

SEP 17 1991

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

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

SUBJECT: PHASE I REVIEW OF STUDY PLAN FOR CHARACTERIZATION OF THE
YUCCA MOUNTAIN UNSATURATED-ZONE GASEOUS PHASE MOVEMENT
(S.P.8.3.1.2.2.6, REV 0)

As requested, we have completed the Phase I review of the Study Plan for Characterization of the Unsaturated-Zone Gaseous Phase Movement Rev 0 (see enclosure). This review was conducted using the Review Plan for NRC Staff Review of DOE Study Plans, Revision 1 (December 6, 1990).

The subject study plan consists of one activity, the gaseous phase circulation study (8.3.1.2.2.6.1). The work involves the determination of flow, temperature, and gas composition profiles by logging wells USW-UZ6 and USW-UZ6s. The activity will also consist of flow interference tests, tracer tests, and a gas-flow modeling study. The results of this study may be used in the preparation of other study plans and will require at least two years of data collecting.

The principal finding of this review is that the study plan could be a candidate for detailed technical review based on the importance of the issues being addressed and the state-of-the-art investigation methods being employed. However, we do not recommend that a detailed review be conducted because later study plans will be collecting data more directly related to performance assessment. In addition, the technical details required for such a review will not be available until 30 to 60 days before the associated testing is started. For this reason, we recommend that once the work begins, technical exchanges including field visits be held periodically. We also wish to record here our present judgement that a detailed technical review should be reserved for those later study plans which will investigate repository induced gas flow in much greater detail.

In addition to our finding, we wish to suggest to DOE that the gas-flow modeling activity not be limited to the use of only one numerical model. The data may be sufficient to test other models as well and should certainly be provided in

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a manner that will allow other investigators of this phenomena to test existing gas-flow models and/or develop new ones.

We do not require the submittal of additional references at this time.

This review was conducted by Rex Wescott of the Hydrologic Transport Section who can be reached on extension 20167.

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Margaret V. Federline, Branch Chief
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Division of High-Level Waste Management

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As stated

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PHASE I REVIEW: DOE PLAN FOR CHARACTERIZATION OF THE YUCCA
MOUNTAIN UNSATURATED-ZONE GASEOUS PHASE MOVEMENT
(STUDY PLAN 8.3.1.2.2.6, Revision 0)

by

Rex G. Wescott

Hydrologic Transport Section
Hydrology & Systems Performance Branch
Division of High-Level Waste Management, NMSS
U.S. Nuclear Regulatory Commission

September 16, 1991

Introduction

The stated purpose of the DOE "Study Plan for Characterization of the Yucca Mountain Unsaturated-Zone Gaseous Phase Movement" is to describe USGS plans to develop an understanding of the processes that cause gaseous phase circulation through the unsaturated rock comprising Yucca Mountain based on observations and tests made at one site. Data from this study will be used in study plan 8.3.1.3.8.1 (Gaseous radionuclide transport calculations and measurement), study plan 8.3.1.3.7.1 (Retardation sensitivity analysis) and other studies regarding fluid flow in the unsaturated hydrologic system. This study plan consists of one activity, the gaseous-phase circulation study.

A Phase I review of the study plan was done with respect to (A) DOE/NRC agreement on the content of study plans, (B) Identification of objections, (C) Closure of NRC open Items, and (D) The need for a Detailed Review (See Review Plan for NRC Staff Review of DOE Study Plans, Revision I, 12/6/90).

Evaluation of Study Plans Relative to the Agreement and to the Responsible DOE Contractors OA Program (Objectives 1 and 5)

Criterion 1 - The content of the study plan under review is reasonably consistent, as appropriate for the activities, tests and analyses described, with the Agreement (NRC-DOE meeting on the level of detail for site characterization plans (SCP) and study plans, May 7-8, 1986).

Staff Review: Attached (Attachment A) is an itemized checklist of the study plan content as compared to the agreement on content resulting from the NRC/DOE level of detail meeting. In general, the content of the study plan is reasonably consistent with the agreement. The details of field tests are contained in the

technical procedures which were not provided as part of the study plan. Also, many of these technical procedures have not as yet been written. However, the overall descriptions of the tests and analyses as provided in the study plan are complete enough for the staff to make a determination as to the apparent adequacy of the study plan.

Criterion 2- All study plan references have been provided when the study plan was issued.

Staff Review: The study plan lists 32 references in addition to the DOE Site Characterization Plan (SCP) and the USGS Quality Assurance Program Plan for Nevada Nuclear Waste Storage Investigation. Of these only 8 were listed as references for Chapter 3, Hydrology, of the SCP. Of the remainder, most appeared to be available as government reports, articles in technical journals, textbooks, and publications by the National Laboratories. Those references necessary to help understand some of the technical details of the problem and the proposed modeling approach were already available in-house. The Staff will, therefore, not request any copies of references at this time.

Criterion 3:- Open items relative to the QA program of the DOE contractor responsible for the study plan that could call into question the quality of the study plan, have been resolved.

Staff Review : [TO BE DETERMINED BY THE QA REVIEWER]

Identification of Objections (objectives 2 through 6)

Criterion 1 - Potential adverse effects on repository performance:

Staff Review: Adverse effects are not expected. No new drilling, trench construction, or road construction is proposed. No offroad vehicle activity is planned, although there will be some offroad foot traffic.

Criterion 2 - Potential significant and irreversible/unmitigable effects on characterization that would physically preclude obtaining information necessary for licensing.

Staff Review: None. No interference is expected between these tests and other characterization activities, nor will these tests affect

any other activities.

Criterion 3 - Potential significant disruption to characterization schedules or sequencing of studies that would substantially reduce the ability of DOE to obtain information necessary for licensing.

Staff Review: The potential exists that the gases introduced during the tracer tests might result in residual concentrations that could interfere with future tests. Based on past drilling observations, however, and the fact that gas tracers will be introduced only in the Tiva Canyon welded unit and only in much smaller volumes than they were during drilling, it is anticipated that residual gas tracer concentrations will drop below their detection limits within a few months of the tests.

Criterion 4 -Inadequacies in the QA program which must be resolved before work begins.

Staff Review: [TO BE DETERMINED BY THE QA REVIEWER]

Closure of NRC Open Items (Objectives 8 and 11)

Staff Review: Not applicable - DOE did not propose to close any open items with this study plan in its transmittal letter.

Need for Detailed Technical Review

A study plan is a candidate for a detailed technical review if it meets any of the following 5 criteria from step 6 of part 4.2 of the Review Plan. In summary: this study plan is a candidate for a detailed technical review based on criteria 1 and 3. However, in regard to criterion 1 (key site related issues), this study plan will only provide limited input as compared to other more directly related study plans which have not yet been submitted. In regard to criterion 3 (unique tests or analysis methods), procedures are expected to be developed during the actual field work. Therefore, we suggest that a detailed technical review not be conducted. As an alternative, we suggest that technical exchanges, possibly with accompanying field visits, be used to monitor the progress of the data collection program. In our opinion, a detailed technical review will be more useful for those later study plans which may be written based on the results of this study. Each criterion is discussed below:

Criterion 1- The study plan may be related to one or more key site related issues.

Staff Review: Information derived from the study will principally support the performance determination of radionuclide releases to the accessible environment. Much of the information derived from this study is expected to be qualitative in nature with quantitative parameters only valid for that part of the repository where they are measured. Study results may also help resolve issues concerned with releases from the repository engineered-barrier system. The primary support for performance related issues will come from the results of later investigations such as 8.3.1.3.7 (radionuclide retardation by all processes) and 8.3.1.3.8 (retardation of gaseous radionuclides), however. In addition, the scope of this study plan is limited, consisting of only one test location with various tests being performed using the same existing boreholes. The staff notes that DOE has also listed groundwater travel time (GWTT) as a major issue to which this study plan applies. In consideration of the types of tests to be performed and the limited applicability of the results of the tests to the repository as a whole, the staff does not believe that this study will significantly contribute to resolution of the GWTT issue.

Criterion 2- The study plan pertains to some NRC open items.

Staff Review:- The study plan does not directly pertain to any NRC open items.

Criterion 3- The study plan describes unique, state-of-the-art tests or analysis methods that do not have a supportive scientific history of providing data usable in licensing.

Staff Review: The study plan describes a number of techniques that are relatively new investigation methods or have not been used on the scale being proposed by the study plan.

Criterion 4- The study plan describes a study critical to the evaluation of site performance that cannot be repeated for a number of years due to its disruption of the natural baseline.

Staff Review: As previously discussed under criterion 1 of this part, many of the results from this study will not be used directly for

evaluating the performance of the site. The only change to be made to the existing baseline will be by the addition of small amounts of gases for the tracer tests. The concentrations of these gases are expected to drop below their detection limits within a few months of the tests. Hence, those tests measuring the seasonal effects on flow could be repeated the following year (if not during the same year).

Criterion 5 - The study has some other critical relationship to potential licensing concerns.

Staff Review: The staff has no licensing concerns in regard to this study plan other than those listed above.

ATTACHMENT A

Phase I Review of Study Plan 8.3.1.2.2.6
Characterization of the Yucca Mountain Unsaturated-Zone
Gaseous Phase Movement

Rex G. Wescott, Hydrologic Transport Section
September 16, 1991

I. Purpose and Objective

Describe the information to be obtained in the study.

Yes No N/A

Provide the rationale for information to be obtained.

Yes No N/A

II. Rationale for Study/Investigation

Provide rationale for tests and analysis, indicating alternatives considered and options, advantages, and limitations.

Yes No N/A

Within the scope of this study, as many approaches as feasible will be used to determine the factors that control gaseous-phase circulation and to estimate the magnitude of the various relevant parameters.

Provide the rationale for the number, location, duration and timing of tests, considering uncertainty, and identify obvious alternatives.

Yes No N/A

Describe the constraints for the study, considering:

- Potential site impacts

Yes No N/A

All sampling will be conducted in holes USW UZ-6, USW UZ-6s, and neutron access holes USW N71-N76 and N93-N95.

- Need to simulate repository conditions

Yes No N/A

This is intended to be a study of present condition gas flow in the mountain.

- Required Accuracy and precision

Yes No N/A

The accuracy and precision of the various instruments and of the measured values are described in the technical procedures.

- Limits of Analytical Methods

Yes No N/A

However, limits of some of the procedures can be deduced from the discussion provided in the study plan.

- Capability of Analytical Methods
Yes No N/A
- Time required vs. time available
Yes No N/A
- Scale of Phenomena and Parameters
Yes No N/A
- Interference among test
Yes No N/A
- Interference between tests and ES
Yes No N/A

III. Description of Tests and Analysis
For each Type of Test

- Describe general approach that will be used.
Yes No N/A
- Describe key parameters that will be measured in test and experimental conditions under which the test will be conducted.
Yes No N/A
- Indicate number of tests and locations.
Yes No N/A
- Summarize test methods if non-standard procedure, summarize steps of test, how it will be modified, and reference technical procedure.
Yes No N/A

Many of the test procedures have not as yet been developed.

- Indicate level of QA and provide rationale for any tests not QA level.
Yes No N/A
[TO BE DETERMINED BY QA REVIEWER]
- Reference the applicable specific QA requirements applied to test.
Yes No N/A
[TO BE DETERMINED BY QA REVIEWER]

- Specify tolerance, accuracy, and precision required in test.

Yes _____ No X N/A _____

The tolerance, accuracy, and precision associated with the instrumentation will be provided in the technical procedures manuals.

- Indicate range of expected results and basis for those results.

Yes X No _____ N/A _____

- List equipment requirements, briefly describing special equipment.

Yes _____ No X N/A _____

Equipment requirements will be provided in the technical procedure documents.

- Describe techniques to be used for data reduction and analysis.

Yes _____ No X N/A _____

Techniques for data reduction and analysis are expected to be provided in the procedures document.

- Describe representativeness of test, indicating limitations and uncertainties that apply to use of results.

Yes X No _____ N/A _____

- Provide illustrations of test locations.

Yes X No _____ N/A _____

- Discuss relationship of test to set performance goals and confidence levels.

Yes X No _____ N/A _____

Appendix 7.2 is cited in section 1.3 but not provided with the study plan. However, parameter goals and confidence limits are provided in Table 4.2-1.

For Each Type of Analysis

- State purpose of analysis, indicate conditions to be evaluated and describe any uncertainty analysis.

Yes X No _____ N/A _____

- Describe methods of analysis, including analytical expressions and numerical models to be used.

Yes No N/A

- Reference the technical procedures document that will be followed during analysis.

Yes No N/A

- Indicate levels of QA applied.

Yes No N/A

[TO BE DETERMINED BY QA REVIEWER]

- Identify data input requirements.

Yes No N/A

- Describe expected output and accuracy.

Yes No N/A

For the gas-flow modeling study the accuracy of the output will depend upon the accuracy of the input and the modeling assumptions. For the various profiles, the accuracy of the analysis will be the same as the accuracy of the measuring instrument which is discussed in the technical procedure associated with that test.

- Describe representativeness of analytical approach, indicating limitations and uncertainties that apply to results.

Yes No N/A

IV. Application of Results

Briefly discuss where results from study will be used for support of other studies.

Yes No N/A

Refer to specific performance assessment analyses.

Yes No N/A

Describe where information from study will be used in construction equipment and engineering system design and development.

Yes No N/A

Describe where information from study will be used in planning other characterization activities.

Yes No N/A

V. Schedules and Milestones

Provide durations of and interrelationships among principal activities associated with this study.

Yes No N/A

List key milestones including decision points associated with study activities.

Yes No N/A

Describe timing of study relative to other studies and other program activities.

Yes No N/A

Provide dates for activities for the study plans: reference section 8.5 in SCP.

Yes No N/A

Dates are expressed in terms of fiscal years after inception of the study plan.