UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of	)	Docket No. 63-001
	)	
U.S. DEPARTMENT Of ENERGY	)	
	)	
	)	
(High Level Waste Repository)	)	December 22, 2008
	)	
	)	

WHITE PINE COUNTY'S REQUEST FOR HEARING AND PETITION FOR LEAVE TO INTERVENE INCLUDING SUPPORTING CONTENTIONS ON THE APPLICATION BY THE U.S. DEPARTMENT OF ENERGY FOR AUTHORITY TO CONSTRUCT A GEOLOGIC REPOSITORY AT A GEOLOGIC REPOSITORY OPERATIONS AREA AT YUCCA MOUNTAIN

I. INTRODUCTION

Notice of a proposed 10 CFR Part 63 licensing action by the Nuclear Regulatory Commission (NRC), published in the Federal Register October 22, 2008, affords the opportunity to request a hearing and petition to intervene. 73 Fed Reg 63,029 (2008). Pursuant to10 CFR § 2.309(a), White Pine County, Nevada hereby submits, by and through its attorney Richard W. Sears, its request for a hearing and petition for leave to intervene, including supporting contentions, in the proceeding to authorize the U.S. Department of Energy (DOE) to construct a geologic repository at geologic repository operations area at Yucca Mountain in Nye County, Nevada. The County's petition is based on a copy of the license application, including supporting National Environmental Policy Act (NEPA) that the DOE delivered to White Pine County, which it purported to be the same as the application submitted to the NRC.

As described in greater detail below, White Pine County's intent with regard to its participation in the Yucca Mountain licensing proceeding is quite simple. In the absence of a discretionary decision by DOE to do so voluntarily, the County seeks to have NRC require DOE to further supplement its environmental impact statement to include 1) estimates of the public health and environmental consequences of contaminated ash from a volcanic eruption at the repository site being deposited at locations downwind from the repository site, including White Pine County; 2) estimates of the public health and environmental consequences of the transport of radionuclides in volcanic gases at locations downwind from the repository site, including White Pine County; and 3) identification of various measures for mitigating the public health and environmental consequences of a volcanic eruption through the Yucca Mountain repository upon areas downwind of the Yucca Mountain site, including White Pine County.

II. BACKGROUND

A. Procedural History

Pursuant to Section 2(31) of the Nuclear Waste Policy Act (NWPA), as amended, the Secretary of Energy designated White Pine County as an "affected unit of local government". With funding provided by DOE pursuant to Section 116(c) of the NWPA, White Pine County has conducted an effective independent Yucca Mountain oversight program. The County's repository oversight activities have included consistent participation in DOE's Yucca Mountain related NEPA compliance initiatives. At every opportunity afforded it, the County has sought to encourage DOE to understand and avoid or minimize potential repository system impacts on White Pine County. The two most important issues brought to the attention of DOE with regularity by the County were

volcanism as an atmospheric pathway for radiation exposure in White Pine County and impacts associated with highway transport of nuclear waste through White Pine County.

In a November 22, 1995 document submitted to DOE, White Pine County provided comments on the scope of issues to be addressed in the environmental impact statement subsequently prepared by DOE entitled *Draft 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* (DOE/EIS-0250) ("Yucca Mountain DEIS"). Among many issues raised in the letter was a concern that the Yucca Mountain DEIS consider alternatives which "achieve containment of radioisotopes during volcanic eruption". November 22, 1995 attachment to letter from Brent Eldridge to Wendy R. Dixon at 6; WHP 000000046 and WHP 000000039.

. On January 26, 2000, White Pine County submitted to DOE a document entitled, "Comments to Draft 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", in which the County stated, "White Pine County is troubled by the DOE's failure in the DEIS to recognize the County and its residents as potentially impacted by on-going and proposed radioactive waste management activities in Nevada. During scoping, White Pine County made a credible case for consideration of the impacts of low probability/high consequence events such as volcanism upon the residents and environment of the County". January 26, 2001 attachment to letter from Brent Eldridge to Wendy R. Dixon at 7; WHP 000000042.

On October 10, 2000, White Pine County wrote to the DOE to express grave concern over the Department's failure to consider potential atmospheric pathway impacts to the County and encouraged the Secretary of Energy to delay recommending the Yucca

Mountain site to the President until this and other issues had been appropriately considered. The County's letter specifically stated, "White Pine County remains very concerned about the Department of Energy's focus upon groundwater as the most likely exposure pathway. As a consequence, atmospheric routes for exposure are not given nearly the level of analysis in supporting documents. Conclusions regarding preliminary site suitability appear to be largely based upon extensive assessment of groundwater contamination. The County is concerned that uncertainties associated with atmospheric pathways have not been sufficiently narrowed. Without further analysis of atmospheric pathways, the level of risk associated with the repository system cannot be judged to be acceptable. Further work by the Department to better understand probabilities and consequences (including cumulative dose) of exposure from atmospheric pathways must be undertaken prior to formulation of a site recommendation." October 10, 2000 letter from Cheryl Noriega to Carol Hanlon at 3; DEN000769536..

In a letter dated November 20, 2002, the County provided DOE with comments to the document entitled *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* (DOE/EIS-0250F) ("Yucca Mountain FEIS") in which was stated, "The County requests that DOE explain its intent to issue a Mitigation Action Plan thereby complying with its own regulations. DOE is requested to ensure that the Mitigation Action Plan will be prepared separate of any document prepared for the NRC licensing process. DOE is encouraged however, to use the mitigation plan as a basis for conditions to be included in a possible license from the NRC." November 20, 2002 letter from David Provost to Margaret Chu at 5; WHP000000031

Pursuant to 10 CFR 2.1009 White Pine County submitted to NRC a letter dated September 22, 2004 in which the County provided its initial LSN certification. White Pine County has also monitored activities of the Pre-Licensing Application Presiding Officer Board.

On January 2, 2008, White Pine County provided DOE with extensive comments on its *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* (DOE/EIS-0250F-S1D) ("Repository DSEIS"). In reviewing the Repository DSEIS the County again found that DOE had failed to consider volcanism-related atmospheric exposure pathways in White Pine County. The following specific comments regarding volcanism and atmospheric exposure pathways were included in said letter:

> "White Pine County is downwind from the Nevada Test Site (NTS) and received high levels of radioisotope deposition (particularly on several readily accessible area mountaintops) as a result of above-ground weapons tests. As a consequence, the County is particularly concerned about potential atmospheric exposure pathways that may be associated with the Yucca Mountain project.
> On Page 5-3, Chapter 5 of the Repository DSEIS the definition of reasonably maximally exposed individual does not apply to atmospheric transport pathways but to groundwater transport. A separate definition of reasonably maximally exposed individual related assessment of exposure consequences is needed for atmospheric pathways. The FSEIS should include and analyze exposure consequences for different definitions of reasonably maximally exposed individual specifically defined for groundwater and atmospheric pathways.
> On Page 5-10 of Section 5.1.1.4 of the Repository DSEIS, the justification given for not assessing population dose does not apply to inhalation resulting from the volcanic eruption modeling case atmospheric pathway. The FSEIS should include a population dose related to exposure/inhalation from the volcanic eruption modeling case atmospheric pathway, similar to that provided for gaseous release of Carbon 14 on Page 5-31 of the DSEIS.
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> In the Repository DSEIS on Page 5-24 the definition of reasonably maximally exposed individual does not apply to atmospheric transport pathways but to groundwater transport. There is no acceptable definition of reasonably maximally exposed individual related to atmospheric pathways provided within the DSEIS. The FSEIS must include a definition for and analyze the consequences to

reasonably maximally exposed individual relating specifically to atmospheric transport pathways associated with the Volcanic Eruption Modeling Case.

Page 5-25, Section 5.5 of the Repository DSEIS includes a definition of reasonably maximally exposed individual that is based upon climatological data found in the Repository FEIS (see Figure 3-3, Page 3-16). This data includes wind rose plots at 10 and 60 meters. The use of this data is inappropriate for use with Volcanic Eruption Modeling Case in which a volcanic plume would be at much greater heights where prevailing wind direction and speeds may be quite different than those at 10 and 60 meters. The Volcanic Eruption Modeling Case presented in the FSEIS should be based upon prevailing wind direction and speed data at an elevation commensurate with the height of the expected plume, which most certainly is greater than 10 to 60 meters.

At Page F-42 of Section F.4.2.1.2 of the Repository DSEIS the text indicates that members of the public would receive a radiation dose from exposure pathways for the contaminated ash layer. The DSEIS fails to consider inhalation prior to deposition on land surface and related acute and latent cancer risk. The FSEIS should consider the consequences of inhalation of radioisotopes prior to deposition on the land surface in further analysis of the Volcanic Eruption Modeling Case. The FSEIS should present the mean inhalation dose immediately following volcanic eruption and prior to ash deposition. The analysis of the Volcanic Eruption Modeling Case in the FSEIS should not be limited to only NRC required analysis of impacts but should consider the full range of impacts, even to the extent they are extra regulatory, for purposes of NEPA disclosure." January 2, 2008 letter from Mike Simon to Dr. Jane Summerson at 4.

On June 3, 2008, the U.S. Department of Energy (DOE) submitted a license application to the NRC, pursuant to 10 CFR Part 63, to construct a geologic repository at a geologic repository operations area at Yucca Mountain. DOE submitted the 2002 EIS with the license application on June 3, 2008. DOE submitted the Repository SEIS to NRC on June 16, 2008, in accordance with 10 CFR § 51.67(b).

In an August 6, 2008 letter, White Pine County provided written comments to the DOE's *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* (DOE/EIS-0250F-S1D) (" Repository FSEIS"). In responding to DOE's Repository FSEIS response to the County's comments on the Repository DSEIS, the County stated in its letter:

> "Clarifying that the RMEI could be exposed from atmospheric exposure is important. Volcanic eruption is noted by DOE as a low-probability event but, nonetheless, a potential source of impact in the first 1,000 years after repository closure. Atmospheric ash can be transported considerable distances.
>
> Ash from the Mt. St. Helens eruption, for example, reached 12 miles in altitude and was deposited 4-5 inches deep at Yakima Washington approximately 90 miles away. (and deposits were traced as far away as Minnesota and Oklahoma). The Chernobyl accident, although not a volcanic activity, distributed radioactivity in doses affecting health and safety some 680 miles from the damaged nuclear reactor site. Similar impacts could result from an eruptive event at Yucca Mountain.
>
> The message is that it shouldn't be assumed that impacts would be limited to the vicinity of the Yucca Mountain site. The FSEIS should have reflected this." Attachment 1 to August 6, 2008 letter from Mike Simon to Dr. Jane Summerson at 20; DEN001601251.

In response to a Notice of Intent to further supplement the Repository SEIS published in the Federal Register on October 24, 2008, White Pine County provided DOE with a letter dated November 19, 2008 in which the County encouraged DOE to expand the scope of issues to be addressed in the Supplemental Final EIS being prepared at the request of NRC staff to include the following issues: 1) to include estimates of the public health and environmental consequences of contaminated ash from a volcanic eruption at the repository site being deposited in White Pine County; 2) include estimates of the public health and environmental consequences of the transport of radionuclides in volcanic gases at locations downwind from the repository site, including White Pine County; and 3) discuss various measures for mitigating the public health and environmental consequences of a volcanic eruption through the Yucca Mountain repository (much work has been done to help areas downwind from volcanic events to mitigate the consequences of ash preposition and gaseous inhalation) upon areas downwind of the Yucca Mountain site, including White Pine County. November 19, 2008 letter from Mike Simon to Dr. Jane Summerson at 2; WHP000000050.

Most recently, Dr. Mike L. Baughman, a consultant to White Pine County, met on December 9, 2008 with DOE's Dr. Jane Summerson to discuss White Pine County's November 19, 2008 comment letter and to further encourage DOE to voluntarily expand the scope of the Supplemental Final EIS. Although she noted that DOE was taking the County's comment seriously, Dr. Summerson observed that she was not currently authorized to make the requested commitment to expand the scope of the Supplemental Final EIS.

For nearly 14 years, White Pine County has been seeking to have DOE assess the potential for radiation exposure in White Pine County resulting from a DOE postulated volcanic eruption at Yucca Mountain and to describe alternative measures to mitigate said impacts. Through numerous NEPA compliance initiatives, DOE has had opportunities to voluntarily disclose such impacts and describe related mitigation. To date, DOE has not disclosed in any NEPA document the extent to which a volcanic eruption through the repository could impact the environment and public health in White Pine County or presented alternatives for mitigating said impacts.

B. Factual Background

The license, if granted, would authorize the Department of Energy to construct a deep geologic repository at a geologic repository operations area at Yucca Mountain in Nye County, Nevada. If constructed, repository underground facilities would include emplacement drifts, nominally 18 ft in diameter, used to provide emplacement for 70,000 MTHM of waste contained in about 11,000 waste packages. The area required to accommodate the waste packages is about 1,250 acres. This area includes approximately 40 miles of emplacement drifts excavated by tunnel boring machines.

Yucca Mountain is within the southwestern Nevada volcanic field. It is the product of both volcanic activity and faulting. Crater Flat, which between Bare Mountain to the West and Yucca Mountain to the east, contains four prominent volcanic cinder cones that rise above the valley floor. Repository SEIS at 3-20. DOE has determined that a volcanic eruption through the repository is a possible, although low-probability, event. The estimated probability of a volcanic dike intrusion through the repository is reported by DOE to range between 1 chance in 133,000 and 1 in 1,800. Repository FSEIS at 3-22.

Figure 3-3 in the Repository FSEIS indicates that prevailing daytime winds at 60 meters above the ground are predominately from the south, blowing to the north. Winds blowing south to north also tend to be stronger than northerly winds at the site. Repository FSEIS at 3-15. The White Pine County line is located approximately 230 km to the north and northeast of the Yucca Mountain site. The TSPA LA analysis results reported in the Repository FSEIS are based upon the potential for a violent Strombolian eruption with a 13 km-high plume. Given prevailing wind direction and speed, it is highly probable that a measureable amount of contaminated ash would be deposited in White Pine County.

The Repository FSEIS limits disclosure of postclosure radiological impacts to the annual committed effective dose equivalent to the RMEI, a hypothetical individual living south of Yucca Mountain. Repository FSEIS at 5-25. Review of the Yucca Mountain FEIS and Repository FSEIS reveal a failure of the EISs to 1) consider and analyze estimates of the public health and environmental consequences of contaminated ash from a volcanic eruption at the repository site being deposited at locations downwind from the repository site, including White Pine County; 2) consider and analyze estimates the public health and environmental consequences of the transport of radionuclides in

volcanic gases at locations downwind from the repository site, including White Pine County; and 3) identify and discuss various measures for mitigating the public health and environmental consequences of a volcanic eruption through the Yucca Mountain repository upon areas downwind of the Yucca Mountain site, including White Pine County. Failure of the Repository FSEIS to analyze and disclose impacts from a volcanic eruption to areas other than the RMEI appear rooted in a decision by DOE to limit said analyses to those required by EPA and NRC regulations. In fact, in DOE's response to White Pine County comments on the Repository DSEIS contained in Volume III of the Repository FSEIS, DOE states, "The EPA and NRC regulations that relate to the licensing of the proposed repository require that DOE's performance assessment must consider all potential pathways of radionuclide transport and exposure for the RMEI. DOE has modified Section S.3.2.1.3 of the SEIS Summary and the introductory section to Chapter 5 to make this clear. The TSPA results in the SEIS consider all potential pathways, including airborne releases. DOE used the same characteristics of the RMEI, including location and lifestyle, for all TSPA calculations. The impacts of the Volcanic Eruption Modeling Case stem from contamination of the soil and feed into the same biosphere model as the Groundwater Case. The biosphere model converts soil contamination to dose. The Volcanic Eruption Modeling Case does not explicitly include the inhalation dose in the results because they would be very small in comparison with the groundwater pathway doses related to the eruption processes. For example, if the eruption occurred 1,000 years after closure, the annual inhalation dose to the RMEI at the specified location would be about 1 percent of the groundwater pathway dose. At 10,000 years, the annual inhalation dose to the RMEI at the specific location would be about 0.1

percent of the groundwater pathway dose (DIRS 178871-SNL 2008, Figure 6.5-14)." Repository FSEIS at CR-489.

Because the Repository FEIS and the Repository FSEIS omit 1) any consideration and analysis of the environmental and public health consequences of radiation contaminated tephra deposition in White Pine County and other downwind areas, other than for the location of the Reasonably Maximally Exposed Individual (RMEI); 2) any consideration and analysis of the environmental and public health consequences of atmospheric transport and deposition of radionuclides in volcanic gases for the Reasonably Maximally Exposed Individual (RMEI) and in White Pine County and other downwind areas; 3) any discussion of means to mitigate the adverse environmental and public health consequences of radiation contaminated tephra deposition originating from a volcanic eruption through the Yucca Mountain repository in White Pine County and other downwind areas, other than for the RMEI; and 4) any discussion of means to mitigate the adverse environmental and public health consequences of atmospheric transport of radionuclides in gases originating from a volcanic eruption through the Yucca Mountain repository for the RMEI and in White Pine County and other downwind areas; NRC cannot adopt the Yucca Mountain FEIS and the Repository FSEIS without the addition of supplementary information.

III. DISCUSSION

A. Requirements for Intervention

A request for hearing or petition for leave to intervene must state: the nature of the requester's/petitioner's rights under the Atomic Energy Act to be made a party; the nature and extent of the requester's/petitioner's property, financial, and other interest in the proceeding; and the possible effect of any decision or order that may be issued in the

proceeding on the requester's/petitioner's interest. 10 CFR § 2.309(d). In addition, the petition must include at least one contention that satisfies the admissibility standards in 10 CFR § 2.309(f). In addition, environmental contentions addressing any DOE environmental impact statement or supplement must also conform to the requirements and address the applicable factors described in Section III(B) of NRC's October 22, 2008 Notice of Hearing, particularly regarding conformance with requirements and address the applicable factors outlined in 10 CFR § 51.109.

The Commission considers judicial constructs of standing in deciding whether a requester's/petitioner's interest may be impacted by a licensing proceeding. Therefore, the requester's/petitioner's injury must be found to fall within the realm of interests sought to be protected by the Atomic Energy Act (AEA) and the National Environmental Policy Act (NEPA). Atlas Corporation (Moab, Utah facility), LBP-97-9, 45 NRC 414, 416 (1997) (*referring to* Yankee Atomic Electric Co. (Yankee Nuclear Power Station), CLI-96-1, 43 NRC 1, 6 (1996)). The petition must assert injury-in-fact; the injury must be fairly connected to the challenged action; and the injury must be redressable by the Commission. Id.; *Lujan v. Defenders of Wildlife*, 504 U.S. 555, 560-61 (1992). While the petitioner has the burden of establishing standing, the presiding officer is to "construe the petition in favor of the petitioner." Georgia Institute of Technology (Georgia Tech Research Reactor), CLI-95-12, 42 NRC 111, 115 (1995); Atlas, 45 NRC at 416.

B. White Pine County Has a Right to Made a Party to the Proceeding

Section 189a of the Atomic Energy Act, 42 USC § 2339(a), grants the right to a hearing "upon the request of any person whose interest may be affected by the [licensing] proceeding and shall admit such person as a party to the proceeding." As more fully

discussed below, White Pine County has a right to participate in the proceeding to protect the County's citizens and its proprietary and sovereign interests.

First, under the doctrine of parens patriae, the County has a quasi-sovereign right to protect the interests of its citizens. *Hawaii v. Standard Oil Co. of California*, 405 U.S. 251, 258 (1972); *Alfred L. Snapp & Son v. Puerto Rico*, 458 U.S. 592, 600-607 (1982).

Second, the County has the right to protect its proprietary and sovereign interest in its land, public facilities, tax base and water rights. White Pine County owns 4768.665 acres of land, some of which is unimproved providing watershed and open space and other lands upon which are located roads, government administration facilities, libraries, parks, and other public facilities.

In addition, White Pine County has the right to protect its interests in surface and groundwater rights which have been granted to the County by the Nevada State Engineer or otherwise acquired under the laws of Nevada.

White Pine County has been recognized as an affected unit of local government and is entitled to appear and participate in the hearing proceedings as affected unit. Accordingly, White Pine County hereby Petitions the Nuclear Regulatory Commission to be recognized and allowed to participate in the proceedings as an Affected Unit of Local Government whether or not the accompanying contentions are accepted in the proceedings.

C. White Pine County Has Significant Interests in this Proceeding

As established above, White Pine County has significant interest that it seeks to protect through intervention in this proceeding. First, the County has an interest in protecting the health and safety of its numerous citizens who live, work, or travel in areas downwind of the proposed Yucca Mountain geologic repository and related routes likely

to be used for rail and highway transportation of spent nuclear fuel and other high-level radioactive waste destined for the repository. The health and welfare of these citizens could be seriously jeopardized by exposure to radiation caused by a volcanic eruption at the Yucca Mountain site or a breach of containment of a shipping container.

In addition to health and safety, the interests protected by the County include the economic welfare of its citizens. This includes protecting the integrity of ground and surface water, which is depended upon by the County to attract industrial development, local residents for culinary and landscaping purposes and local ranchers for irrigation and livestock. It also includes protecting the area's tax base, which may be adversely affected by a reduction in taxable sales, a drop in property values and loss of economic development.

D. White Pine County Will Suffer Injury In-Fact if the NRC Licenses the Repository Without Conditions Regarding Consideration and Analysis of Impacts to Downwind Areas Associated with Volcanic Eruption and Mitigation of Identified Impacts

White Pine County has standing to intervene in this proceeding because the proposed Yucca Mountain geologic repository threatens to cause "distinct and palpable" injury to the County and its citizens. *Kelley v. Selin*, 42 F.3d 1501, 1508 (6th Cir.), cert. denied, 115 S. Ct. 2611 (1995), quoting *Warth v. Seldin*, 422 U.S. 490, 501 (1975). In particular, issuance of a license may injure the health and safety of County residents and visitors who live, work or travel in areas downwind of the proposed repository or along transportation routes. It may also injure the integrity of ground and surface water, other aspects of the environment and the County's tax base.

The risk that the proposed geologic repository and related transportation systems may cause harm to public health and safety and the environment is recognized in NRC

regulations and in the application submitted by DOE. First, the NRC has made a generic determination that the construction and operation of a geologic repository constitutes a major federal action significantly affecting the human environment. See 10 CFR §§ 51.20(a) and 51.20(b)(13). Because the NRC requires the preparation of an Environmental Impact Statement (EIS) for a geologic repository, it presumptively constitutes an activity that may injure public health and safety or the environment in whose defense the County has a critical interest.

Second, the NRC's emergency planning regulations at 10 CFR § § 63.161 and 72.32 recognize the possibility of an accidental radiological release from the repository and therefore require emergency planning for geologic repositories. In addition, DOE's license application recognizes and discusses the features, events and processes and the possibility of accidents causing the release of radioactive material. See License Application at 1-14 and Repository FSEIS at 5-25. Such radioactive releases could injure emergency responders and other citizens downwind of the repository and in the vicinity of transportation routes. The proposed repository threatens to cause injury-in-fact to emergency responders and citizens in other ways not recognized by the applicant. For instance, the application and the EISs do not discuss the risks to the public of deposition of radiologically contaminated tephra in White Pine County and other down wind areas, other than the RMEI. The County is also concerned that deposition of radiologically contaminated tephra could impair the quality of ground and surface water in the area, thus adversely affecting public health and the environment.

The possible shipment of spent nuclear fuel and other high-level radioactive waste on state and federal highways through White Pine County poses a direct risk of accidents and injury. In fact of the highway shipping alternatives analyzed in the Yucca Mountain

FEIS, routes through White Pine County are characterized by relatively high incident-free and accident risks. Yucca Mountain FEIS at J-117.

Finally, NRC's failure to make an informed decision is a cognizable injury under the National Environmental Policy Act:

> [O]nce the plaintiff has established the likelihood of the increased risk for purposes of injury in fact, to establish causation, ... the plaintiff need only trace the risk of harm to the agency's alleged failure to follow the National Environmental Policy Act's procedures. Under the National Environmental Policy Act, an injury results not from the agency's decision, but from the agency's uninformed decision-making.
> *Committee to Save the Rio Hondo v. Lucero*, 102 F. 3d. 445, 451 (10th Cir. 1996).

The DOE license submittal, including the Yucca Mountain FEIS and the Repository FSEIS do not contain sufficient information regarding the consequences of a volcanic eruption through the repository for the NRC to make an informed decision or for White Pine County, or other interested parties, to make a meaningful challenge to the licensing action. Such shortcomings harm the interests of White Pine County and its citizens.

E. White Pine County's Concerns Fall Within the Zone of Interests Protected by the Atomic Energy Act, the Nuclear Waste Policy Act and the National Environmental Policy Act

White Pine County's concerns deal with health, safety and environmental consequences and risks directly attributable to licensing the Yucca Mountain geologic repository, and as such are within the zone of interest protected by the Atomic Energy Act. Vermont Yankee, LBP-90-6, 31 NRC at 89 (the Atomic Energy Act protects the public from undue hazards posed by the nuclear industry). The zone of interest protected by the Atomic Energy Act also includes protection of property as well as protection of life from radiological hazards. Gulf States Utilities, LPB-94-3, 39 NRC at 38 (radiological protection under the Act is afforded for both human life and property); 42 USC§§ 2133(b) and 2201(b). The County's interests in protecting the quality of the

environment fall within the zone of interest protected by NEPA. Babcock and Wilcox (Apollo, Pennsylvania Fuel Fabrication Facility), LBP-93-4, 37 NRC 72, 80-81 (1993). White Pine County may act to protect its citizen's interest under the Atomic Energy Act and NEPA.

F. The Injury Caused by the Proposed Repository is Redressable

White Pine County's injury may be fully redressed by NRC's finding that adoption of the Yucca Mountain FEIS and the Repository FSEIS is only practicable if the documents are supplemented to further address volcanic eruption impacts and related mitigation.

IV. CONTENTIONS

WHI-NEPA-1

Title: Failure of Environmental Impact Statements to Fully Disclose Consequences of Radiation Contaminated Tephra Deposition in Areas Other Than That Directly Applicable to the Reasonably Maximally Exposed Individual[1]

Contention: Because the Yucca Mountain FEIS and the Repository FSEIS omit any consideration or analysis of the environmental and public health consequences of radiation contaminated tephra deposition in White Pine County and other downwind areas, NRC cannot adopt the EISs without the addition of supplementary information.

Basis: In derogation of 42 USC § 102(2)(C) and 40 CFR 1502.16, the Department of Energy's *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* (DOE/EIS-0250F) ("Yucca Mountain FEIS"), as supplemented by *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* (DOE/EIS-0250F-S1) ("Repository FSEIS"), omits any consideration or analysis of the environmental and public health consequences of radiation contaminated tephra deposition in White Pine County and other downwind areas, other than for the location of the Reasonably Maximally Exposed Individual (RMEI).

Section 102 (42 USC § 4332) of the National Environmental Policy Act (NEPA) requires the Department of Energy (DOE) to prepare, and Section 114(f) of the Nuclear

[1] This contention is supported by the Affidavit of Dennis Geist, attached hereto as Attachment 1, the resume of Dennis Geist, attached hereto as Attachment 2, the December 1, 2008 document entitled, "Assessment of Tephra-Fall Hazards to White Pine County" prepared by Dennis Geist, attached hereto as Attachment 3 and the Affidavit of Mike Baughman included as Attachment 4.

Waste Policy Act (NWPA) requires the Nuclear Regulatory Commission (NRC), to the extent practicable adopt (10 CFR § 51.109 (c)), a detailed statement which fully assesses the environmental impact and any adverse environmental effects which cannot be avoided of constructing and operating the proposed Yucca Mountain geologic repository. Because DOE has omitted from the Yucca Mountain FEIS and the Repository FSEIS, any disclosure of the environmental and public health consequences of radiation contaminated tephra deposition in White Pine County and other downwind areas, NRC cannot adopt the Yucca Mountain FEIS and the Repository FSEIS without the addition of supplementary information. The criterion of 10 CFR § 51.109 (c)(2), for "significant and substantial new information or new considerations [that would] render such environmental impact statement inadequate", is met for those portions of the Yucca Mountain FEIS and the Repository FSEIS that consider impacts from a volcanic eruption.

Relevance to the Scope of the Proceeding: See response to following section.

Material Relevance: Pursuant to Section 102 (42 USC § 4332) of NEPA, DOE has prepared an environmental impact statement, as first supplemented, which purports to fully assesses the environmental impact and any adverse environmental effects which cannot be avoided of constructing and operating the proposed Yucca Mountain geologic repository. In accordance with 10 CFR § 51.67(b) DOE has submitted the Yucca Mountain FEIS and Repository FSEIS to NRC. In accordance with NWPA, Section 114(f), NRC is to adopt the Yucca Mountain FEIS and the Repository FSEIS to "the extent practicable". NRC staff has conducted a review to determine whether it is practicable to adopt the Yucca Mountain FEIS and the Repository FSEIS in accordance with the criteria in (10 CFR § 51.109 (c). In a September 5, 2008 report entitled, *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, (ML082420342), the NRC staff announced it had concluded that it is practicable to adopt the Yucca Mountain FEIS and the Repository FSEIS, with supplementation. The NRC staff determination on the practicability of adopting the Yucca Mountain FEIS and the Repository FSEIS is without prejudice on the outcome of the review by the NRC of DOE's license application under 10 CFR Part 63.

NRC's NEPA regulations (10 CFR § 51.109 (c)(2)) provide that it will not be practicable to 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." As discussed below, the failure of the Yucca Mountain FEIS and the Repository FSEIS to completely and adequately characterize potential volcanic eruption-related contaminant release in White Pine County and other similar downwind areas is a significant new consideration that renders the Yucca Mountain FEIS and the Repository FSEIS inadequate without further supplementation.

Statement of Alleged Facts: The Repository FSEIS states, "In developing the TSPA-LA model for the analysis in this Repository SEIS, DOE took into consideration the regulatory requirements in the proposed EPA and NRC standards to provide a perspective on potential radiological impacts during the postclosure period. For this SEIS, DOE based the analyses on the TSPA-LA model that serves as the basis for the compliance assessment included in DOE's application to the NRC for construction and authorization and a license to receive and possess radioactive materials at the repository." Repository SEIS at 5-3. Consistent with NUREG-1748 ("Environmental Review Guidance for Licensing Actions Associated with NMSS Programs"), the use of a regulatory

requirement to limit an analysis of impacts is not necessarily appropriate in the context of NEPA.

Future igneous activity at the site is included in the features, events, and processes (FEPs) that are incorporated in the total system performance assessment (TSPA) for the repository, because the mean annual probability of intersection of the repository by an igneous event is slightly greater than the probability threshold value for exclusion in proposed 10 CFR 63.114(a)(4)). Yucca Mountain Repository License Application Safety Analysis Report, DOE/RW-0573, 2008 (SAR) at 2.3.11-1. A volcanic eruption involving intersection of the repository with accompanying tephra deposition is then a reasonably foreseeable event requiring analysis and disclosure of related consequences in the Repository FSEIS.

The two most important parameters in the dispersal of tephra are plume height and the wind velocity vectors (speed and direction). Geist, Dennis, Assessment of Tephra-Fall Hazards to White Pine County, December 1, 2008 (Geist) at 1. Meteorological data from the Yucca Mountain region indicate that tephra originating from a volcanic eruption at Yucca Mountain would be transported to the northeast, which is the direction to White Pine County. Geist at 1. and Sandia National Laboratory (SNL), Atmospheric Dispersal and Deposition of Tephra from a Potential Volcanic Eruption at Yucca Mountain, Nevada, MDL-MGR-GS-000002 Rev 3, 2007. (SNL 2007). In addition, high altitude wind data also indicate that tephra could be transported to the north, east, southeast and south from Yucca Mountain. Geist at 1 and SNL 2007, Appendix D. Accordingly, tephra dispersal from a potential volcanic eruption at Yucca Mountain is plausible in downwind areas including White Pine County. Geist at 1.

The eruptive-scenario evaluated in the SAR does not report any consideration of the transport of contaminated ash to White Pine County, located northeast of the Yucca Mountain site. Instead, the analysis is focused entirely on the effects of the RMEI location in Amargosa Valley, south of the Yucca Mountain site. Geist at 1. This limitation in the geographic scope of analysis is carried forward into the Repository FSEIS. In fact, as stated in the Repository FSEIS, "The analysis for this Repository SEIS estimated potential human health impacts from the groundwater and atmospheric transport pathways at the location of the reasonably maximally exposed individual (RMEI; 40 CFR 197.21), which is approximately 18 kilometers (11 miles) downgradient from the proposed repository." Repository FSEIS at 5-3.

Deposition of radiologically contaminated tephra from a volcanic eruption at Yucca Mountain posits significant public health and environmental consequences. DOE has postulated as a credible event, a violent Strombolian eruption intersecting the Yucca Mountain repository, with a 13 km high plume. SAR at 2.3.11-80. If such a volcanic event were to occur, it is highly probable that a measureable amount of contaminated ash would be deposited in White Pine County. Reasonable estimates for ash deposition in White Pine County on the basis of experience with actual eruptions similar to that postulated in the Repository FSEIS range from 20 to 1000gm/m^2 Geist at 2.This compares to estimates of deposition of tephra at the RMEI location utilized by DOE in the TSPA-LA of 0.02 gm/m^2. Geist at 2.

Dosage from tephra fallout at locations within White Pine County may exceed those estimated for the RMEI in the Repository FSEIS. The particle sizes of the waste are reported to be between 12 μm and 2mm, with a mode of 13 μm (SNL 2007). The critical issue for radioactive contamination is the distribution of the fine ash fraction. The SAR

acknowledges that ASHPLUME does not adequately model transport and deposition of particles <15 μm. The finer ash and radwaste particles are the most likely to make it to White Pine County in the event of an eruption. Geist at 2. As shown in Figure 6.5-14 of the TSPA-LA, the DOE estimate of the annual dosage from the primary tephra fallout at the RMEI location is 4×10^{-6} mrem. TSPA-LA at F6.5-14. Assuming the estimates of tephra deposition rates in White Pine County stated above, and a linear relationship between tephra mass and dosage, one anticipates dosages of 0.004 to 0.2 mrem from primary ash deposition in White Pine County. Geist at 3.

Information in the Yucca Mountain FEIS and the Repository FSEIS does not adequately characterize how, and to what extent, tephra originating from a volcanic eruption through the Yucca Mountain repository will be deposited in White Pine County and other similar downwind areas. Nor does the Yucca Mountain FEIS or the Repository FSEIS adequately disclose the environmental and public health consequences of radiation contaminated tephra deposited in White Pine County and other similar downwind areas.

Concentration of contaminated ash by erosion and transport will exacerbate dosages in White Pine County. Alluvial fans can have thickness of reworked ash that is as much as 100 times those of the primary deposits in small areas where reworked tephra is concentrated by sedimentary processes. Geist at 3. The redistribution model utilized by DOE indicates that immediately after eruption, redistribution of the tephra increases the annual dosage 5-fold (to 2×10^{-5} mrem) relative to the primary tephra at the RMEI location. TSPA-LA at F6.5-14. This increases to 1×10^{-4} mrem 10,000 years after the eruption. Geist at 3. Assuming a linear relationship between dosage and ash accumulation, dosages might increase as much as 100-fold in pockets where contaminated ash is thickened 100-fold by sedimentary processes. Geist at 3. Issues

influencing tephra redistribution in White Pine County as compared to that considered by DOE for the RMEI include 1) Forty-Mile Wash is small, only 33 km^2 many drainages in White Pine County are many times this size; 2) details of local slopes, the geometry of stream networks, and precipitation are important to tephra reworking and redistribution; and 3) for the calculations in the TSPA-LA, most of the volume of the erupted tephra is deposited in upper Forty-Mile Wash, and that thins to almost zero in its lower part. (SNL 2007). In White Pine County, a smaller volume of tephra would be distributed much more evenly. Geist at 3.

The failure of the Yucca Mountain FEIS and the Repository FSEIS to disclose tephra deposition and related environmental and public health consequences in areas other than the location of the RMEI is inconsistent with NEPA, is counter to DOE and NRC regulations for implementing NEPA and requires NRC to conclude that it is impracticable to adopt the Yucca Mountain FEIS and the Repository FSEIS without further supplementation to address this deficiency.

WHI-NEPA-2

Title: Failure of Environmental Impact Statements to Fully Disclose the Consequences of Atmospheric Transport of Radionuclides in Volcanic Gases[2]

Contention : Because the Yucca Mountain FEIS and the Repository FSEIS omit any consideration or analysis of the environmental and public health consequences of atmospheric transport of radionuclides in volcanic gases for the Reasonably Maximally Exposed Individual and in White Pine County and other downwind areas, NRC cannot adopt the EISs without the addition of supplementary information.

Basis: In violation of 42 USC § 102(2)(C) and 40 CFR 1502.16, the Department of Energy's *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* (DOE/EIS-0250F) ("Yucca Mountain FEIS"), as supplemented by *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* (DOE/EIS-0250F-S1D) ("Repository SEIS") omits any consideration or analysis of the environmental and public health consequences of atmospheric transport and deposition of radionuclides in volcanic gases for the Reasonably Maximally Exposed Individual (RMEI) and in White Pine County and other downwind areas.

Section 102 (42 USC § 4332) of the National Environmental Policy Act (NEPA) requires the Department of Energy (DOE) to prepare, and Section 114(f) of the Nuclear

[2] This contention is supported by the Affidavit of Dennis Geist, attached hereto as Attachment 1, the resume of Dennis Geist, attached hereto as Attachment 2, the December 1, 2008 document entitled, "Assessment of Tephra-Fall Hazards to White Pine County" prepared by Dennis Geist, attached hereto as Attachment 3 and the Affidavit of Mike Baughman included as Attachment 4.

Waste Policy Act (NWPA) requires the Nuclear Regulatory Commission (NRC), to the extent practicable adopt (10 CFR § 51.109 (c)), a detailed statement which fully assesses the environmental impact and any adverse environmental effects which cannot be avoided of constructing and operating the proposed Yucca Mountain geologic repository. Because DOE has omitted from the Yucca Mountain FEIS and the Repository SEIS, any consideration or analysis of the environmental and public health consequences of atmospheric transport of radionuclides in volcanic gases for the RMEI and in White Pine County and other downwind areas, NRC cannot adopt the Yucca Mountain FEIS or the Repository SEIS without the addition of supplementary information. The criterion of 10 CFR § 51.109 (c)(2), for "significant and substantial new information or new considerations [that would] render such environmental impact statement inadequate", is met for those portions of the Yucca Mountain FEIS and the Repository FSEIS that consider impacts from a volcanic eruption.

Relevance to the Scope of the Proceeding: See response to following section.

Material Relevance: Pursuant to Section 102 (42 USC § 4332) of NEPA, DOE has prepared an environmental impact statement, as first supplemented, which purports to fully assesses the environmental impact and any adverse environmental effects which cannot be avoided of constructing and operating the proposed Yucca Mountain geologic repository. In accordance with 10 CFR § 51.67(b) DOE has submitted the Yucca Mountain FEIS and Repository FSEIS to NRC. In accordance with NWPA, Section 114(f), NRC is to adopt the Yucca Mountain FEIS and the Repository FSEIS to "the extent practicable". NRC staff has conducted a review to determine whether it is practicable to adopt the Yucca Mountain FEIS and the Repository FSEIS in accordance

with the criteria in (10 CFR § 51.109 (c). In a September 5, 2008 report entitled, *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*, (ML082420342), the NRC staff announced it had concluded that it is practicable to adopt the Yucca Mountain FEIS and the Repository FSEIS, with supplementation. The NRC staff determination on the practicability of adopting the Yucca Mountain FEIS and the Repository FSEIS is without prejudice on the outcome of the review by the NRC of DOE's license application under 10 CFR Part 63.

NRC's NEPA regulations (10 CFR § 51.109 (c)(2)) provide that it will not be practicable to 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." As discussed below, failure of the Yucca Mountain FEIS and the Repository FSEIS to completely and adequately characterize radiation contaminated gases resulting from a volcanic eruption at the Yucca Mountain site and related environmental and public health consequences for the RMEI and in White Pine County and other similar down-wind areas is a significant new consideration that renders the Yucca Mountain FEIS and the Repository SEIS inadequate without further supplementation.

Statement of Alleged Facts: The Repository FSEIS states, "In developing the TSPA-LA model for the analysis in this Repository SEIS, DOE took into consideration the regulatory requirements in the proposed EPA and NRC standards to provide a perspective on potential radiological impacts during the postclosure period. For this SEIS, DOE based the analyses on the TSPA-LA model that serves as the basis for the compliance

assessment included in DOE's application to the NRC for construction and authorization and a license to receive and possess radioactive materials at the repository." Repository SEIS at 5-3. Neither the TSPA, the Yucca Mountain FEIS or the Repository FSEIS consider the transport of radionuclides in volcanic gases.

Because gas is dispersed much more widely in the atmosphere than is tephra, the contribution of volcanic gases on atmospheric transport of radionuclides may be significant. Geist, Dennis, Assessment of Tephra-Fall Hazards to White Pine County, December 1, 2008 (Geist) at 3. For example, as reported by Delmelle and Stix in Encyclopedia of Volcanoes, Edited by H. Sigurdson, B.F. Houghton, S.T. McNutt, R. Rymer, J. Stix, (EDs), 2000, at pp. 803-816, acidic fumes (Vog) routinely are carried 200 km downwind from the volcanic vent at Kilauea, Hawaii. Geist at 3.

Information in the Yucca Mountain FEIS and the Repository FSEIS does not adequately characterize how and to what extent radionuclides may be transported with volcanic gases resulting from the DOE postulated volcanic eruption through the Yucca Mountain repository. Further, the EISs do not describe to what extent radionuclides will be deposited in White Pine County and other similar down-wind areas. Nor does the Yucca Mountain FEIS or the Repository FSEIS adequately consider or analyze the environmental and public health consequences of radionuclides transported by volcanic gases to White Pine County and other similar down-wind areas. The failure of the Repository SEIS to disclose volcanic gases related radionuclide transport and deposition and related environmental and public health consequences at the location of the RMEI and in White Pine County and other similar downwind areas is inconsistent with NEPA, is counter to DOE and NRC regulations for implementing NEPA and requires NRC to

conclude that it is impracticable to adopt the Yucca Mountain FEIS and the Repository FSEIS without further supplementation to address this deficiency.

WHI-NEPA-3

Title: Failure of Environmental Impact Statements to Discuss Means to Mitigate Adverse Impacts of Radiation Contaminated Tephra Deposition in Areas Other Than That Directly Applicable to the Reasonably Maximally Exposed Individual[3]

Contention: Because the Yucca Mountain FEIS and the Repository FSEIS omit any discussion of means to mitigate adverse the environmental and public health impacts of radiation contaminated tephra deposition in White Pine County and other downwind areas, NRC cannot adopt the EISs without the addition of supplementary information.

Basis: In violation of 40 CFR 1502.16(h), the Department of Energy's *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* (DOE/EIS-0250F) ("Yucca Mountain FEIS"), as supplemented by *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* (DOE/EIS-0250F-S1D) ("Repository FSEIS") omits any discussion of means to mitigate the adverse environmental and public health consequences of radiation contaminated tephra deposition originating from a volcanic eruption through the Yucca Mountain repository in White Pine County and other downwind areas, other than for the RMEI.

Section 102 (42 USC § 4332) of the National Environmental Policy Act (NEPA) requires the Department of Energy (DOE) to prepare, and Section 114(f) of the Nuclear

[3] This contention is supported by the Affidavit of Dennis Geist, attached hereto as Attachment 1, the resume of Dennis Geist, attached hereto as Attachment 2, the December 1, 2008 document entitled, "Assessment of Tephra-Fall Hazards to White Pine County" prepared by Dennis Geist, attached hereto as Attachment 3 and the Affidavit of Mike Baughman included as Attachment 4.

Waste Policy Act (NWPA) requires the Nuclear Regulatory Commission (NRC), to the extent practicable adopt (10 CFR § 51.109 (c)), a detailed statement which discuses means to mitigate adverse environmental effects of constructing and operating the proposed Yucca Mountain geologic repository. Because DOE has omitted from the Yucca Mountain FEIS and the Repository FSEIS, any discussion of means to mitigate adverse the environmental and public health impacts of radiation contaminated tephra deposition in White Pine County and other downwind areas, NRC cannot adopt the Yucca Mountain FEIS and the Repository FSEIS without the addition of supplementary information. The criterion of 10 CFR § 51.109 (c)(2), for "significant and substantial new information or new considerations [that would] render such environmental impact statement inadequate", is met for those portions of the Yucca Mountain FEIS and the Repository FSEIS that consider mitigation.

Relevance to the Scope of the Proceeding: See response to following section.

Material Relevance: Pursuant to Section 102 (42 USC § 4332) of NEPA, DOE has prepared an environmental impact statement, as first supplemented, which purports to fully assesses the environmental impact and any adverse environmental effects which cannot be avoided of constructing and operating the proposed Yucca Mountain geologic repository. In accordance with 10 CFR § 51.67(b) DOE has submitted the Yucca Mountain FEIS and Repository FSEIS to NRC. In accordance with NWPA, Section 114(f), NRC is to adopt the Yucca Mountain FEIS and the Repository FSEIS to "the extent practicable". NRC staff has conducted a review to determine whether it is practicable to adopt the Yucca Mountain FEIS and the Repository FSEIS in accordance with the criteria in (10 CFR § 51.109 (c). In a September 5, 2008 report entitled, *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, (ML082420342), the NRC staff announced it had concluded that it is practicable to adopt the Yucca Mountain FEIS and the Repository FSEIS, with supplementation. The NRC staff determination on the practicability of adopting the Yucca Mountain FEIS and the Repository FSEIS is without prejudice on the outcome of the review by the NRC of DOE's license application under 10 CFR Part 63.

NUREG 1748 requires that mitigation measures, "even for impacts that by themselves would not be considered significant, must be addressed in any EIS utilized by NRC to meet its obligation under NEPA. NUREG 1748 at 5-25. Accordingly, the Yucca Mountain FEIS and Repository FSEIS should have described measures to mitigate the environmental and public health consequences of volcanic eruption-related contaminant release in White Pine County and other similar downwind areas. The required discussion of mitigation must include measures that avoid, minimize, rectify, reduce over time, or compensate for adverse impacts.

NRC's NEPA regulations (10 CFR § 51.109 (c)(2)) provide that it will not be practicable to 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." As discussed below, failure of the Yucca Mountain FEIS and the Repository FSEIS to completely and adequately discuses means to mitigate adverse environmental and public health effects of volcanic eruption-related contaminant release in White Pine County and other similar

down-wind areas is a significant new consideration that renders the Yucca Mountain FEIS and the Repository FSEIS inadequate without further supplementation.

Statement of Alleged Facts: The Repository FSEIS states, "In developing the TSPA-LA model for the analysis in this Repository SEIS, DOE took into consideration the regulatory requirements in the proposed EPA and NRC standards to provide a perspective on potential radiological impacts during the postclosure period. For this SEIS, DOE based the analyses on the TSPA-LA model that serves as the basis for the compliance assessment included in DOE's application to the NRC for construction and authorization and a license to receive and possess radioactive materials at the repository." Repository SEIS at 5-3. Consistent with NUREG-1748 ("Environmental Review Guidance for Licensing Actions Associated with NMSS Programs"), the use of a regulatory requirement to limit an analysis of impacts is not necessarily appropriate in the context of NEPA.

Future igneous activity at the site is included in the features, events, and processes (FEPs) that are incorporated in the total system performance assessment (TSPA) for the repository, because the mean annual probability of intersection of the repository by an igneous event is slightly greater than the probability threshold value for exclusion in proposed 10 CFR 63.114(a)(4)). Yucca Mountain Repository License Application Safety Analysis Report, DOE/RW-0573, 2008 (SAR) at 2.3.11-1. A volcanic eruption involving intersection of the repository with accompanying tephra deposition is then a reasonably foreseeable event requiring analysis and disclosure of related consequences in the Repository FSEIS.

The two most important parameters in the dispersal of tephra are plume height and the wind velocity vectors (speed and direction). Geist, Dennis, Assessment of Tephra-Fall Hazards to White Pine County, December 1, 2008 (Geist) at 1. Meteorological data from the Yucca Mountain region indicate that tephra originating from a volcanic eruption at Yucca Mountain would be transported to the northeast, which is the direction to White Pine County from Yucca Mountain. Geist at 1 and Sandia National Laboratory (SNL), Atmospheric Dispersal and Deposition of Tephra from a Potential Volcanic Eruption at Yucca Mountain, Nevada, MDL-MGR-GS-000002 Rev 3, 2007. (SNL 2007). In addition, high altitude wind data also indicate that tephra could be transported to the north, east, southeast and south from Yucca Mountain. Geist at 1 and SNL 2007, Appendix D. Accordingly, tephra dispersal from a potential volcanic eruption at Yucca Mountain is plausible in downwind areas including White Pine County. Geist at 1.

The eruptive-scenario evaluated in the SAR does not report any consideration of the transport of contaminated ash to White Pine County, located northeast of the Yucca Mountain site. Instead, the analysis is focused entirely on the effects of the RMEI location in Amargosa Valley, south of the Yucca Mountain site. Geist at 1. This limitation in the geographic scope of analysis is carried forward into the Repository FSEIS. In fact, as stated in the Repository FSEIS, "The analysis for this Repository SEIS estimated potential human health impacts from the groundwater and atmospheric transport pathways at the location of the reasonably maximally exposed individual (RMEI; 40 CFR 197.21), which is approximately 18 kilometers (11 miles) downgradient from the proposed repository." Repository SEIS at 5-3.

Deposition of radiologically contaminated tephra from a volcanic eruption at Yucca Mountain posits significant public health and environmental consequences. DOE has postulated as a credible event, a violent Strombolian eruption intersecting the Yucca Mountain repository, with a 13 km high plume. SAR at 2.3.11-80. If such a volcanic event were to occur, it is highly probable that a measureable amount of contaminated ash would be deposited in White Pine County. Geist at 1. Reasonable estimates for ash deposition in White Pine County on the basis of experience with actual eruptions similar to that postulated in the Repository FSEIS range from 20 to 1000gm/m^2 . Geist at 2. This compares to estimates of deposition of tephra at the RMEI location utilized by DOE in the TSPA-LA of 0.02 gm/m^2. Geist at 2.

Dosage from tephra fallout at locations within White Pine County may exceed those estimated by DOE for the RMEI in the Repository FSEIS. The particle sizes of the waste are reported to be between 12 μm and 2mm, with a mode of 13 μm (SNL 2007). The critical issue for radioactive contamination is the distribution of the fine ash fraction. The SAR acknowledges that ASHPLUME does not adequately model transport and deposition of particles <15 μm. The finer ash and radwaste particles are the most likely to make it to White Pine County in the event of an eruption. Geist at 2. As shown in Figure 6.5-14 of the TSPA-LA, the DOE estimate of the annual dosage from the primary tephra fallout at the RMEI location is 4×10^{-6} mrem. Geist at 2 and TSPA-LA at F6.5-14. Assuming the estimates of tephra deposition rates in White Pine County stated above, and a linear relationship between tephra mass and dosage, one anticipates dosages of 0.004 to 0.2 mrem from primary ash deposition in White Pine County. Geist at 3.

Concentration of contaminated ash by erosion and transport will exacerbate dosages in White Pine County. Alluvial fans can have thickness of reworked ash that is as much as 100 times those of the primary deposits in small areas where reworked tephra is concentrated by sedimentary processes. Geist at 3. The redistribution model utilized by DOE indicates that immediately after eruption, redistribution of the tephra increases the annual dosage 5-fold (to 2×10^{-5} mrem) relative to the primary tephra at the RMEI location. Geist at 3 and TSPA-LA at F6.5-14. This increases to 1×10^{-4} mrem 10,000 years after the eruption. Assuming a linear relationship between dosage and ash accumulation, dosages might increase as much as 100-fold in pockets where contaminated ash is thickened 100-fold by sedimentary processes. Geist at 3. Issues influencing tephra redistribution in White Pine County as compared to that considered by DOE for the RMEI include 1) Forty-Mile Wash is small, only 33 km^2 many drainages in White Pine County are many times this size; 2) details of local slopes, the geometry of stream networks, and precipitation are important to tephra reworking and redistribution; and 3) for the calculations in the TSPA-LA, most of the volume of the erupted tephra is deposited in upper Forty-Mile Wash, and that thins to almost zero in its lower part. (SNL 2007). In White Pine County, a smaller volume of tephra would be distributed much more evenly. Geist at 3.

In addition to not adequately characterizing how and to what extent tephra originating from a volcanic eruption through the Yucca Mountain repository will be deposited in White Pine County and other similar downwind areas or disclosing the environmental and public health consequences of radiation contaminated tephra deposited in White Pine County and other similar downwind areas; the Yucca Mountain

FEIS and the Repository FSEIS fail to completely and adequately discuses means to mitigate adverse environmental and public health effects of volcanic eruption-related contaminant release in White Pine County and other similar down-wind areas.

WHI-NEPA-4

Title: Failure of Environmental Impact Statements to Discuss Means to Mitigate Adverse Impacts of Atmospheric Transport of Radionuclides in Volcanic Gases[4]

Contention: Because the Yucca Mountain FEIS and the Repository FSEIS omit any discussion of means to mitigate adverse the environmental and public health consequences of atmospheric transport of radionuclides in volcanic gases originating from a volcanic eruption through the Yucca Mountain repository for the RMEI and in White Pine County and other downwind areas, NRC cannot adopt the EISs without the addition of supplementary information.

Basis: In violation of 40 CFR 1502.16(h), the Department of Energy's *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* (DOE/EIS-0250F) ("Yucca Mountain FEIS"), as supplemented by *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* (DOE/EIS-0250F-S1D) ("Repository SEIS") omits any discussion of means to mitigate the adverse environmental and public health consequences of atmospheric transport of radionuclides in gases originating from a volcanic eruption through the Yucca Mountain repository for the RMEI and in White Pine County and other downwind areas.

[4] This contention is supported by the Affidavit of Dennis Geist, attached hereto as Attachment 1, the resume of Dennis Geist, attached hereto as Attachment 2, the December 1, 2008 document entitled, "Assessment of Tephra-Fall Hazards to White Pine County" prepared by Dennis Geist, attached hereto as Attachment 3 and the Affidavit of Mike Baughman included as Attachment 4.

Section 102 (42 USC § 4332) of the National Environmental Policy Act (NEPA) requires the Department of Energy (DOE) to prepare, and Section 114(f) of the Nuclear Waste Policy Act (NWPA) requires the Nuclear Regulatory Commission (NRC), to the extent practicable adopt (10 CFR § 51.109 (c)), a detailed statement which discuses means to mitigate adverse environmental effects of constructing and operating the proposed Yucca Mountain geologic repository. Because DOE has omitted from the Yucca Mountain FEIS and the Repository FSEIS, any discussion of means to mitigate adverse the environmental and public health consequences of atmospheric transport of radionuclides in volcanic gases originating from a volcanic eruption through the Yucca Mountain repository for the RMEI and in White Pine County and other downwind areas, NRC cannot adopt the Yucca Mountain FEIS and the Repository FSEIS without the addition of supplementary information. The criterion of 10 CFR § 51.109 (c)(2), for "significant and substantial new information or new considerations [that would] render such environmental impact statement inadequate", is met for portions of the Yucca Mountain FEIS and the Repository FSEIS that consider mitigation.

Relevance to the Scope of the Proceeding: See response to following section.

Material Relevance: Pursuant to Section 102 (42 USC § 4332) of NEPA, DOE has prepared an environmental impact statement, as first supplemented, which purports to fully assesses the environmental impact and any adverse environmental effects which cannot be avoided of constructing and operating the proposed Yucca Mountain geologic repository. In accordance with 10 CFR § 51.67(b) DOE has submitted the Yucca Mountain FEIS and Repository FSEIS to NRC. In accordance with NWPA, Section 114(f), NRC is to adopt the Yucca Mountain FEIS and the Repository FSEIS to "the

extent practicable". NRC staff has conducted a review to determine whether it is practicable to adopt the Yucca Mountain FEIS and the Repository FSEIS in accordance with the criteria in (10 CFR § 51.109 (c). In a September 5, 2008 report entitled, *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*, (ML082420342), the NRC staff announced it had concluded that it is practicable to adopt the Yucca Mountain FEIS and the Repository FSEIS, with supplementation. The NRC staff determination on the practicability of adopting the Yucca Mountain FEIS and the Repository FSEIS is without prejudice on the outcome of the review by the NRC of DOE's license application under 10 CFR Part 63.

NUREG 1748 requires that mitigation measures, "even for impacts that by themselves would not be considered significant, must be addressed in any EIS utilized by NRC to meet its obligation under NEPA. NUREG 1748 at 5-25. Accordingly, the Yucca Mountain FEIS and Repository FSEIS should have described measures to mitigate the environmental and public health consequences of volcanic eruption-related contaminant release in White Pine County and other similar downwind areas. The required discussion of mitigation must include measures that avoid, minimize, rectify, reduce over time, or compensate for adverse impacts.

NRC's NEPA regulations (10 CFR § 51.109 (c)(2)) provide that it will not be practicable to 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." As discussed below, the failure of the Yucca Mountain FEIS and the Repository FSEIS to completely

and adequately discuses means to mitigate adverse environmental and public health effects of volcanic eruption-related contaminant release in White Pine County and other similar down-wind areas is a significant new consideration that renders the Yucca Mountain FEIS and the Repository FSEIS inadequate without further supplementation.

Statement of Alleged Facts: The Repository FSEIS states, "In developing the TSPA-LA model for the analysis in this Repository SEIS, DOE took into consideration the regulatory requirements in the proposed EPA and NRC standards to provide a perspective on potential radiological impacts during the postclosure period. For this SEIS, DOE based the analyses on the TSPA-LA model that serves as the basis for the compliance assessment included in DOE's application to the NRC for construction and authorization and a license to receive and possess radioactive materials at the repository." Repository SEIS at 5-3. Consistent with NUREG-1748 ("Environmental Review Guidance for Licensing Actions Associated with NMSS Programs"), the use of a regulatory requirement to limit an analysis of impacts is not necessarily appropriate in the context of NEPA.

Future igneous activity at the site is included in the features, events, and processes (FEPs) that are incorporated in the total system performance assessment (TSPA) for the repository, because the mean annual probability of intersection of the repository by an igneous event is slightly greater than the probability threshold value for exclusion in proposed 10 CFR 63.114(a)(4)). Yucca Mountain Repository License Application Safety Analysis Report, DOE/RW-0573, 2008 (SAR) at 2.3.11-1. A volcanic eruption involving intersection of the repository is then a reasonably foreseeable event requiring analysis and disclosure of related consequences in the Repository FSEIS.

The Repository FSEIS states, "In developing the TSPA-LA model for the analysis in this Repository SEIS, DOE took into consideration the regulatory requirements in the proposed EPA and NRC standards to provide a perspective on potential radiological impacts during the postclosure period. For this SEIS, DOE based the analyses on the TSPA-LA model that serves as the basis for the compliance assessment included in DOE's application to the NRC for construction and authorization and a license to receive and possess radioactive materials at the repository." Repository SEIS at 5-3. Neither the TSPA, the Yucca Mountain FEIS or the Repository FSEIS consider the transport of radionuclides in volcanic gases.

Because gas is dispersed much more widely in the atmosphere than is tephra, the contribution of volcanic gases on atmospheric transport of radionuclides may be significant. Geist, Dennis, Assessment of Tephra-Fall Hazards to White Pine County, December 1, 2008 (Geist) at 3. For example, as reported by Delmelle and Stix in Encyclopedia of Volcanoes, Edited by H. Sigurdson, B.F. Houghton, S.T. McNutt, R. Rymer, J. Stix, (EDs), 2000, at pp. 803-816, acidic fumes (Vog) routinely are carried 200 km downwind from the volcanic vent at Kilauea, Hawaii. Geist at 3.

Information in the Yucca Mountain FEIS and the Repository FSEIS does not adequately characterize how and to what extent radionuclides will be transported with volcanic gases resulting from the DOE postulated volcanic eruption through the Yucca Mountain repository. Further, the EISs do not describe to what extent radionuclides will be deposited in White Pine County and other similar down-wind areas. Nor does the Yucca Mountain FEIS or the Repository FSEIS adequately consider or analyze the environmental and public health consequences of radionuclides transported by volcanic

gases to White Pine County and other similar down-wind areas. The failure of the Yucca Mountain FEIS and the Repository FSEIS to consider and analyze volcanic gas related radionuclide transport and deposition and related environmental and public health consequences at the location of the RMEI and in White Pine County and other similar downwind areas is inconsistent with NEPA, is counter to DOE and NRC regulations for implementing NEPA and requires NRC to conclude that it is impracticable to adopt the Yucca Mountain FEIS and the Repository SEIS without further supplementation to address this deficiency.

In addition to not adequately characterizing how and to what extent tephra originating from a volcanic eruption through the Yucca Mountain repository will be deposited in White Pine County and other similar down-wind areas or analyzing the environmental and public health consequences of radiation contaminated tephra deposited in White Pine County and other similar down-wind areas; the Yucca Mountain FEIS and the Repository FSEIS fail to completely and adequately discuss means to mitigate adverse environmental and public health effects of volcanic eruption-related contaminant release in White Pine County and other similar downwind areas.

Relief Requested

White Pine County has presented five reasons supporting its participation in the Licensing Application proceedings: a) its right to participate as an affected unit of local government; b) the tephra deposition omission by the DOE; c) the radionuclide contaminated VOG omission by the DOE; d) the tephra mitigation omission by the DOE; and e) the radionuclide contaminated VOG omission by the DOE. Because DOE omitted consideration, analyses and mitigation of both tephra deposition and contaminated VOG

in White Pine County, Nevada the NRC cannot approve the License Application without violating its own rules and regulations prohibiting material omissions that affect the health and safety of persons within the repository zone of risk.

DATED this 22 day of December, 2008.

Respectfully submitted,
Richard Sears
District Attorney, No. 5489
White Pine County District Attorney's Office
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Telephone: (775) 289-8828
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Attachment 1

Affidavit of Dennis Geist

AFFIDAVIT OF DENNIS GEIST

STATE OF CALIFORNIA
COUNTY OF SAN FRANCISCO | ss.

1. After first being duly sworn, Affiant makes the following factual assertions based upon personal knowledge and his review of the documents and reports cited in the reference section and body of Affiant's report entitled" Assessment of Tephra Fall Hazards to White Pine County" (Assessment), attached to the Request of White Pine County for Hearing and Petition for Leave to Intervene (Petition) filed in the Licensing hearing for the Yucca Mountain Repository License Application site.
2. Affiant holds a doctorate in Geology awarded by the University of Oregon and teaches, lectures and publishes in scientific journals on volcanism.
3. Affiant reviewed the documents referred to in the foregoing "Assessment" and relied upon them in the preparation of the Assessment.
4. Affiant relied upon the best scientific evidence and analysis available in the preparation of the Assessment.
5. Affiant believes the assertions in the Assessment to be reliable to a reasonable degree of scientific certainty.

6. The assertions in the Assessment relate significant and substantial new information not considered and assessed in the Environmental Impact Statements provided to the Nuclear Regulatory Commission in support of the Yucca Mountain Repository License application.

Dated: 12/18/08

Dennis Geist, Ph.D.
University of Idaho

SUBSCRIBED AND SWORN to

Before me this 18th day of December, 2008.

Brian Richardson
Notary Public, Brian Richardson

BRIAN RICHARDSON
Commission # 1760596
Notary Public - California
San Francisco County
My Comm. Expires Aug 4, 2011

Attachment 2

Report Prepared By Professor Dennis Geist Entitled, Assessment Tephra-Fall Hazards to White Pine County, University of Idaho, December 1, 2008.

Assessment of Tephra-Fall Hazards to White Pine County

Professor Dennis Geist
University of Idaho
November 23, 2008

1. The estimates reported in the SAR for the probability of a volcanic eruption that originates from Yucca Mountain are reasonable. The probability of an eruption intersecting the repository is on order of 2×10^{-8} annually, meaning a chance of about 0.0002 in the 10,000-year lifetime of the repository (SAR 2.3.11.1).

2. The probable style of volcanism cited in the SAR, violent Strombolian with a 13 km-high plume, is very conservative (a bad-case scenario, not the most probable one). A more likely scenario is a less explosive eruption, with smaller volumes of tephra and lower dispersal. The probability of more explosive and larger eruptions in the area is difficult to assess, because that style of volcanism has not occurred in the region in millions of years, but the chances become diminishingly small (10 to 100 times less than violent Strombolian).

3. The approach taken in modeling the disperal of tephra taken by the Sandia group is rigorous, and although details are debatable, the fundamental results are robust (SNL, 2007). The two most important parameters in the dispersal of tephra are plume height and the wind velocity vectors (speed and direction), and the ranges of those included in the models are well justified (SNL 2007; 6.5.2.7 and 6.5.2.8).

Meteorological data from this part of Nevada indicate that tephra would most likely be transported to the northeast, which is the direction to White Pine County from Yucca Mountain (SNL 2007). High altitude wind data also indicate that tephra could be transported to the north (low probability), east, southeast, and south (low probability) from Yucca Mountain (SNL 2007; Appendix D), thus most of my conclusions about potential tephra dispersal are relevant for regions outside White Pine County as well.

4. The eruptive-scenario SAR does not report any consideration of the transport of contaminated ash to White Pine County; instead, it is entirely focused on effects at the RMEI location. Therefore, it is impossible to assess rigorously the hazard at any site other than the RMEI location from the materials accompanying the eruption-scenario SAR and TPSA.

5. *If a violent Strombolian eruption, with a 13 km high plume, were to occur at the repository, it is highly probable that a measurable amount of contaminated ash would be deposited in White Pine County.* The county border is approximately 230 km from the repository, and Ely is 285 km distant. White Pine County is down prevailing wind from Yucca Mountain, and that is by far the most important consideration. Unfortunately, the computer simulations (ASHPLUME code) reported in the SAR and Sandia's more detailed 2007 report are truncated beyond Forty-Mile Wash. I am not an expert in computer models of tephra transport, but I base my conclusion on the fact that White Pine

County is in the direction of the prevailing wind, and consideration of data from comparable eruptions with which I am familiar:

Eruption	**Plume Height (km)**	**Distance (km)**	**Deposition (gm of ash/m^2)**
Ruapehu	8.5	200	20
Paricutin	9	320	0.0003
Hekla 1300	Unknown	240	4000
Hekla 1766	Unknown	190	30,000
Hekla 1845	Unknown	200	5000
Hekla 1980	15 km	230	<= 1000
Hekla 2000	12 km	230	<= 1000

(References: Ruapehu, Bonadonna et al., 2005; Paricutin, Foshag and Gonzales, 1956; Hekla 1300-1845, Thorarinsson, 1967; Hekla 1980, Gronvold et al. 1983).

These are empirical data, and are probably more reliable than computational models for distant transport of fine ash (fine particles are suspended in air in a different way than coarse particles, and the physics of their transport and fall out is not as well understood). The plume heights of the three oldest Hekla eruptions are likely higher than those estimated for the Yucca eruption scenario, because the total volume of tephra erupted is 0.5, 0.4, and 0.28 km^3, versus an anticipated 0.08 km^3 for the Yucca eruption scenario. Thus, reasonable estimates for ash deposition in White Pine County on the basis of the tabulated eruptions range from 20 to 1000 gm/m^2. This equates to a thickness of <= 1 mm.

For comparison, deposition of tephra at the RMEI site (18 km from the volcanic vent) for a variety of eruption parameters, but with a westerly wind, is calculated to be about 0.02 gm/m^2 (SNL 2007 Appendix C). The low amount of deposition is attributable to the fact that the RMEI site is cross wind with respect to Yucca Mountain, and the deposition there cannot be used to assess downwind tephra accumulation.

The particle sizes of the waste are reported to be between 12 μm and 2mm, with a mode of 13 μm (SNL 2007). Thus, the crucial issue for radioactive contamination is the distribution of the fine ash fraction. The SAR acknowledges that ASHPLUME does not adequately model transport and deposition of particles <15 μm. The finer ash and radwaste particles are the most likely to make it to White Pine County in the event of an eruption.

6. The best estimate of the annual dosage from the primary tephra fallout at the RMEI site is 4 x 10^{-6} mrem, and the dosage is at a maximum at the time of eruption (Figure 6.5-14 in the TPSA). I assume that this dosage corresponds to a deposition density of 0.02 gm/m^2 at the RMEI site, but it is difficult to discern this detail from the available reports.

Assuming the estimates of tephra deposition rates in White Pine County stated above, and a linear relationship between tephra mass and dosage, one anticipates potential annual dosages of 0.004 to 0.2 mrem from primary ash deposition in White Pine County.

7. Concentration of contaminated ash by erosion and transport are likely to exacerbate the dosages in White Pine County. In my experience in the inland northwest of the United States, alluvial fans can have thicknesses of reworked ash that are as much as 100 times greater than the original deposit's thickness, which could result in annual dosages 100 times those of the primary deposits in small areas where the reworked tephra is concentrated by sedimentary processes.

The redistribution model performed by the DOE indicates that immediately after eruption, redistribution of the tephra increases the annual dosage 5-fold (to 2×10^{-5} mrem) relative to the primary tephra a the RMEI site (TPSA, Figure 6.5-14). This increases to 1×10^{-4} mrem 10,000 years after the eruption.

It is impossible for me to predict the consequences of tephra redistribution in White Pine County by comparison to the RMEI calculation, but dosages might increase as much as 100-fold in pockets where the contaminated ash is thickened 100-fold by sedimentary processes. This assumes a linear relationship between dosage and ash accumulation. Some issues that make it more complicated than a simple multiplier are:

a. 40-Mile Wash is small, only 33 km^2. Some drainage basins in White Pine County are many times this size.

b. Details of local slopes, the geometry of stream networks, and precipitation are important to tephra reworking and redistribution.

c. Most of the volume of the erupted tephra is deposited in upper Forty-Mile Wash, and that thins to almost zero in its lower part (SNL 2007). In White Pine County, a smaller volume of tephra would be distributed much more evenly.

8. The TPSA does not consider the transport of radionuclides in volcanic gases (Demelle and Stix, 2000). This process may be significant, because gas is dispersed much more widely in the atmosphere than is tephra. For example, acidic fumes (Vog) routinely are carried > 200 km downwind from the volcanic vent at Kilauea, Hawaii.

My colleague, Dr. Anne Taunton, a geochemist, assessed the solubility of uranium dioxide in a typical volcanic gas (pH = 1.2) from a basaltic volcano. She estimates that the concentration of uranium in the vapor would be 0.43 gm/l (condensed fluid, at atmospheric temperature and pressure; Yajima et al., 1995).

The estimated concentration of volatiles in basaltic magmas from the region is 2 to 4.6% by weight (Luhr and Housch, 2002; Nicholis and Rutherford, 2004). The total mass of uranium potentially transported by volcanic gas by a violent Strombolian eruption is therefore on order of 5 million kg. This assumes the acidic gas fully equilibrates with UO_2, which may not be valid, and that this mass of uranium is available for reaction during encounter with the magmatic volatiles (water + acid).

Transport, dilution, and deposition of volcanic gases is poorly understood and depends strongly on low-altititude wind and meteoric conditions (rain or snow). This means of radioactive waste transport is a potential issue that is not addressed anywhere in the SAR or TPSA, so far as I know.

9. The "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" does not make an assessment of the environmental impact of an eruption at Yucca Mountain, beyond what is reported in the TPSA. That is, it only considers the effect of an eruption at the RMEI site, but not any of the surrounding areas.

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Yajima, T., Kawamura, Y., Ueta, S. (1995). Uranium solubility and hydrolysis constants under reduced conditions. *Materials Research Society Symposium Proceedings, 353*, 1137-1142.

Attachment 3

Resume of Dennis Geist

DENNIS J. GEIST
Department of Geological Sciences
University of Idaho
Moscow, ID 83844-3022 USA
208-885-6491 (dgeist@uidaho.edu)

EDUCATION

1985	Ph.D. - University of Oregon, Geology.
1980	A.B. - Dartmouth College, Earth Sciences.

PROFESSIONAL

2000-present	Professor of Geology, University of Idaho.
2001-2008	Chair of the Department of Geological Sciences, University of Idaho
1994-2000	Associate Professor of Geology, University of Idaho.
1990-1994	Assistant Professor of Geology, University of Idaho.
1988-1990	Assistant Professor of Geology, Hamilton College.
1986-1988	Postdoctoral Research Associate, University of Wyoming.
1985	Visiting Assistant Professor, University of Oregon.

AWARDS AND PROFESSIONAL ACTIVITIES

Visiting Scientist, Woods Hole Oceanographic Institution, 2007-2008.
Visiting Fellow, Christ's College and Department of Earth Sciences, University of Cambridge, 2008.
Visiting Director of Science, Charles Darwin Foundation, 2008.
NSF Panel, Geochemistry and Petrology, 2006-2007.
NSF Panel, Ridge2000, 2007-2008.
Executive Committee Snake River Scientific Drilling Project, 2004-present.
Editorial Board, *Journal of Petrology*, 2000-2005.
Board of Advisors, *Journal of Petrology*, 2005-present.
University Research Excellence Award, University of Idaho, 2000.
Co-Chief Scientist, Drift4 cruise, R/V Revelle, 2001.
American Federation of Mineralogical Societies Distinguished Achievement Award 2003.
Geological Society of America, Penrose Conference Committee, 2004-2007.
American Geophysical Union, VGP Publications Committee, 2000-present.
NSF Chautauqua Program Leader, Geology and Biodiversity of the Galápagos. 2007.
Field Trip Leader, Cities on Volcanoes IV, Geology of the Galápagos Islands, 2006.
Convener, Penrose Conference, Evolution of Ocean Island Volcanoes, 1998.
Editorial Board, *Geology*, 1994-1997.
Fellow of the Geological Society of America.
Charles Darwin Foundation (General Assembly), 1998-present.
Plenary Lecture, American Association of Physics Teachers annual meeting, "The Physics of Volcanoes", 2002.
External program reviewer, UNLV Ph.D. program, 1997.
External program reviewer, UNLV Ph.D. program, 2005.
External program reviewer, University of Alaska, Anchorage, 2004.
Scientific participant; Northwest Hawaiian Archipelago Cruise, *R/V Kilo Moana*, 2007; Puna Ridge Cruise, *R/V Thompson*, 1998.
Member, American Geophysical Union.
International Association for Volcanology and Chemistry of the Earth's Interior.

Panel Review Committee, *DOE*, Natural and Accelerated Bioremediation Research Program, 1997; 2000.
Guest Editor, *Journal of Volcanology and Geothermal Research,* 1992.
Ridge Workshop participant: Plume-ridge interaction, 2001.
Symposium convener, Goldschmidt Conference, Basalts and mantle dynamics, 2005.
Symposium convener, AGU joint session, Timescales of magmatism, 2004.
Symposium convener, AGU annual meeting, The 2002 edition of the Evolution of the Igneous Rocks: the 75th Anniversary of Bowen's Lectures, 2002.
Symposium convener, GSA annual meeting, Ocean islands: Where do we go from here? 2000.
Symposium convener, AGU annual meeting: The Yellowstone Hotspot, 1993.
JOI/USSAC Workshop participant: Drilling the oceanic lower crust and mantle, 1989.
JOI/USSAC Workshop participant: Large igneous provinces, 1990.

GRADUATE STUDENTS (Principal Advisor)
Jason Felsman, M.S., in progress
Peter Oswald, Ph.D., in progress
Melissa Sabga, M.S., in progress
Andres Ruiz, M.S., in progress
Susan Wilson, M.S., in progress
Lisa Mayhew, M.S., 2006, Microbial community comparisons as a function of the physical and geochemical conditions of Galapagos Island fumaroles.
Peter Oswald, M.S., 2006, Eocene volcanic rocks of the southern Talkeetna Mountains, Alaska: Anomalous forearc volcanism in an extensional setting.
Bridget Diefenbach, M.S., 2005, Volcanic construction of the Galapagos Platform: Evidence from morphology and geochemistry of large submarine terraces.
Matthew Hoffer, M.S. 2004, Petrology and geochemistry of Cretaceous plutons in the Careywood Quadrangle, Norhtern Idaho.
John Lyons, M.S. 2004, Petrogenesis of ultramafic and mafic xenoliths, Floreana island, Galapagos archipelago: implications for lithospheric evolution.
Charlotte Goddard, M.S. 2003, Relationship of geology to species richness within the islands and islets of the Galapagos archipelago, Ecuador.
Ellen Hedfield, M.S., 2003, Insight into the magmatic evolution of Fernandina volcano, Galapagos, from olivine- and plagioclase-hosted melt inclusions.
Jennifer Gustafson, M.S., 2002, Mobility of selenium from the Red Dog zinc deposit, Alaska.
Rachel Teasdale, Ph.D., 2001, Lavas of the 1998 eruption at Volcan Cerro Azul, Galapagos: Flow emplacement and magma petrogenesis.
Elisa Sims, M.S., 2000, Origin and evolution of Snake River Plain basalts: a geochemically constrained model.
Michelle Bishop, M.S., 1999, Volcanism on the northern margin of the Thunder Mountain caldera complex, Idaho.
Terry Naumann, Ph.D., 1998, Geology and petrology of Cerro Azul volcano, Isabela island, Galapagos archipelago.
Pedro Najar, M.S., 1998, Geology and geochemistry of the Papoose Peak quadrangle in the Salmon and Payette National Forest, Idaho and Valley Counties, Idaho.
Lisa Morrow, M.S., 1996, Volcanic evolution of Guffey Butte volcano, Snake River Plain, Idaho.
Jeff Standish, M.S., 1996, The emergence of a Galapagos shield volcano: Roca Redonda.
Mark Jellinek, M.S., 1994, A window into a caldera-filling ignimbrite: Twin Peaks caldera,

Idaho.
Robert Reynolds, Ph.D., 1994, The geology and petrology of Sierra Negra volcano, Galápagos archipelago.
Roberto Barragan, M.S., 1994, A petrologic transect of the Ecuadorian Andes.
+ 11 undergraduate theses.

UNIVERSITY AND COMMUNITY SERVICE

Provost Search Committee, 2004-2005.
Library Assessment Committee, 2002-2003.
Faculty Evaluation Task Force, 2003-2004.
Co-Chair, Science and Engineering Restructuring Committee, 2001.
Faculty Appeal Hearing Board, 1996-2000 (chair, 1999-2000; 2005-2006); 2003-2006.
Committee on Committees, 1997-1999.
Faculty Affairs Committee, 1994-1997 (chair 1996-1997).
Scientific Misconduct Committee, 1993-1997; 1999-2006.
Faculty Advisor, University of Idaho Rugby Club, 1999-2006.
Departmental Administrators' Review Task Force, 1999-2000.
College of Agriculture Reduction/Restructuring Committee, 1996-1997.
Dean, College of Mines, Search Committee, 1997.
Chair, Graduate Admissions and Awards, Geology Dept., 1995-2000.
Latah Country Planning and Zoning Commission, 1992-1997 (vice chair, 1996-1997).
University Curriculum Committee (1993-1994).
Faculty Council (1995-1997).

PUBLICATIONS

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NON-REFEREED:

John W. Shervais, Michael J. Branney, Dennis J. Geist, Barry B. Hanan, Scott Hughes, Alexander A. Prokopenko, and Douglas F. Williams, HOTSPOT: The Snake River Scientific Drilling Project Tracking the Yellowstone Hotspot Through Space and Time, *Scientific Drilling* v. 3, 56-57, 2006.

Dennis Geist, Karen Harpp, and Robert Reynolds, A field trip guide to the geology of the Galapagos Islands, Cities on Volcanoes 4, Quito, Ecuador, 37 pp., 2006.

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McBirney, AR, Geist, DJ, and Baker, BH, GPP: Petrologic and Geochemical software for the IBM PC, Eugene, OR, 1985 (2nd ed.1992), 33 pp.

CONFERENCE ABSTRACTS:

More than 100 since 1984.

COURSES TAUGHT (times taught)

Mineralogy (2); Igneous Petrology (1); Andesites (1); Field Volcanology (1); Basalt Petrogenesis (2); Magmatic and Metamorphic Fluids (1); Field Geology (11); Physical Geology (18); Igneous and Metamorphic Petrology (17); Volcanology (8); K/T Boundary (1); Humans, Earth, and the Cosmos (1); Optical Mineralogy (3); Physical Petrology (8); Granites (2); Trace Element Methods (2); Survey of Minerals (1); Structural Geology (1); Oceanography (1); Snake River Plain Geology and Hydrology (1); Volcano Deformation (1); Natural History of Islands (1), Active Volcanism (1).

INVITED LECTURES

Portland State University (1985; 2007), Colorado College (1986), University of Wyoming (1986), Boise State University (1987; 2001), Colgate University (1989, 2004), RPI (1989), Franklin and Marshall College (1989), University of Hawaii (1990; 2004), Washington State University (1990), Idaho State University (1991), University of Oregon (1991; 2003; 2005), Oregon State University (1991), University of Washington (1997), Caltech (2000), Spokane CC (2000), UCLA (2001), Woods Hole Oceanographic Institution (2001; 2007), Columbia University (2001), Ecole Normale Superieur de Lyon (2001), Cascade Volcano Observatory (2003), University of British Columbia (2003), Stanford University (2003), Michigan Tech (2005), Nordic Volcanological Institute (2005), Escuela Politecnica Nacional de Quito (2006), University of Massachusetts (2006), Harvard University (2007), University of Cambridge (2008), Durham University (2008).

GRANTS

2007 *NSF*. Collaborative Research, RUI: The Transition from Subduction to Extensional Magmatism in the Dry Valleys of Antarctica.

2006 *NSF*. Intrusion and Eruption Dynamics on Active Galapagos Volcanoes.

2006 *NSF*. Acquisition of an inductively coupled plasma spectrometer and high precision ion chromatograph (Dr. Scott Wood, lead PI).

2005 *National Geographic*. Extremophilic microbes in Galapagos hydrothermal systems.

2004 *NSF*. Collaborative Research: The timescales of magmatic differentiation and their relationship to eruptive style at Hekla volcano, Iceland.

2003 *USGS Edmap*. Geologic map of the Careywood quadrangle, Idaho.

2002 *NSF*. Collaborative Research: the Origin and Evolution of the Galapagos Lithosphere, Floreana Volcano.

2000 *NSF*. Development of an inexpensive continuous GPS system for remote monitoring of volcano deformation.

2000 *NSF*. Compositional buffering of magmas as an indicator of differentiation processes.

2000 *USGS Edmap*. Geologic map of the Thompson Point quadrangle, Idaho.

2000 *NSF*. Collaborative Research: The leading edge of the Galapagos hotspot.

1999 *NSF*. Volcano deformation and magma transport in Galapagos shield volcanoes.

1998 *NSF*. Supplement to "Volcanic evolution in the Galapagos"; monitoring of the active eruption at Cerro Azul.

1998 *National Geographic*. Geologic controls on biodiversity in the Galapagos.

1997 *NSF*. Support for young scientists to attend Penrose conference on Evolution of Ocean Island Volcanoes (with Drs. Wendy Bohrson and Karen Harpp).

1997 *NSF*. REU supplement to "Volcanic evolution in the Galapagos".

1997 *NSF*. ROA supplement to "Volcanic evolution in the Galapagos".

1996 *DOE*. Bioremediation and geologic characterization of Test Area North at the Idaho Water Resources Institute (IWRRI) (with Dr. R. Mink and 8 other PIs).

1996 *NSF*. Volcanic evolution in the Galapagos: a geological, petrological, and geochemical investigation of Volcan Ecuador.

1994 *NSF*: The volcanic and petrologic evolution of Isabela Island, Galápagos archipelago.

1994 *National Geographic*. The emergence of a Galápagos shield volcano, Roca Redona.

1993 *NSF*: Acquisition of a graphite-furnace atomic absorption spectrometer and gradient ion chromatograph (with Dr. Scott Wood).

1993 *NSF*: Acquisition of a powder x-ray diffractometer (with Dr. F. Froes and 6 other PIs).

1993 *University of Idaho Research Council seed grant*: A petrologic transect of the Ecuadorian Andes.

1992 *University of Idaho Research Council seed grant*: Genesis of hot and dry magmas in Central Idaho.

1992 *State Board of Education Research Grant*: Infra- to supra-structure of a magmatic plumbing system.

1992 *NSF*. REU supplement to "Contrasting differentiation processes in oceanic magma chambers.

1992 *NSF*: Contrasting differentiation processes in oceanic magma chambers: Cerro Azul and Sierra Negra volcanoes, Galápagos.

1991 *University of Idaho Research Council seed grant*: Petrogenesis of magmas from the Challis Volcanic Field, Central Idaho.

1989 *NSF*: Contrasting differentiation processes in oceanic magma chambers: Sierra Negra and Alcedo Volcanoes, Galápagos Islands.

1989 *Pew Foundation*: Development of Introductory Level Courses in Geology (with Drs.Barbara Tewksbury, Kurt Hollocher, and Michael Owen).

1989 *NSF*: A modern x-ray laboratory for undergraduate instruction.

1988 *NSF*: Petrogenesis of the Felsic Series of the Vandfaldsdalen Macrodike, East Greenland (with Dr. Craig White).

1982 *GSA Penrose Fund*: Support of PhD thesis research.

1982 *Sigma Xi Research:* Support of PhD thesis research.

Attachment 4

Affidavit of Mike Baughman

AFFIDAVIT OF MIKE BAUGHMAN

STATE OF NEVADA

COUNTY OF CARSON CITY

ss.

1. After first being duly sworn, Affiant makes the following factual assertions based upon personal knowledge and his review of the documents entitled *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* (DOE/EIS-0250F) ("Yucca Mountain FEIS") and *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* (DOE/EIS-0250F-S1D) (" Repository FSEIS") considered in the Request of White Pine County for Hearing and Petition for Leave to Intervene (Petition) filed in the Licensing hearing for the Yucca Mountain Repository License Application site.

2. Affiant holds a doctorate awarded through the Environment, Technology and Society program at Clark University at Worcester, Massachusetts and has served as a consultant on numerous National Environmental Policy Act (NEPA) compliance projects over the past 14 years.

3. Affiant reviewed the documents referred to above and believes the assertion that said documents 1) fail to consider and analyze estimates of the public health and environmental consequences of contaminated ash from a volcanic

eruption at the repository site being deposited at locations downwind from the repository site, including White Pine County; 2) fail to consider and analyze estimates of the public health and environmental consequences of the transport of radionuclides in volcanic gases at locations downwind from the repository site, including White Pine County; and 3) do not identify various measures for mitigating the public health and environmental consequences of a volcanic eruption through the Yucca Mountain repository upon areas downwind of the Yucca Mountain site, including White Pine County to be true and correct.

4. The assertions in the contentions filed by White Pine County in support of its Request for Hearing and Petition to Intervene relate significant and substantial new information not considered and assessed in the Environmental Impact Statements provided to the Nuclear Regulatory Commission in support of the Yucca Mountain Repository License application.

Dated: 12-19-08

Mike Baughman, Ph.D.
President
Intertech Services Corporation

SUBSCRIBED AND SWORN to

Before me this 19 day of 2008. (DECEMBER)

Notary Public

NOTARY PUBLIC
STATE OF NEVADA
County of Carson City
ROBERT LESMES
No: 03-3361-8
My Appointment Expires April 21, 2012