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WSRC-RP-2005-01788
Rev. 0

Key Words:
TPBAR
LTA
UDQE
ILV

Retention:
Permanent

Impact of the Proposed Addition of 3 Un-extracted Cycle 6 TPBARs to the Lead Test Assembly

Prepared by:
Robert A. Hiergesell

October, 2005

Westinghouse Savannah River Company LLC
Savannah River Site
Aiken, SC 29808

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LIST OF ACRONYMS and ABBREVIATIONS

TPBAR	Tritium Producing Burnable Absorber Rod
ILV	Intermediate Level Vaults
LTA	Lead Test Assembly
SA	Special Analysis
UDQE	Unreviewed Disposal Question Evaluation

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Introduction

The Tritium Readiness Program is planning to ship three (3) additional unextracted Tritium Producing Burnable Absorber Rods (TPBARs) in the Lead Test Assembly (LTA) container to SRS for disposal. These rods are from the PIE (Post Irradiation Examination) program that is currently underway at ANL-W and will not have been extracted. The three rods were irradiated in Watts Bar Cycle 6 (irradiation was completed on February 22, 2005) after which they were sent to ANL-W for neutron radiography and gamma scanning. Once arriving at SRS, the LTA will be placed within the first TPBAR disposal container which will then be disposed within the Intermediate Level Vault (ILV). To determine the potential impact with respect to those performance measures, this UDQE addresses the proposed action to include the 3 PIE TPBARs, with an associated 2.8E+04 Ci of tritium, within the LTA.

The first TPBAR disposal container was previously evaluated to determine its suitability for disposal within the ILV in a Special Analysis (SA), see Hiergesell and Wilhite, 2004. At the time that investigation was conducted the plan was to place 32 unextracted TPBARs containing ~1.71E+05 Ci of tritium within the LTA. In addition to this, the first TPBAR disposal container is expected to contain 900 extracted TPBARs with an associated ~1.2E+05 Ci of tritium. That study concluded that the placement of the disposal container, along with the LTA and its original contents, could be disposed within the ILV without causing any exceedance of DOE Order 435.1 performance measures. It should be noted that the 900 extracted TPBARs are a bounding case for the purposes of the SA and that the current best estimate is that only 474 extracted TPBARs will actually be placed in the container.

In Hiergesell and Wilhite, 2004, one of the major considerations in determining suitability for disposal was evaluating the release of tritium from the disposal container and its subsequent migration from the ILV into the groundwater flow system. Part of the tritium source term in that investigation was the estimated tritium permeation rate from the LTA container, which is housed within the larger TPBAR disposal container. The calculation of the LTA tritium permeation rate was documented in a separate report, Vinson, et. al., 2004. The calculation was conservative and provided a worst-case, steady-state rate of 24 Ci/year.

Evaluation

To evaluate the question of whether the proposed addition of 3 unextracted TPBARs will have a significant impact on the suitability of disposing the initial TPBAR container within the ILV, a new calculation of the rate of tritium permeation through the LTA walls was conducted and is documented in Clark, 2005. The new analysis took into account the added 2.81E+04 Ci of tritium associated with 3 unextracted TPBARs (see email from Brizes to Hiergesell in the Appendix) as well as changes in the design features of the LTA that were proposed after the initial tritium permeation rate calculation. The increase from the previous LTA total of 1.71E+05 Ci to a new LTA total of 225,253 Ci, represents a 16.4 percent increase in the LTA tritium inventory. The increase of 2.8E+04 Ci represents only a 9.6 percent increase of the overall TPBAR disposal container inventory.

The LTA design change is reflected in the latest engineering drawings, INL PRO/E Drawing Number W0024-1750-ED-01, Sheet 2 of 3 and primarily involves switching from a box-shaped container to a cylindrically shaped container.

The new tritium permeation calculation indicates that despite the increase in tritium activity within the LTA, the worst-case, steady-state diffusion rate will be 15 Ci/year versus the originally calculated 24 Ci/yr. The reduction is attributed to the reduction in overall surface area of the new LTA container through which tritium can diffuse.

In addition to tritium, the 3 PIE TPBARs were handled in the ANL-W hot cell and it is assumed that they acquired a small quantity of surface contamination of other radionuclides. This issue was addressed in Hiergesell and Wilhite, 2004, and smear data from the hot cells (at PNNL and ANL-W) were used to estimate the bounding limit of contamination that might have been transferred to the TPBARs and the shrouds that they were held within. Since the 3 additional TPBARs were evaluated at ANL-W, the smear data from that hot cell were again utilized to estimate the bounding limit of any additional surface contamination that might have been acquired during testing. Using the same method of analysis as before and assuming that the 3 TPBARs were contained within several shrouds that will also be placed within the LTA, an estimate of the additional surface contamination was made. The maximum increase for any of the radionuclides was found to be ~ 1.1 percent more than was determined in Hiergesell and Wilhite, 2004. Considering that none of these radionuclides will escape the TPBAR disposal container during the 1000-year PA period of performance the slight increase in inventory of these radionuclides will have no impact on the suitability for disposing the TPBAR disposal container within the ILV.

Results

The new LTA tritium permeation rate of 15 Ci/yr (Clark, 2005) is less than the permeation rate utilized to determine the overall suitability of disposing the first TPBAR container within the ILV (Hiergesell and Wilhite, 2004). That Special Analysis concluded that the higher LTA tritium permeation rate, 24 Ci/yr, was inconsequential to the disposal suitability of the container. Therefore, since the higher LTA tritium permeation rate was found to be inconsequential with respect to disposal of the TPBAR disposal container, it is logical to conclude that the new, lower, tritium permeation rate is also inconsequential.

To complete this UDQE, the following questions, which must be addressed in any UDQE, are answered with respect to the proposed addition of 3 unextracted TPBARS to the LTA:

a. *Is the proposed activity or new information outside the bounds of the approved PA/CA (e.g., does the proposed activity or new information involve a change to the basic disposal concept as described in the PA/CA such as critical inputs/assumptions or an increase in inventory analyzed in the CA)?*

No. This activity is bounded by the approved PA/CA and does not involve any changes to the basic disposal concept of placing the TPBAR container within the ILV.

b. *Does the proposed activity or new information cause the PA/CA performance measures to be exceeded?*

No. The DOE Order 435.1 performance measures are not exceeded by the proposed action of adding 3 additional unextracted TPBARs to the LTA.

c. Would the radionuclide disposal limits in the approved PA need to be changed to implement the proposed activity?

No. While this UDQE addresses a small increase in tritium inventory (~1.71E+05 Ci to ~2.25E+5 Ci) and a very small increase in the inventory of other surface contamination radionuclides, the new design changes to the LTA container reduce the surface area through which tritium may diffuse such that the estimate of the permeation rate is lower than was previously calculated in the disposal authorizing SA. The fact that there is a very small increase (~ 1.1 percent) in non-tritium radionuclides is inconsequential since they will not escape either the LTA or TPBAR disposal container within the PA period of compliance.

d. Does the new information involve a change in the radionuclide disposal limits in the approved PA?

No. The new information about the geometric shape of the LTA container has the effect of reducing the estimated permeation rate of tritium through the LTA walls, thus no change to radionuclide disposal limits are needed.

e. Does the proposed activity or new information involve a change to the DAS?

No. Since neither the basic disposal concept nor disposal limits are changed from that evaluated in the SA and CA, the Disposal Authorization Statement will not be changed as a result of this proposed activity.

CONCLUSION

The proposed action of adding the 2.81E+04 Ci of tritium associated with 3 additional un-extracted TPBARs to the LTA can be accomplished without exceeding the previously estimated impact of placing the LTA within the first TPBAR disposal container. The miniscule increase in non-tritium radionuclides is inconsequential since the TPBAR disposal container effectively isolates the radionuclide contents over the PA period of compliance such that they cannot migrate away from the ILV.

REFERENCES

Clark, E.A., 2005. *Revised Estimate of Tritium Permeation Rate out of LTA Container*, SRNL-MTS-2005-20036, Savannah River National Laboratory, WSRC, Aiken, SC, 29808.

Email correspondence from William Brizes to Robert Hiergesell dated 9/07/05, *Clarification to Memo "Re: Additional TPBARs in LTA Container"*

Hiergesell, R.A., and E.L. Wilhite, 2004. *Special Analysis: Evaluation of the Proposed Disposal of the Initial TEF-TPBAR Waste Container within the E-Area Low-Level Waste Facility Intermediate Level Vault*. WSRC-TR-2004-00498, Rev. 0. Westinghouse Savannah River Company, Aiken, SC 29808.

INL PRO/E Drawing Number W0024-1750-ED-01, Sheet 2 of 3.

Vinson, D.W., K.H. Subramanian, and E.L. Clark, 2004. *Containment Materials Performance for TPBAR Disposa*l, WSRC-TR-2004-00374, Westinghouse Savannah River Company, Aiken, SC, 29808.

APPENDIX

Email from Brizes to Hiergesell:

William Brizes/WSRC/Srs
09/07/2005 09:44 AM

To: Robert Hiergesell/SRNL/Srs@Srs, Tom Butcher/SRNL/Srs@Srs
cc: bobby-d.smith@srs.gov, Catherine Flavin/BSRI/Srs@Srs, Elmer
Subject: Clarification to Memo "Re: Additional TPBARs in LTA Container"

Bob, 240 TPBARs were irradiated in Watts Bar Cycle 6.

* 215 TPBARs have been sent to SRS and are being stored in LWT Cask 8.
* 19 TPBARs will be sent to SRS in October 2005 and will be stored in LWT Cask 6.
* 3 TPBARs were sent to PNNL for PIE.
* 3 TPBARs were sent to ANL-W for neutron radiography and gamma scanning.

TOTAL 240 TPBARs

The 3 TPBARs that were sent to ANL-W will be included in the LTA TPBAR shipment that will be made to SRS. (September 2006 to October 2007) The three rods will be cut into four foot lengths and will not be extracted. PNNL will handle their 3 TPBARs.

The Cycle 6 irradiation was completed February 22, 2005. Each rod contained 0.974 grams of tritium at the time the reactor was shut down.

We have submitted a Draft of the FY06 AOP. However, will additional funding be required in FY06 to support the inclusion of three additional TPBARs in the LTA TPBAR shipment? Is the analysis of the 32 LTA TPBARs bounding/conservative enough to include the 3 PIE rods from Cycle 6?

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