

**Regional Position**  
**Information Follow-up Items from IR070-00036/2015001 and IR070-00036/2015002**

**July 15, 2015**

This document is to support U.S. Nuclear Regulatory Commission's (NRC's) technical position regarding the three Information follow-up items (IFIs) documented in NRC inspection reports noted above. These are:

- Burial Pit Identification
- Sidewall Sampling
- Derived concentration guideline level (DCGL) vs. Gamma Walkover Surveys

Each IFI discussion will be broken down as follows:

- Licensee Position
- NRC Position based upon Referenced Documents
- NRC Position based upon release criteria/regulations
- Path Forward for Resolution

**1.0 Burial Pit Identification**

a. Licensee Position:

The licensee believes that all burial pits have been identified for the following reasons.

- i. Core bore holes were drilled at approximately 20 foot intervals (**HDP-TBD-HP-601**) in the areas where documented and undocumented burials were to have been anticipated. The soil from these core bore were used by the licensee to determine whether the licensee could exit from Criticality Controls (Section 6.1.1.4).
- ii. The licensee stated in Section 7.1.2 of **HDP-TBD-HP-601** that once the radiological surface survey and soil samples indicated no contamination above the Nuclear Criticality Safety (NCS) limits and visual inspection indicated no debris/waste, the area would undergo core boring to obtain a sample core to evaluate the soil to the criteria of Criticality Safety Control (CSC) 23. The visual inspection of the core sample validates that debris/waste had been removed from a burial pit that has been remediated. The CSC 23 can be found in **HDP-PR-HP-605** which states "**Administrative CSC 23:** *In the event that the 235U mass content ascribed to an Assay Container exceeds 350 g 235U all MAA operations SHALL cease and SHALL NOT resume until the NCS Organization has been notified and has approved resumption of operations.*"

- iii. Figure 13 of **HDP-RPT-FSS-303** is a diagram of the burial pit area with an Excavation Depth legend ranging from 6.64 feet to -26.72 feet (0 reference is not mentioned). This diagram showed how much material was excavated from the burial pits.
- iv. The licensee stated in Section 5.1 of **HDP-TBD-HP-601** that reliance upon characterization data and core bores from the original surface, which may not have provided sufficient statistical strength to demonstrate all burial pits had been identified, was no longer required. The licensee contended that the actual excavation process proved to be adequate and provided a greater margin of assurance that all burial pits were identified.
- v. The licensee stated in Section 5.6 of **HDP-TBD-HP-601** excavation of the entire overburden layer of the documented and undocumented burial pit area ensures that a 100% visual inspection and radiological survey of subsurface soil was completed at a minimum depth of 4 feet. All subsurface soil, which also comprises the soil underlying an individual burial pit, in the documented and undocumented burial pit area was then excavated to a depth to meet the Final Status Survey DCGL criteria.

b. NRC Position based upon Referenced Documents

- i. **Section 2.5.1 of the Decommissioning Plan (DP)** notes that for documented burial pits the nominal dimension of each Burial Pit is 20 ft wide by 40 ft long by 12 ft deep. If the burial pits were indeed 20 ft wide by 40 ft long, Core Bores drilled at 20 ft intervals might be adequate, although still not addressed in the DP. However, Figure 1 of **HDP-TBD-HP-601** clearly shows that few of the burial pits are the nominal size referenced in the DP. In fact, several burial pits have dimensions of approximately, 10x15 ft; less than the nominal size referenced in the DP.
- ii. The licensee references NCS limits for the conditions to determine whether contamination is present in the core bore samples. However, the licensee's procedures and information within the DP for gathering such information does not contain information associated with how radiation measurements are correlated to the DCGL's.
- iii. The excavation depth in Figure 13 of **HDP-RPT-FSS-303** does not provide information associated with the depth at which burial pits could be identified. Specifically, the reference point of 0 ft. is not defined; the licensee failed to clarify the reference point in any of its procedures or work plans.
- iv. It is the licensee's position that a statistical strength calculation means no additional effort is required to demonstrate all burial pits had been identified.

However, the NRC could not identify in the licensee's DP where the NRC had addressed or approved a statistical approach for the identification of burial pits.

- v. The licensee's procedure referenced visual inspections to identify burial pits. However, the NRC's Safety Evaluation Report (SER) approving the DP did not confirm the acceptability of a visual inspection to identify burial pits. The NRC recognizes that **section 10.9.2.1.1 of the DP** titled "Buried Waste and Contaminated Soil Remediation" states that visual scans were necessary to identify Items with the potential to contain fissile material (e.g., a process filter); Items that resemble intact containers; Bulky objects with linear dimensions exceeding the permitted excavation '*cut depth*'; and Metallic items. But the DP does not acknowledge the discolorations in the soil or the like as an acceptable means to identify burial pits.

c. NRC Position based upon release criteria/regulations

It is the NRC's position that:

- i. The licensee is outside of the bounds of its DP as the burial pit sizes are significantly smaller than originally reported in the DP. The licensee shall acknowledge burial pits being smaller than 20' x 40' and address how they implemented the intent of the DP with the smaller burial pits.
- ii. The Core Bore sample analysis was adequate to determine whether the licensee should get out of criticality controls. However, there is no technical basis to show the scanning results of the core were adequate to meet the DCGL criteria. Consequently, the licensee has yet to provide justification or adequate survey data to demonstrate that their site as met the release criteria of 10 CFR 20.1402.
- iii. Based upon the regulatory guidelines in effect when burial was permitted at the Hematite site and the possibility of additional soil added to the original surface of the pits, the NRC concedes that burial pits lower than 10 feet are unlikely based upon the CY 2001 surface data. However, the Figure 13 of **HDP-RPT-FSS-303** does not provide adequate information that remediation efforts extended to an adequate depth to demonstrate whether burial pits existed under the soil layer or not. Therefore, there is no basis for determining that the licensee had identified all burial pits; a potential violation of 10 CFR 20.1501 referencing 10 CFR 20.1402.
- iv. The NRC did not approve, nor will it approve, a statistical strength methodology to demonstrate that all burial pits were identified. Due to the amount of radioactive material that might be present in a missed burial pit, this situation would likely result in an exceedance of the NRC's release criteria. Failure to identify a burial pit containing licensed material would be a violation of 10 CFR

20.1402 – Failure to provide adequate surveys to identify a burial pit would be violation of 10 CFR 20.1501 referencing 10 CFR 20.1402.

- v. The licensee is outside of the bounds of its DP as the DP does not include criteria for identification of burial pits.

d. Path Forward for Resolution

Since the licensee is currently backfilling the burial pits, the options have been reduced. However, the following would be considered reasonable:

- Since undocumented burial pits were found outside of the original documented burial pit area, the licensee would redefine, with NRC review and approval, an expanded burial pit area; and
- For burial pits which were excavated to less than 10 feet above original grade when burial pits were originally made (ca. 1960's), a bore hole could be dug at intervals no greater than 10 feet apart (this is based upon the smallest sized burial pit the licensee has identified to date) at a depth of 12 feet. For every 2 feet of soil, a procedure for the radiological analysis, reviewed and approved by the NRC, could be implemented to ensure that radiological contamination above the DCGL's could be identified; and
- The licensee would also radiologically "log" each hole, establish procedures which would be reviewed and approved by the NRC. This would provide a higher confidence level that a smaller burial pit or area of contamination was not missed.

## 2. **Sidewall Sampling**

a. Licensee Position

The licensee believes that the sidewalls of excavated areas have been adequately surveyed to comply with NRC regulations. The licensee's basis for that conclusion has changed numerous times over the last 6-9 months. Below are the positions that are the most recent.

- i. The sidewalls do not require any soil sampling as the licensee considers the sidewalls as part of the above soil surface. Consequently, the exposed sidewall surface is not considered part of the survey unit.
- ii. The licensee sizes survey units utilizing the top-down view approach. Consequently, the licensee does not consider the sidewalls as a part of the

Class 1 survey unit. The licensee points to **Section 14.4.3.3 of the DP** titled “Reference Grid And Sampling And Measurement Locations”. This Section states the survey sampling and measurement locations are a function of the sample size and the survey unit size. The guidance provided in **Section 4.8.5 and Section 5.5.2.5 of MARSSIM** has been incorporated into this DP section. For the FSS within open land areas, the licensee’s current strategy is to utilize civil surveyors and/or GPS based off of the North American Datum 83 (NAD83) State of Missouri East coordinate system, or an equivalent coordinate reference system as discussed in **Section 6.10.1 of MARSSIM**.

**Section 6.10.1 of MARSSIM** titled “Positioning Systems “ states documenting the location of measurements is important for demonstrating the reproducibility of the results. There are a variety of positioning systems available that provide a range of accuracy and precision that can be evaluated during survey planning to determine their applicability to a particular site. These positioning systems can be used to establish a reproducible reference coordinate system or to locate individual measurements using an established reference coordinate system (e.g., longitude and latitude).

- iii. The licensee performs bias soil sampling of the side walls and infers Tc-99 through gamma walkover scans from uranium identification. Through this method, the licensee believes that a MARSSIM soil sample grid pattern is not necessary.
- iv. The licensee believes that biased soil sampling of the sidewalls is adequate to show the DCGL criteria is being met.
- v. Following discussions with the NRC, the licensee created **HEM-15-MEMO-039** which states, in part, effective immediately, evaluate if additional sidewall sampling is necessary in Land Survey Areas based on the following criteria:
  - If any systematic or biased sample Tc-99 result from the survey unit exceeded 10% of the applicable DCGL; and
  - If vertical or near vertical sidewalls exist within the survey unit; and
  - If those sidewalls exceed 12 inches in height vertically; and
  - If those sidewalls exceed (in aggregate) 5 % of the total survey unit surface area (e.g., greater than 100 m<sup>2</sup> of sidewall in a 2,000 m<sup>2</sup> survey unit); then sidewall sampling is necessary. (Latest)
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If all the conditions above are met, soil sampling is required.

b. NRC Position based upon Referenced Documents

- i. Based upon NRC's review of the DP, sidewalls survey requirements of the burial pits are not addressed. Additionally, the NRC considers all exposed soil as part of a survey unit. This pertains to sidewall areas and is consistent with survey methodology the NRC staff has approved at past sites (Mallinckrodt and Breckenridge). Such practice is also consistent with the practices of ORAU, who is the NRC's independent contractor.
- ii. Same response as given for 2.b.i above.
- iii. During the DP review, the NRC disagreed with HDP's proposed use of U-235 as a surrogate for hard to detect (HTD) Tc-99. WEC's request for additional information (RAI) response 14.3a, provided in attachment 10 of **HEM-11-96** dated July 5, 2011; states "The Tc-99 surrogate relationship is prohibited from use in the evaluation of analytical results to determine compliance with the final status survey dose criteria."

Since the license amendment approving the DP was issued, the licensee has not provided any technical information from its remediation and survey efforts to support that U-235 can be used as a surrogate for Tc-99.

- iv. **Section 14.4.3.1.1 of the DP** titled "Decision Errors" states that a Type I error will always be set at 0.05 unless prior NRC approval is granted for using a less restrictive value. The NRC's contention is that all exposed soil in the burial pits shall be part of the survey unit Classification system. As noted in the licensee's latest FSS submittal for LSA 10-01 and LSA 10-2 (HDP-RPT-FSS-202), the sidewalls are considered part of the Class 1 survey unit. Biased sampling for the purposes of determining whether a Type I error had occurred is not acceptable in MARSSIM; the sample shall be random for the purposes of statistics.
- v. The licensee's existing position on sidewall sampling is not the approach which what was presented during discussions with the NRC. Specifically, each criteria was discussed, as a group, for the determination whether soil sampling of the sidewalls shall take place. However, the licensee is presently misrepresenting the approach which the NRC agreed. The NRC has determined that the licensee's documented position is not conservative and could lead to large quantities of soil not being surveyed appropriately. Such a situation would be inconsistent with the requirements of 10 CFR 20.1501.

c. NRC Position based upon release criteria/regulations

- i. The DP does not address sidewall sampling of burial pits. This presents a situation where licensed material may remain onsite which exceeds the applicable DCGL's. This presents a situation where the licensee's survey may be inadequate and inconsistent with the requirements of 10 CFR 20.1501 with respect to 10 CFR 20.1402.
- ii. Same response as given for 2.c.i above.
- iii. The NRC rejected the licensee's surrogate position in the DP and subsequently the licensee has not provided any additional information to justify a surrogate position. Therefore, implications of a surrogate relationship could again result in an inadequate survey and inconsistent with the requirements 10 CFR 20.1501 with respect to 10 CFR 20.1402.
- iv. The licensee is changing its Type I criteria without NRC approval, which could be a violation of the DP.
- v. The licensee's position for sidewall sampling is not conservative nor what was discussed with the NRC. The licensee provided inadequate justification to show that their criteria would identify the presence of licensed material in the sidewall in quantities which could exceed applicable DCGLs. Therefore, this presents a situation where the licensee's survey may be inadequate and inconsistent with the requirements of 10 CFR 20.1501 with respect to 10 CFR 20.1402.

d. Path Forward for Resolution

Since the licensee is currently backfilling the burial pits, the options have been reduced. However, the following would be considered reasonable:

The licensee would provide all data associated with burial pit walls to include, but not limited to:

- Total surface area;
- Percentage surface of within survey unit;
- Bias sample radiological measurements for all nuclides of interest, including Tc-99; and
- Locations of all bias sampling;

The NRC would then specifically review the data for each sidewall to determine whether it met the release criteria. If either the licensee provides the NRC inadequate information or elevated measurements are identified exceeding the release criteria, the licensee shall commit to performing core bores in the immediate area of the sidewalls in accordance with a procedure developed by the licensee and review and approved by NRC. Such a procedure shall ensure that the number, depth and survey techniques are specifically addressed to ensure the release criteria has been met.

For all areas which have not been backfilled, the licensee would also make a written commitment to the NRC to include all future sidewalls in all calculations and sampling points for the survey unit they are within. If the sidewalls are outside of the survey unit, the sidewalls shall be considered its own survey unit.

### 3. **DCGL vs. Gamma Walkover Surveys**

#### a. Licensee Position

The licensee submitted **HEM-15-MEMO-021** as the technical document to show gamma walkover surveys (scans) meet the DCGL's. Specifically, the document states that **Chapter 14.3.2** of the Hematite DP states "The average net count rate corresponding to the  $DCGL_w$  will be determined based on surveyor experience in correlating the count rate observed in the field to the results of subsequent laboratory analysis of samples, and then used to identify the locations requiring additional remediation". Therefore the Scan IAL of 4,000 ncpm was compared to the biased sample results that were collected during Final RASS of "Area 1".

#### b. NRC Position based upon Referenced Documents

The licensee did not provide a mathematical or other modeling correlation between the DCGL's and survey meter readers or the Investigation Action Level (IAL). Consequently, The NRC could not make an independent evaluation on the correlation between the DCGL's and the survey measurements or the IAL. Without such a correlation, the NRC cannot independently relate those gamma readings made with a NaI 2x2 detector with the DCGLs (release criteria) and therefore a potentially significant variations in the results for the Radionuclides of Concern gamma emitters could exist. This includes the determination of the U-235 enrichment.

However, it should be noted that NRC's independent confirmatory surveys performed in several survey units did not identify any significant differences between the NRC's confirmatory survey results and the licensee survey meter readings.



c. NRC Position based upon release criteria/regulations

Based upon the lack of information on how the licensee is relating survey meter readings to DCGL's, the NRC is concerned that significant contamination could be unidentified during a gamma walkover scan such that the DCGL's may not be met. As such, the surveys may be inadequate and inconsistent with the requirements of 10 CFR 20.1501 with respect to 10 CFR 20.1402.

d. Path Forward for Resolution

Since the licensee is currently backfilling the burial pits, the options have been reduced. However, following would be considered reasonable:

The licensee shall provide a Technical Basis Document which uses actual data to develop formulas or theoretical formulas or models relating worse case or, if data is available, reasonable case relating survey meter readings to the DCGL's. The NRC shall review and approve the Technical Basis Document and verify worse case scenarios and known scenarios for accuracy.

If the technical basis documents cannot adequately demonstrate that the site meets the dose criteria of 10 CFR 20.1402, the licensee shall create a survey plan to conduct additional surveys to demonstrate the dose criteria of 10 CFR 20.1402 is met. The licensee shall submit this survey plan to the NRC for review and approval before it is implemented.