UNITED STATES
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WM DOCKET CONTROL CENTER

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MEMORANDUM FOR: Hubert J. Miller, Chief
Repository Projects Branch
Division of Waste Management, NMSS

FROM: Frank A. Costanzi, Chief
Waste Management Branch
Division of Radiation Programs
and Earth Sciences, RES

SUBJECT: BWIP SUPPORTING DOCUMENT "PROBABILISTIC MODELING OF RADIONUCLIDE RELEASE" BY B. SAGAR ET AL.

RES staff have reviewed the subject document and the Aerospace Corporation January 1985 progress report, which contains a review of the document.

We question the view of the Aerospace staff that "the Sagar report represents an acceptable overall approach to waste package performance assessment." The approach of the Sagar report ignores both the spatial and temporal changes in the environment of the underground facility that can be expected over time, and which may have significant effects on the time, quantities, concentrations, and chemical species of radionuclides released from the underground facility. For example, the Sagar report uses a Monte Carlo scheme based upon the assumption of strictly random package failures to model radionuclide release. However, the collective thermal behavior of the waste packages will be such that the resaturation history of a waste package at a corner of the emplacement area will be quite different from that of one in the center. From a simple picture where the "clock" on corrosion starts when the packing around the metallic overpack becomes damp, it is clear that the number of waste packages per unit time having their "clocks started" will be governed by the geometry of the repository and parameters of heat generation and fluid flow. The same sort of argument should apply to any physically realistic model, and indicates that a realistic approach to modelling release must at least take into account the perimeter to area ratio.

Whether this assumption of strictly random failures, or other similar simplifying assumptions introduce significant errors in calculations of repository performance is not known, and cannot be known with out first performing a more realistic analysis. Neither Aerospace nor the Sagar report give any indication that this has been done.

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LPDR ✓

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(Return to WM, 623-SS)

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Attached are some detailed comments on the Sagar report prepared by Dr. McNeil of my staff. I hope they are useful.

William R. Ott
for Frank A. Costanzi, Chief
Waste Management Branch
Division of Radiation Programs
and Earth Sciences, RES

Enclosure:
As Stated

COMMENTS OF M. MCNEIL ON "PROBABILISTIC MODELING OF RADIONUCLIDE RELEASE" BY B. SAGAR ET. AL.

- The report assumes that general corrosion is the dominant mechanism for failure. However, Fe_2O_3, FeOOH, and $Fe(OH)_3$ are all rather insoluble, and Fe tends to acquire a moderately protective film in almost any groundwater. To assume that general corrosion is so rapid as to rule out any prospect of localized corrosion or of environmentally assisted cracking one would need to assume that there was quite rapid flow of water and that either radiolysis or other mechanisms kept this water fairly well oxygenated. In saying "quite rapid" flow I mean flows comparable to that of surface groundwater in areas with significant rainfall.

- The data of Anantatmula et al. which are used to fit various parameters in the "container corrosion model" (section 2.1.1) were collected under extremely anoxic conditions. The approach to radiation effects in section 2.1.1 may only be valid under conditions so anoxic as to be irrelevant to repositories.

- There is no reason to believe that an Arrhenius plot (2.1.1, equation 1) is appropriate in a situation where the dominant reactions are surface reactions and water behavior is critical; use of the Arrhenius plot implicitly assumes invariance of mechanism.

- Unfortunately, it is not obvious how one should best model release from a repository. The non-independence of major variables such as temperature and local water chemistry makes it very difficult to apply simple Monte Carlo (or related) schemes. To do so confidently would require a demonstration that the coupling is so weak as to not significantly enter into the calculations of waste package/repository performance.