

**UNITED STATES OF AMERICA  
 NUCLEAR REGULATORY COMMISSION  
 ATOMIC SAFETY AND LICENSING BOARD**

**Before Administrative Judges:**

<b>ASLBP BOARD</b> <b>09-876-HLW-CAB01</b> <b>William J. Froehlich,</b> <b>Chairman</b> <b>Thomas S. Moore</b> <b>Richard E. Wardwell</b>	<b>ASLBP BOARD</b> <b>09-877-HLW-CAB02</b> <b>Michael M. Gibson,</b> <b>Chairman</b> <b>Lawrence G. McDade</b> <b>Nicholas G. Trikouros</b>	<b>ASLBP BOARD</b> <b>09-878-HLW-CAB03</b> <b>Paul S. Ryerson,</b> <b>Chairman</b> <b>Michael C. Farrar</b> <b>Mark O. Barnett</b>
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In the Matter of:	)	February 17, 2009
	)	
U.S. Department of Energy	)	
	)	Docket No. 63-001
(High Level Waste Repository	)	
Construction Authorization Application)	)	

**ERRATA TO ANSWER OF THE U.S. DEPARTMENT OF ENERGY TO THE  
 STATE OF NEVADA’S PETITION TO INTERVENE**

It has come to the U.S. Department of Energy’s attention that its Answer to the State of Nevada’s Petition to Intervene, filed on January 16, 2009, contains minor errors, mostly to citations, on nine pages of the 2048 page document.

Attached is a table (Attachment 1) identifying the pages on which these errors occur, identifying the text to be corrected, and providing the corrected text. Also attached are replacements for the affected pages (Attachment 2), which reflect the corrections identified in the table.

Respectfully submitted,

*Signed (electronically) by Alex S. Polonsky*

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Dated in Washington, DC  
this 17th day of February 2009

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NUCLEAR REGULATORY COMMISSION**

**ATOMIC SAFETY AND LICENSING BOARD**

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	)	

**CERTIFICATE OF SERVICE**

I hereby certify that copies of the “**ERRATA TO ANSWER OF THE U.S. DEPARTMENT OF ENERGY TO STATE OF NEVADA’S PETITION TO INTERVENE**” and the accompanying attachment have been served on the following persons this 17th day of February 2009 by the Nuclear Regulatory Commission’s Electronic Information Exchange.

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## Attachment 1

### Errata to Answer of the U.S. Department of Energy to the State of Nevada’s Petition to Intervene, filed January 16, 2009

<u>Page Number; Paragraph; Line</u>	<u>Correction:</u>
Page 517; Paragraph 2; Lines 10-13	Change: “at Fig. 6.3.3-3, p. 6-152” to “Section 8.1, at 8-2”  Delete: “The process-level simulations also included convection of steam and air, condensation, and boiling. SAR Fig. 2.3.3-42, p. 2.3.3-140.”
Page 853; Paragraph 2; Line 5	Change: “2.3.6.4.4.12” to “2.3.6.4.4.1”
Page 931; Paragraph 1; Line 1  Line 3	Change “6.3.4.1” to “2.3.6.4.1”  Change “§ 6.34.1” to “2.3.6.4.1”
Page 1101; Paragraph 3; Line 8	Change “2.3.8.2.1” to “2.3.8.3.1”
Page 1149; Paragraph 1; Line 17	Change “SAR Section 2.3.10, at p. 40.” to “SAR Section 2.3.10, at 2.3.10-41.”
Page 1339; Paragraph 1; Lines 8-9	Change “See “Features, Events, and Processes for the Total System Performance Assessment: Analyses,” ((Mar. 6, 2008) LSN# DEN001584824 at 2.2-155 to -156 (Table 2.2-2))” to “See SAR Section 2.2, at 2.2-155 to -156 (Table 2.2-2).”
Page 1469; Paragraph 3; Line 4	Change “SAR § 2.4.1.7” to “SAR § 2.4.2.1.7”

<u>Page Number; Paragraph; Line</u>	<u>Correction:</u>
Page 1478; Paragraph 2; Line 8	Change “LSN# DOC.20080312.0001” to “LSN# DEN001579005”
Page 1559; Paragraph 1; Line 5	Change “LSN: DEN2001632124; DEN2002077196” to “LSN: DN2001632124; DN2002077196”

## Attachment 2

Accordingly, Nevada's claim of noncompliance with 10 C.F.R. § 63.114(a)-(b) and (f) also does not raise a genuine dispute of material fact or law. The contention's arguments also raise no genuine dispute of material fact or law for the reasons set forth below.

First, Nevada has not correctly characterized the Application. Nevada incorrectly claims that the DOE model suppresses "emergent behavior" and ignores coupled process effects on seepage occurrence and magnitude. That is not accurate. The thermal seepage model (SAR Section 2.3.3.3) consists of a family of process-level numerical simulations, and an abstraction that bounds the seepage responses from these simulations. The simulations combine spatially heterogeneous permeability and calibrated hydrologic properties from the ambient seepage model (SAR Section 2.3.3.2) with thermal loading. A wide range of percolation flux boundary conditions were simulated. Liquid water reflux associated with a boiling zone in the host rock above the drifts is a common feature of these simulations. BSC, "Drift-Scale Coupled Processes (DST and TH Seepage) Models", MDL-NBS-HS-000015 REV 02, Section 8.1, at 8-2 (LSN# DN2001895599) (2005). Therefore, this bounding approach does *not* suppress process interactions.

As discussed in the previous section, not only was it erroneous for Nevada to allege that DOE's process-level simulations are inconsistent with the cited laboratory studies, but also DOE in fact addressed the potential for unsteady flow suggested by these physical model studies. To evaluate the effect of episodic flow on thermal seepage, thereby addressing the potential for unsteady flow, the thermal seepage model supporting information (SAR Section 2.3.3.3.3.2, pp. 2.3.3-65 to -67) includes comparison with an alternative conceptual model of episodic liquid water flow in fractures in superheated rock. Results from the alternative model confirm that

the LA. In particular, the contention does not allege, even qualitatively, that the use of a different method would result in more accurate modeling of the corrosion, or would be inconsistent with the reasonable expectation standard. As stated by another licensing board, the mere fact that a model may not provide completely accurate results, or does not provide an exact representation of the actual conditions, is not a sufficient basis for rejecting the model.

*Cleveland Elec. Illuminating Co.* (Perry Nuclear Power Plant, Units 1 and 2), LBP-85-35, 22 NRC 514, 543-44, 550 (1985). Accordingly, Nevada has failed to raise a genuine dispute of material law or fact by this claim.

Thus, notwithstanding whether Nevada's contention is correct or not, the contention does not demonstrate that DOE's results are inconsistent with the reasonable expectation standard. In this regard, Nevada ignores the demonstration of the conservatism of the model presented by DOE in SAR Section 2.3.6.4.4.1, "Abstracted Model for Localized Corrosion." See SAR § 2.3.6.4.4.1 at 2.3.6-41 (noting that: "[i]f localized corrosion due to seepage brines occurs, the affected area is modeled as the wetted waste package surface underneath the breached portion of the drip shield . . . . This treatment is *conservative*, because the model is based upon samples with tight crevices, and only the area between the waste package and the emplacement pallet will be tightly creviced.") (emphasis added).

Nevada next alleges that, "SAR Subsection 2.3.5.6 does not comply with 10 C.F.R. § 63.114(f), which requires that any performance assessment used to demonstrate compliance with Section 63.113 must evaluate in detail degradation, deterioration, or alteration processes of engineered barriers, if the magnitude and time of the resulting radiological exposures to the reasonably maximally exposed individual, or radionuclide releases to the accessible environment, would be significantly changed by their omission." Petition at 467.

at 510. In this regard, Nevada ignores the provisions of SAR section 2.3.6.4.1 which provides that “[o]nce localized corrosion initiates, the rate of propagation is conservatively modeled at a constant rate.” *See* SAR 2.3.6.4.1 at 2.3.6-31. Lastly, Nevada alleges, without support or reference to any relevant scholarship or expert opinion, that “[t]he localized corrosion propagation rates ... in SAR Subsection 2.3.6.4.3.2.1 are not based upon corrosion rates obtained from relevant environment-specific experimentation...” but [r]ather ... are apparently based upon a DOE literature review of experiments that ... are not directly applicable to estimating the actual corrosion rates that would occur under a salt cap on a waste package surface.” Petition at 510.

Nevada’s wide-ranging and diverse allegations noted above have one thing in common; they all are made with utterly no support from any documentary supporting reference or expert opinion. In fact, the many and varied assertions contained in Nevada’s Statement of Alleged Facts or Expert Opinion set forth in subsection 5 of Nevada’s contention amount to merely unsupported assertions of counsel. As such, they cannot provide adequate support for a contention. A contention “will be ruled inadmissible if the petitioner ‘has offered no tangible information, no experts, no substantive affidavits’, but instead only ‘bare assertions and speculation.’” *Fansteel*, CLI-03-13, 58 NRC at 203 (quoting *GPU Nuclear, Inc.* (Oyster Creek Nuclear Generating Station), CLI-00-06, 51 NRC 193, 208 (2000)).

Even if these claims were construed to have been submitted by an expert, they would not be sufficient to support a contention. With respect to factual information or expert opinion proffered in support of a contention, “the Board is not to accept uncritically the assertion that a document or other factual information or an expert opinion supplies the basis for a contention.”

06, 51 NRC 193, 208 (2000)). Accordingly, Nevada has not satisfied this regulation and its contention should be dismissed on that basis.

**a. Existence of a Genuine Dispute on a Material Issue of Law or Fact, With Supporting References to the License Application**

DOE has already demonstrated that Nevada's contention, criticizing DOE's sorption characteristics of the upper and lower natural barriers, is not material. DOE has also demonstrated that Nevada has failed to proffer adequate factual support or expert opinion. For these reasons, and because it is unduly speculative and neglects to specify the ramifications of its alleged errors, Nevada's contention does not raise a genuine dispute of material fact or law.

The unsupported conclusions employed in this contention contain certain fundamental errors and omit relevant analyses conducted by DOE. For example, Nevada faults DOE's use of crushed tuff for sorption experiments, alleging that these experiments "incorrectly expose all crystal faces to transporting fluids" and "[s]pecific surface areas for reactions in crushed tuff experiments are so much greater than exposed specific surface areas for either fracture flow or matrix transport." Petition at 608. However, DOE did consider the effect of grain size and crushing of tuffaceous rock on the valuation of sorption, as extensive documentation demonstrates. SAR Section 2.3.8.3.1 notes that crushing tuff does not impact sorption because of the high surface area of the intact rock. Section 6.1.3.1 of "Radionuclide Transport Models Under Ambient Conditions" further addresses this result, discussing in more detail the numerous studies on the effects of crushing rock samples for sorption measurements. *See* "Radionuclide Transport Models Under Ambient Conditions", Bechtel SAIC, Co. LLC, (July 13, 2007), LSN# DN2002466365 at 6-12 to -13. One such study concludes that crushed tuff samples with particle sizes in the range 75 to 500 micrometers (the size fraction used for most Kd determinations used in TSPA-LA) show essentially the same sorption characteristics as does intact tuffaceous rock.

With regard to Nevada's claim that DOE failed to fully account for uncertainty, the NRC has recognized that a substantial amount of uncertainty will exist in any model attempting to represent and predict the future of complex systems. *See* 66 Fed. Reg. 55,732 (Nov. 2, 2001) ("The first-of-a-kind nature of the repository and the evaluation over a very long time period result in significant uncertainty being included in the performance assessment.") For that reason, 10 C.F.R. § 63.114(b) does not require that uncertainties be eliminated or even minimized, but accounted for. This is precisely what DOE has done. For instance, SAR Section 2.3.10 at p. 41, fully recognized that "These coefficients differ among elements, chemical forms, and animal products, and uncertainty is considerable for most elements." This is also noted in one of the technical reports underlying SAR Section 2.3.10 which stated: "[d]irect measurements of transfer coefficients are scarce. Many published values are derived from sources other than explicit experimental data . . . Therefore, uncertainty in the transfer coefficient values is considerable for most elements." "Biosphere Model Report," Rev. 02, August 2007, at 6-108 LSN# DN2002481577. Contrary to what this contention suggests, DOE took account of uncertainty: "[t]o incorporate uncertainty and variation in the transfer coefficients, geometric means and standard deviations were calculated for each element using values reported in the reviewed literature." SAR Section 2.3.10, at 2.3.10-41.

Moreover, the NRC has explicitly recognized the appropriateness for postclosure models to utilize simplified assumptions, and therefore, that in and of itself, is not a basis for criticizing DOE's primary reliance on secondary sources for animal product transfer coefficients. As stated in NUREG-1804, "Yucca Mountain Review Plan," pg. 2.2-2:

In many regulatory applications, a conservative approach can be used to decrease the need to collect additional information or to justify a simplified modeling approach. Conservative estimates for

- FEP 2.1.07.01.0A – Rockfall
- FEP 2.1.07.04.0B – Hydrostatic Pressure on Drip Shield
- FEP 2.1.07.05.0B – Creep of Metallic Materials In the Drip Shield
- FEP 2.1.09.28.0B – Localized Corrosion on Drip Shield Surface Due to Deliquescence
- FEP 2.1.11.06.0B – Thermal Sensitization of Drip Shields
- FEP 2.1.11.07.0A – Thermal Expansion/Stress of In-Drift EBS Components
- FEP 2.1.13.02.0A – Radiation Damage in EBS

*See* SAR Section 2.2, at 2.2-155 to -156 (Table 2.2-2).

General design information for the drip shield is contained in SAR Subsection 2.3.4.5.1.1 and, contrary to the contention's assertion, is sufficient for purposes of evaluating possible failure mechanisms. As described in that section, the main structural (load bearing) element of the drip shield is a simple framework whose bulkheads and support beams will be manufactured of Titanium Grade 29 (UNS R56404). *See* SAR at 2.3.4-115. Drip shield plates are placed continuously over the bulkheads and the support beams, and are manufactured of Titanium Grade 7. *See id.* The plates provide the ultimate functionality of the structure to prevent (1) dripping of water from the drift roof and walls onto the waste packages; and (2) impacts of loose rock blocks from the drift roof and the walls directly onto the waste packages. *Id.* This design information provides adequate information for evaluating the failure modes of the drip shield in TSPA.

The probability of failure of the drip shield in TSPA is defined by fragility curves for buckling of the sidewalls of the drip shield or tensile rupture of the drip shield plates. SAR at 2.3.4-162. A key input to the fragility calculations is the plastic load capacity of the structure,



which Nevada cannot yet articulate or describe in sufficient specificity to raise a genuine dispute of material fact.

Similarly, with respect to each of the other claims by Nevada that DOE has taken “limited account” of alternative ways of partitioning the calculations, selecting alternative models, or selecting parameter distributions, Nevada has presented only vague, unsupported theories and has failed to directly controvert DOE’s position as presented in the SAR. A brief summary of the SAR descriptions of each of the claims follows:

- With regard to the partitioning of scenarios into modeling cases, included FEPs are grouped into scenario classes (SAR § 2.2.1.4), which are further partitioned into modeling cases to enable quantitative evaluation (SAR § 2.4.1.2). DOE considered combinations of modeling cases (SAR § 2.4.2.1.7), and demonstrated that the results are a conservative overestimate of consequences from the repository system. For each modeling case, DOE also considered a wide range of future conditions (SAR Table 2.4-5). Thus, DOE considered the effects on performance assessment of the partitioning of scenario classes into modeling cases and of the variability inherent in each modeling case.
- With regard to alternate model abstractions, conceptual and numerical models for the included FEPs (SAR Table 2.2-5) are developed that describe the evolution of the repository system. In model development, DOE considered alternative conceptual models and evaluated the effects of alternative conceptual models on the performance of the repository system. Alternative conceptual model details and the results of DOE’s evaluation of each model are provided in the subsection of the SAR applicable to each model topic, and the details of the corresponding evaluations are in the referenced

Contentions like this one that allege errors, omissions, uncertainties or alternative approaches – without specifying the ramifications or results of such alleged deficiencies – fail to raise a genuine dispute of material fact and are, therefore, inadmissible. *See Fla. Power & Light Co.* (Turkey Point Plant, Unit Nos. 3 and 4), LBP-90-16, 31 NRC 509, 521 (1990). Furthermore, as stated above in Section d, because 10 C.F.R. Part 63 permits DOE to use probabilistic analyses to calculate potential postclosure radiation doses and to report those doses as mean doses, contentions failing to allege an increase in the mean dose above regulatory limits are inadmissible. Thus, as discussed in Section V.A.3 above, contentions, such as this, that allege errors, omissions, uncertainties or alternative approaches, without specifying the ramifications or results of such alleged deficiencies, fail to raise a genuine dispute of material fact.

Second, in its assertion that DOE does not justify the shapes of the probability density functions used in the TSPA, Nevada asserts that “the justification for selecting one distribution shape over another is not provided by DOE either in the LA or in the documentation incorporated within the TSPA model.” Petition at 851. This statement is incorrect, as DOE has provided in the LA and its supporting documentation the justification for the shapes of the probability density functions used in the TSPA. Basically, the specific information for each uncertain parameter in Appendix K of “Total System Performance Assessment Model/Analysis for the License Application” (LSN# DEN001579005), the primary reference for SAR Section 2.4, includes references to documentation that discusses the basis for characterizing uncertainty in each parameter. As explained in Section V.A.3 above, Nevada has had full access to these documents through the LSN. Since Nevada’s imprecise reading of a document cannot be the basis for a litigable contention, *Ga. Inst. of Tech.* (Georgia Tech Research Reactor), LBP-

As discussed in DOE's response to contention NEV-Safety-157, the evaluation of information and analyses developed after the completion of the PVHA is plainly identified in the SAR and supporting documents. *See, e.g.*, SAR Section 2.3.11; BSC, *Characterize Framework for Igneous Activity at Yucca Mountain, Nevada*, ANL-MGR-GS-000001 REV 02, Table 6-4, at 6-16 to 6-17 (LSN: DN2001632124; DN2002077196; DEN001580092) (2004). After analyzing published estimates from 1982 to 2000 of the probability of a volcanic event intersecting the repository footprint, DOE concluded that the estimates, including the mean intersection probability estimated in the PVHA, "cluster at slightly greater than  $10^{-8}$  per year, providing confidence that the PVHA probability estimate is robust." SAR at 2.3.11-24. In addition, DOE evaluated the potential significance of aeromagnetic data gathered after the PVHA was completed for its potential significance to the hazard estimate. SAR at 2.3.11-25. The SAR identifies three separate sensitivity studies, completed following the PVHA, which show that effects of information developed following completion of the PVHA is insignificant. *Id.*

Most significantly, DOE's update to the PVHA (i.e., PVHA-U) was conducted using a panel of eight experts, whose evaluations included data that had become available since the conclusion of the PVHA, including high-resolution aeromagnetic data, drilling, geochemical, and geochronological analyses conducted specifically to support the PVHA-U. "Probabilistic Volcanic Hazard Analysis Update (PVHA-U) for Yucca Mountain, Nevada Rev. 01" (09/02/2008), (LSN# DEN001601965) (cited in Petition at 833). As summarized in DOE's letter to NRC dated October 17, 2008, "The differences between the PVHA-96 and PVHA-U distributions would not significantly affect the estimates of repository performance for either 10,000 years or 1,000,000 years, demonstrating that the PVHA-U results are confirmatory of the