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MEMORANDUM FOR: Lake H. Barrett, Chief
Engineering Branch
Division of Waste Management, NMSS

FROM: Enrico F. Conti, Chief
Waste Management Branch
Division of Radiation Programs
and Earth Sciences, RES

SUBJECT: DRAFT TECHNICAL POSITION ON REPOSITORY ENVIRONMENTAL PARAMETERS RELEVANT TO ASSESSING PERFORMANCE OF HIGH-LEVEL WASTE PACKAGES, NUREG-1076

Per request of Kien C. Chang of your staff, dated June 6, 1984, we have reviewed the subject report from ORNL. In general, the report presented an adequate summary of the state-of -knowledge regarding important environmental parameters for assessing the performance of HLW packages in a repository. All technical aspects of this report are based on existing data and information. We offer the following general comments.

1. A basic assumption of the technical position is the methods proposed by BNL (Sastre and Pescatore) to assess waste package reliability will be the acceptable technique. The BNL's reliability methods are based on probabilistic risk assessment (PRA) technique which requires extensive data bank and operational history to produce valid results. Such does not exist for HLW packages.

2. The technical position is very optimistic about the capability of various waste package assessment models available currently or in the near future. The models for waste packages and components described in pages vi, 1-7, and 1-8 are beyond the state-of-art.

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Attached is a summary of our estimate of the current state of modeling of HLW packages. You may find it useful in proceeding with the development of the technical position. If you have any questions, please contact Dr. Kyo S. Kim of my staff at X74637.

Enrico F. Conti, Chief
Waste Management Branch
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from HLW oversight committee report

5.3.2 PHENOMENOLOGY RELEVANT TO HLW DISPOSAL

There are four major categories of phenomena which have to be understood in order to predict the performance of a HLW repository: fluid mechanics, chemistry, heat transfer, and solid mechanics. The table below lists the potentials, associated extensive and specific intensive variables, and primary measures of movement or deformation for each of the four categories.

Category	Potential	Extensive Variable	Intensive Variable	Primary Measure of Movement or Deformation
Fluid mechanics	Pressure, gravity	Volume	Density	Fluid flow
	Frictional stress	Deformation rate	Strain rate	Strain rate
Chemistry	Chemical potential	Mass or mole number	Concentration	Flux of chemical species
Heat transfer	Temperature	Entropy	Specific entropy	Heat flux
Solid mechanics	Stress	Deformation	Strain	Strain

5.3.3 STATUS OF MODELING FOR DEEP GEOLOGIC DISPOSAL OF HLW

The current state of modeling of physical processes associated with deep geologic disposal of HLW is that the verbal description of what is expected to happen is better understood that the quantitative description. There remain uncertainties associated with both descriptions.

5.3.3.1 WASTE PACKAGE

Both the long term (300 - 1000 yrs) qualitative and quantitative models for the breachment of the overpack and canister of the waste package remain poorly understood. Reliable ways to project behavior from better understood short term models do not exist. Radiation and thermal effects on the degradation of overpacks and canisters are poorly understood for both the short and long terms.

Mechanisms of leaching and dissolution of radionuclides from the waste form are somewhat better understood. However, some controvesy remains over whether leaching or dissolution is the dominant release mechanism. The problem of modeling the influence of elevated temperature on the release of radionuclides from the waste form still needs to be solved.

Additional details on predicting waste package degradation and the release of radionuclides from the waste form are given in Section 5.1.