Docket 70

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

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97-TWR-003

Michael J. Bell, Chief
Engineering and Geosciences Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

70-3091

Dear Mr. Bell:

REQUEST FOR ADDITIONAL INFORMATION - HANFORD INCIDENTAL WASTE CLASSIFICATION

Reference: NRC letter from Michael J. Bell, to Donald D. Wodrich, RL, "Request for Additional Information - Hanford Incidental Waste Classification," dated February 6, 1997.

As requested in the above reference, attached is our response to your review comments of the "Hanford Low-Level Tank Waste Interim Performance Assessment," WHC-EP-0884, Revision 0, dated September 16, 1996. On February 12, 1997, copies of the document referenced in the attached responses, "Data Package for the Hanford Low-Level Tank Waste Interim Performance Assessment," WHC-SD-WM-RPT-166, Revision 0, dated August 1995, were transmitted.

It is my understanding that this information meets your needs and that a meeting on this subject is not needed at this time. If you have any questions or need additional information, please contact me on (509) 376-6550.

Sincerely,

DD Wodrich

Don Wodrich, Senior Technical Advisor
Office of Tank Waste Remediation System

TWR:DDW

Attachment

cc w/attach:
C. Peterson, NHC

NFOH 1/1

Response to Specific Comments from the Review of the
"Hanford Low-Level Tank Waste Interim Performance Assessment,"
WHC-EP-0884, Revision 0
(Comments contained in the letter from Michael J. Bell, NRC)

1a. *The comments suggest that the initial fractional release rate of $4.4x10^{-6}$ for all radionuclides except ^{99}Tc, which has a rate of $8.8x10^{-7}$ may be unrealistically low.* The actual waste form to be disposed is undergoing negotiation between the Department of Energy and two private vendors selected for phase 1 immobilization. Since the waste form is unknown, the base case of the interim performance assessment used the specifications that were included in the request for proposal [RFP] (and now included in the contracts). Please note that for the base case, the release rate for Tc is taken as $4.4x10^{-6}$.

Although this release rate is very low, experiments at the Argonne and Pacific Northwest National Laboratories have shown for a variety of low-level radioactive glass waste forms, this rate can be achieved for the temperatures and pHs expected in the disposal facility.

The initial rate will be determined by a 7-day PCT test and hence should be indicative of the forward rate of glass dissolution. Multi-year experiments at Argonne and Pacific Northwest Laboratories on LD6-5413, a typical low-level waste glass, show that the initial rate is indeed conservative for both Stage II and III of the glass dissolution process.

In addition, to using the release rate specifications, computer simulations based on experimental data for LD6-5412 were performed. These calculations show that the predicted release rate is much lower than required in the RFP.

1b. *The comments state that the release rate for Tc may not be lower than for other components.* For the base case of the interim performance assessment, the release rate for Tc was assumed to be the same as for other elements. The lower rate for Tc release in the RFP could be met in a variety of ways. The most likely way is to separate the Tc from the waste to be immobilized, as the specifications require the release rate calculated relative to the amount of material supplied to the vendor and not to the amount in the waste form. However, from the perspective of a performance assessment, the effect is the same as shown by the sensitivity cases.

1c. *The comments suggest that bulk glass dissolution does not necessarily determine the dissolution rate for high-solubility nuclides, which may be released at much higher rates by diffusion.* The only element that has been observed in experiments at Argonne and Pacific Northwest National Laboratories to be released faster than bulk dissolution is sodium. Experiments with actual vendor glasses are planned to determine whether the fission product nuclides are also subject to this release mechanism. Recent experiments at Argonne National Laboratory suggest that Tc may be bound in some of the secondary phases that are formed from dissolution of LD6-5412 and FLLW-1.

2. *The comments note that the Kd for iodine is usually taken to be 0 and that the interim performance assessment used 3 L/kg.* Kd values for the important elements are based on experiments using Hanford soils (see "Distribution Coefficient Values Describing Iodine, Neptunium, Selenium, Technetium, and Uranium Sorption to Hanford Sediments" by D.I. Kaplan and R.J. Serne, PNL-10379, Sup. 1 - March 1995. This document as well as others forming the data base for the interim performance assessment are contained in "Data Packages for the Hanford Low-Level Tank Waste Interim Performance Assessment," WHC-SD-WM-RPT-166, Rev. 0 - August 1995). Subsequent measurements and reanalysis confirmed that a non-zero Kd is appropriate for Hanford soils, although the value of 3 may be a bit too high.

   Argonne National Laboratory is measuring Tc release from LD6-5412 glass this year. Both Argonne and Pacific Northwest National Laboratories will measure release rates of actual vendor glasses made using actual Hanford tank waste starting next year.

3. *The comments state that dose conversion factors in the interim performance assessment appear to be low compared to other arid sites and should be documented.* The dose conversion factors are documented in "Data and Assumptions for Estimates of Radiation Doses for the Glass Low-Level Waste Interim Performance Assessment, P.D. Roadman, WHC-SD-WM-TI-707 - June 1995. This document as well as others forming the data base for the interim performance assessment are contained in "Data Packages for the Hanford Low-Level Tank Waste Interim Performance Assessment," WHC-SD-WM-RPT-166, Rev. 0 - August 1995). The values used are consistent with the values used in other Hanford risk assessments. Both the values and methods used were reviewed by the Hanford Environmental Dose Oversight Panel.

4. *The comments note that the surface area to volume of the waste form should increase with time due to corrosion and cracking.* As noted in the performance assessment, the simple assumption of uniform decrease in dimensions were used. As more is known about the waste form and its processing, cracking and other events will be included into the performance assessments.

5. *The comments note that interim performance assessment used point values and provided sensitivity studies. The comments suggest that an uncertainty analysis be performed.* The interim performance assessment was produced into order to provide confidence that the disposal of Hanford low-activity tank waste could be performed. Because it was produced so early in the project, many items (waste form, disposal facility location and design) were not known. Reasonable assumptions based on other projects were used for the estimation of values for the base case. Sensitivity cases were defined to determine the impact of these assumptions. For the performance assessments to be submitted for regulatory review, uncertainty analyses will be done.

6. *The comments note that the surface barrier is assumed to be intact for 1,000 years and that the concrete structure for 500 years.* Neither the surface barrier nor the concrete structures have been designed. The results from sensitivity studies assuming no credit for

such structures are very little different from the base case where credit for such structures is taken. The parameters (including design life) for the surface barrier come from work on the Hanford barrier ("Prototype Hanford Surface Barrier: Design Basis Document," D.R. Myers and D.A. Duranceau, BHI-0007 - November 1994). Research on the Hanford surface barrier is continuing. As the design of the disposal facility progresses, analyses to determine the degradation of the structure will occur. However, until design does start, assumptions based on other projects were thought suitable for the interim performance assessment.

7. *The comments suggest that the infiltration rates are not adequately justified. The effect of lateral subsurface flow during storms has been neglected.* The rates were taken from "Estimate of the Natural Ground Water Recharge for the Performance Assessment of a Low-Level Waste Disposal Facility at the Hanford Site" by M.L. Rockhold, M.J. Fayer, C.T. Kincaid, and G.W. Gee, PNL-10508, March 1995. (This document as well as others forming the data base for the interim performance assessment are contained in "Data Packages for the Hanford Low-Level Tank Waste Interim Performance Assessment," WHC-SD-WM-RPT-166, Rev. 0 - August 1995). The value for the first 1,000 years is based on the design specifications of the Hanford surface barrier. Testing of this surface barrier is continuing at Hanford and so far is meeting its specifications (even under precipitation rates of three times normal). The long-term infiltration rates are based on an extensive program at Hanford which has been very favorable reviewed by outside groups. The results of a program including long-term tracer measurements, lysimeter measurements, and computer simulations will be used in the performance assessments created for regulatory review.

   The cause of infiltration at the Hanford Site has been extensively studied. Lateral flow is seen at Hanford but its cause is suspected to be from geologic and hydraulic phenomena (non-horizontal layers, anisotropic hydraulic tensors) rather than storm related events. Since a disposal site is selected, characteristic of vadose zone properties will allow a better answer to these concerns.

8. *The comments indicate that the release calculations are unrealistic because they are based on dissolution is still water.* Because of the low infiltration rates, the waste if not in still water is in an environment in which the water hardly moves. The base analysis case assumes the forward rate of glass dissolution provides the maximum rate since it is based on distilled water. Moreover, the simulations of glass dissolution do assume flowing water but at rates consistent with water infiltration. These calculations show that the system is diffusion dominated with a very small advective component.

9. *The comments note that the contaminants are assumed to be diluted using the area of the disposal facility, not of the waste packages.* The computer model used in the base analysis case was a full facility model. The results of these simulations clearly show that the water and contaminants do spread laterally enough to cover the gaps between vaults in the alternate layout design. In fact, the calculations are conservative, since the lateral dispersion will extend beyond the area of the disposal facility.

10. *The comments note that the vadose zone modeling neglects heterogeneity within layers.* This is true. The site of the disposal action not yet been determined. Once the site(s) have been determined, then site characterization will be performed. The effect of any preferred flow paths will be determined.