Chapter 5 – Dose Modeling RAI Responses

RAI No.	Issues	Path Forward	3/4/11 Discussion Points	Proposed Resolution	NRC Concurrence
1	1. Utilization of site characterization data for Ra and Th as a basis for measurement of Ra & Th during the FSS may not be appropriate. This specifically relates to using threshold values determined during characterization as decision points for FSS results. 2. There is inconsistency between the statements: "Th-232 and Ra-226 will be included in the analysis of FSS samples site wide" and "Th-232 will only be included for demonstrating compliance in areas distinguishable from background or when an individual result exceeds the BTV."	1. Measure and use results in compliance demonstration for Ra and Th throughout site in FSS. OR Use the Scenario B approach and take more samples to determine which areas should be measured for demonstrating compliance for the FSS. OR Determine and justify impacted and non-impacted areas on an area-by-area basis and measure for Ra and Th in *areas* that are impacted by Ra and Th as opposed to a point by point comparison. 2. Clarify statements on analysis of Th-232 and use for compliance purposes.	1. HRCR – Appendix A provides the basis for designating the thorium impacted areas. Additional detail was provided in response to HDPC-14 Q4 (contained in HEM 10-80, July 10, 2010), including documentation of the Quantile and Mann-Whitney tests which were performed. 2. HDP has performed an analysis of Ra-226 similar to that performed for Th-232, demonstrating that the area shown in Figure 5-3 is impacted by Ra-226 and also demonstrating that the area outside that shown is not impacted. The radium impacted area is shown in Figure 5-3 of the DP. A revision to this figure was transmitted in response to RAI Chapter 5, question 1 (HEM-10-85). 3. HDP will analyze samples for Th-232 in the Th-232 impacted area, and for Ra-226 in the Ra-226 impacted area. 4. HDP will include the analytical results for Th-232 and Ra-226 for all samples collected in each of these impacted areas in the compliance calculations.	1. Westinghouse will utilize the third option in the NRC's Path Forward, i.e. Determine and justify impacted and non-impacted areas on an area-by-area basis and measure for Ra and Th in areas that are impacted by Ra and Th as opposed to a point by point comparison. 2. Westinghouse will measure for Ra and Th in *areas* that are impacted by Ra and Th as opposed to a point by point comparison. 3. Westinghouse will add a column to HRCR Appendix A to describe the location of thorium impacted areas, and include a figure indicating the location of these areas. 4. Similar to Appendix A, Westinghouse will add Appendix B to the HRCR which will include the basis for designating radium impacted areas, and a figure indicating the location of these areas. Appropriate references to Appendix B will be added to the D-Plan.	
3	Westinghouse showed a sensitivity analysis for the Deep DCGLs but did not discuss how the Uniform DCGLs might be impacted by a similar sensitivity analysis.	Perform a sensitivity analysis showing how the *Uniform* Tc-99 DGCLs change with variation in the contaminated zone thickness. Send an updated Figure 5-5.	Westinghouse will perform the requested analysis.	1. Westinghouse has performed a sensitivity analysis showing how the Uniform Tc-99 DGCL is affected with variation in the contaminated zone thickness. For the sensitivity analysis, depth of the contaminated zone was varied from 6.7 meters to 9.1 meters while adjusting the size of the unsaturated zone so that the sum of the two remained equal to 9.1 meters. The analysis shows that the model is insensitive to the contaminated zone thickness, as shown in Attachment 1. 2. Figure 5-5 has been revised and is provided as Attachment 2.	
5	Plant transfer factors for Pa-231 and milk transfer factor for Ra need to be revised.	Provide RESRAD files with revised DCGL values after correcting for transfer factors.	1. Westinghouse has corrected the plant transfer and milk transfer factors. 2. Westinghouse currently plans to provide the revised DCGL tables and associated Resrad input files with the revision to the DP.	1. The revised factors are shown as highlighted text in Attachment 3 and 4 to this document. 2. Westinghouse will provide the revised DCGL tables and associated RESRAD input files (DP Chapter 5 Appendices) with the revision to the DP. If requested, the files can be emailed to NRC.	

RAI No.	Issues	Path Forward	3/4/11 Discussion Points	Proposed Resolution	NRC Concurrence
6	Conservatism of assumed ratios of radionuclide concentrations in sensitivity analysis is not adequately justified. Some areas of the site have a higher ratio of Tc, than assumed in the sensitivity analyses (i.e., 20%) and the behavior of this radionuclide can be significantly different than other radionuclides.	Perform a sensitivity analysis assuming 100% Tc-99 to see what parameters are sensitive. If additional parameters are found to be sensitive when there is only Tc-99 present, treat these as sensitive parameters in all CSMs.	Westinghouse will perform the requested analysis.	1. Westinghouse performed a sensitivity analysis assuming 100% of the activity was attributed to Tc-99 to determine sensitive parameters. The analysis showed that in addition to the parameters noted as sensitive in Table 5-5 of the Hematite Decommissioning Plan (HDP), the Milk Transfer Factor was a sensitive parameter for only the Uniform CSM. The effect on the DCGL (when recalculated using the 75^{th} percentile of the distribution from NUREG-6697) was relatively minor, and resulted in a maximum reduction of approximately 2%. Attachment 5 provides the sensitivity analysis results and a comparison of DCGLs. As a further refinement to this evaluation, the sensitivity analysis for the Uniform CSM was repeated, using a distribution representative of actual site conditions for the Tc-99 concentration and the average concentration values for all other radionuclides. The radionuclides used in the analysis are shown in Attachment 6. The analysis indicated that the Milk Transfer Factor was not a sensitive parameter. In consideration that the sensitivity for milk transfer factor had only minor impact for the 100% Tc-99 case, and was not identified as a sensitive parameter in the second assessment that was based on actual site conditions, Westinghouse will continue to treat this factor as an insensitive parameter (consistent with the sensitivity analysis presented in the DP).	

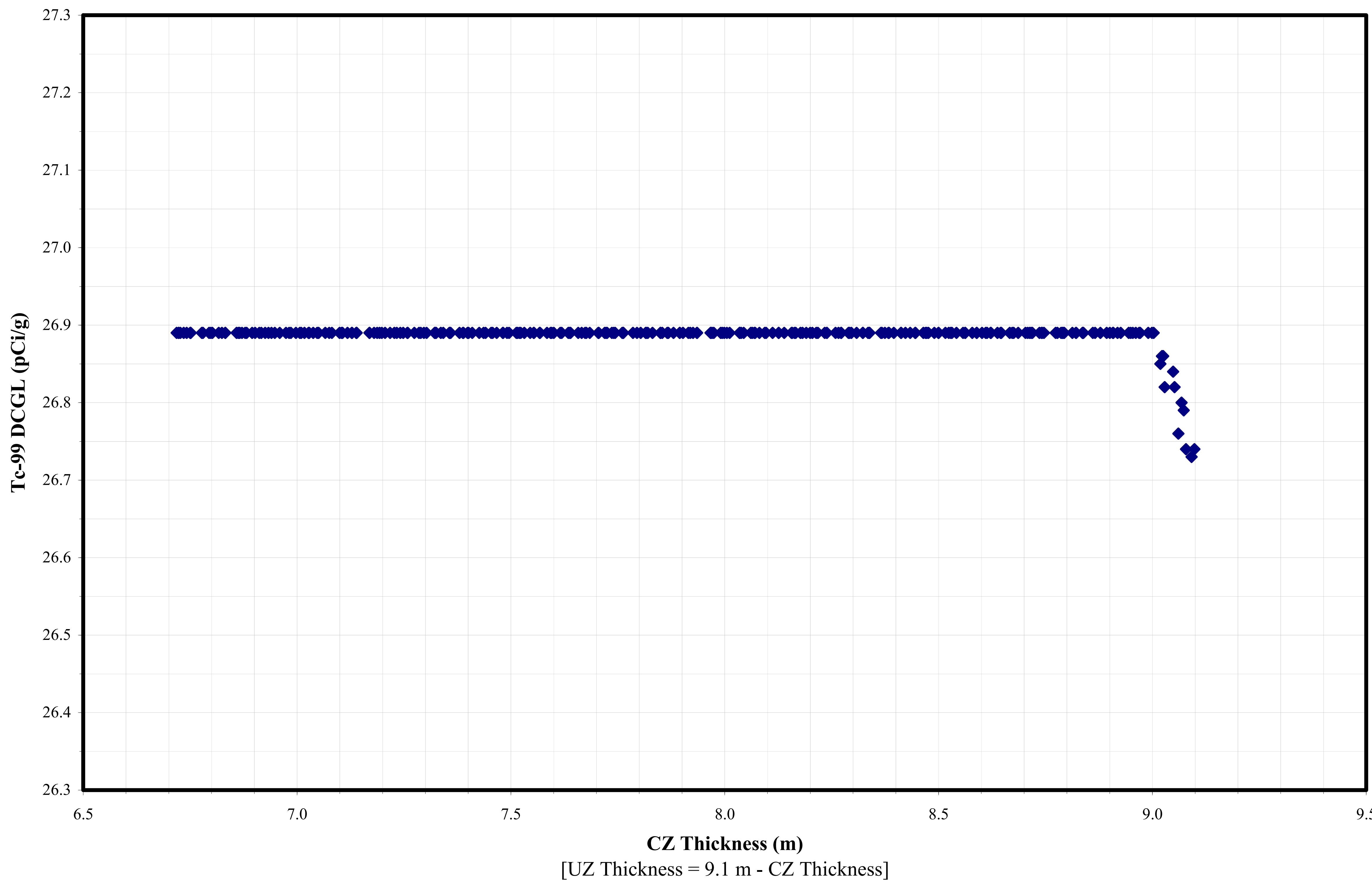
RAI No.	Issues	Path Forward	3/4/11 Discussion Points	Proposed Resolution	NRC Concurrence
8	The higher value assumed by Westinghouse for root depth is less conservative for the Surface, Root, and Excavation CSMs.	Provide a basis for why the site-specific value of 0.6 m was averaged with non-site specific data from NUREG-6697 of 1.1 m or use the site specific value for root depth in the dose assessment.	1. The following sentence from the RAI response to HDP-C5Q8 from HEM-10-85 was incorrectly stated: "As noted in the DP section and the NRC's RAI, choosing a larger value for the root depth is conservative for the Surface and Root models." As stated later in the response and in DP Section 5.3.4.4.5, Westinghouse recognizes that the root depth parameter is negatively correlated with dose for the Surface and Root models. 2. Westinghouse does not consider the 0.6 m root depth value to be a site specific parameter as it would be applied in the framework used to determine appropriate RESRAD input factors. 3. An appropriate selection could be the 25th percentile of the root depth PDF from NUREG/CR-6697 Table 6.1-2 which is 1.225 meters. 4. In order to determine a more appropriate value for this parameter, Westinghouse first considered the average root depths provided in NUREG/CR-6697, Attachment C, Table 6.1-1 and Table 6.1-2 (DP section 5.3.4.4.5). The weighted average root depth was 1.1 m. 5. As another potential input to the root depth determination, Westinghouse reviewed applicable regional data regarding typical agricultural crops grown in Jefferson County (i.e. corn, soybeans and wheat). The summed weighted root depth was 0.6 m for the three types of crops. 6. Because corn, soybeans, and wheat are clearly not fully representative of the broader range of crops considered in the Resident Farmer scenario, it was considered reasonable to average the root depth results from both methods. 7. The selected value (0.9 m) is more conservative than the 25th percentile of the root depth PDF from NUREG/CR-6697 Table 6.1-2 which is 1.225 meters.	Based on the discussion points, Westinghouse will continue to use the 0.9 m parameter. No action required.	

RAI No.	Issues	Path Forward	3/4/11 Discussion Points	Proposed Resolution	NRC Concurrence
9	It is unclear as to which Np-237 DCGL will be used for contamination below 1.5 m.	Clarify that the Uniform or Deep DCGL for Np-237 (0.3 pCi/g) will be used for contamination that exists below 1.5 m, while the Excavation DCGL will be used for all other radionuclides.	1. The Uniform or Deep DCGL for Np-237 (0.3 pCi/g) will be used for contamination that exists below 1.5 m, while the Excavation DCGL will be used for all other radionuclides 2. DP Section 5.3.6 will be revised to clarify this point: *From a technical perspective, the Deep DCGLs provided in Table 5-9 would be applicable to residual radioactivity in soil below 3 m because the hypothetical excavation does not exceed 3 m. However, a review of Table 5-9 shows that (with the exception of Np-237) the Excavation DCGL values are bounding and as such, as an ALARA measure, <u>with the exception of Np-237. Because of this, </u>the Excavation DCGLs will be applied to soil at all depths below 1.5 m. <u>Below 1.5m, the Uniform or Deep DCGL will be used for Np-237, as appropriate</u>.* 3. DCGL values have been adjusted to account for the contribution of Np-237 which is an insignificant radionuclide. (DP section 4.3.5, 14.1.3.1)	1. The DP will be revised as described in the Discussion Points. 2. In response NRC's observation that the Np-237 DCGL for the Deep CSM is inconsistent with other RAI responses, Westinghouse recommends a modification to the methodology be used to evaluate the contribution from insignificant radionuclides. Hematite will address the issue by submitting a revised response to NRC RAI HDPC-14-Q1, that describes the revised approach. (see Attachment 7) 3. Westinghouse will provide formal transmittal of Chapter 14, Question 1 revision following discussion with NRC.	
10	It is unclear as to which DCGL will be used to determine the area factor for Np-237 for depths greater than 1.5 m.	Ensure Area Factor for Np-237 for depths greater than 1.5 m is based on the Uniform or Deep DCGL for Np-237. Provide RESRAD Summary Reports for development of Area Factors.	1. As discussed in Section 14.1.3.1 of the Hematite Decommissioning Plan (HDP), Np-237, along with Pu-239/240 and Am-241, are considered insignificant radionuclides. As discussed in Section 3.3 of NUREG-1575, Vol. 2, by adjusting the remaining DCGLs, the dose from insignificant radionuclides is now accounted for in demonstrating compliance and the insignificant radionuclides are eliminated from further consideration during final status survey. Therefore, no Np-237 area factors are required during final status surveys. 2. Westinghouse plans to provide the RESRAD summary reports with the revision to the DP.	Westinghouse will provide the RESRAD Summary Reports for development of Area Factors with the revision to the DP as an Appendix to Chapter 5. . If requested, the files can be emailed to NRC.	
11	Westinghouse does not provide sufficient evidence to demonstrate that the groundwater concentrations would decline over time from their current values after release of the facility.	Clarify how the leachate source term will be removed during the remediation of the contaminated soil in the burial pits and under the process buildings. Clarify if there will be dewatering of the pore space at the depths where the measurements of the leachate in Table 4-28 were taken. If these measurements were taken below the CZ, clarify how the complete source term will be removed.	1. The majority of the leachate source term within the pore space of contaminated soil will be removed with the soil during excavation. Leachate remaining within the excavation (e.g., either draining from the contaminated soil during excavation, or from infiltration into the excavation) will be pumped from the excavation and treated and/or sampled prior to release. Dewatering to a greater depth (i.e., within the non-contaminated soil that remains) will not occur. The complete source term in the leachate will not be removed given that non-contaminated (i.e. less than DCGL) soil will not be excavated. However, source term that remains in the pore space of non-contaminated soil following excavation will be accounted for by laboratory analysis of the soil samples that include leachate in the pore space of the post-excavation samples.	Westinghouse will perform sampling as appropriate of unexcavated soil below the CZ associated with monitoring wells to verify DCGLs are met. The specifics for this sampling will be provided with the response to RAI for DP Chapter 3, HDP-3-Q9.	

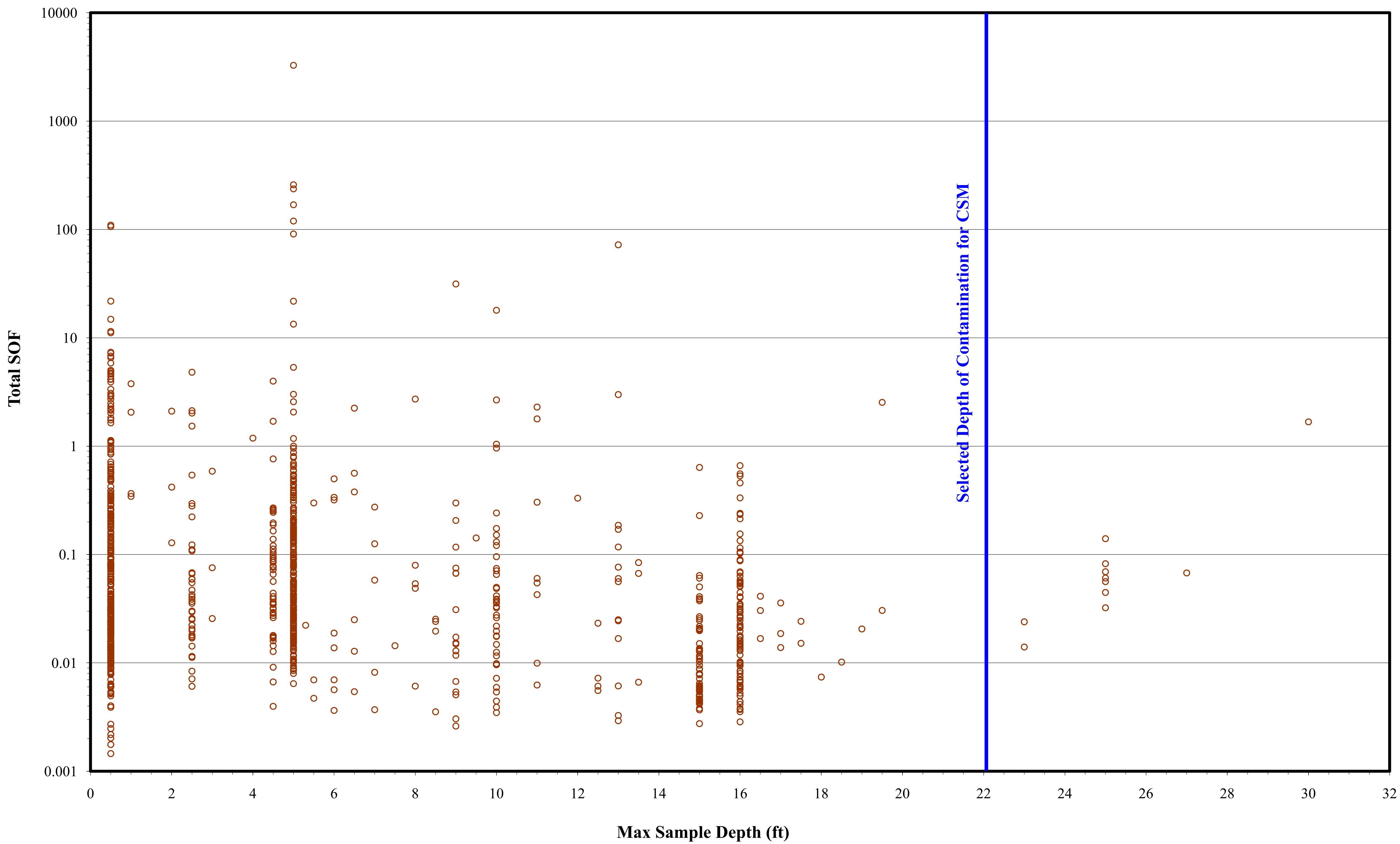
RAI No.	Issues	Path Forward	3/4/11 Discussion Points	Proposed Resolution	NRC Concurrence
14	Source lifetime parameter assumed in RESRAD is non-conservative.	The source lifetime parameter used in RESRAD BUILD should reflect the most likely value. The DCGL calculations should be updated to include this.	1. Westinghouse recognizes that the 25th percentile value of 17,918 days is not conservative when compared to the 10,000 day value mentioned in NUREG/CR6697 Section J.4.10, however, use of the 25th percentile value is consistent with current regulatory guidance and is consistent with what has been used at other decommissioning sites. 2. The 10,000 day value is described as 'most likely' in relationship to the frequency distribution presented in NUREG/CR 6697 (a triangular distribution) and is not necessarily the most appropriate value as applied to a specific application. 3. The 10,000 day value in Section J.4.10 is based on a 'suggestion' by the ANS of " an air release rate of 4 E-6/h for solid powders that are covered with a substantial layer of debris or are constrained by indoor static conditions." This is applicable to buildings that will undergo significant demolitions, and is not representative of the conditions that exist for HDP buildings to remain, i.e. essentially clean buildings that will undergo little to no remediation. 4. Westinghouse selected the 25th percentile value based on the lack of site specific data for this parameter and believes it to be more appropriate than the 10,000 day value which the commenter has suggested.	Westinghouse will continue to use the 17,918 d source lifetime. No action required.	
17	WEC did not address second half of path forward: "If volumetrically contaminated building material will remain on site, provide volumetric DCGL values for the buildings."	Provide volumetric DCGL values as requested, or explain to what criteria survey results will be compared.	1. Volumetric contamination does not exist within the buildings expected to remain at the time of license termination. 2. In the unlikely event that volumetric contamination is identified, the volumetrically contaminated materials will be disposed or appropriate DCGL will be developed at that time and submitted to NRC for approval.	No action required.	

Attachment 1

Sensitivity Chart of Uniform CSM DCGL vs. Increasing CZ Thickness



Attachment 2-Revised DP Figure 5-5



Attachment 3, revised plant transfer factor table (excerpt from Table 5-6)

RESRAD			INPUT PARAMETER			
Parameter	**Code**	**Default**	**Value**	**Units**	**Justification**	**Reference**
HEMATITE CUSTOM DOSE FACTOR LIBRARY						
Plant Transfer Factors						
Uranium	BRTF(92,1)	2.50 E-03	3.70 E-03	unitless	P1 Physical Parameter. The 75th quantile of NUREG/CR-6697 PDF used.	Reference 5-4
Plutonium	BRTF(94,1)	1.00 E-03	1.00 E-03	unitless	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Technetium	BRTF(43,1)	5.00 E+00	9.27 E+00	unitless	The 75th quantile of NUREG/CR-6697 PDF used.	Reference 5-4
Thorium	BRTF(90,1)	1.00 E-03	9.93 E-04	unitless	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Neptunium	BRTF(93,1)	2.00 E-02	2.00 E-02	unitless	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Americium	BRTF(95,1)	1.00 E-03	1.00 E-03	unitless	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Actinium	BRTF(89,1)	2.50 E-03	1.00 E-03	unitless	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Protactinium	BRTF(91,1)	1.00 E-02	1.00 E-02	unitless	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Lead	BRTF(82,1)	1.00 E-02	4.00 E-03	unitless	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Radium	BRTF(88,1)	4.00 E-02	7.40 E-02	unitless	The 75th quantile of NUREG/CR-6697 PDF used.	Reference 5-4

Attachment 4, revised milk transfer factor table (excerpt from Table 5-6)

RESRAD			INPUT PARAMETER			
Parameter	**Code**	**Default**	**Value**	**Units**	**Justification**	**Reference**
Milk Transfer Factors						
Uranium	BRTF(92,3)	6.00 E-04	6.00 E-04	(pCi/L) / (pCi/d)	P2 Physical Parameter. The 75th quantile of NUREG/CR-6697 PDF used.	Reference 5-4
Plutonium	BRTF(94,3)	1.00 E-06	9.90 E-07	(pCi/L) / (pCi/d)	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Technetium	BRTF(43,3)	1.00 E-03	1.00 E-03	(pCi/L) / (pCi/d)	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Thorium	BRTF(90,3)	5.00 E-06	4.90 E-06	(pCi/L) / (pCi/d)	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Neptunium	BRTF(93,3)	5.00 E-06	1.00 E-05	(pCi/L) / (pCi/d)	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Americium	BRTF(95,3)	2.00 E-06	2.00 E-06	(pCi/L) / (pCi/d)	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Actinium	BRTF(89,3)	2.00 E-05	2.00 E-06	(pCi/L) / (pCi/d)	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Protactinium	BRTF(91,3)	5.00 E-06	4.90 E-06	(pCi/L) / (pCi/d)	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Lead	BRTF(82,3)	3.00 E-04	3.00 E-04	(pCi/L) / (pCi/d)	The median of NUREG/CR-6697 PDF used.	Reference 5-4
Radium	BRTF(88,3)	1.00 E-03	1.00 E-03	(pCi/L) / (pCi/d)	The median of NUREG/CR-6697 PDF used.	Reference 5-4

ATTACHMENT 5
SUMMARY OF 100% TC-99 SENSITIVITY ANALYSIS

Sensitivity Results for Hematite Uniform Conceptual Site Model

Description of Probabilistic Variable	Coefficients for Peak of Mean Dose by Repetition						
	PRCC						
	1		2		3		Avg. Coeff
	Sig	Coeff	Sig	Coeff	Sig	Coeff	
Kd of Tc-99 in Saturated Zone	11	-0.04	5	-0.08	5	-0.13	-0.08
Plant transfer factor for Tc	**1**	**1.00**	**1**	**1.00**	**1**	**1.00**	**1.00**
Meat transfer factor for Tc	4	-0.12	4	0.09	12	-0.03	-0.02
Milk transfer factor for Tc	**2**	**0.58**	**2**	**0.51**	**2**	**0.56**	**0.55**
Fish transfer factor for Tc	13	-0.01	6	0.08	8	-0.08	0.00
Well pumping rate	9	-0.05	8	0.07	13	0.00	0.01
Mass loading for inhalation	6	0.07	13	0.01	11	0.03	0.04
Indoor dust filtration factor	8	0.07	9	-0.06	4	-0.18	-0.06
Depth of soil mixing layer	12	-0.03	7	-0.08	10	0.04	-0.02
Depth of roots	10	-0.05	11	0.03	3	-0.21	-0.08
Wet weight crop yield of fruit, grain and non-leafy vegetables	5	-0.09	12	0.02	9	-0.05	-0.04
Weathering removal constant of all vegetation	7	0.07	3	-0.13	6	0.11	0.02
Wet foliar interception fraction of leafy vegetables	3	0.16	10	-0.05	7	-0.11	0.00

NOTE: Highlighted rows indicate variables that are considered sensitive.

Tc-99 DCGL Comparison

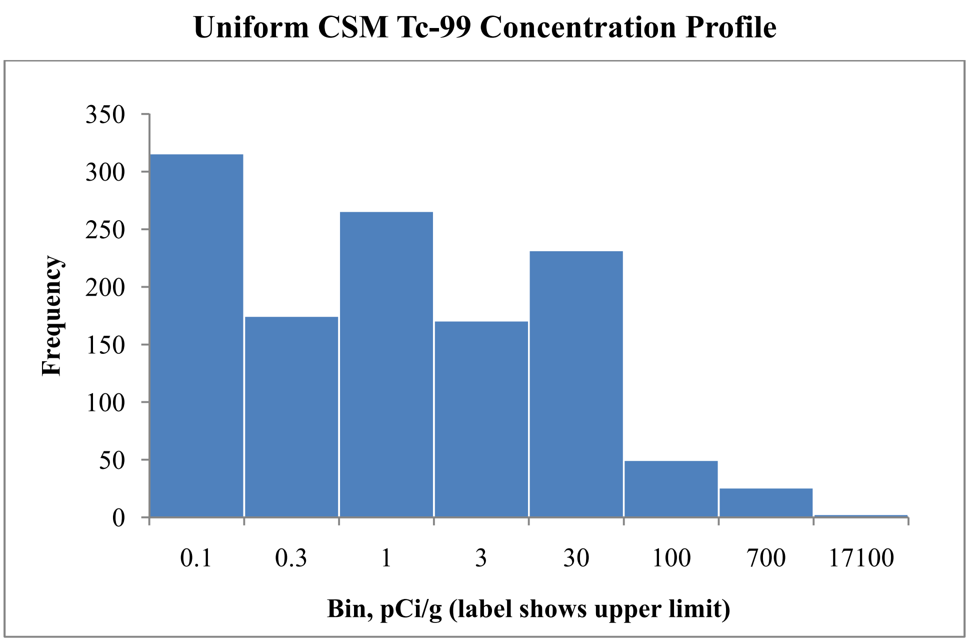
CSM	HDP DCGL from Tables 5-7 – 5-10 (pCi/g)	DCGL (pCi/g) Using 75th Percentile of Tc Milk Transfer Factor	Percent Change
Surface	162.0	159.0	-1.9%
Root	32.3	31.7	-1.9%
Deep	105,800	104,200	-1.5%
Uniform	26.9	26.4	-1.9%

Tc-99 Excavation Scenario Concentration Resulting in 25 mrem/yr Comparison

HDP Table 5-11 Result (pCi/g)	Concentration (pCi/g) Using 75th Percentile of Tc Milk Transfer Factor	Percent Change
39.7	39.6	-0.3%

Attachment 6
Radionuclide Concentrations Used in Actual Site Conditions Sensitivity Analysis

Radionuclide	Concentration
Am-241	7.13E-03
Np-237	2.03E-02
Pu-239/240	1.63E-03
U-234	4.19E+02
U-235	5.75E+00
U-238	1.41E+01
Tc-99	See figure, below



Attachment 7-Proposed Re-Write of DP-14 Question 1 RAI Response

1. (HDPC-14-Q1) Comment: Section 14.1.3.1 of the Hematite Decommissioning Plan (HDP) and Section 2.2 of the "Derivation of Surrogates and Scaling Factors for Hard-To-Detect Radionuclides" indicate that Np-237, Pu-239/240, and Am-241 are considered to be insignificant radionuclides of concern. This conclusion was based on the aggregate dose of these radionuclides being less than 10% of the Total Effective Dose Equivalent (TEDE) for each Conceptual Site Model. Population activity concentration results are given for these radionuclides in the Surrogate Report (DO-08-008), but it is not clear how the average concentration and associated statistics were determined.

   Basis: Per guidance in NUREG-1757, Vol. 2, Rev. 1, Section 3.3, "It is important that the licensee documents the radionuclides and pathways that have been considered insignificant and eliminated from further consideration and that the licensee justifies the decision to consider them insignificant."

   Path Forward: Provide details on how the average concentration, variance, and range of the results were determined for insignificant radionuclides of concern.

   Westinghouse Response:

   Please note that there is an error in the column heading in Table 2-2 of DO-08-008. A value is reported for each of the three CSMs in units of "Dose (mrem per year)" . The values actually represent the fractional contribution to the DCGL (average SOF) for each of the three CSMs.

   The details for identifying radionuclides that may be insignificant contributors to dose is contained in *Derivation of Surrogates and Scaling Factors for Hard-to-Detect Radionuclides*, Revision 0 July 2009, and are summarized below.

   > *Existing radiological characterization data were compiled and segregated into sample populations consistent with the conceptual site models (CSMs) that were used to derive the DCGLs. The CSMs were defined by the depth of the soil below ground surface (bgs) and include: Surface Stratum: 0 meters to 0.15 meters bgs; Root Stratum: > 0.15 meters to 1.5 meter bgs; and, Deep Stratum: > 1.5 meters to depth. In each of the soil sample populations, the average activity concentration for Am-214, Np-237 and Pu-239/240 was divided by the proposed DCGLs that were developed from dose-modeling performed in support of DP development to obtain the dose contribution. The proposed DCGLs are presented in Table 2-1, and the dose contributions from Am-214, Np-237 and Pu-239/240 are provided in Table 2-2.*

Since the time this document was submitted to NRC, Westinghouse Electric Company, LLC (Westinghouse) has re-considered the method that was selected for this determination, and recommends that the dose contribution from insignificant radionuclides be defined based on site-wide average concentrations as opposed to average values within each individual CSM. Westinghouse believes this is appropriate because the CSM boundaries are constructs used for modeling purposes and do not necessarily represent the radionuclide concentration profile.

In addition, Westinghouse recommends that the dose contribution from insignificant radionuclides be calculated using the Uniform CSM rather than the CSM appropriate to each sample's depth. Because a sample was not collected at each depth consistent with the Surface, Root, and Deep CSMs, the previous method of dividing the sample's result by the applicable DCGL by depth may not have accounted for the total dose in the vertical soil column at the sample location. Rather, as discussed in the paragraph above, the site-wide average concentration will be determined for each radionuclide, and then divided by the Uniform DCGL applicable to the radionuclide to determine the dose contribution from that radionuclide.

The recommended method includes first calculating the average concentration for each radionuclide (across all samples), then calculating the SOF for each radionuclide by dividing each by the applicable Uniform CSM DCGL., and then comparing the sum of these three SOF values to 0.10 of the DCGL. (2.5 mrem/year)

Section 2.2, paragraphs 1 – 3 of DO-08-008, "*Derivation of Surrogates and Scaling Factors for Hard-To-Detect Radionuclides" will be revised to state the following:*

> *Characterization data for all the impacted site areas were reviewed to determine if any of the radionuclides of concern listed in Section 2.1 were considered insignificant dose contributors using methods consistent with the guidance provided in NUREG-1757 (Reference 6-3). In summary, the aggregate dose contribution from insignificant radionuclides must not exceed 10 percent of the TEDE criterion, or 2.5 mrem per year. Additionally, the aggregate dose from insignificant radionuclides must be included with the total dose from all radionuclides when demonstrating compliance with the TEDE criterion.*
>
> *Radiological characterization data for Am-241, Pu-239, and Np-237 were compiled. For each radionuclide, the average concentration across all sample locations was calculated. The SOF values from Am-241, Np-237 and Pu-239/240 were determined by dividing each average radionuclide sample activity by the corresponding Uniform CSM DCGL.. The aggregate dose from each all three insignificant radionuclides (Am-241, Pu-239, and*

Np-237) was determined by summing the individual radionuclide SOF contributions and multiplying by 25 mrem..

The aggregate dose contribution from Am-214, Np-237 and Pu-239/240 was determined to be 1.7 mrem, which is less than 10 percent of the TEDE; and thus, these radionuclides are considered to be insignificant radionuclides of concern. The characterization sample data and SOF calculations are provided in Appendix A. The proposed DCGLs used in this calculation are presented in Table 2-1, and the contribution of Am-241, Np-237 and Pu-239/240 are provided in Table 2-2.

Tables 2-1, 2-2, and A-1 will be revised as follows.

Table 2-1, Proposed Site-Specific Uniform CSM Soil DCGLs (pCi/g)[a,b]

Radionuclide	DCGL
U-234	209.6
U-235 + D c	55.3
U-238 + D c	181.0
Tc-99	26.9
Th-232 + C c	2.1
Ra-226 + C d,e	2.2
Np-237 + D c	0.3
Pu-239/240	83.1
Am-241	79.3

a The reported soil limits are the activities for the parent radionuclide as specified.

b DCGL values shown have been updated to include changes to RESRAD input factors in accordance with applicable RAI responses.

c "+ D" = plus short-lived decay products.

d "+ C" = plus the entire decay chain (progeny) in secular equilibrium.

e This DCGL only applies to those areas of the site identified as a Ra-226 impacted area.

f Np-237 DCGL in the Deep CSM is based on the alternate excavation scenario

Table 2-2, Dose Contribution from Insignificant Radionuclides

Insignificant Radionuclide	Average Concentration (pCi/g)	DCGL	Average SOF	Dose Contribution (mrem/yr)
n-241	5.1E-03	7.9E+01	6.4E-05	1.6E-03
Np-237 + D	2.0E-02	3.0E-01	6.8E-02	1.7E+00
Pu-239/240	1.6E-03	8.3E+01	2.0E-05	4.9E-04
Total			6.8E-02	1.7E+00

Table A-1, Summary of Statistics - Am-241, Np-237 and Pu-239/240

Number of Samples			
Insignificant Radionuclide	Conceptual Site Model (CSM)		
	Surface	Root	Deep
Am-241	390	434	456
Np-237	74	57	19
Pu-239/240	74	57	19

Insignificant Radionuclide	Average Concentration (pCi/g)
Am-241	5.1E-03
Np-237	2.0E-02
Pu-239/240	1.6E-03

Additionally, the last two sentences in Section 14.1.3.1 of the Hematite Decommissioning Plan (HDP) will be revised as follows:

> *"The contribution of insignificant radionuclides was calculated to be 1.7 mrem per year (or 6.8 percent of the TEDE criterion) for Np-237, Pu-239/240, and Am-241 for all soil depths. Details of the calculations are taken from Section 2.2 of Reference 14-4."*