

MEMORANDUM FOR: Joseph Holonich, Director  
Repository Licensing and Quality Assurance  
Project Directorate  
Division of High-Level Waste Management

FROM: Margaret V. Federline, Chief  
Hydrology and Systems Performance Branch  
Division of High-Level Waste Management

SUBJECT: PHASE I REVIEW OF STUDY PLAN 8.3.1.2.2.5,  
DIFFUSION TESTS IN THE EXPLORATORY STUDIES  
FACILITY [RITS 411421 TAC L60265]

As requested, we have completed the Phase I review of the Study Plan 8.3.1.2.2.5, Diffusion Tests in the Exploratory Studies Facility. This review was conducted using the Review Plan for NRC Staff Review of DOE Study Plans Revision 1 (December 6, 1990). The stated purpose of the DOE "Study Plan 8.3.1.2.2.5, Revision 0, titled "Diffusion Tests in the Exploratory Studies Facility," is to investigate the ability of diffusion to reduce the rate of ground water radionuclide transport from the repository through the unsaturated zone to the underlying water table or to the surface. Data from this study will help to compute retardation due to the diffusion of long-lived radioactive waste species such as <sup>99</sup>Tc and <sup>129</sup>I. In conjunction with tuff sample laboratory measurements of diffusion (Study Plan 8.3.1.3.6.2), these data will also help to define the statistical basis for the diffusion parameters used in performance assessment modeling.

The diffusion tests will use in situ testing to determine the extent to which nonsorbing tracers diffuse into the water-filled pores of the Topopah Spring welded unit and the vitric and zeolitic zones of the Calico Hills nonwelded unit. In the Exploratory Study Facility plans, each diffusion test will be performed in an alcove (approximately 6m x 6m) in the exploratory drifts of the Topopah Springs unit and the Calico Hills unit. From boreholes drilled in the alcoves, tracers will be introduced and permitted to diffuse into the rock. At the end of the test, emplacement locations will be overcored, and tracer concentrations will be measured.

One test interference effect not considered by this study plan is the potential for exploratory drifts to influence the results of diffusion testing by drying the rock. By referencing calculations by Sobolik, et al, in the "Movement of Shaft and Drift Construction Water in Yucca Mountain, Nevada - An Extended Study, (SAND91-0791, Sandia National Laboratories)," the staff

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was able to reach a conclusion that there would probably be no measurable drying effects on this experiment. However, should this study be sensitive to moisture contents, the design of the experiment may need to be reconsidered as improved predictions of Exploratory Study Facility drying effects are completed, or changes occur to Exploratory Study Facility design and scheduling.

In conducting this review the NRC staff did not identify an "objection" level concern. However, in making this determination the staff did not consider test interference and repository performance impacts from the construction of exploratory tunnels in the Topopah Springs unit or the Calico Hills unit. It is anticipated that the DOE will consider these effects in its ongoing evaluation of characterization activities and that the NRC staff will review against these potential concerns when the DOE has identified an exploratory facilities design and conducted an analysis of how the design meets relevant 10 CFR 60 regulations.

This study plan is a candidate for a detailed technical review based on criteria 1 and 3 from step 6 of part 4.2 of the Review Plan. This review has shown that the study plan is related to one or more key site related issues and references many prototype tests.

The review was conducted by William Ford of the Hydrologic Transport Section; if you have any concerns he can be reached at extension 504-2506.

*MS by Sher Bahadur*

Margaret V. Federline, Chief  
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*WJF*

Enclosures:  
As stated

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ATTACHMENT A  
ITEMIZED CHECKLIST OF STUDY PLAN CONTENT  
DIFFUSION TESTS IN THE EXPLORATORY STUDIES FACILITY

I. PURPOSE AND OBJECTIVE

Is the information to be obtained in the study described?  
Yes  No  N/A

Is the rationale for information to be obtained provided?  
Yes  No  N/A

II. RATIONALE FOR STUDY/INVESTIGATION

Does the study plan provide the rationale for tests and analysis, indicating alternatives considered and options, advantages, and limitations?  
Yes  No  N/A

Does the study plan provide the rationale for the number, location, duration and timing of tests, considering uncertainty, and identify obvious alternatives?  
Yes  No  N/A

Does the study plan describe the constraints for the study?  
Yes  No  N/A

In describing the constraints for the study, does the study plan consider potential site impacts?  
Yes  No  N/A

In describing the constraints for the study, does the study plan consider the need to simulate repository conditions?  
Yes  No  N/A

In describing the constraints for the study, does the study plan consider the required accuracy and precision?  
Yes  No  N/A

In describing the constraints for the study, does the study plan consider the limits of analytical methods?  
Yes  No  N/A

In describing the constraints for the study, does the study plan consider the capability of analytical methods?  
Yes  No  N/A

In describing the constraints for the study, does the study plan consider time required vs. time available?

Yes  No  N/A

In describing the constraints for the study, does the study plan consider the scale of phenomena and parameters?

Yes  No  N/A

In describing the constraints for the study, does the study plan consider interference among tests?

Yes  No  N/A

In describing the constraints for the study, does the study plan consider interference between tests and exploratory shaft

Yes  No  N/A

### III. DESCRIPTION OF TESTS AND ANALYSIS

For each type of test does the study plan describe the general approach that will be used?

Yes  No  N/A

For each type of test does the study plan describe the key parameters that will be measured in the test and experimental conditions under which the test will be conducted?

Yes  No  N/A

For each type of test does the study plan indicate the number of tests and locations?

Yes  No  N/A

For each type of test does the study plan summarize the test methods if non-standard procedure, summarize steps of the test, how it will be modified, and reference technical procedure?

Yes  No  N/A

Not all of the technical procedures have been developed. Out of 13 technical procedures identified in the report, 11 have yet to be developed.

For each type of test does the study plan indicate the level of QA and provide the rationale for any tests not QA level one?

Yes  No  N/A

QA grading packages for the activities of this study plan will be prepared separately, according to AP-5.28Q, "Quality Assurance Grading". The resultant Quality Assurance Grading Report will be issued as a controlled document.

For each type of test does the study plan reference the applicable specific QA requirements applied to the test?

Yes \_\_\_\_\_ No X N/A \_\_\_\_\_

Determination of the quality status for the activities of this study will be made separately, according to AP-6.17Q, "Determination of the Importance of Items and Activities", which implements NUREG-1318, "Technical Position on Items and Activities in the High-Level Waste Geologic Repository Program Subject to Quality Assurance Requirements". The results of that determination will be contained in the Q-List, Quality Activities List and non-Selection Record, which will be controlled documents.

For each type of test does the study plan specify the tolerance, accuracy, and precision required in the test?

Yes X No \_\_\_\_\_ N/A \_\_\_\_\_

For each type of test does the study plan indicate the range of expected results and the basis for those results?

Yes X No \_\_\_\_\_ N/A \_\_\_\_\_

For each type of test does the study plan list the equipment requirements, briefly describing special equipment?

Yes X No \_\_\_\_\_ N/A \_\_\_\_\_

For each type of test does the study plan describe the techniques to be used for data reduction and analysis?

Yes X No \_\_\_\_\_ N/A \_\_\_\_\_

For each type of test does the study plan describe the representativeness of test, indicating limitations and uncertainties that apply to use of results?

Yes X No \_\_\_\_\_ N/A \_\_\_\_\_

For each type of test does the study plan provide illustrations of test locations?

Yes X No \_\_\_\_\_ N/A \_\_\_\_\_

For each type of test does the study plan discuss the relationship of the test to set performance goals and confidence levels?

Yes X No \_\_\_\_\_ N/A \_\_\_\_\_

For each type of analysis does the study plan state the purpose of analysis, indicate conditions to be evaluated and describe any uncertainty analysis?

Yes  No  N/A

For each type of analysis does the study plan describe the methods of analysis, including analytical expressions and numerical models to be used?

Yes  No  N/A

For each type of analysis does the study plan reference the technical procedures document that will be followed during analysis?

Yes  No  N/A

For each type of analysis does the study plan indicate the levels of QA applied?

Yes  No  N/A

QA grading packages for the activities of this study plan will be prepared separately, according to AP-5.28Q, "Quality Assurance Grading". The resultant Quality Assurance Grading Report will be issued as a controlled document.

For each type of analysis does the study plan identify data input requirements?

Yes  No  N/A

For each type of analysis does the study plan describe the expected output and accuracy?

Yes  No  N/A

For each type of analysis does the study plan describe the representativeness of the analytical approach, indicating limitations and uncertainties that apply to results?

Yes  No  N/A

#### IV. APPLICATION OF RESULTS

Does the study plan briefly discuss where results from study will be used for support of other studies?

Yes  No  N/A

Does the study plan refer to specific performance assessment analyses?

Yes  No  N/A

Does the study plan describe where information from the study will be used in construction equipment and engineering system design and development?

Yes  No  N/A

Does the study plan describe where information from the study will be used in planning other characterization activities?

Yes  No  N/A

#### V. SCHEDULES AND MILESTONES

Does the study plan provide durations of and interrelationships among principal activities associated with this study?

Yes  No  N/A

Does the study plan list key milestones including decision points associated with study activities?

Yes  No  N/A

Does the study plan describe the timing of the study relative to other studies and other program activities?

Yes  No  N/A

Does the study plan provide dates for activities for the study plans: reference section 8.5 in SCP?

Yes  No  N/A

Specific dates are not included in this study plan, because the schedule depends upon the ESF construction schedule, which has been revised from that originally stated in the SCP.