WAS FOLLOWED
- REVIEW GROUP SELECTION WAS BASED ON INDIVIDUALS' QUALIFICATIONS, BACKGROUND, AND EXPERTISE IN THEIR SPECIFIC DISCIPLINES
- INDOCTRINATION AND TRAINING ACCORDING TO QIP 2.1 WAS PROVIDED TO REVIEW GROUP MEMBERS

APPENDIX E
TECHNICAL REVIEW GROUP MEMBERS

B.2-82

M. COMAR/DOE (CHAIRMAN)	ENGINEERING
D. WAGG/WESTON (CO-CHAIRMAN)	ENGINEERING
M. LUGO/WESTON (CO-CHAIRMAN)	LICENSING
M. MOZUMDER/DOE	GEOSCIENCES
S. SINGAL/DOE	REGULATORY
P. KUMAR/WESTON	ENGINEERING
S. VAN CAMP/WESTON	GEOSCIENCES
H. BERMANIS/WESTON	LICENSING
L. IBE/WESTON (OBSERVER)	QA
B. SCOTT/WESTON	SYSTEMS
G. HUANG/CER	LICENSING
D. FENSTER/WESTON	GEOSCIENCES
A. PAPADOPOULOS/WESTON	ENGINEERING
D. MICHLEWICZ/WESTON	SAFETY ASSESSMENT
H. MINWALLA/WESTON	LICENSING

SDRD TECHNICAL REVIEW GROUP MEMBERS

M. COMAR/DOE (CHAIRMAN)	ENGINEERING
D. WAGG/WESTON (CO-CHAIRMAN)	ENGINEERING
P. KUMAR/WESTON	ENGINEERING
S. VAN CAMP/WESTON	GEOSCIENCES
H. BERMANIS/WESTON	LICENSING
L. IBE/WESTON (OBSERVER)	QA
B. SCOTT/WESTON	SYSTEMS
J. MONTGOMERY/WESTON	ENGINEERING

BASIS FOR DESIGN TECHNICAL REVIEW GROUP MEMBERS

M. COMAR/DOE (CHAIRMAN)	ENGINEERING
D. WAGG/WESTON (CO-CHAIRMAN)	ENGINEERING
P. KUMAR/WESTON	ENGINEERING
S. VAN CAMP/WESTON	GEOSCIENCES
H. BERMANIS/WESTON	LICENSING
B. SCOTT/WESTON	SYSTEMS
J. MONTGOMERY/WESTON	ENGINEERING

DOCUMENTATION RESULTING FROM GROUP REVIEWS

- REPORT ON APPLICABILITY OF 10 CFR 60 REQUIREMENTS
- TECHNICAL REVIEW REPORT ON APPENDIX E
- TECHNICAL REVIEW REPORT ON SDRD
- TECHNICAL REVIEW REPORT ON A/E BASIS FOR DESIGN DOCUMENTS

RELATED DOCUMENTATION OUTSIDE THE SCOPE OF THE GROUP REIVEWS

- BASELINE CHANGE PROPOSALS FOR APPENDIX E
- REVISED APPENDIX E
- HQ DIRECTION TO PROJECT FOR REVISING SDRD & BASIS FOR DESIGN
- REVISED SDRD
- REVISED BASIS FOR DESIGN (F&S, H&N)

SUMMARY OF REVIEW RESULTS

- TOTAL 10 CFR 60 REQUIREMENTS: 157
- TOTAL REQUIREMENTS APPLICABLE: 46
- THERE ARE AREAS OF 10 CFR 60 THAT WERE NOT EXPLICITLY ADDRESSED IN THE DESIGN REQUIREMENTS DOCUMENTS

SUMMARY OF PRELIMINARY ASSESSMENT OF SIGNIFICANCE OF 10 CFR 60 REQUIREMENTS NOT EXPLICITLY ADDRESSED IN APPENDIX E/SDRD

- SIX ITEMS OF MINOR OR POTENTIALLY MINOR SIGNIFICANCE TO ESF TITLE I DESIGN
  - 60.21(c)(1)(ii)(D)
  - 60.21(c)(1)(ii)(E)
  - 60.131(b)(2)
  - 60.131(b)(6)
  - 60.133(g)
  - 60.140(d)(1)

- ONE ITEM MAY HAVE SIGNIFICANCE TO THE TITLE II DESIGN PROCESS
  - 60.21(c)(1)(ii)(D)

- PRELIMINARY ASSESSMENT OF SIGNIFICANCE TO TITLE I DESIGN WAS BASED PARTLY ON THE TECHNICAL ASSESSMENT REVIEW CONDUCTED DURING THE ESF 100% TITLE I DESIGN REVIEW

PRELIMINARY ASSESSMENT OF SIGNIFICANCE OF 10 CFR 60 REQUIREMENTS NOT EXPLICITLY ADDRESSED IN APPENDIX E/SDRD

	10 CFR 60 REQUIREMENT	PRELIMINARY ASSESSMENT OF SIGNIFICANCE	REMARKS
1	60.15(b)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
2	60.15(d)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
3	60.16	NONE	COMPLIANCE REQUIRED PRIOR TO SHAFT SINKING
4	60.21(c)(1)(ii)(D)	POTENTIALLY MINOR	(1) EVALUATION OF ALTERNATIVE SHAFT LOCATIONS TO BE PREPARED PRIOR TO START OF TITLE II (2) IDENTIFICATION OF ESF COMPONENTS IMPORTANT TO WASTE ISOLATION TO BE MADE PRIOR TO START OF TITLE II (3) EVALUATION OF ALTERNATIVES TO THE MAJOR DESIGN FEATURES IMPORTANT TO WASTE ISOLATION TO BE CONDUCTED DURING TITLE II
5	60.21(c)(1)(ii)(E)	POTENTIALLY MINOR	(1) IDENTIFICATION OF ESF COMPONENT IMPORTANT TO SAFETY TO BE MADE PRIOR TO START OF TITLE II (2) NO ESF COMPONENTS ARE EXPECTED TO BE IMPORTANT TO SAFETY
6	60.72(a)	NONE	COMPLIANCE WITH THIS REQUIREMENT IS NOT NEEDED UNTIL START OF ESF CONSTRUCTION
7	60.72(b)	NONE	COMPLIANCE WITH THIS REQUIREMENT IS NOT NEEDED UNTIL START OF ESF CONSTRUCTION

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PRELIMINARY ASSESSMENT OF SIGNIFICANCE OF 10 CFR 60 REQUIREMENTS NOT EXPLICITLY ADDRESSED IN APPENDIX E/SDRD (CONTINUED)

	10 CFR 60 REQUIREMENT	PRELIMINARY ASSESSMENT OF SIGNIFICANCE	REMARKS
8	60.111(a)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
9	60.111(b)(1)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
10	60.111(b)(3)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
11	60.131(b)(2)	POTENTIALLY MINOR	(1) IDENTIFICATION OF ESF COMPONENT IMPORTANT TO SAFETY TO BE MADE PRIOR TO START OF TITLE II (2) NO ESF COMPONENTS ARE EXPECTED TO BE IMPORTANT TO SAFETY
12	60.131(b)(6)	POTENTIALLY MINOR	(1) IDENTIFICATION OF ESF COMPONENTS IMPORTANT TO SAFETY TO BE MADE PRIOR TO START OF TITLE II (2) NO ESF COMPONENTS ARE EXPECTED TO BE IMPORTANT TO SAFETY
13	60.131(b)(9)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
14	60.133(a)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
15	60.133(c)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
16	60.133(e)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*

PRELIMINARY ASSESSMENT OF SIGNIFICANCE OF 10 CFR 60 REQUIREMENTS NOT EXPLICITLY ADDRESSED IN APPENDIX E/SDRD (CONTINUED)

	10 CFR 60 REQUIREMENT	PRELIMINARY ASSESSMENT OF SIGNIFICANCE	REMARKS
17	60.133(g)	MINOR	(1) TITLE I DESIGN COMPLIES WITH 60.111(a), WHICH IS REFERENCED HERE* (2) TITLE I DESIGN COMPLIES WITH 60.133(e), WHICH WOULD SHOW COMPLIANCE WITH 60.133(g)(2) REGARDING STABILITY OF OPENINGS TO ASSURE CONTINUED FUNCTIONING DURING NORMAL AND ACCIDENT CONDITIONS* (3) FURTHER EVALUATION TO BE DONE DURING TITLE II, TO ASSURE FUTURE ABILITY TO PROVIDE VENTILATION SEPARATION BETWEEN EMPLACEMENT AND EXCAVATION AREAS
18	60.133(i)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
19	60.137	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
20	60.140(b)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
21	60.140(c)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
22	60.140(d)(1)	MINOR	POTENTIAL IMPACTS CAUSED BY PERFORMANCE CONFIRMATION TESTING TO BE EVALUATED DURING TITLE II DESIGN
23	60.141(a)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
24	60.141(b)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*

PRELIMINARY ASSESSMENT OF SIGNIFICANCE OF 10 CFR 60 REQUIREMENTS NOT EXPLICITLY ADDRESSED IN APPENDIX E/SDRD (CONTINUED)

	10 CFR 60 REQUIREMENT	PRELIMINARY ASSESSMENT OF SIGNIFICANCE	REMARKS
25	60.141(c)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
26	60.141(d)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
27	60.141(e)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
28	60.142(a)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
29	60.142(b)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
30	60.142(c)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*
31	60.142(d)	NONE	TITLE I DESIGN COMPLIES WITH REQUIREMENT*

NOTE: * AS DETERMINED BY THE TECHNICAL ASSESSMENT REVIEW CONDUCTED DURING THE ESF 100% TITLE I DESIGN REVIEW

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REVIEW RESULTS

APPLICABLE 10 CFR 60 REQUIREMENTS		APPENDIX E		SDRD	
		ADDRESSED	NOT EXPLICTLY ADDRESSED	ADDRESSED	NOT EXPLICITLY ADDRESSED
1	60.15(b)		X	1.2.6.0 FR(1) 1.2.6.4 C(10) 1.2.6.6 C(2)	
2	60.15(d)		X		X*
3	60.16		X		X*
4	60.21(c)(1)(ii)(D)		X		X
5	60.21(c)(1)(ii)(E)		X		X
6	60.21(c)(11)	6.0 C(T)		1.2.6.0 C(10) 1.2.6.9 PC(1)	
7	60.72(a)	6.1 PC(4)(a)			X
8	60.72(b)	6.1 PC(4)(a)			X
9	60.74	6.0 PC(1) 6.1 PC(3)		1.2.6.0 PC(2) 1.2.6.6 PC(17) 1.2.6.8 PC(10)	
10	60.111(a)		X		X*
11	60.111(b)(1)		X		X
12	60.111(b)(3)		X		X
13	60.112	6.0 C(W)		1.2.6.0 C(3) 1.2.6.0 PC(10) 1.2.6.6 PC(3) 1.2.6.8 C(2)	
14	60.113(a)(1)(i)	6.0 PC(6)(c)		1.2.6.0 C(3) 1.2.6.6 PC(3) 1.2.6.6 PC(4)	
15	60.113(a)(1)(ii)	6.0 PC(6)(c)		1.2.6.0 PC(4) 1.2.6.0 PC(10) 1.2.6.0 C(3)	
16	60.130	THROUGHOUT		THROUGHOUT	
17	60.131(b)(1)	6.0 C(G)		1.2.6.0 C(4)	
18	60.131(b)(2)	6.0 C(H)			X
19	60.131(b)(3)	6.0 C(D) 6.0 C(I) 6.0 C(L) 6.0 PC(5)		1.2.6.0 PC(8) 1.2.6.0 PC(9) 1.2.6.0 C(2) 1.2.6.0 C(5) 1.2.6.0 C(7) 1.2.6.7.8	
20	60.131(b)(4)(i)	6.0 C(J)		1.2.6.0 C(6)	
21	60.131(b)(6)		X		X

REVIEW RESULTS (CONTINUED)

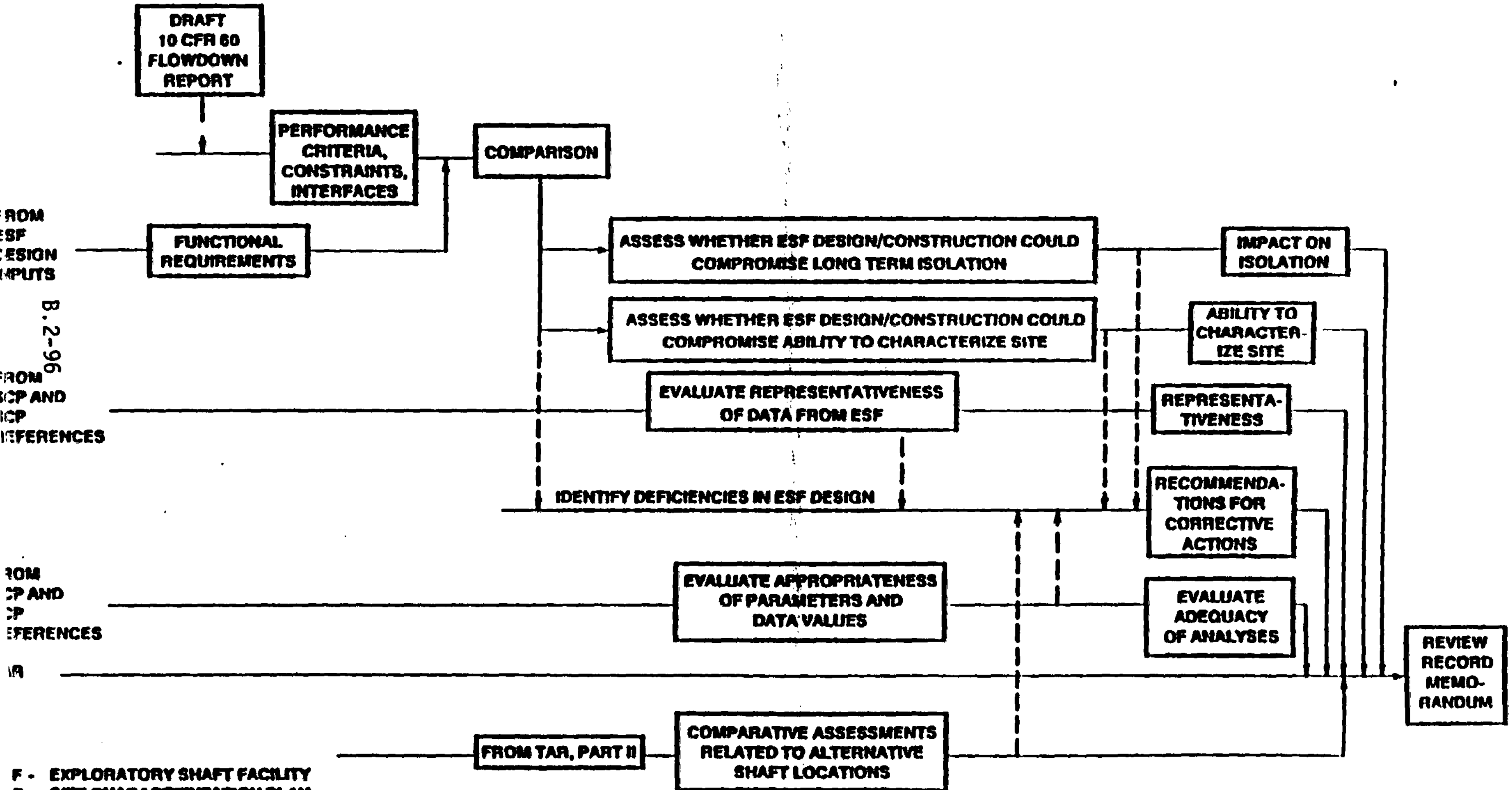
APPLICABLE 10 CFR 60 REQUIREMENTS		APPENDIX E ADDRESSED	APPENDIX E NOT EXPLICTLY ADDRESSED	SDRD ADDRESSED	SDRD NOT EXPLICITLY ADDRESSED
22	60.131(b)(9)	6.0 PC(3)(e) 6.0 PC(4)(a) 6.1 PC(5)(a)			X
23	60.133(a)	6.0 C(C)			X
24	60.133(b)	6.0 PC(1)(a) 6.0 PC(1)(b) 6.0 PC(1)(c) 6.0 PC(1)(k)		1.2.6.0 PC(2) 1.2.6.6 PC(17)	
25	60.133(c)		X		X
26	60.133(d)	6.6 PC(1)(f)		1.2.6.0 PC(7) 1.2.6.0 PC(9) 1.2.6.6 PC(18) 1.2.6.7.6 PC(6) 1.2.6.7.6 PC(7)	
27	60.133(e)		X*		X*
28	60.133(f)	6.0 C(E) 6.6 PC(1)(c) 6.6 PC(1)(d)		1.2.6.6 PC(3) 1.2.6.6 PC(23) 1.2.6.4 C(2) 1.2.6.4 C(3) 1.2.6.5 C(2) 1.2.6.5 C(3)	
29	60.133(g)		X*		X*
30	60.133(h)	6.0 PC(6)(c)		1.2.6.0 C(3) 1.2.6.6 PC(3)	
31	60.133(i)		X	1.2.6.0 C(8)	
32	60.137		X*		X*
33	60.140(b)	6.1 PC(3) 6.9 PC(2)			X
34	60.140(c)	6.1 PC(3) 6.9 PC(2)			X
35	60.140(d)(1)	6.1 PC(3) 6.9 PC(2)			X
36	60.141(a)	6.1 PC(3) 6.9 PC(2)			X
37	60.141(b)	6.1 PC(3) 6.9 PC(2)			X
38	60.141(c)	6.1 PC(3) 6.9 PC(2)			X
39	60.141(d)	6.1 PC(3) 6.9 PC(2)			X

REVIEW RESULTS (CONTINUED)

APPLICABLE 10 CFR 60 REQUIREMENTS	APPENDIX E ADDRESSED	APPENDIX E NOT EXPLICTLY ADDRESSED	SDRD ADDRESSED	SDRD NOT EXPLICITLY ADDRESSED
40 60.141(e)	6.1 PC(3) 6.9 PC(2)			X
41 60.142(a)	6.1 PC(3) 6.9 PC(2)			X
42 60.142(b)	6.1 PC(3) 6.9 PC(2)			X
43 60.142(c)	6.1 PC(3) 6.9 PC(2)			X
44 60.142(d)	6.1 PC(3) 6.9 PC(2)			X
45 60.151	6.1 PC(6)		1.2.6.0 PC(5) 1.2.6 INTRO	
46 60.152	6.1 PC(6)		1.2.6.0 PC(5) 1.2.6 INTRO	

*PARTIALLY ADDRESSED IN DOCUMENT

COMPONENTS OF TECHNICAL ASSESSMENT REVIEW



F - EXPLORATORY SHAFT FACILITY
P - SITE CHARACTERIZATION PLAN
R - TECHNICAL ASSESSMENT REVIEW

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NNI.881219.0082

ATTACHMENT 3

Presentation on the Status of ESF, Title I DAA and the Comparative Evaluations

STATUS OF PLANS FOR
TITLE I EXPLORATORY SHAFT FACILITY
DESIGN ACCEPTABILITY ANALYSIS

AND

COMPARATIVE EVALUATIONS RELATED TO
ALTERNATIVE SHAFT LOCATIONS

DOE-NRC MEETING

DECEMBER 8, 1988

MAXWELL B. BLANCHARD

REVIEW OF ELEMENTS OF DOE PLAN FOR CONDUCTING DESIGN ACCEPTABILITY ANALYSIS OF TITLE I EXPLORATORY SHAFT DESIGN

- ELEMENTS OF DESIGN ACCEPTABILITY ANALYSIS CORRELATE WITH STEPS OR PARTS OF STEPS IN THE NRC LETTER (LINEHAN TO STEIN, 11-14-88), ATTACHMENTS 2 AND 3

- THE DESIGN ACCEPTABILITY ANALYSIS WILL BE COMPLETED THROUGH A TECHNICAL ASSESSMENT REVIEW ACCORDING TO QUALITY MANAGEMENT PROCEDURE (QMP) 02-08

- FINAL DOCUMENTATION OF THE TECHNICAL ASSESSMENT REVIEW (THE TECHNICAL ASSESSMENT REVIEW RECORD MEMORANDUM) WILL INCLUDE:

  — RECOMMENDATIONS FOR APPROPRIATE CORRECTIVE ACTIONS IN TITLE II DESIGN FOR ANY DEFICIENCIES IDENTIFIED IN TITLE I DESIGN

  — RECOMMENDATIONS FOR MODIFICATIONS IN THE SITE CHARACTERIZATION PROGRAM IF RESULTS OF DATA REASONABLENESS AND REPRESENTATIVENESS REVIEWS WARRANT SUCH CHANGES

DOE-NRC Meeting
12-8-88
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COMPONENTS OF DOE DESIGN ACCEPTABILITY ANALYSIS

ATTACHMENT 2: NRC LETTER	COMPONENTS OF DESIGN ACCEPTABILITY ANALYSIS	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
Step 1a	2.3.1 Identify all 10 CFR Part 60 requirements that are applicable to the design and construction of the ESF	10 CFR 60 Flowdown Report	Review draft Flowdown Report
	Identify subset of 10 CFR Part 60 functional requirements that are relevant to 1,2,3*	SCP 8.4 has a compilation focused directly on 1,2,3*	Evaluate set of functional requirements for ESF in 10 CFR 60 and correlate to NRC concerns 1, 2, & 3*
	2.3.2 Assess the completeness of the SDRD against the list of functional requirements identified in 2.3.1		Use correlations from 2.3.1; identify the functional requirements included/ not included in SDRD

* 1, 2, & 3 refer to the NRC concerns expressed Step 2 of Attachment 2 to their letter: 1. isolation capability of the site will not be compromised; 2. capability to characterize the site will not be compromised; and 3. characterization will provide representative data.

COMPONENTS OF DESIGN ACCEPTABILITY ANALYSIS (CONTINUED)

ATTACHMENT 2: NRC LETTER	ELEMENTS OF DOE ACTION PLAN	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
Step 1, part (b)	2.3.2 Develop a list of Design and physical features/interfaces and siting, design, testing and PA	Draft YMMGDS, ESF Design, Const. & Ops Plans, SCP, SCP/CDR and list from 2.3.1	Identify design and physical features of ESF and interfaces related to 1, 2, & 3* [This is subset of ESF design information that is either defined or impacted by siting of the ESF, repository design, ESF testing, surface-based testing, or ESF/repository performance assessments.]
	Develop performance criteria and constraints for list from 2.3.1 considering list from 2.3.2 in context of 1, 2, & 3*	As above	Identify or develop (in context of 1, 2, & 3*) performance criteria and constraints for each correlation in 2.3.1, considering the list of interfaces and design/physical features from 2.3.2.
	Categorize criteria into subsets with similar impacts		

COMPONENTS OF DESIGN ACCEPTABILITY ANALYSIS (CONTINUED)

ATTACHMENT 2: NRC LETTER	COMPONENTS OF DESIGN ACCEPTABILITY ANALYSIS	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
Step 1, second option in part (c)	2.3.2 Assess the completeness of the SDRD against the list of performance criteria/constraints		On basis of correlations in 2.3.1, identify relevant performance criteria and constraints included/not included in SDRD.

COMPONENTS OF DESIGN ACCEPTABILITY ANALYSIS (CONTINUED)

ATTACHMENT 2: NRC LETTER	COMPONENTS OF DESIGN ACCEPTABILITY ANALYSIS	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
Step 2	2.3.3 Assess the current design against the design criteria to:		
(1)	a. Demonstrate the long term waste isolation capability of the site will not be compromised	Point Paper Response Obj # 4 & Sect. 8.4.3	For each criterion on the lists generated for 2.3.1 & 2.3.2 - assess whether the criteria or interfaces are relevant to 1, 2, & 3* ; (ii) the relevant criteria and interfaces were considered in the ESF design or existing assessments of ESF adequacy; and iii) the adequacy of the treatment.
(2)	b. Demonstrate that the capability to characterize the site will not be compromised.	Point Paper Response Obj # 3 & # 4 & Sect. 8.4	Same as a.

COMPONENTS OF DESIGN ACCEPTABILITY ANALYSIS (CONTINUED)

ATTACHMENT 2: NRC LETTER	COMPONENTS OF DESIGN ACCEPTABILITY ANALYSIS	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT	ACTION REQUIRED REVIEW
(3)	c. Demonstrate that characterization will provide representative data	Sec 8.4.2., SAND Repts & letters on subject ESF	Summarize representativeness arguments with emphasis on location; Assess role of ESF in developing representative program. Assess whether criteria or interfaces in 2.3.1 & 2.3.2 are relevant to representativeness concern. Assess whether the (i) criteria were considered; and (ii) the adequacy of the treatment.
Step 2: last half of paragraph	2.3.4 Demonstrate the adequacy of the analyses, including the appropriateness of data and considerations of data uncertainty	ESF RIB, RIB, and Summaries of relevant evaluations and analyses in Section 8.4	See Below*

*Required Action: A. Identify critical design features related to NRC concerns 1, 2, & 3
B. Identify analyses related to critical design features
C. Identify parameters used in analyses
D. Identify data values used for parameters
E. Identify and group key data used in design of critical design features
F. Determine how sensitive the critical design features are to uncertainty
G. Identify what are reasonable values for the parameters
H. Identify the differences between C. and G.
I. Evaluate overall adequacy of analyses in (b).

COMPONENTS OF DESIGN ACCEPTABILITY ANALYSIS (CONTINUED)

ATTACHMENT 2: NRC LETTER	COMPONENTS OF DESIGN ACCEPTABILITY ANALYSIS REVIEW	AVAILABLE INFORMATION FOR TECHNICAL ASSESSMENT	ACTION REQUIRED
Step 3	NRC-DOE meetings held 11-23-88, & scheduled for 12-8-88 to review draft action plans	Briefing package used in discussion with NRC on 11-23-88	Prepare update for use on 12-8-88
Step 4	4.3 Prepare input and recommendations for Review Record Memorandum		Prepare Technical Assessment Review Record Memorandum
Step 5	2.3.5 Identify deficiencies, if any, in criteria list or interface list, concomitant deficiencies and impact on ESF design and plans correct.	Results of 2.3.1 & 2.3.2	Summarize deficiencies, if any, in criteria lists from 2.3.1 & 2.3.2 in context of concerns (1, 2, 3*). Summarize deficiencies, if any, from 2.3.3. Prepare recommendations for corrective actions.

COMPARATIVE EVALUATIONS RELATED TO ALTERNATIVE SHAFT LOCATIONS

ELEMENTS OF EVALUATION	INFORMATION AVAILABLE FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
2.4 Prepare Comparative Evaluation of alternative shaft locations, considering (1) current site conditions; (2) expected changes to these conditions over next 10,000 years; (3) low-probability disruptive events and processes over next 10,000 yrs; and (4) alternative conceptual models of conditions at the site.	SCP Chapters 1-4; Section 8.4.3 (Impacts on Isolation); Sinnock & Lin (SNL, 1986).	A qualitative 3-part evaluation will be conducted

Evaluation of Bertram report (SAND 84-1003, ESF Site and Construction Method Recommendation Report) has 3 parts:

2.4.1. Compare alternative locations with one another, without ESF present, for:

a. significant differences among alternative locations in their potential for providing waste isolation;

b. The influence these differences might have had on selection of ESF location.

2.4.2 Compare alternative locations with one another (considering any significant differences that were observed in 1a), assuming ESF has been constructed, to:

a. Examine any adverse effects on isolation;

b. Examine the influence these effects might have had on selection of ESF location.

COMPARATIVE EVALUATIONS RELATED TO ALTERNATIVE SHAFT LOCATIONS

ELEMENTS OF EVALUATION	INFORMATION AVAILABLE FOR TECHNICAL ASSESSMENT REVIEW	ACTION REQUIRED
2.4.3 Compare the five alternative locations to the Yucca Mt. site with regard to factors contributing to waste isolation. Consider parameters such as GWTT, thickness of UZ below repository, thickness of zeolite units beneath repository, and presence of volcanic glass.		

ATTACHMENT 4

TAR Notice

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PRELIMINARY DRAFT

TECHNICAL ASSESSMENT REVIEW NOTICE

TECHNICAL ASSESSMENT REVIEW
OF THE EXPLORATORY SHAFT FACILITY (ESF)
TITLE I DESIGN CONTROL PROCESS

DECEMBER/JANUARY 1988/1989

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
LAS VEGAS, NEVADA

PRELIMINARY DRAFT

Responsibility for Conducting Technical Assessment Review

By transmitting this document to the Yucca Mountain Project managers, the Yucca Mountain Project Office authorizes the Science Applications International Corporation (SAIC), Las Vegas, NV, as the YMP designee, to conduct the Technical Assessment Review described in this document, and requests that staff support be provided for that review.

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TABLE OF CONTENTS (CONTINUED)

1.0 PREFACE

1.1 Introduction

In recent interactions with the U. S. Nuclear Regulatory Commission (NRC), the U. S. Department of Energy (DOE) has been asked to furnish information related to the 10 CFR Part 60 requirements that were considered in the Title I design of the Exploratory Shaft Facility (ESF) for the Yucca Mountain site, located in Nye County, Nevada. Appendix I is a November 14, 1988 letter from the NRC (John J. Linehan, Acting Director of Repository Licensing Project Directorate) to the DOE (Ralph Stein, Acting Associate Director, Office of Systems Integration and Regulations) explaining some of their concerns related to the acceptability of the Title I ESF design. In order to provide an integrated package of information to the NRC in response to their concerns, the DOE has decided to conduct a review of the package of information relevant to the concerns expressed by the NRC according to Quality Management Procedure (QMP) 02-08 entitled Technical Assessment Review (TAR). Science Applications International Corporation (SAIC) will plan, organize, conduct, document, and coordinate the TAR. This document, together with the transmittal letter from the YMP, satisfies the purpose and scope of QMP-02-08 Section 3.2, Technical Assessment Review Notice.

1.2 Technical Assessment Review Definitions

This TAR is being conducted by the DOE and other participating organizations according to the Quality Assurance Plan NV/88-9, Section III (Scientific Investigation and Design Control), Paragraph 5.0, (Technical Reviews), and the definitions in Appendix A for verification and technical review. QMP-02-08 adequately fulfills the intent and definitions for technical review specified in NV/88-9.

2.0 SCOPE OF THE TECHNICAL ASSESSMENT REVIEW

This section provides a description of the purpose and scope of the technical assessment review of the design control process used to develop the Title I design for the ESF. This review is divided into two parts: Part I addresses all elements of the Title I ESF design acceptability analysis, and Part II focuses on the comparison of alternative locations for the ESF. Both Parts I and II of the TAR will develop a set of review conclusions, together with recommendations for corrective actions, if it is determined that such actions are necessary as a result of the review.

2.1 Purpose of Technical Assessment Review

The purpose of the review is to: (a) determine if applicable 10 CFR Part 60 requirements were considered during Title I design of the ESF (Appendix I, Letter, NRC to DOE, Step 1, a); (b) evaluate design interfaces (Appendix I, Letter, NRC to DOE, Step 1, b); and (c) assess how the design criteria and interfaces considered during Title I ESF design address the applicable 10 CFR Part 60 requirements and interfaces (i.e. provide an analysis that "demonstrates how the current design criteria used for the Title I addresses (a) and (b)" (Appendix I, Letter, NRC to DOE, Step 1, c). In the letter from the NRC (Appendix I), the DOE was asked to analyze the ESF Title I design criteria in terms of "three general objectives in 10 CFR Part 60: (1) the long-term waste isolation capability of the site is not compromised; (2) the ability to characterize the site is not compromised; and (3) the ESF site characterization activities would provide representative data." The NRC also requested that this analysis "address the appropriateness of the data used in the design and how the uncertainties were considered." Those parts of the design that are found deficient in this analysis are to be identified by the DOE, as well as the impacts on the overall design, and actions are to be taken to correct the deficiency. A related concern to be addressed by the TAR is described on Attachment 3 of the NRC letter (Appendix I). This concern focuses on a determination of any potential differences in the isolation capability of alternative locations for the ESF.

2.2 Components of Technical Assessment Review Package

Documents that are likely to be included in the TAR package include the Generic Requirements Document/Appendix E; the ESF-SDRD, Volumes I and II; the Reference Information Base (RIB); the ESF Design Scope and Planning Document for Title I Design, prepared by Fenix & Scisson; the ESF Title I Scope and Planning Basis Document, prepared by Holmes & Narver; the ESF Title I Design Basis Document, prepared by Holmes & Narver; all codes and standards specified in these documents; the Nuclear Waste Repository in Tuff Subsurface Facility Conceptual Design ESF/Repository Interface Control Drawing Number R07048A, Sheets, 1-15, prepared by Sandia National Laboratories (SNL); the Draft 10 CFR Part 60 Flowdown Report, prepared by DOE/Headquarters (HQ); applicable parts of the Site Characterization Plan for the Yucca Mountain Site; and other documents determined to be necessary by the TAR Chairman or team members.

2.3 Scope of Part I of Technical Assessment Review - Exploratory Shaft Facility Title I Design Acceptability Analysis

Part I of the TAR includes five discrete elements. Each element is reviewed in the following sections. A logic diagram displaying the elements of Part I is shown in Figure 1.

2.3.1 Technical Assessment Review Part I - Element 1: Assessment of 10 CFR Part 60 Requirements in the Yucca Mountain Project Subsystem Design Requirements Document

Preparation of this element of the Technical Assessment Review (TAR) package has been assisted by actions taken by DOE/HQ. An analysis of the flowdown of 10 CFR Part 60 requirements into the Generic Requirements Document, Appendix E has recently been completed. This analysis was conducted in accordance with the DOE/HQ Quality Implementing Procedure (QIP) 3.2 for Technical Reviews. Some of the products from the DOE/HQ review will be used in Part I, Element 1 of the TAR. A draft package containing the following items will serve as input to the TAR team: Report on Applicability of 10 CFR 60 Requirements; Technical Review Report on Appendix E (GR); Technical Review

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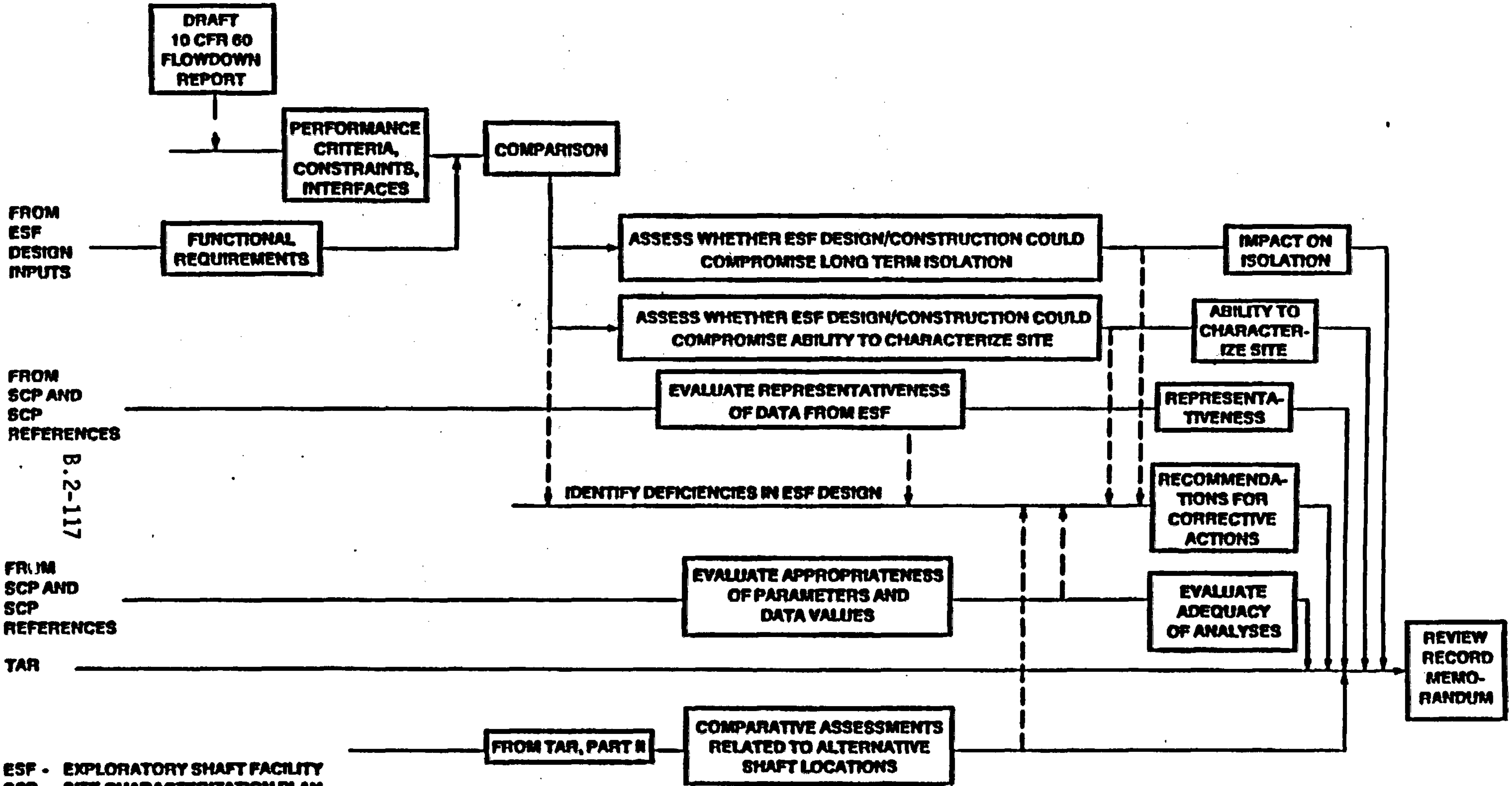
FIGURE 1: Logic diagram for Part I of Technical Assessment Review: Design acceptability analysis

COMPONENTS OF TECHNICAL ASSESSMENT REVIEW



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ESF - EXPLORATORY SHAFT FACILITY
SCP - SITE CHARACTERIZATION PLAN
TAR - TECHNICAL ASSESSMENT REVIEW

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Report on A/E Design Basis Documents; Baseline Change Proposals for Appendix E; and, DOE/HQ direction to YMP for revising the SDRD and Basis for Design.

In Element I, the TAR members will review the information provided by the DOE/HQ flowdown analysis about 10 CFR Part 60 requirements that are applicable to the ESF Title I design. The subset of 10 CFR Part 60 requirements that are relevant to the NRC's concerns expressed in Step 2 of Attachment 2 of their letter (See Appendix I) will be identified. The NRC concerns are summarized as follows: (1) isolation capability of the site will not be compromised; (2) capability to characterize the site will not be compromised; and (3) site characterization will provide representative data. The TAR team will assess the completeness of the coverage of these requirements in the SDRD and will identify any requirements not adequately covered. The results of this review will be summarized as recommendations in the TAR Record Memorandum (See Section 4.2.2).

2.3.2 Technical Assessment Review Part I - Element 2: Evaluation of Design Interfaces and Assessment of Completeness of Title I ESF Design Requirements

Element 2 of the TAR consists of reviewing the list of design and physical features and interfaces for siting of the ESF, repository design, ESF testing, surface-based testing, or ESF and repository performance assessments. A partial list of sources for this information are provided in Section 2.2. The TAR team will identify those design and physical features and interfaces that are related to the three NRC concerns: (1) isolation capability of the site will not be compromised; (2) capability to characterize the site will not be compromised; and (3) site characterization will provide representative data. Performance criteria and constraints for the 10 CFR Part 60 requirements that were found to be relevant to the NRC concerns in TAR Part I, Element 1, will be correlated with the subset of design/physical features and interfaces that are related to the NRC concerns. The TAR team will then review the SDRD and other design documentation to determine those performance criteria and constraints that are adequately represented and those for which additional performance criteria and constraints should be developed. Recommendations resulting from Part I, Element 2, for performance criteria and constraints that should be added to the SDRD will be prepared as a part of the TAR Record Memorandum.

2.3.3 Technical Assessment Review Part I - Element 3: Assessment of Adequacy of the Current ESF Title I Design Criteria

For Element 3 of Part I of the TAR, the TAR team will review the current 100 % Title I ESF design to determine if the requirements, criteria, constraints, and interfaces identified in Elements 1 and 2 are adequately reflected in the design or in existing assessments. The focus of this element of the TAR is on those requirements, criteria, constraints, and interfaces relevant to the NRC's three concerns: (1) long term waste isolation capability of the site will not be compromised; (2) capability to characterize the site will not be compromised; and (3) characterization will provide representative data. For purposes of assessing the representativeness of data to be obtained during site characterization, the role of the ESF in developing a representative program will be reviewed.

The criteria and interfaces identified in Elements 2 will be reviewed to determine if they are relevant to the representativeness concern.

Element 3 will also include an assessment of the adequacy of those calculations summarized in SCP Section 8.4 that address the three major concerns expressed by the NRC, and summarized in the previous paragraph.

The Review Record Memorandum for the 100% Title I ESF Design Review will serve as a component of the TAR package. Recommendations resulting from any deficiencies identified in the current design under this element will be included in the Review Record Memorandum for this TAR.

2.3.4 Technical Assessment Review Part I - Element 4: Assessment of the Appropriateness of Data Used in Design Analyses, Consideration of Data Uncertainties, and Adequacy of Evaluations

Element 4 of Part I of the TAR will focus on the parameters and data used for performance analyses and calculations related to the three NRC concerns presented in Section 2.3.3. Many of the relevant analyses are summarized in Section 8.4 of the Site Characterization Plan (SCP) and described in more detail in supporting references. The TAR will evaluate the adequacy of the analyses and calculations, including the appropriateness of the data or values used in those calculations that address the concerns expressed by the NRC. The appropriateness and reasonableness of the data and parameters will be reviewed relative to the data and parameters included in the Reference Information Base for the Yucca Mountain Project and other sources as deemed necessary by the TAR team. The team will also review the analyses and calculations to establish how uncertainties in data and models were used to determine that items described in 2.3.2 (1), (2), and (3) have been adequately satisfied.

The steps that will be taken in Element 4 are as follows:

a. Identify critical design features relevant to NRC concerns (See Section 2.3.3);
b. Identify analyses related to critical design features in (a);
c. Identify parameters used in analyses in (b);
d. Identify data values used for parameters in (c);
e. Identify and group key data used in design of critical design features according to NRC concerns;
f. Determine how sensitive the critical design features (a) are to uncertainty;
g. Identify what are reasonable values for the parameters;
h. Identify the differences between c and g;
i. Evaluate overall adequacy of analyses in (b)

All recommendations related to the appropriateness of the analyses and data will become part of the Review Record Memorandum for this TAR.

2.3.5 Technical Assessment Review Part I - Element 5: Assessment of Impacts on Design and Recommendations for Corrective Measures

Element 5 of Part I of the TAR will result in a summary of the deficiencies, if present, in the requirements, criteria, constraints, and interfaces identified in the current ESF 100% Title I Design Package (Sections 2.3.1 - 2.3.3), as well a summary of any deficiencies identified in assessments, including data and parameter values used, of impacts of site characterization (Section 2.3.4). The TAR team will develop recommendations for correcting the deficiencies and will include the recommendations in the Review Record Memorandum for this TAR. These recommendations will include consideration of any deficiencies so significant as to bring into question the adequacy of the ESF Title I design presented in the SCP.

2.4 Scope of Part II of Technical Assessment Review: Assessment of the Alternative Locations for the Exploratory Shaft Facility

Part II of the TAR is being conducted in response to the NRC's concerns expressed on Attachment 2 of their letter, included with this package as Appendix I. These concerns are related to whether the alternative locations considered for the ESF in Bertram (1985; SAND84-1003) may have differed in their waste isolation capabilities, and further, what effects these differences might have had if they had been an explicit part of the selection process. Part II is composed of three distinct elements, which are described in following sections. All three elements will assess the alternative locations relative to current site conditions; expected changes in current conditions over the next 10,000 years; low-probability disruptive events and processes over the next 10,000 years; and alternative conceptual models of conditions at the site. Figure 2 provides the overall logic for Part II of the TAR.

2.4.1 Technical Assessment Review Part II - Element 1: Assessment of Alternative Locations for the ESF to Determine if there are Significant Differences in the Potential for Providing Waste Isolation Without the ESF Present

The five alternative ESF locations considered in the Bertram (1985) document will be reviewed without an ESF present, to determine if there are significant differences among the alternative locations in their potential for providing waste isolation. The influence any differences might have had on selection of the ESF location will then be examined.

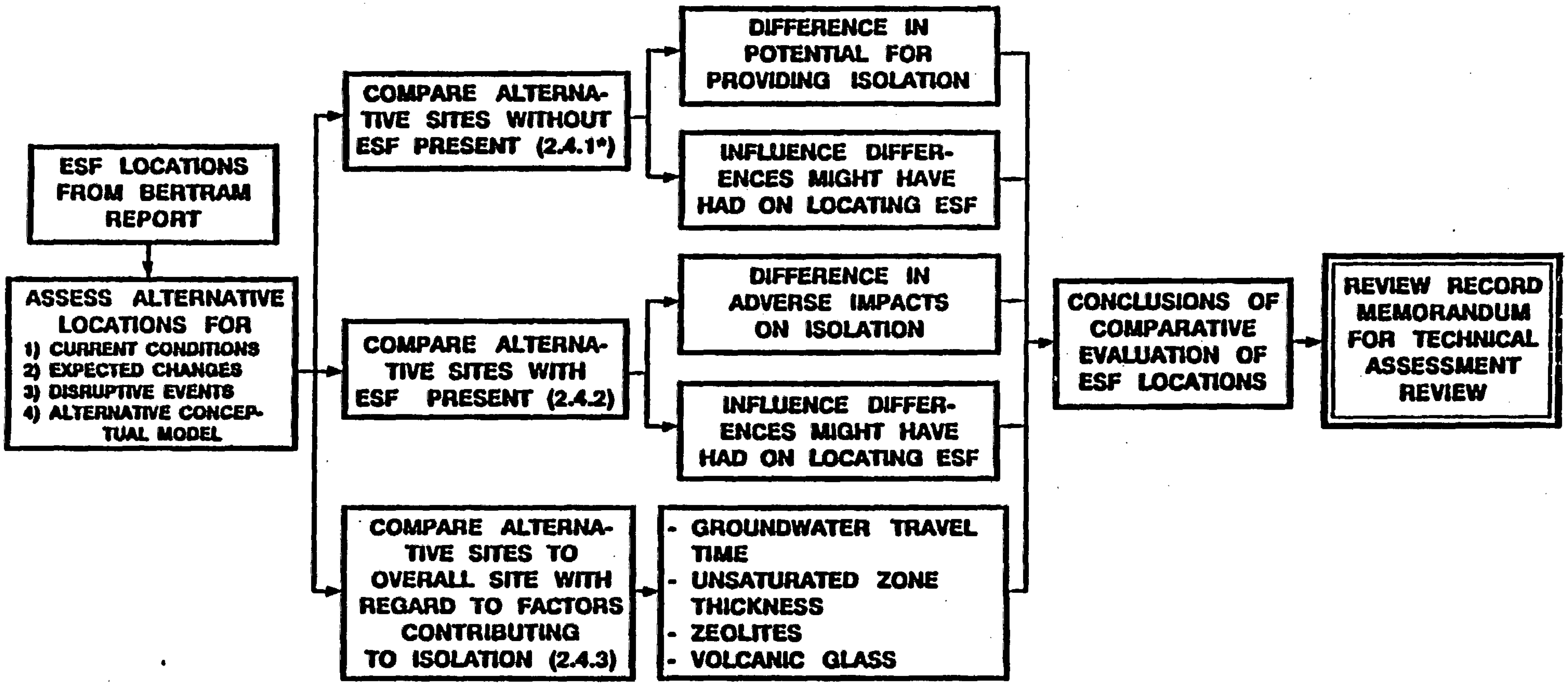
All input related to differences in isolation potential among the alternative locations and recommendations resulting from this review will become a part of the TAR Record Memorandum.

2.4.2 Technical Assessment Review Part II - Element 2: Assessment of Alternative Locations for the ESF to Determine if there are Significant Differences in the Potential for Providing Waste Isolation with the ESF Present

The five alternative ESF locations considered in the Bertram (1985) document will be compared, assuming that an ESF has been constructed at each

Figure 2: Logic for Part II of Technical Assessment Review: Evaluation of alternative locations for the Exploratory Shaft Facility

COMPARATIVE ANALYSIS OF ALTERNATIVE ESF LOCATION



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ESF - EXPLORATORY SHAFT FACILITY
SDRD - SUBSYSTEM DESIGN REQUIREMENTS DOCUMENT
* - SECTION REFERENCES IN TECHNICAL ASSESSMENT REVIEW NOTICE

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alternative location, to determine if there are any differences in potential adverse impacts on isolation capabilities at the sites. The influence any differences might have had on selection of the ESF location will be examined.

All input and recommendations related to potential differences in the isolation potential of alternative shaft locations will become a part of the TAR Record Memorandum.

2.4.3 Technical Assessment Review Part II- Element 3: Assessment of Alternative ESF Locations Compared to Isolation Potential for the Overall Site

The five alternative ESF locations considered in the Bertram (1985) document will be compared with other possible ESF locations within the conceptual perimeter drift boundary of the repository with regard to factors contributing to waste isolation. Parameters such as ground-water travel time; thickness of the unsaturated zone below the repository horizon; thickness of the zeolite units beneath the repository horizon; and the presence of volcanic glass wil be considered.

All conclusions and recommendations related to the variation of factors contributing to isolation at the alternative ESf locations will become a part of the TAR Record Memorandum.

3.0 PLAN BASIS

3.1 Organizations

The following organizations will participate in the Technical Assessment Review:

- o U. S. Department of Energy/Headquarters (DOE/HQ)
- o U. S. Department of Energy/Nevada - Yucca Mountain Project Office (PO)
- o Roy F. Weston, Inc.
- o U. S. Geological Survey (USGS)
- o Science Applications International Corporation (SAIC)
- o Sandia National Laboratories (SNL)
- o Los Alamos National Laboratory (Los Alamos)

SAIC will provide a small multidisciplinary team, the Technical Assessment Review Committee (TARC), to act as a part of the Technical Assessment Review Team. The TARC will include a YMP Branch Chief, who is responsible for ensuring that all actions taken by the TARC are in accord with YMP policy. The TARC will also include a Review Chairman, a Review Secretary, a Quality Assurance specialist, and one or two technical specialists with responsibility for assisting the Review Chairman in assembling the TAR products into an integrated package. The following individuals are designated as members of the TARC:

YMP - Technical Assessment Review Committee Representative: Robert Levich
TARC Chairman: Jerry King

TARC Secretary: David Goings
SAIC Quality Assurance: John Jardine (alternate: Peter Karnoski)
Technical Specialist: Carolyn Rutland

The TARC chairman is responsible for coordinating all efforts among the members of the TAR team, with the assistance of the YMP-TARC representative. Organizations participating in the TAR will provide reviewers for the review team, and will designate a lead reviewer for their respective organization. A suggested list of lead reviewers is provided in Table 1. The TARC chairman may add other reviewers to the team as he deems necessary for successful completion of the TAR.

3.2 Technical Assessment Review Team Selection

Selection of team members is based on the individual's independence, qualifications, and technical or scientific speciality. Specific parts the TAR review package will be identified as requiring familiarity with various documents or regulations.

Table 1: List of suggested reviewers and specialities for each participating organization.

Organization	Representative	Speciality
DOE/HQ	Jeff Kimball	ESF Regulatory Requirements
YMPO	Arch Girdley	ESF Regulatory Requirements
Weston	Mike Lugo	NRC Regulatory Requirements
SAIC	Mike Voegele	Correlation of NRC Design Requirements to ESF Design
	August Mathussen	ESF Performance Analyses Database
	Keith Kersch	Impacts of Site Characterization on Site Hydrology
	John Shaler	Mining Engineering & ESF Design
SNL	Joe Tillerson	Correlation of NRC Design Requirements to ESF Design
	Scott Sinnock	Comparison of Alternative ESF Locations
	Felton Bingham	Performance Analyses to Assess ESF Impacts
USGS	Bill Wilson Bill Langer	Adequacy of Hydrologic Calculations in 8.4
PNL	Charlie Voss	General Geotechnical Review and Geomechanics

This is a tentative list and will be confirmed by the participating organizations on the first official day of the review proceedings.

In order to meet the qualifications specified, each team member will, as a minimmm, possess a Bachelors Degree and five years of experience or the demonstrated equivalency of training and experience in their area of expertise. Team member's qualifications will be certified and documented by the team member's supervisor. Documentation will be prepared on the YMPO Proficiency Review Report, Form no. N-QA-007 and provided to the TARC Secretary on or before the first day of the start of the review. Background data/material substantiating the qualification certification should be retained at the team member's place of employment. Background data/material may be subject to audit by personnel from the Nuclear regulatory Commission or the U.S. Department of Energy. The completed form N-QA-007 will be included in the TAR Record Memorandum. This section satisfies QMP-02-08, Section 5.2.

3.3 Location and Time of Technical Assessment Review

A schedule for the TAR is provided in Section 5.0. The TAR will officially begin at a workshop, attended by all members of the review team on December 12-13, 1988, in Room 637 at the SAIC offices in Las Vegas, NV, located at 101 Convention Center Drive. The workshop will convene at 8:30 a.m. It is likely that a number of working sessions will be scheduled in order to complete the TAR on the planned schedule. The TARC Chairman is responsible for determining the need for additional TAR team working sessions and scheduling rooms and logistical support.

4.0 TECHNICAL ASSESSMENT REVIEW PROCESS

4.1 Pre-Review

The PO has requested that SAIC conduct a Technical Assessment Review with multiple participating organizations. The Technical Assessment Review Committee Secretary will coordinate all review activities, including transmitting the meeting announcements, review notice, and TAR package to all team members. The participating organizations are requested to provide the reviewer qualifications, and to make the reviewers available for the duration of the TAR.

The TARC Secretary should ensure that a Technical Assessment Review Notice announcing the planned review is sent to each participating organization. As noted earlier, this document, together with the formal transmittal letter from the YMP, constitutes the TAR Notice. Upon receipt of this Review Notice, the cognizant managers at the participating organizations should respond to the TAR Chairman by letter, with copy to the YMP representative, providing an acknowledgement of receipt of the Review Notice, statements of qualifications for the reviewers from their respective organizations, and should arrange for the necessary commitment of reviewers for the TAR period. SAIC will provide meeting rooms and logistical support for the reviewers throughout the duration of the TAR.

Reviewers must complete the YMP QA training on QMP-02-08 prior to acceptance of their input into the review process. An integral part of the reviewer's qualification training consists of attendance at the initial Review Presentation and Indoctrination, active participation during the TAR, and providing input to the TAR Review Record Memorandum.

4.2 Review Process Outline

An overview of the purpose and scope of this TAR and QA training for the TAR will be provided at the initial TAR team meeting on December 12-13, 1988 (Room 637, SAIC offices, Las Vegas, NV). Prior to the meeting, reviewers are required to become familiar with QMP-02-08, and with this document, describing the scope of the TAR. The TARC will identify the documents that are to be included in the TAR package and will make this package available to the reviewers at the initial meeting. This action will satisfy Sections 3.4 and 4.2 of QMP-02-08, compiling a data package for the TAR.

The principal guidance to be provided to the reviewers, in addition to the purpose and scope of the TAR includes: responsibility of participants; guidelines for preparation of input to the Review Record Memorandum; and review input preparation instructions.

Reviewers for each participating organization are to provide input for the Review Record Memorandum to the TARC Secretary. It is the reviewer's responsibility to ensure that his/her input is appropriate, relevant, and not redundant to other input submitted by other reviewers from his organization. Reviewers will use the TAR input form attached to this package (modified from N-QA-006). The TARC Chairman or Secretary will review the input to ensure it is within scope and appropriate. The TARC Chairman and the cognizant YMP representative on the TARC will resolve problems related to preparation of input and development of recommendations on the basis of the input. The TARC Secretary will compile all input into an integrated package for inclusion in the Review Record Memorandum.

Some input resulting from this TAR will lead to the development of a list of recommendations to be provided to DOE management for deficiencies that should be corrected in the ESF Title II Design. Other input may lead to recommendations for changes that should be made in the site characterization plans for the Yucca Mountain site. These recommendations would be incorporated into semiannual progress reports as appropriate. It is the intent of the DOE that some form of recommendations should result from all problems identified as a result of the TAR. If unreconciled differences of opinion occur or if reviewers are uncertain as to the appropriate recommendation to be offered, the TAR Secretary will include these items as open items in the Review Record Memorandum (RRM). If it is judged to be appropriate by the TARC Chairman, the cognizant manager from the participating organization may be requested to provide a recommendation for closing the open item prior to completion of the TAR. This satisfies Sections 5.5.3 and 5.5.5 of QMP-02-08.

Remaining open items and recommended actions resulting from the TAR will be addressed during the DOE Management Assessment Review, planned to immediately follow completion of the TAR. The purpose of the Management Assessment Review is to ensure that plans are in place to address all recommended actions resulting from the TAR. This action satisfies Section 5.7 of QMP-02-08, Closure of Resolution.

4.2.1 Instructions to Reviewers

A. General Guidance

The reviewer should provide concise statements of concerns and recommended actions as a result of the TAR. Input from the reviewers should be understandable without dialog, and should provide specific information about actions that can be taken to resolve all problems identified during the TAR. The TAR Review Record Memorandum should be assembled with enough detail to communicate the intent of the input.

B. Specific Guidance

1. The input should not, in general, be provided in the form of questions.

2. Use of terms such as "more detail required", "change" or "clarify" without specific suggestions should be avoided.

3. Provide supporting evidence if a technical error is identified. Provide a page number and paragraph if a supporting document is cited.

4. The reviewer should restrict his input to his specific area of qualified expertise.

5. All input must be written on the TAR input forms provided.

6. To meet the short schedule imposed on this TAR, reviewers are required to sign a "Reviewer Designation Authority", which designates signature authority to their organization's lead reviewer so that the review process can continue in the absence of any individual reviewer.

7. The TARC Chairman will review, sign, and date each reviewer's input included in the Review Record Memorandum to ensure that all TAR results are presented as supporting information, recommendations for actions, or as open items to be considered by the DOE Management Assessment Review.

4.2.2 Development of Input to the Review Record Memorandum

Input Development

The TARC Chairman will provide written instructions to the reviewers at the initial TAR meeting on December 12-13, 1988. These instructions will describe the sequence of steps to be followed in reviewing the TAR package; developing input to the Review Record Memorandum; reviewing the word-processed packages of each reviewer's input; and participating in working sessions to develop recommendations for correction of deficiencies, as well as those open items to be included in the Review Record Memorandum for the TAR.

4.2.3 Input Identification

A scheme will be developed by the TARC Chairman and provided to reviewers at the initial TAR meeting on December 12-13, 1988. The input from each reviewer will be given an identification number that will include, at least, a designation as to the organization providing the input, and the initials of the reviewer.

4.3 Review Record Memorandum

The TARC Secretary collects all reviewer input, recommendations and other relevant information from the TAR and prepares a final report in the form of a Review Record Memorandum (RRM). The TARC Chairman, as well as the cognizant YMP representative on the TARC, sign the RRM, and issue it to the YMP Office. The dates for issuance of the RRM are shown on the schedule in Section 5.0.

The RRM shall contain, at a minimmm, the following items:

Scope of the Review
Technical Assessment Review Notice
Technical Assessment Review Meeting minutes
Technical Assessment Review Team Selection Record
Technical Assessment Review Input Records
List of meeting attendees and their Technical Assessment Review Responsibilities
Documentation of Design Acceptability Analyses and Performance Analyses
Recommendations for Actions to Address Design Deficiencies
Documentation of Open Items

The RRM will be issued approximately 15 calendar days after the final TAR meeting to reach a consensus on actions needed to address deficiencies.

5.0 SCHEDULE/ACTIVITIES

6.0 ACRONYMNS

APPENDIX I

November 14, 1988, Letter from Linehan to Stein

Rcvd 11/17/88

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

NOV 1 4 1988

Pg 1

Mr. Ralph Stein, Acting Associate Director
Office of Systems Integration and Regulations
Office of Civilian Radioactive Waste Management
U. S. Department of Energy RW-24
Washington, D. C. 20545

Dear Mr. Stein:

The purpose of this letter is to transmit a copy of the meeting minutes prepared by the Nuclear Regulatory Commission (NRC) staff covering the November 3, 1988 meeting on the design control issues associated with the exploratory shaft facility. The minutes, along with supporting attachments, are contained in the enclosure. If you have any additional questions, please contact the NRC project manager for this subject, Mr. Joe Holonich at (301) 492-3403 or FTS 492-3403.

Sincerely,

John J. Linehan

John J. Linehan, Acting Director
Repository Licensing Project Directorate
Division of High-Level Waste Management

Enclosures: As stated

cc: C. Gertz, DOE
R. Loux, State of Nevada
K. Turner, GAO

8802112

Pg 2

ENCLOSURE

On November 3, 1988 members of the Nuclear Regulatory Commission (NRC) staff met with representatives from the Department of Energy (DOE), the State of Nevada, and Nye County, Nevada to discuss the design control on the exploratory shaft facility (ESF). A list of attendees is contained in Attachment 1. During the meeting, the NRC staff identified one acceptable approach DOE could use to demonstrate the adequacy of the current design. The approach was reviewed and revised based on input received from other participants. The final, tentatively agreed upon version is contained in Attachment 2. In addition, DOE presented its approach to evaluating alternative exploratory shaft locations. A copy of this is contained in Attachment 3. The NRC staff noted that it believes that the DOE approach by itself would not be acceptable; however, further staff discussions would be necessary before a final position would be taken.

Joseph J. Holonich 11/4/88

Joseph J. Holonich, Sr. Project Manager
Repository Licensing Project Directorate
Division of High-Level Waste Management
Office of Nuclear Material Safety and Safeguards
U. S. Nuclear Regulatory Commission

Pg 3

Attachment 1

Attendees

NRC
J. Holonich
J. Kennedy
J. Linehan
K. Stablein
M. Nataraja
D. Gupta
J. Conway

STATE OF NEVADA
C. Johnson

NYE COUNTY
E. Holstein

DOE
E. Wilmont
G. Appel
R. Stein
J. Saltzman
L. Barrett
S. Echols

WESTON
D. Siefken

GENERAL ACCOUNTING OFFICE
K. Turner
E. Nakamura

Pg 4

Attachment 2

Design Acceptability Analysis

In the site characterization plan (SCP), the Department of Energy (DOE) will be providing design information on the exploratory shaft facility (ESF) that was developed without a design control process that met 10 CFR Part 60, Subpart G. Before the staff can comment on the ESF design information presented in the SCP, DOE must first demonstrate that the design meets the applicable 10 CFR Part 60 technical requirements. One acceptable approach to demonstrate the acceptability of the ESF design is outlined below.

Develop and implement a plan that meets the appropriate requirements of 88-9 and addresses Steps 1 and 2.

Step 1

Provide an analysis for 10 CFR Part 60 requirements which:

(a) identifies all 10 CFR Part 60 requirements that are applicable to the design and construction of the ESF;

(b) evaluates design interfaces; and

(c) generates design criteria based on (a) and (b) or demonstrates how the current design criteria used for the Title I addresses (a) and (b).

Step 2

DOE should analyze the current design against the design criteria generated under 1(c). This analysis should demonstrate that the ESF design and construction satisfy the three general objectives in 10 CFR Part 60. These are: (1) the long-term waste isolation capability of the site is not compromised; (2) the ability to characterize the site is not compromised; and (3) the ESF site characterization activities would provide representative data. This analysis should also address the appropriateness of the data used in the design and how the uncertainties were considered. The analysis is not intended to meet NUREG-1298, "Qualification of Existing Data for HLW Repositories," but will demonstrate the reasonableness of the data for the type of analyses being performed.

Step 3

DOE needs to brief NRC on the design control process and quality assurance applied to the ESF Title I design to the degree it was relied upon in the design acceptability analysis as well as the methodology for and status of the design acceptability analysis prior to the SCP.

Step 4

DOE should submit the design acceptability analysis to the staff for review along with the SCP.

Step 5

For any area of the design found unacceptable by DOE during the design acceptability analysis, DOE should identify the impact on the overall design and the DOE actions to correct the deficiency.

Step 6

After the SCP is issued, DOE should independently confirm the design acceptability analysis through an on-site review that is observed by NRC.

Step 7

Based on the results of Step 6, the NRC staff will assess the need for it to conduct a visit to evaluate the QA and technical aspects of the ESF Title I design and the design acceptability analysis.

Step 8

The ability of the staff to comment on the ESF will be dependent on the timeliness and ability of DOE to demonstrate the adequacy of the design and to independently confirm the design acceptability.

Prior to the start of sinking of the ESF, DOE must have a fully qualified QA program, including design control, in place for ESF activities.

P45

III. PERFORM COMPARATIVE EVALUATIONS RELATED TO ALTERNATIVE SHAFT LOCATIONS TO EXAMINE:

- ANY SIGNIFICANT DIFFERENCES IN THE CAPABILITY OF THOSE LOCATIONS TO ISOLATE OR CONTAIN WASTES AND WHAT INFLUENCE, IF ANY, THESE DIFFERENCES MAY HAVE HAD ON THE SELECTION OF THE PREFERRED SHAFT LOCATION IF THEY HAD BEEN AN EXPLICIT PART OF THE SELECTION PROCESS

- ANY SIGNIFICANT ADVERSE EFFECTS THAT A SHAFT MIGHT HAVE ON THE ABILITY OF THE LOCATION TO CONTAIN AND ISOLATE WASTE AND WHAT INFLUENCE, IF ANY, THESE DIFFERENCES MAY HAVE HAD ON THE SELECTION OF THE PREFERRED SHAFT LOCATION IF THEY HAD BEEN AN EXPLICIT PART OF THE SELECTION PROCESS

ATTACHMENT 5

Presentation on the Preliminary Results of the

Applicable 10 CFR Part 60 Requirements

DOE-NRC Meeting
12-8-88
Backup Material
page 1

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS

	APPLICABLE 10 CFR 60 REQUIREMENTS	NRC CONCERNS 1	2	3
1	60.15(b) ..site characterization to include in situ exploration & testing at depths of waste emplacment			X
2	60.15(d)(1)	X		
	(2)	X		X
	(3)	X		X
	(4)			
3	60.16			
4	60.21(c)(1)(ii)(d)	X		
5	60.21(c)(1)(ii)(e)			
6	60.21(c)(11)	X		
7	60.72(a)			
8	60.72(b)			
9	60.74	X	X	X
10	60.111(a)			
11	60.111(b)(1) ..preserve the option of waste retrieval throughout ...			
12	60.111(b)(3)			
13	60.112	X		
14	60.113(a)(1)(i)	X		
15	60.113(a)(1)(ii)	X		
16	601.130	X		

DOE-NRC Meeting
12-8-88
Backup Material
page 2

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS (CONTINUED)

	APPLICABLE 10 CFR 60 REQUIREMENTS	NRC CONCERNS 1	2	3
17	60.131(b)(1)...structures, systems components important to safety .. designed natural phenomena and environmental conditions anticipated ...will not intefere with necessary safety functions....			
18	60.131(b)(2)			
19	60.131(b)(3)			
20	60.131(b)(4)(i)			
21	60.131(b)(6)			
22	60.131(b)(9)			
23	60.133(a)(1)	X		
	(2)	X	X	
24	60.133(b)...underground facility to be designed with sufficient flexibility to allow adjustments...to accomodate specific site conditions	X	X	X
25	60.133(c)			
26	60.133(d)	X	X	
27	60.133(e)(1)			
	(2)	X	X	
28	60.133(f)	X	X	
29	60.133(g)			
30	60.133(h)	X		
31	60.133(i)	X		
32	60.137	X		X
33	60.140(b)			
34	60.140(c)			

REVIEW OF FLOWDOWN: PRELIMINARY RESULTS (CONTINUED)

APPLICABLE 10 CFR 60 REQUIREMENTS		NRC CONCERNS 1	2	3
35	60.140(d)(1)..program does not adversely affect the ability of the natural and engineered elements of the geologic repository to meet the performance objectives.....	X		
36	60.141(a)			
37	60.141(b)			
38	60.141(c)			
39	60.141(d)			
40	60.141(e)			
41	60.142(a)			
42	60.142(b)			
43	60.142(c)			
44	60.142(d)			
45	60.151	X	X	X
46	60.152	X	X	X

NRC CONCERN ABOUT RELYING ON EXISTING DATA AT FACE VALUE

DOE RESPONSE

(A) SECTION 2.3.4 - ELEMENT 4, ASSESSMENT OF DATA USED IN DESIGN ANALYSIS AND CONSIDERATION OF DATA UNCERTAINTIES:

DESCRIBES THE TASK AND SPECIFIES THAT ASSESSMENTS WILL BE CONDUCTED OF THE DATA AND THE ANALYSES THAT FORM THE BASIS FOR THE CONCLUSIONS THAT (1) THE LONG-TERM WASTE ISOLATION CAPABILITY OF THE SITE IS NOT COMPROMISED; AND (2) THE ABILITY TO CHARACTERIZE THE SITE IS NOT COMPROMISED. THE ASSESSMENT DESCRIBES A COMPREHENSIVE 10-STEP APPROACH.

(B) QMP-02-08, PARA. 3.1 REQUIRES QUALIFIED INDIVIDUALS OTHER THAN THOSE WHO PRODUCED THE TECHNICAL WORK BEING REVIEWED.

EXAMPLE OF DATA "REASONABLENESS" ANALYSIS (TAR 2.3.4)

A. CRITICAL DESIGN FEATURES
Elevation of current ESF location

B. ANALYSES RELATED TO CRITICAL DESIGN FEATURE
Analysis of surface water flooding of exploratory shaft due to occurrence of Probable Maximum Flood (PMF)

C. PARAMETERS USED IN ANALYSIS
1. Thunderstorm probable maximum precipitation
2. Clear water peak flood discharge volume of PMF
3. Flood discharge volume for PMF with debris
4. Topography of Coyote Wash
5. Elevation of exploratory shaft collar

D. DATA VALUES
14 inches in 6 hours; volume of 129 acre-feet for Coyote Wash drainage area; 3354 cfs (C1)
3,350 cubic feet per second (C2)
5,025 cubic feet per second (C3)
Topography taken from topographic maps (C4)
≈4,140 feet above mean sea level (C5)

E. SENSITIVITY OF CRITICAL DESIGN FEATURES TO UNCERTAINTY
SCP estimates that peak flood discharge value needed to flood the shaft is 45 times larger than the clear water PMF discharge

F. REASONABLE VALUES FOR PARAMETERS
Current values are reasonable and indicate that even an increase in the PMF discharge by an order of magnitude would not flood the shaft

APPENDIX IV

NRC and State-of-Nevada Comments on Preliminary Draft TAR Plan

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DEC 19 1988

NN1.881229.0015

Mr. Ralph Stein, Associate Director
Office of Systems Integration and Regulation
Office of Civilian Radioactive Waste Management
U. S. Department of Energy RW-24
Washington, D. C. 20545

Dear Mr. Stein:

SUBJECT: COMMENTS ON TECHNICAL ASSESSMENT REVIEW NOTICE

The purpose of this letter is to transmit several concerns identified by the U. S. Nuclear Regulatory Commission (NRC) staff on the Technical Assessment Review (TAR) Notice provided by the U. S. Department of Energy (DOE) at the December 8, 1988 meeting on the exploratory shaft facility (ESF) design acceptability analysis (DAA). Based on its review of the TAR Notice, the NRC staff has identified two general and 19 specific comments or questions. These are detailed in the enclosure. In addition to the staff comments, the State of Nevada also has comments on the Notice. Both the staff and State of Nevada comments were discussed with representatives from DOE on a December 14, 1988 conference call.

In order for the staff to be able to complete its review of the ESF DAA on a timely basis, DOE should provide its response to these comments as part of the DAA submittal. If DOE cannot meet this schedule, please inform the staff of this within five working days of the date of this letter. If you require any additional assistance, please contact the NRC project manager for this subject, Mr. Joe Holonich, who can be reached at (301) 492-3403 or FTS 492-3403.

Sincerely,

John Linehan

John J. Linehan, Director
Repository Licensing and Quality
Assurance Project Directorate
Division of High-Level Waste Management

cc: C. Gertz, DOE/NV
R. Loux, State of Nevada

ENCLOSURE
STAFF COMMENTS ON TAR NOTICE

General Comment 1

Throughout the document, the Department of Energy (DOE) states that the issues of importance pertain to (1) waste isolation, (2) ability to characterize the site, and (3) representativeness of the site. At the December 8, 1988 meeting, the NRC staff stated that the design acceptability analysis (DAA) needs to cover all of the applicable 10 CFR Part 60 requirements. DOE should revise the Technical Assessment Review (TAR) to incorporate this.

General Comment 2

Where is the need to conduct a quality assurance (QA) surveillance, if not an audit, covered in the TAR? The staff cannot find a description of this activity. The only mention of QA is on page 10 where the TAR states: "Background data/material may be subject to audit by personnel from the Nuclear regulatory (sic) Commission or the U. S. Department of Energy." This effort is not sufficient. Therefore, DOE should revise the TAR Notice to describe how and to what level QA surveillances or audits will be performed.

Comment 1, Page 1, Section 2.1

Item (c) in Section 2.1 deals with how the design criteria and interfaces considered during Title I ESF design address the applicable 10 CFR Part 60 requirements and interfaces. This does not achieve the objectives of item 1(c) of the DAA which requires that DOE generate new criteria for those portions of 10 CFR Part 60 that were not considered in the design. Section 2.1 limits the approach to only those that were considered during Title I design.

Comment 2, Page 2, Section 2.2

In this section DOE discusses several documents that are to be included in the TAR package. Not included are the comments on the 50% and 100% design reviews. DOE should provide the rationale for not including these two documents. In addition, DOE should discuss how reference documents will be included in the TAR.

Comment 3, Page 2, Section 2.3.1

On the fourth line from the bottom of the page, DOE states that "Some of the products from the DOE/HQ review will be used in Part I, Element I of the TAR." Please identify the specific products or types of products that should be considered.

Comment 4, Page 4, Section 2.3.1 (Continued)

In the last paragraph of this section, fourth line from the end, DOE states that: "The TAR team will assess the completeness of the coverage of these requirements in the SDRD and will identify any requirements not adequately covered." First, the staff is concerned that the assessment will not cover all of the applicable 10 CFR Part 60 requirements because DOE has limited the scope of the TAR to cover only those requirements that fulfill the three major objectives. Second, DOE should add the following words to the end of the sentence, "... or that conflict with 10 CFR Part 60 requirements."

Comment 5, Page 4, Section 2.3.2

Please clarify the scope of Element 2.

Comment 6, Page 4, Section 2.3.2

Midway through Section 2.3.2 DOE makes the following sentence.

> "Performance criteria and constraints for the 10 CFR Part 60 requirements that were found to be relevant to the NRC concerns in TAR Part I, Element 1, will be correlated with the subset of design /physical features and interfaces that are related to the NRC concerns."

What are the subset of design/physical features and interfaces and how are they determined?

Comment 7, Page 4, Section 2.3.2

It does not appear that DOE considered organizational interfaces in its evaluation of interfaces. Please provide a description of how organizational interfaces are considered.

Comment 8, Page 5, Section 2.3.4

In step a. of the steps listed in this section, the TAR states: "critical design features relevant to NRC concerns?" What are the critiical design features and how are they determined?

Comment 9, Page 5, Section 2.3.4

In Step 2. of the DAA, DOE is suppose to address the appropriateness of the data used in the analysis as well as describe how uncertainties are considered. Where and how are uncertainties considered in steps a. through i?

Comment 10, Pages 4 and 5, Sections 2.3.3 and 2.3.4

In Section 2.3.3, DOE describes the process for demonstrating the adequacy of the design, and in Section 2.3.4 discusses how the appropriateness of data will be determined. Are these two steps reversed? If not, why not?

Comment 11, Page 5, Section 2.3.4

Should step h. read: Identify the differences between (d) and (g); instead of between (c) and (g)?

Comment 12, Page 6, Section 2.4

How are the recommendations in the Bertram report (SAND 84-1003) being considered?

Comment 13, Page 8, Section 2.4.3

Why did DOE exclude flooding and erosion from the parameters to be considered in the alternatives analysis?

Comment 14, Page 8, Section 2.4.3

There is no discussion of how DOE considered site representativeness and the ability to characterize the site in its determination of ESF location. In addition, DOE does not describe how alternatives to the major design features of the ESF will be considered. Where and how will this be done?

Comment 15, Page 8, Section 3.1

Why is Reynolds Electric and Enginnering Comapny (REECo) not included in the organizations involved in the TAR?

Comment 16, Page 9, Section 3.2

Several individuals who are identified as suggested reviewers or specialists for the TAR effort have been previously involved in the ESF design. How does DOE ensure the independence of the TAR with their involvement?

Comment 17, Page 9, Section 3.2

Why are individuals from the Los Alamos National Laboratory and REECo not included on the the list of suggested reviewers? In addition, a representative from Battelle Pacific Northwest Laboratory (PNL) is listed as a suggested reviewer; however, PNL is not included on the list of organizations involved in the TAR. Please explain this descrepancy.

Comment 18, Page 9, Section 3.2

There are no dedicated geologists on the list of suggested reviewers. Please explain why DOE did not consider one?

Comment 19, Page 11, Section 4.2

On the last paragraph of page 11, DOE states that recommendations for changes that should be made to the SCP will be incorporated into semiannual progress reports. If significant deficiencies are found with the information in the SCP, DOE cannot wait for semiannual progress reports. However, there is no provision for this in the TAR. Please provide a discussion of what steps will be followed if a significant deficiency is found.

RICHARD H. BRYAN
Governor

STATE OF NEVADA

ROBERT R. LOUX
Executive Director

NN1.881223.0117

AGENCY FOR NUCLEAR PROJECTS
NUCLEAR WASTE PROJECT OFFICE

Capitol Complex
Carson City, Nevada 89710
(702) 885-3744

ACTION
CC: POWELL / DIXON
CC: GERTZ / WILMOT
CC: ~~SMITH~~ KAISER
CC: VOLEK - SAIC
CC: ROBISON
CC: PETRIE
CC: BACA
CC: IORII / ROBSON
CC: DYMMEL / EDWARDS
CC: MORLEY
REC'D IN WMPO
12-23-88

December 19, 1988

Mr. Ralph Stein, Acting Associate Director
Office of System Integration and Regulations
Office of Civilian Radioactive Waste Management
Washington, D.C. 20545

Dear Mr. Stein:

The purpose of this letter is to submit the comments of the State of Nevada regarding the Preliminary Draft of the Technical Assessment Review Notice describing the Technical Assessment Review of The Exploratory Shaft Facility Title I Design Control Process as presented at the NRC/DOE meeting in Washington, D.C. on December 08, 1988.

The State of Nevada has the following general comments:

G1. As defined in QMP NV/88-9, a "Technical Review" is an "a documented traceable review performed by qualified personnel who are independent of those who performed the work----Technical reviews are indepth, critical reviews, analyses and evaluation of documents etc----." We question whether the scope as presented will result in an indepth review. We find the TAR notice lacking in scope of review guidelines; guidance to reviewers on use of supporting data in individual files; and review rationale and justification for data assumptions used.

G2. Step 1a of the NRC letter to DOE (November 14, 1988, Linehan to Stein, Attachment 2) requests the DOE to identify ALL 10 CFR Part 60 requirements that are applicable to the design and construction of the ESF. The TAR Notice seems to indicate that the review will focus <u>only</u> on the three general objectives in 10 CFR Part 60 as outlined in Step 2 of the above letter. All requirements should be revisited.

The State also has the following specific comments:

S1. Page 2, Sec 2.1. The final sentence of Sec. 2.1 reads, " This concern focuses on a determination of any potential differences in the isolation capability of alternative locations for the ESF". We suggest that the scope here be enlarged to "focus on a determination of all potential differences in the performance capabilities of alternate locations for the ESF as well as alternatives to major design features." Our point here is that isolation should not be the only criteria involved and neither should location be the only alternative feature compared.

S2. Page 3, Flowchart of Components. It is our understanding that the TAR Review Recommendation will accompany the presentation of the SCP in late December of 1988. Yet the flowsheet indicates that part of the review input will be from the "SCP and SCP References" (center left margin). How can the SCP be used as a source when it is not yet published or reviewed by the NRC or public?

S3. Same ref as S2. Referring to the "Recommendations for Corrective Actions" box (lower right) we point out that some of these corrective actions could well change the design basis for Title II Design work or even require revisions to the Title I Design. The chart fails to show how these courses of action are accommodated.

S4. Page 5, Sec. 2.3.3. Final paragraph of this section states that the Review Record Memorandum for the 100% Title I ESF Design Review will serve as a component of the Tar Package. We do not view this document as a "given" and therefore a questionable input source. Actually, this document should be one of the many reviewed by the TARC.

S5. Page 6, Sec. 2.4. In the assessment of alternative locations for the ESF as shown in the Bertram Report it is important to consider all applicable criteria of Part 60, not just the isolation capabilities of each site. Examples of other comparisons: how are the various sites affected by site characterization/repository construction; how do the sites compare regarding representativeness?

S6. Page 6, Sec 2.4.2. Last paragraph talks of a comparison of the ESF sites assuming that an ESF has been constructed at each alternative location. We question on what design are these theoretical ESF's based? If you use a generic design there will be little, if any difference in the five facilities. To our knowledge only one site specific design exists, that for the Coyote Wash site. To use site specific designs in order to get a realistic comparison, four more designs must be developed.

S7. Page 8, Sec 2.4.3. Element 3 describes comparison of the Bertram Report sites with other possible sites within the conceptual perimeter drift boundary. What is the rationale for considering only sites <u>within</u> the boundary? Further, are the parameters listed for consideration the only criteria that will be reviewed. There are more.

S8. Page 9, Table 1, Suggested Reviewers. We question the independence of one member of the team, since one of his works, SAND82-0650 is referenced in the Bertram Report. We also question why the team includes no QA specialists.

S9. Page 10, Sec. 4.1. We see no indication of the duration of the TARC review. The notice requests a "necessary commitment" for the team members but our page 14 (Schedule/Activities) is blank. We fear that the time remaining before the December 30 SCP delivery date will not permit an indepth review.

S10. Page 11, Sec 4.2. The final sentence on this page outlines the procedure to settle unreconciled differences within the TAR team, namely via a recommendation requested from a manager from a participating organization. We point out that this action will perhaps breach the independence of the team by introducing input from outside the team.

I look forward to your suggested resolution of these comments. Please feel free to contact this office if you require clarification of any of the above comments.

Sincerely,

Carl A. Johnson /for

Robert L. Loux
Executive Director

cc: John Linehan, NRC
Carl Gertz, DOE/YMP

APPENDIX V

Responses to NRC and State-of-Nevada Comments on Preliminary Draft TAR Plan

RESPONSES TO NRC STAFF COMMENTS ON TAR NOTICE

General Comment 1

Throughout the document, the DOE states that the issues of importance pertain to (1) waste isolation, (2) ability to characterize the site, and (3) representativeness of the site. At the December 8, 1988 meeting, the NRC staff stated that the design acceptability analysis (DAA) needs to cover all of the applicable 10 CFR 60 requirements. DOE should revise the TAR to incorporate this.

DOE Response

The TAR identified all applicable 10 CFR 60 requirements, analyzed in detail how Title I ESF Design addressed those requirements related to the three major issues cited above (hereinafter referred to as Concerns 1, 2 and 3), and, per the agreement reached at the December 8, 1988 meeting, provided a rationale for why a detailed analysis of other Part 60 requirements can be deferred to Title II design activities. These other Part 60 requirements are identified and considered in Section 2.6 of the Review Record Memorandum (RRM), and it is concluded there that detailed ESF design and performance criteria for these requirements can be developed and implemented in Title II Design, with low likelihood of any changes to the Title I Design that would result in significant modification to the schedule, configuration, or technical approach for ESF-related site characterization activities.

General Comment 2

Where is the need to conduct a quality assurance (QA) surveillance, if not an audit, covered in the TAR? The staff cannot find a description of this activity. The only mention of QA is on page 10 where the TAR states: "Background data/material may be subject to audit by personnel from the Nuclear Regulatory Commission or the U.S. Department of Energy." This effort is not sufficient. Therefore, DOE should revise the TAR Notice to describe how and to what level QA surveillances or audits will be performed.

DOE Response

The need to conduct a surveillance is a management decision that need not necessarily be identified in the TAR Notice. The TAR Notice was issued in compliance with Quality Management Procedure QMP-02-08, Rev. 0 and satisfies the requirements of the Yucca Mountain Project (YMP) Quality Assurance Plan, NNWSI/88-9, Rev. 2. The Quality Assurance Plan provides for annual audits of activities conducted by each of the Project Participants and for surveillances of activities as necessary. Two surveillances of the TAR process were, in fact, jointly conducted by DOE Headquarters (HQ) and the YMP, with an NRC observer present.

Comment 1, Page 1, Section 2.1

Item (c) in Section 2.1 deals with how the design criteria and interfaces considered during Title I ESF design address the applicable 10 CFR Part 60 requirements and interfaces. This does not achieve the objectives of item 1(c) of the DAA which requires that DOE generate new criteria for those portions of 10 CFR Part 60 that were not considered in the design. Section 2.1 limits the approach to only those that were considered during Title I design.

DOE Response

The TAR identified all ESF-applicable 10 CFR 60 requirements, identified those requirements related to Concerns 1, 2, and 3, generated design criteria for this subset of Part 60 requirements, and assessed the adequacy of the Title I Design against the design criteria. In accordance with the agreement reached at the December 8, 1988 meeting, a rationale is provided in the RRM (Section 2.6) for why criteria development for other Part 60 requirements can be deferred to Title II design activities. The DOE is generating design criteria based on all applicable 10 CFR 60 requirements and design interfaces as a prerequisite to ESF Title II Design.

Comment 2, Page 2, Section 2.2

In this section DOE discusses several documents that are to be included in the TAR package. Not included are the comments on the 50% and the 100% design reviews. DOE should provide the rationale for not including these two documents. In addition, DOE should discuss how reference documents will be included in the TAR.

DOE Response

The objective of the TAR was to perform an independent review of ESF Title I Design, and previous reviews were not revisited. Comments on the 50% and 100% design reviews were, therefore, not included in the TAR Package. Documents included in the TAR Package were those documents that TAR Team members needed to assess to determine the adequacy of the ESF Title I Design, i.e., the Subsystem Design Requirements Document (SDRD) used for ESF Title I Design, those documents that constitute the ESF Title I Design, and reports with calculations or analyses that support the Title I Design (see Appendix E of RRM).

In addition to documents in the TAR Package, the TAR Team utilized "resource documents" and reference material. Resource documents are documents used by the TAR Team to support the DAA, such as the Part 60 regulatory flowdown analysis (see response to Comment 3) and Section 8.4 of the statutory SCP. All resource documents utilized are documented in the TAR Review Record Memorandum (RRM). Reference material is cited in normal fashion in the RRM, and cited references were verified.

Comment 3, Page 2, Section 2.3.1

On the fourth line from the bottom of the page, DOE states that "Some of the products from the DOE/HQ review will be used in Part I, Element I of the TAR."

Please identify the specific products or types of products that should be considered.

DOE Response

A report by the Technical Oversight Group (TOG), "Applicability of 10 CFR Part 60 Requirements to the Yucca Mountain Exploratory Shaft Facility," was used as the starting point for the DAA. This report was prepared by DOE/HQ under DOE/HQ Quality Implementing Procedure 3.2 for technical reviews. The TAR Team used this report as a basis for identifying the Part 60 requirements that ESF Title I Design should address. The TOG report was the only product utilized from the subject HQ review.

Comment 4, Page 4, Section 2.3.1 (Continued)

In the last paragraph of this section, fourth line from the end, DOE states that: "The TAR team will assess the completeness of the coverage of these requirements in the SDRD and will identify any requirements not adequately covered." First, the staff is concerned that the assessment will not cover all of the applicable 10 CFR Part 60 requirements because DOE has limited the scope of the TAR to cover only those requirements that fulfill the three major objectives. Second, DOE should add the following words to the end of the sentence, "...or that conflict with 10 CFR Part 60 requirements."

DOE Response

The first part of this comment reiterates the concerns stated in Comment 1 and in General Comment 1. Please refer to the responses to those comments here.

Potential conflicts of ESF Title I Design with Part 60 requirements were considered by the TAR Team in TAR Part I, Element 3, in which the adequacy of ESF Title I Design was judged against design/performance criteria relevant to Concerns 1, 2 and 3 and in the development of the rationale for why development of criteria for Part 60 requirements not related to Concerns 1, 2 and 3 can be deferred to Title II Design activities. It is thus not necessary to add the requested phrase to the scope of TAR Part I, Element 1, which assessed the SDRD against Part 60 requirements.

Comment 5, Page 4, Section 2.3.2

Please clarify the scope of Element 2.

DOE Response

The objective of TAR Part I, Element 2 was to assess the extent to which the design/performance criteria and constraints in the SDRD used during Title I Design address Part 60 requirements relevant to Concerns 1, 2 and 3. This was accomplished, for each relevant requirement (identified in TAR Part I, Element 1) by: (1) Identifying interfaces to testing, performance assessment, site, and repository design; (2) determining the ESF physical system elements for which criteria are needed; (3) preparing a correlation matrix which reflects these relationships; (4) developing a list of criteria for each requirement and physical system element; and (5) comparing these criteria against the criteria in the SDRD.

Comment 6, Page 4, Section 2.3.2

Midway through Section 2.3.2 DOE makes the following sentence (sic).

> "Performance criteria and constraints for the 10 CFR Part 60 requirements that were found to be relevant to the NRC concerns in TAR Part I, Element 1, will be correlated with the subset of design/physical features and interfaces that are related to the NRC concerns."

What are the subset of design/physical features and interfaces and how are they determined?

DOE Response

The subset of design/physical features comprises surface facilities, the site, surface utilities, the ground surface, the first shaft, the second shaft, underground (U/G) excavations, U/G utilities, U/G tests, and decommissioning. The subset of interfaces consists of testing, performance assessment, the site, and the repository.

The subject subsets were determined by identifying those features and interfaces that are either defined or impacted by siting of the ESF, repository design, ESF testing, surface-based testing, or ESF- and repository performance assessments.

Comment 7, Page 4, Section 2.3.2

It does not appear that DOE considered organizational interfaces in its evaluation of interfaces. Please provide a description of how organizational interfaces are considered.

DOE Response

The TAR Team assessed the adequacy of the ESF Title I Design itself, and did not review the organizational interfaces or procedures by which the Title I Design was developed. Because the Title I Design was found to be acceptable, it may be concluded, however, that the organizational interfaces and procedures for ESF Title I Design were also acceptable. The organizational interfaces in place for Title I Design have been documented in a separate YMP report, "Yucca Mountain Project ESF Title I Design Control Process Review Report."

<u>Comment 8, Page 5, Section 2.3.4</u>

In step a. of the steps listed in this section, the TAR states "<u>critical</u> design features relevant to NRC concerns?" What are the critical design features and how are they determined?

<u>DOE Response</u>

The reference to critical design features was deleted and does not appear in the final TAR Plan. The focus of TAR Part I, Element 4 was expanded to include analyses and calculations relevant to Concerns 1, 2, and 3, not just analyses and calculations related to critical design features that are relevant to Concerns 1, 2, and 3.

<u>Comment 9, Page 5, Section 2.3.4</u>

In Step 2 of the DAA, DOE is suppose (sic) to address the appropriateness of the data used in the analysis as well as describe how uncertainties are considered. Where and how are uncertainties considered in steps (a) through (i)?

<u>DOE Response</u>

The subject section of the TAR Plan was modified, and steps (a) through (i) were not prescribed in the final TAR Plan. The steps followed in TAR Part I, Element 4 are detailed in Section 2.3 of the RRM.

The adequacy of the treatment of uncertainty in particular analyses and calculations which supported ESF Title I Design was assessed by individual reviewers with technical qualifications appropriate for the material being reviewed, e.g., qualified hydrogeologists were assigned to review the adequacy of supporting hydrogeological analyses and calculations, including the appropriateness of data and assumed parameter values and the adequacy of the treatment of uncertainty. The names of the reviewers and the results of each review are documented in Appendix I of the RRM.

<u>Comment 10, Pages 4 and 5, Sections 2.3.3 and 2.3.4</u>

In Section 2.3.3, DOE describes the process for demonstrating the adequacy of the design, and in Section 2.3.4 discusses how the appropriateness of data will be determined. Are these two steps reversed? If not, why not?

<u>DOE Response</u>

The two steps referred to in this comment were performed concurrently rather than sequentially. In TAR Part I, Element 3, a subcommittee of the TAR Team assessed the adequacy of ESF Title I Design against design/performance criteria. In TAR Part I, Element 4, a different subcommittee concurrently evaluated data reasonableness and treatment of uncertainty. The significance of deficiencies identified in both Elements 3 and 4 was judged and recommendations for corrective measures were developed in Part I, Element 5.

Comment 11, Page 5, Section 2.3.4

Should step h. read: Identify the differences between (d) and (g); instead between (c) and (g)?

DOE Response

Yes; this was a typographical error in the draft Plan. However, in the final Plan, steps (a) through (i) do not appear (see response to Comment 9).

Comment 12, Page 6, Section 2.4

How are the recommendations in the Bertram report (SAND 84-1003) being considered?

DOE Response

The Bertam report recommended a location near Coyote Wash for the ESF and recommended that conventional mining (blasting) techniques be used for ESF construction (as opposed to a number of drilling options).

Part II of the TAR (see Chapter 3 of the RRM) evaluated significant differences in waste-isolation potential of alternative exploratory-shaft locations and assessed what influence, if any, these differences might have had on the selection of the preferred shaft location had they been an explicit consideration in the location-selection process described in the Bertram report.

The TAR did not revisit the recommendation to use conventional mining techniques for ESF construction. However, design/performance criteria for ESF construction methods were generated and used to assess the adequacy of Title I Design (see Sections 2.2 and 2.3 of the RRM).

Comment 13, Page 8, Section 2.4.3

Why did DOE exclude flooding and erosion from the parameters to be considered in the alternatives analysis?

DOE Response

DOE did not exclude flooding and erosion from the parameters that were considered in the alternatives analysis. The topography of the site was used as a surrogate measure of each alternative site's potential for flooding and erosion (see Chapter 3 and Appendix J of the RRM).

Comment 14, Page 8, Section 2.4.3

There is no discussion of how DOE considered site representativeness and the ability to characterize the site in its determination of ESF location. In addition, DOE does not describe how alternatives to the major design features of the ESF will be considered. Where and how will this be done?

DOE Response

The Title I ESF Design must preserve the ability to characterize the site and the ability of the site program to collect data that are representative of the site. These two general requirements are referred to here as NRC Concerns 2 and 3, respectively, and were addressed in the TAR through the generation of detailed design criteria and comparison of the Title I Design against these criteria (See Sections 2.2 and 2.3 of the RRM).

To provide the NRC staff with information in addition to that developed in the DAA, a comparative evaluation of alternative shaft locations with respect to factors associated with waste-isolation potential was conducted in Part II of the TAR. Although data representativeness and ability to characterize the site were not explicitly considered in the compilation of information about each alternative location, information germane to waste-isolation potential is also germane to data representativeness and site-characterization ability. A conclusion of the comparative evaluation (see Chapter 3 of the RRM) is that the current ESF location will permit detailed characterization of a part of the repository which may have the lowest waste-isolation potential and will, therefore, provide for a conservative representation of site characteristics.

Comment 15, Page 8, Section 3.1

Why is Reynolds Electric and Engineering Company (REECo) not included in the organizations involved in the TAR?

DOE Response

TAR Team members were chosen based on technical qualifications, independence, familiarity with the Yucca Mountain Project, availability, and the need for a manageable number of participants. The DOE believes that the TAR Team collectively embodies more than sufficient program knowledge and technical expertise to accomplish the scope and purpose of the TAR. In particular, the TAR Team included mining engineers with extensive experience related to the practical aspects of implementing the ESF design.

The DOE recognizes the need for involvement in the design process of the participants who are responsible for design, scientific tests, performance assessment, and construction and operation. REECo personnel were not involved in the TAR, but are involved in the Title II Design prerequisite activities and will be involved in Title II Design.

Comment 16, Page 9, Section 3.2

Several individuals who are identified as suggested reviewers or specialists for the TAR effort have been previously involved in the ESF design. How does DOE ensure the independence of the TAR with their involvement?

DOE Response

The independence criteria established for the TAR are that no TAR reviewer can have been a principal contributor to ESF Title I Design or to the version of the

SDRD which was used for Title I Design. Some Project Office and DOE/HQ personnel who are familiar with ESF Title I Design were purposefully chosen so that the TAR Team could conduct a thorough and timely review. This approach to choosing review team members is consonant with NRC guidance provided for peer reviews in NUREG-1298 (page 23, response to Comment #2-4).

Compliance with the independence criteria was certified by each team member's employer. In addition, each team member filled out a questionnaire documenting any connections to ESF Title I Design. The employer certifications and questionnaires may be found in Appendix C of the RRM.

Comment 17, Page 9, Section 3.2

Why are individuals from the Los Alamos National Laboratory and REECo not included on the list of suggested reviewers? In addition, a representative from Battelle Pacific Northwest Laboratory (PNL) is listed as a suggested reviewer; however, PNL is not included on the list of organizations involved in the TAR. Please explain this discrepancy.

DOE Response

The final list of TAR Team members includes an individual from Los Alamos National Laboratory (see Appendix H of the RRM). Regarding REECo representation, please see the response to Comment 15.

The final TAR Plan includes PNL on the list of organizations involved in the TAR.

Comment 18, Page 9, Section 3.2

There are no dedicated geologists on the list of suggested reviewers. Please explain why DOE did not consider one? (sic)

DOE Response

Three people on the original list of suggested reviewers are qualified geologists. The final list of TAR reviewers includes four qualified geologists (see Appendix H of the RRM).

Comment 19 Page 11, Section 4.2

On the last paragraph of page 11, DOE states that recommendations for changes that should be made to the SCP will be incorporated into semiannual progress reports. If significant deficiencies are found with the information in the SCP, DOE cannot wait for semiannual progress reports. However, there is no provision for this in the TAR. Please provide a discussion of what steps will be followed if a significant deficiency is found.

DOE Response

Several revisions to the SCP were recommended by the TAR Team, with an indication that the revisions could be appropriately addressed in semiannual progress reports (see Section 2.4 of the RRM). No deficiencies in the SCP were found that would significantly impact the Title I ESF Design.

RESPONSES TO STATE OF NEVADA COMMENTS ON TAR NOTICE

Comment G1

As defined in QMP NV/88-9, a "Technical Review" is an "a documented traceable review performed by qualified personnel who are independent of those who performed the work----Technical reviews are in-depth, critical reviews, analyses and evaluation of documents etc----." We question whether the scope as presented will result in an in-depth review. We find the TAR notice lacking in scope of review guidelines; guidance to reviewers on use of supporting data in individual files; and review rationale and justification for data assumptions used.

DOE Response

The development of review criteria and a methodology for developing and documenting conclusions and recommendations was an intermediate objective of the review; it would have been inappropriate to specify these in advance. The TAR Team developed a process involving subcommittees for developing and documenting criteria, conclusions, and recommendations that is documented in detail in the Review Record Memorandum.

The final TAR Plan discusses the use of "resource documents" in the conduct of the TAR. Resource documents are documents used by the TAR Team to support the Design Acceptability Analysis (DAA), such as Section 8.4 of the statutory SCP. These documents are distinguished from documents in the TAR Package, which are those documents being assessed for adequacy, i.e., SDRD used for ESF Title I Design and those documents that constitute ESF Title I Design. A list of resource documents and documents in the TAR Package is provided in Appendix E of the TAR Review Record Memorandum (RRM).

Reviewers were free to use information in individual files with the caveat that, in all cases, the basis for their conclusions had to be documented and included in the RRM, (see Section 2.2 of the final TAR Plan).

Comment G2

Step 1a of the NRC letter to DOE (November 14, 1988, Linehan to Stein, Attachment 2) requests the DOE to identify ALL 10 CFR Part 60 requirements that are applicable to the design and construction of the ESF. The TAR Notice seems to indicate that the review will focus only on the three general objectives in 10 CFR Part 60 as outlined in Step 2 of the above letter. All requirements should be revisited.

DOE Response

The TAR identified all applicable 10 CFR 60 requirements, analyzed in detail how Title I ESF Design addressed those requirements related to the three major issues cited above (hereinafter referred to as Concerns 1, 2 and 3), and, per the agreement reached at the December 8, 1988 meeting, provided a rationale for why a detailed analysis of other Part 60 requirements can be deferred to Title II design activities. These other Part 60 requirements are identified and considered in Section 2.6 of the Review Record Memorandum (RRM), and it is concluded there that detailed ESF design and performance criteria for these requirements can be developed and implemented in Title II Design, with low likelihood of any changes to the Title I Design that would result in significant modification to the schedule, configuration, or technical approach for ESF-related site characterization activities.

Comment S1. Page 2, Sec. 2.1

The final sentence of Sec. 2.1 reads, "This concern focuses on a determination of any potential differences in the isolation capability of alternative locations for the ESF." We suggest that the scope here be enlarged to "focus on a determination of all potential differences in the performance capabilities of alternate locations for the ESF as well as alternatives to major design features." Our point here is that isolation should not be the only criteria involved and neither should location be the only alternative feature compared.

DOE Response

The Title I ESF Design must preserve the ability to characterize the site and the ability of the site program to collect data that are representative of the site. These two general requirements are referred to here as NRC Concerns 2 and 3, respectively, and were addressed in the TAR through the generation of detailed design criteria and comparison of the Title I Design against these criteria (See Sections 2.2 and 2.3 of the RRM).

To provide the NRC staff with information in addition to that developed in the DAA, a comparative evaluation of alternative shaft locations with respect to factors associated with waste-isolation potential was conducted in Part II of the TAR. Although data representativeness and ability to characterize the site were not explicitly considered in the compilation of information about each alternative location, information germane to waste-isolation potential is also germane to data representativeness and site-characterization ability. A conclusion of the comparative evaluation (see Chapter 3 of the RRM) is that the current ESF location will permit detailed characterization of a part of the repository which may have the lowest waste-isolation potential and will, therefore, provide for a conservative representation of site characteristics.

Comment S2. Page 3, Flowchart of Components.

It is our understanding that the TAR Review Recommendation will accompany the presentation of the SCP in late December of 1988. Yet the flowsheet indicated that part of the review input will be from the "SCP and SCP References" (center left margin). How can the SCP be used as a source when it is not yet published or reviewed by the NRC or public?

DOE Response

Although the SCP was not distributed until late December, 1988, the DOE reviewed and approved the SCP in November of 1988 in order to arrange for printing and distribution of the many copies anticipated to be requested by interested parties. The TAR team therefore had access to the approved final SCP and SCP references during the entire Technical Assessment Review process. A review of the SCP by the NRC or the public is not a constraint to the review process conducted by the DOE.

Comment S3.

Same ref as S2. Referring to the "Recommendations for Corrective Actions" box (lower right) we point out that some of these corrective actions could well change the design basis for Title II Design work or even require revisions to the Title I Design. The chart fails to show how these courses of action are accommodated.

DOE Response

No recommendations for revisions to the Title I Design resulted from the TAR, but recommendations were made regarding prerequisites to the start of Title II Design work and Title II Design work itself, and were documented on TAR Comment Record forms (see Appendix G of the RRM). One or more supplements to the RRM will be issued when resolutions on the TAR recommendations are obtained and documented on these forms.

Comment S4. Page 5, Sec. 2.3.3

Final paragraph of this section states that the Review Record Memorandum for the 100% Title I ESF Design Review will serve as a component of the TAR Package. We do not view this document as a "given" and therefore a questionable input source. Actually, this document should be one of the many reviewed by the TARC.

DOE Response

The subject statement was incorrect and does not appear in the final TAR Plan. The TAR Package comprises those documents being reviewed for adequacy, i.e., the SDRD that was used for ESF Title I Design, documents that constitute ESF Title I Design, and reports with calculations or analyses which supported Title I Design. The TAR Team conducted a new, independent design review and did not revisit earlier design reviews.

Comment S5. Page 6, Sec. 2.4

In the assessment of alternative locations for the ESF as shown in the Bertram Report it is important to consider all applicable criteria of Part 60, not just the isolation capabilities of each site. Examples of other comparisons: how are the various sites affected by site characterization/repository construction; how do the sites compare regarding representativeness?

DOE Response

Please refer to the response to Comment S1.

Comment S6. Page 6, Sec. 2.4.2

Last paragraph talks of a comparison of the ESF sites assuming that an ESF has been constructed at each alternative location. We question on what design are these theoretical ESF's based? If you use a generic design, there will be little, if any difference in the five facilities. To our knowledge only one site specific design exists, that for the Coyote Wash site. To use site specific designs in order to get a realistic comparison, four more designs must be developed.

DOE Response

The subject paragraph has been clarified in the final TAR Plan to indicate that the comparative evaluation considers potentially adverse effects that an exploratory shaft might have on the isolation capability of alternative locations and the influence these effects might have had on the selection of the ESF location, had they been explicitly considered in the location-selection process. Consideration of ESF-design-specific differences in the potential effects of a shaft on waste-isolation potential is outside the scope of the comparative evaluation.

Comment S7. Page 8, Sec 2.4.3.

Element 3 describes comparison of the Bertram Report sites with other possible sites within the conceptual perimeter drift boundary. What is the rationale for considering only sites within the boundary? Further, are the parameters listed for consideration the only criteria that will be reviewed.(sic) There are more.

DOE Response

The primary function of the ESF is to obtain information about the geologic formations which would be relied on to isolate emplaced waste. Accordingly, the ability of the ESF to obtain the information needed to characterize the waste-isolation potential of the site is the paramount consideration in ESF location and design, assuming that the waste-isolation potential of the prospective repository to be associated with the ESF substantially exceeds postclosure performance requirements. For this reason, the comparative evaluation of exploratory shaft locations considered the waste-isolation potential of sites within the conceptual perimeter drift boundary.

The parameters listed for consideration were only examples. Other parameters were, in fact, considered, such as topography and the location of faults.

Comment S8. Page 9, Table 1, Suggested Reviewers

We question the independence of one member of the team, since one of his works, SAND82-0650 is referenced in the Bertram Report. We also question why the team includes no QA specialists.

DOE Response

The independence criterion established for participation as a reviewer in the TAR was that the reviewer can not have been a principal contributor to the SDRD that was used for Title I Design or to the Title I Design itself. Authorship of a report that is referenced in a document which supports the Title I Design easily satisfies this criterion.

A QA specialist was not required assess to whether the ESF Title I Design meets the applicable requirements of 10 CFR 60. 10 CFR 60.151 requires that a quality assurance program be applied to all systems, structures and components important to safety, to design and characterization of barriers important to waste isolation and activities related thereto. No aspect of Title I design has the potential to preclude or delay the implementation of a fully qualified QA program or procedures for identifying and controlling the design of items important to safety or to waste isolation.

Comment S9. Page 10, Sec. 4.1

We see no indication of the duration of the TARC review. The notice requests a "necessary commitment" for the team members but our page 14 (Schedule/ Activities) is blank. We fear that the time remaining before the December 30 SCP delivery date will not permit an in-depth review.

DOE Response

The TAR was initiated on December 13, 1988 and was concluded on February 3, 1989. This time period permitted an in-depth review.

Comment S10. Page 11, Sec. 4.1

The final sentence on this page outlines the procedure to settle unreconciled differences within the TAR team, namely via a recommendation requested from a manager from a participating organization. We point out that this action will perhaps breach the independence of the team by introducing input from outside the team.

DOE Response

DOE agrees that the subject procedure would have been inappropriate. The description of the comment-resolution process was modified in the final TAR Plan (Section 4.3). It turned out, however, that there were no unreconciled differences of opinion between TAR Team members.p

APPENDIX B-3

Differences between TAR Plan and Conduct of TAR

DATE: February 2, 1989

FROM: Jerry L. King

TO: TAR File

SUBJECT: DIFFERENCES BETWEEN THE TAR PLAN AND THE ACTUAL CONDUCT OF THE TAR

As documented in the Introduction to the Review Record Memorandum (Chapter 1), the final TAR Plan (Appendix B-2) was issued after the TAR was initiated, as a remedial action taken in response to a Standard Deficiency Report on the requirement to have the Plan subject to document control. The TAR Plan was finalized at a point when review activities were substantially complete and it reflects the actual conduct of the TAR. Thus, there are no differences between the review methodology described in the final TAR Plan and the methodology actually employed. Revisions to the draft TAR Plan that resulted from the Project Office review (under QMP-06-03) are documented on Document Review Sheets, in Appendix B-4.

Jerry L. King 2/2/89

Jerry L. King, TAR Chairperson

APPENDIX B-4

Project Office Review Comments on
Draft TAR Plan and Responses

DOCUMENT REVIEW SHEET

N-QA-041
12/87

Document Originator R. A. Levich/J. L. King

Document No. NN1-1989-1016 Rev. No. ________ Date 12 December 1988

Document Title Technical Assessment Review Plan - Exploratory Shaft Facility Title I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Location

Name of Reviewer Maxwell B. Blanchard

Comments Required By (Date) January 27, 1989

Dispute Correspondence ________

Signature of Reviewer Maxwell Blanchard Date 1-26-89

TYPE OF REVIEW REQUIRED

- [X] Management*
- [ ] Quality Assurance
- [ ] Technical**
- [X] Regulatory*

*Regulatory & Management Reviewers Indicate Preference for a

1) Peer Review: [ ] Yes [X] No
2) Technical Review: [ ] Yes [X] No

**Technical Reviewers Indicate Preference for a Peer Review: [ ] Yes [ ] No

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
1 (Major)	5 2 8	Paragraph 2.4.5 Paragraph 2.3 See Below Paragraph 4.3 The TAR plan lacks a discussion that explains how QMP 02-08, Para 5.5 will be satisfied. Please add statements or phrases to paras 2.3, 2.4.5 and 4.3 that acknowledge that QMP 02-08 para 5.5 will be satisfied by tracking the recommended corrective actions into the appropriate project document and identifying the entity responsible for resolution.	JK		See Section 4.4 of revised Plan	MBB Blanchard 2-3-89	

B.4-1

Document Title Technical Assessment Review Plan - Exploratory Shaft Facility Title I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Location

Name of Reviewer Maxwell B. Blanchard

Maxwell Blanchard 1-26-89

COMMENT NO & TYPE	PAGE NO.	COMMENTS (REVIEWER'S COMMENTS)	ACCEPT (RESOLUTION)	REJECT (RESOLUTION)	REASONING (RESOLUTION)	ACCEPT (REVIEWER'S DISPOSITION FOR MAJOR COMMENTS)	REJECT (REVIEWER'S DISPOSITION FOR MAJOR COMMENTS)
2 (Major)	1	Paragraph 2.0 After incorporating comments from QMP 06-03 review, I recommend that the TAR be issued as a controlled document per QMP 06-02 so that any future revisions to the TAR can be distributed appropriately.	JK			MBBlanchard 2-3-89	
3 (Major)	iii	Add appendix II to table of contents Add a copy of the letter from Appel, OCRWM, to Blanchard, dated Dec. 22, 1988, which transmits the NRC and State comments of Dec. 19, 1988, to the Yucca Mountain Project Office for consideration.	JK		Transmittal letter is Appendix IV in revised Plan	MBBlanchard 2-3-89	
		Add a section or subsection that explains how those comments have been addressed; what the responses are; and where the TAR was revised, if it was revised due to the comments.	JK		Comment responses are provided in Appendix V of revised Plan	MBBlanchard 2-3-89	
4 (Major)	8	Para 4.3 - Because Para 5.2.1 of QMP 02-08 requires training be satisfied why not add training to the list?	JK		Training records added to list of documents to be included in Review Record Memorandum - see Sec. 4.5	MBlanchard 2-3-89	

DOCUMENT REVIEW CONTINUATION SHEET

Document Title Technical Assessment Review Plan - Exploratory Shaft Facility Title I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Location

Name of Reviewer Maxwell B. Blanchard

Maxwell Blanchard 1-26-89

REVIEWERS COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
5 (Major)	8	Para 4.3 - Although QMP 02-08 does not require a QALA, the DOE has stated to the NRC that the TAR activity will meet the needs of QA level I. Therefore, it appears that a QALA per QMP 02-06 be added to the list and accompany the Review Record Memorandum	JK		QALAS added to list; see Sec. 4.5	MBBlanchard 2-3-89	
6 (Major)	1	The TAR Plan is intended to be used as a plan rather than a procedure, therefore, some flexibility in its application is intended, subject to the constraints of QMP-02-09. The Preface should explicitly provide for such flexibility and state that any deviations from the Plan will be detailed in the record of the TAR.	JK		See Section 1.3.	MBBlanchard 2-3-89	
7 (Major)		Sections 2.1 and 2.4 These sections of the draft TAR Plan state that the design acceptability analysis (DAA) will evaluate the Title-I ESF design against three general objectives in 10 CFR Part 60 pertaining to waste isolation,	JK		See Sec. 2.1, paragraph 3 and Sec. 2.3.6	MBBlanchard 2-3-89	

B.4-3

DOCUMENT REVIEW CONTINUATION SHEET

Document Title Technical Assessment Review Plan - Exploratory Shaft Facility Title I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Location

Name of Reviewer Maxwell B. Blanchard

Maxwell Blanchard 1-26-89

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
7 Cont'd (Major)		ability to characterize the site, and data representativeness. The NRC expects that the design acceptability analysis will address all requirements of 10 CFR 60, not just those that pertain to the stated three general objectives. At the December 8, 1988 meeting, the NRC staff agreed that this consideration could be an evaluation of the impact on the Title I design of omitting an applicable requirement, and a rationale describing why, if the impact was not significant, any design considerations could be delayed until Title II design. The description of the purpose of the TAR should provide for addressing all applicable 10 CFR 60 requirements in a manner consistent with the NRC agreement.					
8 (Minor)		Section 2.4.2 Step 1(b) of the 14 November, 1988 letter from Linehan to Stein asks for an evaluation of design interfaces. This section provides for that evaluation but this is not reflected in the title of the	JC		See Section 2.3.2.	MBBlanchard 2-3-89	

DOCUMENT REVIEW CONTINUATION SHEET

Document Title Technical Assessment Review Plan - Exploratory Shaft Facility Title I Design Acceptability Analysis and Comparative Evaluation of Alternative ESF Location

Name of Reviewer Maxwell B. Blanchard

Maxwell Blanchard 1-26-89

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
8 Cont'd (Minor)		section. Suggest modifying the title to reflect the fact that design interfaces will be evaluated.					
9 (Minor)		Sections 2.5.1 and 2.5.2 The titles of these sections refer to the presence or absence of a hypothetical ESF. However, the evaluations described in these sections explicitly consider the potential effect on waste-isolation potential of an exploratory shaft, not an entire exploratory shaft facility. Suggest changing "ESF" to "Exploratory Shaft" in the titles of these two sections.	JP		See Sections 2.4 and subsections	MBBlanchard 2-3-89	
10 (Major)		Section 4.0 The description of the review process should address the treatment of dissenting professional opinions within the TAR Team.	SK		See Section 4.3	MBBlanchard 2-3-89	

B.4-5

DOCUMENT REVIEW SHEET

N-QA-041
12/87

Document Originator JERRY KING / SAIC
Document No. NA Rev. No. 0 Date 12-DEC-1988
Document Title EXPLORATORY SHAFT FACILITY (ESF) TITLE-I DESIGN ACCEPTABILITY ANALYSIS & COMPARATIVE EVALUATION OF ALTERNATIVE ESF LOCATIONS
Name of Reviewer EDWIN L. WILMOT
Comments Required By (Date) 1/27/89
Dispute Correspondence
Signature of Reviewer [signature] Date 1/27/89

TYPE OF REVIEW REQUIRED

☒ Management* ☐ Quality Assurance
☐ Technical** ☐ Regulatory*

*Regulatory & Management Reviewers Indicate Preference for a
1) Peer Review: ☐ Yes ☐ No
2) Technical Review: ☐ Yes ☐ No

**Technical Reviewers Indicate Preference for a Peer Review: ☐ Yes ☐ No

B.4-6

COMMENT NO & TYPE	PAGE NO	REVIEWER'S COMMENTS	RESOLUTION: ACCEPT	RESOLUTION: REJECT	RESOLUTION: REASONING	REVIEWER'S DISPOSITION FOR MAJOR COMMENTS: ACCEPT	REVIEWER'S DISPOSITION FOR MAJOR COMMENTS: REJECT
1 SUGGESTION	1	INTRODUCTION SHOULD INCLUDE DISCUSSION OF COMPARATIVE EVALUATION OF ESF LOCATIONS AS INDICATED IN DOCUMENT TITLE	JK			[initials]	
2 EDITORIAL	1	REFERENCE TO QAP IS WRONG. SHOULD READ "NNWSI/88-9"	JK			[initials]	
3 MAJOR	1	UNDER SEC. 2.1, MUST DISCUSS HOW TAR WILL ADDRESS ALL OTHER 10CFR60 REQUIREMENTS	JK			[initials]	
4 MAJOR	3	UNDER SEC. 2.4.1, AS IN COMMENT 3	JK		Added new element, No. 6, to address all other Part 60 requirements; see 2.3.6 in revised Plan.	[initials]	

DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title EXPLORATORY SHAFT FACILITY (ESF) TITLE-I DESIGN ACCEPTABILITY ANALYSIS & COMPARATIVE EVALUATION OF ALTERNATIVE ESF LOCATIONS

Name of Reviewer EDWIN L. WILMOT

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
5 MAJOR	8	AN ICN SHOULD NOT BE PREPARED; COMMENT RESOLUTION SHOULD TAKE PLACE AS PER QMP-02-08.	JK				

B.4-7

DOCUMENT REVIEW SHEET

N-QA-041
12/87

Document Originator J. KING
Document No. ——
Rev. No. 8
Date 12/12/88
Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMPARATIVE EVALUATION OF ALTERNATIVE ESF LOCATIONS
Name of Reviewer J. BLAYLOCK
Comments Required By (Date)
Dispute Correspondence
Signature of Reviewer James Blaylock
Date 2/3/89

TYPE OF REVIEW REQUIRED

☐ Management* ☒ Quality Assurance
☐ Technical** ☐ Regulatory*

*Regulatory & Management Reviewers Indicate Preference for a
1) Peer Review: ☐ Yes ☐ No
2) Technical Review: ☐ Yes ☐ No

**Technical Reviewers Indicate Preference for a Peer Review: ☐ Yes ☐ No

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
1.		TABLE OF CONTENTS INDICATES APP. I IS A PART OF THE REVIEW PACKAGE; APP. I IS NOT INCLUDED. DID REVIEWERS HAVE ACCESS TO PERTINENT INFO.? HOW?	JK 2/4/89		Appendix I was to have contained a NRC-to-DOE letter transmitting minutes of a meeting on ESF design control issues. Technical Assessment Review (TAR) Team members had access to the information in this letter through several Team members who were intimately familiar with the letter. However, the letter was intended as introductory material only and did not establish the scope of the review or contain material that needed to be assessed by the reviewers.	JB 2/4/89	
2.		CLARIFY THE REVISION 8 DESIGNATION NOTED ON THE PLAN.	JK 2/4/89		The "Rev. 8" designation was an error; it should have read "Rev. 0."	JB 2/4/89	

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DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMP. EVAL. OF ALT. ESF LOCATIONS - TECHNICAL ASSESSMENT REVIEW

Name of Reviewer J. BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
3.		¶ 1.2 states that the definitions for "verification" and "technical review" in App. A of 88-9 are satisfied by the design acceptability analysis. • 'Verification' in 88-9, is defined as the following: Section I, Pg. I-3, ¶ 3.2 – "... Verification of conformance to established requirements (acceptance) is accomplished by individuals or groups within the QA organization unless specifi-	JK 2/4/89		The TAR was not intended to incorporate a verification conducted by individuals or groups within the QA organization, as the term is defined in App. A of 88-9; it was intended only to provide "technical verification," as the term is used in the App. A definition of "Technical Review." The words, "for verification," have been struck from the TAR Plan.	JB 2/4/89	

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DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMP. EVAL. OF ALT. ESF LOCATIONS - TECHNICAL ASSESSMENT REVIEW

Name of Reviewer J BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
3. (continued)		cally exempted elsewhere in this document." Provide clarification as to how this has been accommodated in the DAA analysis/review.					
4.		¶2.2 - Several documents are referenced which are currently - or at the time of the review - "DRAFT" status. Examples are: • GR, App. E • ESF SDRD	JK 2/4/89		The statement that the GR, App. E is part of the TAR Package was in error and has been struck from the TAR Plan. The TAR reviewed the (12/18/87) version of the ESF SDRD which was actually used for Title I Design, to help assess the adequacy of the Title I Design as a final product; subsequent revisions to the SDRD did not affect the Title I Design and were not addressed by the TAR. Similarly, the TAR reviewed	JB 2/4/89	

DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMP. EVAL. OF ALT. ESF LOCATIONS – TECHNICAL ASSESSMENT REVIEW

Name of Reviewer J BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
		- RIB, (VERSION NOT IDENTIFIED) - DRAFT 10CFR60 FLOW-DOWN REPORT - SEC. 8.4 / SCP • WHAT CONTROLS WERE UTILIZED TO IDENTIFY WHERE THESE DOCUMENTS WERE USED, SO THAT ONCE THE FINAL, APPROVED VERSION IS ISSUED, A COMPARISON CAN BE MADE TO IDENTIFY ANY CHANGES BETWEEN			the version (3.0) of the RIB that was used for Title I Design. The SCP was released on 12/28/88, but the DOE reviewed and approved the SCP in November 1988 to arrange for printing and distribution; the TAR team had access to the approved final SCP and SCP references during the period of performance of the TAR. The Chairperson of the committee that authored the 10 CFR 60 Flowdown Report was a TAR member and was charged with apprising the TAR Chairperson of any changes between the draft and final versions of the Report; the Report was finalized before the TAR closed and a memorandum certifying that no changes occurred is included in Appendix F of the TAR Review Record Memorandum (RRM).		

DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMP. EVAL. OF ALT. ESF LOCATIONS - TECHNICAL ASSESSMENT REVIEW

Name of Reviewer J BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
4. (CONT'D)		THE FINAL & PREVIOUS VERSIONS USED, THE IMPACT OF ANY CHANGES ON ANY ANALYSES WHICH USED THE "DRAFT" INFORMATION - AND THE CORRECTIONS NEEDED.					
5.		WERE DEFICIENCIES IN THE 10CFR 60 FLOWDOWN OR ANY OTHER REFERENCE DOCUMENT IDENTIFIED? · PLEASE IDENTIFY AS APPROPRIATE.	JC 2/4/89		The identification of ESF-applicable 10 CFR 60 requirements in the Flowdown Report was used as the starting point for the TAR; this identification was not revisited. The TAR did result in recommendations for revisions to Section 8.4 of the SCP, which are documented on TAR Comment Record Forms in Appendix G of the Review Record Memorandum.	JB 2/4/89	

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DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMP. EVAL. OF ALT. ESF LOCATIONS - TECHNICAL ASSESSMENT REVIEW

Name of Reviewer J BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
6.		¶ 2.4.1 states that it will utilize the draft products of an analysis of the flowdown of 10 CFR 60 requirements into the Generic Req't Document App. E. • Were the draft products identified by title, or some unique identifier for traceability (See Comment 4) • Explain how and where identified in the RRM or other mechanism.	JF 2/4/89		Only one draft product, the 10 CFR 60 Flowdown Report, was utilized. The TAR Plan text has been clarified in this regard. No unique identifier was attached to the subject report; however, as described in the response to Comment 4, there were no changes between the draft version utilized and the final version of the report.	JB 2/4/89	

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DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

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Name of Reviewer J BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
7.		¶2.4.2 - Describe the criteria used for "... evaluating/assessing the adequacy of the performance/design criteria and constraints.	JK 2/4/89		Subcommittee 1 of the TAR Team generated design criteria for applicable 10 CFR 60 requirements (as identified in the Flowdown Report) that are related to (1) waste-isolation potential, (2) ability to characterize the site (i.e., potential for interference with planned tests) and (3) ability to obtain data that are (continued on attached sheet)	JB 2/4/89	
8.		¶2.4.2 states: "... The TAR team will then review the SDRD and other design documentation to identify existing design/performance criteria and constraints which pertain to the relevant subset of	JK 2/4/89		(#8) The objective of this element of the TAR was to evaluate the information used as the basis of Title I ESF Design, with respect to applicable Part 60 requirements and major NRC concerns. The subcommittee considered documented information that was prepared or used in conjunction with the Title I ESF Design. The available documents included the Title I ESF SDRD and the Design	JB 2/4/89	

DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMP. EVAL. OF ALT. ESF LOCATIONS - TECHNICAL ASSESSMENT REVIEW

Name of Reviewer J BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
		design features and interfaces. • Clarify whether and "other design documentation was used" & how identified as part of TAR documentation (RRM, etc.).			Basis documents from the design contractors (F&S, H&N). However, the content of the Design Basis documents that is relevant to the evaluation is included in the SDRD. The Title I ESF SDRD and attendant ECR's were therefore used to identify existing design/ performance criteria and constraints which pertain to the relevant subset of design features and interfaces.		
9.		¶ 2.4.3 - Clarify the following: • ESF 100% Title I Design Report is referenced for use - Clarify when issued formally by Project Office.	JK 2/4/89		(#9) The Yucca Mountain Project Exploratory Shaft Facility Title I Design Report was issued on 12/21/88. Copies of the issued document were obtained for use in the DAA.	JB 2/4/89	

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DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMP. EVAL. OF ALT. ESF LOCATIONS - TECHNICAL ASSESSMENT REVIEW

Name of Reviewer J BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
10.		¶2.4.3 - Clarify the following: "... if the requirements, criteria, constraints and interfaces... are adequately reflected in the design or in existing assessments of ESF design adequacy." Clarify/provide specifics of which existing assessments of ESF design adequacy were used by title, revision, date, etc.	JC 2/4/89		The design acceptability analysis (DAA) performed in the TAR was a new, independent assessment of design adequacy, based on the newly available 10 CFR 60 Flowdown Report. Hence, no "existing assessments of ESF design adequacy" were reviewed in the TAR. The reference to "existing assessments" has been deleted from the TAR Plan.	JB 2/4/89	

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DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMP. EVAL. OF ALT. ESF LOCATIONS - TECHNICAL ASSESSMENT REVIEW

Name of Reviewer J BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
11.		¶2.4.3 - Clarify/define "relevant criteria" and the basis for the TAR team to make their determination as to "relevance".	JF 2/4/89		(#11) The "relevant criteria" referred to are the criteria developed for the DAA, consisting of existing design/performance criteria and constraints which pertain to the subset of design features and interfaces that were related to the applicable portions of Part 60 and the major NRC concerns, plus additional criteria and constraints added as necessary in the judgement of the reviewers.	JB 2/4/89	
12.		¶2.4.4 - Clarify the following: "... The appropriateness and reasonableness of data and parameters included in the RIB and in other sources, as appropriate."	JF 2/4/89		(#12) Each of the reviewers in TAR Part 1, Element 4 was instructed to review one or more documented analyses, with respect to a set of standard questions developed by the data review subcommittee #2 for implementing this element of the TAR Plan. One of the questions related to the reasonableness of the RIB-reported values for the parameters that were important in the study. (continued on attached sheet)	JB 2/4/89	

DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMP. EVAL. OF ALT. ESF LOCATIONS - TECHNICAL ASSESSMENT REVIEW

Name of Reviewer J BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
		• Clarify "other sources" and identify.					
13.		¶ 2.4.5 - HOW ARE "DEFICIENCIES" DEFINED IF MOST OF THE RERERENCE DOCUMENTS BEING USED ARE "DRAFT".	JC 2/4/89		As clarified in the response to Comment 4, the TAR reviewed those analyses and calculations that were used to support the Title I Design effort, whether they were draft or final at the time; any deficiencies identified refer to the product that was actually used and not to any subsequent revisions.	JB 2/4/89	
14.		¶ 2.5.1 - states, "... THE INFLUENCE ANY SUCH DIFFERENCES MIGHT HAVE HAD ON SELECTION OF	JC 2/4/89		(#14) The information compiled with respect to the potential for each location to isolate waste, was based on the technical experience and judgement of the members of subcommittee #3 of the TAR team. The process	JB 2/4/89	

DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF TITLE I DESIGN ACCEPTABILITY ANALYSIS & COMP. EVAL. OF ALT. ESF LOCATIONS - TECHNICAL ASSESSMENT REVIEW

Name of Reviewer J BLAYLOCK

REVIEWER'S COMMENTS			RESOLUTION			REVIEWER'S DISPOSITION FOR MAJOR COMMENTS	
COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	ACCEPT	REJECT
		THE ESF LOCATION WILL THEN BE EXAMINED." • CRITERIA FOR HOW THIS "EXAMINATION WILL BE CONDUCTED, WHAT WILL BE REVIEWED, ETC. • DEFINE "SIGNIFICANT DIFFERENCES"			of considering such information involved extensive discussion among the subcommittee members, and was too complex to be constrained by criteria developed a priori. The subcommittee discussions resulted in development of a set of "surrogate characteristics" to represent what is known about the relative waste isolation characteristics of the alternative locations. (continued on attached sheet)		
15.		¶2.5.3 - WHERE ARE THE "PARAMETERS" SPECIFIED?	JK 2/4/89		(#15) The subcommittee #3 was responsible for identifying the "parameters" to be used. The method developed for implementing Part 2 of the TAR Plan was to identify "surrogate characteristics" in Part 2, Element 1 for comparing the performance potential of the alternative	JB 2/4/89	

DOCUMENT REVIEW CONTINUATION SHEET

N-QA-041
12/87

Document Title ESF Title I Design Acceptability Analysis & Comp. Eval. of Alt. ESF Locations – Technical Assess. Rev.

Name of Reviewer J Blaylock

COMMENT NO. & TYPE	PAGE NO.	COMMENTS	ACCEPT	REJECT	REASONING	REVIEWER'S DISPOSITION FOR MAJOR COMMENTS: ACCEPT	REJECT
					(#15 cont.) locations. These same characteristics were then used in Element 3 as the "parameters" considered in the comparison of the five alternative locations with other possible locations in the site area. The concept of "surrogate characteristics" was necessary because total system performance has not yet been assessed for the site. The characteristics were selected based on the technical experience and judgement of the subcommittee members.		
16.	7.	P3.2 – For Review Team members outside the Project, were specific contracts for services issued; If so, How?	JF 2/4/89		(#16) No review team members were from agencies outside of the Project.	JB 2/4/89	
17.	7.	P4.2 – states + TAR will not involve comment-resolution . . . • However, comment resolution is required per 88-9, Rev. 2 and Project SEMP, P 4.2.5.2	JF 2/4/89		(#17) The TAR Plan has been revised to provide for comment resolution using the Technical Assessment Review Comment Record forms provided for by QMP-02-08, Rev. 0.	JB 2/4/89	

B.4-20

Attachment Sheet for Comments on TAR Plan

(#7, continued) representative of the site, for each of the physical components of the ESF, based on the experience and professional judgment of the subcommittee members. The adequacy of criteria in the SDRD was judged by comparison with the criteria generated by the subcommittee.

(#12, continued) Reviewers were asked to assess the appropriateness of the data and parameter values used in the study, using data values in the RIB and other sources, as appropriate, based on the experience and professional judgment of the reviewer. Reviewers were required to document the basis for their assessment of adequacy, including any "other sources" used.

(#14, continued) Evaluation of the significance of differences identified between locations was also based on technical judgement because quantitative relationships between the "surrogate characteristics" and waste isolation performance have never been established definitively. The basis for examining the influence that differences in waste isolation characteristics would have had on selection included consideration of the following: (1) how each alternative compared to the regulatory performance objectives for the repository; and (2) given that each alternative would be likely to result in the repository meeting the regulatory performance objectives, the need to locate the exploratory shafts where relatively unfavorable waste isolation conditions could best be investigated.

JK
2/4/89

JB
2/4/89

(14)

Observation No. SR-89-004-0
Page 3 of 3

To: J. Blaylock, YMPO QA Manager Date: February 7, 1989

From: K. Sommer, OCRWM OQA
K.G. Sommer

The response to Observation SR-89-004-01 has been evaluated by one of the OCRWM Headquarters technical surveillance team members who originally identified the Observation. The response adequately addresses the technical aspects of the concern identified in the Observation and closure of the Observation is now dependent on the Project Office evaluation of quality assurance aspects of the response.

4/dlh