August 31, 2000

Dr. Stephan J. Brocoum, Assistant Manager
Licensing and Regulatory Compliance
U.S. Department of Energy
Yucca Mountain Site Characterization Office
P.O. Box 30307
North Las Vegas, NV 89036-0307

SUBJECT: ISSUE RESOLUTION STATUS REPORT (KEY TECHNICAL ISSUE: EVOLUTION OF THE NEAR-FIELD ENVIRONMENT, REVISION 3)

Dear Dr. Brocoum:

As you know, the staff of the U.S. Nuclear Regulatory Commission (NRC) have developed a program for early resolution of technical issues at the staff level. Revision 0 of this Issue Resolution Status Report (IRSR) on the Key Technical Issue (KTI) of Evolution of the Near-Field Environment (ENFE) focused on defining those coupled thermal-hydrologic-chemical (THC) processes that will occur and affect a repository at Yucca Mountain (letter dated November 7, 1997, from N. K. Stablein to S. Brocoum). Revision 1 updated the discussion of the subissue on the chemical environment for the waste package to reflect the latest design of the waste package and introduced a new subissue on criticality in the near-field environment (letter dated August 28, 1998, from N. K. Stablein to S. Brocoum). Revision 2 focused on the application of the acceptance criteria, developed in the previous versions, to the U.S. Department of Energy (DOE) Viability Assessment (VA; letter dated July 14, 1999, from C.W. Reamer to S. Brocoum). Revision 3 (enclosure to this letter) updates the status of issue resolution based on information available to the staff prior to May 15, 2000. DOE models, abstractions, and analyses were assessed based on information provided in DOE's Total System Performance Assessment-Site Recommendation (TSPA-SR) Methods and Assumptions report, Revision 3 of DOE's Repository Safety Strategy, and the preliminary, draft, DOE Process Model Reports and Analysis and Model Reports that were available. Our review comments provide guidance on changes which we consider necessary such that an acceptable and high-quality license application can be prepared by DOE.

Consistent with NRC regulations on prelicensing consultations and a 1992 agreement with DOE, staff-level resolution can be achieved during prelicensing consultation. The purpose of issue resolution is to assure that sufficient information is available on an issue to enable the NRC to docket the license application. Resolution at the staff level does not preclude an issue being raised and considered during the licensing proceedings, nor does it prejudge what the NRC staff evaluation of that issue will be after its licensing review. Issues are "closed" if the DOE approach and available information acceptably address staff questions such that no information beyond what is currently available will likely be required for regulatory decision making at the time of initial license application. Issues are "closed-pending" if the NRC staff has confidence that the DOE proposed approach, together with the DOE agreement to provide

the NRC with additional information (through specified testing, analysis, etc.) acceptably addresses the NRC's questions such that no information beyond that provided, or agreed to, will likely be required at time of initial license application. Issues are “open” if the NRC has identified questions regarding the DOE approach or information, and the DOE has not yet acceptably addressed the questions or agreed to provide the necessary additional information in the license application. Pertinent additional information could raise new questions or comments regarding a previously “closed” issue.

Section 5 of the enclosed IRSR summarizes our independent pre-licensing review of some DOE documents supporting DOE’s SR. The staff recognizes the preliminary nature of the draft Analysis and Model Reports and Process Model Reports; specifically, they have not been accepted by DOE. Thus, the staff has not used the information contained in those draft documents to resolve any open subissues in this report. To aid the issue resolution process, however, the staff has reviewed and provided comments on the sufficiency of the information in the preliminary documents to address staff concerns. After a review of the final Process Model Reports or other documents that indicate DOE’s acceptance of the information in the preliminary documents, the staff will consider whether it is appropriate to close the subissues or any portion the subissues. We request that any technical exchange and management meeting to discuss issue resolution of the ENFE KTI be scheduled no sooner than 90 days after the last Analysis and Model Report or Process Model Reports supporting the SR is finalized and provided to NRC.

Based on available DOE documents, the ENFE subissue on coupled THC effects on seepage and flow (subissue 1) is “open.” To close this subissue DOE will need to provide technical bases for neglecting thermal alteration of non-welded units (i.e., Calico Hills unit and Paintbrush Tuff), demonstrate that thermal alteration of these units are unimportant to performance, or include the effects in abstracted models. In addition, DOE will need to provide the technical bases for exclusion of other Features, Events, and Processes (FEPs) that may impact repository performance (e.g., neglecting mineral precipitation in a highly localized zone at the interface between fractures and matrix, and cementitious materials (in ventilation shafts and tunnels) interacting with tuff host rock).

The ENFE subissue on coupled THC effects on the waste package chemical environment (subissue 2) is “open.” Because DOE has now included a drip shield in the proposed design for SR, the scope of subissue 2 has been expanded to address the drip shield chemical environment. DOE has made significant advances in its TSPA abstraction of the waste package chemical environment. However, two major assumptions: (1) coupled THC processes can be decoupled, evaluated separately, and then re-coupled without adversely affecting predictions of repository performance; and (2) reaction kinetics are unimportant (i.e., all reactions proceed to equilibrium) have inadequate technical bases. DOE will need to evaluate the potential for elevated fluoride concentrations in water contacting the drip shield to cause localized corrosion of the drip shield. In addition, DOE will need to provide the technical bases for exclusion of many other FEPs that may impact repository performance. We also note that the Waste Package Degradation Process Model Report does not assess the status of resolution with respect to the ENFE KTI.

Subissue 3 of the ENFE KTI addresses coupled THC effects on the radionuclide release and is “open.” DOE abstractions relevant to this subissue represent significant improvements relative to DOE’s approach used in the TSPA-VA and represent a constructive response to staff

reviews of the TSPA-VA. The potential effects of some THC processes (FEPs) were neglected without sufficient technical basis and DOE will need to provide adequate technical bases, for example, using sensitivity analyses, for neglecting these processes in their abstractions of the chemical environment for radionuclide release.

The ENFE subissue on coupled THC effects on the radionuclide transport (subissue 4) is "open." DOE made significant advances in its total system performance assessment abstraction of radionuclide transport through engineered and natural barriers. However, DOE will need to provide a more thorough technical basis or supporting calculations to justify a number of excluded FEPs, especially those based on low consequence. In addition, DOE must demonstrate that the effects of THC processes will not adversely affect fracture/matrix interactions and sorptive minerals found in the Calico Hills vitric units. Changes in fracture and matrix interaction could affect matrix diffusion and radionuclide retardation in the unsaturated zone. DOE must demonstrate that coupled THC effects on radionuclide transport are unimportant to performance, or include the effects in abstracted models.

The criticality subissue (ENFE subissue 5) is "closed-pending" resolution of open items concerning DOE's criticality analysis methodology raised in the NRC safety evaluation report and DOE documentation of the technical basis for screening of criticality FEPs in the performance assessment.

Since Revision 2 of the ENFE IRSR, there have been interactions between DOE and NRC at technical exchanges, Appendix 7 meetings, and DOE sponsored workshops where our concerns have been discussed. We have been encouraged with the response of DOE and its contractors and their efforts to address our concerns, in particular your efforts to release the preliminary draft FEPs database have substantially facilitated progress towards issue resolution. We note that DOE is currently revising all Analysis and Model Reports on FEPs, and we expect that our comments on your existing FEP analysis will be addressed in the revised reports. We will review your FEP screening analysis to determine its completeness and whether an adequate technical basis has been provided for those features, associated with coupled THC processes, that you have screened out from the performance assessment. Your FEP analysis and our review of the analysis will provide the best near-term opportunity to resolve subissues within the ENFE KTI.

We did receive formal comments from you on Revision 2 of the ENFE IRSR (letter dated March 22, 2000, from S. Brocoum to C.W. Reamer) and we would welcome your formal comments on Revision 3. We have addressed your comments on Revision 2 of the ENFE IRSR in this revision. We would like to note that we continue to have very successful interactions with DOE project personnel on the thermal testing program and appreciate the opportunity to attend the various performance assessment workshops. The enclosure should be viewed as a status report that provides the staff's most current views on documents related to the evolution of the near-field environment affecting the repository at Yucca Mountain that support DOE's SR.

We welcome a dialogue on the potential effects of the evolution of the near-field environment on the repository with DOE, the U.S. Nuclear Waste Technical Review Board, State of Nevada, and other interested parties. If you have any questions about this letter, please contact Bret Leslie of my staff at (301) 415-8063, or via internet mail service (bwl@nrc.gov).

Sincerely,

/RA/

Janet R. Schlueter, Acting Chief
High-Level Waste Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure: Issue Resolution Status Report (Key Technical Issue: Evolution of the Near-field Environment, Revision 3)

cc: See attached list

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Letter to S. Brocoum from J. Schlueter dated: August 31, 2000

cc: R. Loux, State of Nevada
S. Frishman, State of Nevada
L. Barrett, DOE/Wash, DC
A. Brownstein, DOE/Wash, DC
S. Hanauer, DOE/Wash, DC
C. Einberg, DOE/Wash, DC
D. Shelor, DOE/Wash, DC
N. Slater, DOE/Wash, DC
R. Dyer, YMPO
S. Brocoum, YMPO
R. Clark, YMPO
C. Hanlon, YMPO
T. Gunter, YMPO
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M. Voegele, M&O
S. Echols, Winston & Strawn
B. Price, Nevada Legislative Committee
J. Meder, Nevada Legislative Counsel Bureau
D. Bechtel, Clark County, NV
E. von Tiesenhousen, Clark County, NV
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L. Bradshaw, Nye County, NV
M. Murphy, Nye County, NV
J. McKnight, Nye County, NV
B. Ott, White Pine County, NV
D. Weigel, GAO
W. Barnard, NWTRB
R. Holden, NCAI
C. Williams, NIEC
R. Arnold, Pahrump County, NV
J. Lyznicky, AMA
R. Clark, EPA
F. Marcinowski, EPA
R. Anderson, NEI
R. McCullum, NEI
S. Kraft, NEI
J. Kessler, EPRI
R. Wallace, USGS
R. Craig, USGS
W. Booth, Engineering Svcs, LTD
J. Curtiss, Winston & Strawn