RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-10	Section 5.2 Waste Characterization, Section 6.4 of HDP-TBD-WM-906	Portion of Area 1 that is excluded	10CFR20.2002(a)	The northeast portion of Area 1 and Area 5 will be excluded from this request, but the exact boundary and methods for keeping the materials from intermixing with materials that will be sent to USEI are not described.	Provide a detailed description (e.g., enlarged map with discernable boundaries) that delineates the boundaries of the areas that will be excluded from this request. Describe the procedures for ensuring that the excluded wastes will not be intermixed with other wastes prior to shipment.
Response Summary: A figure showing the areas excluded from this request is provided.					
Response Detail: The attached Figure A to RAI CH-10 is an actual picture of the slabs. During the application of fixative to the surface of the slabs, different colors were added to the fixative to denote areas that were included (green) and excluded (blue). The same type of identification and control measures (e.g., separate staging areas and containers) used to segregate burial pit soil/debris that do not meet USEI criteria will be employed for the excluded portions of the concrete slabs, piping and miscellaneous equipment.					

Figure A to RAI CH-10. Concrete Slab Color Designations
Green fixative indicates the portion of the slab that is included in the additional 20.2002 request.
Blue fixative indicated the portion of the slab that is excluded in the additional 20.2002 request.

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-11	Section 5.2.2 Piping, Section 7.0 of HDP-TBD-WM-906	Missing Units	10CFR20.2002(a)	There are no units provided in Table 7-2 of HDP-TBD-WM-906.	Clarify units.
Response Summary: Typographical error.					
Response Detail: The units for the values in Table 7-2 of HDP-TBD-WM-906 are g/cm^3.					

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-12	Section 5.2.2 Piping, Section 7.0 of HDP-TBD-WM-906, Appendix G.	Piping Characterization Incomplete	10CFR20.2002(a)	Table 7-3 assumes the same piping inventory for Building 253, 254, 255, and "Outside". These inventories appear to be the maximum of "Outside Process Building" or Building 255 from Appendix G. Appendix G does not include data for Building 253 and 254.	Please include data for Building 253 and 254 in Appendix G if it is available. If no such data exists, please describe why the values assumed for these buildings in Table 7-4 are adequate.

Response Summary: Samples were not collected from piping underneath Buildings 253 and 254 since in-situ gamma radiation measurements of this piping did not detect radiation levels greater than the instrument detection level (0.1 mR/hr). The response to RAI-GEN-1 addresses establishment of a procedure for survey/sampling of piping after its excavation.

Response Detail: The piping associated with Building 253 consists of a 10 inch PVC main line with inputs from roof drains as it proceeds from the southern boundary to the building northwards. This line terminates at Manhole #8 from which a sample was collected. The sample result (1431-MS-101011-15-1 from Figure 1 of Appendix G of HDP-TBD-WM-906) at Manhole #8 is included in the data set (Appendix G data excluding Buildings 240 and 260) from which the maximum value was selected and assigned to the Building 253 piping.

The piping associated with Building 254 consists of a 15 inch reinforced concrete main line with inputs from roof drains and input from one process drain that originates in Building 255. Three samples (1404-MS-101014-15-1, 1461-MS-101022-15-1, 1428-MS-101019-16-1) were collected from Building 255 process piping that feed into the line that inputs to the 15 inch reinforced concrete main line. All three sample results were included in the data set from which the maximum value was selected and assigned to the Building 254 piping.

While data specific to Buildings 253 and 254 piping is not available, use of the maximum sample concentration from piping that is from “Outside Process Building” and from Building 255 is conservative based on:

- The piping that feed (primarily roof drains) the piping specific to Building 253 and 254
- The lack of elevated in pipe radiation levels, and
- Inclusion of sample results from the upstream feed piping in the data set from which the surrogate value was determined.

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-13	Section 6	MicroShield ®[1] modeling of worker dose	10CFR20.2002(d)	Some of the parameters used in the MicroShield calculations for the worker dose differ from those used by Westinghouse in the May 2009 20.2002 request and it is not clear why: • The orientation of the excavator and the stabilization workers in relation to the gondola is different in this request • The shield is used for determining buildup in the excavator and stabilization worker scenarios in the current request, while the source was used for buildup in the previous request • The thickness of the shielding for the gondola surveyor is less in the current request (0.794 cm) than in the previous one (2.53 cm) Also, note that the geometry assumed for the stabilization tank as the source of exposure to the stabilization worker in both this HDP request and the May 2009 request was assumed to be gondola shaped. This differs from the geometry (a cube) assumed in 20.2002 requests submitted by other licensees also involving shipments for disposal at USEI. Given that the disposal site and process is the same for these cases, no explanation was provided as to the basis for the differences in source configurations.	Describe the basis for changing the values for these parameters for these scenarios from the May 2009 submittal. The Microshield® model utilized by Westinghouse to calculate the dose to the stabilization operator assumed the source was shaped as a gondola and that the operator was located 2 m away from the source. Westinghouse should provide justification for the assumed source shape in the Hematite analysis versus the cube shape assumed for other disposals at USEI.

Response Summary: The justifications for changing the three identified parameters are provided. These factors did not change the bounding dose, which continues to be the excavation operator.

Response Detail:

The orientation of the excavator and the stabilization workers in relation to the gondola is different in this request

The orientation of the excavator and the stabilization workers has been revised to be consistent with the initial request. See response pertaining to source buildup below.

The shield is used for determining buildup in the excavator and stabilization worker scenarios in the current request, while the source was used for buildup in the previous request

The source is the more appropriate selection for the buildup material based on the number of mean free path (MFP) lengths associated with

[1] MicroShield® is a trademark of Grove Software, Inc., registered in the U.S. and other countries..

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
				it as compared to the shield. The use of the shield for building up in the current submittal is erroneous. Dose factors for the excavation operator (using the source as the buildup material) were recalculated (MicroShield results attached). This recalculation also includes a modification to the exposure geometry for the excavation / stabilization operator, gondola surveyor and transportation worker. In the original submittal the dose points for each of these scenarios were placed on the incorrect plane. These changes result in a decrease in the external exposure to the transportation worker and gondola surveyor and a slight in increase in dose to the excavator operator / stabilization worker. The increase in external dose to the excavation operator (9.4E-4 mrem/yr to 2.7E-3 mrem/yr) is insignificant in comparison to the accompanying internal dose which is assigned (1.8E-1 mrem/yr). The increase in dose to the stabilization operator is also insignificant (3.14E-5 mrem/yr to 9.13E-5 mrem/yr) when compared to the assigned internal dose (6.11E-3 mrem/yr). *The thickness of the shielding for the gondola surveyor is less in the current request (0.794 cm) than in the previous one (2.53 cm)* The shield thickness for the gondola surveyor in the current request is based on the thickness of the railcar wall (0.794 cm) as opposed to the prior request in which the same shielding was afforded the surveyor as the excavator operator. The assumptions in the current request more accurately reflect the actual conditions in which the surveyor is oriented to the side of the car and the excavation operator is above the car. The one inch shielding afforded the excavation operator is based on the deck thickness for the excavation gantry. Dose factors for the gondola surveyor and excavator operator for the prior 20.2002 request were also recalculated (MicroShield results attached). There is a slight increase in external dose to the gondola surveyor (1.2E-3 mrem to 2.5E-3 mrem) and a slight decrease in external dose to the excavator operator (8.4E-4 mrem to 4.2E-4). These changes do not change the results of the assessment which reported the dose to the truck driver (which is unaffected by these changes) as bounding. *Westinghouse should provide justification for the assumed source shape in the Hematite analysis versus the cube shape assumed for other disposals at USEI* The difference in source shape in the external dose model used for the stabilization operator is due to the use of gondola railcars for waste shipment by HDP versus trucks by other applicants.	

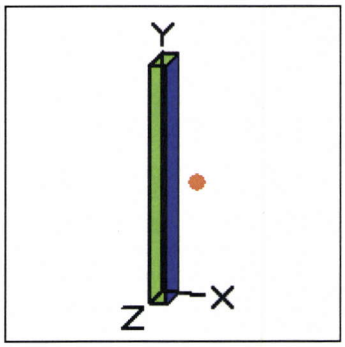
MicroShield 7.02 Westinghouse Electric Company (08-MSD-7.02-1424)

Date	By	Checked

Filename	Run Date	Run Time	Duration
GondolaOpU234Rev2.ms7	June 14, 2012	8:59:14 AM	00:00:00

Project Info	
Case Title	Case 1
Description	Case 1
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	121.92 cm (4 ft)
Width	274.32 cm (9 ft)
Height	1.8e+3 cm (60 ft)



Dose Points			
A	X	Y	Z
#1	324.46 cm (10 ft 7.7 in)	914.4 cm (30 ft)	137.16 cm (4 ft 6.0 in)

Shields			
Shield N	Dimension	Material	Density
Source	6.12e+07 cm³	Concrete	1.54
Shield 1	2.54 cm	Iron	7.86
Air Gap		Air	0.00122

Source Input: Grouping Method - Actual Photon Energies				
Nuclide	Ci	Bq	μCi/cm³	Bq/cm³
Pa-234				
Pa-234m				
Th-231				
Th-234				
U-234	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
U-235				
U-238				

Buildup: The material reference is Source Integration Parameters	
X Direction	20
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.013	2.377e+11	0.000e+00	1.240e-23	0.000e+00	1.668e-24
0.0532	2.670e+09	1.824e-15	2.107e-14	4.339e-18	5.012e-17
0.1214	9.065e+08	3.742e-03	7.089e-02	5.861e-06	1.110e-04
Totals	**2.413e+11**	**3.742e-03**	**7.089e-02**	**5.861e-06**	**1.110e-04**

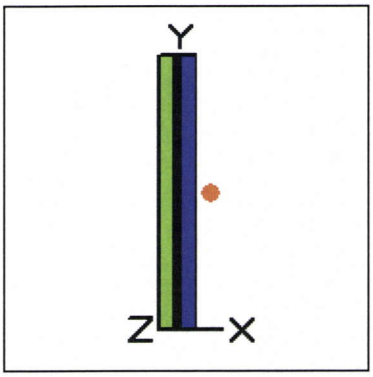
MicroShield 7.02
Westinghouse Electric Company (08-MSD-7.02-1424)

Date	By	Checked

Filename	Run Date	Run Time	Duration
GondolaOpU235Rev2.ms7	June 14, 2012	8:42:02 AM	00:00:00

Project Info	
Case Title	Case 1
Description	Case 1
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	121.92 cm (4 ft)
Width	274.32 cm (9 ft)
Height	1.8e+3 cm (60 ft)



Dose Points			
A	X	Y	Z
#1	324.46 cm (10 ft 7.7 in)	914.4 cm (30 ft)	137.16 cm (4 ft 6.0 in)

Shields			
Shield N	Dimension	Material	Density
Source	61.164 m³	Concrete	1.54
Shield 1	.025 m	Iron	7.86
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Pa-234				
Pa-234m				
Th-231	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
Th-234				
U-234				
U-235	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
U-238				

Buildup: The material reference is Source Integration Parameters	
X Direction	20
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.306e+12	0.000e+00	1.388e-22	0.000e+00	1.191e-23
0.03	3.316e+11	5.347e-70	6.946e-23	5.299e-72	6.884e-25
0.06	1.075e+10	7.580e-11	1.136e-09	1.506e-13	2.257e-12
0.08	2.655e+11	6.847e-04	1.405e-02	1.083e-06	2.223e-05
0.1	2.365e+11	8.195e-02	1.723e+00	1.254e-04	2.637e-03
0.15	3.524e+11	7.890e+00	1.276e+02	1.299e-02	2.101e-01
0.2	1.397e+12	1.305e+02	1.698e+03	2.303e-01	2.997e+00
Totals	**4.899e+12**	**1.384e+02**	**1.827e+03**	**2.434e-01**	**3.210e+00**

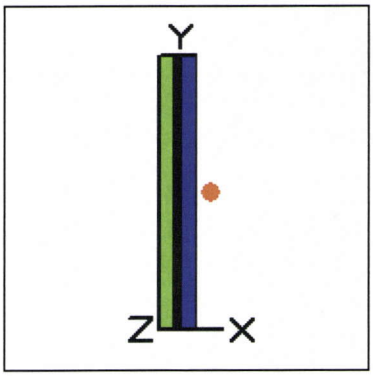
MicroShield 7.02
Westinghouse Electric Company (08-MSD-7.02-1424)

Date	By	Checked

Filename	Run Date	Run Time	Duration
GondolaOpU238Rev2.ms7	June 14, 2012	8:55:56 AM	00:00:01

Project Info	
Case Title	Case 1
Description	Case 1
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	121.92 cm (4 ft)
Width	274.32 cm (9 ft)
Height	1.8e+3 cm (60 ft)



Dose Points			
A	X	Y	Z
#1	324.46 cm (10 ft 7.7 in)	914.4 cm (30 ft)	137.16 cm (4 ft 6.0 in)

Shields			
Shield N	Dimension	Material	Density
Source	61.164 m³	Concrete	1.54
Shield 1	.025 m	Iron	7.86
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Pa-234	9.7863e-002	3.6209e+009	1.6000e-003	5.9200e+001
Pa-234m	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
Th-231				
Th-234	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
U-234				
U-235				
U-238	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004

Buildup: The material reference is Source Integration Parameters	
X Direction	20
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	4.318e+11	0.000e+00	2.600e-23	0.000e+00	2.230e-24
0.04	4.432e+06	1.500e-35	2.462e-27	6.634e-38	1.089e-29
0.06	8.858e+10	6.244e-10	9.358e-09	1.240e-12	1.859e-11
0.08	3.217e+09	8.298e-06	1.702e-04	1.313e-08	2.694e-07
0.1	1.389e+11	4.813e-02	1.012e+00	7.363e-05	1.548e-03
0.15	1.142e+09	2.556e-02	4.134e-01	4.209e-05	6.807e-04
0.2	7.638e+08	7.135e-02	9.286e-01	1.259e-04	1.639e-03
0.3	2.630e+08	9.104e-02	8.739e-01	1.727e-04	1.658e-03
0.4	2.223e+08	1.623e-01	1.259e+00	3.162e-04	2.453e-03
0.5	3.302e+08	4.126e-01	2.709e+00	8.098e-04	5.317e-03
0.6	1.349e+09	2.576e+00	1.478e+01	5.028e-03	2.885e-02
0.8	7.513e+09	2.761e+01	1.293e+02	5.252e-02	2.459e-01
1.0	2.402e+10	1.455e+02	5.864e+02	2.682e-01	1.081e+00
1.5	5.067e+08	7.420e+00	2.342e+01	1.248e-02	3.940e-02
2.0	6.537e+07	1.725e+00	4.729e+00	2.667e-03	7.313e-03
Totals	**6.987e+11**	**1.856e+02**	**7.658e+02**	**3.424e-01**	**1.416e+00**

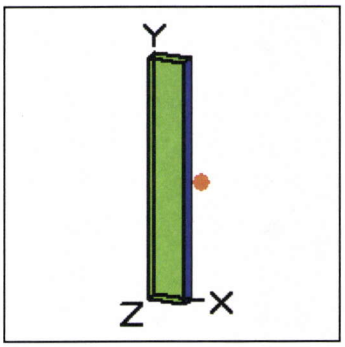
MicroShield 7.02
Westinghouse Electric Company (08-MSD-7.02-1424)

Date	By	Checked

Filename	Run Date	Run Time	Duration
GondolaSurveyU234Rev2.ms7	June 14, 2012	9:08:55 AM	00:00:00

Project Info	
Case Title	Case 1
Description	Case 1
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	274.32 cm (9 ft)
Width	121.92 cm (4 ft)
Height	1.8e+3 cm (60 ft)



Dose Points			
A	X	Y	Z
#1	375.0 cm (12 ft 3.6 in)	914.4 cm (30 ft)	60.96 cm (2 ft)

Shields			
Shield N	Dimension	Material	Density
Source	61.164 m³	Concrete	1.54
Shield 1	.008 m	Iron	7.86
Air Gap		Air	0.00122

Source Input: Grouping Method - Actual Photon Energies				
Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Pa-234				
Pa-234m				
Th-231				
Th-234				
U-234	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
U-235				
U-238				

Buildup: The material reference is Source Integration Parameters	
X Direction	20
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.013	2.377e+11	6.019e-160	1.650e-23	8.097e-161	2.220e-24
0.0532	2.670e+09	1.036e-05	6.028e-05	2.464e-08	1.434e-07
0.1214	9.065e+08	1.709e-01	1.234e+00	2.677e-04	1.933e-03
Totals	**2.413e+11**	**1.709e-01**	**1.234e+00**	**2.677e-04**	**1.934e-03**

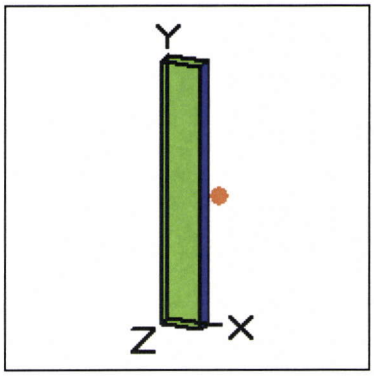
MicroShield 7.02
Westinghouse Electric Company (08-MSD-7.02-1424)

Date	By	Checked

Filename	Run Date	Run Time	Duration
GondolaSurveyU235Rev2.ms7	June 14, 2012	9:10:54 AM	00:00:00

Project Info	
Case Title	Case 1
Description	Case 1
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	274.32 cm (9 ft)
Width	121.92 cm (4 ft)
Height	1.8e+3 cm (60 ft)



Dose Points			
A	X	Y	Z
#1	375.0 cm (12 ft 3.6 in)	914.4 cm (30 ft)	60.96 cm (2 ft)

Shields			
Shield N	Dimension	Material	Density
Source	61.164 m³	Concrete	1.54
Shield 1	.008 m	Iron	7.86
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Pa-234				
Pa-234m				
Th-231	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
Th-234				
U-234				
U-235	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
U-238				

Buildup: The material reference is Source Integration Parameters	
X Direction	20
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.306e+12	6.737e-159	1.847e-22	5.778e-160	1.584e-23
0.03	3.316e+11	2.711e-22	6.351e-22	2.686e-24	6.295e-24
0.06	1.075e+10	1.055e-03	7.226e-03	2.096e-06	1.435e-05
0.08	2.655e+11	2.699e+00	2.164e+01	4.271e-03	3.424e-02
0.1	2.365e+11	1.593e+01	1.248e+02	2.436e-02	1.909e-01
0.15	3.524e+11	1.437e+02	9.317e+02	2.366e-01	1.534e+00
0.2	1.397e+12	1.201e+03	6.751e+03	2.121e+00	1.192e+01
Totals	**4.899e+12**	**1.364e+03**	**7.830e+03**	**2.386e+00**	**1.368e+01**

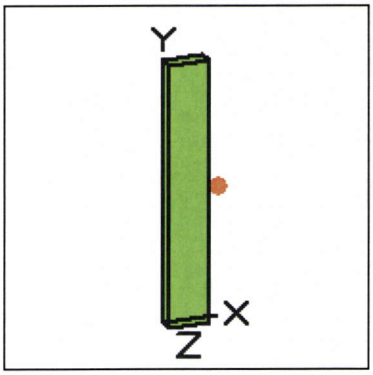
MicroShield 7.02
Westinghouse Electric Company (08-MSD-7.02-1424)

Date	By	Checked

Filename	Run Date	Run Time	Duration
GondolaSurveyU238Rev2.ms7	June 14, 2012	10:33:38 AM	00:00:01

Project Info	
Case Title	Case 1
Description	Case 1
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	274.32 cm (9 ft)
Width	121.92 cm (4 ft)
Height	1.8e+3 cm (60 ft)



Dose Points			
A	X	Y	Z
#1	375.0 cm (12 ft 3.6 in)	914.4 cm (30 ft)	60.96 cm (2 ft)

Shields			
Shield N	Dimension	Material	Density
Source	61.164 m³	Concrete	1.54
Shield 1	.008 m	Iron	7.86
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Pa-234	9.7863e-002	3.6209e+009	1.6000e-003	5.9200e+001
Pa-234m	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
Th-231				
Th-234	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
U-234				
U-235				
U-238	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004

Buildup: The material reference is Source Integration Parameters	
X Direction	20
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	4.318e+11	1.262e-159	3.459e-23	1.082e-160	2.967e-24
0.04	4.432e+06	2.585e-14	8.894e-14	1.143e-16	3.934e-16
0.06	8.858e+10	8.690e-03	5.952e-02	1.726e-05	1.182e-04
0.08	3.217e+09	3.271e-02	2.622e-01	5.176e-05	4.150e-04
0.1	1.389e+11	9.352e+00	7.327e+01	1.431e-02	1.121e-01
0.15	1.142e+09	4.653e-01	3.018e+00	7.663e-04	4.969e-03
0.2	7.638e+08	6.571e-01	3.692e+00	1.160e-03	6.517e-03
0.3	2.630e+08	5.092e-01	2.352e+00	9.660e-04	4.461e-03
0.4	2.223e+08	7.214e-01	2.899e+00	1.406e-03	5.649e-03
0.5	3.302e+08	1.581e+00	5.711e+00	3.102e-03	1.121e-02
0.6	1.349e+09	8.843e+00	2.926e+01	1.726e-02	5.712e-02
0.8	7.513e+09	8.075e+01	2.346e+02	1.536e-01	4.462e-01
1.0	2.402e+10	3.790e+02	1.002e+03	6.986e-01	1.847e+00
1.5	5.067e+08	1.601e+01	3.621e+01	2.694e-02	6.091e-02
2.0	6.537e+07	3.340e+00	6.902e+00	5.165e-03	1.067e-02
Totals	**6.987e+11**	**5.012e+02**	**1.400e+03**	**9.233e-01**	**2.567e+00**

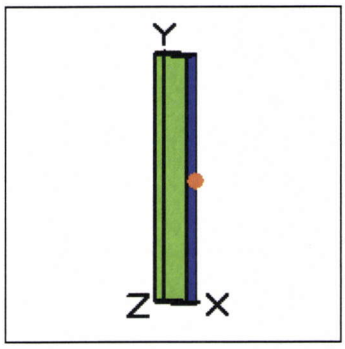
MicroShield 7.02
Westinghouse Electric Company (08-MSD-7.02-1424)

Date	By	Checked

Filename	Run Date	Run Time	Duration
GondolaTransportationU234Rev2.ms7	June 14, 2012	9:27:32 AM	00:00:00

Project Info	
Case Title	Case 1
Description	Case 1
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	274.32 cm (9 ft)
Width	121.92 cm (4 ft)
Height	1.8e+3 cm (60 ft)



Dose Points			
A	X	Y	Z
#1	305.592 cm (10 ft 0.3 in)	914.4 cm (30 ft)	60.96 cm (2 ft)

Shields			
Shield N	Dimension	Material	Density
Source	2160.0 ft³	Concrete	1.54
Shield 1	.026 ft	Iron	7.86
Air Gap		Air	0.00122

Source Input: Grouping Method - Actual Photon Energies				
Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Pa-234				
Pa-234m				
Th-231				
Th-234				
U-234	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
U-235				
U-238				

Buildup: The material reference is Source Integration Parameters	
X Direction	20
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.013	2.377e+11	7.672e-169	2.841e-23	1.032e-169	3.821e-24
0.0532	2.670e+09	1.319e-05	7.793e-05	3.138e-08	1.853e-07
0.1214	9.065e+08	2.749e-01	2.070e+00	4.305e-04	3.242e-03
Totals	**2.413e+11**	**2.749e-01**	**2.070e+00**	**4.305e-04**	**3.242e-03**

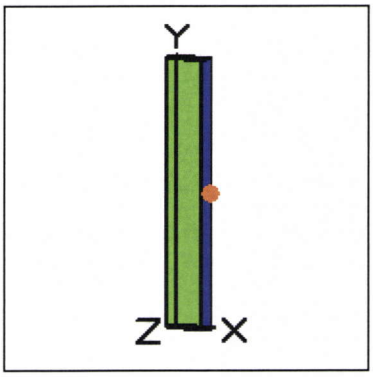
MicroShield 7.02
Westinghouse Electric Company (08-MSD-7.02-1424)

Date	By	Checked

Filename	Run Date	Run Time	Duration
GondolaTransportationU235Rev2.ms7	June 14, 2012	9:28:31 AM	00:00:00

Project Info	
Case Title	Case 1
Description	Case 1
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	274.32 cm (9 ft)
Width	121.92 cm (4 ft)
Height	1.8e+3 cm (60 ft)



Dose Points			
A	X	Y	Z
#1	305.592 cm (10 ft 0.3 in)	914.4 cm (30 ft)	60.96 cm (2 ft)

Shields			
Shield N	Dimension	Material	Density
Source	2160.0 ft³	Concrete	1.54
Shield 1	.026 ft	Iron	7.86
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Pa-234				
Pa-234m				
Th-231	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
Th-234				
U-234				
U-235	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
U-238				

Buildup: The material reference is Source Integration Parameters	
X Direction	20
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	2.306e+12	8.587e-168	3.179e-22	7.365e-169	2.727e-23
0.03	3.316e+11	3.849e-23	2.345e-22	3.815e-25	2.324e-24
0.06	1.075e+10	1.441e-03	9.986e-03	2.862e-06	1.984e-05
0.08	2.655e+11	3.976e+00	3.227e+01	6.292e-03	5.106e-02
0.1	2.365e+11	2.459e+01	1.979e+02	3.761e-02	3.028e-01
0.15	3.524e+11	2.397e+02	1.635e+03	3.947e-01	2.693e+00
0.2	1.397e+12	2.073e+03	1.229e+04	3.659e+00	2.170e+01
Totals	**4.899e+12**	**2.341e+03**	**1.416e+04**	**4.098e+00**	**2.474e+01**

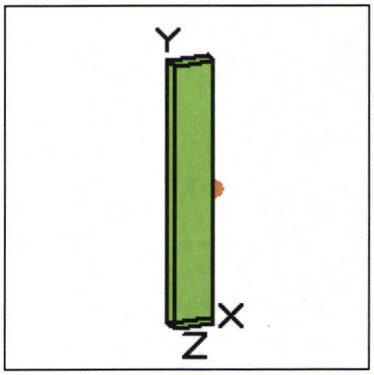
MicroShield 7.02
Westinghouse Electric Company (08-MSD-7.02-1424)

Date	By	Checked

Filename	Run Date	Run Time	Duration
GondolaTransportationU238Rev2.ms7	June 14, 2012	10:06:44 AM	00:00:01

Project Info	
Case Title	Case 1
Description	Case 1
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	274.32 cm (9 ft)
Width	121.92 cm (4 ft)
Height	1.8e+3 cm (60 ft)



Dose Points			
A	X	Y	Z
#1	305.592 cm (10 ft 0.3 in)	914.4 cm (30 ft)	60.96 cm (2 ft)

Shields			
Shield N	Dimension	Material	Density
Source	6.12e+07 cm³	Concrete	1.54
Shield 1	.794 cm	Iron	7.86
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Pa-234	9.7863e-002	3.6209e+009	1.6000e-003	5.9200e+001
Pa-234m	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
Th-231				
Th-234	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004
U-234				
U-235				
U-238	6.1164e+001	2.2631e+012	1.0000e+000	3.7000e+004

Buildup: The material reference is Source Integration Parameters	
X Direction	20
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	4.318e+11	1.608e-168	5.955e-23	1.379e-169	5.108e-24
0.04	4.432e+06	1.932e-14	6.756e-14	8.545e-17	2.988e-16
0.06	8.858e+10	1.187e-02	8.226e-02	2.358e-05	1.634e-04
0.08	3.217e+09	4.818e-02	3.910e-01	7.625e-05	6.188e-04
0.1	1.389e+11	1.444e+01	1.162e+02	2.209e-02	1.778e-01
0.15	1.142e+09	7.764e-01	5.296e+00	1.278e-03	8.722e-03
0.2	7.638e+08	1.134e+00	6.723e+00	2.001e-03	1.187e-02
0.3	2.630e+08	9.036e-01	4.390e+00	1.714e-03	8.328e-03
0.4	2.223e+08	1.298e+00	5.468e+00	2.528e-03	1.065e-02
0.5	3.302e+08	2.869e+00	1.083e+01	5.631e-03	2.125e-02
0.6	1.349e+09	1.616e+01	5.569e+01	3.154e-02	1.087e-01
0.8	7.513e+09	1.491e+02	4.486e+02	2.836e-01	8.533e-01
1.0	2.402e+10	7.049e+02	1.922e+03	1.299e+00	3.543e+00
1.5	5.067e+08	3.014e+01	6.976e+01	5.072e-02	1.174e-01
2.0	6.537e+07	6.328e+00	1.332e+01	9.786e-03	2.060e-02
Totals	**6.987e+11**	**9.281e+02**	**2.659e+03**	**1.710e+00**	**4.882e+00**

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-14	Section 6.3 and 6.6	Truck driver dose may be underestimated	10CFR20.2002(d)	Section 6.3 states that the truck driver is present during the transloading of waste from the gondola to the truck. However, the external and internal doses to the truck driver from this exposure do not appear to be included in the truck driver dose.	Clarify if the truck driver could receive an additional dose during the transloading of the waste and, if so, provide a revised estimate of the dose to the truck driver
Response Summary: Transloading of the waste is included in the time used for the dose calculation.					
Response Detail: The 45 minute time estimate for the truck drivers includes the time to transload the waste from the railcar to the trucks at the rail transfer facility					

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-15	Section 7.1 Post Closure Analysis, Attachment 4	RESRAD Summary File	10CFR20.2002(d)	Attachment 4 to Enclosure 1 to HEM 12-2 lists the shipped concentrations and the modeled concentrations after dilution is taken into account. The modeled concentrations do not match the concentrations in the RESRAD Summary Report. The RESRAD report uses 1 pCi/g for all radionuclides instead of the modeled concentrations. The dose in the RESRAD summary report does not match the dose provided for post-closure of 0.8 mrem.	Provide correct RESRAD Summary File for post-closure dose.
Response Summary: RESRAD was used to generate dose to source ratios, which are used to calculate the post-closure dose. RESRAD was not used to directly calculate the post-closure dose.					
Response Detail: The RESRAD input concentrations were set at 1.0 so as to generate dose to source ratios. The use of RESRAD for generating dose to source ratios is shown on page 23 of the output file in Attachment 5 to Enclosure 1 of HEM-12-2. The dose to source ratio is multiplied by the modeled radionuclide concentration (from the first table on page 2 of Attachment 4 to Enclosure 1 of HEM-12-2) to determine the post closure dose. For example, the dose to source ratio for Tc-99 of 1.983 (from page 23 of the RESRAD output file) is multiplied by the Tc-99 concentration of 0.38 pCi/g (from page 2 of Attachment 4) to determine the post closure dose of 0.8 mrem from Tc-99.					

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-16	Section 8.0 of HDP-TBD-WM-906	Typo	10CFR20.2002(a)	2nd paragraph, refers to Table 7-3, should be Table 8-3.	Correct typo.
Response Summary: Typographical error.					

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
Response Detail: The first sentence of the second paragraph of Section 8.0 of HDP-TBD-WM-906 should read "…radionuclides (Table 8-3) were…."					

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-17	Section 8.0 and Section 9.0 of HDP-TBD-WM-906	Typo	10CFR20.2002(a)	Table 8-2, 8-3, and 9-1 HDP-TBD-WM-906 are labeled "Concentration", but the table shows curie amounts, not concentrations.	Label the Tables appropriately.
Response Summary: Typographical error.					
Response Detail: The titles of Tables 8-2, 8-3, and 9-1 in HDP-TBD-WM-906 should not have included the word "Concentration."					

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-18	Section 8.0 of HDP-TBD-WM-906	Items of Misc. Equipment Included	10CFR20.2002(a)	Are all the items in Table 8-1 included in the alternate disposal request? Are any excluded?	Clarify which items in Table 8-1 are included in the request and which ones, if any are excluded.
Response Summary: All of the items in Table 8-1 are included in this additional alternate disposal request.					
Response Detail: All of the items in Table 8-1 are included in this additional alternate disposal request. None are excluded.					

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-19	Section 9.0 of HDP-TBD-WM-906	Soil Characterization	10CFR20.2002(a)	An insufficient amount of information is provided to describe how the total curie amounts in Table 9-1 are calculated from the concentrations of the soil samples in Appendix H. It is unclear how the estimated volumes are calculated from the contours.	Describe how the values in Table 9-1 are estimated.
Response Summary: The methods of calculating the volumes and curie amounts are described for soil under the process building slabs.					

Response Detail: *Volume*

Using in-situ density of 1.69 g/cm^3 and post-excavation density of 1.44 g/cm^3, the calculated in-situ volume is multiplied by 1.69/1.44 to get the post-excavation volume that would be shipped and is presented in Table 9-1 of HDP-TBD-WM-906.

The in-situ volume is calculated using the projected excavation contours shown on Figure H-1 in Appendix H of HDP-TBD-WM-906. These contours are based on both radiological and chemical contamination. The Graphical Information System (GIS) that generated the

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward

contours was also used to generate the area covered by the contours.

Since the soil sample data were taken within the depth profiles of 0 – ½ ft, ½ ft – 5 ft, and > 5 ft, separate volume estimates were calculated for each of these profiles. Each of these three volume estimates was then subdivided based on whether the soil was beneath Building 253 or not because data from Building 253 represented a distinct population. Additional detail on how the volume contours shown in Figure H-1were converted to numerical values is included below.

Curie Amounts

Results from samples taken from within these six volume estimates where then averaged (mean). Tables H-1 through H-12 show the sample results and statistics associated with each of the six volume estimates. The locations of the Sample Stations are shown in Figure H-2 in HDP-TBD-WM-906. Finally, the average concentration for each radionuclide was multiplied by the volume to arrive at the total activities shown in Table 9-1.

Volume Calculation – all layers

Conversion – in-situ volume to shipped volume
- Shipped density is 90 lb/ft^3,
- In-situ density is 1.69 g/cm^3 = 105.5 lb/ft^3
- Conversion from in-situ volume to shipped = 105.5 / 90 = 1.17
- Conversion from cubic yards to cubic meters = 0.765 m^3 / yd^3

Therefore: Conversion from cubic yards in-situ to cubic meters shipped = 0.765 * 1.17 = 0.895

Volume Calculation - 0 - 1/2 ft layer

Row No.	Depth (ft)	SHAPE_Area (ft^2)	Location	Volume (ft^3)	Interval (ft)
A1	1	75	Rad excavation around slab	75	1
A2	1	534	Rad excavation around slab	534	1
A3	1	2383	Rad excavation around slab	2383	1
A4	1	10941	Rad excavation limestone area	10941	1
Total				47259	(ft^3)
				1750	(yd^3)

Basis: SUM (A1 through A4)*0.5+0.25*B2
1/2 of sum of (A1 through A4) since they are 0 - 1 ft layers and calculation is for 0.5 ft layer
1/4 of buffered slab value (row B2 from calculation table below) added since it is a 0 - 2 foot layer

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward

Total Under BLD 253 = Building Footprint to 1/2 foot
= 9585 ft * 0.5 ft * 1 yd^3 / 27 ft^3 = 178 yd^3 (in-situ)
= **159 m^3 (shipped)**

Total Excluding BLD 253 =1750 yd^3 - 178 yd^3 = 1573 yd^3 (in-situ) = **1408 m^3 (shipped)**

Volume Calculation - 1/2 - 5 ft layer

Row No.	Depth (ft)	SHAPE_Area (ft^2)	Location	Volume (ft^3)	Interval (ft)
B1	2	3038	Area 6 Rad	3038	1
B2	2	80585	Buffered slab excavation	161171	2
B3	2	486	Rad excavation near SV	486	1
B4	4	452	Area 1 VOC	904	2
B5	3	8624	Area 2a Rad and VOC	8624	1
B6	4	2990	Area 2a Rad and VOC	2990	1
B7	4	4066	Area 2a Rad and VOC	8132	2
B8	4	2312	Area 3 VOC	4624	2
B9	3	584	Area 4 Rad and VOC	584	1
B10	4	422	Area 4 Rad and VOC	422	1
B11	4	2248	Area 4 Rad and VOC	4497	2
B12	5	292	Area 4 Rad and VOC	292	1
B13	4	113	Area 5 VOC	226	2
B14	3	2240	Area 6 Rad	2240	1
B15	4	1617	Area 6 Rad	1617	1
B16	5	1144	Area 6 Rad	1144	1
B17	3	274	Rad excavation near SV	274	1
Total				167938 (ft^3)	
				6220 (yd^3)	

Basis: SUM (B1, B3 through B17) + 0.75*B2 + 0.5*SUM (A1 through A4)
3/4 of buffered slab value (B2) since it is a 0 - 2 foot layer
1/2 of SUM (A1 through A4) since they are 0 - 1 ft layers

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward

Total Under BLD 253 = Building Footprint from 1/2 to 2 foot + (Area 2a Rad and VOC)
= 9585 * 1.5 * 1/27 + B5 + B6 + 0.5 * B7
= 1113 yd^3 (in-situ) = **997 m^3 (shipped)**
½ of B7 since this 1 ft of this 2 ft sample interval is below 5 ft

Total Excluding BLD 253 = 6220 yd^3 - 1113 yd^3 = 5107 yd^3 (in-situ) = **4573 m^3 (shipped)**

Volume Calculation - > 5 ft layer

Row No.	Depth (ft)	SHAPE_Area (ft^2)	Location	Volume (ft^3)	Interval (ft)
C1	6	314	Area 1 VOC	627	2
C2	8	201	Area 1 VOC	401	2
C3	10	113	Area 1 VOC	226	2
C4	12	50	Area 1 VOC	100	2
C5	14	12	Area 1 VOC	25	2
C6	6	3603	Area 2 Rad and VOC	7206	2
C7	8	3165	Area 2 Rad and VOC	6330	2
C8	10	2752	Area 2 Rad and VOC	5504	2
C9	12	2364	Area 2 Rad and VOC	4729	2
C10	14	2002	Area 2 Rad and VOC	4004	2
C11	16	1665	Area 2 Rad and VOC	3329	2
C12	18	1352	Area 2 Rad and VOC	2705	2
C13	20	1066	Area 2 Rad and VOC	2131	2
C14	22	804	Area 2 Rad and VOC	1608	2
C15	24	567	Area 2 Rad and VOC	1135	2
C16	6	113	Area 2b Rad and VOC	226	2
C17	8	50	Area 2b Rad and VOC	100	2
C18	10	12	Area 2b Rad and VOC	25	2
C19	6	1941	Area 3 VOC	3882	2
C20	8	1595	Area 3 VOC	3190	2

RAI No.	Section	Issue	Regulatory Link	Discussion		Path Forward
C21	10	1275	Area 3 VOC	2549		2
C22	12	979	Area 3 VOC	1958		2
C23	14	717	Area 3 VOC	1435		2
C24	16	496	Area 3 VOC	993		2
C25	18	316	Area 3 VOC	632		2
C26	20	176	Area 3 VOC	352		2
C27	22	77	Area 3 VOC	154		2
C28	24	18	Area 3 VOC	37		2
C29	6	1886	Area 4 Rad and VOC	3773		2
C30	8	1550	Area 4 Rad and VOC	3100		2
C31	10	1238	Area 4 Rad and VOC	2476		2
C32	12	952	Area 4 Rad and VOC	1904		2
C33	14	698	Area 4 Rad and VOC	1396		2
C34	16	483	Area 4 Rad and VOC	967		2
C35	18	308	Area 4 Rad and VOC	616		2
C36	20	172	Area 4 Rad and VOC	344		2
C37	22	75	Area 4 Rad and VOC	151		2
C38	24	18	Area 4 Rad and VOC	36		2
C39	6	50	Area 5 VOC	100		2
C40	8	12	Area 5 VOC	25		2
	Total			70478	(ft^3)	
				2610	(yd^3)	

Basis: Sum (C1 through C40)

Total Under BLD 253 = 1/2 (Area 2 Rad and VOC) + (Area 2b Rad and VOC)
= 1/2 Sum (C6 through C15) + Sum (C16 through C18)
=729 yd^3 (in-situ) = **653 m^3 (shipped)**
½ applied where 1 ft of a 2 ft sample interval is above 5 ft

Total Excluding BLD 253 =2610 yd^3 - 729 yd^3 = 1881 yd^3 (in-situ) = **1684 m^3 (shipped)**

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-20	Section 6 and Section 7	Cumulative Doses Not Provided for Worker or Intruder Scenarios	10CFR20.2002(d)	Westinghouse only provides one cumulative dose - that of the Post Closure Long Term Dose. The cumulative impacts for other dose scenarios are not discussed.	Please provide a discussion of the cumulative doses for all scenarios considered in this request. If cumulative doses do not apply, please provide the basis for their exclusion.

Response Summary: For all scenarios, the cumulative doses for this 20.2002 request and the 20.2002 request approved in Amendment 58 are provided.

Response Detail:

Scenario	Maximum Dose This 20.2002 Request (mrem/yr)	Maximum Dose 20.2002 Request Approved in Amendment 58 (mrem/yr)	Cumulative Maximum Dose (mrem/yr)
Individual Worker	0.18	0.47	0.65
Intruder Construction	15	9	24
Intruder Acute Well Drilling	2.7	2.9	5.6
Intruder Chronic Well Drilling	0.5	2	2.5

Job Function	Maximum Individual Worker Dose (mrem/yr)		
	This 20.2002 Request	20.2002 Request Approved in Amendment 58	Total
Gondola surveyor	1.61E-03	1.10E-01	1.12E-01
Excavator Operator	**1.86E-01**	4.70E-01	**6.6E-01**
Gondola Cleanout	2.20E-02	5.90E-02	8.10E-02
Truck Surveyor	2.10E-03	9.30E-02	9.51E-02
Truck Driver	1.20E-02	**4.90E-01**	5.02E-01
Stabilization Operator	6.21E-03	1.60E-02	2.22E-02
Cell Operator	1.30E-01	3.80E-01	5.10E-01

(Bold Font indicates maximum value)

RAI No.	Section	Issue	Regulatory Link	Discussion	Path Forward
CH-21	Section 7.4 Sensitivity Analysis, Attachment 4	Sensitivity Analysis for Post Closure Dose	10CFR20.2002(d)	The sensitivity analysis describes a 13 week scenario where the dose is 1.6 mrem, but in Attachment 4, the dose for13 weeks is approximately 0.99 mrem.	Please describe the reason for the difference in reported doses.

Response Summary: Attachment 4 to Enclosure 1 to HEM-12-2 contains the correct information.

Response Detail: The figure and associated text in Section 7.4 of Enclosure 1 to HEM-12-2 do not reflect the data in Attachment 4 to Enclosure 1. The corrected figure is presented below, along with a revision to the last sentence of the second paragraph in Section 7.4 of Enclosure 1.

As shown in this Figure, the post closure dose increases only slightly as the shipment time decreases, remaining below 1.0 mrem for a 13 week duration.

Figure 1, Sensitivity Analysis – Shipping Rate versus Post-Closure Dose.