July 12, 2010

Mr. E. Kurt Hackmann
Director, Hematite Decommissioning Project
Westinghouse Electric Company
3300 State Road P
Festus, MO 63028

SUBJECT: WESTINGHOUSE HEMATITE DECOMMISSION PLAN REVIEW REQUESTS FOR ADDITIONAL INFORMATION

Dear Mr. Hackmann:

By your letter dated August 12, 2009, you submitted a request for approval of the Westinghouse Hematite Decommissioning Plan (DP) [ADAMS Nos. ML092330123, ML092330125, ML092330127, ML092330129, ML092330131, and ML092330132]. The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed your request. As a result of that review the staff has identified areas where additional information is required in order to complete its review. Enclosed is a request for additional information (RAI) covering Chapter 5 of the DP, Dose Modeling.

The NRC will be transmitting RAIs covering the remaining Chapters of the DP and other documents submitted in support of the Hematite decommissioning in future communications.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders," a copy of this letter will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html.

Please provide your response to the RAIs within 30 days of the date of this letter. If you have any further questions, please contact me at (301) 415-5928 or via email at john.hayes@nrc.gov.

Sincerely,

/RA/

John J. Hayes, Senior Project Manager
Materials Decommissioning Branch
Decommissioning and Uranium Recovery
Licensing Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

Enclosure: Hematite DP Chapter 5 RAI

cc: Westinghouse- Hematite Service List

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Hematite Decommissioning Plan Chapter 5 – Dose Modeling
Request for Additional Information

1. (HDP-C5-Q1)
Comment: The Hematite Decommissioning Plan (HDP), Section 5.2, states that Ra-226 and Th-232 are only found in certain locations of the site, but the location and extent of contamination is not thoroughly illustrated. Also, the Th-232 model assumes the entire surface area of the site is contaminated even though it is stated to be found in limited locations. Also, it is unclear if these radionuclides will be measured for across the entire site area during the Final Status Survey (FSS) to ensure they meet the derived concentration guideline levels (DCGLs).

Basis: The area of the contaminated zone is a necessary RESRAD input parameter for determining the DCGLs. Section 5.2 of the DP discusses how Th-232 and Ra-226 are modeled separately from the other Radionuclides of Concern (ROCs). In HDP Figure 5-3, Ra-226 Impacted Areas, the legend uses a triangle to designate "Elevated Ra-226 Locations." However, the diagram does not have any triangles identifying the Ra-226 locations within the "Ra-226 Impacted Area." The DP states that Th-232 is only found in certain locations within the area of buried waste and that Ra-226 is only present at two locations within the buried waste. The Hematite Radiological Characterization Report (HRCR) describes Th-232 in isolated areas in the Burial Pits Soil, and Soil Southeast of the Process Buildings and Surrounding Areas. However, in Table 5-6 of the DP describing the RESRAD Input Parameters, the size of the Th-232 model contaminated zone is the entire site area of 153,375 m^2 while the Ra-226 model assumes a limited area of 1,292 m^2. It is unclear why the area is not reduced in the Th-232 model if the contaminant is only found in certain areas. If a larger area was intended to be used, then it is unclear why Th-232 was modeled separately from the other ROCs.

Path Forward: Please provide an updated Figure 5-3 identifying the elevated Ra-226 locations. Also, provide further basis for the contaminated zone areas used in the Th-232 model. Also, clarify if Ra-226 and Th-232 will be measured for across the whole site area during the FSS and explain how the absence of Th-232 and Ra-226 in other areas of the site will be verified if those radionuclides will not be measured for in those areas in the FSS.

2. (HDP-C5-Q2)
Comment: The site-specific Kds discussed in Section 5.3.4.2 require additional explanation.

Basis: Table 5-6 of the DP states as part of the justification for the distribution coefficients, "As expected, both of the site-specific Kds were between the loam and clay values reported in Table 3.9-2. This is consistent with the silty-clay soil type." The site-specific Kd of 106 cm^3/g used for Tc-99 is significantly greater than the literature value commonly associated with that of clay (1 cm^3/g) and loam (0.1 cm^3/g). The Kd for the Contaminated Zone (CZ) and Unsaturated Zone (UZ) for uranium and technetium are determined through lab experiments described in Reference 5-6. The batch experiments used to determine the site-specific Kd may have resulted in removal of the sorbate by precipitation reactions, overestimating the value of the Kd. The analyses tested Kds using the batch test with samples at 3 depths from 6 boreholes on the site.

The recommended Tc Kd value (106 cm^3/g) is the average of 11 data points from the adsorption test only that range from 15.1 to 172.9. The study acknowledges that the recommended site-specific value is significantly higher than the literature values. Because the spiking agent, TcO-4, is highly soluble, removal of the Tc from solution is likely due to the reduction of Tc(VII) to Tc(VI) which is much less soluble. (The reduction likely resulted from abiotic reactions with reduced chemical species such as Fe+2.) The U.S. Environmental Protection Agency (EPA) Guidance[1] on measuring Kds states that if the batch experiments are not performed correctly to prevent significant removal of the sorbate by precipitation reactions, the Kd can be significantly overestimated (EPA, 1999 pg 3.4). The large recovery of Tc in the solid residue may be explained through chemical reduction followed by precipitation, instead of sorbtion. Use of a no-solids control group can aid in accuracy of results, but there is not mention of a no-solids control in Reference 5-7.

To obtain the recommended value for uranium, the mean of the adsorption tests (excluding 3 low outliers) is averaged with the mean of the desorption tests (excluding one very high outlier). Even excluding the outliers, significant variability in the measured Kds is reflected by standard deviations that are almost as great as the mean value. The arithmetic mean of data points with a large standard deviation does not take into account the uncertainty and variability existing in the data set.

Path Forward: In order to use the site-specific experiment specify if a no-solids control was applied in the experiment and provide the results from the no-solids control. Also provide justification as to why the average values adequately account for the range of results in the lab experiments. Alternatively, if a no-solids control was not included in the experiment, do not use the site-specific Kds and instead apply conservative literature values for the Kd of technetium and uranium in the CZ and UZ in calculating DCGLs.

3. (HDP-C5-Q3)
Comment: Additional justification is required concerning the values chosen for the depth of the contaminated zone and the thickness of the unsaturated zone as described in Section 5.3.4.2 of the DP.

Basis: Reference 5-6 provides evidence through boreholes that the soil type classification up to 9.1 m is clay (30 ft). Reference 5-7, p. ix states "…overall thickness of alluvium deposits underlying Joachim Creek valley … ranges from 17-45 ft [about 5-14 meters] and is comprised of fine grained silt and clay that overlies sand and gravel near the bedrock surface." Table 5-6 in DP describing site specific parameters, states that NUREG 1757 is used in determining the UZ thickness. The thickness is derived from assuming the total depth of the clay layer assumed to be 9.1 m (30 ft), and subtracting the layer of the Cover+CZ. For example, for DEEP and Uniform, UZ thickness = 9.1 - 6.7 = 2.4. For ROOT, UZ = 9.1 – 1.5 = 7.6. Therefore, the UZ

[1] Understanding Variation in Partition Coefficient, Kd, Values. Volume I: The Kd Model of Measurement and Application of Chemical Reaction Codes.

thickness is directly dependent on a site-specific parameter of 9.1 m referring to the 30 feet in 5-4. The CZ thickness depends on the Conceptual Site Model (CSM) (e.g., Surface is 0.15 m, and Root is 1.5m). NUREG 1757 suggests the depth of 0.15m (top 6 inches) for surface contamination. The DP, pg 5-7 states that the 1.5 m depth is justified based on the erosion rate. The depth 0.6 m is the amount of thickness which will be eroded in 1000 years at a rate of .0006 m/yr. The depth of roots assumed is 0.9 m. The depth 0.6 m is added to 0.9 to obtain 1.5m. Setting the CZ to 1.5 m will ensure that the thickness of the CZ for ROOT CSM is equal to or greater than the depth of the roots for the entire 1,000 yr period. The CZ thickness is based on the analysis of Figure 5-5 for Deep (6.7 m).

Section 5.3.4.2 states that the depth of the contaminated zone for the DEEP CSM was determined through analysis of characterization data of the site. This data is provided in Figure 5-5 in units of sum of fraction, but the concentrations at each depth are not provided. It is difficult to determine the significance of the data points below 6.7m without knowing the concentration values and the radionuclide that was detected at certain depths. It is also not clear if the DEEP, UNIFORM, or Alternative Excavation CSM was used as the denominator for determining the sum of fraction unit for depths greater than 1.5 m.

Path Forward: Justify the values chosen for the depth of the contaminated zone for the DEEP and UNIFORM CSM, and the thickness of the unsaturated zone. In order to adequately characterize the depth and extent of contamination, the concentrations used in the numerator of the calculation in determining sum of fraction units for Figure 5-5 should be provided. Also, clarify which DCGL was used in determining the sum of fraction units at the various depths. In order to adequately characterize the unsaturated zone thickness, show that the value of 9.1 m is appropriate and adequately takes into account the range of thickness of the alluvium deposits underlying Joachim Creek within the site reported in site characterization studies.

4. (HDP-C5-Q4)

Comment: Section 5.3.4.2 discusses the value assumed for the evapotranspiration coefficient. This value is inconsistent with the assumptions regarding related parameters such as irrigation rate, precipitation rate, evapotranspiration rate, and runoff coefficient. It is not evident that the value chosen for the evapotranspiration coefficient is adequately conservative. Furthermore, the value chosen for the runoff coefficient does not match the site-specific data.

Basis: The evapotranspiration coefficient is correlated with irrigation rate, which is correlated with precipitation rate, and well pumping rate. Precipitation rate is correlated with runoff coefficient. Table 5-6 of the DP states that the calculated value for evapotranspiration coefficient (based on the assumed values for evapotranspiration rate, precipitation rate, irrigation rate, and runoff coefficient) is greater than 1.0. (The value calculated is 1.02). Since the evapotranspiration coefficient cannot possibly be larger than 1.0, the DP states that the maximum of the PDF provided in NUREG-6697 was used instead. However, the maximum value in NUREG-6697 is 0.75, and the value assumed in the DP is 0.8.

The timing of the Np-237 peak dose is sensitive to the assumed value for the evapotranspiration coefficient and related parameters, so the value for evapotranspiration coefficient should be sufficiently justified. Furthermore, the values chosen for the evapotranspiration coefficient could impact the sensitivity of results to the values chosen for the Kds of certain radionuclides such as Np-237.

The runoff coefficient is estimated based on a method described in NUREG-6697, Attachment C, Table 4.2-1 assuming flat cultivated land with intermediate combination of clay and loam. This method results in a runoff coefficient of 0.8. However, in a document supporting the 2004 DP titled "Derivation of Site-Specific DCGLs for Westinghouse Electric Co. Hematite Facility", on pg A-3, of the value chosen for runoff coefficient is 0.305 based on 12" annual average runoff, and 38" average annual precipitation. In Section 3.3 of the 2009 DP, p. 3-5, it is restated that the area receives 12" of average annual runoff. It is not clear why the runoff coefficient assumptions changed from the 2004 DP if the site-specific data has not changed. It is also not clear why applying a generic empirical method in NUREG-6697 is the chosen approach over using the site-specific data.

Path Forward: Justify the values assumed for the evapotranspiration coefficient and runoff coefficient. Given the uncertainty in these parameters, explain how the values chosen are adequately conservative. Rectify the inconsistencies in the assumptions regarding correlated parameters such as irrigation rate, precipitation rate, evapotranspiration rate, and the runoff coefficient. Reevaluate the sensitivity of the Kds of relevant nuclides if a new value is assumed for the evapotranspiration coefficient.

5. (HDP-C5-Q5)

Comment: Westinghouse Electric Company (WEC) departs from their parameter selection approach for the plant transfer factor for Pa-231 and the milk transfer factor for Ra outlined in Section 5.3.4. The values assumed are neither the default RESRAD parameter values, nor are they the median value of the probability distribution function (PDFs) in NUREG-6697.

Basis: Pa-231 is a progeny of U-235, so the dose from this radionuclide impacts the DCGL for U-235. The milk transfer factor for Ra impacts the U-234 and the Ra DCGLs. The Pa-231 plant transfer factor and the Ra milk transfer factor are determined to be non-sensitive, so the median value of the PDF in NUREG-6697 should be applied if the value is changed from the RESRAD default. The Pa-231 plant transfer factor assumed (1e-3) does not match the median of the PDF in NUREG-6697, Table 6.2.1, pg. 6-5 (1e-2) or the RESRAD default (2e-2). Similarly, the milk transfer assumed for Ra (1e-4) does not match the median of the PDF or the RESRAD default (both are 1e-3).

Path Forward: Justify the value used for the plant transfer factor for Pa-231 and for the milk transfer factor for Ra. If new values are applied, reevaluate the DCGLs for these radionuclides.

6. (HDP-C5-Q6)

Comment: The DP, Section 5.3.4.3, states that the sensitivity of the non-site specific parameters was determined using the probabilistic method in RESRAD for each CSM, assuming a different ratio of ROCs was used for the source term in each CSM. The ratios assumed require further justification. Also, it is not clear why the Alternative Excavation was not included as one of the CSMs in the sensitivity analysis.

Basis: NUREG-1757, Vol. 2, Appendix I states that the licensee may use expected concentrations or relative ratios, but also says they should evaluate the effect of uncertainty on the relative ratios. The ratios are based on the average concentration characterizing each soil layer, but the standard deviation of these data points is not provided. Since the Alternate Excavation CSM is used to determine the DCGLs that will be used in the DEEP zone (with the exception of Np-237), a sensitivity analysis should be performed for this CSM to determine any additional key parameters. It is unclear why the sensitivity of parameters was not tested for the Excavation CSM.

Path forward: Describe the data source for the averages used in Table 3-1 of reference 5-4. Evaluate the effect of uncertainty on the relative ratios of soil activity concentrations used. Perform a sensitivity analysis for the Alternative Excavation CSM, or explain why the important parameters for this model have already been identified using one of the other CSMs. Evaluate the sensitive parameters for the Alternate Excavation CSM.

7. (HDP-C5-Q7)

Comment: The Kds of Ac-277, Np-237, and Th-232 are determined to be sensitive parameters as described in Section 5.3.4.4, and therefore, should be treated conservatively.

Basis: NUREG-1757 Vol 2, Appendix I states that sensitive parameters should be treated conservatively by applying the 25^{th} or 75^{th} percentile of the distribution unless site-specific data is available. Section I.6.4.2 states, "…for the physical parameters, the licensee should use site-specific information for the physical parameters addressing geohydrologic and meteorologic conditions. The level of justification for the parameter values should be based on sensitivity analyses. Alternatively, sensitivity analyses may be used to support the use of default distributions or representative values."

The DP, Section 5.3.4.4, describes that these Kds values are based on soil type as opposed to the 25^{th} or 75^{th} quantile of a generic distribution. For example, the 25^{th} percentile of the distribution for Np-237 Kd in NUREG-6697 is 3.75 cm^3/g. This value is deemed to be inconsistent with the silty clay soil type in the contaminated and unsaturated zones. The value chosen for the contaminated and unsaturated zone Kd is 25 cm^3/g , which is the mean of literature values corresponding to clay, and the saturated zone value is the mean of literature values corresponding to sand, or 5 cm^3/g. The mean value taken from literature samples for a specific soil type does not constitute a site-specific Kd. Furthermore, it is unclear why the recommendations for the neptunium and americium Kds provided in Reference 5-6 were not followed in the DP. Reference 5-6 suggests using a value of 2 cm^3/g for neptunium, and a value of 1000 cm^3/g for americium Kd. In acknowledging that the value of 2 cm^3/g is conservative, Reference 5-6, p. 44 also states "…if the calculated DCGL based on this conservative

Kd is significantly smaller than in situ Np levels and will require significant clean-up efforts, site-specific laboratory measurements may be warranted." However, it is not evident that WEC has pursued laboratory measurements for neptunium Kds. This is a similar case for americium.

The representative value for the soil type should be adequately conservative, and should consider the uncertainty in the literature estimates for that soil type. For example, the 25^{th} percentile of the literature PDF for Np-237 in silt is 11 cm^3/g. Knowledge of site soil type can be used to inform the choice for the representative Kd, either by applying a narrower distribution or a conservative representative value for distribution of that soil type. Alternatively, if the licensee wishes to use site-specific Kd values, the values should be determined through taking samples and using laboratory analysis.

Path Forward: Demonstrate that the values used for the Kds of Ac-277, Np-237, and Th-232 for the contaminated and saturated zones are sufficiently conservative through sensitivity analysis. Alternatively, obtain site-specific data to measure site-specific Kds for these radionuclides through laboratory analysis. If new Kds are chosen for these radionuclides, adjust the DCGLs in Chapter 5 and Chapter 14 accordingly.

8. (HDP-C5-Q8)
Comment: The value chosen for Root Depth in Section 5.3.4.4 of the DP requires further justification.

Basis: On p 5-15 of the DP, a site-specific value (0.6 m), estimated from Missouri data, is described for root depth. The DP also states that the generic weighted average root depth for fruits, vegetables and grains, and leafy vegetables is 1.1 m. The value of 0.6 m is averaged with 1.1 m to obtain the chosen value of 0.9 m. The basis for why these values are averaged is not provided. The value of 0.9 m is also coincidentally the RESRAD default value for Root Depth, but this is not the reason provided for using the value of 0.9 m. The range of values in NUREG-6697 is 0.3 m to 4.0 m.

Root depth is negatively correlated with dose for SURFACE and ROOT because the longer the root, the more clean soil the root is able to reach in proportion to its total length. It is positively correlated with dose for DEEP because the longer the root, the greater the proportion of it that lies in the DEEP section. Applying a value of 0.9 m instead of 0.6 m would lower the doses for SURFACE and ROOT, but increase the doses for DEEP. The value chosen for Root Depth should be adequately conservative for the SURFACE, ROOT, and Alternative Excavation Conceptual Site Models.

Path Forward: Explain the basis for why the site-specific value of 0.6 m was averaged with non-site specific data from NUREG-6697, or choose the site-specific value. Demonstrate that the value chosen for Root Depth is adequately conservative for the SURFACE, ROOT and Alternative Excavation CSMs through a sensitivity analysis.

9. (HDP-C5-Q9)
Comment: The proposed DEEP DCGLs do not protect the intruder and should not be used under any circumstance.

Basis: The DCGLs should be defined to protect the intruder from receiving no more than 0.25 mSv/yr. Section 5.3.6 of the DP describes the Alternate Scenario for Deep DCGLs, referred to as Excavation. This scenario is applied to develop DCGLs for contamination below 1.5 m up to 6.7 m that result in acceptable doses to the Intruder. The DCGLs developed with the DEEP CSM are orders of magnitude above the other DCGLs. The DEEP DCGLs result in doses well above the limit for the intruder. Doses above 0.25 mSv are not acceptable for unrestricted release. Still, WEC has reserved the right to use the DEEP DCGLs. Page 5-17 of the DP, "However, Westinghouse reserves the option to apply the DEEP DCGLs if continued excavation would introduce undue hazards to the personnel or to members of the general public, or would result in costs that are not justified based on the ALARA principle. If the application of the DEEP DCGLs is required, the residual concentrations will be less than those listed in Table 5-9 but may exceed the Excavation DCGLs."

Path Forward: Justify how the intruder scenario meets the dose criteria if the DEEP DCGLs are used. Alternatively, remove the right to use the DEEP DCGLs from the DP, and substitute the Alternative Excavation DCGLs in all instances where the DEEP DCGLs are used in the DP.

10. (HDP-C5-Q10)
Comment: More information is necessary to review the Area Factors for the Soil as described in Section 5.3.7, and for Building DCGLs as described in Section 5.4.5.

Basis: The RESRAD files used to calculate the $DCGL_{EMC}$ for buildings and soil are not included in the DP. These files are required to verify that the inputs and outputs to RESRAD are correct. Also, area factors are not defined for the DEEP layer. If the UNIFORM area factors will apply for all areas of elevated activity at depths below 1.5 m, this should be clearly stated. The footnote on Table 14-12 indicates that the length parallel to the aquifer was determined for each Area Size by determining the diameter of a circle with the area of the CZ, and multiplying by a factor of 343/291, where 343 is the diameter of a circle with area 99,539 and 291 is the length applied for the contaminated zone. The reason for multiplying by this factor is unclear.

Path Forward: Provide the RESRAD Summary Files for determining the $DCGL_{EMC}$ for buildings and soil. Explain the rationale behind the ratio used in calculating the length parallel to the aquifer. Verify which area factors will be applied for depths greater than 1.5 m.

11. (HDP-C5-Q11)
Comment: The source term in RESRAD is solely from contaminated soil. Contamination has been found in the upper aquitard, a region below the contaminated soil, as stated in the DP in Table 4-28. This contamination would serve as an additional source term if it reaches the lower aquifer. The cumulative impact of both source terms on the soil DCGLs should be considered.

Basis: As stated in NUREG-1757, the potential radiation dose that could result from groundwater contamination should be accounted for when demonstrating compliance with the dose limit of 0.25 mSv/yr. Section 5.3.8 states that very low, insignificant concentrations of Tc-99 are potentially present in site groundwater. Section 5.3.8 does not make any statements about the levels of U-234 in the groundwater. These current measured values in Table 4-28 of the DP for Tc-99 are 13.4 pCi/L in the sand/gravel aquifer and 48.9 pCi/L in the bedrock aquifer. For U-234, the measured values are 6.8 pCi/L and 12.4 pCi/L. The current measured groundwater concentrations do not adequately capture the leachate source term in the upper aquitard that could potentially contaminate the groundwater in the lower aquifer. Table 4-28 displays measured concentration values of 7,900 pCi/L of U-234 in leachate at an unknown screen depth, and 6,400 pCi/L of Tc-99 in the overburden hybrid. Note that these concentrations are not accounted for in the contaminated soil source term either.

When estimating the groundwater dose, it is important to use the maximum groundwater concentration projected within 1,000 years as input to the groundwater contamination. The maximum projected groundwater concentration should be used for dose estimation instead of the maximum measured groundwater concentration unless there is sufficient evidence to demonstrate that the groundwater concentrations would decline over time from their current measured values after the release of the facility. Section 5.3.8 states "Groundwater doses will be calculated by multiplying the groundwater concentration identified, if any, for a given ROC by the corresponding DSR_{GW} listed in Table 5-14." However, it is not clear how the groundwater concentrations may change in the next 1,000 years resulting from the leachate migration. The migration of volatile organic compounds offsite suggests the presence of fast pathways through which radionuclides could also travel. The potential dose from this source term should be combined with the dose from the soil and accounted for in the determination of the soil DCGLs.

Path Forward: Estimate the peak dose contribution from the source term contamination currently present in the leachate for Tc-99 and U-234 if it were to reach the groundwater over the 1,000 year period of performance. Estimate the dose when groundwater source term is cumulatively considered with the soil contamination source term, and adjust the soil DCGLs as necessary. Alternatively, provide sufficient evidence to demonstrate that the groundwater concentrations would decline over time from their current values after the release of the facility.

12. (HDP-C5-Q12)

Comment: The value used for direct ingestion in RESRAD-BUILD as described in Section 4.2.3.1 of the DP seems to be based on information about indirect ingestion rates.

Basis: The information in NUREG/CR-5512 that was used as the basis for the direct ingestion parameter is for "secondary ingestion" which is defined in NUREG/CR-5512 as the "Ingestion of removable surface contamination inside buildings that is transferred from contaminated surfaces via hands, food, and other items to the mouth". This differs from direct ingestion, which corresponds to the consumption of the contaminated material directly from the source. Therefore, it might not be appropriate to use the information on secondary ingestion in NUREG/CR-5512 as the basis for the direct ingestion parameter.

Path Forward: Provide additional justification for the value selected for the direct ingestion parameter or provide a revised analysis using an appropriate value for this parameter.

13. (HDP-C5-Q13)
Comment: It is not clear how the median, 25th, and 75th percentile values used in the RESRAD-BUILD analyses were calculated from the distributions provided in NUREG-6697.

Basis: The values used in the RESRAD-BUILD analyses for parameters such as the deposition velocity, resuspension rate, building exchange rate, and the source lifetime were based on median, 25th percentile, and 75th percentile of distributions presented in NUREG-6697 as described in Section 5.4.3.1 of the DP. However, it is not clear how these values were calculated from these distributions.

Path Forward: Provide a description of the methodology used to calculate the median, 25th percentile, and 75th percentile values from the distributions in NUREG-6697.

14. (HDP-C5-Q14)
Comment: The value used for the source lifetime parameter in RESRAD-BUILD may not sufficiently bound the calculated dose.

Basis: The source lifetime parameter was identified in Section 5.4.3.2 as being a sensitive parameter with a negative correlation to dose, and the 25th percentile of the distribution in NUREG-6697, or 17,918 days, was selected for this parameter value. However, the source lifetime distribution in NUREG-6697 is a triangular distribution with a most likely value of 10,000 days. Because the calculated dose is sensitive to the value of this parameter, it may not be appropriate to select a value for this parameter that results in a lower dose than the “most likely” value.

Path Forward: Provide additional information supporting the parameter value used for the source lifetime in RESRAD-BUILD, or provide a revised analysis using an alternate value for this parameter.

15. (HDP-C5-Q15)
Comment: The value used for the building exchange rate in RESARAD-BUILD is inconsistent with the value described for this parameter in the text of the DP. In addition, information on the current building exchange rates is not provided in the DP.

Basis: Section 5.4.3.2 of the DP identifies the building exchange rate as a sensitive parameter with a negative correlation to dose and that the 25th percentile of the distribution for this parameter from NUREG-6697 was therefore used for this parameter. However, in Table 5-16, the value used for this parameter corresponds to the 75th percentile value. Also, more information is needed about the building exchange rates observed for the buildings that will remain at the time of license termination. Although the usage and configuration of these buildings may change in the future, the air exchange rates currently observed in these buildings provides useful information about the expected range of air exchange rates that may exist in the future.

Path Forward: Provide a revised analysis that uses the correct value (i.e., the 25th percentile instead of the 75th percentile) for the building exchange rate. Provide information about the current air exchange rates in the buildings that will remain at the time of license termination.

16. (HDP-C5-Q16)
Comment: The range of ratios observed for the radionuclides in the samples taken from the buildings was not considered in the RESRAD-BUILD sensitivity analysis.

Basis: The sensitivity analysis that was performed for the RESRAD-BUILD calculations described in Section 5.4.3.2 was based on the relative ratios of radionuclides that are presented in Table 4-1 of the DP. These values seem to be based on the total amount of a radionuclide in the samples divided by the total activity of all radionuclides in the samples. This corresponds to a mass weighted average of the ratios over all of the building samples. However, based on the data presented in Table 4-1, the relative ratios of the radionuclides seem to vary widely from sample to sample. Because the dose from different radionuclides can be sensitive to different parameters, it is important to consider uncertainty in the relative ratios of the radionuclides in the sensitivity analysis.

Path Forward: Provide an evaluation of the effect of uncertainty in the relative ratios of the radionuclides on the outcome of the sensitivity analysis.

17. (HDP-C5-Q17)
Comment: It is not clear how the volumetric contamination in the buildings will be evaluated if it is found.

Basis: The DCGL values described in Section 5.4.4 derived for the buildings that will remain on site are areal concentrations for surface contamination. It is not clear what criteria will be used if areas of volumetric contamination are found in the buildings. In addition, Chapter 4 of the DP states that isolated spots of elevated activity were identified within the seams and joints on the concrete floor, which implies that volumetric contamination may exist in these areas.

Path Forward: Provide information about how volumetric contamination will be evaluated if any is found within the buildings. If volumetrically contaminated building material will remain on site, provide volumetric DCGL values for the buildings.

18. (HDP-C5-Q18)
Comment: DCGL values discussed in Section 5.4.4 were not provided for the ventilation ducts in the buildings that will remain on site and the dose to the building occupant from contaminated ducts was not considered.

Basis: It is not clear how the residual contamination in the interior of ventilation ducts will be evaluated because DCGL values were not provided for the ducts. In addition, the potential for the residual contamination in the ducts to cause a dose to the building occupants was not evaluated. Because the building surface DCGL values correspond to a dose of 0.25 mSv/yr, an individual who receives a dose from the building surfaces as well as the interior of the ducts could receive a dose that is above 0.25 mSv/yr.

Path Forward: Provide information about the DCGL values that will be used for the interior of ducts. Also provide information about the potential dose from the residual contamination in the ducts to a building occupant. If the potential dose from the residual contamination in the ducts is not insignificant, revise the building surface DCGL values to account for the fact that the occupant could receive a dose both from residual contamination on the building surfaces and the residual contamination in the ducts.

19. (HDP-C5-Q19)
Comment: The conceptual model used for calculating the DCGL values for the pipes described in Section 5.5 does not seem consistent with the expected configuration of the residual contamination following decommissioning activities.

Basis: There are several aspects of the conceptual model assumed in calculating the DCGL values for pipes that need additional clarification. In the calculation of these DCGL values, it is assumed that the pipe is filled with soil that has an activity of radionuclides equal to the DCGL values calculated for the root depth soil layer (i.e., 15 cm to 1.5 m). These volumetric DCGL values were then converted to an areal value on the interior surface of the pipe, which is effectively equivalent to assuming a dilution of the material on the surface of the pipe over the whole volume of the pipe. This resulted in the proposed areal DCGL values to be larger for large pipes than for small pipes because in the large pipes the material was averaged over a larger volume. The pipes that remain on site at the time of license termination may remain in service and may not be filled with soil, so it is not clear that this conceptual model applies. In addition, the dose to an individual may be different from a thin skin of contamination on the surface of the pipe than from a volumetric source containing the same amount of activity. Furthermore, the contribution of the pipes to the dose for the resident and building occupant scenarios is not considered and the potential dose from the pipes being excavated and reused is not considered. Information on the depth of the pipes below the ground surface was also not provided. The depth of the pipes can have a large impact on the dose because of the shielding from the soil or pavement above the pipe.

Path Forward: Provide additional justification for the assumed conceptual model used in the development of the DCGL values for pipes, including the basis for assuming that the residual contamination in the pipes is averaged over the volume of the pipe. Alternatively, a new calculation of DCGL values for the pipes can be performed and provided along with justification for the conceptual model assumed in the new calculation. The potential dose from the pipes to the building occupant and resident receptors should be considered, and the potential dose from a pipe that is dug up and reused should also be considered. Information on the depth of the pipes below the ground surface should also be provided.

Clarifying Comments

1. Comment: There appears to be a mistake in the units for Table 5-15.

   Basis: Table 5-15 provides approximate building dimensions in meters. However, in Table 5-16, the same values for the building dimensions are reported as being in feet.

   Path Forward: Provide the correct units for the dimensions provided in Table 5-15.

2. Comment: There appears to be a typo in the number of years required for 0.6 m of erosion to occur.

   Basis: On page 5-7, it is stated that "potential erosion over 100 years is estimated to be 0.6 m". However, the erosion rate used in RESRAD corresponds to 0.6 m of erosion in 1000 years.

   Path Forward: Provide the correct number of years required for 0.6 m of erosion to occur.

3. Comment: Section 5.4.3.1 seems to cite the wrong table.

   Basis: On page 5-21, it is stated "The activity fractions of the ROCs in site buildings are provided in Chapter 4, Table 4-2". However, this information is not presented in Table 4-2.

   Path Forward: Provide the correct reference for the location of this information.

4. Comment: Some possible discrepancies have been identified in the information presented in Table 5-21 of the Decommissioning Plan about the buried piping expected to remain at license termination.

   Basis: The piping listed in Table 5-21 for buried piping expected to remain at license termination includes piping for Building 240. However, Chapter 4 of the DP indicates that this building will be demolished prior to license termination. Additionally, this table does not include piping for Building 231, which is expected to remain at the time of license termination. Chapter 4 of the DP also states that Building 115 (Fire Pump House), the Sanitary Wastewater Treatment Plant (SWTP) Shed and Building 235 may also remain on site at the time of decommissioning, but piping associated with these buildings is not included in this table.

   Path Forward: Clarify if piping associated with Building 240 will remain at the time of license termination and clarify if any piping associated with Building 231 will remain on site. Provide information on piping associated with Building 115, Building 235, and the SWTP that may remain on site at the time of license termination.

5. Comment: A DCGL value is not listed in Table 5-12 for Np-237.

Basis: The DP states, "Np-237 is an exception and the DEEP DCGL (of 0.3 pCi/g) will be used", but it is not clear if 0.3pCi/g will be used for SURFACE, ROOT, and UNIFORM layers as well as the DEEP layer.

Path Forward: Please clarify if the DEEP value of 0.3 pCi/g should appear in the 5-12 Table. Please also clarify the values intended to be used for SURFACE, ROOT and UNIFORM.