Hematite Final Status Survey Issues and Technical and Regulatory Bases

July 15, 2015

Issue: Inputs into the Scan MDC

During the review of HDP-TBD-FSS-002, Survey Area Release Record for Land Survey Area 10, Survey Units 01 and 02 (LSA 10-01 and LSA 10-02) in Support of Hematite Decommissioning Project License Termination (ADAMS Accession No. ML15176A780), the U.S. Nuclear Regulatory Commission (NRC) staff evaluated the manner in which Westinghouse Electric Corporation, LLC (WEC) has utilized post-processed data in the $MDCR_{Surveyor}$ and Scan MDC calculations. From this review, the NRC staff determined that it is inappropriate to either remove the surveyor efficiency term or to set it to a value of 1, which indicates 100% efficiency.

Technical Basis

The calculations of the Scan MDC and $MDCR_{Surveyor}$ from NUREG-1507, upon which Decommissioning Plan (DP) Equation 14-36 is based, are designed around the human performance of surveys. The surveyor efficiency term in particular considers the efficiency of human performance in conducting the survey and the surveyor acknowledgment of elevated counts during the survey by stopping and appropriately investigating areas of potentially elevated contamination. To completely remove the surveyor efficiency implies that human performance would not be utilized to acknowledge and investigate elevated count rates. Additionally, it assumes perfect surveyor technique, including maintaining assumed observation intervals and detector to ground distance.

However, the actual implementation of Final Status Survey (FSS) scanning surveys at the Hematite Decommissioning Project (HDP) site indicates that human performance is still required. For example WEC noted in Section 5.1.3.2 of HDP-RPT-FSS-202that “FSS technicians performing GWS in the SU used the 4,000 ncpm IAL as a field guide to know when to slow or pause the GWS for more deliberate investigation. If during the GWS, audible count rates noticeably increase above the general area average (i.e., > minimum detectable count rate), FSS technicians are required to pause momentarily and observe count rates. If sustained count rates are approaching the IAL, further focused investigation is conducted within the locally elevated area.”

Additionally, the Global Positioning System (GPS) was not used to verify surveyor maintained specified observation interval or detector to ground distance. Furthermore, the setup of the GPS logging system for the surveys of LSA 10-01 and LSA 10-02 appears to be inconsistent with the Scan MDC calculations as described in HDP-TBD-FSS-002. WEC’s $MDCR_{Surveyor}$ calculation uses an observation interval of 1.64 seconds, while the results in the FSS record for LSAs 10-01 and 10-02 indicate a different observation interval. The FSS record indicates in Section 5.1.3.2 that “All GWS measurements on the excavation floor and sidewalls collected with the NaI detector(s) were connected to a Trimble Differential Global Positioning System (DGPS) and with a handheld data logger. The logging frequency in the survey unit was 1 GWS

measurement per second." As such, WEC has not adequately demonstrated that human factors have been completely removed from the scanning and investigation process in order to utilize a surveyor efficiency of 1 in the $MDCR_{Surveyor}$ calculation. In addition, the setup of the GPS data logger appears to be inconsistent with the observation interval used by the technician in the field. Therefore, it is not appropriate to utilize a surveyor efficiency of 1 in the calculation of $MDCR_{Surveyor}$ and Scan MDC.

Regulatory Basis

10 CFR 20.1402 states a site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a Total Effective Dose Equivalent (TEDE) to an average member of the critical group that does not exceed 25 mrem (0.25 milliSievert[mSv]) per year. 10 CFR 20.1501 requires the licensee shall make or cause to be made, surveys of areas, including the subsurface, that may be necessary for the licensee to comply with the regulations in this part. The scan MDC describes the minimum detection concentration that will be detected during the scan surveys. An adequate scan MDC value is therefore required to demonstrate that the surveys at HDP were adequate to demonstrate the site meets the release criteria described in 10 CFR 20.1402.

Section 14.4.4.2.9 (Open Land Area Gamma Scan MDCs) of the HDP DP discusses Scan MDC calculations where it is indicated that "the scan MDC value (in pCi/g) for open land surface scans can be developed following the guidance in Section 6.8.2 of Reference 14-7 [NUREG-1507, Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions] and Section 9.3.5 of Reference 14-10 [Abelquist, E.W., Decommissioning Health Physics: A Handbook for MARSSIM Users], and that "this section of the DP follows the methodology in Reference 14-3 [DO-08-003, "Hematite Radiological Characterization Report"] of postulating an elevated area, modeling the exposure rate using MicroShield®, and then determining a scan MDC using manufacturer reported conversion factors for exposure rates to count rates." However, NUREG-1507 was published in 1998, and survey technologies utilizing GPS and Geographic Information Systems (GIS) were not readily available at that time. As such, the current NUREG-1507 does not address the usage of post-processed data and the associated human performance results. However, NUREG-1507 is currently under revision, and one of the topics being evaluated is the usage of post-processed data and the effects on the MDC. Preliminary experimental results in the development of the revised NUREG indicate that setting the surveyor efficiency to 1 when utilizing post-processed data is not appropriate. While it is acknowledged that an ongoing revision does not represent the current official version of the NUREG, this information is presented to inform the licensee that present knowledge on the topic does not appear to validate the licensee's methodologies.

Section 14.4.4.2.9 of the DP provides an example Scan MDC calculation in, which uses a surveyor efficiency of 0.5. However, Section 14.4.4.2.9 of the DP includes a statement indicating that a surveyor efficiency of 0.5 will be used for manually recorded data and that "for data obtained using GPS and subsequently post-processed using GIS software, the surveyor efficiency is not applicable and the MDC values are reduced by approximately 29 percent."

Section 14.4.2.10 of the DP additionally states “By using the GPS system, it is more readily available to relocate specific areas for further investigation, survey, and sampling as necessary”. However, Secton 14.4.2.10 does not state how the system will be implemented during FSS. As stated above human performance factors are still included in the current implementation of the FSS survey and investigation, causing the change of surveyor efficiency to 1 (or 100% efficiency) to be inappropriate.

Path Forward

Since the methodologies presented by WEC do not indicate that human performance is fully removed from this process, it is not acceptable to set surveyor efficiency equal to 1. Utilization of a surveyor efficiency of 0.5 would be acceptable, which is consistent with the surveyor efficiency for manually recorded data as indicated in Section 14.4.4.2.9 of the DP. Increase in surveyor efficiency is additionally possible, if WEC could provide adequate justification in the FSSR for the increase.

Issue: Description of Remediation Activities Following Initiation of Final Status Survey

Field logs provided in Appendix I of HDP-RPT-FSS-202 indicate a hot spot was identified and remediated in LSA 10-01 following the initiation of the FSS. However, no information regarding the remediation, or follow-up sampling, appeared to be provided in the record.

Technical Basis

Without this information, the NRC staff cannot conduct an independent evaluation of the FSS record to ensure the HDP FSS for LSA 10-01 was in accordance with their approved DP. Additionally, it is unclear if any remediation activities following FSS were conducted in LSA 10-02.

Regulatory Basis

Remediation which occurs after the start of the FSS can affect areas that have already been surveyed, resulting in areas where residual radioactivity is higher than what is presented in the survey. Additionally, remediation is not allowed to be completed just to ensure systematic measurements will pass MARSSIM based statistical tests as it lowers the confidence in the test. Without a description of remediation activities that occurred after initiation of the FSS, the NRC staff cannot independently verify the appropriateness of the HDP FSS to ensure 10 CFR 20.1402 was met.

Additionally, HDP DP Section 14.4.3.7 states, “If remediation is performed within a unit, then the areas affected are subject to re-survey. Any re-surveys will be designed and performed as specified in this plan based on the appropriate classification of the survey unit.” Additionally, the last paragraph in the same section states, “If remediation is required in only a small area of a Class 1 survey unit, any replacement measurements or samples required will be made within the remediated area at randomly selected locations following verification that the remediation activities did not affect the remainder of the unit. Re-survey will be required in any area of a survey unit affected by subsequent remediation activities. Additional guidance regarding the

failure and re-survey of a survey unit is provided in Section 8.5.3 of MARSSIM and Chapter 13 of Decommissioning Health Physics: A Handbook for MARSSIM Users."

Path Forward

Provide a section in the FSS record template which will be used to describe all remediation activities which occurred after the initiation of the FSS. If remediation activities occur within the survey unit following initiation of the FSS, include a description of the reason why remediation is necessary (i.e. survey measurements, size of hot spot, etc.); type of remediation which occurred (i.e. size of remediation, actions taken to remediate, timeframe when remediation occurred in regard to FSS, etc.); verification, including survey results, demonstrating the remediation activities did not affect the remained of the unit; and placement and results of any replacement measurements or samples collected.

Issue: Appropriate Sampling of the Reuse Pile

Upon review of WEC FSS plans and submittals, the NRC staff indicated concerns regarding composite sampling for Tc-99 and the usage of a modified investigation level (MIL) for reuse piles at HDP. This issue was previously documented in an email from Jack Hayes to Ken Pallagi on May 14, 2015 and discussed in publically noticed calls.

Technical Basis

HDP follows a process in which every truckload of potential reuse soil is assayed by High Resolution Gamma Spectroscopy (HRGS), then dumped at a designated laydown area. At the laydown area the pile is radiologically scanned to identify potential hot spots for removal or to demonstrate uniformity. The scan measurements are compared to the Reuse Material Screening Level (RML). However, this scan measurement cannot detect hot spots of hard to detect Tc-99.

Following the scan, 4 aliquots of soil from randomly selected areas of the pile are collected. The aliquots are combined and homogenized and sent for offsite analysis to determine Tc-99 concentrations. As the homogenization of 4 aliquots can dilute a sample, direct comparison with Tc-99 derived concentration guideline level (DCGL) threshold is inappropriate to detect hot spots which exceed it. Therefore, the NRC current position on usage of aliquot, or composite, samples for hard to detect radionuclides to demonstrate compliance with radiological release criteria is to use a modified investigation level (MIL) for comparison with threshold concentration levels, such as a DCGL.

A MIL would be calculated based upon the TC-99 $DCGL_W$ divided by the number of increments in a composition. Therefore, the MIL for the uniform stratum scenario would be the Tc-99 $DCGL_W$ (25.1 pCi/g) divided by the number of aliquots (4), which is equal to 6.28 pCi/g. Other MILs would be 37.8, 7.5, or 18.5 pCi/g for the surface stratum, root stratum, and excavation scenario DCGLs, respectively. The NRC staff notes it appears there were 2 samples identified in Piles 1&2, and 7 samples from Pile 3 that exceeded the uniform Tc-99 MIL.

Regulatory Basis

10 CFR 20.1402 states a site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year. 10 CFR 20.1501 requires the licensee shall make or cause to be made, surveys of areas, including the subsurface, that may be necessary for the licensee to comply with the regulations in this part.

As reuse soil is going to remain on site, an appropriate survey of reuse soil is necessary to ensure the dose criteria of 10 CFR 20.1402 is met before the site would be considered acceptable for unrestricted use. Therefore, either survey results or a justification must be provided to demonstrate Tc-99 hot spots which could result in dose exceeding the 10 CFR 20.1402 are not present in the reuse soils.

HDP DP Section 14.3.2.4 states "For each stockpile of soil, the average concentration of the stockpile will be calculated and accounted based on a weighted average of each lift or container as the material is added to the stockpile. This average value will then be used to evaluate the dose impacts of using that particular stockpile of soil as backfill." Through review of the implementation of this methodology and several discussions with HDP, the NRC staff has determined this approach is not adequate to account for potential hot spots of hard to detect Tc-99. As stated above, the current NRC position on usage of composite samples when no surrogate is available is to demonstrate compliance with radiological release criteria is to use MILs for comparison. As such, the usage of an MIL would be appropriate, and the composite samples which exceeded the MIL would indicate the potential for a hot spot in the area being sampled.

Path Forward

The NRC staff has provided the WEC with three acceptable options for a path forward on this item during publically noticed teleconference calls. These options are:

1) WEC could only place re-use soils in a layer where the results (using the MIL for Tc-99) are below the associated DCGL. In other words, the current re-use piles (Combined 1 & 2, and 3) would not be acceptable per the uniform DCGL model. They may be acceptable for surface or deep (excavation DCGL) layers.

2) WEC could rely on mixing of soils to physically dilute the hot spots. Mixing was not approved in their DP, nor mentioned in their DP, and WEC asserts that the mixing is not intentional. Regardless of the original intent, if WEC wishes to rely on mixing to meet a lower DCGL, it seems appropriate that they follow the current guidance in NUREG-1757, Vol. 1, Section 15.13, to justify that the reuse soil have been appropriately mixed to dilute potential hot spots.

3) WEC could evaluate potential hot spots on per truckload bases and account for the contribution of that dose in the survey unit where the affected re-use soils are ultimately placed.

Issue: Demonstration of compliance with the dose criteria in 10 CFR 20.1402 based on FSS data

During NRC's review of FSS record for LSA 10-1 and 10-02, the NRC staff noted that challenging aspects of the final demonstration of compliance with the dose criteria in 10 CFR 20.1402 were not included in this technical report. Some of these aspects were not applicable to these survey units or cannot be completed at this time because other data is not available. The NRC staff believes that it would be beneficial for Hematite to provide example calculations to the NRC that include these features as early in the FSS process as is practical in order to expedite the FSS review process.

Technical Basis

During the FSS process, an evaluation of the data from each survey unit needs to be performed to demonstrate compliance with the 25 mrem/yr dose criteria for unrestricted release in 10 CFR 20.1402. The contribution from the all sources of residual contamination needs to be considered in this evaluation (e.g., average residual contamination in the survey unit, elevated areas, and groundwater).

In the DP and associated documents, WEC provided a general description of the methodology that they intended to use to evaluate the residual contamination from the various sources. However, WEC did not provide a detailed integrated example of the demonstration of compliance with the 25 mrem/yr dose criteria that included all sources. The NRC staff's experience is that the details of combining the dose contribution from all sources using FSS data can be complicated and that unanticipated issues may arise in the actual calculations.

In addition, Hematite's soil DCGLs are more complicated than most sites because two sets of soil DCGL values were included in the DP (i.e., the uniform DCGLs and a three layer approach DCGLs). The three layer approach is a novel approach that is outside of the standard MARSSIM guidance, so unanticipated issues may also arise in the implementation of this approach.

Regulatory Basis

10 CFR 20.1402 states a site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year.

Path Forward

A demonstration of compliance with dose criteria in 10 CFR 20.1402 is needed for unrestricted release of the site. This evaluation needs to be performed for each survey unit and needs to include all sources of residual contamination. The NRC staff suggests that WEC provide the NRC with example calculations of these evaluations that include the challenging aspects identified above as early in the FSS process as is practical. While it is not a requirement for

WEC to provide this information early, the NRC staff believes that this would expedite the FSS review. Also, an early review of these calculations by the NRC staff would reduce the risk of the NRC concluding that the demonstration of compliance with the dose criteria from all sources is not adequate after an area has been backfilled, which could make resolution of the NRC's concerns significantly more difficult.