Hematite Decommissioning Plan Chapter 14 – Facility Radiation Surveys
Request for Additional Information

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.

2. (HDPC-14-Q2) Comment: HDP Section 14.2.7 Adequacy of the Characterization states that "Samples have been taken in each area, along with historical information, provide a clear picture of the residual radioactive materials and its vertical and lateral extent at the site." Section 14.1.4.2 Buildings and Structural Surfaces derives gross activity structural Derived Concentration Guideline Levels (DCGLs) from the fractional abundances from sample residues from floor drains and not from samples from the structures. It is not clear (with some of the very low fractional abundances and large DCGLs) if the nuclides should be eliminated and what effect this has on the derived gross activity DCGL. For example, it is not clear why Tc-99 is included in the calculation when it is the only pure beta emitter, a low fractional abundance, and a high DCGL.

   Path Forward: Provide an evaluation of the Radionuclides of Concern (ROCs), justify the dose contribution, and ensure the derived gross DCGL is conservative.

3. (HDPC-14-Q3) Comment: Section 14.1.4.3.1 Surrogate Radionuclides appears to provide an acceptable method for in inferring ROCs when U-235 is present but it is not clear how Surrogate will be determined when U-235 is not present.

   Path Forward: Please describe the criteria and process for determining the nuclides when U-235 is not present of very low specific activity, or low detect ability; and the quality assurance procedures to ensure surrogate ratios are maintained during the survey process.

4. (HDPC-14-Q4) Comment: Section 14.2.6 of the HDP (Justification for Non-Impacted Areas) states that "Sufficient survey coverage and an adequate number of samples were obtained in the areas subsequently designated as non-impacted to serve as the basis for

this classification. The survey measurements and laboratory data from the samples showed radioactivity levels in all cases to be only a small fraction of the DCGLs, and in most instances, within the range of background." Per MARSSIM guidance, non-impacted areas should not contain residual radioactivity above background. However, the justification given in Section 14.2.6 indicates that some residual radioactivity above background may be located in areas that have been classified as non-impacted.

There are also inconsistencies between what is stated in Section 14.2.6 of the HDP and the Radiological Characterization Report (DO-08-003) (RCR). It is indicated in the Executive Summary of the RCR that "The conclusion that areas were non-impacted was based on a review of the Historical Site Assessment (HSA), gamma scan measurements, and analytical results obtained from soil sampling. Non-impacted areas do not show detectable Tc-99 activity or concentrations of licensed radioactivity statistically distinguishable from background."

The justification for non-impacted areas needs to be revised and re-evaluated to ensure that non-impacted areas, and associated background reference areas, are consistent with MARSSIM guidance and do not contain residual radioactivity above background.

Basis: The following discussions from MARSSIM should be considered when designating impacted vs. non-impacted areas:

> *MARSSIM Section 3.6 - Evaluation of Historical Site Assessment Data*
> If process knowledge suggests that no residual contamination should be present and the historical analytical data also suggests that no residual contamination is present, the process knowledge provides an additional level of confidence and supports classifying the area as non-impacted. However, if process knowledge suggests no residual contamination should be present but the historical analytical data indicate the presence of residual contamination, the area will probably be considered impacted.
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> *MARSSIM Section 4.4 - Classify Areas by Contamination Potential*
> Class 3 areas: Any impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a small fraction of the $DCGL_w$, based on site operating history and previous radiological surveys. Examples of areas that might be classified as Class 3 include buffer zones around Class 1 or Class 2 areas, and areas with very low potential for residual contamination but insufficient information to justify a non-impacted classification.

Path Forward: Provide a revised justification of non-impacted areas that is consistent with MARSSIM. Re-evaluate (and re-classify if necessary) any currently designated non-impacted areas that may contain residual radioactivity above background levels.

5. (HDPC-14-Q5): Comment: Section 14.2.8 of the HDP (Inaccessible or Not Readily Accessible Areas) indicates that some areas, such as drain systems and the Sanitary Wastewater Treatment Plant, were not fully characterized due to inaccessibility.

Path Forward: Provide clarification that while drains and certain areas may not be currently accessible, they will be surveyed as Class 1 areas during decommissioning to demonstrate compliance with the DCGLs or for removal.

6. (HDPC-14-Q6): Comment: It is stated in Section 14.4 of the HDP (Final Status Survey Design) that "Guidance for conducting an FSS on piping internals is outside the scope of MARSSIM. These special situations will be evaluated by judgment sampling and measurements. Pipe crawlers or other specialty conveyance devices will be deployed using conventional instrumentation. If advanced technology instrumentation, such as in-situ gamma-spectroscopy, is selected for use, a technical support document will be developed which describes the technology to be used and how the technology meets the objectives of the survey." NRC expects to review and approve methodology used for embedded pipe characterization. Technical support documentation for embedded piping should be consistent with MARSSIM and NUREG-1757 guidance.

   Basis: Guidance in NUREG-1757, Vol. 2, Rev. 1, Appendix O states that acceptable methodology for characterizing embedded pipes should address the following issues:

   - radionuclides of interest and chosen surrogate,
   - levels and distribution of contamination,
   - internal surface condition of the piping,
   - internal residues and sediments and their radiation attenuation properties,
   - removable and fixed surface contamination,
   - instrument sensitivity and related scan and fixed minimum detectable concentrations,
   - piping geometry and presence of internally inaccessible areas/sections,
   - instrument calibration, and
   - data quality objectives (DQOs).

   Appendix O additionally notes that "Regardless of the source of the information, it is incumbent on the licensee to develop and document a comprehensive approach to embedded pipe and buried piping characterization that accounts for limitations and uncertainties, taking into account MARSSIM guidance in developing the related DQOs. It should also specifically address each of the critical issues in the bulleted list above."

   Path Forward: Provide for NRC approval a comprehensive approach to embedded pipe and buried piping characterization that accounts for limitations and uncertainties, taking into account MARSSIM guidance in developing the related DQOs.

7. (HDPC-14-Q7): Comment: It is stated in Section 14.4.1 of the HDP (Final Status Survey Design) that "Although expected to occur infrequently, a situation could arise where it can be determined that, the origin of a location of localized elevated concentration (>$DCGL_w$) within a Class 2 or 3 survey unit is understood, and it is highly unlikely that a similar condition exists elsewhere within the survey unit. In this instance, it may be determined that reclassification and re-survey are not required. This determination will be thoroughly documented in the release record, and will be based on further research into operational history, the results of additional scan surveys and sampling, or a combination of these sources of information." This statement is

inconsistent with MARSSIM, and needs to be revised. A similar statement is given in Section 14.4.3.1.11 of the HDP (Small Areas of Elevated Radioactivity) as "Instances where a measurement obtained in a Class 2 or 3 survey unit exceeds the $DCGL_w$ may not require reclassification and re-survey provided that the investigation demonstrates that the area of elevated radioactivity is localized in nature, and there is sufficient evidence to support that a similar condition is not likely elsewhere in the survey unit." This statement is also not consistent with MARSSIM, and needs to be revised. Similar statements in Section 14.4.3.6 (Remediation and Reclassification) that deal with isolated elevated areas should also be revised.

Basis: The following excerpts from MARSSIM describe NRC expectations for reclassification of Class 2 or 3 areas:

> *MARSSIM Section 4.4 - Classify Areas by Contamination Potential*
> As a survey progresses, reevaluation of this classification may be necessary based on newly acquired survey data. For example, if contamination is identified in a Class 3 area, an investigation and reevaluation of that area should be performed to determine if the Class 3 area classification is appropriate. Typically, the investigation will result in part or all of the area being reclassified as Class 1 or Class 2. If survey results identify residual contamination in a Class 2 area exceeding the DCGL or suggest that there may be a reasonable potential that contamination is present in excess of the DCGL, an investigation should be initiated to determine if all or part of the area should be reclassified to Class 1.
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> *MARSSIM Section 5.5.3 - Developing an Integrated Survey Strategy*
> Identification of contamination suggests that the area may be incorrectly classified. If so, a re-evaluation of the Class 3 area classification should be performed and, if appropriate, all or part of the survey unit should be resurveyed as a Class 1 or Class 2 area.
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> Westinghouse Electric Company (WEC) correctly notes in Section 14.4.3.1.11 of the HDP that "the consideration of small areas of elevated radioactivity typically applies only to Class I survey units since Class 2 and Class 3 survey units should not have contamination in excess of the $DCGL_w$," but seems to contradict this principle in other parts of the DP.

Path Forward: Revise statements on classification so that they are consistent with MARSSIM guidance for reclassification of survey areas. For areas being reclassified, the results of the investigation of measurements exceeding the investigation level and the basis for reclassification from a higher to lower designation (i.e. Class 3 or 2 areas reclassified to either Class 2 or 1 areas) should be appropriately documented in the final status survey report.

8. (HDPC- 14- Q8) Comment: Under Section 14.4.2.1.5 (Develop a Decision Rule) of the HDP it is stated that "If the SOF is greater than or equal to unity (1), then the Radiation Safety Officer will be consulted to determine further action. Potential actions included are remediation, reclassification, additional data collection, or dose assessment." It is not clear what is meant by "dose assessment" or how the stated potential actions, other than remediation, would affect a SOF level that is greater than 1.

Path Forward: Please clarify what is meant by “dose assessment” and how the stated potential actions, other-than remediation would affect an SOF level that is great than 1.

9. (HDPC 14-Q9) Comment: In the “Th-232 Soil Concentration Comparison With Background Th-232 Soil Concentration (RCR, Appendix A)” WEC provides an analysis based on two background reference areas. Nuclear Regulatory Commission (NRC) Guidance recommends using at least four reference areas. A detailed analysis on the determination of the number of reference areas, and the number of samples per area, was not provided.

   Basis: NRC guidance in NUREG-1757, Appendix A, A.3.4 states the following:

   > When there may be a significant difference in backgrounds between different areas, a Kruskal-Wallis test, as described in Chapter 13 of NUREG–1505, can be conducted to determine whether there are, in fact, significant differences in mean background concentrations among potential reference areas.
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   > While NUREG–1505 does not recommend specific values for the Kruskal–Wallis test, NRC staff recommends at least 15 samples in each of at least 4 reference areas and a Type I error rate of KW = 0.2 to provide an adequate number of measurements for the determination of whether there is a significant difference in the background concentrations. However, different values may be appropriate on a site–specific basis.

   The HDP refers to this guidance in Section 14.4.2.5, and notes that “the site may consider this and other statistical guidance options in the evaluation of apparent significant variations in background reference area.” The discussion in the “Th-232 Soil Concentration Comparison With Background Th-232 Soil Concentration (HRCR, Appendix A)” indicates that two background reference areas (consisting of 16 samples each) were used, but there is no statistical analysis of how WEC arrived at this scenario. It is also not clear what background values were used in this analysis, and NRC staff has assumed that the data provided in Table 4-50 of the RCR were used. However, Appendix A of the RCR gives an example Th-232 background value of 1.83 pCi/g that does not exist in Table 4-50.

   Path Forward: Provide a detailed analysis of how the number and sample size of background areas was determined. This analysis should be consistent with guidance provided in NUREG-1505, Section 13.5, “Determining the Number of Reference Areas and the Number of Samples.”

   Provide the actual data used for the background reference areas.

10. (HDPC-14-Q10) Comment: Under the discussion of HPGe Spectrometer Analysis in Section 14.4.4.2.6 of the HDP it is stated that "The MDCs as provided by the [Gamma Spectrometer] operational software will be similar to the following equation: [Equation 14-31]." The actual equation to be used should be provided.

    Path Forward: Provide the actual equation(s) to be used for MDC calculations.

11. (HDPC-14-Q11) Comment: Section 14.4.4.2.6 of the HDP states that "Thorium-232 radioactivity concentration (inferred from the Ac-228 TAP) will be reported for use in areas distinguishable from background or for sample results greater than the BTV of 1.7 pCi/g (see Section 14.2). There does not appear to be a discussion of this topic in Section 14.2.

    Path Forward: Provide the reference to the discussion on thorium-232 indistinguishability from background. Also, consider the separate RAI on RCR, Appendix A dealing with the appropriateness of the proposed analysis of thorium-232 in background.

12. (HDPC-14-Q12) Comment: In Section 14.4.3.1.8 of the HDP there is a reference to Equation 5-1 of NUREG-1507 that may be used to calculate the number of sampling and measurement locations. Equation 5-1 in NUREG-1507 deals with total efficiency of a distributed source. This is likely a misprint that was intended to refer to Equation 5.1 of NUREG-1575.

    Path Forward: Correct this statement to refer to the intended reference.

13. (HDPC-14-Q13) (relates to HDP-4Q14) Comment: Section 14.4.4.1.5.5, Building Foundations and Sub-grade Soil, does not provide a specific reference in the HAS and RCR for drawing conclusions that there is no contamination in excess on structures surfaces and beneath the slabs and foundations of the buildings. It is also stated that, "it does not appear that residual radioactivity is present on the exterior surfaces that exceed the remedial goal." It is not clear why building exteriors would be discussed in this section and there is no discussion on volumetric contamination.

    Path Forward: Please clarify this section.

14. (HDPC-14-Q14)) Comment: Section 14.4.4.1.5.5, Building Foundations and Sub-grade Soil, it states that floor drains in Building 110 and 230 have determined to have residual contamination and may require remediation or removal. It also states that WEC may have to core through slabs and foundations to facilitate collection of soil samples. The technical basis for determining if the floor drains will need to be removed, how they will be surveyed, and the criteria WEC will apply to ensure floor drains have not leaked material under the slabs is not clearly stated. Also, it is not clear what survey criteria will be employed to detect the accumulation and migration to subsurface soils from cracks, floor and wall interfaces, etc…

Path Forward: Please clarify this section.

15. (HDPC-14-Q15) Comment: Section 14.4.4.6.4 of the HDP was supposed to deal with groundwater as it relates to "Final Status Survey Implementation." However, it only briefly mentions that assessments of residual radioactivity in groundwater will be performed via monitoring wells and refers to Section 14.3 for additional information. The referenced section was reviewed, and there is no discussion of groundwater. Rather, Section 14.3 deals with "Remedial Action Support (In-Process) Surveys."

Path Forward: Provide a detailed discussion of how groundwater will be assessed during "Final Status Survey Implementation."

16. (HDPC-14-Q16) Comment: HDP Table 14-19, Total Weighted Efficiency Example Calculation identifies Instrument Efficiency as "nominally" 0.40 for Tc-99, Th-234 and other beta emitters for 126 cm^2 gas flow proportional detector with a 0.8 mg/cm^2 window in the $\alpha + \beta$ mode. Based on manufacturer technical literature for this type of detector, the nominal efficiencies are 32 % for Tc-99 and 35 % Pu-239 for $\alpha + \beta$ counting. Based on the Hematite radionuclides of concern, a mixture of $\alpha + \beta$ emitters are expected and therefore the lower, more conservative efficiencies should be employed.

Path Forward: Revise Table 14-19 to be consistent with the manufacturer's technical information, evaluate HDP instrument calibration and health physics procedures to ensure instrument efficiencies are properly applied and the health physics technician training program is consistent with the procedures. Evaluate efficiencies used in operational and characterization surveys to determine if lower efficiencies would result in higher radioactivity measurements and the effect on information provided in the DP.