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MEMORANDUM FOR: Hubert J. Miller, Chief  
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FROM: Seth M. Coplan  
High-Level Waste Technical  
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SUBJECT: SITING AND DESIGN SUITABILITY ISSUES FOR NTS

Attached are the Siting and Design Suitability Issues for the Nevada Nuclear Waste Storage Investigations (NNSWI). These issues are complete and will be transmitted to the DOE. This satisfies OPS Plan commitment 311212F.

ORIGINAL SIGNED BY

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Enclosure:  
As stated

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SITING AND DESIGN SUITABILITY ISSUES  
FOR THE  
NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS

1. Groundwater Flow

Conditions Before Waste Emplacement

What is the accessible environment for application of the EPA standard on radionuclide releases?

What are the groundwater flow paths and travel times under present conditions?

- a. What is the groundwater flux through the unsaturated tuffs at the Yucca Mountain site?
- b. What are the flow paths and travel times through the saturated zone?
- c. What are the hydrologic processes and important hydrologic parameters in the unsaturated zone?

- d. How and to what extent do structural, stratigraphic and lithologic heterogeneities affect ground water flow?
- e. Does the flow system in the tuffs at the Yucca Mountain site communicate with a deeper, regional flow system?
- f. What information on groundwater movement is provided by the water temperature distributions?
- g. What information on groundwater movement is provided by a study of water chemistry?
- h. What information on groundwater movement is provided by the water age determinations?

What is the basis for identification of the hydrostratigraphic units that are used for modeling and testing?

- a. How is the choice of units supported by data from lithology/stratigraphy, hydraulic parameters, and hydraulic heads?

- b. How is water chemistry used to identify hydrostratigraphic units?
- c. What is the relationship between the hydrostratigraphic units and the units tested for hydrologic parameters?
- d. What is the relationship between the hydrostratigraphic units and the units used in groundwater modeling?
- e. What are the hydrologic parameters of each unit tested?

What are the groundwater recharge and discharge locations, mechanisms and amounts for the the groundwater flow systems that include the Yucca Mountain site?

- a. What is the water balance for these systems?
- b. What are the groundwater recharge locations, mechanisms and amounts?
- c. What are the groundwater discharge locations, mechanisms and amounts?

- d. What boundary conditions are used to model the flow systems?
- e. What is the basis for selection of the boundary conditions?

Conditions After Waste Emplacement

What are the expected effects on groundwater flow paths, groundwater travel times and possible radionuclide releases of future, repository-induced changes?

What are the expected effects on groundwater flow paths, groundwater travel times and possible radionuclide releases of future, natural changes?

What are the expected effects on groundwater flow paths, groundwater travel times and possible radionuclide releases of future, human-induced changes, excepting repository-induced changes?

2. Waste Form and Waste Package

How are the components of the waste form and waste package predicted to perform through the period of waste isolation?

What are the likely failure modes relevant to performance of each component of the waste form and package?

What is the expected useful life of the waste package?

3. Retardation

What are the effects of groundwater chemistry on radionuclide migration?

- a. What is the chemistry of the groundwater?
- b. What are the important radionuclide species to be expected in the groundwater?
- c. What are the solubilities of the expected radionuclide species?
- d. What is the capacity of the groundwater system to buffer Eh and pH?
- e. What is the contribution of particulates and colloids in the groundwater to radionuclide migration?

What are the effects of the host rocks and mineral phases on radionuclide migration?

- a. What are the principal mineral phases that are in contact with the groundwater?

- b. What is contribution of the mineral phases to radionuclide migration?

What is the effect on radionuclide transport of changes in chemistry of the engineered barriers as a result of waste emplacement?

What is the effect on radionuclide transport of changes in chemistry of the natural barriers as a result of waste emplacement?



4. Facility Design

At repository depth and temperatures, what is the strength of the tuff and will the strength be adequate to maintain stable, mined openings?

Are the repository design criteria and the functional description shown to be complete and accurate with respect to the performance objectives?

- a. How do the design criteria accommodate the retrievability option?
- b. How do the design criteria assure that rock stress will not significantly impact the long-term performance of the waste package?

Is the design shown to be consistent with the design criteria and the functional description and appropriate to satisfaction of the performance objective?

How is the conceptual design shown, by analysis, to accommodate

mechanical and thermal effects due to construction and waste emplacement?

How is repository performance expected to be affected by construction of the Exploratory Shaft?

a. What is the effect due to repository construction?

What is the nature of changes that would affect radionuclide retardation due to repository construction and waste emplacement?

a. What are likely phase changes in the minerals that are in contact with the groundwater?

b. What are the kinetics of likely phase changes?

c. What are the cumulative effects of (a) and (b) on radionuclide retardation?

How are the backfill and seals predicted to perform through the period of waste isolation?

a. What are the predicted repository conditions relevant to

performance of each component?

- b. What are the likely failure modes relevant to performance of each component?

5. Geologic Stability

What are the probabilities and nature of natural changes that would affect repository performance?

- a. What is the potential for volcanism that would affect repository performance?
- b. What is the potential for fault movement that would affect repository performance?
- c. What is the potential for seismicity that would affect repository performance?

What are the probabilities and nature of human-induced changes, excluding repository construction, that would affect repository performance?

- a. What are the probabilities and nature of groundwater withdrawals that would affect repository performance?
- b. What are the probabilities and nature of groundwater recharge that would affect repository performance?

- c. What is the potential for disruption of a repository at Yucca Mountain by weapons testing at the NTS?

What is the seismic hazard and risk to surface and subsurface facilities during repository operations?

How does the value of mineral resources at the repository location compare with the values in other areas of similar size within the geologic setting?

6. Institutional

What was the decision-making process for selection of the candidate area and site including technical, institutional and environmental factors?

What other sites are under consideration for characterization?