JUN. 17 1994

MEMORANDUM FOR: Joseph J. Holonich, Chief
High-Level Waste and Uranium
Recovery Projects Branch
Division of Waste Management/NMSS

FROM: Michael J. Bell, Chief
Engineering and Geosciences Branch
Division of Waste Management/NMSS

SUBJECT: COMMENTS ON SITE CHARACTERIZATION PROGRESS REPORT (PR) NO. 9.

Enclosed please find the comments on Progress Report No. 9 from the Engineering and Geosciences Branch.

Although the Geosciences/Geotechnical Engineering staff does have minor concerns on Progress Report No. 9, no new comments or questions have been generated. These concerns will be identified in study plan reviews. Also, although one SCA question (Question 17) had been closed, PR 9 still identifies it as open.

The Engineering and Material staff raised 3 new comments and 2 questions which are enclosed.

The comments have been compiled by A. K. Ibrahim, if you have any question please contact him at 415-6651.

(ORIGINAL SIGNED BY:)

Michael J. Bell, Chief
Engineering and Geosciences Branch
Division of Waste Management/NMSS

Enclosure: As stated

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ENCLOSURE

SECTION 2.2.2.7 Study 8.3.1.3.4.1 Activity 8.3.1.3.4.1.2 - Sorption as a function of sorbing element concentrations

QUESTION 1

Does activity 8.3.1.3.4.1.2 (Sorption as a function of sorbing element concentrations) include competitive sorption ?

BASIS

During spent fuel dissolution, sorption properties of radionuclides may be different from those obtained under controlled conditions. The controlled conditions for sorption measurements normally do not include several types of actinide ions (e.g. ions of U, Pu, Am and Cm). The coexistence of many different types of ions will lead to a competitive sorption of the ions; as a result, effective sorption coefficients will decrease. This concern is stated in a more generic way in the SCA Comment 25 and the YMP was expected to address this by writing Study Plan 8.3.4.2.4.1 Characterization of Chemical and Mineralogical Changes in the Post-Emplacement Environment. The NRC has not been provided with a copy of the study plan and the progress has not been discussed in the PR.

RECOMMENDATION

In future YMP work, include sorption experiments and studies to account for all actinide ions. Include discussion of work in this area planned for under Study Plan 8.3.4.2.4.1.

REFERENCE

NUREG-1347, Comment 25, October, 1989.

SECTION 2.6.1.3 Activity 1.10.2.3.3 - Criticality.

QUESTION 2

What design strategies are being considered by YMP to ensure long-term criticality safety in the design of the waste packages ?

BASIS

This section discusses the option of using ^{10}B enriched boron or other neutron absorber materials to ensure criticality safety. To compensate for a partial depletion of absorber materials, the PR states that extra neutron absorber material must be included initially to control criticality in the out years. However, over long time periods, the absorber materials, the spent fuels and indeed the containers themselves may lose their integrity and therefore may change criticality safety.

RECOMMENDATION

In future PR studies, address the effects of possible loss of absorber materials, spent fuels and the container on criticality safety. SECTION 2.6.1.3

Section 2.6.1.3 Activity 1.10.2.3 - Criticality.

COMMENT 1

This section discusses a number of important results concerning waste package designs including burnup credits and criticality potential of spent nuclear fuel as a function of time. However, no references are provided on documentation of the results.

BASIS

The NRC staff is informed of the results of studies stated in this section through technical NRC/DOE exchange. Nevertheless, documentation of study results should be referenced in the PR to support NRC evaluation of YMP's progress.

RECOMMENDATION

Future PRs should include up-to-date references where study results are documented.

SECTION 2.6.1.5 Design Activity 1.10.2.5 - Performance Evaluation
Activity 1.10.2.5.1 - Container oxidation and corrosion.

COMMENT 2

This section states that dry oxidation data for iron-based materials in the 100° - 250°C range are almost nonexistent. To obtain a penetration equation for dry oxidation for this temperature range, data at elevated temperatures, 454°C and 538°C, for air oxidation of carbon steels were extrapolated using Arrhenius approach. Oxidation rate for dry oxidation at all temperature of interest is assumed to be constrained by bulk diffusion of oxygen. Dry oxidation rate so obtained may therefore not be conservative.

BASIS

Grain boundary oxidation for alloys can occur at high temperatures (Rothman, 1986). The data discussed in this section were extrapolated to lower temperatures. This approach ignores the possibility that, at lower temperatures, grain boundary oxidation may occur and may not be constrained by matrix diffusion. If grain boundary oxidation does occur, the dry oxidation rate so obtained will be higher than the oxidation rate projected in the PR study.

RECOMMENDATION

In future PR studies, include consideration of grain boundary oxidation in the container penetration analysis.

REFERENCES

Rothman M.F., Oxidation Resistance of Gas Turbine Combustion Materials, Gas Turbine Conference and Exhibit, Houston, Texas, March 18-21, 1986.

NUREG-1347, Questions 49 and 50, October 1989.

SECTION 2.6.3.2 Activity 1.5.2.1 - Characterization of the Spent Fuel Waste Form
Subactivity 1.5.2.1.1 - Dissolution and leaching of spent fuel

COMMENT 3

In Subactivity 1.5.2.1.1, the flow-through dissolution data presented set an upper limit of dissolution rates of spent fuel under repository conditions. Perhaps, immersion test data may be very useful for the releases of C-14, Tc-99, I-129 and Cs-135.

BASIS

The releases of C-14 and fission products from the spent fuel dissolution tend to exceed EPA standards (Oversby, V.M. 1986 and Wilson, C.N. 1990). This postulate is based on our present understanding that (a) reprecipitated materials may not retain fission products, and (b) the spent fuel matrix may dissolve continuously.

RECOMMENDATION

The YMP needs to confirm the presence/absence of precipitates in spent fuel leaching and dissolution environment through immersion tests. In future PR studies, include the role of reprecipitates in the spent fuel dissolution.

REFERENCES

Oversby, V.M., Important Radionuclides in High Level Nuclear Waste Disposal: Determination Using A Comparison of the EPA and NRC Regulations, UCRL 94222, Feb. 1986.

Wilson, C.N., Results from NNWSI Series 3, Spent Fuel Dissolution Tests, PNL-7170, June 1990.

NUREG-1347, Appendix A CDSCP Comment 110, October 1989.