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APR 24 1986

J. J. Linehan
Section Leader
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Division of Waste Management
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

REVIEW OF "NNWSI PHASE II MATERIALS INTERACTION TEST PROCEDURE AND PRELIMINARY RESULTS" (ANL-84-81)

On March 6, 1986, you transmitted Nuclear Regulatory Commission (NRC)/Brookhaven National Laboratory comments on the subject report to my office. The NRC review was conducted as the result of an agreement reached at the July 23-24, 1985, Waste Package Meeting.

We have provided your comments on ANL-84-81 to Lawrence Livermore National Laboratory and their response is enclosed for your consideration.

We appreciate your effort in this matter. Please do not hesitate to contact us if you have any questions or wish to discuss the enclosed material in more detail.

Donald L. Vieth, Director
Waste Management Project Office

WMPO:JSS-1132

Enclosure:
As stated

cc w/encl:
J. P. Knight, DOE/HQ (RW-23), FORS
C. R. Head, DOE/HQ (RW-24), FORS
L. D. Ramspott, LLNL, Livermore, CA
N. K. Stablein, NRC, Washington, DC
P. T. Prestholt, NRC, Las Vegas, NV
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cc w/o encl:
V. J. Cassella, DOE/HQ (RW-22), FORS

(F) (H)

Lawrence Livermore National Laboratory

NWM:LR 86-83

April 7, 1986

Donald L. Vieth, Director
Waste Management Project Office
U.S. Department of Energy
Nevada Operations Office
P.O. Box 14100
Las Vegas, NV 89114

SUBJECT: WMPO ACTION ITEM 86-973; NRC REVIEW OF NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS PROJECT PHASE II MATERIALS INTERACTION TEST PROCEDURE AND PRELIMINARY RESULTS (ANL-84-81, JANUARY 1985)

Dear Don:

Per the above subject request, please find attached comments by Roger Aines of my staff.

L. Ramspott
LLNL Technical Project Officer
for NNWSI

LR:sg

cc: R. Aines
V. Oversby

April 1, 1986

To: Larry Ramspott

From : Roger Aines

Subject: Comments on the NRC/Brookhaven Review of "NNWSI Phase II Materials Interaction Test Procedure and Preliminary Results"

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The major item of concern for the NRC appears to be the extent to which tuff interactions are included in this test. The appeal of the Analog Test is that these interactions are included in a scaled-down repository model. However, the validity of the scaling cannot be demonstrated at this time. The Analog Test would be better named the Analog Experiment. John Bates' experience with this apparatus indicates that it is difficult to control the water flow rates, mechanisms and paths. Each experiment is different because of the slightly different properties of the tuff. As such, John does not believe that this can be considered a <u>test</u> of a waste form. The Unsaturated Test (as the Phase II Materials Interaction Test is now known) is performed under rigorous and reproducible conditions appropriate to a test. The Analog Test is valuable in assessing the types of interactions that are possible and in correlating the interaction types to the Unsaturated Test. For instance, the alteration and water-mark patterns on the glass in the Analog Test are the same as those in the Unsaturated Test, indicating that in the Analog Test water also contacts the waste form by dripping onto it.

As originally envisioned, the Unsaturated Test would measure some interactions of radionuclides with tuff as a result of the leachate solutions dripping into a tuff cup. This proved unworkable because the slight variability in the composition of the tuff, obscured the release of elements from the glass. We could not detect glass release accurately with tuff present.

However, it does not appear to be necessary or even desirable to have tuff present in this type of experiment. As the NRC and Brookhaven note, the canister/glass system will be effectively isolated in the repository. Water will enter the top of the can, react, and then exit the can <u>before interacting with the tuff</u>. We feel that this situation can best be addressed by first obtaining accurate information on the release from the glass in the presence of canister material, and that is the purpose of the Unsaturated Test. Given the expected longevity of a perforated container, it is distinctly unrealistic to test glass in direct contact with tuff rock.

Note that we are not eliminating work on the transfer of released radionuclides to tuff rock. We have published the results of one study of static leaching in tuff cups and are currently reviewing a second publication. Analysis of radionuclide penetration into tuff from these experiments and the Unsaturated Tests in which tuff was included is currently being done on the Cameca ion probe. We believe that the Unsaturated Test provides more consistent, accurate, and useful results if the complications of tuff addition are removed.

Brookhaven notes that clean, as-machined stainless steel should be sufficient in the place of "aged" material. We disagree. Bates' experience indicates that when steel is in direct contact with the glass, the minor changes in the metal brought about by machining and welding can be significant. Tests with deliberately sensitized material show dramatic differences due to the formation of iron-nickel silicates. This is an important parameter. While the results of this test are useful in estimating release rates, the primary motivation for its creation was to study materials interactions. The discolored and rusted appearance of a sensitized DWPF pour canister after a few months in the open demonstrates that interaction of "as produced" stainless steel will not give an accurate picture of repository interactions. Even though NNWSI will pack the DWPF can in an unaltered container, the altered metal is still in contact with the glass.

Finally, the use of J-13 water equilibrated at 90 C is required to accurately model repository interactions. The water is the only direct coupling mechanism between the rock and the waste form. Any water contacting the waste at 90 C will first have come through rock at 90 C. Increased understanding of repository water chemistry may indicate a better initial water than J-13; that could be accommodated in the test.

The NRC memo notes that they are unclear about the way in which we will apply the results of the Unsaturated Test to calculating future performance. The primary aim of this test is to measure materials interactions and to correlate those interactions with release rates. We will combine the results of all our glass testing methods to arrive at estimates of release. The Unsaturated Test provides direct input about release rates in the presence of a specific set of materials interactions; in developing a model for release in the repository, these release figures will be incorporated according to the importance of those interactions. No single test can provide a universal release rate under the variable conditions in the unsaturated zone.