JUL 20 1994

MEMORANDUM FOR: Joseph J. Holonich, Chief
High-Level Waste and Uranium
Recovery Projects Branch
Division of Waste Management, NMSS

FROM: Michael J. Bell, Chief
Engineering and Geosciences Branch
Division of Waste Management, NMSS

SUBJECT: REVIEW OF DOE STUDY PLAN 8.3.1.15.1.5, REVISION 1 - "EXCAVATION INVESTIGATIONS"

This memorandum transmits the review results of DOE Study Plan (SP) 8.3.1.15.1.5, Revision 1. The review was conducted in accordance with the procedures in the "Review Plan for NRC Staff Review of DOE Study Plans, Revision 2, March 10, 1993." Based on the review, there are no objections to this SP. However, the staff notes that there is a lack of integration of this SP with other SPs. Further discussions on this issue can be found under items 4 and 7 of the Enclosure. This SP has some information on model validation, an issue raised in Site Characterization Analysis (SCA) Comment 56. However, some of the bases of the SCA Comment are related to other SPs which are yet to be submitted by DOE and reviewed by NRC. Therefore, SCA Comment 56 will remain open. The details of the review of this SCA Comment also can be found in the Enclosure.

Dr. Banad Jagannath performed this review and Dr. Mysore Nataraja performed the IQA review. If you have any questions on this review, please contact Banad Jagannath at 415 6653.

(ORIGINAL SIGNED BY:)

Michael J. Bell, Chief
Engineering and Geosciences Branch
Division of Waste Management, NMSS

Enclosures: As stated

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ENCLOSURE

REVIEW OF DOE STUDY PLAN 8.3.1.15.1.5, REVISION 1

"EXCAVATION INVESTIGATIONS"

The conclusions of this review are based on findings for the five criteria of the specific approach given in Section 4.1 of the review plan, and findings for the ten objectives of the review given in Section 2.2 of the review plan. The findings for the ten objectives are the following:

1. The level-of-detail of the Study Plan (SP) is generally consistent with the NRC/DOE agreement of May 7-8, 1986. However, the SP does not provide specific details, for example, on the exact location of the proposed testing, typical lay out of the proposed instrumentation, and experimental procedures (EPs) and test procedure (TPs) to be used. The staff recognizes that in this investigation, the actual site conditions dictate some of the details such as specific location of monitoring and exact number of instruments to be used. It is also expected that EPs and TPs to be used in this investigation will be provided for NRC review if and when requested. Therefore, the staff considers the SP to be in general compliance with the NRC/DOE agreement on the level-of-detail.

2. The objectives of the SP are generally consistent with the objectives of the Excavation Investigations presented in the Site Characterization Plan (SCP) and the SP approach appears to be reasonable because the instruments and monitoring techniques proposed in this SP, are those commonly used by the rock mechanics community. In addition, the parameters being measured/monitored are appropriate for performing model validation. The three experiments of the SP (Access Convergence, Demonstration Breakout Room (DBR), and Sequential Drift Mining) are designed to provide data to assess repository excavation performance and to provide input to a data base to be used in the validation of rock mass constitutive models for predicting the deformational behavior of the rock mass around excavated openings.

3. The excavations proposed for this study (not including the ESF excavations) consist of excavating a repository-opening size DBR, and sequential drift mining openings. The DBR will be excavated in that part of the Topopah Spring unit (TSw1) which is believed to have high lithophysal content. The location of the sequential drift mining experiment is yet to be decided but is expected to be in the general vicinity of the main test level (MTL). It should be noted that the location of the MTL within the ESF is yet to be finalized. Design decisions on the exact location of experiments and the number of tests will be based on the conditions encountered at the site, as a result, the specific details on the location and number of tests planned in this SP are absent. Therefore, whether the proposed tests have a potential for creating preferential pathways can only be determined after the test locations are finalized. The SP recognizes the need to minimize the amount of water to be used in these tests. The volume of material to be excavated in the above two experiments for this SP is not significant when

compared to the overall excavations planned for the ESF at the site, therefore, any adverse impact on repository performance as a result of this investigation is likely to be minimal.

4. The monitoring activities of this SP are similar to some of the activities of the SP "In Situ Design Verification". This SP recognizes the need for coordinating the TBM operations and the monitoring activities for the access convergence experiment. However, other studies (for example, In Situ Design Verification, Geologic mapping activity etc.) will also be either impacting or be impacted by the activities of this SP, because the activities of all these SPs will be taking place in the immediate vicinity of the TBM. Proper coordination among these activities needs to be emphasized in the corresponding SPs so as not to cause any unnecessary interference on other site characterization activities at the ESF.

5. This SP was developed under an OCRWM-approved and NRC accepted Quality Assurance (QA) program. QA aspects of this SP have been reviewed by the HLUR branch.

6. The SP does not propose any use of radioactive materials in testing described in this investigation.

7. Although the staff did not identify any objections, comments, or questions, and it is likely that the plan enables DOE to obtain information for licensing, the staff notes a lack of integration among SPs similar to that observed in other SP reviews. Specifically:

   (1) SP 8.3.1.15.1.2 "Laboratory Thermal Expansion Testing", states that some of the samples for testing will be obtained from work done under this SP, but there is no mention of that in this SP;

   (2) SP 8.3.1.15.1.8 "In Situ Design Verification", involves in situ monitoring of openings using methods very similar to those proposed under this SP. While SP 8.3.1.15.1.8 mentions Experimental Procedures (EP) and Test Procedures (TP) for the monitoring activities, the cover letter accompanying this SP states that, there are no EPs and TPs and that only scientific notebooks will be used to document the work. However, SCP Section 8.3.1.15.1.5 Excavation Investigations and Tables 5-1, 5-2, and 5-3 indicate that EPs and TPs will be developed for this SP. This discrepancy needs to be clarified. Since most of the monitoring activities under this SP use standard equipment and procedures routinely used in the industry, appropriate EPs and TPs should be developed and followed to achieve consistency in data collection among SPs performing similar work.

8. DOE states that the information on SCA Comment 56 in this SP is unchanged from that provided in Rev. 0, dated January 1989. DOE in its letter of transmittal did not ask for resolution of this Comment. The information in this SP relevant to SCA Comment 56 is that rock mass response (deformation and load/stress causing it) will be monitored and will be used to validate constitutive models that will be used to predict the

deformational behavior of the rock mass around excavated openings. However, the data set that will be used in validating the models comes from numerous studies identified in Table 1-2 of this SP. In addition, SCA Comment 56 has bases that are concerned with the activities of some of the SPs that are yet to be reviewed (for example, In Situ Thermomechanical Properties). Because the comment is concerned with issues that are not completely addressed by this SP, the comment will remain open until all other SPs identified in Table 1-2 of this SP have been received and reviewed.

9. The results of the review are presented in this memo.

10. No new items were identified for the OITS.

The five steps of the specific approach given in Section 4.1 of the review plan are linked to the ten objectives described above.

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| Section 8.3.1.15.1 | Investigation: Studies to provide the required information for spatial distribution of thermal and mechanical properties, p. 8.3.1.15-31 |
| Section 8.3.5.20 | Analytical Techniques Requiring Significant Development |

SCA COMMENT 56

The validation of models should be a part of the overall test program. It is not clear that these aspects have been addressed by the test program.

EVALUATION OF DOE RESPONSE

- SCA Comment 56 refers to Section 8.3.1.15.1 of which Section 8.3.1.15.1.5 is a part. The DOE response in this SP states that data monitored in this SP provides input into a data base that will be used to validate rock mass constitutive models for predicting the deformational behavior of the ground around excavated openings. Stress and deformation response of the rock mass is monitored around the excavations in this study and this data will be used in the model validation exercise. Monitored data from many other SPs (in Table 1-2 of this SP) contribute to this model validation exercise, and some of those SPs have not been reviewed by the staff.

- The instrumentation proposed and the parameters monitored are in general agreement with the industry practice. However, the SP provides only general information and lacks specific details on experimental and technical procedures to be used.

- Until all the relevant SPs which provide monitored data on thermal and mechanical response of rock mass to excavations are reviewed, the staff considers this comment open.