UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
U.S. Department of Energy	)	**Docket No. 63-001**
	)	
(High Level Waste Repository	)	

NYE COUNTY, NEVADA PETITION TO INTERVENE AND CONTENTIONS

I. INTRODUCTION

1. Identity of Petitioner

Petitioner is Nye County, Nevada, acting through the Nye County Nuclear Waste Repository Project Office. Petitioner's address and telephone number is:

Nye County NWRPO
1210 East Basin Rd., Suite #6
Pahrump, Nevada 89060
(775) 727-7727

The Applicant, the United States Department of Energy (Applicant, or, DOE), has applied for a construction authorization for a high-level radioactive waste repository at a geologic repository operations area at Yucca Mountain, Nevada under 10 CFR Part 63. Petitioner Nye County, Nevada is the local governmental body in which the proposed Yucca Mountain repository is wholly located, and as such is entitled to intervene as a matter of right under 10 CFR §2.309(d)(2)(iii). In addition to being entitled to intervene as a matter of right under the NRC rules, Nye County also is entitled to intervene as a party which has standing to intervene and present the contentions attached hereto. Nye County is not only the local government with jurisdiction over the site of the Yucca Mountain repository under section 101(31) of the Nuclear Waste Policy Act (42 USC 10101 (31), and is therefore within the zone of interests protected by that statute, but also has

alleged sufficient “injury in fact” if its contentions are not accepted and addressed to maintain standing.

Nye County designates “Nye (Joint) Safety 5” and “Nye (Joint) Safety 6” as Joint Contentions that are being submitted pursuant to 10 CFR § 2.309(f)(3). These contentions are being jointly offered by Nye, Churchill, Esmeralda, Lander, and Mineral Counties, Nevada, and Inyo County, California. For each of these joint contentions, Nye County is the participant that has authority to act with respect to each such contention.

2. Preamble

Provided that the concerns raised by Nye County in its contentions filed today are addressed and satisfied by NRC's inclusion of appropriate conditions on construction authorization, Nye County believes that the repository will be constructed and operated in a manner which adequately protects the residents of Nye County and the public from radiological releases and exposures. It has been Nye County’s position that the repository safety analyses may be severely over-conservative, causing the radiological consequences to be overestimated. [see January 9 and 10, 2008 letters and attachments from Nye County Board of County Commissioners Chairman, Gary Hollis to Dr. Jane Summerson of DOE). Letter to Dr. Jane Summerson, OCRWM EIS Manager, RE: Nye County’s Comments on SEIS Drafts (DOE/EIS-0250F-S2D and DOE/EIS-0369D) LSN NYE000002220; -Letter to Dr. Jane Summerson, OCRWM EIS Manager, RE: Nye County, Situs Jurisdiction, Comments on the Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (Draft Repository SEIS), LSN NYE000002226.] If properly explained by NRC in its decision document, the use of overly conservative assumptions and worst case scenarios in the

development of the repository design should assure the public that, overall, the construction and operation of the repository will be adequately protective of public health and safety.

II. TABLE OF CONTENTS

I. INTRODUCTION Page 1

1. Identity of Petitioner Page 1

2. Preamble Page 3

II. TABLE OF CONTENTS

Nye-Safety-1 Failure to include activities in the performance confirmation program sufficient to assess the adequacy of information used to evaluate the capability of the upper natural barrier (UNB) following repository closure. Page 6

Nye-Safety-2 Failure to include activities in the performance confirmation program sufficient to assess the adequacy of information used to evaluate the capability of the lower natural barrier (LNB) following repository closure. Page 19

Nye-Safety-3 Failure to include activities in the performance confirmation program sufficient to assess the adequacy of information used as the basis for the site-scale model relied upon to evaluate the capability of the saturated zone (SZ) feature of the lower natural barrier (LNB) following repository closure. Page 32

Nye-Safety-4 Failure to fully consider possible air quality and radiological changes due to pre-closure construction and operational activity. Page 44

III. DESIGNATION OF JOINT CONTENTIONS

Nye (Joint) Safety-5 Failure to include the requirements of the National Incident Management System (NIMS), dated March 1, 2008, and related documentation in Section 5.7 Emergency Planning of the Yucca Mountain Repository Safety Analysis Report (SAR). Page 56

Nye (Joint)-Safety-6 The LA lacks any justification or basis for excluding potential aircraft crashes as a category 2 event sequence8 Page 67

IV. DESIGNATION OF NEPA CONTENTIONS

Nye NEPA-1 Failure to adequately consider cumulative impacts to the environment over time, from releases of radiological and other contaminants to groundwater and from surface water discharges. Page 73

V. CONCLUSION Page 85

VI. CERTIFICATE OF SERVICE Page 86

APPENDIX

Nye NEPA-1

Supporting Affidavit for Nye NEPA-1 Exhibit A

CONTENTIONS

NYE-SAFETY-1

Failure to include activities in the performance confirmation program sufficient to assess the adequacy of information used to evaluate the capability of the upper natural barrier (UNB) following repository closure.

1. Statement of issue of law or fact. (2.309(f)(1)(i))

The Applicant fails to include activities in the performance confirmation program required as part of the Safety Analysis Report (SAR) [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR Table 4-1; SAR p. 4-43 to 4-47). LSN DEN001592183] sufficient to assess the adequacy of the assumptions, data, and analyses that support modeling of the features and processes, particularly infiltration, seepage, and unsaturated zone (UZ) flow, that contribute to and provide the basis for the stated capability of the UNB to prevent or substantially reduce the amount and rate of water seeping into emplacement drifts. See 10 CFR 63.102(m) and 63.131(a)(2). Given the uncertainty in the infiltration modeling, site-specific activities should be conducted, and data gathered, to assess the adequacy of the basis for treatment of surface water runoff, evaporation, transpiration, depth of surficial soils, and properties of shallow bedrock in the infiltration model. For the UZ flow model, site specific activities and data are needed to evaluate the adequacy of the bases for treatment of the distribution of property values for fractures and matrix in the various hydrologic units, fracture–matrix flow and interaction, and the role of the Paintbrush non-welded unit in attenuating and diverting flow. For the seepage model, site specific activities and data are needed to evaluate the adequacy of the bases for treatment of the spatially variable

rock and fracture properties, and the hydrological parameters that control seepage potential under both ambient (pre-emplacement) and higher-temperature (post-emplacement) conditions.

2. Explanation of basis. (2.309(f)(1)(ii))

The UNB consists of two features: 1) surface topography and surficial soils, and 2) the unsaturated zone (UZ) above the repository. Surface topography and surficial soils are relied upon to limit infiltration into the UZ during the period up to 10,000 years after repository closure through a combination of evaporation, transpiration, and runoff. Net infiltration, modeled as a function of climate state, is input to evaluation of UZ flow. The UZ above the repository is relied upon to prevent or limit seepage into emplacement drifts by attenuating episodic flow of percolating water and by diverting flow around the drift opening through a combination of capillarity and thermal processes. Seepage is the principal source of water considered in evaluating the performance of the engineered barrier system (EBS) and transport of radionuclides through the UZ feature of the lower natural barrier (LNB). The Applicant proposes to monitor present-day precipitation and seepage as the principal means to evaluate the capability of the UNB [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 4-13, 4-15 to 4-18). LSN DEN001592183] These limited activities are not sufficient to assess the adequacy of the basis for modeling the features and processes assessed in evaluating the capability of the UNB.

3. Issue is within scope of proceeding. (2.309(f)(1)(iii))

See response to 4 below.

4. Issue raised is material to findings NRC must make. (2.309(f)(1)(iv))

a. The SAR must include "[a] *description of the performance confirmation program that meets the requirements of subpart F*…." [10 CFR 63.21(c)(17)]

b. "*Performance confirmation means the program of tests, experiments, and analyses that is conducted to evaluate the adequacy of the information used to demonstrate compliance with the performance objectives in subpart E….*" [10 CFR 63.2]

c. Specifically, "[a] *performance confirmation program will be conducted to evaluate the adequacy of assumptions, data, and analyses that led to the findings that permitted construction of the repository and subsequent emplacement of the wastes.*" [10 CFR 63.102(m)]

d. The Applicant has failed to adequately address the requirement that the performance confirmation program must provide data that indicate, where practicable, whether: "*Natural and engineered systems and components required for repository operation, and that are designed or assumed to operate as barriers after permanent closure, are functioning as intended and anticipated.*" [10 CFR 63.131(a)(2)]

5. <u>Statement of alleged facts or opinions and references to be relied upon</u>. (2.309(f)(1)(v))

a. The performance confirmation activities proposed by the Applicant, which are limited to precipitation and seepage monitoring, [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR Table 4-1; SAR p. 4-43 to 4-47). LSN DEN001592183] are not sufficient to assess the adequacy of the basis for modeling the features and processes assessed in evaluating the capability of the UNB, as shown below.

b. Three barriers are identified as important to waste isolation (ITWI): the UNB, the EBS, and the LNB. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-3). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-10, 6-11). LSN DEN001580576]

c. The UNB consists of two features: 1) surface topography and surficial soils, and 2) the UZ above the repository, both of which are also identified as ITWI. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-5 and SAR p. 2.1-11). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-41). LSN DEN001580576]

d. Surface topography and surficial soils are relied upon to limit infiltration into the UZ for the first 10,000 years following repository closure through a combination of evaporation, transpiration, and runoff. The UZ above the repository is relied upon to prevent or limit seepage into emplacement drifts by attenuating episodic flow of percolating water and diverting percolation laterally. At the drift walls, flow is diverted around the drift opening through a combination of capillarity and thermal processes. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-5 and SAR p. 2.1-11). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-41). LSN DEN001580576]

e. Three processes are modeled in evaluating the capability of the UNB, the features of the UNB, and the contribution of the UNB to repository performance: infiltration, UZ flow, and drift seepage. [*Yucca Mountain Repository License Application, General Information and*

Safety Analysis Report. DOE/RW-0573 REV 0. 2008. (SAR Table 2.1-5, p. 2.1-140). LSN DEN001592183; *Performance Confirmation Plan*. TDR-PCS-SE-000001 REV 05 ADD 01. 2008 (p. A-5[a] to A-7[a]). LSN DEN001584610; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-101, 6-102). LSN DEN001580576] Future climate conditions are considered in all models. Nye County does not dispute the three climate scenarios used as input to the infiltration model during the first 10,000 years following repository closure. Nor does Nye County dispute the range for average deep percolation flux used to represent long-term average climate for the post-10,000-year period, which is specified in the NRC proposed rule. See 10 CFR 63.342(c)(2) [70 FR 53319-53320].

f. Maps showing spatial variation in infiltration are developed for each of three climate scenarios for the period up to 10,000 years after repository closure using the infiltration model. These maps are used to define conditions at the top boundary of the UZ model. [*Simulation of Net Infiltration for Present-Day and Potential Future Climates*. MDL-NBS-HS-000023 REV 01 ADD 01. 2008 (p. 6-167 to 6-189, and 6-58[a] to 6-89[a]). LSN DEN001570570; *UZ Flow Models and Submodels*. MDL-NBS-HS-000006 REV 03 ADD 01. 2007 (p. 6-12 to 6-17). LSN DEN001572665] One additional climate scenario for the post-10,000-year period is considered, based on the distribution of average percolation flux to the repository stipulated in 10 CFR 63.342(c)(2) [70 FR 53319-53320]. Because the flux at the upper boundary must be specified for the UZ flow model, the stipulated values of average percolation flux at the repository are projected up to the ground surface and matched with infiltration maps developed for the pre-10,000-year period that most closely match the target values for average infiltration. These maps are then scaled to satisfy the target values for average infiltration needed to meet the NRC-specified percolation values. These scaled

maps of spatially variable infiltration are used as the upper boundary condition for the UZ flow model to generate the post-10,000-year flow fields. [*UZ Flow Models and Submodels*. MDL-NBS-HS-000006 REV 03 ADD 01. 2007 (p. 6-18). LSN DEN001572665] As a consequence, infiltration model results become the *de facto* basis for input to the UZ model for the period within 10,000 years of disposal and the period after 10,000 years of disposal through the period of geologic stability.

g. Sources of infiltration model uncertainty include: (1) the accuracy of the approach for estimating evapotranspiration at the site, (2) the accuracy of the approach for representing subsurface water flow, (3) the accuracy of the assumption that evapotranspiration from bedrock is negligible, and (4) the accuracy of the distributed runoff model used to represent surface water flow. [*Simulation of Net Infiltration for Present-Day and Potential Future Climates*. MDL-NBS-HS-000023 REV 01 ADD 01. 2008 (p. 6-99[a]). LSN DEN001570570]

h. Technical evaluations of the Applicant's infiltration model were prepared by the U.S. Nuclear Waste Technical Review Board [*Technical Evaluation of the U.S. Department of Energy Yucca Mountain Infiltration Estimates*. 2008 (p. 1 and 2). LSN DEN001573555] and the Oak Ridge Institute for Science and Education [*Independent Review of Simulation of Net Infiltration for Present-Day and Potential Future Climates*. 2008 (p. v and vi). LSN DEN001595302] Both evaluations raise questions regarding uncertainties in the spatial representation of net infiltration based on the Applicant's model [documented in *Simulation of Net Infiltration for Present-Day and Potential Future Climates*. MDL-NBS-HS-000023 REV 01 ADD 01. 2008 (p. 6-99[a]). LSN DEN001570570] and note that site-specific data could be used to address these issues.

i. Percolation flux through the unsaturated zone is one important factor affecting overall repository performance in TSPA calculations. The quantity as well as the spatial and temporal variations in percolation flux will directly affect (1) the amount of water flowing into waste emplacement drifts, (2) moisture conditions and the corrosion environment of waste packages within the drifts, (3) radionuclide release from the repository, and (4) radionuclide migration from the unsaturated zone to the saturated zone. Percolation fluxes through unsaturated fractured tuffs cannot be readily measured in the field, and, thus, indirect data and model results have to be used to estimate these fluxes. Model studies indicate that the accuracy of model predictions for percolation fluxes in the Yucca Mountain unsaturated zone depend on many factors, including (1) net infiltration rates over the surface boundary, (2) geological models and conceptualizations, (3) distribution of rock-property values for fractures and matrix, and (4) treatment of fracture–matrix flow and interaction. [*UZ Flow Models and Submodels*. MDL-NBS-HS-000006 REV 03 ADD 01. 2007 (p. 6-80). LSN DEN001572665]

j. Comparisons of the calculated repository percolation fluxes with those of the surface infiltration maps indicate that percolation fluxes at the repository are very different from surface infiltration patterns, especially in the northern part of the model domain. [*UZ Flow Models and Submodels*. MDL-NBS-HS-000006 REV 03 ADD 01. 2007 (p. 6-80). LSN DEN001572665] Overall, percolation results display different patterns from surface infiltration because of both lateral flow within the Paintbrush Tuff non-welded unit and flow focusing into faults. [*UZ Flow Models and Submodels*. MDL-NBS-HS-000006 REV 03 ADD 01. 2007 (p. 6-81). LSN DEN001572665]

k. Drift seepage refers to the flow of liquid water into waste emplacement drifts. Water that seeps into drifts may contact the EBS, mobilize radionuclides, and result in advective transport of radionuclides through breached waste packages and into the UZ feature of the LNB. Therefore, a calculation of the amount and distribution of seepage is included in the TSPA-LA. The objective of seepage modeling is to synthesize and simplify the relevant input for the seepage calculations to be conducted in the TSPA-LA. [*Abstraction of Drift Seepage*. MDL-NBS-HS-000019 REV 01 ADD 01. 2007 (p. 6-1). LSN DN20022460184] It is recognized that the amount of seepage is sensitive to key hydrological parameters (e.g., capillary strength, permeability, and percolation flux) that are both spatially variable and uncertain. Seepage modeled under ambient and somewhat idealized conditions may need to be adjusted for the impact of additional factors, including thermal perturbation in response to the heat emitted from the radioactive waste, transient changes in rock properties as a result of mechanical and chemical processes, and impact of rock bolts providing potential pathways for seepage. The average percolation flux at Yucca Mountain is less than 10 mm/year, a flux value that would typically not give rise to seepage because it is below the seepage threshold value. However, the maximum percolation fluxes may be much higher at certain emplacement locations (as a result of spatial variability over the repository horizon and/or future climate changes), which is reflected in the probability distribution for percolation flux arriving at the repository horizon. [*Abstraction of Drift Seepage*. MDL-NBS-HS-000019 REV 01 ADD 01. 2007 (p. 6-2). LSN DN20022460184] These distributions are based on the percolation maps derived from the infiltration and UZ models.

l. On average over all waste packages, the mean seepage percentage for present-day climate is 1.1%. In other words, during the present-day climate, on average about 99% of the percolation flux would be diverted around intact emplacement drifts. [*Abstraction of Drift*

Seepage. MDL-NBS-HS-000019 REV 01 ADD 01. 2007 (p. 6-29[a], 6-30[a]). LSN DN20022460184] The heat generated by the decay of the radioactive waste results in rock temperatures elevated from ambient for thousands of years after emplacement. For the current repository design, these temperatures will be high enough to cause boiling conditions in the drift vicinity, giving rise to local water redistribution and altered flow paths. [*Abstraction of Drift Seepage*. MDL-NBS-HS-000019 REV 01 ADD 01. 2007 (p. 6-12). LSN DN20022460184] It therefore appears unlikely that seepage would be detected under present-day climate and ambient conditions by the seepage monitoring proposed as part of the performance confirmation program. It is less likely that this monitoring activity would detect seepage under thermally accelerated conditions where liquid water would be vaporized.

m. The Applicant rates the importance of infiltration, UZ flow, and seepage to the capability of the UNB and repository performance as low during the first 10,000 years, and the importance of UZ flow and seepage as medium during the post-10,000-year period. [*Performance Confirmation Plan*. TDR-PCS-SE-000001 REV 05 ADD 01. 2008 (p. A-5[a] to A-7[a]). LSN DEN001584610]

n. The NRC staff ranked present-day infiltration of medium significance to waste isolation because estimates of present-day infiltration rates are important for estimating deep percolation rate. The deep percolation rate, in turn, affects the quantity of water coming into contact with the EBS. [NUREG-1762, Rev. 1. *Integrated Issue Resolution Status Report*. 2004. Appendix D: *Risk Insights Baseline Report* (p. 4-51 to 4-54). LSN NRC000027054] Note that this conclusion was based on a 10,000-year compliance period. [10 CFR 63.303, 66 FR 55813, 2001]

o. The NRC staff ranked seepage of high significance to waste isolation because seepage determines the amount of water that comes into contact with the EBS and affects the transport of radionuclides. Quantitative assessments of seepage are complicated by factors such as heterogeneity in UZ properties, thermal perturbations to UZ flow, capillary processes, drift degradation, and thermal effects. [NUREG-1762, Rev. 1. *Integrated Issue Resolution Status Report*. 2004. Appendix D: *Risk Insights Baseline Report* (p. 4-56, 4-57). LSN NRC000027054] Note that this conclusion was also based on a 10,000-year compliance period. [10 CFR 63.303, 66 FR 55813, 2001]

p. The Applicant rates the following processes and characteristics as important to the capability of the topography and surficial soils feature of the UNB: climate change and recharge, precipitation, infiltration, surface runoff and evapotranspiration, topography and morphology, rock properties, and fractures and fracture flow. The following are rated as important to the capability of the UZ feature of the UNB: climate change and recharge, UZ flow, stratigraphy and rock properties, fractures and fracture flow, flow diversion around repository drifts and water influx at the repository (seepage). [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR Table 2.1-2, p. 2.1-117 to 120). LSN DEN001592183]

q. The principal activities proposed by the Applicant to assess the adequacy of the assumptions, data, and analyses that support modeling of the features and processes that contribute to and provide the basis for the stated capability of the UNB to prevent or substantially reduce the amount and rate of water seeping into the emplacement drifts are limited to the following: 1) monitoring of present-day precipitation and 2) monitoring of seepage at ambient (or near-

ambient) temperatures and at representative repository temperatures in thermally accelerated drifts. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 4-13). LSN DEN001592183; *Performance Confirmation Plan*. TDR-PCS-SE-000001 REV 05 ADD 01. 2008. (Table 3-1, p. 3-2, Table 3-2, p. 3-4, and p. 3-9)]). LSN DEN001584610] A secondary activity involves subsurface water and rock testing (information potentially related to fast paths and percolation history for UZ flow model). [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 4-13). LSN DEN001592183; *Performance Confirmation Plan*. TDR-PCS-SE-000001 REV 05 ADD 01. 2008. (Table 3-1, p. 3-2, Table 3-2, p. 3-4, and p. 3-10)]). LSN DEN001584610] UZ testing is planned, but it focuses on radionuclide transport processes relevant to the UZ transport model for evaluating the capability of the UZ feature of the LNB. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 4-19). LSN DEN001592183; *Performance Confirmation Plan*. TDR-PCS-SE-000001 REV 05 ADD 01. 2008. (Table 3-2, p. 3-4, p. 3-26)]). LSN DEN001584610]

r. As noted above, there is no dispute over the three climate scenarios used as input to the infiltration model during the first 10,000 years following repository closure. Nor is there a dispute over the range for average deep percolation flux used to represent long-term average climate for the post-10,000-year period, which is specified in the NRC proposed rule at 10 CFR 63.342(c)(2) [70 FR 53319-53320]. Given the multiple processes and characteristics identified as important to the capability of the topography and surficial soils and UZ features of the UNB [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR Table 2.1-2, p. 2.1-117 to 120).

LSN DEN001592183], however, the proposed precipitation and seepage monitoring activities provide limited or no information to assess the adequacy of the basis for key elements in the infiltration, UZ flow, and seepage models. No explanation is provided for the omission of such activities.

s. For infiltration, no activities are proposed to evaluate the adequacy of the bases for treatment of surface runoff, evaporation, transpiration, depth and properties of surficial soils, and properties of shallow bedrock (including the influence of fractures and fracture flow) in modeling net infiltration associated with present-day precipitation. The spatially variable results from the infiltration model for each climate scenario are used to define the upper boundary conditions for the UZ flow model. For UZ flow, in addition to those activities that may be needed to assess the basis for infiltration modeling, no activities are proposed to evaluate the adequacy of the bases for treatment of the distribution of rock-property values for fractures and matrix, particularly those for the Paintbrush Tuff non-welded unit that determine the extent to which episodic flow of percolating water from net infiltration may be attenuated or diverted laterally and focused into faults. The percolation maps at the repository level derived from the UZ flow model are the basis for seepage evaluations. In addition to the fact that seepage under present-day ambient or thermally accelerated conditions is unlikely to be detected, no activities are proposed to evaluate the adequacy of the bases for treatment of the spatially variable rock and fracture properties that control the potential for diversion of flow around drift openings through a combination of capillarity and thermal processes.

t. PROPOSED REMEDY: As a condition to issuance of construction authorization, NRC should require the Applicant to revise the proposed performance confirmation program to

include additional site specific activities and data gathering to address the gaps identified, or provide adequate basis for their omission.

6. References to portions of the application or environmental documents. (2.309(f)(1)(vi))

[*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR Table 4-1; SAR p. 2.1-2, p. 2.1-3, p. 2.1-5, p. 2.1-11, p. 2.1-117 to 120, p. 2.1-140, p. 4-13, p. 4-15 to 4-18, p. 4-19, p. 4-43 to 4-47). LSN DEN001592183]

Postclosure Nuclear Safety Design Bases. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-10, 6-11, p.6-41, p. 6-101, 6-102). LSN DEN001580576]

Simulation of Net Infiltration for Present-Day and Potential Future Climates. MDL-NBS-HS-000023 REV 01 ADD 01. 2008 (p. 6-58[a] to 6-89[a], p. 6-99[a], p. 6-167 to 6-189). LSN DEN001570570;

Independent Review of Simulation of Net Infiltration for Present-Day and Potential Future Climates. 2008 (p. v and vi). LSN DEN001595302

UZ Flow Models and Submodels. MDL-NBS-HS-000006 REV 03 ADD 01. 2007 (p. 6-12 to 6-17, p. 6-18, p. 6-80, p. 6-81). LSN DEN001572665

Abstraction of Drift Seepage. MDL-NBS-HS-000019 REV 01 ADD 01. 2007 (p. 6-1, p. 6-2, p. 6-12, p. 6-29[a], p. 6-30[a]). LSN DN20022460184

Performance Confirmation Plan. TDR-PCS-SE-000001 REV 05 ADD 01. 2008 (p. A-5[a] to A-7[a], Table 3-1, p.3-2, Table 3-2, p. 3-4, p. 3-9, Table 3-10, p. 3-26). LSN DEN001584610]

NUREG-1762, Rev. 1. *Integrated Issue Resolution Status Report*. 2004. Appendix D: *Risk Insights Baseline Report* (p. 4-51 to 4-54, p. 4-56, p. 4-57). LSN NRC000027054

10 CFR 63.21(c)(17)

10 CFR 63.102(m)

10 CFR 63.131(a)(2)

10 CFR 63.342(c)(2) [70 FR 53319-53320

7. Statement Regarding Joint Ownership

Nye County is not claiming joint ownership of this contention with any other entity.

NYE-SAFETY-2

Failure to include activities in the performance confirmation program sufficient to assess the adequacy of information used to evaluate the capability of the lower natural barrier (LNB) following repository closure.

1. Statement of issue of law or fact. (2.309(f)(1)(i))

The Applicant fails to include activities in the performance confirmation program required as part of the Safety Analysis Report [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR Table 4-1, p. 4-43 to 4-47). LSN DEN001592183] sufficient to assess the adequacy of the assumptions, data, and analyses that support modeling of the features and processes that contribute to and provide the basis for the stated capability of the LNB to prevent or substantially reduce the rate of movement of radionuclides from the repository to the accessible environment. See requirements at 10 CFR 63.102(m) and 63.131(a)(2) Additional site-specific testing and monitoring activities are required to address uncertainties in the basis for the models used to evaluate the capabilities of the features of the LNB. For the unsaturated zone (UZ) model, activities should be conducted to assess the adequacy of the basis for treatment of (1) net infiltration rates over the mountain; (2) the heterogeneity of welded and nonwelded tuffs, their flow properties, and spatial distributions, especially below the repository; (3) fracture properties in zeolitic units and faults; (4) lateral diversion caused by zeolites; and (5) transport properties. For the saturated zone (SZ) model, activities should be conducted to assess the adequacy of the basis for treatment of (1) parameters related to SZ flow, including uncertainty in groundwater-specific discharge, flowing interval porosity, alluvium effective porosity, and horizontal anisotropy; (2) parameters related to matrix diffusion, including flowing interval spacing, effective diffusion coefficient, and matrix porosity; (3) parameters related to sorption, including sorption coefficients for tuff and alluvium; (4)

parameters used to model colloid-facilitated transport including colloid retardation factor, groundwater concentration of colloids, and sorption coefficients onto colloids; and (5) the location of the northern and western boundaries the alluvium along the inferred flow path in the SZ because the movement of radionuclides through the SZ is affected by the contrast in the flow between these two media and because the retardation characteristics of the two media are different.

2. Explanation of basis. (2.309(f)(1)(ii))

The LNB consists of two features: 1) the UZ below the repository and 2) the SZ that underlies the UZ and extends down gradient to the accessible environment. The features of the LNB below the repository horizon are relied upon to prevent or substantially reduce the rate of radionuclide movement to the accessible environment through a variety of natural processes and characteristics. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-9). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-48, 6-49). LSN DEN001580576] The processes that contribute to the capability of the UZ and SZ are functions of uncertain and spatially variable hydrologic and transport properties. The performance confirmation activities proposed by the Applicant are limited to: 1) mapping and transport testing within the repository as a surrogate for testing in the UZ below the repository to the water table and 2) monitoring of water levels and chemistry, hydrologic and transport testing in fault zones, and transport testing in the alluvium as the principal means to evaluate the capability of the SZ below the repository to the accessible environment. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 4-15, 4-19 to 4-24). LSN DEN001592183] These limited activities

are not sufficient to assess the adequacy of the basis for modeling the features and processes assessed in evaluating the capability of the LNB.

3. Issue is within scope of proceeding. (2.309(f)(1)(iii))

See response at 4.

4. Issue raised is material to findings NRC must make. (2.309(f)(1)(iv))

a. The SAR must include "[a] *description of the performance confirmation program that meets the requirements of subpart F….*" [10 CFR 63.21(c)(17)]

b. "*Performance confirmation means the program of tests, experiments, and analyses that is conducted to evaluate the adequacy of the information used to demonstrate compliance with the performance objectives in subpart E….*" [10 CFR 63.2]

c. Specifically, "[a] *performance confirmation program will be conducted to evaluate the adequacy of assumptions, data, and analyses that led to the findings that permitted construction of the repository and subsequent emplacement of the wastes.*" [10 CFR 63.102(m)]

d. The Applicant has failed to adequately address the requirement that the performance confirmation program must provide data that indicate, where practicable, whether: "*Natural and engineered systems and components required for repository operation, and that are designed or assumed to operate as barriers after permanent closure, are functioning as intended and anticipated.*" [10 CFR 63.131(a)(2)]

5. Statement of alleged facts or opinions and references to be relied upon. (2.309(f)(1)(v))

a. The performance confirmation activities proposed by the Applicant are limited to: 1) mapping and transport testing within the repository as a surrogate for testing in the UZ below the repository to the water table and 2) monitoring of water levels and chemistry, hydrologic and transport testing in fault zones, and transport testing in the alluvium as the principal means to evaluate the capability of the SZ below the repository to the accessible environment. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 4-15, 4-19 to 4-24). LSN DEN001592183] These activities are not sufficient to assess the adequacy of the basis for modeling the features and processes assessed in evaluating the capability of the LNB, as shown below.

b. Three barriers are identified as important to waste isolation (ITWI): the upper natural barrier (UNB), the engineered barrier system (EBS), and the LNB. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-3). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases.* ANL-WIS-MD-000024 REV 01. 2008 (p. 6-10, 6-11). LSN DEN001580576]

c. The LNB consists of two features: 1) the UZ below the repository and 2) the SZ below the UZ and down gradient to the accessible environment, both of which are also identified as ITWI. The features of the LNB below the repository horizon are relied upon to prevent or substantially reduce the rate of radionuclide movement to the accessible environment through a variety of natural processes and characteristics. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008.

(SAR p. 2.1-9). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-48, 6-49). LSN DEN001580576]

d. In the UZ, low water percolation rates, matrix diffusion, and sorption of radionuclides onto mineral surfaces are relied upon to reduce the rate of movement of radionuclides to the water table. Perched water bodies, found primarily where low-permeability, sparsely fractured zeolitic rock units predominate, may laterally divert flow to major faults and increase the local rate of flow to the water table. If transport occurs where vitric layers predominate, the rate of movement to the water table is reduced because the vitric layers have relatively high matrix porosity and permeability and matrix flow dominates. The SZ includes the volcanic rock (tuff) and alluvium below the water table. The SZ is relied upon to limit the movement of radionuclides to the accessible environment as a result of low groundwater flow rates, particularly in the alluvium, as well as matrix diffusion, sorption, and filtration of colloids that could potentially transport radionuclides. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-9, 2.1-10). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-49). LSN DEN001580576] The processes that contribute to the capability of the UZ and SZ are functions of uncertain and spatially variable hydrologic and transport properties.

e. Four processes are modeled in evaluating the capability of the LNB, the features of the LNB, and the contribution of the LNB to repository performance: UZ flow, UZ transport, SZ flow, and SZ transport. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR Table 2.1-5, p. 2.1-140). LSN DEN001592183; *Performance Confirmation Plan*. TDR-PCS-SE-000001 REV 05

ADD 01. 2008 (p. A-6[a] and A-11a]). LSN DEN001584610; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-106, 6-107). LSN DEN001580576] Future climate conditions are considered in all models. There is no dispute over the three climate scenarios used as input to the infiltration and UZ flow modeling during the first 10,000 years following repository closure. There is also no dispute over the range for average deep percolation flux used to represent long-term average climate for the post-10,000-year period, which is specified in the NRC proposed rule at 10 CFR 63.342(c)(2) [70 FR 53319-53320]. The UZ flow and transport models both rely upon estimates of spatially variable percolation flux at and below the repository horizon that are based on infiltration model results for each climate scenario. [*UZ Flow Models and Submodels*. MDL-NBS-HS-000006 REV 03 ADD 01. 2007 (p. 6-12 to 6-17 and 6-18). LSN DEN001572665]

f. The UZ flow and transport models are appropriate tools for characterizing flow and transport processes in the Yucca Mountain UZ. The accuracy and reliability of the UZ flow and transport model predictions are dependent on the accuracy of estimated model properties, other types of input data, and hydrogeological conceptual models. Past site investigations have shown that large variations exist in the flow and transport parameters over the spatial and temporal scales of the mountain. Even though considerable progress has been made in this area, uncertainty associated with the UZ flow model input parameters exists. The major uncertainties in the UZ model parameters are: (1) the accuracy of estimated current, past, and future net infiltration rates over the mountain; (2) quantitative descriptions of the heterogeneity of welded and nonwelded tuffs, their flow properties, and detailed spatial distributions within Yucca Mountain, especially below the repository; (3) fracture properties in zeolitic units and faults from field studies; (4) evidence of lateral diversion caused by zeolites; and (5) transport properties (e.g., sorption coefficients in different rock types, matrix

molecular diffusion coefficients in different units for different radionuclides, dispersivities in fracture and matrix systems). The Applicant notes that these uncertainties exist and states that most are captured within the range of flow field generated. [*UZ Flow Models and Submodels*. MDL-NBS-HS-000006 REV 03 ADD 01. 2007 (p. 8-8). LSN DEN001572665]

g. Radionuclides that migrate through the UZ to the water table are transported through the SZ before they can reach the accessible environment. The SZ feature of the LNB includes the fractured volcanic rocks from below the repository to approximately 12 to 14 km southeast and south of Yucca Mountain and the saturated alluvium at the water table from the volcanic aquifer to the accessible environment. The movement of radionuclides in the SZ is slow because the velocity of water that can carry such radionuclides is low. In addition, other processes cause the rate of movement of radionuclides to be slower compared to the rate of movement of the water. [*Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-96). LSN DEN001580576]

h. The flow in the volcanic aquifers is predominantly in the fractures. The matrix materials of the volcanic tuffs generally have a lower hydraulic conductivity than observed in flowing fractures under natural groundwater-flow conditions. The matrix materials also have significantly greater effective porosity than do fractures, so there is a correspondingly greater volume of fluid stored in the matrix pore space of these saturated aquifers. The additional stored fluid and pore space is important to radionuclide transport because radionuclides can exchange between the fractures and matrix via matrix diffusion. This diffusive exchange results in a slower effective travel velocity for the bulk of the released radionuclides relative to water flow velocities in the fractures. [*Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-97). LSN DEN001580576]

i. Because the alluvial materials are a porous medium, water flow and radionuclide transport occur in the intergranular pores in the alluvium. The effective porosity of the alluvium is greater than the fracture porosity of the tuffs. Consequently, pore velocities in the alluvium, are smaller than those in the fractures of the volcanic aquifers. Although matrix diffusion is not considered to be important in the alluvium, radionuclide rate of movement can be slow if the water velocity is slow. In addition, sorption onto minerals in the alluvium results in retardation of radionuclides relative to the water movement in these sediments. [*Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-97). LSN DEN001580576]

j. The volcanic rocks and alluvial material in the SZ also reduce the rate of movement of radionuclides associated with colloids. Filtration of colloids results in retardation of the movement of radionuclides embedded in the colloids or irreversibly sorbed to these colloids. Radionuclides that are sorbed reversibly to colloids are affected by matrix diffusion in the volcanic aquifers and by sorption in the alluvial units, retarding the movement of these colloid-associated radionuclides relative to the movement of water in the SZ. [*Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-97). LSN DEN001580576]

k. Uncertain parameters related to SZ flow include uncertainty in the groundwater-specific discharge, flowing interval porosity, alluvium effective porosity, and horizontal anisotropy. Uncertain parameters related to matrix diffusion include flowing interval spacing, effective diffusion coefficient, and matrix porosity. Uncertain parameters related to sorption include the sorption coefficients for various radionuclides for tuff and alluvium. Uncertain

parameters used to model colloid-facilitated transport include the colloid retardation factor, fast fraction of colloids, groundwater concentration of colloids, and sorption coefficients onto colloids. [*Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-99). LSN DEN001580576]

l. There is also uncertainty associated with the location of the northern and western boundaries the alluvium along the inferred flow path in the SZ at distances of approximately 10 to 18 km downgradient from the repository. The portions of the flow path devoted to fractured volcanic rock and alluvium are important to SZ capability because the movement of radionuclides through the SZ is affected by the contrast in the flow between these two media and because the retardation characteristics of the two media are different. [*Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-100). LSN DEN001580576]

m. The Applicant rates the importance of UZ flow to the capability of the LNB and repository performance as low during the first 10,000 years and medium during the post-10,000-year period. [*Performance Confirmation Plan*. TDR-PCS-SE-000001 REV 05 ADD 01. 2008 (p. A-6[a]). LSN DEN001584610] The importance of UZ transport is rated as low during both the 10,000-year and post-10,000-year periods. SZ flow and transport are each rated as being of medium importance during both the 10,000-year and post-10,000-year periods. [*Performance Confirmation Plan*. TDR-PCS-SE-000001 REV 05 ADD 01. 2008 (p. A-11[a]). LSN DEN001584610]

n. The NRC staff ranked UZ flow paths and related hydrologic properties of medium significance to waste isolation because of spatial variability in the rate of water movement

through the Calico Hills unit beneath the repository depending on whether the unit is zeolitized or vitric along the flow path. Retardation processes (sorption, matrix diffusion) affecting transport in the UZ were ranked of medium significance because of spatial variability in hydrologic properties in the units beneath the repository. [NUREG-1762, Rev. 1. *Integrated Issue Resolution Status Report*. 2004. Appendix D: *Risk Insights Baseline Report* (p. 4-57 to 4-64). LSN NRC000027054] Note that these conclusions were based on a 10,000-year compliance period. [10 CFR 63.303. 66 FR 55813. 2001]

o. The NRC staff ranked SZ flow paths and, in particular, the transport distance within the alluvial portion of the aquifer, of medium significance to waste isolation because of the large capacity of the alluvium to retard a majority of the radionuclides. The effect of retardation in the saturated alluvium on radionuclide transport was ranked of high significance to waste isolation. The effects of matrix diffusion and colloids on transport in the SZ were ranked of medium significance to waste isolation. [NUREG-1762, Rev. 1. *Integrated Issue Resolution Status Report*. 2004. Appendix D: *Risk Insights Baseline Report* (p. 4-64 to 4-70). LSN NRC000027054] Note that these conclusions were also based on a 10,000-year compliance period. [10 CFR 63.303. 66 FR 55813. 2001]

p. The Applicant rates the following processes and characteristics as important to the capability of the UZ feature of the LNB: climate change and recharge, UZ flow, stratigraphy and rock properties, fractures and faults, perched water, fracture flow, advection and dispersion, matrix diffusion and imbibition, sorption. The following are rated as important to the capability of the SZ feature of the LNB: climate change and recharge, SZ flow, stratigraphy and rock properties, fractures and faults, water conducting features, advection and dispersion, matrix diffusion, sorption. [*Yucca Mountain Repository License Application, General*

Information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008. (SAR Table 2.1-4, p. 2.1-135 to 139). LSN DEN001592183]

q. The principal activities proposed by the Applicant to assess the adequacy of the assumptions, data, and analyses that support modeling of the features and processes that contribute to and provide the basis for the stated capability of the LNB to prevent or substantially reduce the rate of movement of radionuclides from the repository to the accessible environment are limited to the following: 1) mapping and transport testing within the repository as a surrogate for testing in the UZ below the repository to the water table and 2) monitoring of water levels and chemistry, hydrologic and transport testing in fault zones, and transport testing in the alluvium as the principal means to evaluate the capability of the SZ below the repository to the accessible environment. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 4-15, 4-19 to 4-24). LSN DEN001592183]

r. As noted above, there is no dispute over the three climate scenarios used as input to the infiltration model during the first 10,000 years following repository closure. There is also no dispute over the range for average deep percolation flux used to represent long-term average climate for the post-10,000-year period, which is specified in the NRC proposed rule at 10 CFR 63.342(c)(2) [70 FR 53319-53320]. Given the multiple processes and characteristics identified as important to the capability of the UZ and SZ features of the LNB (Nye Safety-2, Section 5, Para. p. above), however, the proposed mapping and transport testing within the repository as a surrogate for testing in the UZ below the repository, and monitoring of water levels and chemistry, hydrologic and transport testing in fault zones, and transport testing only in the alluvium provide limited or no information on key elements in the UZ flow and

transport, and SZ flow and transport models. No explanation is provided for the omission of such activities.

s. As noted in Section 5, Paragraph e above, both the UZ flow and transport models rely on estimates of spatially variable percolation flux at and below the repository horizon that are based on infiltration model results for each climate scenario. For UZ flow and transport, in addition to the absence of activities that may be needed to assess the basis for infiltration modeling, no activities are proposed to evaluate the adequacy of the bases for treatment of the distribution of property values for fractures and matrix as a function of stratigraphy, fault properties, perched water, lateral diversion and focusing of flow into faults, fracture flow, and transport processes (advection, dispersion, matrix diffusion, and sorption) in the UZ below the repository to the water table, particularly in the Calico Hills non-welded unit. The percolation maps at the repository level derived from the UZ flow model are the basis for transport modeling. To assess the bases for modeling SZ flow and transport, only hydrologic and transport testing in fault zones, and transport testing at the alluvial testing complex are proposed. No activities are proposed to evaluate the adequacy of the bases for treatment of the distribution of property values for fractures and matrix as a function of stratigraphy, water conducting features, and transport processes (advection, dispersion, matrix diffusion, and sorption) in the fractured volcanic rocks that make up the SZ below the repository and down gradient to the alluvial portion of the SZ. There are also no activities proposed to address the uncertainty in the location of the boundaries and to characterize the transport properties of the alluvium along the inferred flow path in the SZ.

t. REMEDY: As a condition to issuance of construction authorization, NRC should require the Applicant to revise the proposed performance confirmation program to include additional site

specific data gathering, testing, and monitoring activities to address the gaps identified, or provide adequate basis for their omission.

6. References to portions of the application or environmental documents. (2.309(f)(1)(vi))

Yucca Mountain Repository License Application, General Information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-3, p. 2.1-9, p. 2.1-10, table 2.1-5, p. 2.1-140, Table 4-1, p. 4-15, p.4-19 to 4-24, p. 4-43 to 4-47). LSN DEN001592183

Postclosure Nuclear Safety Design Bases. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-10, p. 6-11, p. 6-48, p. 6-49, p. 6-96, p.6-97, p. 6-106, p. 6-107). LSN DEN001580576

Performance Confirmation Plan. TDR-PCS-SE-000001 REV 05 ADD 01. 2008 (p. A-6[a] and A-11a]). LSN DEN001584610;

UZ Flow Models and Submodels. MDL-NBS-HS-000006 REV 03 ADD 01. 2007 (p. 6-12 to 6-17, p. 6-18, p. 8-8). LSN DEN001572665

10 CFR 63.2

10 CFR 63.21(c)(17)]

10 CFR 63.102(m)

10 CFR 63.131(a)(2)

7. Statement Regarding Joint Ownership

Nye County is not claiming joint ownership of this contention with any other entity.

NYE-SAFETY-3

Failure to include activities in the performance confirmation program sufficient to assess the adequacy of information used as the basis for the site-scale-model relied upon to evaluate the capability of the saturated zone (SZ) feature of the lower natural barrier (LNB) following repository closure.

1. Statement of issue of law or fact. (2.309(f)(1)(i))

The applicant fails to include activities in the performance confirmation program required as part of the Safety Analysis Report (SAR) [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR Table 4-1, p. 4-43 to 4-47). LSN DEN001592183] sufficient to assess the adequacy of the assumptions, data, and analyses that support the site-scale model used in evaluating the capability of the SZ feature of the LNB to limit the movement of radionuclides to the accessible environment [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-9, 2.1-10). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-49). LSN DEN001580576]. See 10 CFR 63.102(m) and 63.131(a)(2). The resolution of the regional model, from which the site-scale model is derived, is such that its use as a source of inputs for calibration of the site-scale model introduces uncertainty. Because of data gaps and discrepancies between the regional model and site-scale model, Nye County asserts that additional information is needed to determine conditions along the boundaries of the site-scale model to assess the adequacy of the basis for this model in evaluating the capability of the SZ. Nye County proposes that a series of wells be drilled on the site model boundaries, particularly the northern and eastern boundaries, to allow accurate measures of hydraulic gradients and that each well be tested to provide accurate measures of key aquifer parameters. It is only through direct measurement that discrepancies

between the two models can be resolved and the adequacy of the basis for the site-scale model evaluated. The collection of this additional data will preclude the need to use inputs from the regional model in calibrating the site-scale model and allow the site-scale model to stand alone.

2. Explanation of basis. (2.309(f)(1)(ii))

The LNB consists of two features: 1) the unsaturated zone (UZ) below the repository and 2) the SZ that underlies the UZ and extends down gradient to the accessible environment. The SZ includes the volcanic rock (tuff) and alluvium below the water table. The SZ is relied upon to limit the movement of radionuclides to the accessible environment [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-9, 2.1-10). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-49). LSN DEN001580576]. The processes that contribute to the capability of the SZ are functions of uncertain and spatially variable geologic, hydrologic, and transport properties. The site-scale SZ model relies on inputs from the Death Valley regional flow system (DVRFS or regional) model [*Saturated Zone Site-Scale Flow Model*. MDL-NBS-HS-000011 REV 03. 2007. (p. 6-3 to 6-7) LSN DN2002478808], but the regional model lacks the appropriate level of resolution and a foundation of well-distributed data sets to ensure the adequacy of the basis for the site-scale model. The performance confirmation activities proposed by the Applicant are limited to monitoring of water levels and chemistry, hydrologic and transport testing in fault zones, and transport testing in the alluvium as the principal means to evaluate the capability of the SZ below the repository to the accessible environment [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 4-15, 4-19 to 4-24). LSN DEN001592183]. These limited activities are not sufficient to assess the adequacy of the basis for the site-scale model used in evaluating the capability of the SZ feature of the LNB.

3. Issue is within scope of proceeding. (2.309(f)(1)(iv))

See response at 4.

4. Issue raised is material to findings NRC must make. (2.309(f)(1)(v))

a. The SAR must include "[a] *description of the performance confirmation program that meets the requirements of subpart F*…." [10 CFR 63.21(c)(17)]

b. "*Performance confirmation means the program of tests, experiments, and analyses that is conducted to evaluate the adequacy of the information used to demonstrate compliance with the performance objectives in subpart E*…." [10 CFR 63.2]

c. Specifically, "[a] *performance confirmation program will be conducted to evaluate the adequacy of assumptions, data, and analyses that led to the findings that permitted construction of the repository and subsequent emplacement of the wastes.*" [10 CFR 63.102(m)]

d. The Applicant has failed to adequately address the requirement that the performance confirmation program must provide data that indicate, where practicable, whether: "*Natural and engineered systems and components required for repository operation, and that are designed or assumed to operate as barriers after permanent closure, are functioning as intended and anticipated.*" [10 CFR 63.131(a)(2)]

5. Statement of alleged facts or opinions and references to be relied on. (2.309(f)(1)(vi))

a. The performance confirmation activities proposed by the Applicant are limited to: 1) monitoring of water levels and chemistry, 2) hydrologic and transport testing in fault zones, and 3) transport testing in the alluvium as the principal means to evaluate the capability of the SZ below the repository to the accessible environment [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 4-15, 4-19 to 4-24). LSN DEN001592183]. These limited activities are not sufficient to assess the adequacy of the basis for the site-scale model used in evaluating the capability of the SZ feature of the LNB.

b. Three barriers are identified as important to waste isolation (ITWI): the upper natural barrier (UNB), the engineered barrier system (EBS), and the LNB. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-3). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-10, 6-11). LSN DEN001580576]

c. The LNB consists of two features: 1) the UZ below the repository and 2) the SZ below the UZ and down gradient to the accessible environment, both of which are also identified as ITWI. The SZ is relied upon to limit the movement of radionuclides to the accessible environment as a result of low groundwater flow rates, particularly in the alluvium, as well as matrix diffusion, sorption, and filtration of colloids that could potentially transport radionuclides [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report.* DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-9, 2.1-10). LSN DEN001592183; *Postclosure Nuclear Safety Design Bases*. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-48, 6-49). LSN DEN001580576]. The processes that contribute to the capability

of the UZ and SZ are functions of uncertain and spatially variable hydrologic and transport properties.

d. Yucca Mountain is part of the Alkali Flat-Furnace Creek sub-basin of the Death Valley groundwater basin (covered by the DVRFS or regional model). Discharge within the sub-basin occurs at Alkali Flat (Franklin Lake Playa) and, possibly, Furnace Creek in Death Valley. Water inputs to the sub-basin include groundwater inflow/outflow along the northern, eastern, and western boundaries of the sub-basin, recharge from precipitation in high-elevation areas of the sub-basin, and recharge from surface runoff in Fortymile Canyon and Fortymile Wash (covered by the site-scale flow model with inputs from the regional model). North and northeast of Yucca Mountain, recharge from precipitation also occurs at Timber Mountain, Pahute Mesa, Rainier Mesa, and Shoshone Mountain. [*Saturated Zone Site-Scale Flow Model*. MDL-NBS-HS-000011 REV 03. 2007. (p. 6-3) LSN DN2002478808]

e. The regional and site-scale numerical groundwater flow models that are the bases for evaluating the capability of the SZ and for the Total System Performance Assessment (TSPA) have considerable uncertainty. This uncertainty is based in part upon the resolution of the models, the underlying assumptions, and the methodologies used in developing input data sets and calibration targets. The site-scale flow model has a greater grid resolution than the regional model. Near the repository, the site-scale model exhibits a high level of resolution because it is based on the Geologic Framework Model (GFM) with inputs derived from a scale of 1:24,000 or less [*Saturated Zone Site-Scale Flow Model*. MDL-NBS-HS-000011 REV 03. 2007. (p. 6-29) LSN DN2002478808]. Thus the site-scale model is able to include significant structural features and details close to the repository that are not included within the regional Hydrologic Framework Model (HFM) or the site-scale HFM. *Id*.

Beyond the GFM, which is smaller than the area covered by the site-scale model, the site-scale model is based primarily on the HFM derived from the regional HFM used to develop the regional flow model. [*Saturated Zone Site-Scale Flow Model*. MDL-NBS-HS-000011 REV 03. 2007. (p. 6-29) LSN DN2002478808]. The regional geologic framework model was developed based upon geologic detail at scales of 1:100,000 to 1:250,000 and the results were then "lumped" into hydrostratigraphic units that serve as the basis for the regional HFM. This process effectively eliminated much of the detail that is present in the regional geologic framework model. Although of higher resolution in grid size throughout, the resolution of the site-scale model is only marginally better than the regional model across a large part of the model domain where data are absent and the site-scale HFM is substituted as an input.

f. Numerical models, by their very nature are limited in their ability to accurately reflect the complex natural environments that they are intended to simulate. While Nye County recognizes the great efforts that have gone into the development of the regional and site-scale models, the County also recognizes that there is considerable uncertainty in the model results, the results are by no means unique, and the models are not better than the data and conceptualizations that are used as the underpinnings of the models.

g. The Applicant conducted an evaluation to determine the suitability of the use of the 2004 DVRFS model for use in the development of the site-scale model [*Saturated Zone Site-Scale Flow Model*. MDL-NBS-HS-000011 REV 03. 2007. (Appendix C, p. C-1 to C-18) LSN DN2002478808]. This evaluation noted that the regional model is unqualified overall, and focused on the data sets used to support the site-scale model, specifically, recharge to the upper zone of the site-scale model, and the extracted cell-by-cell fluxes output from the

regional model and input as calibration targets for the site-scale model. The appropriateness and accuracy of the methods used by the U.S. Geological Survey (USGS) to develop the regional model inputs and outputs, and the appropriateness for the applied use in the site-scale model were evaluated. The intent was to demonstrate that the processes used to generate the data were done by qualified professionals, are reliable, and there are prior uses of these types of data. The evaluation concluded that the regional model database was well researched, the model was appropriately constructed, and the resulting output provides a reasonable simulation of regional flow. The evaluation further concluded that uncertainties in the simulated fluxes along the lateral boundaries of the SZ site-scale model are potentially significant, but the use of the regional flux data in the site-scale model is appropriately generalized considering the level of uncertainty.

h. The Applicant updated the site-scale model to incorporate new data from Nye County's Independent Scientific Investigations Program (ISIP) and field investigations conducted as part of the volcanic hazard assessment, [*Saturated Zone Site-Scale Flow Model*. MDL-NBS-HS-000011 REV 03. 2007. (p. 6-29) LSN DN2002478808]. While these data were useful in identifying flow pathways, the degree of heterogeneity in the geologic media, and quantifying key hydraulic parameters, the distribution of these data is limited, with the result that large areas of the site-scale model still lack site-specific hydrogeologic data. The heterogeneity identified in these investigations is **not** included in the regional HFM and, as a result, is not carried forward into the HFM for the site-scale model in areas beyond the GFM.

i. Based upon these evaluations and the results of field investigations, Nye County asserts that the regional and site-scale models are not of sufficient resolution to simulate known pathways for groundwater flow that are critical in evaluating the capability of the SZ to limit

the movement of water and radionuclides to the accessible environment, or in evaluating the fluxes of water that may come primarily from the east boundary of the site-scale model and that may dilute the concentration of any constituents that may be released from the repository. The resolution of the regional model is such that its use as a source of inputs for calibration of the site-scale model introduces uncertainty. Additional data are needed to quantify the boundary fluxes, particularly along the northern and eastern portions of the model, in order to assess the adequacy of the information used as the basis for the site-scale model.

j. The SZ site-scale flow model [*Saturated Zone Site-Scale Flow Model*. MDL-NBS-HS-000011 REV 03. 2007. (Figure A6-5, p. A-91). LSN DN2002478808] shows a number of large areas with no control within and adjacent to the model boundary. There are only two widely spaced wells drilled in the vicinity of the eastern boundary of the model domain (67 and 186), one location on the north (30-32) and one well on the extreme northwest boundary (68). None of these wells have corresponding wells on the other side of the model boundary that are suitable for the calculation of hydraulic gradients across the model boundaries.

k. The effects of the lack of control along the boundaries of the site-scale model become apparent when the differences between the regional-model derived target flow-rates and those simulated in the site-scale model are examined [*Saturated Zone Site-Scale Flow Model*. MDL-NBS-HS-000011 REV 03. 2007. (Table 6-11, p. 6-74). LSN DN2002478808]. In four of the eight cases evaluated, the absolute value of the predicted flow is significantly different from the target (>60%), and in three of these cases, the predicted flow is in the opposite direction from the target value.

l. The regional and site-scale flow models also rely upon estimates of recharge that have been developed using inconsistent methodologies that may have resulted in significant underestimates of this important parameter, which would affect the output of the site-scale model. The recharge component can be divided into two data types: 1) those resulting from specific studies of infiltration at Yucca Mountain and streambed infiltration within the area encompassed by the site model; and 2) the recharge estimates for the regional model that are one of the key parameters in determining flux rates across the eastern boundary of the site-scale model. The first data types are based upon measurements and data supported models. The recharge estimates for the regional model are not supported by data or measurements [Hevesi, J.A., A.L. Flint, and L.E. Flint, 2003, Simulation of the net infiltration using a distributed parameter watershed model for the Death Valley region, California and Nevada, U.S. Geological Survey, Water Resources Investigation Report 03-4090, pp. 24-25, LSN DN2001618950.] and Nye County asserts that these estimates significantly underestimate the recharge to the regional system. The modeled recharge rates are one of the key factors in establishing the flux across the site-scale model boundaries. The collection of specific data along the boundaries of the site-scale model will provide more reliable estimates of fluxes into and out of the site-scale model, permit the assessment of the adequacy of the basis for the model, and preclude the need to use the uncertain outputs from the regional model as calibration targets for the site-scale model.

m. The regional flow model also relies upon estimates of evapotranspiration that were developed using inconsistent methodologies and that may have resulted in significant underestimates of this important parameter in evaluating discharge and overall water balance in the flow system. As a result of the lack of standard practices and methods, Nye County asserts that there is considerable uncertainty in the inputs and outputs for the regional model, and, hence,

in the boundary conditions used in calibrating the site-scale model. In particular, the estimates of evapotranspiration did not take into account the depth to groundwater under the regional discharge areas at Ash Meadows, Franklin Playa, and Death Valley, as well as in other discharge areas of the regional model, and this exclusion represents a fundamental issue regarding the basis for estimates of evapotranspiration for the Death Valley regional flow system and the use of this model in calibrating the site-scale model.

n. A review of the regional and site-scale flow models and supporting documents finds that the application of methods in estimating recharge and evapotranspiration were not consistent with accepted measures. The data collected was not of a density commensurate with the significance of these input parameters. The use of different assumptions, methods, and techniques would have yielded substantially different results, and the uncertainty associated with the input parameters has not been adequately addressed. Nye County contends that because of the methods used in estimating recharge and groundwater discharge via evapotranspiration, the regional groundwater flow model may significantly underestimate these two key inputs. Therefore, to assess the adequacy of the basis for the site-scale model, more accurate estimates of groundwater fluxes across the model boundaries are needed. Additional field data collection activities are warranted to collect the fundamental hydrogeologic data that are needed to assess the adequacy of the site-scale model and to ensure that the model provides a reasonable simulation of the capabilities of the SZ flow system at Yucca Mountain.

o. With the above noted data gaps and discrepancies between the regional model and site-scale model, Nye County asserts that additional information is needed to determine conditions along the boundaries of the site-scale model to assess the adequacy of the basis for this model

in evaluating the capability of the SZ. Nye County proposes that a series of wells be drilled on the site model boundaries, particularly the northern and eastern boundaries, to allow accurate measures of hydraulic gradients and that each well be tested to provide accurate measures of key aquifer parameters. It is only through direct measurement that discrepancies between the two models can be resolved and the adequacy of the basis for the site-scale model evaluated. The collection of this additional data will preclude the need to use inputs from the regional model in calibrating the site-scale model and allow the site-scale model to stand alone.

p. REMEDY: As a condition to issuance of construction authorization, NRC should require the Applicant to revise the performance confirmation program to include additional site-specific data gathering and testing activities to quantify the boundary fluxes, particularly along the northern and eastern portions of the site-scale model, in order to assess the adequacy of the information used as the basis for the site-scale model, or to provide an adequate basis for the omission of these activities.

6. <u>References to portions of the application or environmental documents</u>. (2.309(f)(1)(vi))

Yucca Mountain Repository License Application, General Information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008. (SAR p. 2.1-3, p. 2.1-9, p. 2.1-10, Table 4-1, p. 4-15, pp. 4-19 to 4-24, p. 4-43 to 4-47). LSN DEN001592183

Postclosure Nuclear Safety Design Bases. ANL-WIS-MD-000024 REV 01. 2008 (p. 6-10, p. 6-11, p. 6-48, p. 6-49). LSN DEN001580576

Saturated Zone Site-Scale Flow Model. MDL-NBS-HS-000011 REV 03. 2007. (Figure A6-5, p. A-91, pp. 6-3 to 6-7, p. 6-11, p. 6-29, p. 6-74, Appendix C, pp. C-1 to C-18) LSN DN2002478808

10 CFR 63.2

10 CFR 63.21(c)(17)]

10 CFR 63.102(m)

10 CFR 63.131(a)(2)

7. Statement Regarding Joint Ownership

Nye County is not claiming joint ownership of this contention with any other entity.

NYE-SAFETY-4

Inadequate consideration of the radiation dose from naturally occurring radon emitted as a result of repository construction and normal operations

1. Statement of Issue of Law or Fact (2.309(f)(1)(i))

DOE has failed to fully identify, examine, and evaluate the effect of construction and operational activities upon air quality and personnel in the general environment around Yucca Mountain, as required by 40 CFR 197, 10 CFR §63.111, §63.112, §63.202, and §63.204 . Specifically, DOE has inadequately considered the radiation dose to members of the public from naturally occurring radon and its decay products emitted as a result of repository construction and normal operations.

2. Explanation of Basis (2.309(f)(1)(i))

In its Supplemental Environmental Impact Statement (SEIS), DOE has identified radiation dose to members of the public of about 7.5 mrem per year for most years of repository operations and monitoring. This is about 50% of the safety standard maximum of 15 mrem for any year of preclosure operations as stated in 40 CFR 197 and 10 CFR 63, and 75% of the 10 CFR 20.1101 air emissions ALARA guideline of 10 mrem per year. The reported dose is 99.8% due to releases of naturally occurring radon and its decay products caused by ventilating the repository underground systems. DOE has inappropriately ignored and failed to report that radiation dose caused by repository construction and operations in its License Application (LA). Furthermore, DOE has utilized nine meteorological station locations (SAR Figure 5-20) to represent Yucca Mountain present-day climate conditions. With the estimated dose being such a high percentage of the 15 mrem allowed dose to a member of the public and possible channeling effects of local terrain in the repository vicinity, this network of meteorological stations may be inadequate to

assure public protection. While Nye County believes that DOE has likely grossly overestimated the radiological dose from radon and its decay products, if DOEs estimates are accurate (or underestimate the dose), Nye County residents may not be adequately protected. It is incumbent on DOE, and NRC as the repository regulator, to provide reasonable assurance that all members of the public in the repository vicinity will be adequately protected during repository construction, operations, and monitoring phases.

3. Issue Is Within the Scope of the Proceeding (2.309(f)(1)(iv))

Determination of the radiation dose to members of the public is the key criteria associated with determination of whether or not the repository can be operated safely. For preclosure safety, the safe limit established by the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission (NRC) is 15 millirem per year as defined in 40 CFR 197 and 10 CFR 63. To determine whether or not this safety limit has been met, DOE must consider all sources of radiation dose to the public that are caused by any aspect of repository construction and operations. The regulatory basis for this requirement is described in detail in the next section of this contention.

4. Issue Raised Is Material to Findings NRC Must Make (2.309(f)(1)(v))

a 40 CFR 197.4 and 10 CFR 63.204 state the requirements for preclosure repository safety that DOE must meet almost identically in the EPA and NRC regulations, respectively, as follows:

> **40 CFR § 197.4 What standard must DOE meet?**
>
> The DOE must ensure that no member of the public in the general environment receives more than an annual committed effective dose equivalent of 150 microsieverts (15 millirems) from the combination of: (a) Management and storage (as defined in 40 CFR 191.2) of radioactive material that: (1) Is subject to 40 CFR 191.3(a); and (2) Occurs outside of the Yucca Mountain repository but

> within the Yucca Mountain site; and (b) Storage (as defined in §197.2) of radioactive material inside the Yucca Mountain repository.
>
> **10 CFR § 63.204 Preclosure Standard**
>
> DOE must ensure that no member of the public in the general environment receives more than an annual dose of 0.15 mSv (15 mrem) from the combination of: (a) Management and storage (as defined in 40 CFR 191.2) of radioactive material that: (1) Is subject to 40 CFR 191.3(a); and (2) Occurs outside of the Yucca Mountain repository but within the Yucca Mountain site; and (b) Storage (as defined in § 63.202) of radioactive material inside the Yucca Mountain repository.

Storage is defined identically by both the EPA and the NRC as: retention (and any associated activity, operation, or process necessary to carry out successful retention) of radioactive material with the intent or capability to readily access or retrieve such material (40 CFR 191.2 and 10 CFR 63.202). As a direct result of storage operations (construction, operation, and ventilation of the subsurface repository), naturally occurring radon and its decay products will be released into the atmosphere and will result in radiation dose to members of the public [Repository SEIS Section 4.1.7.2.6, Table 4-24, page 4-68, LSN DEN001593669].

b. DOE is required to perform a preclosure safety analysis of the geologic repository operations area that must include an identification and systematic analysis of naturally occurring and human-induced hazards at the geologic repository operations area, including a comprehensive identification of potential event sequences (10 CFR 63.112 (b)). Additionally, DOE must provide the data used to identify naturally occurring and human-induced hazards at the geologic repository operations area (10 CFR 63.112 (c)). It must further provide the technical basis for either the inclusion or exclusion of specific, naturally occurring and human-induced hazards in the safety analysis (10 CFR 63.112 (d)).

5. <u>Statement of Alleged Facts or Opinions and References to be Relied On (2.309(f)(1)(vi))</u>

Radon Dose

a. In DOE's repository LA, DOE has ignored in its preclosure safety analysis the human induced release of radon-222 and its decay products that would likely result in a substantial radiological dose to members of the public (Repository Supplemental EIS Section 4.1.7.2.6, Table 4-24, page 4-68). DOE incorrectly states in its SAR section 1.8.1, page 1.8-3 that, "Preclosure dose analyses for airborne releases do not include ^{222}Rn and its daughter products that are part of the normal background radiation environment. The potential contribution to dose from ^{222}Rn and its decay products is excluded by 10 CFR 20.1101(d) for air emissions."

b. 10 CFR 20.1101(b) and (d) illustrate DOE's misinterpretation of that regulation.

> **§ 20.1101 Radiation protection programs.**
>
> * * *
>
> b) The licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA).
>
> * * *
>
> (d) To implement the ALARA requirements of § 20.1101 (b), and notwithstanding the requirements in § 20.1301 of this part, a constraint on air emissions of radioactive material to the environment, excluding Radon-222 and its daughters, shall be established by licensees other than those subject to § 50.34a, such that the individual member of the public likely to receive the highest dose will not be expected to receive a total effective dose equivalent in excess of 10 mrem (0.1 mSv) per year from these emissions. If a licensee subject to this requirement exceeds this dose constraint, the licensee shall report the exceedance as provided in § 20.2203 and promptly take appropriate corrective action to ensure against recurrence.

c. Contrary to the DOE assertion that 10 CFR 20.1101(d) provides an exclusion to the requirements of 10 CFR 63 as related to naturally occurring Radon-222, this section actually

provides an additional constraint on airborne radiation releases by other licensees. 10 CFR 20.1301 noted in the quoted section requires licensees to meet 100 mrem dose limits to members of the public, but 10 CFR 63 already has a radiation exposure limit of 15 mrem per year to any member of the public, so the 10 CFR 20.1301 limit is less stringent than the 10 CFR 63 limit. 10 CFR 20.1101(d) puts a further constraint on the 100 mrem limit in 10 CFR 20.1301 requiring that licensees further limit dose to the public from air emissions of radioactive material to 10 mrem per year, to monitor such air emissions, and to report any exceedance of 10 mrem per year to NRC followed promptly by corrective action to ensure against recurrence of exceeding this limit.

d. Nye County agrees that the additional constraint of 10 mrem per year and the reporting requirement in 10 CFR 20.1101(d), from Radon-222 releases, are not literally applicable to the repository according to the scope of 10 CFR 20. However, to assert that this in some way provides an exclusion under 10 CFR 63 (which must conform to 40 CFR 197) is without basis. Additionally, in the spirit of good ALARA practices, Nye County believes that DOE should take steps to ensure airborne releases of radioactive materials resulting directly from repository construction and operations from all sources do not cause more than 10 mrem annual radiation exposure beyond the existing baseline to any Nye County member of the public. Nye County also believes that the ALARA regulation in 10 CFR 20 were put in place without regard to the possibility of NRC regulated activities having a direct causal relationship to the release of Radon-222 and its longer lived decay products that would cause substantial radiation dose to members of the public, as is the case for a repository in Nye County, Nevada, at Yucca Mountain.

e. To provide adequate protection from radiation to a Nye County resident located at or near the site boundary, DOE must evaluate and take appropriate action to limit exposure not only resulting directly from radiation emitted from the radioactive materials being stored until disposal, but in addition must provide appropriate evaluation and protection from the radon released during construction and operations primarily from ventilation of the subsurface repository. The annual radiation dose to a Nye County resident living near the southeastern boundary of the repository site is stated by DOE in its Repository Supplemental EIS as being nominally 7.5 mrem per year [Repository Supplemental EIS Section 4.1.7.2.6, Table 4-24, page 4-68, LSN DEN001593669] over the entire monitoring period and approximately the same amount during a portion of the operations and closure phases. This is approximately 50% of the 15 mrem allowable dose limit to the public specified in 40 CFR 197.4 and 10 CFR 63.204, as noted above (and 75% of the 10 CFR 20.1101 air emissions ALARA guideline).

f. Although the NRC typically does not regulate the radiological dose from naturally occurring sources, the process for setting and enforcing the standard for Yucca Mountain radiological safety is far from typical. The Nuclear Waste Policy Act, as amended, Section 121(a), requires the EPA to set standards for protection of the general environment from offsite releases from radioactive material in repositories. Section 121(b) requires the NRC to promulgate requirements and criteria that it will use in approving or disapproving construction, operation, and closure of repositories. Section 121(b) also requires that the NRC requirements not be inconsistent with the EPA standards. As noted above, 10 CFR 63.112 sets radiological protection requirements for naturally occurring and human-induced hazards. This is appropriate since the Nye County, Nevada, residents who are located near

the site should be protected from all radiological sources, not just sources contained in the spent nuclear fuel and high level radioactive waste.

g. Furthermore, DOE has not provided sufficient design evaluation to show the relationship between design criteria and the requirements specified at 10 CFR 63.111 (a) and (b) or the design bases and their relation to the design criteria 10 CFR 63.112 (f). 10 CFR 63.111 (a) (2) requires that for normal operations and category 1 event sequences that the dose to any real member of the public beyond the site boundary cannot exceed the preclosure standard specified in Section 40 CFR 197.4 and 10 CFR 63.204. These regulations specify that DOE must ensure that no member of the public in the general environment receives more than an annual dose of 15 mrem from the combination of management and storage of radioactive material. DOE has stated that the annual dose from radon and its decay products released as a result of preclosure ventilation during the monitoring stage of storage operations would be 7.5 mrem per year for decades [Repository SEIS Section 4.1.7.2, Table 4-24, page 4-68, LSN DEN001593669].

h. The calculated value was for the SEIS and presumably was not done to the rigorous Quality Assurance requirements of NRC required safety calculations. No reference for the calculations could be found in the DOE's SEIS and it was not apparent that any consideration was given to uncertainties in the calculation that could cause annual variations that would be expected to occur and cause the dose in the maximum year to be higher than the single annual estimate presented for each year during the repository monitoring phase. The SAR should consider the annual variation of the estimated dose from factors such as natural variation in weather or other uncertainties in the calculation to provide reasonable assurance

that no member of the Nye County public receives more than a 15-mrem exposure resulting from repository operations during any year.

i. DOE has also failed to evaluate design alternatives that could avoid or mitigate the consequences of radon released from ventilation operations. DOE states that about 99.8% of offsite dose from the normal repository operations and monitoring phases would come from exposure to radon and its decay products released from ventilation operations [Repository Supplemental EIS Section 4.1.7.2, Table 4-24, page 4-68, LSN DEN001593669]. Additionally, DOE's estimate of a nominal 7.5 mrem per year for decades during the monitoring phase is inadequate to show that the maximum dose standard of 15 mrem per year is met every year of preclosure operations. Since the nominal annual average of 7.5 mrem is about 50% of the maximum annual allowable dose during the entire preclosure monitoring phase (and 75% of the 10 CFR 20.1101 air emissions ALARA guideline), annual variation may cause the annual maximum dose limit to be approached or exceeded if DOE's nominal estimates are accurate.

Adequacy of Monitoring to Model Offsite Radiation Dose

j. DOE collected meteorological data to establish climate conditions. However, localized wind patterns including wind channeling and convection currents are known to exist in and around the repository site. Convection currents caused by the uneven heating of the ground may create small scale vortices capable of picking up dust and debris from the desert surface and casting it hundreds of feet in the air. These vortices, commonly called dust devils, occur frequently in the Mojave Desert and particularly in the Amargosa Valley. Dust resulting from the repository construction and excavation activities as well as operational activities

will contain radon, its daughter products, and possibly other radionuclides that may be lifted by these vortices in plumes high in the air.

k. DOE utilized nine meteorological station locations [SAR Figure 5-20] to represent Yucca Mountain present-day climate conditions. While possibly sufficient for assessing regional climate conditions this system does not sufficiently monitor localized wind disturbances and patterns which result from the channeling effects of the local terrain and the uneven heating of the ground surface. SAR Tables 1.1-10 through 1.1-18 indicate climatic wind speed and direction information, and show wind speed and direction vary throughout the day. In addition, SAR Tables 1.1-27 through 1.1-63, when compared with SAR Figure 5-20, indicate the winds tend to follow terrain channels. The applicant has not provided adequate monitoring stations to evaluate the effects of wind channeling and uneven heating on the flow of particulate mater and radionuclide discharges caused by preclosure construction and operations. Localized wind patterns may concentrate radionuclides to a level exceeding the regulations. In other words, an exposed Nye County citizen located in an area of concentrating wind patterns within the general environment could receive a higher dose of radiation than is predicted using data from the meteorological stations cited by DOE. [*Yucca Mountain Repository License Application, General Information and Safety Analysis Report*. DOE/RW-0573 REV0. 208 (SAR p. 5-140, p 1.1-200 through 1.1-217, and 1.1-222 through 1.1-297). LSN DEN001592183]

l. No plans have been provided for locating additional monitoring stations at or near the southern and western boundaries of the land withdrawal area to determine the presence and/or the amount (concentrations) of airborne pollutants being carried in the direction of area workers and residents by topographically directed airstreams. Instead, the Applicant

concluded that for non-radiological air quality analysis, "The highest concentrations of all criteria pollutants except PM_{10} would be less than 3 percent of applicable standards in all cases" [SEIS 4.1.2.5 Total Impacts to Air Quality from All Periods, page 4-15]. A similar conclusion was made for radiological materials [SEIS Appendix D, Table D-5, page D-15, LSN DEN001593669].

m. PROPOSED REMEDY: Before construction authorization, NRC should require DOE to include the offsite dose from the release of radon and its decay products during repository construction, operation, and ventilation of its subsurface repository in its compliance estimates in the SAR per the preclosure standard stated in 10 CFR 63.204. Additionally, the NRC should require DOE to institute a preclosure monitoring network as soon as practicable to establish a baseline for background radon (and its decay products) and other radionuclides that could be released during preclosure operations.

n. NRC should require DOE to identify terrain likely to channel and concentrate air movement and to locate monitoring stations in those air streams near the southern and western boundaries of the land withdrawal area. Baseline data should be collected for those areas before construction begins, and monitoring should continue throughout construction and operation of the repository. Such monitoring would not only improve the applicant's safety analysis by including a (currently ignored) potential pathway of radionuclide transport and exposure. Early detection of concentrated airborne radionuclide contaminants would allow immediate mitigation and avoid the possible exposure of a member of the Nye County public located in the path of the plume to a dose of radiation in excess of or approaching that allowed under the regulations.

o. It is important that the radiation and airborne transport monitoring network begin sufficiently prior to construction authorization that a thorough understanding of the baseline radiation levels and their natural annual variation is obtained. Additionally, because the dose estimates from radon are 50% of the 10 CFR 63.204 preclosure safety standard (and 75% of the 10 CFR 20.1101 air emissions ALARA guideline), NRC should require the monitoring network to continue operations for the entire preclosure period. The monitoring of other radionuclides could be delayed until a few years before repository operations, but their monitoring should also continue for the entire preclosure period. In all cases, results should be reported to NRC and the Nye County Nuclear Waste Repository Project Office annually. Any unanticipated results should be explained and appropriate actions should be taken. For example, if radiation levels during construction and operations are higher than estimated, DOE's safety analysis should be updated and appropriate actions taken to protect Nye County citizens. If radiation levels are below those estimated, allowance could be made for updates to the dose estimates considering the monitoring data as input to the estimates. Under either circumstance the safety of Nye County residents would be ensured.

6 <u>References to portions of the application or environmental documents</u>. (2.309(f)(1)(vi))

Yucca Mountain Repository License Application, General Information and Safety Analysis Report. DOE/RW-0573 REV0. 208 (SAR Tables 1.1-10 through 1.1-18, Tables 1.1-27 through 1.163, p. 1.8-3, p. 2.3-10, Figure 5-20, p. 5-140, pp. 1.1-200 through 1.1-217, pp. 1.1-222 through 1.1-297). LSN DEN001592183

Final Supplemental Environmental Impact Statement (SEIS) for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada DOE/EIS-0250F-S1, June 2008, Section 4.1.2.5, page 4-15; Section 4.1.7.2.6, page 4-68; Appendix B, paragraph B.4, pages B-6 to B-8; Appendix B, paragraph B.5.2, page B-10; Appendix D, paragraph D.2.2, pages D-8 and D-9; ,Appendix D, paragraph D.4.1.1, pages D-15 and D-16; and Appendix D, Table D-5, page D-15; LSN DEN001593669

10 CFR 20.1101(d)

10 CFR 20.1301

10 CFR 63.111(a), (b), (f)

10 CFR 63.112 (b); (c); (e)(1); (e)(4); (f)(1).

10 CFR 63.204

40 CFR 197.4

7. Statement Regarding Joint Ownership

Nye County is not claiming joint ownership of this contention with any other entity.

NYE -JOINT-SAFETY-5

Failure to include the requirements of the National Incident Management System (NIMS), dated March 1, 2004, and related documentation in Section 5.7 Emergency Planning of the Yucca Mountain Repository Safety Analysis Report (SAR).

1. Statement of issue of law or fact. [2.309(f)(1)(i)]

The applicant failed to include key interoperability and standardized procedure and terminology requirements of the National Incident Management System (NIMS), in the Emergency Planning required as part of the Safety Analysis Report [Yucca Mountain Repository License Application, General Information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR Section 5.7; SAR pp 5.7-1 to 5.7-55). LSN DEN001592183] to sufficiently ensure the ability of Nye County and other offsite agencies to properly plan and respond to onsite emergency actions. See requirements at 10 CFR 63.161 and 10 CFR 72.32(b).

2. Explanation of basis. [2.309(f)(1)(ii)]

The applicant is required by 10 CFR 61.161 and 10 CFR 72.32(b) to prepare an emergency plan which will provide for offsite notification and coordination, offsite assistance and participation in exercises, arrangements for providing information to the public, the training of offsite response personnel, and provisions for prompt communications among principal response organizations to offsite emergency personnel who would be responding onsite. The SAR addresses NRC directives and DOE requirements, but does not include the critical interoperability and communications requirements of the National Incident Management System (NIMS), dated March 1, 2004, that was promulgated subsequent to the NRC regulations cited above. NIMS has been implemented for the federal government under Homeland Security Presidential Directive/HSPD-5, dated February 28, 2003; HSPD-7, dated December 17, 2003; and by HSPD-

8, dated December 17, 2003. [Homeland Security Presidential Directive/HSPD-5 (February 28, 2003) LSN NYE000002223; HSPD-7(December 17, 2003).LSN NYE000002213; HSPD-8 (December 17, 2003) LSN NYE000002212.] Homeland Security National Preparedness Guidelines, dated September 2007, and the Homeland Security National Response Framework, dated January 2008, further describe how the various government agencies should work together. [Homeland Security National Preparedness Guidelines, dated September 2007, LSN NYE000002216; Homeland Security National Response Framework, dated January 2008, LSN NYE000002217.] NIMS and HSPD-5 are anticipated to be specifically included in the requirements of 10 CFR 73.32(b) as a subsequent, pertinent directive to ensure public safety and the full participation of Nye County in emergency planning and offsite assistance to Yucca Mountain. The absence of a specific reference to the new Federal requirements from the cited NRC regulations in no way alleviates DOE and NRC responsibility to ensure the implementation of such requirements.

3. Issue is within scope of proceeding. [2.309(f)(1)(iii)]

See response at 4.

4. Issue raised is material to finding NRC must make. [2.309(f)(1)(iv)]

a. The SAR contains no reference to the NIMS or Homeland Security Presidential Directive (HSPD)-5. The incorporation of NIMS is basic to ensuring the proper coordination and integration of Nye County and other offsite responder agencies in the emergency plan. "HSPD-5 requires all Federal departments and agencies to adopt the NIMS and to use it in their individual domestic incident management and emergency prevention, preparedness, response, recovery, and mitigation programs and activities, as well as in support of all actions

taken to assist State, local, or tribal entities." [National Incident Management System, Preface, Homeland Security, March 1, 2004]

b. The SAR must include:

- "Notification and coordination. A commitment to and a brief description of the means to promptly notify offsite response organizations and request offsite assistance, …" [10 CFR 72.32(b)(8)]

- "Exercises. (i) Provisions for conducting quarterly communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies." [10 CFR 73.32(b)(12)]

- "Comments on Plan. The licensee shall allow the offsite response organizations expected to respond in case of an accident 60 days to comment on the initial submittal of the licensee's emergency plan before submitting it to NRC. Subsequent plan changes need not have the offsite comment period unless the plan changes affect the offsite response organizations." [10 CFR 72.32(b)(14)]

- "Offsite assistance. The applicant's emergency plans shall include the following:
    - a brief description of the arrangements made for requesting and effectively using offsite assistance on site and provisions that exist for using other organizations capable of augmenting the planned onsite response.
    - Provisions that exist for prompt communications among principal response organizations to offsite emergency personnel who would be responding onsite." [10 CFR 72.32(b)(15)]

- "Arrangements made for providing information to the public." [10 CFR 72.32(b)(16)]

c. Because the applicant failed to include NIMS or adopt the NIMS requirements, the NRC has no assurance of communications and equipment interoperability, or the integration of local government participation in effective emergency planning and the provision of emergency information to the public. Failure to include these principles encourages site personnel to act independently of surrounding governmental agencies, greatly increases the likelihood of miscommunication and misunderstanding, and limits the ability of offsite responders to be sure their equipment will fully integrate with onsite equipment. Additionally, because the applicant intends to forward only those emergency plan changes deemed by the applicant to

affect the offsite agency, it is very possible that important issues will be missed. The same holds true if the offsite agency does not coordinate changes to their plans.

5. Statement of alleged facts or opinions and references to be relied upon [2.309(f)(1)(v)]

a. While the DOE SAR addresses the NRC directives and DOE requirements as they are currently written, it does not include the requirements of the National Incident Management System (NIMS), dated March 1, 2004. NIMS has been implemented for the federal government under Homeland Security Presidential Directive/HSPD-5, dated February 28, 2003; HSPD-7, dated December 17, 2003; and by HSPD-8, dated December 17, 2003. [Homeland Security Presidential Directive/HSPD-5 (February 28, 2003) LSN NYE000002223; HSPD-7(December 17, 2003) LSN NYE000002213; HSPD-8 (December 17, 2003) LSN NYE000002212.] Homeland Security National Preparedness Guidelines, dated September 2007, and Homeland Security National Response Framework, dated January 2008, further identify how the various government agencies should work together. [Homeland Security National Preparedness Guidelines, dated September 2007, LSN NYE000002216; Homeland Security National Response Framework, dated January 2008, LSN NYE000002217.] In accordance with the above directives, specific information on Nye County participation in the planning effort should be submitted to NRC in a future SAR revision or supplement prior to the License Application update required by NRC before DOE can be granted a license to receive and possess radioactive material under 10 CFR 63. This information should include the following revisions as a minimum.

- "Notification and coordination. A commitment to and a brief description of the means to promptly notify offsite response organizations and request offsite assistance, …" [10 CFR 72.32(b)(8)]

- "The communications system provides communication services for data, voice, and video transmissions throughout the repository, both the surface and the subsurface. The communications system permits reliable communications under anticipated

circumstances during both normal and emergency conditions. The communication system supports safeguards and security, fire protection, employee safety and health, construction, operations, and emergency management." [Yucca Mountain Repository License Application, General information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR p. 5.7-12, Section 5.7.5.2.4.5). LSN DEN001592183]

- The preceding statement from the DOE License Application contains no reference to ensuring integrated or interoperable communications where offsite emergency responders are concerned. Interoperable communications are too critical to effective emergency response to merely assume they are in place. The same is true of Section 5.7.5.2.4.6 Emergency Communications (SAR p 5.7-12), in which there is no reference to communications with offsite emergency responders. Nye County believes that the inclusion of these specific NIMS concepts are required to ensure effective and efficient response capabilities are in place prior to an emergency.

    - "Effective communications, information management, and information and intelligence sharing are critical aspects of domestic incident management. Establishing and maintaining a common operating picture and ensuring accessibility and interoperability are principal goals of communications and information management." [National Incident Management System, page 54, Homeland Security, March 1, 2004]

- By including NIMS requirements, or at least a commitment to the requirements at this time, in the emergency plan, many of the assumed conditions will be specifically addressed. For example, the SAR Section 5.7.5.2.4.5 Communications, begins "The communications system provides communications services for data, voice, and video transmissions throughout the repository, …" Under this section all site communications are included – the unspoken assumption being that the site will be able to communicate with all surrounding offsite jurisdictions and any offsite responders. The same assumption that all communications will work appears in Section 5.7.5.2.4.6 Emergency Communications. Yet there is no assurance that all agencies involved will have interoperable communications – especially in an emergency situation. NIMS requires reviews for communications integration and interoperability and that steps be taken to ensure first responders can communicate with site personnel and networks.

- "Exercises. (i) Provisions for conducting quarterly communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies." [10 CFR 73.32(b)(12)]

- "Exercises will be conducted biennially, at a minimum, to test the adequacy and effectiveness of organizational command and control, implementing procedures, notification and communication networks, emergency equipment, response organization performance, and the overall emergency preparedness program. Exercises are designed and conducted for maximum realism and attempt to duplicate the sense of stress inherent in an actual emergency situation.

- Exercises will be designed to test integrated response capabilities of the repository and offsite response agencies, the NRC, and the DOE headquarters organization. Offsite response organizations (including the NRC and DOE headquarters organization) shall be invited to participate in the biennial exercises; however, their participation is not required." [Yucca Mountain Repository License Application, General information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR p. 5.7-36). LSN DEN001592183]

- "Preparedness requires a unified approach. A major objective of preparedness efforts is to ensure mission integration and interoperability in response to emergent crises across functional and jurisdictional lines, as well as between public and private organizations." [National Incident Management System, page 30, Homeland Security, March 1, 2004] The inclusion of NIMS in the emergency plan will ensure that exercises are fully interoperable and utilize the same terminology and standard operating procedures for all responding agencies.

- "Comments on Plan. The licensee shall allow the offsite response organizations expected to respond in case of an accident 60 days to comment on the initial submittal of the licensee's emergency plan before submitting it to NRC. Subsequent plan changes need not have the offsite comment period unless the plan changes affect the offsite response organizations." [10 CFR 72.32(b)(14)]

    - "The Emergency Plan will be provided to offsite response organizations identified in the Emergency Plan for review prior to submittal to the NRC. The offsite response organizations will have 60 days to review and comment on the Emergency Plan. Offsite response organization comments, if provided, will be included with the Emergency Plan submitted to the NRC. Comments from offsite response organizations, as appropriate, will be dispositioned in subsequent revisions to the Emergency Plan. If subsequent revisions to the Emergency Plan affect the offsite response organizations, future revisions will also be provided to those organizations for review. The comment period for subsequent revisions to the Emergency Plan will be 60 days. Comments provided by offsite organizations during this period will again be included with the revised Emergency Plan submitted to the NRC." [Yucca Mountain Repository License Application, General information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR p. 5.7-41, Section 5.7.5.2.4.5). LSN DEN001592183]

b. The President, through the Department of Homeland Security, has required the implementation of NIMS by federal, state, local and tribal governments to avoid the inability to work together efficiently and seamlessly demonstrated during 9/11 and Hurricane Katrina. Based upon that hard learned emergency response experience there is no assurance that this section, while meeting the specific requirements of 10 CFR 72.32(b)(14), takes into account the coordination of all changes to emergency plans (onsite or offsite) that may have a

possible bearing on nearby agencies. For example, changes in the number of personnel or equipment at a fire station due to mission changes may not be seen as affecting another agency. But the change may require a response from another location and an associated delay in arrival time to assist the other agency. Or, if both agencies decided to reduce their stations in an area due to budget restrictions, the ability of each to assist the other will have been reduced in an overall view. All changes need to be coordinated.

c. As stated in NIMS "Preparedness is the responsibility of individual jurisdictions; this responsibility includes coordinating various preparedness activities among all appropriate agencies within a jurisdiction, as well as across jurisdictions and with private organizations. This coordination is effected by mechanisms that range from individuals to small committees to large standing organizations. These mechanisms are referred to in this document as "preparedness organizations," in that they serve as ongoing forums for coordinating preparedness activities in advance of an incident. Preparedness organizations represent a wide variety of committees, planning groups, and other organizations that meet regularly and coordinate with one another to ensure an appropriate focus on planning, training, equipping, and other preparedness requirements within a jurisdiction and/or across jurisdictions. The needs of the jurisdictions involved will dictate how frequently such organizations must conduct their business, as well as how they are structured. When preparedness activities routinely need to be accomplished across jurisdictions, preparedness organizations should be multijurisdictional.. Preparedness organization at all jurisdictional levels should:

- •establish and coordinate emergency plans and protocols including public communications and awareness;
- •integrate and coordinate the activities of the jurisdictions and functions within their purview;
- •establish the standards, guidelines, and protocols necessary to promote interoperability among member jurisdictions and agencies;

- •adopt standards, guidelines, and protocols for providing resources to requesting organizations, including protocols for incident support organizations;
- •set priorities for resources and other requirements; and
- •ensure the establishment and maintenance of multiagency coordination mechanisms, including EOCs, mutual-aid agreements, incident information systems, nongovernmental organization and private-sector outreach, public awareness and information systems, and mechanisms to deal with information and operations security." [National Incident Management System, Preface, Homeland Security, March 1, 2004, Nye County RID #7569, Nye County LSN Assession No. nye_rid7569_01_00.pd, an NRC LSN Assession number will be provided when available.]

d. Furthermore, DOE unilaterally assigning Nye County 60 days to review emergency plans and changes does not comply with the spirit of the communications requirements of NIMS. The commitment in DOE's emergency plan should be to engage in communications with local government to ensure a fully integrated emergency plan and response system is in place, to the extent that the local community agrees to work cooperatively. In the case of Nye County, it is our desire to work cooperatively with DOE to ensure the safety of our citizens. This entails a common communications plan, not simply the opportunity for Nye County to review documents 60 days before DOE unilaterally implements its emergency plans.

- "Offsite assistance. The applicant's emergency plans shall include the following:
  - a brief description of the arrangements made for requesting and effectively using offsite assistance on site and provisions that exist for using other organizations capable of augmenting the planned onsite response.
  - Provisions that exist for prompt communications among principal response organizations to offsite emergency personnel who would be responding onsite." [10 CFR 72.32(b)(15)]

- SAR Section 5.7.15.1 Planning Goals states: "To facilitate a coordinated and planned emergency response, provisions for advance arrangements with offsite organizations will be addressed in the Emergency Plan. These arrangements include:
    - •Identification of offsite response organizations that have agreed to provide support, as well as other support organizations capable of augmenting the planned onsite response
    - •Means for requesting offsite assistance
    - •Provisions for prompt communications among principal response organizations with offsite emergency personnel who would be responding

- •Provisions for providing and maintaining emergency response facilities and equipment to support the emergency response
- •The availability of adequate methods, systems, and equipment for assessing and monitoring actual or potential consequences of a radiological emergency
- •Provisions for medical services for contaminated or injured individuals
- •Arrangements for radiological emergency response training to be offered to offsite support organizations that may be called upon to assist in an onsite emergency
- •Documentation of assistance agreements in the form of letters of agreement or memoranda of understanding." [Yucca Mountain Repository License Application, General information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR p. 5.7-42, Section 5.7.5.2.4.5). LSN DEN001592183]

- Provision for prompt communications does not ensure interoperable communications. Nor does the paragraph contain any reference to ensuring the equipment of the responding agencies is compatible with the onsite equipment. However, the following NIMS requirement exists for DOE and NRC.

- "Incident communications are facilitated through the development and use of a common communications plan and interoperable communications processes and architectures. This integrated approach links the operational and support units of the various agencies involved and is necessary to maintain communications connectivity and discipline and enable common situational awareness and interaction. Preparedness planning must address the equipment, systems, and protocols necessary to achieve integrated voice and data incident management communications." [National Incident Management System, page 18, Homeland Security, March 1, 2004]

- "Arrangements made for providing information to the public." [10 CFR 72.32(b)(16)]

- SAR Table 5.7-7 and Figure 5.7-1 contain no provision for a Nye County Representative within the Joint Information Center Staff to provide local liaison and insight for any information which will be released and which will affect the County and its residents. Nye County, as the Site Host for the repository, has a strong and practical interest in the impact that center pronouncements will have on county residents. [Yucca Mountain Repository License Application, General information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR p. 5.7-52, and p. 5.7-55). LSN DEN001592183]

- "Public Information Functions Must Be Coordinated and Integrated Across Jurisdictions and Across Functional Agencies; Among Federal, State, Local, and Tribal Partners; and with Private-Sector and Nongovernmental Organizations." [National Incident Management System, p. 36, Homeland Security, March 1, 2004]

e. In summary, the inclusion of NIMS in the emergency plan is not meant to denigrate the actions which have been taken to prepare this plan. It is intended to strengthen the plan by ensuring that all participants are working from the same integrated script (Standard Operating Procedures, terminology, etc.), with fully interoperable communications and equipment.

f. Nye County remains committed to a continued emergency management relationship with the Yucca Mountain Site, as is evidenced by the Memorandum of Understanding (MOU) between the US DOE/OCRWM and Nye County, Nevada signed by Edward F. Sproat, III, Director, DOE/OCRWM, on January 14, 2008, and by Joni Eastley, Chairman, Nye County Board of Commissioners, on February 5, 2008. [Memorandum of Understanding (MOU) between the US DOE/OCRWM and Nye County, Nevada signed by Edward F. Sproat, III, Director, DOE/OCRWM, on January 14, 2008, and by Joni Eastley, Chairman, Nye County Board of Commissioners, on February 5, 2008, LSN NYE000002221.] The MOU delineates communication and coordination for mutual assistance associated with DOE/OCRWM activities and the commitment to participate in broader multi-agency emergency response and planning activities to include all governmental agencies active in Nye County.

6. References to portions of the application or environmental documents. [2.309(f)(1)(vi)]

Yucca Mountain Repository License Application, General Information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR Section 5.7; SAR pp 5.7-1 to 5.7-55). LSN DEN001592183

Homeland Security Presidential Directive/HSPD-5 (February 28, 2003) LSN NYE000002223.

Homeland Security Presidential Directive/HSPD-7(December 17, 2003) LSN NYE000002213.

Homeland Security Presidential Directive/HSPD-8 (December 17, 2003) LSN NYE000002212.

Homeland Security National Preparedness Guidelines, dated September 2007, LSN NYE000002216.

Homeland Security National Response Framework, dated January 2008, LSN NYE000002217.

National Incident Management System, Preface, Homeland Security, March 1, 2004, LSN NYE000002211.

Memorandum of Understanding (MOU) between the US DOE/OCRWM and Nye County, Nevada signed by Edward F. Sproat, III, Director, DOE/OCRWM, on January 14, 2008, and by Joni Eastley, Chairman, Nye County Board of Commissioners, on February 5, 2008, LSN NYE000002221.

10 CFR 63.161

10 CFR 72.32(b)

7. Statement Regarding Joint Ownership

Nye County is jointly sponsoring this Safety Contention with the Nevada Counties of Churchill,

Esmeralda, Lander, and Mineral, and Inyo County, California.

NYE - JOINT-SAFETY-6

The LA lacks any justification or basis for excluding potential aircraft crashes as a category 2 event sequence.

1. Statement of Issue of Law or Fact (2.309(f)(1)(i))

Contrary to the requirements of 10 CFR 63 to provide the technical basis for the inclusion or exclusion of specific human-induced hazards in the repository preclosure safety analysis, the Department of Energy (DOE) has merely assumed the U.S. Air Force (USAF) will restrict their activities in the repository vicinity. No basis or justification for that assumption is provided by DOE in its repository License Application (LA) or supporting documents.

2. Explanation of Basis 2.309(F)(1)(ii))

In its LA Safety Analysis Report (SAR), DOE takes credit for various flight restrictions on USAF operations in the vicinity of the proposed repository [SAR section 1.6.3.4.1, pages 1.6-21, -22, and -23 LSN DEN001592183]. In the same SAR section on page 1.6-22, DOE states, "The accident an alysis conducted assumed that such flight restrictions would occur." No further basis or justification of this critical assumption is discussed. In the same SAR section on page 1.6-23, DOE discusses its event sequence probability calculations (based in large part on the noted unsupported assumption) and states, "Consequently, the aircraft hazard to the surface facilities is screened out as an initiating event."

3. Issue is Within the Scope of the Proceeding (2.309(f)(1)(iv))

Determination of potential event sequences is a key step in DOE's repository preclosure safety analysis required by 10 CFR 63.112. Without understanding the potential event sequences and their probability, neither NRC, nor other stakeholders can judge with reasonable assurance that

the repository can be operated safely. The regulatory basis for this requirement is described in detail in the next section of this contention.

4. Issue Raised Is Material to Findings NRC Must Make (2.309(f)(1)(v))

a. 10 CFR 63.111 states the performance objectives for the repository through permanent closure. The relevant portions of that regulation states the following requirements:

> **Preclosure Performance Objectives**
>
> **§ 63.111 Performance objectives for the geologic repository operations area through permanent closure.**
>
> * * *
>
> *(b)* Numerical guides for design objectives.
>
> * * *
>
> (2) The geologic repository operations area must be designed so that, taking into consideration any single Category 2 event sequence and until permanent closure has been completed, no individual located on, or beyond, any point on the boundary of the site will receive, as a result of the single Category 2 event sequence, the more limiting of a TEDE of 0.05 Sv (5 rem), or . . .
>
> (c) *Preclosure safety analysis*. A preclosure safety analysis of the geologic repository operations area that meets the requirements specified at § 63.112 must be performed. This analysis must demonstrate that:
>
> (2) The design meets the requirements of § 63.111(b).
>
> * * *

b. Preclosure safety analysis is defined in 10 CFR 63.112. The relevant portions follow:

> **§ 63.112 Requirements for preclosure safety analysis of the geologic repository operations area.**
>
> The preclosure safety analysis of the geologic repository operations area must include:
>
> (a) A general description of the structures, systems, components, equipment, and process activities at the geologic repository operations area;

(b) An identification and systematic analysis of naturally occurring and human-induced hazards at the geologic repository operations area, including a comprehensive identification of potential event sequences;

* * *

(d) The technical basis for either inclusion or exclusion of specific, naturally occurring and human-induced hazards in the safety analysis;

c. Further guidance regarding the identification and evaluation of potential event sequences is provided in the NRC Yucca Mountain Review Plan (NUREG-1804, Revision 2) on pages 2.1-25 and -26 as follows:

2.1.1.4 Identification of Event Sequences

Review Method 2 Categories 1 and 2 Event Sequences

Verify that the U.S. Department of Energy has properly considered the hazards and initiating events reviewed . . .

Acceptance Criterion 1 Adequate Technical Basis and Justification are Provided for the Methodology Used and Assumptions Made to Identify Preclosure Safety Analysis Event Sequences

(1) Methods selected for event sequence identification are appropriate, and are consistent with Agency [NRC] guidance or standard industry practices or are adequately justified.

(2) The methods selected are consistent with, and supported by, site-specific data; and

(3) Assumptions made in identifying event sequences are valid and reasonable.

The definition of event sequence in 10 CFR 63.2 is also relevant to this contention as follows.

§ 63.2 Definitions

Event sequence means a series of actions and/or occurrences within the natural and engineered components of a geologic repository operations area that could potentially lead to exposure of individuals to radiation. An event sequence includes one or more initiating events and associated combinations of repository system component failures, including those produced by the action or inaction of operating personnel. Those event sequences that are expected to occur one or more times before permanent closure of the geologic repository operations area are referred to as Category 1 event sequences. Other event sequences that have at least one chance in 10,000 of occurring before permanent closure are referred to as Category 2 event sequences.

5. Statement of Alleged Facts or Opinions and References to be Relied On (2.309(f)(1)(vi))

a. DOE is required to perform a preclosure safety analysis of the geologic repository operations area that must include an identification and systematic analysis of naturally occurring and human-induced hazards at the geologic repository operations area, including a comprehensive identification of potential event sequences (10 CFR 63.112 (b)). Additionally, DOE must provide the data used to identify naturally occurring and human-induced hazards at the geologic repository operations area (10 CFR 63.112 (c)). It must further provide the technical basis for either the inclusion or exclusion of specific, naturally occurring and human-induced hazards in the safety analysis (10 CFR 63.112 (d)). This technical basis must be implemented by the determination of potential event sequences that result in release of and public exposure to radioactive contaminates that could occur during repository operations and determining the probability of such event sequences. If the event sequences are such that they could occur with a probability of at least one chance in 10,000 over the period of preclosure repository operations, DOE must prepare consequence calculations and compare those calculated consequences to prescribed standards in 10 CFR 63.111(b)(2).

b. Contrary to these requirements, DOE has failed to provide any justification or basis for its assumption that it can achieve a binding agreement with the USAF to prescribe flight restrictions on its operations in the vicinity of the repository. DOE merely makes the unsupported assumption that, "The accident analysis conducted assumed that such flight restrictions would occur." Without the flight restrictions assumed by DOE, its calculation of aircraft crash event sequence probability would likely have significantly different results. Based on the assumption and its prominence in SAR section 1.6.4.3.1 and in Bectel SAIC

Company (BSC) calculation, "Frequency Analysis of Aircraft Hazards for License Application," page 22 [BSC identifier 000-00C-WHS0-00200-000-00E and DOE LSN Participant Accession Number ALOA.20071023.0985], it is presumed that without the unjustified assumption that an aircraft crash into repository facilities would be much more probable and categorized as a category 2 event sequence per 10 CFR 63.2. The consequences of such an aircraft crash are unknown because DOE has not performed a consequence analysis using NRC regulated processes because of its claim that the probability of such an event sequence is below the regulatory probability threshold for category 2 event sequences.

c. Nye County believes that before NRC allows DOE to begin construction of the repository, it should require a binding agreement between DOE and the USAF mandating the flight restrictions assumed by DOE in its preclosure safety analysis. At a minimum, DOE should be required to provide justification and basis for its assumption showing that there is reasonable assurance, such as documentation from the USAF, that such an agreement with the USAF is forthcoming with a prescribed implementation date or milestone. NRC should also make ongoing flight restrictions as assumed in DOE's safety analysis a condition of any license it issues for DOE to receive and possess nuclear materials at the repository. Otherwise, it is unknown whether or not the USAF would implement such restrictions and DOE's safety analysis is without basis in regard to the aircraft crash event sequence categorization. Such an indeterminate state is not adequate to show that repository workers and other Nye County residents in the vicinity of the repository will be safe.

6. References (including relevant LA sections)

Yucca Mountain Repository License Application, General Information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR Section 1.6.3.4.1, pp. 1.6-21, 6-22, and 6-23, Section 5.7; SAR pp 5.7-1 to 5.7-55). LSN DEN001592183

NRC "Yucca Mountain Review Plan," pp. 2.1-25 and -26 (NUREG-1804, Revision 2)
Bechtel SAIC Company calculation, "Frequency Analysis of Aircraft Hazards for License Application," page 22 (BSC identifier 000-00C-WHS0-00200-000-00E and DOE LSN Participant Accession Number ALA.20071023.0985)

10 CFR 63.2

10 CFR 63.111 (b), (c)

10 CFR 112 (a), (b), (d)

7. Statement Regarding Joint Ownership

Nye County is jointly sponsoring this Safety Contention with the Nevada Counties of Churchill,

Esmeralda, Lander, and Mineral, and Inyo County, California.

NYE-NEPA-1

Failure to Adequately Consider Cumulative Impacts to the Environment, Over Time, from Releases of Radiological and Other Contaminants to Groundwater and from Surface Water Discharges.

1. Statement of Issue of Law or Fact. (2.309(f)(1)(i)

NRC's regulations implementing the National Environmental Policy Act ("NEPA") require that the Department of Energy's (DOE's) license application for the repository must be accompanied by an Environmental Impact Statement ("EIS") prepared in accordance with the Nuclear Waste Policy Act, 10 CFR § 63.21(a), and further provide that NRC may not adopt any environmental impact statement prepared by DOE for a geologic repository if there is "significant and substantial new information or new considerations [that would] render such environmental impact statement inadequate." 10 CFR § 51.109(c)(2). The failures of DOE's 2002 Environmental Impact Statements and the 2008 Repository Supplemental EIS (collectively "EISs") to completely and adequately characterize potential contaminant releases to groundwater, and from surface discharges, as well as to adequately characterize the potential impacts on the environment from those releases and discharges, constitute significant new and additional considerations that render the EISs inadequate for that portion of the EISs that consider impacts to groundwater and from surface discharge over the long term, pursuant to the related legal requirements' of NEPA itself, 42 U.S.C. §§ 4332(C); the Nuclear Waste Policy Act, 42 U.S.C. § 10134(f) provisions pertaining to NEPA compliance for the repository; DOE's regulations implementing NEPA, 10 CFR Part 1021; and NRC's regulations implementing NEPA, 10 CFR Part 51 & 63. Therefore, NRC may not adopt the EIS without further supplementation. 10 CFR § 51.109(c)(2).

2. Explanation of Basis. (2.309(f)(1)(i)

DOE's analysis of the post-closure behavior of the repository recognizes that the release of contaminants to groundwater can be expected to occur over a very long period of time (DOE, 2008b, Chapter 5). Based upon available scientific evidence, this is a reasonably foreseeable outcome for the repository as it is currently characterized. The EISs consider impacts to groundwater, and discharges to the surface, but the analysis does not provide adequate discussion of the cumulative amounts of radiological and non-radiological contaminants that may be released to the groundwater or discharged to the surface over time. The EISs also fail to adequately discuss how these contaminants, individually and collectively, would behave in the aquifer, on the surface, and in the associated environment. Therefore, the discussions of groundwater impacts and surface discharges in the EISs are incomplete and inconsistent with well-established NEPA requirements, as well as DOE's and NRC's own regulations which require a complete and adequate discussion of environmental consequences of the proposed action. See, e.g., 10 CFR Part 63.21(a); 10 CFR Part 51 & Appendix A(6)-(7); 10 CFR §§ 1021.310; 1021.314. Based upon those gaps in required information, the standards for "reopening" contained in 10 CFR § 2.326 are also met. The failure to completely and adequately characterize such impacts itself constitutes an omission of a significant environmental consideration, irrespective of the magnitude of the potential environmental and health impacts quantified by further analysis. Given the importance of groundwater as a natural resource in Nye County and the arid Yucca Mountain region, supplementation is required pursuant to 42 U.S.C. § 10134(f) and 10 CFR § 6.51.109(c)(2) to ensure the 2002 EIS and the Repository Supplemental EIS adequately consider groundwater and surface water impacts.

3. Issue is within scope of proceedings. (2.309(f)(1)(iii))

See discussion under item 4 below.

4. Issue raised is material to findings NRC must make. (2.309(f)(1)(iv))

The inter-related EIS provisions of the Nuclear Waste Policy Act, NEPA, and NRC's NEPA regulations require that an adequate EIS accompany NRC's authorization of construction and the issuance of a license for the repository. 42 U.S.C. § 10134(f); 42 U.S.C. §§ 4332(C); 10 CFR § 51.109(c)(2). Whether or not additional cumulative analyses of groundwater releases and surface discharges are "significant and substantial new information or new considerations [that would] render such environmental impact statements inadequate" are issues directly linked to the finding which NRC must make regarding whether it is "practicable" for NRC to adopt DOE's EISs pursuant to 42 U.S.C. § 10134(f)(4). Therefore, the legal and technical issues raised by this contention are within the scope of this licensing proceeding and are material to findings NRC must make either in adopting DOE's EISs, or in requiring supplementation to the DOE's EISs.

5. Statement of alleged facts or opinions and references to be relied upon. (2.309(f)(1)(v))

a. Environmental impacts of the proposed repository actions over the long-term are considered in Volume 1, Chapter 5 of the 2002 EIS and the 2008 Repository Supplemental EIS. Discussions of potential impacts on groundwater, and on human health through a groundwater pathway, comprise much of these chapters. Expected impacts on groundwater are derived from the modeled release of both radioactive and non-radioactive material from the repository as components of the engineered barrier system slowly corrode and lose their capability to contain their contents.

b. The repository lies above the water table, in the unsaturated zone. The EISs state that water-borne releases from the repository are likely to travel downward in a nearly vertical direction and reach the groundwater below the repository site. The EISs describe the regional groundwater flow model used by DOE. *See* Section 3.1.4.2 of each EIS. In that model, groundwater flows generally to the south-southeast within an unconfined aquifer of volcanic rocks and alluvium underlying Nye County. The EISs further state that water from this aquifer discharges to the surface primarily at Alkali Flats (Franklin Lake Playa), but that this water does not feed springs in Ash Meadows or Devil's Hole (DOE, 2008b, Sections 3.1.4.2.1, 5.4).

c. DOE's principal means of assessing the effects of release and contaminant transport processes is its Total System Performance Assessment (TSPA), a probabilistic model which considers those features, events, and processes of the engineered and natural system that affect repository performance (DOE, 2008a, Safety Analysis Report, Chapter 2). The EISs use the human dose calculated in the TSPA as the principal measure of radiological impacts on groundwater. This dose is calculated using a model of well withdrawals of contaminated groundwater for drinking and irrigation, and includes consideration of the possible inhalation of surface dust potentially contaminated by well water, at a location approximately 18 km (11 miles) south of the repository in Nye County, the location of the Reasonably Maximally Exposed Individual ("RMEI"). The results are calculated for various increments in time over the million-year period following permanent closure of the repository. In addition to the human dose, TSPA similarly calculates results for the 10,000-year period following closure for radionuclides in

groundwater. The EISs compare the calculated results to the regulatory performance objectives and note that the predicted concentrations are well below the regulatory standards.

d. The EISs consider impacts on groundwater at other locations beyond the RMEI, many of which are within the boundaries of Nye County, to be no greater than those calculated in the TSPA for the RMEI location. In the Repository Supplemental EIS, DOE states that the contaminant plume, as currently modeled, is sufficiently narrow that well withdrawal would capture the entire plume at that location and at all locations beyond the RMEI locale (DOE, 2008b, Section 5.1.1.4). In the 2002 EIS, fractional "scaling factors" as multipliers of the TSPA results at the RMEI were calculated for more distant locations (including Alkali Flats), to account for increased dispersion of a contaminant plume down flow from the RMEI location (DOE, 2002, Section 5.4.1; Appendix 1.4.5).

e. The EISs also describe non-radiological impacts on groundwater for the release of chemically toxic materials. The releases that are analyzed result from the expected corrosion of materials of the engineered barrier system within the repository. The Repository Supplemental EIS provides concentrations for three corrosion-derived elements. These are calculated from annual mass-dissolution rates of exposed engineered material in the repository using methods anticipating well water withdrawal analogous to those used in the TSPA for radioactive contaminants in groundwater (DOE, 2008b, Section 5.7, Appendix F.5). DOE considers the calculated concentrations as bounding for groundwater at all locations.

f. The information provided in the EISs does not adequately characterize how potential contaminants may affect groundwater resources in the volcanic-alluvial aquifer, and the

potential effects from surface discharges. In the EISs, impacts on groundwater are discussed principally to determine if there will be regulatory compliance at the RMEI location. NRC's NEPA regulations in Part 51 and guidance in NUREG-1748, however, properly indicate that compliance with regulatory requirements does not necessarily satisfy the need to adequately consider all environmental impacts of the proposed action. The regulations and guidance recognize that additional analysis and discussion may be needed [e.g., 10 CFR § 51.71; 10 CFR Part 51, Subpart A, Appendix A(7)]. For impacts on groundwater and from surface discharge, additional analysis is necessary and EIS supplementation is required *See generally* U.S. Nuclear Regulatory Commission Staff's Adoption Determination Report for the U.S. Department of Energy's Environmental Impact Statements for the Proposed Geologic Repository at Yucca Mountain, September 5, 2008 (hereinafter referred to as "NRC staff report") which reviewed DOE's EISs and the factual record just presented and reached the same conclusion as Nye County has on the adequacy of the EISs.

g. The EIS states that the large water use at the RMEI location would "consume the entire plume" by withdrawing 3,000 acre feet of water," and since the plume is very narrow, the dose would be the same at all locations further south. This observation may be the remnant of a conservative assumption that 100 percent of nuclides in the groundwater system would be dissolved in the representative volume specified by regulation. However, the assumption does not square with the reasonable expectation that as the distance from the repository increases, the combination of flow from different groundwater basins would add more water, and perhaps different or additional contaminants, to the groundwater flow system. To properly assess impacts at locations south of the RMEI, the assumption of 100% withdrawal, used to make the regulatory assessment, must be modified to reflect what in reality is likely

to happen as the plume moves southward and interacts and mixes with other additions to the flow system. Such a reassessment must take into account the potential for cumulative impacts from contaminant release to the groundwater and from surface discharge, as well as potential dilution of the concentration of radionuclides and other contaminants released to the groundwater.

h. Three distinct, but related aspects of potential impacts on the groundwater system are insufficiently characterized in the EISs and require supplementation. These are (1) the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer over time; (2) the nature and extent of the repository's cumulative impact on groundwater when added to other sources of water, radiological contaminants, and other contamination, surface water runoff and groundwater intrusion of contaminants from past and future activities at the Nevada Test Site ("NTS"); and (3) the potential impacts from discharges of potentially contaminated groundwater to the surface.

i. The EISs indicate likely surface discharge at Franklin Lake Playa (DOE, 2002, Section 5.9; 2008b, Section 5.10). The discussion in these sections of the impacts from potential discharges is limited to a conclusory statement that no detrimental radiological impacts on plants and animals are expected. The limitations of DOE's approach presented in the EISs and the specific needs for supplementation are discussed in detail below.

Need for Supplementation to Fully Consider Cumulative Impacts to Groundwater

j. The principal deficiencies in the EISs' assessments of groundwater are outlined in the NRC staff report and stem from the basic assumption that the full amount of contaminants released each year is removed by means of wells and groundwater withdrawals. That assumption was

conservative and a valid means to demonstrate compliance with exposure standards at the RMEI location, but is not realistic in modeling impacts as the plume continues southward.

k. The volcanic-alluvial aquifer is part of the internally-drained Great Basin, and potential contaminants from the repository have limited means of leaving the aquifer. DOE and NRC staff acknowledge that radioactive decay is the principal means for lowering the levels of many of the radiological contaminants. The EISs characterize radionuclide impacts on groundwater by calculating doses and concentrations for an annual contaminant release captured by well withdrawal of a given volume of groundwater. This methodology assumes that the full amount of contaminants released each year is removed by groundwater withdrawal. While this assumption may have been adopted for the laudable purpose of trying to avoid underestimating annual peak doses or radionuclide levels for regulatory compliance with 10 CFR 63, the assumption fails to account for possible impacts from the plume beyond the point of the hypothetical withdrawal. Because the yearly flux of contaminants is assumed to be removed, the extent of contamination and accumulation in the aquifer of releases over multiple years is not fully considered. Similar reasoning is used in the EISs for estimating impacts on groundwater from non-radiological contaminants. The calculation provided in the EISs is presented as bounding for the quantity of non-radiological material that may be released in a year. This calculation does not consider more than a single year's accumulation of contaminants in the groundwater. For both radiological and non-radiological contaminants, the EISs do not characterize contamination in the aquifer if annual withdrawal did not occur as modeled.

l. Therefore, the EISs have not provided complete and adequate discussion of the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer. A supplement should include the following additional information:

- A description of the full extent of the volcanic-alluvial aquifer, particularly those parts that could become contaminated, and how water (and potential contaminants) can enter or leave the flow system. For example, the DOE license application describes potential groundwater flow farther to the south of Alkali Flats, into the Southern Death Valley subregion of the regional model domain (DOE, 2008a, General Information, Section 5.2.2.2). This component of the groundwater flow system is not discussed in the EISs, but should be.

- An analysis of the cumulative impact of radiological and non-radiological contaminants that can be reasonably expected from NTS sources at locations in Nye County beyond the RMEI location when combined with those being assessed pursuant to NRC's staff report . For example, NTS activities have resulted in radiological contamination on the surface and in the ground water that may enter the Yucca Mountain flow system. Cumulative impacts of NTS and Yucca Mountain contaminants should be considered downstream from the RMEI location.

- Estimates of contamination in the groundwater, given potential accumulation of radiological and non-radiological contaminants over time. NRC staff have suggested that one way to analyze the overall impacts on groundwater may be a mass-balance approach that accounts for mass released, the part of the groundwater flow system affected by the potential releases, and the expected processes that could affect released contaminants. Such an approach in the supplemental analysis would also show the extent of contamination and possible impacts on water quality.

Need for Supplementation to Account for Impacts from Surface Discharges of Groundwater

m. The EISs acknowledge the likelihood of future discharges of contaminated groundwater to the surface. In response to questions regarding possible locations and impacts of these discharges raised in comments on the draft Repository Supplemental EIS, DOE's simply restates its conclusion that any potential impacts from surface discharges would be no greater than those represented by doses associated with groundwater withdrawal and use at the 18-km (11-mi) location (DOE, 2008b, Volume III, responses to Comments pages CR-497 and page CR-330).

n. The discharge of potentially contaminated groundwater to the surface can involve physical conditions that are different from groundwater withdrawal and use in irrigation. These differences may affect how radionuclides can potentially accumulate in near-surface soils. For example, springs in the Yucca Mountain area and Nye County typically discharge water at very low rates. The spring water evaporates quickly and forms mineral deposits at the surface. These mineral deposits can trap and contain potential radionuclide contaminants.

o. In arid lands, evaporation of near-surface groundwater also can lead to precipitation of minerals in soil and shallow sediments, even without spring flow. In contrast, irrigation water penetrates deeper into the soil and can leach minerals from the surface and deposit them in the subsurface. Differences in soil and vegetation also affect how water can move from the surface to the subsurface and form minerals. How much contaminant can accumulate in either a spring deposit or irrigated field depends on how much water is discharged or evaporated at a location, the amount of contamination in the water, and the processes for deposition and removal of minerals and contaminants.

p. Spring deposits that provide evidence for past discharge of groundwater to the surface are common in the Yucca Mountain region, including fossil deposits that formed during past wetter climates. The paleoclimate record indicates that future wetter periods are reasonably expected for the region (e.g., DOE, 2008a, Safety Analysis Report, Section 2.3.1.2). Future surface discharges during wetter periods may involve different amounts of water and contaminants, and different processes for deposition and removal, compared to present conditions.

q. The EISs have not provided a complete and adequate discussion of the impacts on soils and surface materials from the processes involved in surface discharges of contaminated groundwater. A supplement should include the following additional information:

- A description of the locations of potential natural discharge of contaminated groundwater for present and expected future wetter periods (for example, as discussed in DOE, 2008a, Safety Analysis Report, Section 2.3.1.2).

- A description of the physical processes at the surface discharge locations that can affect accumulation, concentration, and potential remobilization of groundwater-borne contaminants.

- Estimates of the amount of contaminants that could be deposited at or near the surface. This involves estimates of the amount of groundwater involved in discharge or near-surface evaporation, the amounts of radiological and non-radiological contaminants in that water, contaminant concentrations in the resulting deposits, and potential environmental impacts (e.g., effects on biota).

Proposed Remedy

r. The EISs do not adequately characterize the potential impact of the proposed action on groundwater and from surface discharge, as detailed in this contention. NRC's staff report, the data and information, including the attached affidavit, relied upon in developing this contention constitute "significant and substantial new information" and/or " new considerations" that were identified after the issuance of DOE's supplemental EIS in June of 2008. Therefore, both the criteria of 10 CFR § 51.109(c)(2) for required EIS supplementation, and the standards for "reopening" contained in 10 CFR § 2.326 are met for the portion of the EISs that consider impacts to groundwater and from surface discharges over the long term. Supplementation is needed to ensure the EISs are adequate.

s. The possibility of cumulative impacts from releases to groundwater and surface discharges also underscores the need for additional monitoring beyond the RMEI location, as discussed in Nye County's Contention entitled Nye-Safety-3.

6. References to portions of the application or environmental documents in dispute.

(2.309(f)(1)(vi))

U.S. Nuclear Regulatory Commission Staff's Adoption Determination Report for the U.S. Department of Energy's Environmental Impact Statements for the Proposed Geologic Repository at Yucca Mountain, September 5, 2008. LSN NRC000029699 (participant ML082420342)

DOE. DOE/EIS-0250F, "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada." North Las Vegas, Nevada: DOE, Office of Civilian Radioactive Waste Management, 2002 Chapter 5, LSN NRC000014953

Yucca Mountain Repository License Application, General Information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 LSN DEN001592183

DOE. DOE/EIS-0250F-S1, "Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada." Las Vegas, Nevada: DOE, Office of Civilian Radioactive Waste Management, June 2008b. LSN DEN001593669

National Environmental Policy Act, 42 U.S.C. § 4332(C)

Nuclear Waste Policy Act, 42 U.S.C. § 10134(f)

10 CFR Parts 51

10 CFR Part 63

10 CFR § 51.109(c)(2)

10 CFR § 63.21(a)

10 CFR Part 1021

10 CFR § 2.326

7. Statement of Joint Ownership

Nye County is not claiming joint ownership of this contention with any other entity.

CONCLUSION

For the foregoing reasons, Nye County, Nevada respectfully requests that its Petition to Intervene be granted, and that each of the foregoing Contentions and Joint Contentions be admitted in this docket for resolution on the merits by the Commission.

Respectfully Submitted,

Signed electronically

Jeffrey D. VanNiel
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Nye County, Nevada

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Counsel for Nye County, Nevada

December 19, 2008

CERTIFICATE OF SERVICE

I hereby certify that the foregoing Petition and attached Exhibit has been served upon all parties listed on the official service list for this proceeding as maintained by the Nuclear Regulatory Commission's Electronic Information Exchange.

Signed electronically
Jeffrey D. VanNiel

NYE NEPA-1

EXHIBIT A

Supporting Affidavit of MaryEllen Giampaoli

December 17, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
U.S. Department of Energy	)	**Docket No. 63-001**
	)	
(High Level Waste Repository)	)	

AFFIDAVIT OF MARYELLEN C. GIAMPAOLI IN SUPPORT OF NYE COUNTY, NEVADA PETITION TO INTERVENE AND CONTENTIONS

I, MaryEllen C. Giampaoli, being first duly sworn, and under penalties of perjury, state as follows:

1. My name is MaryEllen C. Giampaoli. I am Consulting Environmental Compliance Specialist for Nye County, Nevada , and my address and contact information are the following: P.O. Box 127 Blue Diamond, Nevada 89004; phone number (702) 875-4594.

2. I have a Bachelor of Science Degree in Geological Sciences, conferred in 1981 by the University of Illinois, Chicago Circle, and a Master of Science Degree in Geological Science conferred in 1984 by the University of Illinois, Chicago.

3. I have twenty-three years of experience in matters related to compliance with the National Environmental Policy Act, hereinafter referred to as "NEPA".

4. Regarding the subject matter of this Affidavit, my most relevant experience includes service as a consultant to Nye County, Nevada, while coordinating the team review of the Department of Energy's ("DOE") Yucca Mountain Repository Draft Environmental Impact Statement; DOE's Final EIS, officially referred to as DOE/EIS-0250F, "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and

High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada." Las Vegas, Nevada: DOE, Office of Civilian Radioactive Waste Management, 2002; and DOE's Supplemental EIS, officially referred to as DOE/EIS-0250F-S1, "Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada." Las Vegas, Nevada: DOE, Office of Civilian Radioactive Waste Management , June 2008, (hereinafter DOE's Final and Supplemental environmental impact statements will be referred to collectively as "EISs").

5. I am providing this Affidavit in support of Nye County, Nevada's Petition to Intervene and Contention entitled "Nye-NEPA-1", filed today in the DOE licensing proceeding before this Board regarding DOE's application for license to construct a high level nuclear waste repository at Yucca Mountain located Nye County, Nevada.

6. This Affidavit is based upon my analysis of the relevant documents cited in this affidavit, and personal knowledge of the facts discussed hereinafter.

7. Environmental impacts of the proposed repository actions over the long-term are considered in Volume 1, Chapter 5 of the Final EIS, and the Supplemental EIS.

8. I have read and analyzed the EISs relevant to Nye County's contention labeled Nye-NEPA-1.

9. Discussions of potential impacts from the repository on groundwater, and on human health through a groundwater pathway, comprise much of the respective Volumes 1, Chapters 5 of these two EISs.

10. Expected impacts on groundwater identified in the EISs are derived from the modeled release of both radioactive and non-radioactive material from the repository as components of the engineered barrier system slowly corrode and lose their capability to contain their contents.

11. The repository lies above the water table, in the unsaturated zone.

12. The EISs state that water-borne releases from the repository are likely to travel downward in a nearly vertical direction and reach the groundwater below the repository site.

13. The EISs describe the regional groundwater flow model used by DOE, as presented in detail in Section 3.1.4.2 of each EIS.

14. In that model, groundwater flows generally to the south-southeast within an unconfined aquifer of volcanic rocks and alluvium underlying Nye County.

15. The EISs further state that water from this aquifer discharges to the surface primarily at Alkali Flats (Franklin Lake Playa).

16. DOE's principal means of assessing the effects of release and contaminant transport processes is its Total System Performance Assessment (TSPA), a probabilistic model which considers those features, events, and processes of the engineered and natural system that affect repository performance (DOE, 2008, Safety Analysis Report, Chapter 2).

17. The EISs use the human dose calculated in the TSPA as the principal measure of radiological impacts on groundwater.

18. This dose is calculated using a model of well withdrawals of contaminated groundwater for drinking and irrigation, and includes consideration of the possible inhalation of surface dust potentially contaminated by well water, at a location approximately 18 km (11 miles) south of the repository in Nye County, the location of the Reasonably Maximally Exposed Individual ("RMEI").

19. The results are calculated for various increments in time over the million-year period following permanent closure of the repository.

20. In addition to the human dose, the TSPA similarly calculates results for the 10,000-year period following closure for radionuclides in groundwater.

21. The EISs compare the calculated results to the regulatory performance objectives and note that the predicted concentrations are well below the regulatory standards.

22. The EISs consider impacts on groundwater at other locations beyond the RMEI, many of which are within the boundaries of Nye County, to be no greater than those calculated in the TSPA for the RMEI location.

23. In the Repository Supplemental EIS, at Section 5.1.1.4, DOE states that the contaminant plume, as currently modeled, is sufficiently narrow that well withdrawal would capture the entire plume at that location and at all locations beyond the RMEI location.

24. In the 2002 EIS, at Section 5.4.1 and Appendix 1.4.5, fractional "scaling factors" as multipliers of the TSPA results at the RMEI were calculated for more distant locations (including Alkali Flats), to account for increased dispersion of a contaminant plume down flow from the RMEI location.

25. The EISs also describe non-radiological impacts on groundwater for the release of chemically toxic materials.

26. The releases that are analyzed in the EISs result from the expected corrosion of materials of the engineered barrier system within the repository.

27. The Repository Supplemental EIS, at Section 5.7 and Appendix F.5, provides concentrations for three corrosion-derived elements.

28. These are calculated from annual mass-dissolution rates of exposed engineered material in the repository using methods anticipating well water withdrawal analogous to those used in the TSPA for radioactive contaminants in groundwater.

29. DOE considers the calculated concentrations as bounding for groundwater at all locations.

30. It is my professional opinion, based upon a reasonable degree of scientific certainty, that the information provided in the EISs does not adequately characterize how potential contaminants may affect groundwater resources in the volcanic-alluvial aquifer, and the potential effects from surface discharges.

31. In the EISs, impacts on groundwater are discussed principally to determine if there will be regulatory compliance at the RMEI location.

32. NRC's NEPA regulations in Part 51 and guidance in NUREG-1748, however, properly indicate that compliance with regulatory requirements does not necessarily satisfy the need to adequately consider all environmental impacts of the proposed action.

33. The relevant regulations and guidance, including 10 CFR § 51.71 and 10 CFR Part 51, Subpart A, Appendix A(7), recognize that additional analysis and discussion may be needed.

34. It is my professional opinion that, for impacts on groundwater and from surface discharges, additional analysis is necessary and EIS supplementation is required; the basis for my opinion is detailed in paragraphs 35-82 of this Affidavit.

35. I have read and analyzed the relevant portions of the U.S. Nuclear Regulatory Commission Staff's Adoption Determination Report for the U.S. Department of Energy's Environmental Impact Statements for the Proposed Geologic Repository at Yucca Mountain,

September 5, 2008 (hereinafter referred to as "NRC staff report") which reviewed DOE's EISs and the factual record summarized in paragraphs 7 through 34 of this Affidavit, and I note that the NRC staff reached the same conclusion as I have on the adequacy of the EISs.

36. The NRC staff report, having just been issued in September 2008, and information regarding cumulative impacts developed since the issuance of DOE's Supplemental EIS, and outlined in paragraphs 37 through 82 below, constitute significant new and/or additional considerations that render the EISs inadequate under DOE's NEPA regulations and NRC's regulations regarding the adoption of DOE EIS; therefore, further supplementation is required.

37. As stated previously, the EISs state that the large water use at the RMEI location would "consume the entire plume" by withdrawing 3,000 acre feet of water, and since the plume is very narrow, the dose would be the same at all locations further south.

38. However, this assumption is inconsistent with the reasonable expectation that as the distance from the repository increases, the combination of flow from different groundwater basins would add more water, and perhaps different or additional contaminants, to the groundwater flow system.

39. To properly assess impacts at locations south of the RMEI, the assumption of one hundred percent (100%) withdrawal, used to make the regulatory assessment, must be modified to reflect what in reality is likely to happen as the plume moves southward and interacts and mixes with other additions to the flow system.

40. Such a reassessment must take into account the potential for cumulative impacts from contaminant release to the groundwater and from surface discharge, as well as potential dilution of the concentration of radionuclides and other contaminants released to the groundwater.

41. Three distinct, but related aspects of potential impacts on the groundwater system are insufficiently characterized in the EISs and require supplementation: (a) the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer over time; (b) the nature and extent of the repository's cumulative impact on groundwater when added to other sources of water, radiological contaminants, and other contamination, surface water runoff and groundwater contamination from past and future activities at the Nevada Test Site ("NTS"); and (c) the potential impacts from discharges of potentially contaminated groundwater to the surface.

42. The EISs indicate likely surface discharge at Franklin Lake Playa (DOE, 2002, Section 5.9; 2008b, Section 5.10).

43. The discussion in these sections of the impacts from potential discharges is limited to a conclusory statement that no detrimental radiological impacts on plants and animals are expected.

44. The principal deficiencies in the EISs' assessments of groundwater are outlined in the NRC staff report and stem from the basic assumption that the full amount of contaminants released each year is removed by means of wells and groundwater withdrawals.

45. That assumption is not realistic in modeling impacts as the plume continues southward beyond the REMI location.

46. The volcanic-alluvial aquifer is part of the internally-drained Great Basin, and potential contaminants from the repository have limited means of leaving the aquifer.

47. DOE and NRC staff acknowledge that radioactive decay is the principal means for lowering the levels of many of the radiological contaminants.

48. The EISs characterize radionuclide impacts on groundwater by calculating doses and concentrations for an annual contaminant release captured by well withdrawal of a given volume of groundwater.

49. This methodology assumes that the full amount of contaminants released each year is removed by groundwater withdrawal.

50. While this assumption may have been appropriately adopted for the purpose of trying to avoid underestimating annual peak doses or radionuclide levels for demonstrating regulatory compliance with 10 CFR Part 63, the assumption fails to account for possible impacts from the plume beyond the point of the hypothetical withdrawal.

51. Because the yearly flux of contaminants is assumed to be removed, the extent of contamination and accumulation in the aquifer of releases over multiple years is not fully considered.

52. Similar flaws exist in the reasoning used in the EISs for estimating impacts on groundwater from non-radiological contaminants.

53. The calculation provided in the EISs is presented as bounding for the quantity of non-radiological material that may be released in a year.

54. This calculation does not consider more than a single year's accumulation of contaminants in the groundwater.

55. For both radiological and non-radiological contaminants, the EISs do not characterize contamination in the aquifer if annual withdrawal did not occur as modeled.

56. Therefore, the EISs have not provided complete and adequate discussion of the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer.

57. It is my professional opinion that an EIS supplement is required and should include additional information.

58. Among the required additional information is a description of the full extent of the volcanic-alluvial aquifer, particularly those parts that could become contaminated, and how water (and potential contaminants) can enter or leave the flow system.

59. For example, the DOE license application describes potential groundwater flow farther to the south of Alkali Flats (DOE, 2008a, General Information, Section 5.2.2.2).

60. This component of the groundwater flow system is not discussed in the EISs, but should be.

61. Also among the required additional information are estimates of contamination in the groundwater from repository releases, given potential accumulation of radiological and non-radiological contaminants over time.

62. Also among the required supplementation is an analysis of the cumulative impact of radiological and non-radiological contaminants that can be reasonably expected from NTS sources at locations in Nye County beyond the RMEI location when combined with the assessments under Paragraph 59 and 62 .

63. NTS activities have resulted in radiological contamination on the surface and in the ground water that may enter the Yucca Mountain flow system.

64. Cumulative impacts of NTS and Yucca Mountain contaminants should be considered downstream from the RMEI location.

65. NRC staff have suggested that one way to analyze the overall impacts on groundwater may be a mass-balance approach that accounts for mass released, the part of

the groundwater flow system affected by the potential releases, and the expected processes that could affect released contaminants.

66. Such an approach in the supplemental analysis would also show the extent of contamination and possible impacts on water quality.

67. The EISs also acknowledge the likelihood of future discharges of contaminated groundwater to the surface.

68. In response to questions regarding possible locations and impacts of these discharges raised in comments on the draft Repository Supplemental EIS, DOE simply restates its conclusion that any potential impacts from surface discharges would be no greater than those represented by doses associated with groundwater withdrawal and use at the 18-km (11-mi) location (DOE, 2008b, Volume III, responses to Comments pages CR-497 and page CR-330).

69. The discharge of potentially contaminated groundwater to the surface can involve physical conditions that are different from groundwater withdrawal and use in irrigation.

70. These differences may affect how radionuclides can potentially accumulate in near-surface soils. For example, springs in the Yucca Mountain area and Nye County typically discharge water at very low rates.

71. The spring water evaporates quickly and forms mineral deposits at the surface.

72. These mineral deposits can trap and contain potential radionuclide contaminants.

73. In arid lands, evaporation of near-surface groundwater also can lead to precipitation of minerals in soil and shallow sediments, even without spring flow.

74. In contrast, irrigation water penetrates deeper into the soil and can leach minerals from the surface and deposit them in the subsurface.

75. Differences in soil and vegetation also affect how water can move from the surface to the subsurface and form minerals.

76. How much contaminant can accumulate in either a spring deposit or irrigated field depends on how much water is discharged or evaporated at a location, the amount of contamination in the water, and the processes for deposition and removal of minerals and contaminants.

77. Spring deposits that provide evidence for past discharge of groundwater to the surface are common in the Yucca Mountain region, including fossil deposits that formed during past wetter climates.

78. The paleoclimate record indicates that future wetter periods are reasonably expected for the region (e.g., DOE, 2008a, Safety Analysis Report, Section 2.3.1.2).

79. Future surface discharges during wetter periods may involve different amounts of water and contaminants, and different processes for deposition and removal, compared to present conditions.

80. The EISs have not provided a complete and adequate discussion of the impacts on soils and surface materials from the processes involved in surface discharges of contaminated groundwater.

81. A supplement should include the following additional information:

(a.) A description of the locations of potential natural discharge of contaminated groundwater for present and expected future wetter periods (for example, as discussed in DOE, 2008a, Safety Analysis Report, Section 2.3.1.2);

(b.) A description of the physical processes at the surface discharge locations that can affect accumulation, concentration, and potential remobilization of groundwater-borne contaminants;

(c.) Estimates of the amount of contaminants that could be deposited at or near the surface; this involves estimates of the amount of groundwater involved in discharge or near-surface evaporation, the amounts of radiological and non-radiological contaminants in that water, contaminant concentrations in the resulting deposits, and potential environmental impacts (e.g., effects on biota); and

(d.) A cumulative impact analysis of the interaction of groundwater releases and expected surface discharges, together with other releases and discharges from the NTS, at locations beyond the RMEI

I declare that under the penalties of perjury under the laws of the United States of America and the State of Nevada that the foregoing is true and correct.

MaryEllen C. Giampaoli

State of Nevada
County of Nye

Subscribed and sworn to
Before me this 17th day of
December, 2008 by MaryEllen C. Giampaoli.

AUNDREA KOJIS
Notary Public State of Nevada
No. 05-99536-14
My appt. exp. Sept. 9, 2009

NOTARY PUBLIC

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
U.S. Department of Energy	)	**Docket No. 63-001**
	)	
(High Level Waste Repository)	)	

AFFIDAVIT OF MARYELLEN C. GIAMPAOLI IN SUPPORT OF NYE COUNTY, NEVADA PETITION TO INTERVENE AND CONTENTIONS

I, MaryEllen C. Giampaoli, being first duly sworn, and under penalties of perjury, state as follows:

1. My name is MaryEllen C. Giampaoli. I am Consulting Environmental Compliance Specialist for Nye County, Nevada , and my address and contact information are the following: P.O. Box 127 Blue Diamond, Nevada 89004; phone number (702) 875-4594.

2. I have a Bachelor of Science Degree in Geological Sciences, conferred in 1981 by the University of Illinois, Chicago Circle, and a Master of Science Degree in Geological Science conferred in 1984 by the University of Illinois, Chicago.

3. I have twenty-three years of experience in matters related to compliance with the National Environmental Policy Act, hereinafter referred to as "NEPA".

4. Regarding the subject matter of this Affidavit, my most relevant experience includes service as a consultant to Nye County, Nevada, while coordinating the team review of the Department of Energy's ("DOE") Yucca Mountain Repository Draft Environmental Impact Statement; DOE's Final EIS, officially referred to as DOE/EIS-0250F, "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and

High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada." Las Vegas, Nevada: DOE, Office of Civilian Radioactive Waste Management, 2002; and DOE's Supplemental EIS, officially referred to as DOE/EIS-0250F-S1, "Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada." Las Vegas, Nevada: DOE, Office of Civilian Radioactive Waste Management , June 2008, (hereinafter DOE's Final and Supplemental environmental impact statements will be referred to collectively as "EISs").

5. I am providing this Affidavit in support of Nye County, Nevada's Petition to Intervene and Contention entitled "Nye-NEPA-1", filed today in the DOE licensing proceeding before this Board regarding DOE's application for license to construct a high level nuclear waste repository at Yucca Mountain located Nye County, Nevada.

6. This Affidavit is based upon my analysis of the relevant documents cited in this affidavit, and personal knowledge of the facts discussed hereinafter.

7. Environmental impacts of the proposed repository actions over the long-term are considered in Volume 1, Chapter 5 of the Final EIS, and the Supplemental EIS.

8. I have read and analyzed the EISs relevant to Nye County's contention labeled Nye-NEPA-1.

9. Discussions of potential impacts from the repository on groundwater, and on human health through a groundwater pathway, comprise much of the respective Volumes 1, Chapters 5 of these two EISs.

10. Expected impacts on groundwater identified in the EISs are derived from the modeled release of both radioactive and non-radioactive material from the repository as components of the engineered barrier system slowly corrode and lose their capability to contain their contents.

11. The repository lies above the water table, in the unsaturated zone.

12. The EISs state that water-borne releases from the repository are likely to travel downward in a nearly vertical direction and reach the groundwater below the repository site.

13. The EISs describe the regional groundwater flow model used by DOE, as presented in detail in Section 3.1.4.2 of each EIS.

14. In that model, groundwater flows generally to the south-southeast within an unconfined aquifer of volcanic rocks and alluvium underlying Nye County.

15. The EISs further state that water from this aquifer discharges to the surface primarily at Alkali Flats (Franklin Lake Playa).

16. DOE's principal means of assessing the effects of release and contaminant transport processes is its Total System Performance Assessment (TSPA), a probabilistic model which considers those features, events, and processes of the engineered and natural system that affect repository performance (DOE, 2008, Safety Analysis Report, Chapter 2).

17. The EISs use the human dose calculated in the TSPA as the principal measure of radiological impacts on groundwater.

18. This dose is calculated using a model of well withdrawals of contaminated groundwater for drinking and irrigation, and includes consideration of the possible inhalation of surface dust potentially contaminated by well water, at a location approximately 18 km (11 miles) south of the repository in Nye County, the location of the Reasonably Maximally Exposed Individual ("RMEI").

19. The results are calculated for various increments in time over the million-year period following permanent closure of the repository.

20. In addition to the human dose, the TSPA similarly calculates results for the 10,000-year period following closure for radionuclides in groundwater.

21. The EISs compare the calculated results to the regulatory performance objectives and note that the predicted concentrations are well below the regulatory standards.

22. The EISs consider impacts on groundwater at other locations beyond the RMEI, many of which are within the boundaries of Nye County, to be no greater than those calculated in the TSPA for the RMEI location.

23. In the Repository Supplemental EIS, at Section 5.1.1.4, DOE states that the contaminant plume, as currently modeled, is sufficiently narrow that well withdrawal would capture the entire plume at that location and at all locations beyond the RMEI location.

24. In the 2002 EIS, at Section 5.4.1 and Appendix 1.4.5, fractional "scaling factors" as multipliers of the TSPA results at the RMEI were calculated for more distant locations (including Alkali Flats), to account for increased dispersion of a contaminant plume down flow from the RMEI location.

25. The EISs also describe non-radiological impacts on groundwater for the release of chemically toxic materials.

26. The releases that are analyzed in the EISs result from the expected corrosion of materials of the engineered barrier system within the repository.

27. The Repository Supplemental EIS, at Section 5.7 and Appendix F.5, provides concentrations for three corrosion-derived elements.

28. These are calculated from annual mass-dissolution rates of exposed engineered material in the repository using methods anticipating well water withdrawal analogous to those used in the TSPA for radioactive contaminants in groundwater.

29. DOE considers the calculated concentrations as bounding for groundwater at all locations.

30. It is my professional opinion, based upon a reasonable degree of scientific certainty, that the information provided in the EISs does not adequately characterize how potential contaminants may affect groundwater resources in the volcanic-alluvial aquifer, and the potential effects from surface discharges.

31. In the EISs, impacts on groundwater are discussed principally to determine if there will be regulatory compliance at the RMEI location.

32. NRC's NEPA regulations in Part 51 and guidance in NUREG-1748, however, properly indicate that compliance with regulatory requirements does not necessarily satisfy the need to adequately consider all environmental impacts of the proposed action.

33. The relevant regulations and guidance, including 10 CFR § 51.71 and 10 CFR Part 51, Subpart A, Appendix A(7), recognize that additional analysis and discussion may be needed.

34. It is my professional opinion that, for impacts on groundwater and from surface discharges, additional analysis is necessary and EIS supplementation is required; the basis for my opinion is detailed in paragraphs 35-82 of this Affidavit.

35. I have read and analyzed the relevant portions of the U.S. Nuclear Regulatory Commission Staff's Adoption Determination Report for the U.S. Department of Energy's Environmental Impact Statements for the Proposed Geologic Repository at Yucca Mountain,

September 5, 2008 (hereinafter referred to as "NRC staff report") which reviewed DOE's EISs and the factual record summarized in paragraphs 7 through 34 of this Affidavit, and I note that the NRC staff reached the same conclusion as I have on the adequacy of the EISs.

36. The NRC staff report, having just been issued in September 2008, and information regarding cumulative impacts developed since the issuance of DOE's Supplemental EIS, and outlined in paragraphs 37 through 82 below, constitute significant new and/or additional considerations that render the EISs inadequate under DOE's NEPA regulations and NRC's regulations regarding the adoption of DOE EIS; therefore, further supplementation is required.

37. As stated previously, the EISs state that the large water use at the RMEI location would "consume the entire plume" by withdrawing 3,000 acre feet of water, and since the plume is very narrow, the dose would be the same at all locations further south.

38. However, this assumption is inconsistent with the reasonable expectation that as the distance from the repository increases, the combination of flow from different groundwater basins would add more water, and perhaps different or additional contaminants, to the groundwater flow system.

39. To properly assess impacts at locations south of the RMEI, the assumption of one hundred percent (100%) withdrawal, used to make the regulatory assessment, must be modified to reflect what in reality is likely to happen as the plume moves southward and interacts and mixes with other additions to the flow system.

40. Such a reassessment must take into account the potential for cumulative impacts from contaminant release to the groundwater and from surface discharge, as well as potential dilution of the concentration of radionuclides and other contaminants released to the groundwater.

41. Three distinct, but related aspects of potential impacts on the groundwater system are insufficiently characterized in the EISs and require supplementation: (a) the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer over time; (b) the nature and extent of the repository's cumulative impact on groundwater when added to other sources of water, radiological contaminants, and other contamination, surface water runoff and groundwater contamination from past and future activities at the Nevada Test Site ("NTS"); and (c) the potential impacts from discharges of potentially contaminated groundwater to the surface.

42. The EISs indicate likely surface discharge at Franklin Lake Playa (DOE, 2002, Section 5.9; 2008b, Section 5.10).

43. The discussion in these sections of the impacts from potential discharges is limited to a conclusory statement that no detrimental radiological impacts on plants and animals are expected.

44. The principal deficiencies in the EISs' assessments of groundwater are outlined in the NRC staff report and stem from the basic assumption that the full amount of contaminants released each year is removed by means of wells and groundwater withdrawals.

45. That assumption is not realistic in modeling impacts as the plume continues southward beyond the REMI location.

46. The volcanic-alluvial aquifer is part of the internally-drained Great Basin, and potential contaminants from the repository have limited means of leaving the aquifer.

47. DOE and NRC staff acknowledge that radioactive decay is the principal means for lowering the levels of many of the radiological contaminants.

48. The EISs characterize radionuclide impacts on groundwater by calculating doses and concentrations for an annual contaminant release captured by well withdrawal of a given volume of groundwater.

49. This methodology assumes that the full amount of contaminants released each year is removed by groundwater withdrawal.

50. While this assumption may have been appropriately adopted for the purpose of trying to avoid underestimating annual peak doses or radionuclide levels for demonstrating regulatory compliance with 10 CFR Part 63, the assumption fails to account for possible impacts from the plume beyond the point of the hypothetical withdrawal.

51. Because the yearly flux of contaminants is assumed to be removed, the extent of contamination and accumulation in the aquifer of releases over multiple years is not fully considered.

52. Similar flaws exist in the reasoning used in the EISs for estimating impacts on groundwater from non-radiological contaminants.

53. The calculation provided in the EISs is presented as bounding for the quantity of non-radiological material that may be released in a year.

54. This calculation does not consider more than a single year's accumulation of contaminants in the groundwater.

55. For both radiological and non-radiological contaminants, the EISs do not characterize contamination in the aquifer if annual withdrawal did not occur as modeled.

56. Therefore, the EISs have not provided complete and adequate discussion of the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer.

57. It is my professional opinion that an EIS supplement is required and should include additional information.

58. Among the required additional information is a description of the full extent of the volcanic-alluvial aquifer, particularly those parts that could become contaminated, and how water (and potential contaminants) can enter or leave the flow system.

59. For example, the DOE license application describes potential groundwater flow farther to the south of Alkali Flats (DOE, 2008a, General Information, Section 5.2.2.2).

60. This component of the groundwater flow system is not discussed in the EISs, but should be.

61. Also among the required additional information are estimates of contamination in the groundwater from repository releases, given potential accumulation of radiological and non-radiological contaminants over time.

62. Also among the required supplementation is an analysis of the cumulative impact of radiological and non-radiological contaminants that can be reasonably expected from NTS sources at locations in Nye County beyond the RMEI location when combined with the assessments under Paragraph 59 and 62 .

63. NTS activities have resulted in radiological contamination on the surface and in the ground water that may enter the Yucca Mountain flow system.

64. Cumulative impacts of NTS and Yucca Mountain contaminants should be considered downstream from the RMEI location.

65. NRC staff have suggested that one way to analyze the overall impacts on groundwater may be a mass-balance approach that accounts for mass released, the part of

the groundwater flow system affected by the potential releases, and the expected processes that could affect released contaminants.

66. Such an approach in the supplemental analysis would also show the extent of contamination and possible impacts on water quality.

67. The EISs also acknowledge the likelihood of future discharges of contaminated groundwater to the surface.

68. In response to questions regarding possible locations and impacts of these discharges raised in comments on the draft Repository Supplemental EIS, DOE simply restates its conclusion that any potential impacts from surface discharges would be no greater than those represented by doses associated with groundwater withdrawal and use at the 18-km (11-mi) location (DOE, 2008b, Volume III, responses to Comments pages CR-497 and page CR-330).

69. The discharge of potentially contaminated groundwater to the surface can involve physical conditions that are different from groundwater withdrawal and use in irrigation.

70. These differences may affect how radionuclides can potentially accumulate in near-surface soils. For example, springs in the Yucca Mountain area and Nye County typically discharge water at very low rates.

71. The spring water evaporates quickly and forms mineral deposits at the surface.

72. These mineral deposits can trap and contain potential radionuclide contaminants.

73. In arid lands, evaporation of near-surface groundwater also can lead to precipitation of minerals in soil and shallow sediments, even without spring flow.

74. In contrast, irrigation water penetrates deeper into the soil and can leach minerals from the surface and deposit them in the subsurface.

75. Differences in soil and vegetation also affect how water can move from the surface to the subsurface and form minerals.

76. How much contaminant can accumulate in either a spring deposit or irrigated field depends on how much water is discharged or evaporated at a location, the amount of contamination in the water, and the processes for deposition and removal of minerals and contaminants.

77. Spring deposits that provide evidence for past discharge of groundwater to the surface are common in the Yucca Mountain region, including fossil deposits that formed during past wetter climates.

78. The paleoclimate record indicates that future wetter periods are reasonably expected for the region (e.g., DOE, 2008a, Safety Analysis Report, Section 2.3.1.2).

79. Future surface discharges during wetter periods may involve different amounts of water and contaminants, and different processes for deposition and removal, compared to present conditions.

80. The EISs have not provided a complete and adequate discussion of the impacts on soils and surface materials from the processes involved in surface discharges of contaminated groundwater.

81. A supplement should include the following additional information:

(a.) A description of the locations of potential natural discharge of contaminated groundwater for present and expected future wetter periods (for example, as discussed in DOE, 2008a, Safety Analysis Report, Section 2.3.1.2);

(b.) A description of the physical processes at the surface discharge locations that can affect accumulation, concentration, and potential remobilization of groundwater-borne contaminants;

(c.) Estimates of the amount of contaminants that could be deposited at or near the surface; this involves estimates of the amount of groundwater involved in discharge or near-surface evaporation, the amounts of radiological and non-radiological contaminants in that water, contaminant concentrations in the resulting deposits, and potential environmental impacts (e.g., effects on biota); and

(d.) A cumulative impact analysis of the interaction of groundwater releases and expected surface discharges, together with other releases and discharges from the NTS, at locations beyond the RMEI

I declare that under the penalties of perjury under the laws of the United States of America and the State of Nevada that the foregoing is true and correct.

MaryEllen C. Giampaoli

State of Nevada
County of Nye

Subscribed and sworn to
Before me this 17th day of
December, 2008 by MaryEllen C. Giampaoli.

AUNDREA KOJIS
Notary Public State of Nevada
No. 05-99536-14
My appt. exp. Sept. 9, 2009

NOTARY PUBLIC