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April 3, 1984

Ms. M. J. Wise
Repository Projects Branch
Division of Waste Management
U.S. Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Spring, MD 20910

Dear Ms. Wise:

Enclosed you will find our review comments on "Basalt Waste Isolation Project Review by Pacific Northwest Laboratory's Review Team," a letter report dated November 1983. As you requested on March 5, 1984, we reviewed only Chapter 3, with particular attention to Section 3.3.

The costs for this review were $3K.

Sincerely,

Nestor R. Ortiz

Nestor R. Ortiz
Nuclear Fuel Cycle Systems Safety
Department 6430

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REVIEW: "BWIP Review by PNL's Review Team," Chapter 3

A cursory examination of the entire letter report reveals that it contains both a brief review by PNL of the work being done for BWIP and also a summary and evaluation of previous reviews of the BWIP. Previous reviews that are evaluated include comments on the BWIP by, for example, USGS and NRC. One section, however, departs from this format. Section 3.3, "Performance Assessment Issues Relative to Geohydrology," is devoted primarily to criticism of the NRC/SNLA Performance Assessment Methodology and to encourage BWIP to challenge the usefulness of the Methodology. Most of the criticisms of the NRC/SNLA Methodology are presented without references.

The bulk of the letter report appears to be a technical review of prior evaluations of the BWIP program. Chapter 3, however, contains many subjective decisions both for and against the site, for example

- "This favorable condition probably applies to the site" (p. 3.4, line 6),
- "This condition does not seem to be applicable" (p. 3.4, line 26),
- "It does not appear the Hanford site will be disqualified" (p. 3.6, line 21),
- "The site could probably meet four of the potentially favorable conditions but probably does not meet three others" (p. 3.6, last 2 lines).

These subjective judgements are presented without reference or supporting data.

We believe that the content of Section 3.3 indicates a fundamental lack of understanding of the NRC/SNLA Performance Assessment Methodology on the part of PNL. This lack of understanding may indicate a need for a Performance Assessment Review Team.

The second paragraph of Section 3.3 interprets NRC's position to be that only traditional techniques of data analysis and interpretation of large-scale pump tests will be acceptable. The third paragraph of Section 3.3.2, on the other hand, attributes "major hydrologic problems" to NRC's attempt "to move too quickly ...to newer... methods." The writer of this section of the letter report seems to be confused about NRC's position with regard

to the analysis of hydrologic data and is inconsistent in his view of the NRC approach. This confusion is further illustrated by phrases like

- "NRC seems to be saying" (p. 3.18, line 9),
- "NRC has indicated, if one reads between the lines," (p. 3.18, line 12),
- "What appears to be NRC's current course" (p. 3.18, line 20).

It is our belief that for a technical review like this letter report, "reading between the lines" is inappropriate and serves no purpose. The criticism of NRC's supposed requirements for large-scale pump tests also seems to stem from misunderstandings of the NRC position based on "reading between the lines". Results of large-scale pump tests must be used in conjunction with many other kinds of data; we do not believe that NRC intends for BWIP to violate the appropriate assumptions in their analysis of pump tests. Models may or may not be required in these analyses. We agree that the best available, defensible technology should be used (p. 3.18, line 26).

Section 3.3.1, Risk Assessment, questions the validity of applying the full NRC/SNLA risk assessment methodology to geologic systems and states that, to their knowledge, none of the DOE sites has envisioned the need for this type of assessment to comply with the EPA standards (p. 3.19, first 14 lines). In fact, the EPA standard requires a performance assessment that estimates the probability and consequences of events and processes that might affect the disposal system and assembles these estimates into complementary cumulative distributions (EPA, 1984, pp. 10-11). In short, the EPA standard requires a risk assessment. Furthermore, two DOE projects, WIPP and NNWSI, have begun the process of developing such risk assessments for bedded salt (Bingham and Barr, 1979; WIPP FEIS) and tuff (Hunter et al., 1983; Logan et al., 1982). Current SNLA work on a risk assessment for a hypothetical basalt site has not shown any indication that the methodology will be inappropriate for basalt.

This section also suggests that the methodology may be dangerous because it could be misused by allowing "potentially meaningless probabilities" to "mask what we really know about a site" (p. 3.19, lines 14 through 21). Although it would be possible to use the methodology in that way, the staff of SNLA Division 6431 believes that intelligent, honest use of the methodology will highlight the "real safety and uncertainty issues," not put them "in the back seat."

The letter report's unfavorable comments on the EPA standard (p. 3.19, lines 22-26) are presented without references. We are not aware of any references which would support these comments.

We disagree that event-driven risk assessments necessarily ignore interactions between slow system changes (p. 3.19, lines 27-29). We believe that steady-state analyses generally bound such changes. We have already identified a need for a capability to model transient processes.

Section 3.3.2, "Approach to Assessment of Sensitivity and Uncertainty," advocates the use of fully calibrated and validated deterministic hydrologic models and maintains that such models have been successfully applied to many real systems. In addition, this section incorrectly describes and then criticizes the NRC/SNLA approach to uncertainty and sensitivity. The letter report contrasts the supposedly successful, traditional, deterministic approach with the newer, supposedly less fully developed and untested stochastic approach of the NRC. However, the statement either that the deterministic modeling described is traditional or that it has been successfully applied to many real systems is, at best, wishful thinking. A model of the type described may be a starting point, but it is not unique and cannot be validated. SNLA Division 6431 is currently working on a technique to incorporate uncertainty into a deterministic model of this type. In short, to the extent that such deterministic modeling is practical even for research purposes, the NRC/SNLA methodology incorporates it. To the extent that it is not practical or possible, newer methods must be developed.

Section 3.3.2 also refers repeatedly to the "untested" NRC methods (p. 3.20, lines 3 and 25; p. 3.23, line 19). What methods are untested? If "untested" means "not applied to a real site," then we agree; however, we feel that the methods have been thoroughly tested on hypothetical sites.

The statements that the methodology is not well suited for systems with correlated parameters (p. 3.20, line 7; p. 3.23, line 7) are wrong. We do not know how this misunderstanding arose, because the reference cited by PNL in support of the erroneous statement says <u>in the abstract</u> that the method "may be used with any type of sampling scheme for which correlation of input variables is a meaningful concept" (Iman and Conover, 1980, p. iii, lines 6-7).

The last two sentences of the first paragraph of Section 3.3.2 are true, and we are currently investigating ways of handling the types of uncertainty referred to. In previous studies using hypothetical sites, there was no basis for treating constraints on parameter distributions or uncertainty.

The portion of Section 3.3.2 on p. 3.22 displays some confusion about stochastic hydrology and the NRC/SNLA methodology. The assertion that stochastic hydrology produced erroneous conclusions is undocumented. The assertion that it ignores spatial correlations is wrong (p. 3.22, lines 8-10). In fact, stochastic hydrology is based on spatial and temporal correlation of variables.

The letter report also states that the NRC/SNLA approach must be Monte Carlo and the approach to sensitivity would most likely be of the adjoint type (p. 3.22, line 27). In fact, the NRC/SNLA approach is Latin Hypercube Sampling with stepwise regression analysis. This PNL statement is not only incorrect, it is inconsistent with the next paragraph (p. 3.23), which states that the NRC/SNLA approach is LHS.

The letter report encourages BWIP to challenge the NRC position on uncertainty and sensitivity (p. 3.24. line 12). ONWI, another DOE project, has made several comparisons of the various techniques available for sensitivity/uncertainty analysis (see e.g., Harper, 1983; Harper and Gupta, 1983). The techniques compared are generally the statistical methods (of which LHS/Monte Carlo are two) and the adjoint approach. Their conclusions were that "Statistical methods and the adjoint approach are complementary. ...ONWI will use both the statistical [i.e., LHS] and the adjoint methods..." (Harper, 1983, p. 12).

We agree with the last sentence of Section 3.3.2, except that proposed new approaches should be examined not only for potential shortcomings, but also for potential benefits.

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