UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Atomic Safety and Licensing Board

Before Administrative Judges:

ASLBP BOARD
09-892-HLW-CAB04
Thomas S. Moore, Chairman
Paul S. Ryerson
Richard E. Wardwell

In the Matter of	)	
U.S. DEPARTMENT OF ENERGY	)	**Docket No. 63-001-HLW**
(High Level Waste Repository)	)	**December 30, 2009**

STATE OF NEVADA RESPONSE TO
NRC STAFF ANSWERS TO BOARD QUESTIONS

On December 9, 2009, the Construction Authorization Board (Board) issued a Memorandum and Order admitting five new contentions and requiring NRC Staff (Staff) to answer three questions by December 21, 2009 related to the State of Nevada's (Nevada's) petition for waiver in NEV-SAFETY-203. The Memorandum and Order also provided that Nevada could file a response to Staff's answers by December 30, 2009. Nevada's response is set forth below.

I. The Correct Answer to Question 1 is that the Rulemaking Record Demonstrates No Commission Consideration of Either the Stüwe Model or the Data Underlying It.

The Board asked Staff what information in the rulemaking record demonstrates that the Commission considered the Stüwe erosion model or the data underlying it.

1. The Staff answers that "the Commission did not consider the Stüwe model itself" (Staff Response to Board Questions (Staff Answer) at pg. 2). This is an important concession. There is no claim in the Stüwe paper that new information was used in the formulation of the model. The significant new information is in how the data were used and in the scientific insights associated with the development of the model. The Commission recognizes in 10 C.F.R. Part 63 that the models themselves are extremely significant. The Commission not only anticipates that DOE will use "complex predictive models that are supported by limited data" (10 C.F.R. § 63.101), but it also emphasizes the importance of the models themselves when it requires that DOE "consider alternative conceptual models" (10 C.F.R. § 63.114 (a) (3)).

2. The Staff then offers a potentially misleading discussion of whether information in the rulemaking record demonstrates that the Commission considered data underlying the Stüwe model. In an affidavit attached to Staff's Answer, Timothy McCartin and Philip Justus cite five scientific papers referenced in the preamble to the final Part 63 rule that are said to "address erosion" (Staff Answer, Affidavit of Timothy McCartin and Philip Justus at pg. 3). While the papers may "address erosion" to some extent, they also address other scientific subjects, and the Commission relied only upon the papers' discussion of these other subjects. Affiants state that "the consideration of erosion in the rulemaking record is related to the development of the deep percolation rate and not with respect to erosion rates assumed in the Stüwe paper" (*Id.*) but, in fact, the rulemaking record fails to show that the Commission specifically considered erosion even *as related to* the development of the deep percolation rate.

Affiants refer first to "Technical Assessment of Structural Deformation and Seismicity at Yucca Mountain, Nevada," referenced at 74 Fed. Reg. 10811, 10823. The rule preamble here is clear that the Commission used this paper to support a "bedrock permeability model," and Staff

concedes that this paper "was used to support bedrock permeability values used in specifying deep percolation values *rather than* erosion rates" (Affidavit of Timothy McCartin and Philip Justus at pg. 4)[emphasis added]. Affiants next refer to "The Nature of Flow in the Faulted Paintbrush Nonwelded Hydrologic Unit," referenced at 74 Fed. Reg. 10811, 10820. The rule preamble shows that this paper was used only to support the proposition that "the hydrogeologic properties of the PTn unit overlying the repository horizon, *where present*, dampen the magnitude of short term fluctuations in deep percolation that might be associated with future climate change or variability in precipitation" [emphasis added]. This offers no support for the proposition that the Commission actually considered whether or to what extent the PTn unit might erode. Affiants next refer to "Infiltration Tabulator for Yucca Mountain: Bases and Confirmation," referenced at 74 Fed. Reg. 10811, 10823. The rule preamble indicates that this paper was used only to support the proposition that "[NRC] performed independent soil permeability measurements, which provided a basis to evaluate the reasonableness of related DOE data." This has nothing to do with erosion. Affiants next refer to "Long-Term-Average Infiltration at Yucca Mountain, Nevada: Million-Year Estimates," referenced at 74 Fed. Reg. 10811, 10820. This paper is cited in the rule preamble as representing one of two approaches the Commission used "to estimate time-varying sequences of mean annual precipitation that vary over glacial cycles." This has to do with precipitation, not erosion. Finally, affiants refer to "Literature Review and Analysis: Climate and Infiltration," referenced at 74 Fed. Reg. 10811, 10821. The rule preamble indicates that this paper was used because it "provide[s] a comprehensive review and analysis of relevant infiltration and recharge studies that have been conducted for the Yucca Mountain region…." The Commission's very limited discussion of "Literature Review and Analysis: Climate and Infiltration" suggests that it was used only insofar

as it provided data on precipitation and temperature, which were then used in still another study linking temperature and precipitation rates (see 74 Fed. Reg. 10811, 10821-22).

In sum, the rule preamble does not support the proposition that the Commission used any of these five scientific papers for the specific purpose of considering erosion, even as erosion might affect development of the deep percolation rate. The fact that erosion is mentioned in some of the papers is not relevant if the Commission did not use any of the papers for the purpose of estimating erosion. The critical flaw in Staff's argument and affidavit is the assumption that the Commission used all five studies for every scientific purpose related to them, as opposed to the limited purposes discussed in the rule preamble. If the Commission used a particular dictionary to correctly spell "plutonium" in a notice of rulemaking addressing the radiological hazards of plutonium, the fact that that same dictionary also provided a spelling for "uranium" does not mean that the rulemaking somehow, automatically, must also have addressed the radiological hazards of uranium.

3. Staff argues that "in its rulemaking, the Commission did not discuss erosion rates so great that Yucca Mountain would be denuded and the repository would be exposed" because the National Academy of Sciences (NAS) found, nearly fifteen years ago, that "an increase in erosion to the extent necessary to expose the repository (even over a million-year time scale) is extremely unlikely" (Staff Answer at pg. 2). However, the NAS made no formal "finding" here and, indeed, the text appears to be carefully edited to avoid any implication that a formal "finding" or conclusion is being made. The NAS's formal findings (conclusions) and recommendations with operative effect under the Energy Policy Act of 1992 appear in the underlined text on pages 1-14 of the NAS report (LSN# NEV000004270). The relevant formal finding here is that "these physical and geologic processes are sufficiently quantifiable and the

related uncertainties sufficiently boundable that the performance can be assessed over time frames during which the geologic system is relatively stable or varies in a boundable manner" (NAS Report at pg. 9). If anything, this suggests that erosion must be considered in the performance assessment, not that EPA or NRC must ignore erosion because NAS dismissed it as insignificant.

Thus, the Commission was not bound by what the NAS said here almost fifteen years ago, and in any event the NAS report did not excuse the Commission from considering erosion.

4. Staff also opines that "[i]n its rulemaking, the Commission did not consider the Stüwe model and its accompanying unsupported assumptions because it is inconsistent with current scientific understanding of erosion processes at Yucca Mountain" (McCartin and Justus affidavit at pg. 10). The implication here that the Commission considered the Stüwe model and rejected it because it believed its assumptions were inconsistent with current scientific understanding is flatly inconsistent with affiants' earlier statement that the Stüwe model was not in fact considered.

Staff obviously maintains a strong opinion about the validity of the Stüwe model, despite not having completed its post-closure safety evaluation report. Nevertheless, the Staff here confuses itself with the Commission. Not every Staff expert opinion may be attributed to the Commission, just those opinions relied upon explicitly in the rulemaking record. The most that can be said from the rulemaking record is that the Commission appears to have simply assumed that erosion would not be significant and that a repository at Yucca Mountain would remain covered. It is the legitimate purpose of Nevada's waiver request to question that unsupported assumption based on significant new information not previously considered by the Commission, whether or not the same information was considered by Staff.

II. The Correct Answer to Question 2 is that Staff's Counter Affidavits Raise a Factual Dispute that Cannot be Resolved at the Certification Stage

1. Under 10 C.F.R. § 2.335 the Board may consider counter affidavits for the limited purpose of understanding the fundamental and generally applicable scientific principles that are relied upon in a petitioner's *prima facie* case. It may not use counter affidavits to weigh conflicting evidence, and the cases cited by Staff (Staff Answer at pp. 5-7) are not to the contrary. The cited passage from *Public Service Company of New Hampshire (Seabrook Station Units 1 and 2)*, ALAB-895, 28 NRC 7, 20 (1988) (Staff Answer at pg. 6) suggesting that a counter affidavit may "rebut" a petitioner's filing is *dictum*, at best, because no counter affidavits were actually filed in that case. The Appeal Board's use of the term "rebut" may simply have meant that no counter affidavits were filed to "rebut" the proposition that petitioner established a *prima facie* case, not that a *prima facie* case could have been rebutted by weighing conflicting evidence in a counter affidavit. Moreover, a counter affidavit that presented conflicting evidence would address the ultimate merits of the petition. Consideration of such an affidavit at the certification stage would be contrary to the holding in *Pacific Gas & Electric Company (Diablo Canyon Nuclear Power Plant, Units 1 and 2)*, CLI-81-5, 13 NRC 361(1981), that the merits of a waiver petition are reached only after the petition is granted.

2. Staff argues that the published Stüwe paper does not constitute a *prima facie* case because the paper "questions its own model's reliability for use with smaller catchments and smaller gullies, which are the features at Yucca Mountain" (Staff Answer at pp. 5, 8-9). To support this argument, Staff refers to paragraph 15 of the affidavit of Hill, Justus and McCartin attached to its Answer to Nevada's New Contentions Based on Final NRC Rule and to paragraph 4 of another affidavit by Dr. Hill attached to Staff's Answer. These references quote or paraphrase from a portion of section 5 of the published Stüwe paper in a way that makes it

appear that the authors are admitting that their model does not apply to Yucca Mountain, which is highly implausible given that the title of the peer-reviewed article is "Erosional Decay of the Yucca Mountain Crest."

In section 5 of the paper Stüwe *et al.* note, among other things, that "we used minimum values for the parameters so that the estimated erosion time represents an absolute maximum." They also state that "it is, in principle, also possible that the stream power approach is itself inappropriate," but then conclude as follows: "[f]ortunately, it appears that the stream power approach is robust against many different actual processes acting in bedrock channels (e.g., Stüwe *et al*., 2008). We only note that several authors agree that the stream power approach may break down for catchments smaller than about 5 km^2 in size (e.g., Wobus *et al*., 2006) and that the smaller gullies may therefore not be well described by our model."

The overall area represented by the authors' model is 400 km^2, and the authors are simply warning the reader to not to attach too much significance to the fine details of the topographic model they construct but to focus rather on the overall behavior of the model, which is calibrated at the present day by reference to the "real morphology of the Yucca Mountain ridge" (Stüwe *et al.* at section 3.1). Moreover, as indicated from the quotation, the authors advise the reader that the model "may" break down, not that it does or will break down, and that their model may actually underestimate erosion rates. These statements do not constitute an admission that the very title of the published paper is wrong, and do not undercut Nevada's *prima facie* case. When Staff's expert opines that the Stüwe model includes "express limitations …for its ability to represent smaller gullies" (Hill affidavit at paragraph 4), that expert goes beyond the text of the published paper and is presenting what is, in effect, a factual dispute over the applicability of the model to Yucca Mountain.

III. The Correct Answer to Question 3 is that Nevada's Discussion of How the Stüwe Model Addresses Erosion By Sub-Horizontal Eating Back Into the Ridge Addresses a Staff Argument Different from the One Addressed Above.

1. In paragraph 16 of the Hill, Justice, and McCartin affidavit attached to Staff's Answer to Nevada's New Contentions Based on Final NRC Rule (06/11/2009), a Staff expert opined that "Nevada has not presented a reasoned basis to explain how the same amount of erosion that took 11.6 Myr to develop in the past will somehow occur [using the Stüwe model] in less than one million years in the future." This Staff argument is different from the one addressed above.

2. Staff's opinion here used factual information extrinsic to Nevada's affidavit. It is clearly in the nature of a rebuttal to the Stüwe model, and it presents a dispute of fact and opinion that cannot be considered at the certification stage. Nevertheless, to show how Staff's opinion cannot be taken at face value, and that a full merits hearing is necessary to provide a full and true disclosure of the facts, Nevada pointed out in its Reply to Staff's Answer to Nevada's New Contentions (07/03/2009 at pg. 16-17) that Staff's comparison was based on vertical erosion rates, while a study of the Stüwe model showed that this is not a proper comparison. The Stüwe model addressed erosion by sub-horizontal eating back into the ridge, not by a simple downward lowering, as Staff's comparison suggested. This is illustrated in the left hand panels of figure 6 of the published Stüwe paper, which show the development of incised valleys that result in an overall west-east contraction of the highest land (shaded yellow) towards that ridge, that is, a sub-horizontal degradation of the overall topography governed by spatially variable vertical erosion in the gullies. The transects shown on this figure have a length of 16 km and the initial width of the ridge is approximately 3 to 4 km, so this overall contraction occurs on a spatial scale of around 50 to 60 km^2, much larger than the 5 km^2 or less scale at which questions have been raised as to the realism of the model.

Staff's repeated protests that Nevada presented evidence about the nature of the Stüwe model without a supporting affidavit miss the mark. Apart from the fact that the nature of the model is apparent from a reading of the paper itself, Nevada's explanation of the nature of the model is only relevant if the Board were to consider whether, in fact, the comparison in paragraph 16 of the Hill, Justice, and McCartin affidavit undercuts the credibility of the model. As indicated above, such a consideration would be improper at the certification stage because it would impermissibly address the ultimate merits of Nevada's waiver case.

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NUCLEAR REGULATORY COMMISSION

Atomic Safety and Licensing Board

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U.S. DEPARTMENT OF ENERGY	)	**Docket No. 63-001-HLW**
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CERTIFICATE OF SERVICE

I hereby certify that the foregoing State of Nevada Response to NRC Staff Answers to Board Questions, has been served upon the following persons by the Electronic Information Exchange:

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