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MEMORANDUM FOR: Hubert J. Miller, Chief
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FROM: Seth M. Coplan
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SUBJECT: IDENTIFICATION OF NTS ISSUES

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Attached is a list of issues that have been identified for the NTS. The list is divided into five topic review areas to be consistent with the organization of the NTS review team. As is explained in the discussion that accompanies the list, the list includes as much specificity as is possible at this time and will evolve toward greater specificity as our interactions with DOE increase. This list satisfies OPS plan commitment 311212D.

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SYSTEMATIC IDENTIFICATION OF NEVADA TEST SITE ISSUES

Background and Introduction

Under the present U. S. Department of Energy (DOE) schedules for submittal of Site Characterizaton Reports (SCR) to NRC, DOE will submit an SCR for a geologic repository on the Nevada Test Site (NTS) in June 1983. The SCR will be an issue-oriented document. In this connection the SCR should accomplish the following:

1. establish what is known about the site from completed site exploration activities;
2. describe the issues that DOE has identified at the site in light of the results of completed site investigations; and
3. describe the detailed plans to resolve the identified issues.

The issue-oriented nature of the SCR will carry over to the NRC's review and Site Characterization Analysis (SCA). In preparing for that review an essential part of the NRC's work is one of establishing the full set of issues at the earliest possible time. The present document describes

the staff's initial effort to establish the issues that should be considered in an SCR for the NTS.

Approach to Identification of the Issues

To systematically identify the NTS issues, several distinctions that can be made between types of issues prove useful. For the purpose of SCR review and SCA preparation an issue is a question that bears on the suitability for licensing of some aspect of a proposed geologic repository. Used in this sense, the specificity of an issue can range from being general enough to apply to any proposed geologic repository at one extreme to being so specific that it would apply to only one specific site or engineered feature at another. For example: what hydrostratigraphic units should be used for modeling and testing? is a very general issue. On the other hand, should the Bullfrog member of the Crater Flat tuff be treated as a hydrostratigraphic unit? is so specific that it applies only to specific areas of the NTS.

A general issue and a more specific issue may bear a useful relationship to each other in that resolution of the more specific issue is a key step toward resolution of the general issue. In that case, the specific issue can be thought of as a sub-issue of the general issue. In

practice, resolution of a general issue is accomplished by dividing it into an appropriate set of sub-issues such that, each of the sub-issues can be resolved by satisfying a discrete information need.

The last point of the previous paragraph suggests another useful distinction between issues: those that bear on whether the performance objectives and other requirements of 10 CFR Part 60 will be met by a proposed geologic repository and use analyses and measured data for their resolution (potential licensing issues) as opposed to those that bear on the methods of collecting and analysing data (methods issues). Methods issues are sub-issues of potential licensing issues. For example: is there a groundwater travel time to the accessible environment of at least 1,000 years at Yucca Mountain? is a potential licensing issue. To resolve that issue, it is necessary to know hydraulic conductivities. The need for hydraulic conductivity measurements raises sub-issues concerning the type or types of tests to be used (pump tests versus slug tests for example) and the spacing and scale of the tests, all of which are methods issues.

Methods issues will be resolved as site characterization progresses. Thus, in the previous example, decisions will be made during site characterization as to how, where, and at what scale hydraulic

conductivity measurements will be taken. Once these decisions have been made and the measurements taken, the corresponding methods issues are resolved. This is in contrast with the fact that potential licensing issues will not be resolved until the conclusion of the formal licensing process.

In systematically identifying issues, the distinction between methods issues and potential licensing issues provides a useful starting point. The methods issues are essentially those that relate to the plans for issue resolution that DOE will include in the SCR. They will be highly site specific and can be expected to evolve as some are resolved and new ones identified during site characterization. In fact, the focus of interactions between NRC and DOE during site characterization will be identification and resolution of methods issues. Any attempt to identify them at this stage would be somewhat premature. Accordingly, no such attempt has been made. Instead, this document focuses on potential licensing issues.

General issues and specific issues each have advantages that can be used in a systematic identification of issues. General potential licensing issues can be established with relatively little knowledge of the specifics of a particular geologic repository. By using general issues, the process of issue identification can be started even though

the staff's knowledge of the Yucca Mountain site and repository design is as yet somewhat limited. Use of general issues is also advantageous in that their broad, inclusive nature makes it easier to determine whether a set of issues is complete. The inclusive nature of general issues is disadvantageous in working to reach issues resolution. In practice, resolution will be accomplished by addressing the more specific sub-issues. Since data gathering for issue resolution is the ultimate goal of site characterization, it seems worthwhile to also identify as many specific sub-issues as is possible at this time.

The approach to issue identification, that was taken in preparing this document, is the following:

1. identify only potential licensing issues;
2. attempt to identify a complete set of general issues; and
3. identify as many sub-issues of these general issues as can be done at this time.

Limititations of this Effort

The Nevada Nuclear Waste Storage Investigations (NNWSI) are concentrated on the Yucca Mountain site in the southwestern quadrant of

the NTS; however, a repository horizon has not yet been identified. Several welded tuff beds are now under consideration as a candidate host rock. The depths of these beds vary by about 2,000 feet and extend from the saturated zone to well above the water table. Present NNWSI plans call for selection of a repository horizon in December 1982. Until a repository horizon is established, a number of issues can be stated only generally.

A second major limitation concerns the development of a conceptual design. A conceptual design has not yet been developed and under present NNWSI plans no conceptual design will have been completed in time for submittal with the SCR. Until a conceptual design has been completed, many design related issues must remain general.

Overall, the NNWSI are at a substantially earlier stage than those of BWIP. This applies to both investigations and the documentation of results of investigations. In consequence, the NRC staff's knowledge of the Yucca Mountain site is not nearly as extensive as its knowledge of potential repository sites on the Hanford reservation. Therefore, this effort at identification of NTS issues is a " best effort". The list of issues that follows will evolve toward greater specificity as interactions with the DOE increase.

A Transport Issues

A-1 What are the groundwater flow paths, travel times, and radionuclide releases to the accessible environment under existing conditions?

A-1.1 What are the limits of the accessible environment?

A-1.2 What are the hydrostratigraphic units to be used for modeling and testing?

A-1.2.1 Are the deep carbonate aquifers present at the Yucca Mountain site and if so, what is their significance?

A-1.2.2 What is the areal distribution of values for the hydrogeologic parameters needed to calculate groundwater flow paths and travel times?

A-1.2.2.1 What is the extent of vertical groundwater movement at the Yucca Mountain site?

A-1.2.2.2 What is the head distribution as function of depth?

A-1.2.3 What are the effects on groundwater flow of structural, stratigraphic, and lithologic heterogeneities?

A-1.2.4 What is the chemistry and age of groundwater?

A-1.3 What are the groundwater recharge and discharge locations, mechanisms, and amounts?

A-1.4 What are the solubility of radionuclide-bearing compounds and phase stabilities in the groundwater system?

A-1.5 What are the retardation properties of the geologic setting?

A-1.6 Is transport of radionuclides in the vapor phase a potentially significant mechanism for release of radionuclides to the accessible environment?

A-2 What are the expected effects on groundwater flow path, travel time and radionuclide releases to the accessible environment of future natural changes?

A-2.1 What is the effect of potential fault displacment?

A-2.2 What is the effect of potential vulcanism?

A-2.3 What is the effect of potential increases in precipitation?

A-3 What are the expected effects on groundwater flow paths, travel times, and radionuclide releases to the accessible environment of repository-induced changes?

A-3.1 What are the thermal effects on transport related properties of rock?

A-3.2 What is the potential for buoyant driven flow?

A-3.3 What is the potential thermal effect on vapor-phase transport?

A-4 What are the expected effects on groundwater flow paths, travel times, and radionclide releases to the accessible environment of human-induced changes?

A-4.1 What are the effects of potential groundwater use?

A-4.2 What are the effects of potential surface water use?

B Stability Issues

B-1 What are the probabilities and nature of potentially disruptive natural processes and events?

B-1.1 What is the seismic risk at the Yucca Mountain site?

B-1.2 What is the potential for fault displacement in the vicinity of Yucca Mountain?

B-1.2.1 What is the extent of faulting in the vicinity of Yucca Mountain?

B-1.3 What is the potential for vulcanism in the vicinity of Yucca Mountain?

B-1.4 What is the potential for increased precipitation at the NTS?

B-2 What are the probabilities and nature of potentially disruptive repository-induced processes and events?

B-2.1 What is the repository-induced thermal gradient?

B-3 What are the probabilities and nature of potentially disruptive human-induced processes and events?

B-3.1 How does the value of mineral resources at the Yucca Mountain site compare with the values in other areas of similiar size within the geologic setting?

B-3.2 What is the potential for future ground water use?

B-3.3 What is the potential for future surface water use?

B-3.4 What is the potential for vibratory ground motion at the Yucca Mountain site from nuclear tests?

B-3.5 What is the potential for fault movement at the Yucca Mountain site as a result of nuclear tests?

C Rock Mechanics and Repository Design Issues

C-1 Are the repository design criteria and functional description complete, accurate and appropriate for meeting the performance objective of isolating waste?

C-2 Is the conceptual design consistent with the design criteria and functional description?

C-3 Does the conceptual design adequately accommodate stresses in the repository host rock?

C-3.1 What is the stress field at the Yucca Mountain site?

C-3.2 What is the strength of the candidate host rock?

C-4 Does the conceptual design adequately accommodate potentially disruptive natural, repository-induced, and human-induced processes and events?

C-4.1 Does the conceptual design adequately accommodate thermal and mechanical effects due to waste emplacement?

C-4.1.1 What are the thermal effects on the strength of welded tuff?

C-4.1.2 What is the coefficient of thermal expansion for non-welded tuff?

C-4.1.3 What is the effect of water produced by the heating of hydrated minerals?

C-4.2 How is the long-term isolation of radionuclides affected by construction of the Exploratory Shaft?

D Engineered Barriers and Waste Form Issues

D-1 How is the performance or each barrier component expected to be affected by the following parameters:

(a) hydrostatic head differentials and hydraulic conductivities between locations in the near field;

(b) rate of deformation of repository surfaces and resultant loading of engineered system components;

(c) electro-chemical potentials in the repository host rock;

(d) electrical conductivities of the groundwater and the saturated repository host rock;

(e) thermo-dynamic parameters, including heat conductivity, heat capacity and heat transfer coefficients;

(f) gas transfer?

D-2 Will the parameters of D-1 remain within design limits given the occurrence of potentially disruptive natural, repository-induced, and human-induced processes and events?

D-3 What is the effect on radionuclide transport of changes in chemistry of the engineered barriers?

E Institutional and Environmental Issues

E-1 What was the decision making process for selection of the Yucca Mountain site?

E-1.1 What technical factors were considered in selection of the candidate area and site?

E-1.2 What institutional factors were considered in selection of the candidate area and site?

E-1.3 What environmental factors were considered in selection of the candidate area and site?

E-2 What other sites are under consideration for characterization?

E-3 What are the transportation impacts?

E-3.1 What is the potential impact of a repository at the Yucca Mountain site on regional transportation systems?

E-3.2 What are the potential effects on public health and safety of waste shipments?