UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 2, 1999

Dr. Stephan J. Brocoum, Assistant Manager for Licensing
U.S. Department of Energy
Office of Civilian Radioactive Waste Management
Yucca Mountain Site Characterization Office
P.O. Box 30307
Las Vegas, NV 89036-0307

SUBJECT: IMPORTANCE ANALYSIS

Dear Dr. Brocoum:

Tim McCartin, of my staff, and John Greeves, Director, Division of Waste Management, attended the Nuclear Waste Technical Review Board (NWTRB) Repository Panel Meeting on January 25, 1999. They were particularly interested in the presentation by Dennis Richardson, M&O, on "Postclosure Defense in Depth in the Design Selection Process." Our interest arose because: (1) we have been exploring a similar analytical approach, "importance analysis," as a means of understanding the repository functioning, the role of various subsystems, and defense-in-depth through multiple barriers; and (2) some of the results presented were at variance with our intuition and knowledge of how the proposed Yucca Mountain repository works.

I believe this is a topic of potential significance for licensing that requires further discussion by our two staffs. To initiate this dialogue, I have enclosed two documents: (1) a copy of the report prepared by our contractor, the Center for Nuclear Waste Regulatory Analyses (CNWRA), "Importance Measures for Nuclear Waste Repositories," and (2) an analysis, with some discussion, of the impact on repository performance of juvenile failure of all waste packages. Both of these documents are based on the use of the U. S. Nuclear Regulatory Commission (NRC)/CNWRA total system performance assessment code, Total Performance Assessment (TPA), Version 3.1.4. This version of the TPA code: (1) provides no credit for cladding; and (2) uses a model of waste package performance that is not based on the latest U.S. Department of Energy (DOE) waste package design using C-22 as the corrosion-resistant material. Based on preliminary discussions we have had with your staff, there may be other significant differences between our analysis and the results obtained by the M&O. We are currently performing analyses using TPA Version 3.2, which we expect will better represent current DOE designs and compliance strategies.

The report, "Importance Measures for Nuclear Waste Repositories," articulates a method for determining the importance of a component or subsystem by "neutralizing" the functions of that component or subsystem and comparing the system performance with the component functions neutralized to the unperturbed system performance. The more important a component or subsystem is to achieving system performance, the greater the difference will be between unperturbed system performance and system performance with neutralized functions of the subsystem or component. An underlying assumption in this approach is that only the functioning of the subsystem or component under evaluation is to be neutralized; the remainder of the system should be left unchanged. This paper also provides an example of importance

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measures for various system components, based on the TPA 3.1.4 code. These results indicate that although "neutralization" of the waste package noticeably degrades total system performance, (doses are increased by about an order of magnitude), these increases in dose are substantially smaller than those shown by the M&O at the recent NWTRB meeting. Similarly, the NRC staff sensitivity analysis, in which all waste packages were assumed to fail at an early time, shows a noticeable increase in dose, but nowhere near the magnitudes indicated in the M&O analysis. We believe these differences in results may be attributable to: (1) differences in the concepts of neutralization and importance analysis; and/or (2) differences in how total system codes are used to represent the repository system.

I believe it is important to resolve these differences to the extent practicable. If the differences in results arise from different concepts of importance, this may indicate an underlying difference in the concepts for defense-in-depth. Since this is an important aspect of NRC's safety philosophy, we should examine these potential differences well in advance of licensing. If the differences in results arise from different representation of the repository in a total system code, we should examine those potential differences, as they may become important licensing issues. I request that the appropriate member of your staff arrange a meeting between NRC and DOE staffs, and their respective contractors, to discuss these matters. Please contact Dr. Keith I. McConnell of my staff, the manager responsible for this programmatic area.

Sincerely,

Michael J. Bell, Chief
Performance Assessment and High-Level Waste
Integration Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosures: As stated (2)

cc: See attached list

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Importance Measures for Nuclear Waste Repositories

Enclosure 1