West Valley Demonstration Project

WVES LLC

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Subject	:	Melter Flushing Technical Report
To	:	L. E. Rowell AC-COMM
cc	:	M. L. Agnew WV-PL7 D. C. Meess AC-EA
Keywords:		Melter Flushing, Vitrification System, Evacuated Canisters, Nuclear Regulatory Commission
Reference	:	Letter, Docket No. P00M-032, (ADAMS Accession Number ML111151406) "Request for Additional Information on the Draft Waste Incidental to Reprocessing Evaluation for the Vitrification Melter," from Larry W. Camper; Division of Waste Management and Environmental Protection to Mr. Frank Marcinowski; Nuclear Regulatory Commission, dated May 10, 2011

As a result of recent Nuclear Regulatory Commission (NRC) consultation and review associated with DOE's Waste Incidental to Reprocessing Evaluation for the WVDP Melter, some questions have emerged regarding the extent of removal of radioactivity from the Melter prior to its shut down in September 2002. Of particular interest is the impact of processing feed batch materials comprised of vitrification system flushing solutions. The attached technical paper describes a simplified model that provides some insight into this removal question.

As part of retiring the WVDP Vitrification System from service in 2002, a series of system, equipment and component flushes were performed. These flushes were performed with the primary objective to transfer to the Melter as much HLW as technically and economically practical and at the earliest opportunity so that it could be vitrified.

Of the 68 total batches processed through the WVDP Melter, the last two, Batches 76 and 77, were comprised of these flush solutions. Through the combined result of over 100 separate airlifts, there are eight production canisters that contain Batch 76 and 77 feed materials (excluding the Evacuation Canisters).

Processing of these flush solutions from the Melter by airlifting molten glass into production canisters has the cumulative impact of progressively reducing the radioactivity content of the residual pool of molten glass in the melter cavity. Each airlift removes radioactivity that is replaced with less radioactive feed material made from the system flushes thereby reducing the overall inventory in the molten pool in a stepwise manner. During this processing, the volume of molten material in the Melter cavity stays nominally the same but its radioactive inventory decreases until no more feed material is available.

Attached for your reference is a technical paper that discusses this reduction, predicts its approximate magnitude, postulates the impact of further such reduction from processing enough non-radioactive feed material to make one more canister and concludes that such reduction is not economically practical.

This supports the conclusion that flushing of the Melter by processing these progressively less radioactive system flush solutions and then deploying the Evacuated Canisters has removed radioisotopes to the maximum degree technically and economically practical.

D.H Kurasch, Consulting Engineer IV

Attachment: Flushing of the West Valley Demonstration Project Vitrification Melter Technical Report

DHK:JMS

Flushing of the West Valley Demonstration Project Vitrification Melter

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Flushing of the West Valley Demonstration Project Vitrification Melter

June 7, 2011 D.H.Kurasch

Purpose

This paper estimates the impact from flushing of the West Valley Demonstration Project's Vitrification Melter as a result of processing the vitrification system's flushing solutions designated as Batches 76 and 77. An estimate is then made of the impact on the Melter's residual quantity of radioactive material that may have resulted from the processing of a hypothetical Batch 78 assumed to be comprised solely of non-radioactive feed materials to create one additional production canister. These conditions and results are all prior to the implementation of the Evacuated Canister System which physically removed glass from the WVDP Melter cavity as the final removal step prior to shutting off power to the Melter.

Unlike the Evacuated Canisters which reduced radioactive inventory in the Melter cavity by removing molten glass material, Batch flushing consisted of removing the radioactive inventory within a nominally constant volume of molten glass by progressively lowering the concentration of radioactivity within it. The following describes this in more detail.

Introduction and Background

The WVDP Melter processed 68 Batches of radioactive material (numbered 10 through 77) between July 1996 and September 2002. The WVDP Melter vitrified these Batches of radioactive material into 275 HLW production canisters and two evacuation canisters.

The Vitrification Analytical Sample Tracking report number 96-1758 for the first radioactive batch of material processed through the Melter designates this material as Batch 006. This first batch of radioactive feed material was subsequently referred to as Batch 10 for ease of downstream tracking purposes. It is surmised from this, that prior to Batch 10, five non-radioactive Batches were processed in the Melter. Such non-radioactive feed material served two useful purposes. It was used to confirm operability of the system and create the molten pool of glass needed by the WVDP Melter's design to heat and process radioactive material. This molten pool of glass was initially created using external heaters (which were removed after the molten pool had been acceptably established). Once created and maintained, the pool was kept molten via Joule heating whereby electrical current passed between the three electrodes inside the Melter's cavity using the molten glass as the conductor, thereby heating, mixing and maintaining the requisite molten pool of glass. It is likely that non-radioactive glass filled the surface pores, cracks and fissures in the surface of the refractory material that comprises the Melter cavity.

The West Valley Demonstration Project's vitrification system created 275 production HLW canisters between July 1996 and August 2002. These production canisters of vitrified HLW were filled using a process called airlifting.

Airlifting uses air under positive pressure to displace a volume of molten glass material in the outlet port of the Melter and push it into the discharge trough. The outlet port is a 3 inch diameter hole in one of the refractory blocks that slopes upward and away from the lower portion of the Melter cavity. There are two such outlet ports, one for each of the two independent pour spouts. The inlet side of the 3 inch diameter outlet port draws molten glass material from about 9.6 to

13.1 inches above the bottom of the molten pool. (Reference 1) The top of the molten pool of glass in the Melter's cavity in normal operation fluctuates between 23 and 26 inches from the bottom of the cavity (reference 2). The top of the outlet side of the outlet port at the top of its upward slope is 26 inches above the bottom of the Melter cavity. During an airlift, the added volume of air forces (i.e., "lifts") a volume of molten glass over the topmost point of the upward sloping outlet port into a downward sloping trough in the Melter's discharge cavity. The molten glass runs down the angled discharge trough by slope, geometry and gravity. At the end of the trough, the molten glass continues to fall by gravity, in a thin stream, straight down into an open canister positioned below.

Under normal operating conditions, molten glass is airlifted out of the bottom of the cavity faster than new material is added to the top of the Melter's molten pool. As a result, multiple airlifts, typically separated by hours to allow the molten pool to regain its operating height with the addition of new feed material, are used to completely fill a canister.

A starting level for the pool of molten glass was established for each canister made. Typically, this starting level was a nominal 26 inches. (The average of the actual values recorded for the canisters evaluated herein is 25.8 inches. See Attachment A, Level1) After an airlift was ended, the level of the molten pool in the Melter's cavity was allowed to return to this nominal starting operating level with new Batch material. On average, about 15 airlifts are needed to fill a canister in this manner. A single Batch of feed material makes 3 to 5 canisters of glass. During the processing of a Batch, feed material is slowly and continuously fed into the top of the Melter cavity from the Melter Feed Hold Tank (MFHT). In the Melter cavity this feed material is transformed by heat and chemistry and merged into the molten pool of glass. (Reference 2) Each airlift was done until the level of the molten pool in the Melter cavity dropped about ¾ inches. When achieved, airlifting was stopped, the level allowed to increase to the previously established operating level, and the process repeated. The before and after levels and the time they occurred were recorded as part of the records associated with each HLW canister made by the WVDP.

Pertinent to the discussion here, three Batches (the remainder of Batch 75, and the flush solution Batches 76 and 77) of feed material were processed into 10 canisters during 9 months of 2002 (References 3 & 4). Canister WV-402 (number 266 of 275 in sequence) was started on January 3, 2002. After 5 airlifts of material into this canister the west discharge port of the Vitrification Melter plugged. This was the 45th airlift associated with feeding Batch 75 material into the molten pool of glass in the melter cavity. The Melter's east discharge port was brought on line and canister WV-402 finished on May 7, 2002. A total of 16 airlifts were used to fill this canister, 5 from the west pour spout and 11 from the east.

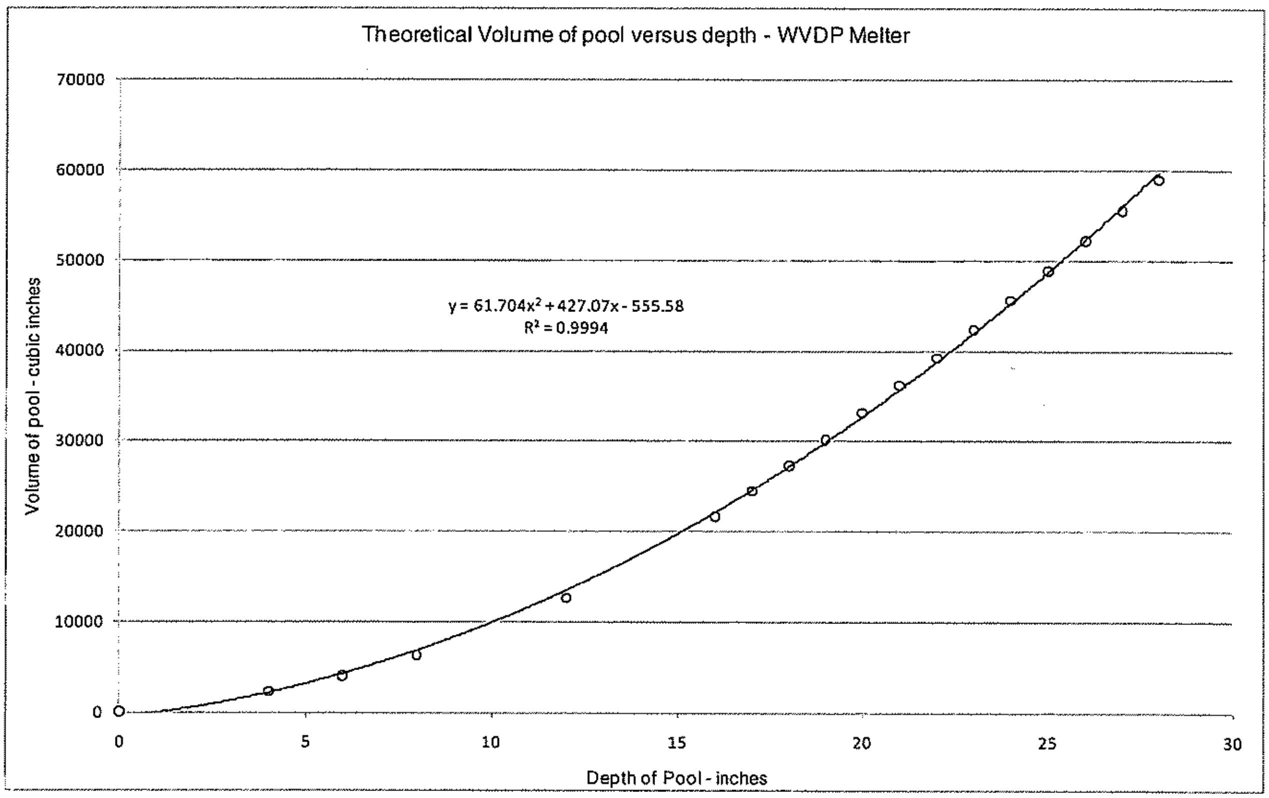
The next canister in sequence, WV-403 (number 267 of 275) was chosen as the starting point here. In total Batch 75 required 82 airlifts over a 5 month period to process. The first airlift into Canister WV-403 was the 57th of Batch 75. The last airlift was the 74th of Batch 75. This indicates that a substantive quantity of Batch 75 feed material had been added to the molten glass pool in the melter cavity by the time WV-403 was made. In addition, as a result of the time needed to switch from the west to the east discharge ports prior to making canister WV-403, this molten material had a relatively long residence time in the Melter cavity. This implies enhanced mixing. The next can in sequence, WV-405 (number 268 of 275) began the processing of the first Batch of solutions from flushing of the WVDP Vitrification System, Batch 76.

Melter Cavity Volume

The Melter cavity is comprised of two geometric shapes: an inverted truncated rectangular pyramid (for the first 16 inches) and a trapezoidal prism between the elevations of 16 and about 28 inches (Reference 5 and 6). The cavity volume at discrete heights using the Melter cavity geometry was calculated, plotted and curve fit in Microsoft Excel. The resulting equation and its goodness of fit are:

> Volume (in3) = $61.704 \times (X^2) + 427.07 \times (X) - 555.58$,
> Where X = depth of pool measured from bottom, in inches
> Goodness of Fit, $R^2 = 0.9994$

This is shown in the graph below.



At an assumed normal operating height of 26 inches, the cavity volume is estimated at 52,157 in^3. Reference 2 indicates a normal operating volume of 860 liters, which is 52,480 in^3. This is considered to verify these volume calculations.

Relative Radioactivity of Batches

Each Batch of material was sampled in the Concentrator Feed Makeup Tank (CFMT) after glass formula preparations were complete, prior to transfer to the Melter Feed Hold Tank for feed to the Melter.

Batches 10 through 69 measured Cs-137 and Sr-90. Batches 70 through 77 measured a broader suite of radioisotopes. This data is shown in the table below for Batches 75, 76 and 77 (Reference 7, 8 and 9) for those radioisotopes common to these three Batches.

This data shows that Batch 76, the first Batch comprised of vitrification system flush solutions, contains 51.49% of the radioactivity of Batch 75. Batch 75 was the last Batch of "purely" HLW transferred from Tank 8D-2 in the Waste Tank Farm. Similarly, Batch 77 contains 11.42% of the radioactivity of Batch 75. The radioactivity is dominated by Cs-137 which comprises more than 92% of the total radioactivity of Batch 75 and 97% of Batch 77.

Common Isotopes	Batch 75 µCi/gm	Batch 76 µCi/gm	Batch 77 µCi/gm
Am-241	3.82E+00	2.08E+00	4.80E-01
Co-60	2.96E-01	2.71E-01	2.46E-02
Cs-137	1.16E+04	6.25E+03	1.39E+03
Pu-238	1.27E+00	5.79E-01	1.04E-01
Pu-239+240	5.36E-01	2.10E-01	4.03E-02
Sr-90	8.70E+02	1.90E+02	4.27E+01
Total Activity Conc.	12,520.0	6,446.5	1,430.0
Relative Factor	1.0000	0.5149	0.1142

The official characterization of canister WV-403 in reference 10, shows it contains 1,992 kg of glass and 31,804 curies when decay corrected to the date it was made (May 13, 2002). Thus it has a curie density of 15.96 Ci per kg of glass. As discussed earlier, it is reasonable to assume that this canister represents Batch 75 feed material. Thus, with Canister WV-403 as the starting point, glass made from Batch 76 material would be only 51.49 % as radioactive as Batch 75 material or 8.22 Ci per kg. Similarly glass made from Batch 77 would be 1.82 Ci per kg.

Methodology

As noted above, this analysis starts with Canister WV-403 (267 of 275) for the starting point of this flushing estimate. As a result of a long residence time in the Melter's glass pool as a result of waiting for the switch from west to east discharge cavity as well as being the next to last canister to be made while Batch 75 material was being fed into the Melter, this Batch 75 material is considered to be especially well mixed and in a nominal steady-state condition with the addition of no new batch feed material.

For Canisters 267 through 275, the starting and ending heights of each airlift as recorded on the canister Airlift Data record sheet included in each canister's Canistered Waste Form Data Package (see reference 3 and 4) were entered into an Excel spreadsheet. Using the cavity volume equation presented earlier, these measured elevations were converted into a volume of glass in the cavity of the Melter. These were converted from cubic inches to cubic centimeters and using a glass density of 2.4 grams per cm^3 (the value used in mass balance calculations during vitrification operations in references 3 and 4) these were then converted into kilograms of glass. Thus subtracting before and after values, the kilograms of glass removed by each airlift were calculated. This data is shown is Attachment A for the nine canisters of interest here.

As described earlier, as each airlift occurs, some radioactive inventory (molten glass) is removed from the Melter's cavity. As this removal is taking place, new radioactive material (feed slurry) is being fed into the glass pool to replace the quantity removed by airlifting. For simplicity, the addition of this new material is not included in this calculation. Generally, if the new material coming into the Melter has less radioactivity than the material leaving, such as the case being examined here, the net effect is a gradual reduction of the curie density of the Melter's molten pool of glass.

Multiplying the kilograms of glass removed by each airlift by the curie per kilogram of glass in the Melter's pool yields an estimate of the curies removed from the Melter and transferred into a canister. Adding new feed material into the Melter's glass pool at a lower curie density (such as adding Batch 76 material to Batch 75 material and Batch 77 to Batch 76) to replace the volume of material removed by airlifting (and restore the height of the pool to pre-airlift values) has the net effect of slightly lowering the curie density of the residual pool prior to the next airlift. When the next airlift finally occurs, after the added material has become part of the molten glass pool in the Melter cavity, the subsequent airlift will remove molten glass at a slightly lower curie density than the previous airlift. This reduction continues for each subsequent airlift until the inventory of new Batch material is exhausted.

Attachment B shows the results of this calculation. Batch 75 uses the 15.96 curie per kilogram density calculated earlier. Batch 76 is assumed to be 51.49% less radioactive and Batch 77 is 11.42% less than Batch 75.

A theoretical Batch 78 is defined with a curie density of zero for the assumed 15 airlifts to fill a hypothetical canister number "276" to define the impact of such additional flushing.

Results

The results of this calculation are shown in the following figure. The figure shows that as the volume of glass in the Melter was maintained at nominally the same level and thus volume, the curies contained in that volume decreased as the flushing solutions were processed. With a starting inventory of about 30,000 curies at the end of processing Batch 75 feed material, the processing of Batch 76 flushing solutions progressively lowered the inventory to about 16,000 curies. The processing of the even less radioactive Batch 77, further reduced the inventory to about 4,300 curies.

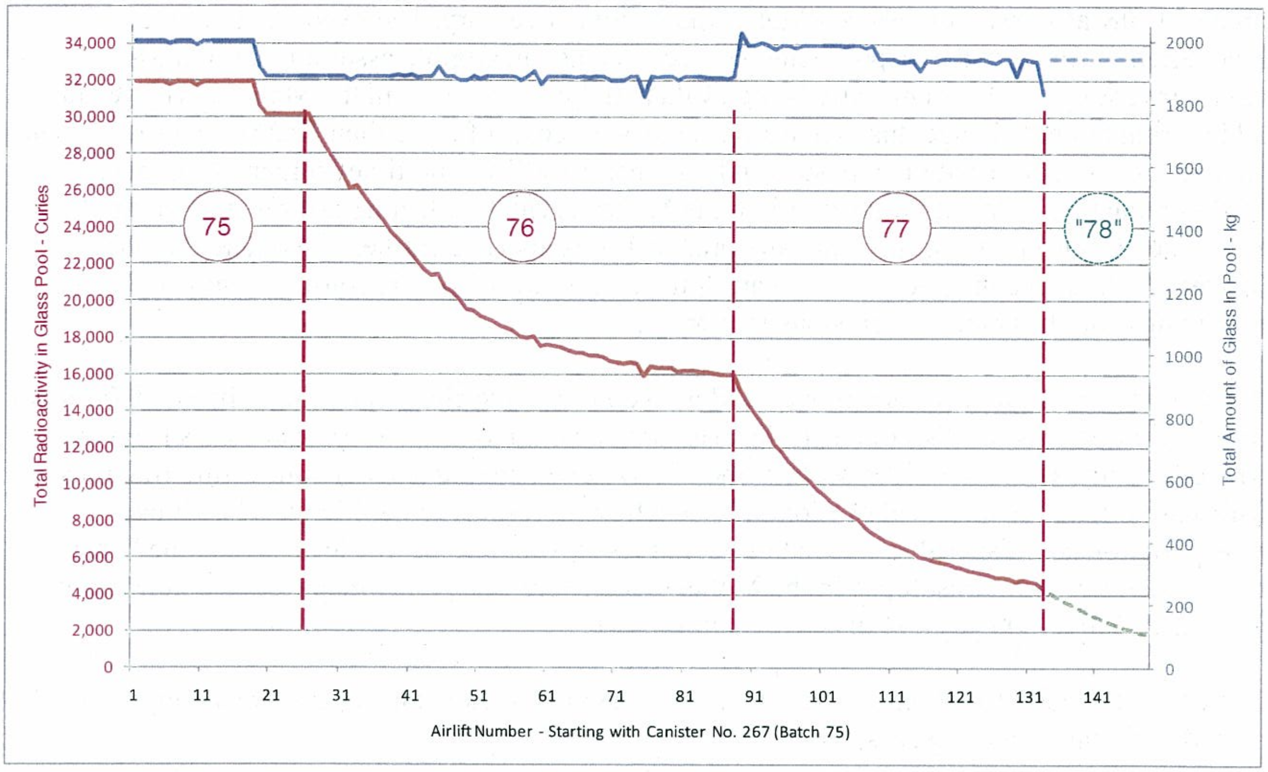
Combined, these flush-solution Batches are estimated to have removed 25,700 curies from the Melter through 107 individual airlifts of progressively less radioactive glass material.

There are two benchmarks that indicate the reasonableness of this evaluation. Canister WV-410, was one of a random 28 canisters for which a glass shard sample from the top of the canister was removed and analyzed. The Production Record for this canister (reference 10) indicates that based on this shard sample, this canister contains 7,914 curies and 2,024 kilograms of glass thus indicating a curie density of 3.91 curies per kilogram. The calculational results here (line 104 associated with 410.15 of Attachment B) predicts a curie density for the top of this canister (where the glass shard was taken) of 4.30 curies per kilogram with the subsequent curie density of the next airlift (line 105 associated with 411.15 of Attachment B) at 4.18 curies per kilogram. These predictions compare favorably with the 3.91 value that was based on the glass shard sample analysis for this canister.

Glass shards were also taken and analyzed from the Evacuation Canisters (reference 11). These analysis results indicate a composite curie density of 2.52 curies per kilogram of glass. The results calculated here (line 133 associated with 412.16 of Attachment B) predict a comparatively favorable curie density of 2.35 curies per kilogram.

Thus it is concluded that the methodology provides a reasonable prediction of the removal of radioisotopes from the Melter as a result of processing the flush solutions. These results also provide evidence of the degree of mixing that occurred within the Melter's pool of molten glass generally confirming and supporting the assumption of homogeneity of the glass in the Melter cavity.

The processing of a theoretical Batch 78 of non-radioactive feed material, assumed to be of sufficient quantity to make one more production canister in 15 airlifts, has been estimated to have reduced the curie inventory of the Melter's molten glass pool from 4,300 curies at the end of Batch 77 to about 1,800 curies at the end of this theoretical Batch 78. This is shown in lines H1 through H15 associated with Canister 276.01 through 276.15 in Attachment B.



Conclusions

Further reduction of the curie inventory in the Melter cavity by processing an additional assumed non-radioactive Batch 78 to make one additional production canister prior to execution of the Evacuated Canisters is not economically practical. The following describes this in more detail.

Theoretically, if this curie removal by processing flush solutions were continued, subsequent reductions in the curies contained in the Melter's molten pool of glass in the cavity would be predicted to occur. This pool of residual glass would get progressively less radioactive. With the Melter near the end of its design lifetime, the probability of a catastrophic Melter failure was getting higher. Such a failure would have inevitably and, for all practical purposes, permanently locked a cavity full of radioactive material in the Melter with little recourse for its removal. As a consequence, positive and timely action to reduce the inventory in a controlled, confident and predictable manner prior to terminating Melter operation (while things were apparently running reasonably smoothly) had a high priority.

Overall, the cost of an additional flushing (removal) cycle for the Melter (the filling of an additional canister) is projected to be greater than \$2.5M. Operator and public exposures associated with the removal, handling, packaging, storage and transportation of the Melter would be the same for the current case being evaluated (i.e., 275 production canisters followed by two Evacuation Canisters) and a theoretical case with less Melter radioactive inventory (i.e., 276 production canisters followed by two Evacuation Canisters).

Projected savings and avoided costs of raw material are estimated to be a onetime cost savings of about $100K as a result of reduced Melter radioactive inventory. The exposure to a future inadvertent intruder at the disposal site has been deemed negligible assuming current Melter cavity inventory levels as currently being evaluated. Less inventory in the Melter cavity would add margin but not change this conclusion. Thus with costs of more than $2.5M, no or negligible savings in operator or public exposure and less than $100K in one-time incidental savings, further reduction of the curie inventory in the Melter cavity by flushing prior to execution of the Evacuated Canisters is not economically practical. It is also and further noted here that the Melter's radioactive inventory that is part of the current evaluation is conservatively high. The following describes these conclusions in more detail.

In its current configuration as removed and with conservative characterization, the WVDP Melter meets requirements for disposal as LLW. The projected removal of additional curies from the Melter's cavity would make the Melter "more" low level, having a lower sum-of-the-fractions. This has no tangible technical or economic benefit with respect to the Melter's handling, transportation and disposal as a result of having less inventory. As low level waste, the hazard represented by the radioisotopes in the Melter's cavity are acceptably managed and nominally gone after 300 to 500 years of disposal in either case.

The estimated costs (in 2002 $) associated with making another canister conservatively sum to $2.5M (per canister) as discussed below.

- At the time of vitrification system operation, annual operating costs were estimated to be between $25M and $30M per year (reference 12). This means that vitrification operations cost more than $0.5M per week. It is assumed here that with reasonable preplanning, the making of a single new canister would have taken about two weeks from start to end, thus costing $1.0M.
- With no available repository for the HLW canisters, safe long term storage, to await the availability of an appropriate repository is included at the WVDP. A heavily shielded chamber in the site's Main Plant Process Building was prepared for this purpose. Annual costs associated with surveillance and maintenance of the central operating systems needed for this storage were nominally between $10M and $17M per year. With such costs justifiably allocated to the canisters being stored there, this amounts to more than $35K per canister per year. Such long term storage had been projected by DOE to be needed for more than 30 years (reference 13), bringing a single canister cost for such storage to more than $1.0M.
- There is a repository fee associated with the disposal of these canisters from the WVDP (reference 14). Although the fee has not yet been officially determined nor negotiated with New York State, DOE has been estimated (reference 15) that about $0.5M per canister is a reasonable nominal value. Thus an additional canister would add $0.5M to the total cost picture. In addition to the disposal fee, there would be a cost associated with transporting a HLW canister from the West Valley site to an appropriate repository; for conservatism, this cost is not included here.

The highest 3 meter dose rate emanating from the existing waste package containing the WVDP Melter is on the bottom of the package under the plugged west discharge port (reference 5). This would be unaffected by a reduction in the curie inventory in the Melter cavity.

The box into which the Melter was placed has 6 inch thick sides and 4 inch thick top and bottom providing both shielding and structural strength with respect to transporting a package the size and weight of the WVDP Melter. It is arbitrarily assumed here (without re-doing the detailed calculations that have been performed for this package) that as a consequence of there being fewer curies in the cavity of the Melter from a projected additional flush cycle and thus less overall dose, that the entire box could be made from 4 inch thick steel material. If this were the result there could be a potential economic benefit related to raw material costs for the package. A 2 inch reduction from the four sides represents about 60 ft^3 of flat steel plate material. This savings in raw material cost as well as subsequent reductions in handling and transportation to the site for use is estimated to be less than $100K.

Operator dose rates associated with the assumed making of an additional canister are not a comparative factor. With operations being fully remote and shielded no substantive change in operator dose is realized.

The cost, time, and operator exposures associated with dislodging, moving and placing the Melter package into its waste handling and transportation box would have nominally been the same irrespective of the curie content within the Melter cavity with no comparative benefit or difference. If the box had weighed less, due to thinner side material as postulated above, it would arguably be a little easier to lift and move into position but with negligible savings. Equipment and operator costs associated with such movements are dominated by those associated with the loaded box not an empty one and the sizes associated with such equipment would be similar to those actually used.

After disposal, an inadvertent intruder scenario at the disposal site could involve inadvertent exposure to the intruder as a result of discovery of the Melter package such as by digging. With an assumed 100 years of institutional control at the disposal site prior to such an event, nominally three half lives of Cs-137, the dose producing radioisotope in the Melter cavity, would have passed. The activity and dose would be about $1/8^{th}$ of what it is today. The NNSS disposal site has determined that the disposal of the WVDP Melter with its current cavity inventory level is negligible with respect to the limiting NNSS intruder scenario. Less inventory in the Melter's cavity, such as may have occurred with an additional removal cycle would add margin to this evaluation but not change the conclusion.

As a result of the above considerations, further reduction of the curie inventory in the Melter cavity by flushing prior to execution of the Evacuated Canisters is not economically practical.

References

1) West Valley Nuclear Services Company, Drawing, Melter Refractory Assy Block Details, Item 44, PNL-011-14, Rev. 5, Dated 3-5-93, ECN 6056

2) L.L. Petkus, Primary Process System 63I, WVNS-SD-63I, Rev. 8, dated 8-22-2002, West Valley Nuclear Services Company

3) West Valley Nuclear Services Company,WVNS Vitrification HLW Canistered Waste Form (CWF) Data Package, Official Record, Canister Number WV402, WV403, WV404, WV405, WV406, dated 09/17/01

4) West Valley Nuclear Services Company,WVNS Vitrification HLW Canistered Waste Form (CWF) Data Package, Official Record, Canister Number WV408, WV409, WV410, WV411, WV412, dated 05/22/02

Reference #	Canister No. (Sequence #)	Batch	Airlift Data	Melter Mass Balance Data
3	WV402 (266)	75	Pg 24, 25	Pg 26, 27
3	WV403 (267)	75	Pg 26, 27	Pg 28, 29
3	WV404 (269)	76	Pg 31, 32	Pg 35, 36
3	WV405 (268)	75 & 76	Pg 28, 29	Pg 31, 32
3	WV406 (270)	76	Pg 26,27	Pg 28, 29
4	WV408 (271)	76	Pg 27, 28	Pg 28, 29
4	WV409 (272)	76 & 77	Pg 31, 32	Pg 27, 28
4	WV410 (273)	77	Pg 26, 27	Pg 28, 29
4	WV411 (274)	77	Pg 30, 31	Pg 26, 27
4	WV412 (275)	77	Pg 27, 28	Pg 29, 30 & 33

5) Processing Equipment Characterization Results, WMG Report 4005-RE-024, Revision 3, dated May 2004, WMG, Inc

6) West Valley Nuclear Services Company, Drawing, Melter Refractory Assy Parts List & General Notes, PNL-011-01 through 18, latest Rev 10, dated 2/16/1996

7) West Valley Nuclear Services Company, Vitrification Analytical Sample Tracking (VAST), Concentrator Feed Makeup Tank Batch 75, VAST ID No. 01-2498, collection date 11-24-2001

8) West Valley Nuclear Services Company, Vitrification Analytical Sample Tracking (VAST), Concentrator Feed Makeup Tank Batch 76, VAST ID No. 02-0552, collection date 04-16-2002

9) West Valley Nuclear Services Company, Vitrification Analytical Sample Tracking (VAST), Concentrator Feed Makeup Tank Batch 75, VAST ID No. 02-1130, collection date 07-18-02

10) C. Wolniewicz, Radionuclide Inventory for HLW Canistered Waste Form Production records, WVNS-CAL-325, Rev. 2, dated 02-25-2010, West Valley Environmental Services LLC

11) West Valley Nuclear Services Company, Vitrification Analytical Sample Tracking (VAST), Evacuated Canisters, VAST ID No. 04-0073, and 04-0074, collection date 09-16-2002

12) West Valley Nuclear Services Company, WVDP Vitrification Fact Sheet, CPA1350MDJ, dated 01-23-1998

13) DOE, Site Utilization Management Plan, WVDP SUMP, DOE Ohio Field Office, dated August 2005

14) U.S. Congress, Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste, Title 10 Code of Federal Regulations, Part 961, 10CFR Part 961, as amended, original 04-18-1983

15) K.D.Sullivan, Western New York Nuclear Service center Site Wide Removal Alternative Technical Report, WSMS-WV-08-0002, dated December 2009, URS Washington Division,

Attachment A

Canister Fill Data From
WVNS Vitrification Canistered Waste Form Data Packages
(Airlift Data Work Sheets from SOP 63-28)
And Calculated kg of Glass Transferred by each Airlift

Canisters 267 through 275

Canister Fill Data From Operations Records - Canisters 267 through 275

Seq. No.	Can No.	AL#	Batch	Date	Time1	Time2	ΔTime	Level1	Level2	ΔLevel		kg Level1	kg Level2	Δkg
267	403	1	75	5/7/2002	22:08	22:30	0:22	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	2	75	5/8/2002	01:44	02:06	0:22	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	3	75	5/8/2002	04:54	05:17	0:23	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	4	75	5/8/2002	11:33	11:47	0:14	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	5	75	5/8/2002	15:55	16:15	0:20	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	6	75	5/8/2002	19:38	19:55	0:17	26.30	25.54	0.76		2,098.5	1,990.1	108.4
267	403	7	75	5/8/2002	23:35	23:44	0:09	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	8	75	5/9/2002	02:52	03:07	0:15	26.30	25.59	0.71		2,098.5	1,997.1	101.3
267	403	9	75	5/9/2002	05:56	06:14	0:18	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	10	75	5/9/2002	10:50	11:03	0:13	26.31	25.50	0.81		2,099.9	1,984.4	115.4
267	403	11	75	5/9/2002	14:48	15:03	0:15	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	12	75	5/9/2002	18:17	18:30	0:13	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	13	75	5/9/2002	22:46	23:07	0:21	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	14	75	5/13/2002	12:30	12:50	0:20	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	15	75	5/13/2002	15:30	15:45	0:15	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	16	75	5/13/2002	18:05	18:10	0:05	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	17	75	5/13/2002	20:43	21:09	0:26	26.30	25.60	0.70		2,098.5	1,998.5	99.9
267	403	18	75	5/13/2002	23:44	00:01	0:17	26.00	25.60	0.40		2,055.3	1,998.5	56.8
										12.48				**1,780.9**
268	405	1	75	5/14/2002	05:26	05:50	0:24	25.50	25.00	0.50		1,984.4	1,914.8	69.7
268	405	2	75	5/28/2002	13:37	14:09	0:32	26.50	24.80	1.70		2,127.4	1,887.2	240.2
268	405	3	75	5/28/2002	17:09	18:13	1:04	25.60	24.80	0.80		1,998.5	1,887.2	111.3
268	405	4	75	5/28/2002	20:54	22:08	1:14	25.90	24.80	1.10		2,041.1	1,887.2	153.8
268	405	5	75	5/29/2002	00:11	00:34	0:23	25.60	24.80	0.80		1,998.5	1,887.2	111.3
268	405	6	75	5/29/2002	02:40	03:00	0:20	25.50	24.80	0.70		1,984.4	1,887.2	97.2
268	405	7	75	5/29/2002	05:49	06:20	0:31	25.50	24.80	0.70		1,984.4	1,887.2	97.2
268	405	8	75	5/29/2002	08:23	08:40	0:17	25.50	24.80	0.70		1,984.4	1,887.2	97.2
268	405	9	76	5/29/2002	10:43	11:02	0:19	25.50	24.80		0.70	1,984.4	1,887.2	97.2
268	405	10	76	5/29/2002	13:10	13:37	0:27	25.50	24.80		0.70	1,984.4	1,887.2	97.2
268	405	11	76	5/29/2002	15:28	16:00	0:32	25.55	24.80		0.75	1,991.5	1,887.2	104.2
268	405	12	76	5/29/2002	20:40	21:30	0:50	25.52	24.79		0.73	1,987.3	1,885.9	101.4
268	405	13	76	5/30/2002	00:05	00:35	0:30	25.50	24.80		0.70	1,984.4	1,887.2	97.2
268	405	14	76	5/30/2002	02:51	03:38	0:47	25.50	24.70		0.80	1,984.4	1,873.6	110.9
										7.00	**4.38**			**1,586.0**
269	404	1	76	5/30/2002	05:48	07:12	1:24	25.52	24.80		0.72	1,987.3	1,887.2	100.0
269	404	2	76	5/30/2002	09:48	10:42	0:54	25.50	24.80		0.70	1,984.4	1,887.2	97.2
269	404	3	76	5/30/2002	14:56	15:12	0:16	25.50	24.80		0.70	1,984.4	1,887.2	97.2
269	404	4	76	5/30/2002	18:05	19:01	0:56	25.50	24.80		0.70	1,984.4	1,887.2	97.2
269	404	5	76	5/30/2002	21:05	21:40	0:35	25.50	24.80		0.70	1,984.4	1,887.2	97.2
269	404	6	76	5/31/2002	02:55	03:30	0:35	25.70	24.80		0.90	2,012.7	1,887.2	125.4
269	404	7	76	5/31/2002	12:36	13:56	1:20	25.51	24.81		0.70	1,985.9	1,888.6	97.2
269	404	8	76	5/31/2002	15:21	16:30	1:09	25.50	24.80		0.70	1,984.4	1,887.2	97.2
269	404	9	76	5/31/2002	18:17	19:11	0:54	25.60	24.81		0.79	1,998.5	1,888.6	109.9
269	404	10	76	5/31/2002	20:37	21:22	0:45	25.58	24.75		0.83	1,995.7	1,880.4	115.3
269	404	11	76	6/1/2002	00:05	00:45	0:40	25.80	24.80		1.00	2,026.8	1,887.2	139.6
269	404	12	76	6/4/2002	22:08	23:49	1:41	25.50	24.80		0.70	1,984.4	1,887.2	97.2
269	404	13	76	6/5/2002	01:45	02:57	1:12	25.50	25.00		0.50	1,984.4	1,914.8	69.7
											9.64			**1,340.4**
270	406	1	76	6/5/2002	07:44	08:11	0:27	26.06	24.80		1.26	2,063.9	1,887.2	176.7
270	406	2	76	6/5/2002	10:31	10:57	0:26	25.50	24.80		0.70	1,984.4	1,887.2	97.2
270	406	3	76	6/5/2002	13:06	13:26	0:20	25.50	24.70		0.80	1,984.4	1,873.6	110.9
270	406	4	76	6/5/2002	18:31	18:53	0:22	26.50	24.70		1.80	2,127.4	1,873.6	253.9
270	406	5	76	6/5/2002	21:12	22:00	0:48	25.50	24.80		0.70	1,984.4	1,887.2	97.2
270	406	6	76	6/5/2002	23:56	01:30	1:34	25.50	24.74		0.76	1,984.4	1,879.0	105.4
270	406	7	76	6/6/2002	07:00	07:21	0:21	25.59	24.80		0.79	1,997.1	1,887.2	109.9
270	406	8	76	6/6/2002	09:17	09:38	0:21	25.50	24.80		0.70	1,984.4	1,887.2	97.2
270	406	9	76	6/6/2002	11:52	12:13	0:21	25.50	24.80		0.70	1,984.4	1,887.2	97.2
270	406	10	76	6/6/2002	14:27	14:47	0:20	25.50	24.80		0.70	1,984.4	1,887.2	97.2
270	406	11	76	6/6/2002	17:02	17:18	0:16	25.60	24.80		0.80	1,998.5	1,887.2	111.3
270	406	12	76	6/6/2002	22:07	23:05	0:58	25.50	24.70		0.80	1,984.4	1,873.6	110.9
270	406	13	76	6/7/2002	03:07	03:44	0:37	25.80	24.79		1.01	2,026.8	1,885.9	141.0
270	406	14	76	6/7/2002	06:20	06:54	0:34	25.50	24.90		0.60	1,984.4	1,901.0	83.5
											12.12			**1,689.4**

Flushing of the West Valley Demonstration Project Vitrification Melter

June 7, 2011 D.H.Kurasch

Canister Fill Data From Operations Records - Canisters 267 through 275 (continued)

Seq. No.	Can No.	AL#	Batch	Date	Time1	Time2	ΔTime	Level1	Level2	ΔLevel		kg Level1	kg Level2	Δkg
271	408	1	76	6/7/2002	09:05	09:38	0:33	25.52	24.60		0.92	1,987.3	1,859.9	127.4
271	408	2	76	6/7/2002	13:00	13:24	0:24	25.50	24.80		0.70	1,984.4	1,887.2	97.2
271	408	3	76	6/7/2002	16:23	16:41	0:18	25.50	24.80		0.70	1,984.4	1,887.2	97.2
271	408	4	76	6/7/2002	19:55	20:15	0:20	25.50	24.80		0.70	1,984.4	1,887.2	97.2
271	408	5	76	6/7/2002	22:23	22:39	0:16	25.50	24.80		0.70	1,984.4	1,887.2	97.2
271	408	6	76	6/8/2002	03:02	03:25	0:23	25.55	24.75		0.80	1,991.5	1,880.4	111.1
271	408	7	76	6/10/2002	11:50	12:33	0:43	25.50	24.79		0.71	1,984.4	1,885.9	98.6
271	408	8	76	6/10/2002	14:04	14:37	0:33	25.50	24.75		0.75	1,984.4	1,880.4	104.1
271	408	9	76	6/10/2002	16:25	17:05	0:40	25.50	24.80		0.70	1,984.4	1,887.2	97.2
271	408	10	76	6/10/2002	20:23	20:48	0:25	25.50	24.80		0.70	1,984.4	1,887.2	97.2
271	408	11	76	6/11/2002	00:24	00:58	0:34	25.50	24.70		0.80	1,984.4	1,873.6	110.9
271	408	12	76	6/11/2002	03:24	03:39	0:15	25.50	24.70		0.80	1,984.4	1,873.6	110.9
271	408	13	76	6/11/2002	06:04	06:24	0:20	25.60	24.70		0.90	1,998.5	1,873.6	125.0
271	408	14	76	6/11/2002	08:23	08:36	0:13	25.50	24.80		0.70	1,984.4	1,887.2	97.2
271	408	15	76	6/11/2002	10:15	10:45	0:30	25.50	24.80		0.70	1,984.4	1,887.2	97.2
271	408	16	76	6/11/2002	14:11	14:38	0:27	25.40	24.30		1.10	1,970.4	1,819.3	151.1
											12.38			**1,716.6**
272	409	1	76	6/11/2002	19:40	20:25	0:45	25.50	24.80		0.70	1,984.4	1,887.2	97.2
272	409	2	76	6/11/2002	22:29	22:49	0:20	25.50	24.77		0.73	1,984.4	1,883.1	101.3
272	409	3	76	6/12/2002	00:46	01:09	0:23	25.50	24.80		0.70	1,984.4	1,887.2	97.2
272	409	4	76	6/12/2002	03:02	03:23	0:21	25.50	24.80		0.70	1,984.4	1,887.2	97.2
272	409	5	76	6/12/2002	05:02	05:25	0:23	25.50	24.70		0.80	1,984.4	1,873.6	110.9
272	409	6	76	6/12/2002	08:11	08:35	0:24	25.50	24.80		0.70	1,984.4	1,887.2	97.2
272	409	7	76	6/12/2002	11:36	11:59	0:23	25.50	24.80		0.70	1,984.4	1,887.2	97.2
272	409	8	76	6/12/2002	14:16	14:35	0:19	25.50	24.80		0.70	1,984.4	1,887.2	97.2
272	409	9	76	6/13/2002	20:06	20:34	0:28	25.50	24.77		0.73	1,984.4	1,883.1	101.3
272	409	10	76	6/13/2002	22:30	23:09	0:39	25.50	24.75		0.75	1,984.4	1,880.4	104.1
272	409	11	76	6/14/2002	01:02	01:30	0:28	25.50	24.75		0.75	1,984.4	1,880.4	104.1
272	409	12	76	6/14/2002	04:37	04:50	0:13	25.50	24.72		0.78	1,984.4	1,876.3	108.2
272	409	13	76	6/14/2002	12:55	13:22	0:27	25.50	24.80		0.70	1,984.4	1,887.2	97.2
272	409	14	77	8/5/2002	16:00	17:06	1:06	27.20	25.78	1.42		2,230.4	2,024.0	206.4
										1.42	**9.44**			**1,516.6**
273	410	1	77	8/6/2002	01:42	01:54	0:12	26.30	25.50	0.80		2,098.5	1,984.4	114.0
273	410	2	77	8/6/2002	03:31	03:41	0:10	26.20	25.50	0.70		2,084.0	1,984.4	99.6
273	410	3	77	8/6/2002	05:50	06:11	0:21	26.27	25.57	0.70		2,094.1	1,994.3	99.8
273	410	4	77	8/6/2002	07:59	08:06	0:07	26.26	25.50	0.76		2,092.7	1,984.4	108.2
273	410	5	77	8/6/2002	10:45	11:14	0:29	26.59	25.40	1.19		2,140.5	1,970.4	170.1
273	410	6	77	8/6/2002	13:28	14:10	0:42	26.20	25.50	0.70		2,084.0	1,984.4	99.6
273	410	7	77	8/6/2002	16:45	17:01	0:16	26.34	25.50	0.84		2,104.2	1,984.4	119.8
273	410	8	77	8/6/2002	18:44	18:56	0:12	26.20	25.45	0.75		2,084.0	1,977.4	106.6
273	410	9	77	8/6/2002	20:50	21:54	1:04	26.20	25.50	0.70		2,084.0	1,984.4	99.6
273	410	10	77	8/6/2002	23:55	00:10	0:15	26.20	25.50	0.70		2,084.0	1,984.4	99.6
273	410	11	77	8/7/2002	03:00	03:20	0:20	26.57	25.50	1.07		2,137.6	1,984.4	153.2
273	410	12	77	8/7/2002	05:39	05:56	0:17	26.35	25.50	0.85		2,105.7	1,984.4	121.2
273	410	13	77	8/7/2002	08:13	08:35	0:22	26.30	25.50	0.80		2,098.5	1,984.4	114.0
273	410	14	77	8/7/2002	10:18	10:28	0:10	26.20	25.50	0.70		2,084.0	1,984.4	99.6
273	410	15	77	8/7/2002	12:09	12:09	0:00	26.26	25.47	0.79		2,092.7	1,980.2	112.4
										12.05				**1,717.3**
274	411	1	77	8/7/2002	15:13	15:27	0:14	26.20	25.50	0.70		2,084.0	1,984.4	99.6
274	411	2	77	8/7/2002	17:08	17:27	0:19	26.20	25.50	0.70		2,084.0	1,984.4	99.6
274	411	3	77	8/7/2002	21:30	21:57	0:27	26.90	25.45	1.45		2,186.0	1,977.4	208.6
274	411	4	77	8/8/2002	00:45	01:28	0:43	26.50	25.50	1.00		2,127.4	1,984.4	143.0
274	411	5	77	8/8/2002	03:08	03:27	0:19	25.90	25.20	0.70		2,041.1	1,942.5	98.6
274	411	6	77	8/8/2002	05:50	06:20	0:30	25.90	25.20	0.70		2,041.1	1,942.5	98.6
274	411	7	77	8/8/2002	08:15	09:00	0:45	25.90	25.20	0.70		2,041.1	1,942.5	98.6
274	411	8	77	8/8/2002	13:39	13:51	0:12	25.90	25.13	0.77		2,041.1	1,932.8	108.3
274	411	9	77	8/8/2002	15:48	15:55	0:07	25.90	25.14	0.76		2,041.1	1,934.2	106.9
274	411	10	77	8/8/2002	17:48	17:55	0:07	25.90	25.15	0.75		2,041.1	1,935.6	105.5
274	411	11	77	8/8/2002	20:10	20:31	0:21	25.90	24.90	1.00		2,041.1	1,901.0	140.1
274	411	12	77	8/12/2002	03:00	03:30	0:30	25.90	25.16	0.74		2,041.1	1,936.9	104.1
274	411	13	77	8/12/2002	05:35	05:50	0:15	25.90	25.12	0.78		2,041.1	1,931.4	109.7
										10.75				**1,521.0**

Canister Fill Data From Operations Records - Canisters 267 through 275 (continued)

Seq. No.	Can No.	AL#	Batch	Date	Time1	Time2	ΔTime	Level1	Level2	ΔLevel	kg Level1	kg Level2	Δkg
275	412	1	77	8/12/2002	08:13	08:26	0:13	25.90	25.20	0.70	2,041.1	1,942.5	98.6
275	412	2	77	8/12/2002	10:40	11:05	0:25	25.90	25.20	0.70	2,041.1	1,942.5	98.6
275	412	3	77	8/12/2002	13:14	13:25	0:11	25.90	25.20	0.70	2,041.1	1,942.5	98.6
275	412	4	77	8/12/2002	15:40	15:58	0:18	25.96	25.20	0.76	2,049.6	1,942.5	107.1
275	412	5	77	8/12/2002	17:53	18:05	0:12	25.92	25.18	0.74	2,043.9	1,939.7	104.2
275	412	6	77	8/12/2002	19:58	20:08	0:10	25.93	25.16	0.77	2,045.3	1,936.9	108.4
275	412	7	77	8/12/2002	22:20	22:26	0:06	25.90	25.18	0.72	2,041.1	1,939.7	101.3
275	412	8	77	8/13/2002	00:50	01:00	0:10	25.87	25.12	0.75	2,036.8	1,931.4	105.4
275	412	9	77	8/13/2002	03:53	04:08	0:15	25.95	25.10	0.85	2,048.2	1,928.6	119.6
275	412	10	77	8/13/2002	06:41	07:23	0:42	25.92	25.20	0.72	2,043.9	1,942.5	101.4
275	412	11	77	8/13/2002	09:53	10:48	0:55	25.90	25.20	0.70	2,041.1	1,942.5	98.6
275	412	12	77	8/13/2002	12:01	12:24	0:23	25.09	24.80	0.29	1,927.2	1,887.2	40.0
275	412	13	77	8/13/2002	21:23	21:35	0:12	26.00	25.20	0.80	2,055.3	1,942.5	112.8
275	412	14	77	8/13/2002	23:53	00:40	0:47	25.90	25.16	0.74	2,041.1	1,936.9	104.1
275	412	15	77	8/14/2002	03:53	04:05	0:12	25.90	25.12	0.78	2,041.1	1,931.4	109.7
275	412	16	77	8/14/2002	09:29	10:17	0:48	25.95	24.38	1.57	2,048.2	1,830.1	218.1
										12.29			1,726.4

Attachment B

Curies in Molten Pool of Glass After Each Airlift

Canisters 267 through 275

And Hypothetical Canister 276

Curies in Molten Pool of Glass in WVDP Melter After Each Airlift - Canisters 267 through 275

AL#	Melter Cavity Start kg	Melter Cavity Start Ci/kg	Melter Cavity Add kg	Melter Cavity Add Ci/kg	Melter Cavity New kg	Melter Cavity New Ci/kg	Melter Cavity Remove kg	Can.AL#	Melter Cavity Remove Ci	Melter Cavity New kg	Melter Cavity New Ci
1	2012.7	15.97	85.8	15.97	2,098.5	15.97	99.9	403.01	1,595.0	1,998.6	31,909.6
2	1998.6	15.97	99.9	15.97	2,098.5	15.97	99.9	403.02	1,595.0	1,998.6	31,909.6
3	1998.6	15.97	99.9	15.97	2,098.5	15.97	99.9	403.03	1,595.0	1,998.6	31,909.6
4	1998.6	15.97	99.9	15.97	2,098.5	15.97	99.9	403.04	1,595.0	1,998.6	31,909.6
5	1998.6	15.97	99.9	15.97	2,098.5	15.97	99.9	403.05	1,595.0	1,998.6	31,909.6
6	1998.6	15.97	99.9	15.97	2,098.5	15.97	108.4	403.06	1,730.7	1,990.1	31,773.9
7	1990.1	15.97	108.4	15.97	2,098.5	15.97	99.9	403.07	1,595.0	1,998.6	31,909.6
8	1998.6	15.97	99.9	15.97	2,098.5	15.97	101.3	403.08	1,617.4	1,997.2	31,887.3
9	1997.2	15.97	101.3	15.97	2,098.5	15.97	99.9	403.09	1,595.0	1,998.6	31,909.6
10	1998.6	15.97	101.3	15.97	2,099.9	15.97	115.4	403.10	1,842.5	1,984.5	31,684.5
11	1984.5	15.97	114.0	15.97	2,098.5	15.97	99.9	403.11	1,595.0	1,998.6	31,909.6
12	1998.6	15.97	99.9	15.97	2,098.5	15.97	99.9	403.12	1,595.0	1,998.6	31,909.6
13	1998.6	15.97	99.9	15.97	2,098.5	15.97	99.9	403.13	1,595.0	1,998.6	31,909.6
14	1998.6	15.97	99.9	15.97	2,098.5	15.97	99.9	403.14	1,595.0	1,998.6	31,909.6
15	1998.6	15.97	99.9	15.97	2,098.5	15.97	99.9	403.15	1,595.0	1,998.6	31,909.6
16	1998.6	15.97	99.9	15.97	2,098.5	15.97	99.9	403.16	1,595.0	1,998.6	31,909.6
17	1998.6	15.97	99.9	15.97	2,098.5	15.97	99.9	403.17	1,595.0	1,998.6	31,909.6
18	1998.6	15.97	56.7	15.97	2,055.3	15.97	56.8	403.18	906.9	1,998.5	31,908.1
19	1998.5	15.97	0.0	15.97	1,984.4	15.97	69.7	405.01	1,112.8	1,914.7	30,570.1
20	1914.7	15.97	212.7	15.97	2,127.4	15.97	240.2	405.02	3,835.0	1,887.2	30,131.0
21	1887.2	15.97	111.3	15.97	1,998.5	15.97	111.3	405.03	1,777.0	1,887.2	30,131.0
22	1887.2	15.97	153.9	15.97	2,041.1	15.97	153.8	405.04	2,455.6	1,887.3	30,132.6
23	1887.3	15.97	111.2	15.97	1,998.5	15.97	111.3	405.05	1,777.0	1,887.2	30,131.0
24	1887.2	15.97	97.2	15.97	1,984.4	15.97	97.2	405.06	1,551.9	1,887.2	30,131.0
25	1887.2	15.97	97.2	15.97	1,984.4	15.97	97.2	405.07	1,551.9	1,887.2	30,131.0
26	1887.2	15.97	97.2	15.97	1,984.4	15.97	97.2	405.08	1,551.9	1,887.2	30,131.0
27	1887.2	15.97	97.2	8.22	1,984.4	15.59	97.2	405.09	1,515.0	1,887.2	29,415.1
28	1887.2	15.59	97.2	8.22	1,984.4	15.23	97.2	405.10	1,480.0	1,887.2	28,734.2
29	1887.2	15.23	104.3	8.22	1,991.5	14.86	104.2	405.11	1,548.3	1,887.3	28,043.3
30	1887.3	14.86	100.0	8.22	1,987.3	14.52	101.4	405.12	1,472.8	1,885.9	27,392.6
31	1885.9	14.52	98.5	8.22	1,984.4	14.21	97.2	405.13	1,381.4	1,887.2	26,820.9
32	1887.2	14.21	97.2	8.22	1,984.4	13.92	110.9	405.14	1,543.6	1,873.5	26,076.4
33	1873.5	13.92	113.8	8.22	1,987.3	13.59	100.0	404.01	1,359.2	1,887.3	25,652.8
34	1887.3	13.59	97.1	8.22	1,984.4	13.33	97.2	404.02	1,295.6	1,887.2	25,155.4
35	1887.2	13.33	97.2	8.22	1,984.4	13.08	97.2	404.03	1,271.3	1,887.2	24,683.1
36	1887.2	13.08	97.2	8.22	1,984.4	12.84	97.2	404.04	1,248.2	1,887.2	24,234.0
37	1887.2	12.84	97.2	8.22	1,984.4	12.61	97.2	404.05	1,226.2	1,887.2	23,806.9
38	1887.2	12.61	125.5	8.22	2,012.7	12.34	125.4	404.06	1,547.6	1,887.3	23,291.1
39	1887.3	12.34	98.6	8.22	1,985.9	12.14	97.2	404.07	1,179.7	1,888.7	22,922.0
40	1888.7	12.14	95.7	8.22	1,984.4	11.95	97.2	404.08	1,161.3	1,887.2	22,547.5
41	1887.2	11.95	111.3	8.22	1,998.5	11.74	109.9	404.09	1,290.2	1,888.6	22,172.2
42	1888.6	11.74	107.1	8.22	1,995.7	11.55	115.3	404.10	1,331.9	1,880.4	21,720.8
43	1880.4	11.55	146.4	8.22	2,026.8	11.31	139.6	404.11	1,579.0	1,887.2	21,345.4
44	1887.2	11.31	97.2	8.22	1,984.4	11.16	97.2	404.12	1,084.7	1,887.2	21,059.8
45	1887.2	11.16	97.2	8.22	1,984.4	11.02	69.7	404.13	767.8	1,914.7	21,091.1
46	1914.7	11.02	149.2	8.22	2,063.9	10.81	176.7	406.01	1,910.7	1,887.2	20,406.9
47	1887.2	10.81	97.2	8.22	1,984.4	10.69	97.2	406.02	1,038.7	1,887.2	20,167.3
48	1887.2	10.69	97.2	8.22	1,984.4	10.57	110.9	406.03	1,171.7	1,873.5	19,794.6
49	1873.5	10.57	253.9	8.22	2,127.4	10.29	253.9	406.04	2,611.6	1,873.5	19,270.4
50	1873.5	10.29	110.9	8.22	1,984.4	10.17	97.2	406.05	988.6	1,887.2	19,193.5
51	1887.2	10.17	97.2	8.22	1,984.4	10.07	105.4	406.06	1,061.9	1,879.0	18,930.7
52	1879.0	10.07	118.1	8.22	1,997.1	9.97	109.9	406.07	1,095.2	1,887.2	18,806.4
53	1887.2	9.97	97.2	8.22	1,984.4	9.88	97.2	406.08	960.3	1,887.2	18,645.1
54	1887.2	9.88	97.2	8.22	1,984.4	9.80	97.2	406.09	952.4	1,887.2	18,491.8
55	1887.2	9.80	97.2	8.22	1,984.4	9.72	97.2	406.10	944.9	1,887.2	18,346.0
56	1887.2	9.72	111.3	8.22	1,998.5	9.64	111.3	406.11	1,072.7	1,887.2	18,188.3
57	1887.2	9.64	97.2	8.22	1,984.4	9.57	110.9	406.12	1,061.1	1,873.5	17,926.2
58	1873.5	9.57	153.3	8.22	2,026.8	9.47	141.0	406.13	1,334.8	1,885.8	17,851.7
59	1885.8	9.47	98.6	8.22	1,984.4	9.40	83.5	406.14	785.3	1,900.9	17,877.0

Curies in Molten Pool of Glass in WVDP Melter After Each Airlift - Canisters 267 through 275 (cont)

AL#	Melter Cavity Start kg	Melter Cavity Start Ci/kg	Melter Cavity Add kg	Melter Cavity Add Ci/kg	Melter Cavity New kg	Melter Cavity New Ci/kg	Melter Cavity Remove kg	Can.AL#	Melter Cavity Remove Ci	Melter Cavity New kg	Melter Cavity New Ci
60	1900.9	9.40	86.4	8.22	1,987.3	9.35	127.4	408.01	1,191.6	1,859.9	17,395.7
61	1859.9	9.35	124.5	8.22	1,984.4	9.28	97.2	408.02	902.2	1,887.2	17,517.0
62	1887.2	9.28	97.2	8.22	1,984.4	9.23	97.2	408.03	897.2	1,887.2	17,418.9
63	1887.2	9.23	97.2	8.22	1,984.4	9.18	97.2	408.04	892.4	1,887.2	17,325.6
64	1887.2	9.18	97.2	8.22	1,984.4	9.13	97.2	408.05	887.8	1,887.2	17,236.9
65	1887.2	9.13	104.3	8.22	1,991.5	9.09	111.1	408.06	1,009.4	1,880.4	17,084.9
66	1880.4	9.09	104.0	8.22	1,984.4	9.04	98.6	408.07	891.4	1,885.8	17,048.5
67	1885.8	9.04	98.6	8.22	1,984.4	9.00	104.1	408.08	936.9	1,880.3	16,922.2
68	1880.3	9.00	104.1	8.22	1,984.4	8.96	97.2	408.09	870.8	1,887.2	16,907.2
69	1887.2	8.96	97.2	8.22	1,984.4	8.92	97.2	408.10	867.3	1,887.2	16,839.0
70	1887.2	8.92	97.2	8.22	1,984.4	8.89	110.9	408.11	985.7	1,873.5	16,652.4
71	1873.5	8.89	110.9	8.22	1,984.4	8.85	110.9	408.12	981.6	1,873.5	16,582.5
72	1873.5	8.85	125.0	8.22	1,998.5	8.81	125.0	408.13	1,101.5	1,873.5	16,508.6
73	1873.5	8.81	110.9	8.22	1,984.4	8.78	97.2	408.14	853.3	1,887.2	16,567.0
74	1887.2	8.78	97.2	8.22	1,984.4	8.75	97.2	408.15	850.6	1,887.2	16,515.5
75	1887.2	8.75	83.2	8.22	1,970.4	8.73	151.1	408.16	1,318.9	1,819.3	15,880.5
76	1819.3	8.73	165.1	8.22	1,984.4	8.69	97.2	409.01	844.3	1,887.2	16,393.4
77	1887.2	8.69	97.2	8.22	1,984.4	8.66	101.3	409.02	877.6	1,883.1	16,314.9
78	1883.1	8.66	101.3	8.22	1,984.4	8.64	97.2	409.03	839.9	1,887.2	16,307.7
79	1887.2	8.64	97.2	8.22	1,984.4	8.62	97.2	409.04	837.9	1,887.2	16,268.9
80	1887.2	8.62	97.2	8.22	1,984.4	8.60	110.9	409.05	953.9	1,873.5	16,114.1
81	1873.5	8.60	110.9	8.22	1,984.4	8.58	97.2	409.06	834.0	1,887.2	16,191.8
82	1887.2	8.58	97.2	8.22	1,984.4	8.56	97.2	409.07	832.2	1,887.2	16,158.6
83	1887.2	8.56	97.2	8.22	1,984.4	8.55	97.2	409.08	830.6	1,887.2	16,127.1
84	1887.2	8.55	97.2	8.22	1,984.4	8.53	101.3	409.09	864.0	1,883.1	16,062.1
85	1883.1	8.53	101.3	8.22	1,984.4	8.51	104.1	409.10	886.3	1,880.3	16,008.6
86	1880.3	8.51	104.1	8.22	1,984.4	8.50	104.1	409.11	884.7	1,880.3	15,979.7
87	1880.3	8.50	104.1	8.22	1,984.4	8.48	108.2	409.12	918.0	1,876.2	15,917.5
88	1876.2	8.48	108.2	8.22	1,984.4	8.47	97.2	409.13	823.2	1,887.2	15,983.8
89	1887.2	8.47	343.2	1.82	2,230.4	7.45	206.4	409.14	1,537.0	2,024.0	15,072.5
90	2024.0	7.45	74.5	1.82	2,098.5	7.25	114.0	410.01	826.2	1,984.5	14,382.2
91	1984.5	7.25	99.5	1.82	2,084.0	6.99	99.6	410.02	696.0	1,984.4	13,867.5
92	1984.4	6.99	109.7	1.82	2,094.1	6.72	99.8	410.03	670.4	1,994.3	13,397.1
93	1994.3	6.72	98.4	1.82	2,092.7	6.49	108.2	410.04	702.0	1,984.5	12,874.6
94	1984.5	6.49	156.0	1.82	2,140.5	6.15	170.1	410.05	1,045.7	1,970.4	12,113.3
95	1970.4	6.15	113.6	1.82	2,084.0	5.91	99.6	410.06	588.8	1,984.4	11,731.6
96	1984.4	5.91	119.8	1.82	2,104.2	5.68	119.8	410.07	680.4	1,984.4	11,269.7
97	1984.4	5.68	99.6	1.82	2,084.0	5.49	106.6	410.08	585.8	1,977.4	10,865.5
98	1977.4	5.49	106.6	1.82	2,084.0	5.31	99.6	410.09	528.6	1,984.4	10,531.3
99	1984.4	5.31	99.6	1.82	2,084.0	5.14	99.6	410.10	512.0	1,984.4	10,200.9
100	1984.4	5.14	153.2	1.82	2,137.6	4.90	153.2	410.11	751.1	1,984.4	9,729.1
101	1984.4	4.90	121.3	1.82	2,105.7	4.73	121.2	410.12	572.7	1,984.5	9,377.6
102	1984.5	4.73	114.0	1.82	2,098.5	4.57	114.0	410.13	520.7	1,984.5	9,064.7
103	1984.5	4.57	99.5	1.82	2,084.0	4.44	99.6	410.14	441.9	1,984.4	8,804.3
104	1984.4	4.44	108.3	1.82	2,092.7	4.30	112.4	410.15	483.5	1,980.3	8,518.2
105	1980.3	4.30	103.7	1.82	2,084.0	4.18	99.6	411.01	416.1	1,984.4	8,291.2
106	1984.4	4.18	99.6	1.82	2,084.0	4.07	99.6	411.02	404.9	1,984.4	8,067.8
107	1984.4	4.07	201.6	1.82	2,186.0	3.86	208.6	411.03	805.0	1,977.4	7,630.5
108	1977.4	3.86	150.0	1.82	2,127.4	3.72	143.0	411.04	531.3	1,984.4	7,372.7
109	1984.4	3.72	56.7	1.82	2,041.1	3.66	98.6	411.05	361.1	1,942.5	7,114.9
110	1942.5	3.66	98.6	1.82	2,041.1	3.57	98.6	411.06	352.4	1,942.5	6,942.3
111	1942.5	3.57	98.6	1.82	2,041.1	3.49	98.6	411.07	344.0	1,942.5	6,778.0
112	1942.5	3.49	98.6	1.82	2,041.1	3.41	108.3	411.08	369.2	1,932.8	6,588.6
113	1932.8	3.41	108.3	1.82	2,041.1	3.32	106.9	411.09	355.4	1,934.2	6,430.7
114	1934.2	3.32	106.9	1.82	2,041.1	3.25	105.5	411.10	342.5	1,935.6	6,283.1
115	1935.6	3.25	105.5	1.82	2,041.1	3.17	140.1	411.11	444.5	1,901.0	6,031.0
116	1901.0	3.17	140.1	1.82	2,041.1	3.08	104.1	411.12	320.6	1,937.0	5,965.8
117	1937.0	3.08	104.1	1.82	2,041.1	3.02	109.7	411.13	330.8	1,931.4	5,824.8

Curies in Molten Pool of Glass in WVDP Melter After Each Airlift - Canisters 267 through 275 (cont)

AL#	Melter Cavity Start kg	Melter Cavity Start Ci/kg	Melter Cavity Add kg	Melter Cavity Add Ci/kg	Melter Cavity New kg	Melter Cavity New Ci/kg	Melter Cavity Remove kg	Can.AL#	Melter Cavity Remove Ci	Melter Cavity New kg	Melter Cavity New Ci
118	1931.4	3.02	109.7	1.82	2,041.1	2.95	98.6	412.01	291.0	1,942.5	5,733.8
119	1942.5	2.95	98.6	1.82	2,041.1	2.90	98.6	412.02	285.7	1,942.5	5,627.9
120	1942.5	2.90	98.6	1.82	2,041.1	2.85	98.6	412.03	280.6	1,942.5	5,527.1
121	1942.5	2.85	107.1	1.82	2,049.6	2.79	107.1	412.04	299.0	1,942.5	5,423.4
122	1942.5	2.79	101.4	1.82	2,043.9	2.74	104.2	412.05	285.9	1,939.7	5,322.3
123	1939.7	2.74	105.6	1.82	2,045.3	2.70	108.4	412.06	292.3	1,936.9	5,222.6
124	1936.9	2.70	104.2	1.82	2,041.1	2.65	101.3	412.07	268.6	1,939.8	5,144.0
125	1939.8	2.65	97.0	1.82	2,036.8	2.61	105.4	412.08	275.3	1,931.4	5,045.5
126	1931.4	2.61	116.8	1.82	2,048.2	2.57	119.6	412.09	307.1	1,928.6	4,951.4
127	1928.6	2.57	115.3	1.82	2,043.9	2.53	101.4	412.10	256.1	1,942.5	4,905.5
128	1942.5	2.53	98.6	1.82	2,041.1	2.49	98.6	412.11	245.7	1,942.5	4,839.7
129	1942.5	2.49	-15.3	1.82	1,927.2	2.50	40.0	412.12	99.9	1,887.2	4,711.9
130	1887.2	2.50	168.1	1.82	2,055.3	2.44	112.8	412.13	275.4	1,942.5	4,743.0
131	1942.5	2.44	98.6	1.82	2,041.1	2.41	104.1	412.14	251.1	1,937.0	4,671.7
132	1937.0	2.41	104.1	1.82	2,041.1	2.38	109.7	412.15	261.3	1,931.4	4,600.2
133	1931.4	2.38	116.8	1.82	2,048.2	2.35	218.1	412.16	512.5	1,830.1	4,300.7

Curies in Molten Pool of Glass in WVDP Melter After Each Airlift - Hypothetical Canister # 276

AL#	Melter Cavity Start kg	Melter Cavity Start Ci/kg	Melter Cavity Add kg	Melter Cavity Add Ci/kg	Melter Cavity New kg	Melter Cavity New Ci/kg	Melter Cavity Remove kg	Can.AL#	Melter Cavity Remove Ci	Melter Cavity New kg	Melter Cavity New Ci
H1	1830.1	2.35	225.2	0.00	2,055.3	2.09	115.0	276.01	240.6	1,940.3	4,060.0
H2	1940.3	2.09	115.0	0.00	2,055.3	1.98	115.0	276.02	227.2	1,940.3	3,832.8
H3	1940.3	1.98	115.0	0.00	2,055.3	1.86	115.0	276.03	214.5	1,940.3	3,618.4
H4	1940.3	1.86	115.0	0.00	2,055.3	1.76	115.0	276.04	202.5	1,940.3	3,415.9
H5	1940.3	1.76	115.0	0.00	2,055.3	1.66	115.0	276.05	191.1	1,940.3	3,224.8
H6	1940.3	1.66	115.0	0.00	2,055.3	1.57	115.0	276.06	180.4	1,940.3	3,044.4
H7	1940.3	1.57	115.0	0.00	2,055.3	1.48	115.0	276.07	170.3	1,940.3	2,874.0
H8	1940.3	1.48	115.0	0.00	2,055.3	1.40	115.0	276.08	160.8	1,940.3	2,713.2
H9	1940.3	1.40	115.0	0.00	2,055.3	1.32	115.0	276.09	151.8	1,940.3	2,561.4
H10	1940.3	1.32	115.0	0.00	2,055.3	1.25	115.0	276.10	143.3	1,940.3	2,418.1
H11	1940.3	1.25	115.0	0.00	2,055.3	1.18	115.0	276.11	135.3	1,940.3	2,282.8
H12	1940.3	1.18	115.0	0.00	2,055.3	1.11	115.0	276.12	127.7	1,940.3	2,155.1
H13	1940.3	1.11	115.0	0.00	2,055.3	1.05	115.0	276.13	120.6	1,940.3	2,034.5
H14	1940.3	1.05	115.0	0.00	2,055.3	0.99	115.0	276.14	113.8	1,940.3	1,920.6
H15	1940.3	0.99	115.0	0.00	2,055.3	0.93	115.0	276.15	107.5	1,940.3	1,813.2