February 6, 1997

Mr. Donald D. Wodrich
Office of Tank Waste Remediation System
U.S. Department of Energy
Richland Operations Office
P.O. Box 550 MSIN S7-50
Richland, WA 99352

70-3091

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION - HANFORD INCIDENTAL WASTE CLASSIFICATION

Dear Mr. Wodrich:

U.S. Nuclear Regulatory Commission staff along with our contractor, the Center for Nuclear Waste Regulatory Analyses, are in the process of reviewing the "Technical Basis for Classification of Low-Activity Waste Fraction from Hanford Site Tanks" (Technical Basis), WHC-SD-WM-TI-699, Rev. 2, as requested in the November 7, 1996, letter from J. Kinzer, U.S. Department of Energy (DOE), to C. Paperiello, U.S. Nuclear Regulatory Commission. In the process of reviewing the Technical Basis, we have also examined several of the supporting references, including the "Hanford Low-Level Tank Waste Interim Performance Assessment" (Interim PA), WHC-EP-0884, dated September 16, 1996. With respect to the Interim PA, we have identified several issues that need to be resolved before NRC staff can fully evaluate your request for agreement that the Hanford tank waste planned for disposal on-site is incidental waste that would not be subject to NRC licensing authority. These comments address the effects of certain assumptions, models, or parameters on dose calculations with respect to meeting the third of the incidental waste classification criteria set forth in the March 2, 1993, letter from R. Bernero, NRC, to J. Lytle, DOE. The comments are listed in the Enclosure.

In order to facilitate the expedited review schedule requested in the November 7 letter, we would like to attempt to resolve these issues in a meeting (face-to-face, or through telecon or videocon) with you and with the PA staff that authored the Interim PA document. Please contact either Jennifer Davis at (301) 415-5874, or Richard Weller at (301) 415-7287 to set up a meeting. We would appreciate it if the meeting could be held very soon, as we are working to meet your scheduled completion date of April 1997.

Sincerely,

/S/

Michael J. Bell, Chief
Engineering and Geosciences Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

Enclosure: As stated
cc: J. Kinzer (w/encl)

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SPECIFIC COMMENTS FROM REVIEW OF THE
"HANFORD LOW-LEVEL TANK WASTE INTERIM PERFORMANCE
ASSESSMENT," WHC-EP-0884, REVISION 0

1. The Interim PA provides a value of an initial fractional radionuclide release rate of 4.4×10^{-6} for all radionuclides except ^{99}Tc, which has a rate of 8.8×10^{-7} (pp. iv and 3-32). These values for the fractional radionuclide release rate may be unrealistically low for the disposal facility. The Interim PA assumes that the fractional radionuclide release rates are limited by the fractional bulk dissolution rate of the glass. However, it is not clear how the fractional release rates for ^{99}Tc, a highly soluble nuclide, could be much smaller than the other isotopes in the glass. These values should be justified. For example, Kerrisk (1984) presents a detailed model for calculating fractional radionuclide release rates for vitrified pressurized water reactor high-level waste for 10 important radionuclides expected in the waste, based on nuclide solubilities, recharge rates, background concentrations of silica, and other factors. A similar evaluation would be appropriate for the Tank Waste Remediation System waste.

   Additionally, the bulk dissolution rate for glass does not necessarily determine the dissolution rate for high-solubility fission products in the glass (such as ^{99}Tc and ^{129}I), because many of these nuclides may have the ability to diffuse out of the glass, and may, therefore, have high release rates. These processes are not included in the Interim PA.

2. The K_d value for I (p. 3-27, Table 3-5) appears to be nonconservative. As standard practice, I is generally considered to be unretarded, i.e., $K_d = 1$ L/kg. (See also Sheppard and Thibault, 1990.) The value presented in the Interim PA, $K_d = 3$ L/kg is somewhat higher. This difference is expected to significantly affect the results. The value used should be altered or justified.

3. Some of the all-pathways dose conversion factors (DCFs) in the Interim PA (p. B-56, Table B-3) appear to be low compared with DCFs for other arid sites (LaPlante, et al., 1995). The Interim PA should include a more detailed technical justification for the selection of the DCFs, because evaluations of disposal facility performance are expected to be very sensitive to the values selected.

Enclosure

4. The derivation of the relative radionuclide release rate (pp. 3-33 and 3-34) may require modification. The equation in the center of page 3-33 describes the absolute radionuclide release rate (in Ci/yr) for the waste form as:

$$RRR(t) = C * S(t) * I(t)/V(t)$$

Where:

- RRR(t) = the radionuclide release rate (Ci/t)
- t = the time
- C = the constant corrosion rate (l/t)
- S(t) = the surface area of the waste form as a function of time (l^2)
- I(t) = the radionuclide inventory in the waste form as a function of time (Ci)
- V(t) = the volume of the waste form as a function of time (l^3)

Assuming that this equation is correct, the relative (or fractional) radionuclide release rate, FRRR(t), i.e., the fraction of radionuclide inventory release rate per unit time would be given by:

$$FRRR(t) = RRR(t)/I(t) = C * S(t)/V(t)$$

The waste area to volume ratio is expected to increase with time due to corrosion of the waste form and cracking due to formation of corrosion products. Because FRRR(t) is directly proportional to the waste area to volume ratio, this quantity would be expected to increase with time. On page 3-34, there is an expression for FRRR(t) that decreases with time. These considerations should be included in the Interim PA, because performance is likely to be highly sensitive to radionuclide release rate.

5. The Interim PA methodology is deterministic, and single values (sometimes best values) of parameters are used. The reviewers are concerned that if the range of measured parameter values were incorporated into the Interim PA, some performance limits might be exceeded. Uncertainty analyses should be performed in addition to the sensitivity analyses presented in the Interim PA.

6. There is insufficient justification for the assumption that the capillary barrier will be intact for 1000 years. The performance of this barrier will degrade with time. Similarly, the Interim PA assumes that the concrete vaults will be intact for 500 years. This assumption seems to be based on a U.S. Nuclear Regulatory Commission Branch Technical Position which specifies that the maximum credit that can be allowed for concrete structures is 500 years. A site-specific justification should be provided for this assumption, since occurrence of earthquakes and other natural events must be accounted for.

7. The infiltration rate of 0.5 mm/yr for the first 1000 years and 3mm/yr thereafter has not been adequately justified. These values may be unrealistically low, and contribution from lateral subsurface flow during storms has been neglected.

8. The release rate calculation appears unrealistic in that the dissolution time for the entire inventory is based on dissolution in still water. In flowing water, waste dissolution will be faster because the fresh water will provide for continuous attack on the waste form. The Interim PA acknowledges that performance results are dependent upon the release rate (pp. 3-32 and 3-35). The dissolution time calculations should be justified or altered.

9. The Interim PA uses an equation which appears to consider that the quantity of radionuclides transported to the base of the vadose zone is dissolved in a volume of water equal to the annual recharge (p. 3-61). This would be unrealistic and nonconservative, particularly for the second design option in which the vaults are interspersed by soil. The volume of water will be the portion of annual recharge that actually flows over the waste. The concentration calculated by the flow and transport code would appear to be more justifiable.

10. Flow and transport modeling neglects heterogeneity within layers, thereby omitting consideration of spatially distributed flow.

REFERENCES

Kerrisk, J.F., "Solubility Limits on Radionuclide Dissolution at a Yucca Mountain Repository," LA-9995-MS, Los Alamos National Laboratory, Los Alamos, NM, 1984.

LaPlante, P.A., S.J. Maheras, and M.S. Jarzemba, "Initial Analysis of Selected Site Specific Dose Assessment Parameters and Exposure Pathways Applicable to the Groundwater Release Scenario at Yucca Mountain," CNWRA 95-018, Center for Nuclear Waste Regulatory Analyses, San Antonio, TX, 1995.

Sheppard, M.I., and D.H. Thibault, "Default Soil/Solid Liquid Partition Coefficients, K_d , for Four Major Soil Types: A Compendium," Health Physics, Vol. 59, No. 4, pp. 471-482, 1990.