December 11, 1995

Dr. Holly Dockery, Chair
Technical Program Committee
1996 International High-Level
Radioactive Waste Management Conference
American Nuclear Society
555 N. Kensington Avenue
La Grange Park, Illinois 60525

Dear Dr. Dockery:

Enclosed is a paper submitted for consideration of the IHLRWM 1996 Program Committee:

"POTENTIAL CHANGES TO TECHNICAL ISSUES IN HLW PERFORMANCE ASSESSMENT" by N. A. Eisenberg and R. G. Wescott

We recognize that it is now past the stated deadline of November 8, 1995, but we understand from conversations with members of the Committee, that this manuscript may still be accepted for review. Thank you for your attention to our submittals.

Sincerely,

Norman A. Eisenberg, Section Leader
Performance Assessment and
Health Physics Section
Performance Assessment and
Hydrology Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure: As stated

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POTENTIAL CHANGES TO TECHNICAL ISSUES IN HLW PERFORMANCE ASSESSMENT

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INTRODUCTION

The recent National Academy of Sciences report on the Technical Bases for Yucca Mountain Standards (TBYMS)[1] recommends a different regulatory approach for assuring safety of the proposed waste repository at Yucca Mountain. Although these recommendations raise significant policy issues[2], they also indicate significant changes in the set of technical issues, related to the performance assessment, that need to be resolved for demonstrating compliance with a standard consistent with these recommendations. Pending legislation[3,4] also mandates changes in the regulatory approach which, in general, have a smaller effect on the technical issues.

Currently the U.S. Nuclear Regulatory Commission (NRC) High-Level Waste (HLW) regulatory program is focused on evaluating "Key Technical Issues" (KTI's). During any given time period, the programmatic activities are planned to address one or more "Vertical Slice(s)" in selected KTI's. Each vertical slice is a focussed activity addressing an aspect of the KTI from top to bottom; e.g. the probability of volcanism would be addressed from the gathering of field data, their synthesis into a probabilistic model, and the use of such a model in a total system performance assessment. Both an evaluation of the U.S. Department of Energy (DOE) program and independent activities by the NRC would be encompassed in each vertical slice; but the emphasis would be on resolution of issues with the DOE. Currently KTI's are: (1) Igneous Activity, (2) Structural Deformation and Seismicity, (3) Container Life and Source Term, (4) Repository Design and Thermal-Mechanical Effects, (5) Unsaturated and Saturated Flow under Isothermal Conditions, (6) Thermal Effects on Flow, (7) Evolution of the Near-Field Environment, (8) Radionuclide Transport, (9) Total System Performance Assessment and Technical Integration, and (10) Support Revision of the U.S. Environmental Protection Agency (EPA) Standard and NRC HLW Rule. The last of these issues is a convenient way to organize this work, but is motivated by and directed toward the response to the changing regulatory environment. The changes to technical issues will be discussed for each of the first 9 KTI's.

DISCUSSION

Table 1 summarizes the changes to key features of the regulation as mandated either by the TBYMS report or by pending legislation. A more extensive discussion of these provisions, in the context of the existing NRC regulatory structure, is given in a companion paper to this.[2] In the following, the implications of these changes for each KTI are discussed.

Igneous Activity For pending legislation, igneous activity is expected to be treated in a performance assessment in a manner similar to that under current regulations. Since the performance period is 10^4 years in both cases, igneous activity will be viewed as a low probability event with potentially high consequences. Imposition of a dose standard under pending legislation will require estimation of the radiological sequelae caused by surficial and possibly atmospheric release of radioactive waste. Furthermore an incremental risk criterion, rather than the current probability criterion of 10^{-3}, could be used as a cutoff for event significance. Under TBYMS recommendations, the potentially longer performance period will increase the probability of a disruptive igneous event occurring and will raise the importance of the timing of such events.

Structural Deformation and Seismicity Under the pending legislation, the treatment of fault displacement through the geologic repository and seismicity will be similar to its current treatment. Under the TBYMS recommendations, the probability of occurrence of faulting and seismic events will increase with performance period. Furthermore, the probability of larger magnitude events will increase, possibly bringing them above the threshold for consideration. A seismic event approaching or equaling the deterministically estimated maximum credible earthquake is almost certain to occur during the longer performance period. These or other large earthquakes may even occur repeatedly. Certainly the repeated occurrence of lesser seismic events will be of concern in addition to cumulative displacement of repeated fault-slips.. Potential changes in flow and transport pathways due to fault and fracture propagation and attendant seismicity may also warrant consideration. Probability will still have to be factored into the analysis of consequences from seismic events, especially in regard to repeated events. The potential for changes in flow and transport pathways is expected to be evaluated through comparisons with historical events both within and outside of the Yucca Mountain Region.