



Department of Energy

Washington, DC 20585

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

Reference: Ltr, Bernero to Barrett, dtd 5/5/93

Dear Mr. Holonich:

On May 5, 1993, the U.S. Nuclear Regulatory Commission (NRC) transmitted three comments, four questions, and three observations on Site Characterization Progress Reports (PR) 6 and 7. The U.S. Department of Energy (DOE) has reviewed the NRC's concerns including the comments, questions, and observations. This letter transmits DOE's response to the open items created in NRC's comments and questions. Enclosures 1 through 7 present DOE's responses to NRC's three specific comments and four questions. This cover letter responds to NRC's general concerns and observations. Also provided is a summary of past progress report notification and discussion of Exploratory Studies Facility (ESF) design changes.

NRC's General Concerns

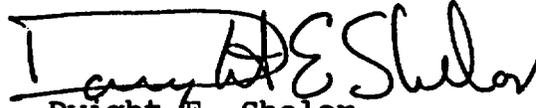
The NRC expressed five general concerns in their cover letter which we are addressing here. The first general concern in paragraph 2 states, in part, ". . . an important component of the staff's review has been to evaluate DOE's progress on SCA concerns, in addition to evaluating whether or not the PR was responsive to the staff's concerns on previous PRs." DOE continues to address the Site Characterization Analysis open items. PR Table 2-1 has been revised in a manner we believe is more user-friendly and will be presented in PR 8. This revised table will present information on those actions that DOE is taking to resolve the remaining SCA open items. We point out that progress in addressing many open items depends on progress in the site characterization program. DOE believes it has fully addressed this NRC concern by reporting how we plan to address the open items in such detail in PR 8. In some cases, the activities required to address the concerns may not be performed until 1997 or later.

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If you have any questions, please contact Ms. Cori Macaluso of my office at 202-586-2837.

Sincerely,



Dwight E. Shelor
Associate Director for
Systems and Compliance
Office of Civilian Radioactive
Waste Management

Enclosures:

1. Administrative Record for Comment 1
2. Administrative Record for Comment 2
3. Administrative Record for Comment 3
4. Administrative Record for Question 1
5. Administrative Record for Question 2
6. Administrative Record for Question 3
7. Administrative Record for Question 4

cc w/ enclosures

- C. Gertz, YMPO w/o enclosures
- T. J. Hickey, Nevada Legislative Committee
- R. Loux, State of Nevada
- D. Bechtel, Las Vegas, NV
- Eureka County, NV
- Lander County, Battle Mountain, NV
- P. Niedzielski-Eichner, Nye County, NV
- L. Bradshaw, Nye County, NV
- W. Offutt, Nye County, NV
- C. Schank, Churchill County, NV
- F. Mariani, White Pine County, NV
- V. Poe, Mineral County, NV
- J. Pitts, Lincoln County, NV
- J. Hayes, Esmeralda County, NV
- B. Mettam, Inyo County, CA
- C. Abrams, NRC

Second, in paragraph 3, the NRC states ". . . many of the staff's concerns related to the amount and quality of information provided in the PRs are still pertinent, and in many areas the PRs still do not provide a clear picture of the status and results of certain site characterization activities, particularly with respect to design activities related to Exploratory Studies Facility (ESF) and waste package." The pertinent portions of PR 8 will reflect the status of ESF design activities as of the end of the reporting period at a level of detail appropriate for the PR. Likewise, with respect to the waste package, PR 8 contains extended discussion on the status and results of site characterization activities related to design of the waste package.

Third, also in paragraph 3, the NRC states ". . . the staff continues to believe that the PRs would be more useful if they were published closer to the end of the reporting period. The staff acknowledges that the timeliness of PR 7 was significantly improved over previous PRs, . . ." The DOE is committed to improving the production cycle for the progress reports. The DOE will try to keep the issue time of the PR to the minimum, consistent with the needed completeness and quality of input. The State of Nevada, however, has indicated (in their letter to the Office of Civilian Radioactive Waste Management [OCRWM], dated December 28, 1992) that they want a 30-day production cycle. We cannot accommodate such a schedule and still achieve our desired level of quality and completeness. Through experience we have learned that release of PRs cannot be much improved beyond 12 weeks following the end of the reporting period.

Fourth, in paragraph 4, the NRC addresses the subject of ESF design changes and the lack of adequate, timely communication and description of such changes. It states, in part, "Although both PR 6 and 7 mention design activities for the ESF, the NRC staff has not received descriptions of many of the changes in the ESF . . . it is recommended that DOE communicate such changes to the NRC as soon as is practicable." Our response to NRC Comment 2 provides a description and history of ESF communication that shows that this criticism is not fully justified in our view.

Fifth, the NRC in paragraph 5 states, "The DOE did not propose to close any open items in either PR (6 or 7)." Consistent with DOE treatment of 31 open items since NRC evaluated DOE's SCA response in July 1991, the action(s) proposing to resolve open items have been reported in specifically directed correspondence. Our means to propose resolution of open items occurs in documentation other than the PRs. PRs will not propose resolving any open items, but will note and update the status of those that have been proposed for resolution, resolved by NRC, or have had other changes in status during the reporting period.

Response to NRC Observations

The NRC provided three observations that are related to the content and structure of the PRs.

NRC Observation 1

Although the PRs include summaries of results of ongoing work, there are instances where the results summarized appeared minimal compared to the number of publications that were referred to in the PRs as either finalized or in review. It is recommended that summaries thoroughly cover results to date.

DOE Response

See DOE's response to NRC's Observations 2 and 3.

NRC Observation 2

References should be as complete as possible, including those for works in press or review. The PRs provide complete references for documents that are already published, but do not provide adequate information for documents mentioned in the text that are in press or under review. Specifically, for documents not yet published, the PRs often provide only the name of the senior author in the text, but no other information, including the title. The lack of a title and other pertinent information (e.g., meeting where the presentation took place or publication) makes it difficult to track the progress of activities in subsequent reports.

One example of incomplete reference information is in PR 7, Section 2.2.11.3, Activity 8.3.1.15.1.3.1, where the results of a report are described and presented, but the author or title is not provided. Another example is in PR 7, Section 2.2.11.6, Study 8.3.1.15.1.6, pages 2-117, where a report is mentioned, but no author or title is provided.

DOE Response

This observation expresses the NRC staff's desire to see more consistency and more complete information provided in references to work in progress. DOE strives to keep inconsistencies such as the ones identified to a minimum, but they can, nevertheless, occur. For works in preparation, press, or review, the titles and authors are provided; but, obviously, not the date of publication. For presentations, the title, presenter, and forum where the presentation took place are provided. However, works in preparation, press, or review will not be included in the references-cited section at the back of the progress reports because no citation yet exists. Mention of work destined for citable outlet is made because principal investigator and other staff time is required in preparing documentation of the work.

With respect to the specific examples of incomplete references given in the staff comments, both references are once again in PR 8, and both references now contain complete information.

NRC Observation 3

Many sections of the PRs provide only cursory summaries of activities. For example, in PR 7, Section 2.2.11.4, Activity 8.3.1.15.4.1, pages 2-114, a "simple mathematical model" is mentioned, with no further description. "A study addressing what variables were important . . ." is mentioned with no description of variables. In Section 2.2.13.11, Activity 8.3.1.17.4.3.2, pages 2-125, "A search for evidence of possible surface-fault rupture . . ." is mentioned with no description of the results of the search. Future PRs should either include additional information or provide a reference as to where the reader can locate further explanation.

DOE Response

The quote regarding the mathematical model needs to be put into context as the paragraph begins stating, "In an initial study to determine the variability . . . seventeen natural fractures . . . were profiled. These data are being analyzed to quantify A simple mathematical model of rough fractures has been developed based on these data. Using this simple model, a computer code is being developed Simulations using this code will allow some physical insight into . . . relationships commonly used The data and analyses are being included in a report being drafted for submittal into a technical journal."

The NRC is requesting the DOE to provide information and details on activities that are still preliminary. In the example the NRC cited, the results from a tool (simple mathematical model) that is still being developed as part of an initial study are being requested to be provided. The results from the model are still being analyzed and not ready to be reported. The referenced statement points out what activity is ongoing. When the work is validated, the data and analyses will be reported, and a citation for the work will be provided.

The second example cited is, "A study addressing what variables are important . . . is mentioned with no description of the variables." The quotation is taken from a sentence that in its entirety states, "A study addressing what variables are important for inclusion into the constitutive description of fractures is continuing." The paragraph concludes with, "The test will be completed in the next few months and the resulting data analyzed." The meaning revealed by the entire quotation is that the study determining what variables are important is still continuing. This request to provide a description of the variables, when the study is still determining what those variables are, is not appropriate.

The third example from Section 2.2.13.11, Activity 8.3.1.17.4.3.2, pages 2-125, is "A search for evidence of possible surface-fault rupture . . . is mentioned, with no description of the results of the search." The staff comment then continues to state, "Future PRs should either include additional information or provide a reference to where the reader can locate further explanation." The sentences following the quoted portion went on to state, "Initial compilation of data . . . was completed and a computerized data base established. A draft open-file report entitled 'Preliminary Assessment of Quaternary Faults within 100 km of Yucca Mountain' (Piety, et al.) was completed in September 1992. The report outlines the small amount of data on age, amount of displacement, recurrence, and slip rate for most of the faults within the area of the study." The reference providing where the reader can locate further explanation is provided, just as the NRC staff requests. When the work is published (i.e., receives participant and DOE approval and is available), a citation will be provided in the PR and a brief summary of the work and/or conclusions will be reported.

Conclusions

From DOE's point of view, the PR is a document that serves many audiences: the NRC, the U.S. Congress, the Nuclear Waste Technical Review Board (NWTRB), other interested parties from the extant scientific community, the State of Nevada and affected units of local government, and the general public. DOE seeks to make the document valuable to all of these parties while fulfilling the NRC's requirements in 10 CFR Part 60.18 (g). This is not easily accomplished. The PRs attempt to reference where information can be found in this complex program and report brief summaries of the work that has some value to all these constituencies. As such, subjective judgement is necessarily involved all through the preparation, review, and approval process for each PR iteration. DOE thinks we have a quality product now, and that it will continue to improve from input such as NRC comments.

The DOE wishes to express its appreciation for the timeliness of the staff review and comments. The timely review made it possible to address some of the comments in PR 8 while it was still in production.

ENCLOSURE 1

NRC COMMENT 1 ON PROGRESS REPORTS 6 AND 7

DOE RESPONSE TO COMMENT 1

SECTION 2.6.5.3 ACTIVITY 1.4.2.1 - SELECTION OF THE CONTAINER MATERIALS FOR THE LICENSE APPLICATION DESIGN

COMMENT 1

Since the issuance of the Site Characterization Plan there has been no updated information provided on the Yucca Mountain Project's official reference advanced conceptual waste package design.

BASIS

Section 2.6.5.3 of PR 6 states that the three materials for advanced conceptual design (ACD) are recommended for use as single container materials in the SCP-CD thin-wall container design and that other materials and design configurations will also be studied during ACD. No further discussions or references are provided on these other materials and design configurations.

Section 2.6.5.3 of PR 7 states that a paper on the selection of candidate materials for waste package conceptual design is in internal review and will be published, but forecasts that no other activity is planned for FY 1993. In addition, for FY 1993 nothing is planned for the activities which directly affect the development of waste package designs (Sections 2.6.5.4 through 2.6.5.12).

DOE is considering substantial waste package changes. For example, DOE (Stahl, 1992) has proposed horizontal drift emplacement of waste packages instead of vertical or horizontal borehole emplacement. In addition, DOE is considering a waste package that has multiple layers. These proposed changes are not discussed or referenced in PRs 6 and 7.

In a NRC/DOE meeting (NRC, 1992) to discuss DOE's preliminary multipurpose canister (MPC) study, DOE representatives stated that the robust twenty-one element self-shielded MPC concepts are being considered for advanced conceptual designs.

Geological considerations, particularly those involving the analysis of the impacts on performance by fault displacement hazards and seismic hazards may be significantly affected by the design of waste emplacement.

RECOMMENDATIONS

Identify in future PR updates, the reference waste package/engineered barrier system design concepts and changes being considered for ACD and license application design.

As a result of the addition of material candidates, DOE should re-examine its materials test program baseline documents to include desired information for all materials under consideration for waste package ACD.

For example, an eight volume document "Survey of Degradation Modes of Candidate Materials for High-Level Radioactive-Waste Disposal Containers" was published by Lawrence Livermore Laboratory in August 1988. Six candidate materials; stainless steel 304L, 316L, Alloy 825; CDA 102 copper, CDA 613 (aluminum bronze) and CDA 715 (70-30 Cu-Ni) were studied in the survey. With the new list of candidate materials, DOE should supplement the survey for Alloy C-4, Titanium Grade 12, and any other materials of interest for waste package ACD.

REFERENCE

NRC, 1993, Memorandum to C. Haughney from S. Ruffin, subject: Meeting with DOE on multi-purpose canister study, dated January 5, 1993.

Stahl, D., 1992, Source term concept and definition: Presentation to the Nuclear Waste Technical Review Board Meeting, Las Vegas, Nevada, October 14-16, 1992.

DOE Response to NRC Comment 1
On Progress Reports (PR) 6 & 7

The DOE agrees with NRC's comment and recommendations. However, detailed information on the waste package to the level apparently sought by NRC was not ready to report in PRs 1 through 7. PR 8 will present current information concerning the waste package program.

The paper referenced in Section 2.6.5.3 in PR 7 is now identified as published, and has been incorporated by reference and included in the list of references in PR 8. Horizontal drift emplacement is mentioned in Section 2.4.3.1 with a reference to a report containing calculations examining drift emplacement options. The topics of a waste package with multiple layers, multipurpose casks, and the effect of waste emplacement method on the analyses of fault displacement and seismic hazards are not yet discussed.

The possible designs for a waste package/engineered barrier continue to be studied and discussed within the program, however, the reference design of the waste package/engineered barrier system in accordance with the Site Characterization Program has not yet been changed. This reference design includes waste packages containing four Pressurized-Water Reactor (PWR) assemblies or the equivalent vertically emplaced in boreholes. The containers are fabricated of 3/8" stainless steel. Additional designs are being studied and considered. Any changes to the reference waste package design, as well as emplacement mode and thermal loadings will not be made until after these studies are completed. The status for these studies and alternative conceptual designs will be discussed in future Progress Reports.

Much useful information bearing upon Comment 1 was discussed at the Technical Exchange on Substantially Complete Containment on August 24, 1993, in Bethesda, Maryland.

ENCLOSURE 2

NRC COMMENT 2 ON PROGRESS REPORTS 6 AND 7

DOE RESPONSE TO COMMENT 2

**SECTION 2.1.2 EXPLORATORY STUDIES FACILITY (ESF) DESIGN AND CONSTRUCTION
SECTION 2.4 REPOSITORY DESIGN**

COMMENT 2

Although the ESF design has undergone major changes since the issuance of the Site Characterization Plan (SCP), those changes and how they affect the potential repository have not been reflected in Progress Reports.

BASIS

Since the issuance of the Site Characterization Plan (SCP) a Title I design has been issued for an ESF [RSN, 1991], and 50% design review meetings have been held for portions of an ESF that is different from the ESF described in the SCP.

In the ESF Alternatives Study (ESFAS) (Dennis, 1991), a brief description is provided for the preferred ESF/repository alternative, which differs from the ESF/repository design presented in the SCP.

In the reviewed progress reports, changes in the heat load are mentioned in Sections 2.4.3.1 and 2.6.1.3. Those changes could alter the repository concept significantly from that presented in the ESFAS and the SCP.

Although the ESF has undergone major changes since the SCP, DOE has not shown how the revised ESF will interface with the repository conceptual design of the SCP, or with a revised repository conceptual design.

DOE has not shown that the phased approach being used for the ESF Title II design will result in a satisfactory design for the complete ESF.

Access to a complete ESF Title II design is critical to understanding how the separate ESF design phases mesh together to form a complete design that is compatible with the conceptual design of the Geologic Repository Operations Area (GROA).

RECOMMENDATIONS

All future progress reports should contain up-to-date information related to ESF and repository design and design changes.

REFERENCES

Dennis, A. W., ed., 1991, Exploratory studies facility alternatives study final report, volumes 1 and 2: Sandia National Laboratories, SAND 91-0025.

RSN, 1991, Title I design summary report for the exploratory studies facility: Raytheon Services Nevada, September 1991.

DOE Response to NRC Comment 2
On Progress Reports 6 & 7

In response to the NRC comment and recommendation, Section 2.1.2 of PR 8 was rewritten to provide "up-to-date information related to ESF and repository design changes." A summary of that information is provided below.

In addition, the history of ESF communications and description provided in progress reports to date is summarized.

The design of the ESF and plans for its construction have changed significantly from those associated with the shaft-based concept presented in the statutory Site Characterization Plan (SCP) (DOE/RW-0199) (December 1988). The Site Characterization Program Baseline (SCPB) (YMP/CM-0011) (February 1991), was produced to present the latest information regarding site characterization activities, including changes to the SCP ESF configuration and supporting design information. Revision 1 of the SCPB incorporated the current ESF configuration from Option 30 in the Exploratory Studies Facility Alternatives Study: Final Report (SAND91-0025) (ESFAS) (DOE, 1991). Since then, all changes related to ESF design and testing have been reported in subsequent revisions to the SCPB. The above have been reported in each PR published since PR 4 (DOE/RW-0307-4). The following is a summary of changes reported in previous PRs:

PR 4 (DOE/RW-0307P-4), Section 2.2.10, reported that the SCPB is being revised to baseline the new ESF configuration.

PR 5 (DOE/RW-0307P-5), Section 2.1.10, noted that the ESF design concept presented as Option 30 in the ESFAS had been incorporated into the SCPB.

PR 6 (DOE/RW-0307P-6), Section 2.1.2, provided further updates on the status of the new ESF design.

PR 7 (DOE/RW-0307P-7), Section 2.1.8, reported that Revision 6 to the SCPB included an update to the ESF design description to make it consistent with the ESF Title I Design. In addition, Section 2.1.2 cited the ESF Title I Design Summary Report (YMP/CC-0019) as a formal reference to PR 7.

The areal heat load used in the baseline repository concept (57 kW/acre) has not changed since the issuance of the Site Characterization Plan, although DOE is currently studying whether or not it should change. The Site Characterization Plan repository design concept is consistent with this heat load. Studies, model validation, and testing programs concerning the heat load are underway and planned for the future. These will provide the information necessary to determine the heat load for license application. The repository concept will be altered to conform to the selected heat load.

The ESF Title I design, completed during 1991, provides preliminary design for the entire ESF and forms the basis for proceeding into Title II design. The conceptual design for a complete ESF/repository layout was evaluated during Title I, and was determined to be an adequate concept providing access to the bulk of the potential repository block while maintaining the flexibility needed to accommodate potentially changing needs (i.e., heat load). Title II design consists primarily of "fleshing out" the Title I concept and developing the detailed design drawings and construction specifications required to build the facility. Title II design is being performed in a phased manner; however, design of those systems which do not lend themselves to a phased design are being developed for the entire facility. Examples of this include design of the ESF ventilation system and the conveyor haulage system. Design of these systems is currently underway taking into account the needs of the entire facility.

The Title I design, along with the repository interface drawings, is included in the SCPB. These two packages show how the potential repository and the current ESF layout interact.

**SUMMARY OF ESF DESIGN CHANGE NOTIFICATION AND
DESCRIPTION IN PROGRESS REPORTS**

What follows is a brief summary of the notification of ESF design developments and changes provided in Progress Reports 4 through 8. While it is acknowledged there remains a need for resolution of such subjects as timeliness, level of detail, and incorporation by reference in the progress report, it is believed that the changes in ESF design have been identified and addressed in progress reports as soon as proposed changes have been studied and approved, whereupon it is appropriate to announce changes.

As the volume of information resulting from the characterization activities continues to expand, it will become even more necessary to summarize and distill that information in progress reports. Thus, it will become increasingly necessary to rely on references to provide the level-of-detail needed by individuals with interest in particular areas. Efforts will be made to improve the consistency of level-of-detail and completeness of reference information throughout the progress reports.

Progress Report 4, dated October 1991
(covering October 1, 1990 - March 31, 1991)

Section 2.1.2, entitled Exploratory Studies Facility Design and Construction, incorporated by reference a preliminary report entitled "Findings of the ESF Alternatives Study" (Stevens and Costin, 1991) that was completed in December 1990. The section went on to provide an overall ranking of the 34 identified ESF configurations at the level of an executive summary. This section also states, "The new ESF configuration, while not final, is presently being referred to as the "Reference Design Concept" (RDC)." Revisions to the Design Summary Report are currently ongoing to incorporate the new ESF RDC. In addition, a plan (DOE 1991) has been prepared and baselined in response to an OCRWM request to develop a phased approach to the ESF design, development, and implementation. This plan describes how the ESF design, construction, and testing activities will be conducted using a phased approach." This plan was included in the List of References at the end of the report and was, therefore, incorporated by reference.

Section 2.1.2.1, entitled ESF Alternatives Study, also noted "During the reporting period, work continued and a preliminary report on the ESFAS was completed as the expert panels continued to evaluate the 34 identified options. On the basis of the documentation and the briefing provided to him, the OCRWM Director requested that the YMP proceed with a design study focusing on the favorable features of the highest-ranked options." This design study is currently being conducted by RSN."

The section then references important meetings with the NWTRB and the NRC with respect to ESFAS being discussed in Section 2.1.7. Section 2.1.7 states "Two formal meetings with the NRC were held, . . . and one in January to discuss the status of the Calico Hills Risk-Benefit Analysis (CHRBA) and ESFAS tasks."

Section 2.1.10 reported that the SCPB (Revision 0) was being revised in preparation for the start of Title II design studies on the ESF and would incorporate changes to program planning based upon the ESF reference design concept. The section also stated that "Although no final decision has been made, the current RDC plans call for a much larger ESF area with access via two inclined ramps drilled by tunnel boring machines."

Thus, in the first reporting period in which the ESF Alternatives Study was completed, it was reported in the progress report. The timeliness and detail included in those reports have been the subject of concern, but both the preliminary ESFAS report and the plan for the phased approach to ESF design, development, and implementation were incorporated by reference. The new configuration was characterized as preliminary, but presented as the reference

design concept, and the phased approach was referenced. The report also references a meeting held with the NRC (in January following completion of the report) for the expressed purpose of discussing the status of the ESFAS task.

Progress Report 5, dated June 1992
(covering April 1, 1991 - September 30, 1991)

Section 2.1.2.1 of PR 5 continued to report status of the ESFAS by noting that the final report was published in September 1991. It also provided continuity by reporting that "The design study that was initiated in the previous reporting period was completed in August 1991." In addition, it provided a very brief description of the ESF reference design concept.

Section 2.1.10, entitled Site Characterization Program Baseline (SCPB), noted that during this reporting period both Revision 0 and Revision 1 were issued. It further noted Revision 1 ". . . of the SCPB incorporated changes to program planning based upon the reference ESF design concept resulting from the ESFAS."

Progress Report 6, dated September 1992
(covering October 1, 1991 - March 31, 1992)

Section 2.1.2, Exploratory Studies Facility Design and Construction, notes that the requirements documents for the ESF were revised to conform to a two-ramp configuration of the ESF, as recommended by the ESFAS, thus continuing to report the developments that flow from the ESF design changes taking place.

Progress Report 7, dated December 1992
(covering April 1, 1992 - September 30, 1992)

Section 2.1.2, Exploratory Studies Facility (ESF) Design and Construction, reported that Revision 1 of the ESF Title I Design Summary Report was issued reflecting the change in name from Exploratory Shaft Facility to Exploratory Studies Facility and the change in ESF configuration based on the ESF Alternatives Study. The same section also noted that a phased approach to ESF Title II design had been adopted by the program.

Section 2.1.8, Site Characterization Program Baseline (SCPB), reported that during the reporting period four revisions of the SCPB were issued. Of those, Revision 6 (issued July 15, 1992) updated Section 8.4 (Planned Site Preparation Activities) to be consistent with the current ESF concept.

Both the ESFAS Final Report and the Title I Design Summary Report for the Exploratory Studies Facility were included in this progress report by reference.

Progress Report 8, to be dated July 1993
(covering October 1, 1992 - March 31, 1993)

In response to the recurring comments that the Progress Report has not been providing sufficient description and notification of changes to ESF design, Section 2.1.2 of PR 8 provides a summary of the changes reported in previous PRs as well as discussion of the design and construction changes and progress occurring during this reporting period.

Section 2.1.6.2 notes the Structural Geology and Geoenvironmental Panel workshop held with the NWTREB to discuss ESF alternative design and construction strategies.

ENCLOSURE 3

NRC COMMENT 3 ON PROGRESS REPORTS 6 AND 7

DOE RESPONSE TO COMMENT 3

SECTION 2.1.1 QUALITY ASSURANCE PROGRAM**COMMENT 3**

The current listing of items and activities (Q-List) covered by the 10 CFR Part 60, Subpart G (which references 10 CFR Part 50 Appendix B) quality assurance program does not appear to have been updated to reflect the Q-List items applicable to the revised ESF design activities.

BASIS

This comment restates the concern expressed in SCP Comment 126.

A number of design packages are presently being developed and finalized without including the related design activities on an updated Q-List.

RECOMMENDATION

Future PRs should include an up-to-date listing or a reference to a listing of those items and activities covered by the 10 CFR Part 60 quality assurance program that are important to safety and waste isolation.

DOE Response to NRC Comment 3
On Progress Reports 6 & 7

The inclusion of detailed information such as the Q-List in progress reports is contrary to the scope and purpose of these reports. PR 8 continues the policy of incorporating such items as references. Section 2.1.1 specifically refers to the Project Q-List and it is included in the List of References. We remind NRC that DOE compiles a transmittal package of not-readily-available references cited in PRs and sends them to NRC under separate cover subsequent to each PR issue.

A detailed Q-List was developed in 1990 (YMP/90-55, Revision 0) which reflected the Conceptual Design for the potential repository as well as interfaces with the Exploratory Shaft Facility as described in the Site Characterization Plan. Reference to this Q-List will be provided to the NRC in Progress Report Number 8. Although the Q-List has not been updated since its development in 1990, the projects grading procedure has been revised and simplified. Natural Barriers have been recently classified to ensure that the Q-List represents the configuration of the Exploratory Studies Facility. These changes are based on recently completed Title II design activities and the determination of importance of potential permanent items. Section 2.1.1 of the PR 8 will note that the Q-List is documented in YMP/90-55, Revision 0, and that current activities are being undertaken to update the Q-List in response to recently completed design activities. The results of this update are expected to be published in PR 9 but only after review of the changes is complete. In general, these changes will result in defining the specific components and structures within systems (previously identified as Q) which perform the Q-related functions.

It should be noted that as a result of the issuance of the Quality Assurance Requirements and Description (QARD), DOE/RW-0333P, Revision 0, as well as earlier changes made to the process of developing and maintaining the Q-List and Quality Activities List (QAL), the need for a specific QAL was eliminated. Participants in the site characterization program are now responsible for reviewing the Q-List and applying appropriate controls to activities performed relative to items on the Q-List. The Q-List is maintained as a controlled document.

ENCLOSURE 4

NRC QUESTION 1 ON PROGRESS REPORTS 6 AND 7

DOE RESPONSE TO QUESTION 1

SECTION 2.2.1.11 STUDY 8.3.1.2.2.7 - HYDROCHEMICAL CHARACTERIZATION OF THE UNSATURATED ZONE

QUESTION 1

What evaluation has DOE made of the potential for air movement from the ESF to adversely impact the collection of geochemical data necessary for site characterization?

BASIS

This question is a more specific example related to SCA Comment 123. Comment 123 related the concern that "The effects of ventilation of the exploratory shafts and the underground testing rooms may have been underestimated in the evaluation of the potential interference with testing and the potential for irreversible changes to baseline site condition; also, there is not an adequate analysis of the effects of ventilation in the ESF on the ability of the site to isolate waste." Furthermore, the comment suggests that "at an early date, but before construction of the exploratory shafts is begun, DOE should provide an analysis that considers the effects on ventilation of the ESF, including both liquid and gas flows, on the rock adjacent to the ESF."

The NRC staff is concerned that surface-based tests planned to obtain chemical data necessary for site characterization could be adversely impacted by the ESF. Excavation of the ESF could compromise specific geochemical surface-based tests by allowing air to circulate from the ESF through the rocks of Yucca Mountain. Study Plan 8.3.1.2.2.7 identifies chemical species that will be sampled in the Yucca Mountain unsaturated zone. Some of these chemical species such as Deuterium, Tritium, Freon-11, Freon-12, Argon 39, Carbon 14, and Oxygen-18 can move through the unsaturated zone in both liquid and gas phases. If air from ESF drifts moves significant distances along paths of high air permeability, such as open fractures, gases from the drifts could mix with liquids and gases in the rock. At locations where this occurs, future geochemical sampling of predisturbance baseline conditions could be compromised.

Current estimates of air flow through the ESF suggest that a significant volume of rock could come in contact with air containing different concentrations and types of chemical species. For example, a presentation by Peters (1992, Table 2), estimated that 264,533 cubic ft./min. (cfm) of air may eventually circulate through the ESF with 178,000 cfm used by internal combustion engines. Alternatively, in Dennis (1991, p. 8-67), it is estimated that air fluxes in the main tunnel could range from 300,000 cfm to 500,000 cfm.

The NRC staff is aware that two studies have been completed estimating the extent of ESF dewatering (Hopkins, 1987, and Sobolik, 1991), but those investigations do not address the impact the ESF on the gathering of chemical data. In addition, we have been unable to find where this concern is addressed by the Site Characterization Plan, or Study Plans 8.3.1.2.2.1, 8.3.1.2.2.3, 8.3.1.2.2.4, and 8.3.1.2.2.7.

Study Plan 8.3.1.2.2.7 references geochemical tests to characterize the Yucca Mountain site. Of the tests described in this study plan, we are particularly concerned with surface-based tests using boreholes, such as geochemical sampling associated with the deep unsaturated zone boreholes described in Study Plan 8.3.1.2.2.3.

RECOMMENDATION

Consideration should be given to the anticipated effect of air movement from the ESF on surface-based geochemical tests. If air movement from the ESF is anticipated to significantly affect the gathering of geochemical data necessary for licensing from surface-based tests, it is recommended that this data be collected before it can be compromised. This recommendation should be considered in a timely manner.

REFERENCES

- Dennis, A.W., 1991, Exploratory studies facility alternatives study final report: Sandia National Laboratories, SAND91-0025, v. 2, p. B-67.
- Hopkins, P., 1987, Effect of drift ventilation on repository hydrology and resulting solute transport implications: Sandia National Laboratories, SAND86-1571.
- Peters, J.W., 1992, Ramp sizing by ventilation requirements: Presentation to Nuclear Waste Technical Review Board Structural Geology & Geoengineering Panel Meeting, Las Vegas, Nevada, Nov. 4-5, 1992.
- Sobolik, S.R., Fewell, M.E., and Eaton, R.R., 1991, Movement of shaft and drift construction water in Yucca Mountain, Nevada - an extended study: Sandia National Laboratories, SAND91-0791.

DOE Response to NRC Question 1
On Progress Reports 6 & 7

The DOE's reply to the NRC's May 13, 1993, letter forwarding a letter from Carl Johnson (NWPO) to B. J. Youngblood of NRC (letter, Shelor to Holonich, dated August 20, 1993) states the Yucca Mountain Site Characterization Project Office (YMPO) response to the technical concerns expressed by the State of Nevada. Almost all of U.S. Geological Survey's recommendations cited in DOE's reply have been acted upon and a drilling and test implementation schedule has been developed by YMPO to acquire the data. The NRC OR may examine the schedule.

Based on the NRC's recommendations for Question 1, we believe our reply to the State of Nevada's concerns reflects a responsive and concerted effort to consider the anticipated effects of air movement associated with ESF excavation on surface-based testing. The state advocates that DOE develop the data to understand ambient conditions of gaseous circulation prior to ESF excavation at the potential repository layer. This is what DOE has planned to do by collecting data from surface boreholes before ESF excavation. Although data are not yet available to show definitely how ESF construction will affect existing pneumatic or geochemical conditions, DOE has committed to monitor the effects of ESF excavation on this data-gathering program as construction proceeds. We believe that YMPO has acted on the NRC's recommendations contained in Question 1 herein and on the recommendations in the state's February 4, 1993, letter to NRC as well.

ENCLOSURE 5

NRC QUESTION 2 ON PROGRESS REPORTS 6 AND 7

DOE RESPONSE TO QUESTION 2

SECTION 2.2.6 POSTCLOSURE TECTONICS (SCP SECTION 8.3.1.8)

**SECTION 2.6.1 POST EMPLACEMENT NEAR-FIELD ENVIRONMENT
(SCP SECTION 8.3.4.2)**

QUESTION 2

How and to what extent is DOE factoring site characterization analyses into its Total System Performance Assessment (TSPA) calculations and how are the results and preliminary conclusions of performance assessment activities being considered in on-going and future site characterization activities?

BASIS

At a December 1992 NRC/DOE Technical Exchange, DOE discussed initial TSPAs which were published by Sandia National Laboratories (SNL) (Barnard and others, 1992) and Pacific Northwest Laboratory (Eslinger and others, 1993). The staff considers that this work demonstrates important progress toward resolution of SCA Comment 1, which addresses the need for DOE to provide early and iterative evaluations of the adequacy of data being gathered and the ability of the site to meet the 10 CFR Part 60 performance objectives.

In PRs 6 and 7, analyses, results, and preliminary conclusions from the TSPA are discussed. It is not clear from these discussions, the extent to which site characterization analyses have been factored into these assessments.

In PR 7, under Study 8.3.1.8.1.2 - Physical Processes of Magmatism and Effects on the Repository (p. 2-98), presentation of a paper describing studies of possible eruptive and subsurface effects of Yucca Mountain site disruption by basaltic volcanism is mentioned. However, what is not discussed, either under this study or in the performance assessment section of the report (Section 2.7), is whether this work was factored into the TSPA analyses on volcanism and, if so, how it was.

A second example concerns the evaluations of the effects of various repository thermal loadings on hydrologic flow, conducted at Lawrence Livermore National Laboratory and SNL and extensively discussed in PR 7 (Study 1.10.4.2 - Hydrologic Properties of Waste Package Environment, pp. 2-151-155). Again, it is not clear from this discussion or from the discussion of performance assessment-related activities in Section 2.7 of the report, the extent to which this work was used or referenced in the TSPA calculations.

RECOMMENDATION

Future Progress Reports should describe more explicitly the implementation of the link between site characterization and performance assessment activities, both in cases (1) when data gathered or analyses conducted under site characterization are used or factored into performance assessment calculations and (2) when results and preliminary conclusions from performance assessment analyses have, are being, or will be factored into on-going and future site characterization activities.

REFERENCES

- Barnard, R.W., Wilson, M.L., Dockery, H.A., Gauthier, J.H., Kaplan, P.G., Eaton, R.R., Bingham, F.W., and Raley, T.H., 1992, TSPA 1991: An initial total-system performance assessment for Yucca Mountain: Sandia National Laboratories, SAND91-2795.
- Eslinger, P.W., Doremus, L.A., Engel, D.W., Miley, T.B., Murphy, M.T., Nichols, W.E., White, M.D., Langford, D.W., and Ouderkirk, S.J., 1993, Preliminary total-system analysis of a potential high-level nuclear waste repository at Yucca Mountain: Pacific Northwest Laboratory, PNL-8444.

DOE Response to NRC Question 2
On Progress Reports 6 & 7

The NRC asks whether the linkages between performance assessment and site characterization will be documented in future Site Characterization Progress Reports. NRC also notes that these linkages have been described in several meetings, but the Progress Reports fail to address or identify instances of their use.

The Total-System Performance Assessment (TSPA) 1991 did not incorporate recent developments in near-field environmental thermal studies, but the TSPA 2 exercise currently underway does incorporate and evaluate this work. In addition, TSPA 2 is the beneficiary of new information and data coming from the surface-based testing program. The final products of the TSPA 2 exercise will be available early in 1994, and Progress Reports corresponding to the reporting period(s) for this work will discuss it, with emphasis on new data used and its impact on total system performance, if any.

TSPA 1991 did incorporate portions of the Sandia National Laboratories work on defining basaltic volcanism scenarios, and also used probability estimates produced by the Los Alamos National Laboratory as part of the site characterization program. The Pacific Northwest Laboratory's TSPA 1991 effort did conceptually similar analyses, but derived probabilities from the general volcanism literature. Hence, their probabilities were somewhat higher, but both the Sandia and the Pacific Northwest Laboratories' results indicated that the particular scenarios analyzed contributed little to total system performance. These results were discussed with the volcanologists on the program, who suggested the small effects were not surprising and may be useful in the annual reprioritization of the SCP's volcanism program. Only selected portions of the total volcanism scenario set were addressed, and other scenarios remain to be evaluated by the site and performance assessment programs.

The NRC's recommendation to include this type of information in future progress reports will be acted upon.

ENCLOSURE 6

NRC QUESTION 3 ON PROGRESS REPORTS 6 AND 7

DOE RESPONSE TO QUESTION 3

SECTION 2.4.3.1 DESIGN ACTIVITY 8.3.1.4.1.1 - DESIGN ACTIVITY TO VERIFY ACCESS AND DRIFT USABILITY

QUESTION 3

How does DOE plan to demonstrate confidence in the drift design methodology?

BASIS

The drift design methodology for the repository (Hardy and Bauer, 1991) is based on an areal power density (APD) of 57 KW/acre (124KW/ha). Sections 4.3.1 and 2.6.1.3 of PR 7 describe calculations that are based on an APD of 114 kW/acre (247 kW/ha).

In Hardy and Bauer (1991), the in situ, thermal, and seismic stresses that act on the support (rock bolts and/or shotcrete) of example drifts are calculated and presented. In Section 12.11 of Hardy and Bauer (1991), it is stated, "rockbolt and shotcrete stresses shown in the preceding sections exceed the allowable stress levels in most cases." Therefore, it has not been demonstrated that the drift design can produce acceptable support stresses for an APD of 57 kW/acre, nor is it demonstrated if, or how, the methodology is affected by an increase in thermal stress produced by an increase in the APD to 114 kW/acre (247kW/ha).

RECOMMENDATION

Demonstrate that the design methodology will result in a successful design or modify the design methodology to produce a support system in which the allowable stresses are not exceeded for the selected APD.

REFERENCE

Hardy, M. P. and Bauer, S.J., 1991, Drift design methodology and preliminary application for the Yucca Mountain Site Characterization Project: Sandia National Laboratories, SAND89-0837.

DOE Response to NRC Question 3
On Progress Reports 6 & 7

DOE plans to demonstrate confidence in the drift design methodology by monitoring the performance of drifts during site characterization. Specifically, four studies are directed toward gathering data for input to design, testing the design methodology by imposing thermal loads, and monitoring ground support system performance in a variety of geologic conditions. These studies are:

8.3.1.15.1.5	Excavation Investigations
8.3.1.15.1.6	In Situ Thermomechanical Properties
8.3.1.15.1.7	In Situ Mechanical Properties
8.3.1.15.1.8	Design Verification

As part of these studies, tests will be conducted to simulate repository conditions over a range of areal power densities that may be used in subsequent repository design. The data developed from these studies will provide a basis for improvement and validation of the design methodology. Subsequent repository designs should include ground support systems and components that meet the criteria established (and confirmed by testing) in the drift design methodology, and all other design requirements.

The report, "Drift Design Methodology and Preliminary Application for the Yucca Mountain Site Characterization Project" (SAND89-0837), details a drift design methodology that can be used in the development of future repository designs. The design methodology itself is independent of specific repository configuration and thermal loading; but ensures that key elements of drift design such as thermal, seismic, and in situ loading are taken into account when developing a ground support system. The preliminary application of the methodology to the SCP-CDR repository design was used only for illustrative purposes in the report and demonstrated that the design was not complete and required further refinement, specifically in the case of the details of the rockbolt designs and shotcrete specifications. It should also be noted that it was not within the scope of the report (SAND89-0837) to suggest modified designs nor to evaluate the compliance of the SCP-CDR design and design and regulatory requirements at other areal power densities such as 114kW/acre.

The heat load per acre used in the baseline repository concept (57kW/a) has not changed since the issuance of the SCP although discussions continue to occur regarding a possible change in this heat-loading concept. The SCP repository design concept is consistent with this heat load per acre. Studies, model validation, and testing programs concerning the heat load per acre are under way and planned for the future. These analyses will provide information necessary to evaluate the heat load per acre. The repository concept will be altered, as appropriate, based on the results of these activities.

ENCLOSURE 7

NRC QUESTION 4 ON PROGRESS REPORTS 6 AND 7

DOE RESPONSE TO QUESTION 4

TABLE 2.1 STATUS OF SCA OPEN ITEMS**QUESTION 4**

What specific plans and studies are proposed to address NRC's Site Characterization Analysis (SCA) open items?

BASIS

In DOE progress reports 6 and 7 Table 2.1 provides the status of SCA open items and identifies proposed methods to resolve those open items. The proposed methods for resolution are listed in general terms in many cases (e.g., Resolution code #5, "Concern addressed by implementation of the YMP plan, Study Plan/activity or other design studies in current technical baseline") and it is unclear what specific activities of the site characterization program will address a particular open item. For example, resolution code #5 does not identify the specific plan or study that would address an individual open item. Identification of a plan or study, would inform the NRC staff about which studies are intended to address various open items.

RECOMMENDATION

Where available, specific references should be provided to identify draft and final reports intended to resolve open items. Activities responding to SCA and study plan concerns should include a reference to the concern in the summary and a brief statement about any progress toward its resolution.

DOE Response to NRC Question 4
On Progress Reports 6 & 7

DOE has revised Table 2-1 (Status of Site Characterization Open Items) of Progress Report 8 to more specifically identify the actions currently planned to address each SCA open item. The actions identified include specific steps that need to be performed to resolve the concern, and/or what specific study plans, studies, reports, etc., that need to be prepared. However, the discussions of all studies and activities reported in PR 8 do not reference each open item to which that particular study or activity may provide input.

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