SAFETY EVALUATION REPORT

REQUEST FOR ALTERNATE DISPOSAL APPROVAL AND EXEMPTIONS FOR SPECIFIC HEMATITE DECOMMISIONING PROJECT WASTE AT US ECOLOGY'S IDAHO FACILITY

April 11, 2013

Table of Contents

Contents

List of Tables

List of Figures:

1. INTRODUCTION

1.1. Westinghouse Request

By letter dated January 16, 2012 (ADAMS Accession Nos. ML12017A188, ML12017A189, and ML12017A190), Westinghouse Electric Company, LLC (WEC) requested that the U.S. Nuclear Regulatory Commission (NRC) approve an amendment to its Hematite license (SNM-33) to permit alternate disposal of licensed material in accordance with Tite 10 of the Code of Federal Regulations (10 CFR) §20.2002. (January 16, 2012 request) The disposal would involve low-activity radioactive materials generated by the Hematite Decommissioning Project (HDP) containing source, byproduct, and special nuclear material (SNM). The January 16, 2012 request includes a request for an exemption from NRC licensing requirements in 10 CFR §30.3 and 10 CFR §70.3 for byproduct material and SNM, respectively. Granting these exemptions would allow these materials to be disposed of at the US Ecology Idaho, Inc. (USEI) facility, even though USEI is not an NRC licensee. On October 4, 2012, USEI requested that it be considered a party to WEC's January 16, 2012, alternate disposal request and exemption request (ADAMS Accession No. ML12313A014). WEC did not request, nor does it need, an exemption for its proposed disposal of source material because the quantities involved are "unimportant" and are exempt from licensing under 10 CFR §40.13(a). The 0.05 weight % referenced in 10 CFR §40.13(a) translates to approximately 339 pCi/g for natural uranium (including U-234, U-235, and U-238, but omitting consideration of decay products). Enclosure 1 to WEC's January 16, 2012 submittal shows in Section 5.1 that the average total activity concentration (sum of all nuclides and progeny and not just uranium) for this waste is approximately 110 pCi/g. Therefore, the 10 CFR §40.13(a) exemption is applicable here.

Granting the January 16, 2012 request would allow WEC to ship the HDP waste to USEI's Resource Conservation and Recovery Act (RCRA) Subtitle C disposal facility in Idaho.

The January 16, 2012 request follows a similar request submitted by WEC (HEM-09-52) on May 21, 2009 (ADAMS Accession No. ML091480071). That request was approved on October 27, 2011 as Hematite License Amendment No. 58 (ADAMS Accession Nos. ML111441087, ML112560105, and ML112560193).

Various types and quantities of SNM are discussed below. SER Section 5 (Criticality Safety) and Section 6 (Material Control and Accountability) discuss SNM in quantities of 1 g or more of U-235. SER Section 7 (Physical Security) pertains to SNM enriched in the U-235 isotope, in quantities of approximately 45 Kg of U-235.

1.2. USEI Facility

The USEI facility is a RCRA Subtitle C hazardous waste disposal facility permitted by the Idaho Department of Environmental Quality (IDEQ), and is not an NRC licensee. On October 4, 2012, USEI submitted a letter (ADAMS Accession No. ML12313A014) to the NRC stating that it had worked with WEC in the preparation and submittal of WEC's alternate disposal request and supporting documentation.

The USEI RCRA facility is located near Grand View, Idaho in the Owyhee Desert. The HDP material would be disposed in Cell 15, which has an area of 88,220 m2 (21.7 acres) and a depth of 33.6 m. The most important natural site features that limit the transport of radioactive material are the low precipitation rate (i.e., 18.4 cm/y (7.4 in. per year)) and the long vertical distance to groundwater (i.e., 61-meter (203-ft) thick on average unsaturated zone below the disposal zone).

As is usual with a RCRA Subtitle C site, a number of engineered features are present to enhance confinement of contaminants over the long term. These features include an engineered cover, liners, and leachate monitoring systems. Operations at the site include a number of systems that minimize the potential for exposure of workers to any waste handled by the facility. These systems include a closed facility with filtered ventilation exhaust for transfer of incoming waste material from the shipping conveyance to trucks for transport to the cell, mechanized equipment for disposition of waste material in the cell, and the application of an asphaltic spray at the end of each day's operations. The site is permitted to receive non Atomic Energy Act material or exempted radioactive material that meets site permit requirements.

1.3. Overview of NRC Review

The NRC reviews §20.2002 requests from the standpoint of the safety implications of disposing of licensed material at disposal facilities that are not licensed by the NRC or an NRC Agreement State.

The NRC's review of a 10 CFR §20.2002 request for disposal of low-activity waste at a RCRA facility covers protection of individuals, inadvertent intruders, and the public. The period of performance is 1,000 years after the expected date of license termination of the facility, consistent with 10 CFR 20.1401 (the License Termination Rule in Subpart E of 10 CFR Part 20). While the 10 CFR Part 20 dose limit for individual members of the public is 1 mSv/yr (100 mrem/yr) (10 CFR §20.1301), the NRC's practice is to approve §20.2002 requests if calculations demonstrate that disposal would not result in a dose exceeding more than a few millirem per year

Because this 10 CFR §20.2002 disposal request includes SNM, the NRC's review must -- in addition to a dose limit analysis – evaluate nuclear criticality safety, material control and accounting, and physical security issues. .

The potential exists that the waste material approved for disposal by Amendment 58 and the material approved for disposal in this SER will be available for shipment to USEI at the same time. Therefore, this SER will discuss the cumulative impact of the alternative disposal of material from both requests.

1.4. Additional Westinghouse Supporting Information

The NRC's review of WEC's January 16, 2012 request resulted in a need for WEC to supplement its request. On May 1, 2012, the NRC made a request for additional information

(RAI) (ADAMS Accession No. ML120890557). WEC provided responses to that request in letters dated June 19, 2012 (ADAMS Accession Nos. ML12173A427, ML12173A428, ML12173A430 and ML12173A431), July 24, 2012 (ADAMS Accession Nos. ML12209A200 and ML12209A201), and October 17, 2012 (ADAMS Accession No. ML12293A029).

2. BACKGROUND

The Hematite site was used for the manufacture of low-enriched, intermediate-enriched, and high-enriched materials during the period of 1956 through 1974. In 1974, the production of intermediate- and high-enriched material was discontinued and all associated materials and equipment were removed from the facility. From 1974 to cessation of manufacturing operations in 2001, the Hematite facility produced nuclear fuel assemblies for commercial nuclear power plants. In 2001, fuel manufacturing operations terminated and the facility license was amended to authorize only decommissioning operations.

Activities at the Hematite site generated a large volume of process wastes contaminated with uranium of varying enrichment. Based on historic documentation, 40 unlined pits were excavated and used for the disposal of contaminated materials generated by fuel fabrication processes at Hematite between 1965 and 1970. The May 2009 alternate disposal request and License Amendment 58 approval covers the disposal of material from these burial pits, other undocumented burial pits, and other soil associated with the remediation of the Hematite site. This January 16, 2012 request involves the disposal of source, byproduct, and special nuclear materials contained in building slabs, asphalt, soils, buried piping and miscellaneous equipment associated with the HDP. While the primary waste types covered by the May 2009 alternate disposal request were expected to be solid materials in the form of soils and associated debris (i.e., trash, empty bottles, floor tile, rags, drums, bottles, glass wool, lab glassware, and filters), the primary waste types covered by the January 2012 request are expected to be concrete, asphalt, piping, soil and miscellaneous equipment.

WEC plans to ship the material associated with the January 16, 2012 request to the USEI facility by rail if the material meets criteria established by WEC and approved by the NRC for this §20.2002 disposal request. Discrete quantities of highly enriched uranium (HEU) will not be shipped to the USEI facility. However, the proposed rail shipments may contain diffuse quantities of HEU spread throughout the waste materials, as discussed further in Section 6 below.

3. DOSE EVALUATION

This SER section evaluates WEC's description of the types of material it plans to ship and its potential to generate radiological dose to various members of the public. WEC supplied information on the source material and a description of the job functions which permitted them to evaluate different possible exposures for various members of the public. These scenarios included the doses to the transportation workers and USEI workers and the post-closure dose to the general public, and to an intruder. For §20.2002 reviews, all the scenarios treat exposed individuals as members of the public because the material is proposed to be sent to a facility that is not licensed by the NRC or an NRC Agreement State. Therefore, the NRC's occupational dose criteria do not apply to workers at USEI.

3.1. Types and Quantities of Material

WEC estimates the volume of the waste that will be a candidate for disposal at USEI associated with this request to be approximately 23,000 m^3 at a waste density of 1.5 g/cm^3 (i.e., approximately 38,700 tons). Since the dose assessment calculations assume this amount as a limit, 23,000 m^3 will be an upper bound on the amount of waste that WEC is permitted to send to USEI under this request. License Amendment 58 had approved for disposal approximately 23,000 m^3 at a waste density of 1.69 g/cm^3 (i.e., approximately 50,000 tons). Therefore, the combined waste amount for both requests is approximately 46,000 m^3. The waste covered by the January 2012 request consists of concrete/asphalt, piping, soil and miscellaneous equipment, and contains low concentrations of source, SNM, and byproduct material contaminants. WEC determined the radionuclides of concern based on studies in the Hematite Historical Site Assessment (ADAMS Accession Nos. ML092870417 and ML092870418). This is summarized in Chapter 4 of the Hematite Decommissioning Plan (ADAMS Accession No. ML092330136).

In Table 4-1 of Attachment 1 (HDP-TBD-WM-906) of Enclosure 1 of the January 16, 2012 Westinghouse submittal (ADAMS Accession No. ML12017A189), WEC presented the expected curie quantities to be shipped to USEI in a volume of approximately 23,000 m^3 of waste. That information is presented in this SER as Table 3-1. The technical basis for each estimate is described in the following sections.

Table 3-1: Source Term Radionuclides and Expected Total Curie Amounts[1]

Material	Shipped Volume (m^3)	U-234 (Ci)[2]	U-235 (Ci)[2]	U-238 (Ci)[2]	Tc-99 (Ci)[2]	Wt% U-235
Concrete/Asphalt	8,249	1.4E+00	6.3E-02	2.9E-01	4.0E-02	3.3
Piping	348	1.1E-01	3.9E-03	1.2E-02	2.6E-03	5.0
Misc. Equipment	39	3.0E-03	1.7E-04	5.4E-04	3.8E-05	4.5
Soil	14,212	6.2E-01	3.2E-02	1.4E-01	2.1E-01	3.4
Total Weighted Average	**22,848**	**2.2**	**0.1**	**0.4**	**0.3**	**3.4**

[1] Values in the table reflect a multiplier of 1.5 to account for uncertainty

[2] Multiply Ci by 3.7x1010 to obtain Bq

WEC based the average expected concentration on the totals in Table 3 1, while for the average cell concentration WEC assumed that the shipped materials will be evenly distributed over 725,000 tons of total waste anticipated to be sent to USEI from various waste generators. In addition, in response to RAI No. CH-22, on page 70 of 167 of HEM-12-67, (ADAMS Accession No. ML121740265) WEC assigns a bounding concentration for each radionuclide corresponding to the Waste Acceptance Criteria (WAC). The bounding concentration was based on 100 percent of the activity being from 3,000 pCi/g of total uranium, with the isotopic composition based on existing sample data. Tc-99 was not considered in the WAC concentration since WAC concentrations were used for the intruder scenarios and Tc-99 was not an important radionuclide for the intruder scenarios. When summed, the WAC concentrations (assuming the progeny radionuclides are at equilibrium) equal the overall WAC of 3,000 pCi/g. The source term estimations are reproduced as Table 3-2 in this SER.

Table 3-2: Assumed Concentrations of Radionuclides *

Radionuclide	Average (Expected) Concentration Shipped from Hematite (pCi/g)	Average Cell Concentration if Shipped at Expected Concentration (pCi/g)	USEI WAC Concentration in Rail Cars (pCi/g)
Tc-99	7.2	0.38	0
U-234	62	3.3	1815
U-235	2.8	0.15	81
U-238	13	0.68	341

* Multiply Ci by 3.7×10^{10} to obtain Bq

3.1.1. Concrete and Asphalt

WEC approximated the volumes for concrete and asphalt through visual inspection and physical measurements of the various structures and items. WEC approximated the concentration levels using the results of a total of 50 sample cores taken over two phases. The locations of the samples were selected on the basis of the results of the first of two gamma walkover surveys. In the first phase of core sampling, WEC collected 21 cores and subsampled in the top ¼ inch, next ½ inch, and remainder of these cores. In the second phase, WEC collected 29 additional cores. These 29 cores were either: (i) analyzed as a whole core (20 cores); (ii) subsampled in the top three inches and the remainder (five cores); or (iii) subsampled in the top ¼ inch and the next ½ inch (four cores). The samples were analyzed for isotopic uranium, Tc-99, Am-241, Np-237, Pu-239, Ra-226, and Th-232. Of the 50 cores, 23 were analyzed for Am-241, Np-237 and Pu-239. Because no samples exceeded the minimum detectable concentration (MDC) for Am-241, and only three samples were slightly above the MDC for both Np-237 and Pu-239, WEC concluded that these three transuranics were present only at trace levels. WEC presented this information in Section 6.1 of Revision 1 of HDP-TBD-WM-906.

WEC performed a second gamma walkover after the buildings at its Hematitie site had been demolished to more precisely delineate areas associated with elevated activity from those that are relatively uncontaminated. WEC identified six areas of elevated activity based on the gamma walkover and sample results. Due to high activity results in Area 5 and a portion of Area 1, WEC excluded these areas from the alternative disposal request. WEC calculated the average of the samples within each non-excluded elevated area. The averages were presented in Table 6-5 of Revision 1 of HDP-TBD-WM-906. WEC calculated a total curie amount for each elevated area and a weighted average for each of the elevated areas using the relative size of each. The radionuclide concentration in concrete outside the process building and the asphalt areas are based on the average concentrations for the non-elevated areas of the process buildings. Finally, WEC calculated an overall weighted average by weighting the included elevated (18%) and non-elevated areas (82%) by relative size.

3.1.2. Piping

WEC approximated the volume and weight of piping based on data obtained from engineering drawings. WEC approximated the concentration of the piping based on swipe and scale/sediment samples taken in 2010. Swipe samples were targeted at areas with high uranium concentrations. Piping was classified based upon system segments according to physical location or system function. A total curie amount for each system was calculated based on the assumed amount of debris within each pipe segment. WEC excluded the piping under Buildings 240 and 260 from this alternate disposal request. Since this piping contains 87 percent of the Tc-99, this piping is not a candidate for disposal at USEI.

3.1.3 Miscellaneous Equipment

WEC characterized equipment based on gamma radiation measurements taken in 2008. The gamma radiations levels were interpreted to a total U-235 enrichment and a U-235 amount using the Monte Carlo N-Particle (MCNP) Transport Code. WEC estimated the U-235 activity concentration (pCi/g) by dividing the total amount of U-235 activity by the mass of each miscellaneous equipment component (HDP-TBD-WM-906). Then WEC calculated concentrations of U-234, U-238, Tc-99, Th-230, Th-232, and Np-237 by applying scaling factors from HDP-TBD-WM-901 (ADAMS Accession No. ML12090A191). WEC stated that “the scaling factors are appropriate because they were based on samples obtained from surfaces that were exposed to the same radionuclide mixture [as the miscellaneous equipment].”

3.1.3. Sub-Slab Soils

WEC predicted the volume of soil that will require excavation based on soil sample results that exceed remediation goals or Derived Concentration Guideline Limits (DCGLs). A total of 94 samples were collected from the soil beneath the former process buildings down to a depth of 16.5 feet (5.03 m) (HDP-TBD-WM-906). The total curie amount contained in the soil to be excavated was estimated based on the concentration results within these areas and analytical calculations as described in Section 3.2.

WEC determined that Ra-226 was present only at background levels, and WEC analyzed for Ra 226 using gamma counts of radium progeny from the top ¼ inch and the remainder of the core of 23 sample cores at 21 locations. WEC calculated the lowest ratio of Ra-226 to U-234 (1.8E-5) among the samples taken from the top ¼ inch and multiplied this by each U-234 activity to find a lower bound for the Ra-226 attributable to U-234 contamination present in the top ¼ inch. This Ra-226 concentration was subtracted from the observed values and this adjusted set of observed values was then compared to the set of observed values from below ¼ inch which are representative of background. Because the adjusted concentration profile for the top ¼ inch was less than or equal to the background sample profile, WEC determined that Ra-226 was present only at background levels (HDP-TBD-WM-906). Therefore, Ra-226 was not included as a radionuclide of concern. Based on interviews with former employees, WEC believes that Ra-226 was introduced into the burial pits from the disposal of contaminated equipment or materials from the Mallinckrodt Site Uranium Division near St. Louis, MO. Radium-226 was not a licensed radionuclide for Hematite, and therefore would not have been expected to have been used in the processes at Hematite (HDP TBD WM 906).

WEC determined that Th-232 was present only at trace levels. WEC measured the Th-232 concentrations for 23 sample cores using alpha spectroscopy. The ratio of Th-232 to U-234 ranged from 4.1E-3 to 3.7E-6. Considering this low ratio range compared to the observed levels of U-234 contamination, WEC concluded that Th-232 is present only at trace levels. Therefore, Th-232 was not included as a radionuclide of concern.

3.2. NRC Evaluation of WEC's Material Characterization

Given that the source term values presented by WEC are an estimate, WEC committed to performing additional characterization of the concrete/asphalt, soils, and piping prior to shipment to verify amounts and to ensure adherence to the Tc-99 limits associated with License Condition 17 of the Hematite license. The adequacy of these future sampling plans is discussed in Section 4 of this SER. The following sections describe NRC's evaluation of the available characterization data, which was used to estimate the dose and help define the limits imposed under License Condition 17.

3.2.1. NRC Evaluation of Concrete/Asphalt Characterization

The NRC's review resulted in several RAIs pertaining to the existing characterization of the concrete/asphalt. These requests were mainly focused on the adequacy of the existing characterization for Tc-99 and on obtaining clarifying information regarding the data presented in the Tables and Figures in the January 16, 2012 request and supporting characterization documents.

The NRC staff requested that WEC provide justification for its conclusion that no areas of Tc 99 have been overlooked given that sample locations were biased based on the gamma walkover survey results and given that a gamma walkover survey does not detect Tc-99, which is a beta emitter. WEC provided additional details regarding the current dataset, and also committed to perform additional sampling on a systematic grid for Tc-99. In Enclosure 2 (ADAMS Accession No. ML12209A201) of their July 24, 2012 RAI response WEC clarified that 33 of the 50 sampling stations were biased. Of these 33 stations, eight stations were in five areas defined as having historical operations involving materials contaminated with Tc-99 (locations 2 – 7; 20, and 21), and 12 stations served to bound the five areas with elevated Tc-99 activity. The other 17 of the 50 sampling stations were not biased. These 17 stations were selected as being representative of the non-elevated areas.

In RAI SA-3, the NRC staff requested clarification on the relationship between the data presented in Tables 6-2 thru 6-4 and Fig 1 of Appendix D of HDP TBD WM-906. In WEC's response to RAI SA-3, WEC clarified that the values for each station shown in Tables 6-2 and 6-3 are weighted average concentrations for all samples from each specific location. For example, if three samples were taken at a certain location (i.e., from top 1/4 inch, next ½ inch, remainder), then each sample result was weighted by the mass or thickness of concrete it represented to determine the average for that location. WEC's response resulted in revisions to Tables 6-2 thru 6-3 and Figure 1 of Appendix D of HDP TBD WM-906 which were presented in Westinghouse response associated with HEM-12-67.

In their response to RAI SA-5, WEC explained that Table 6-5 of HDP-TBD-WM-906, which shows the concentration for each elevated area, is an average of all the samples assumed to be in each of the elevated areas, excluding the bounding samples around the perimeter of the elevated areas which had lower concentrations. WEC provided additional details on how the calculations were performed for each of the elevated areas.

As noted in Section 3.1.1 of this SER, WEC is excluding Area 5 and a portion of Area 1 from the request for alternative disposal due to high Tc-99 activity results. The NRC staff asked WEC in RAI CH-10 how they would distinguish between these excluded and included areas during the review. In WEC's response to RAI CH-10 they provided Figure A which shows with different colored fixatives those areas that were included (green) and those that were excluded (blue). WEC stated that this methodology for the excluded portions of the concrete slabs is the same type of identification and control measures (e.g., separate staging areas and containers) as will be used to segregate burial pit soil/debris covered in Hematite Amendment 58 that does not meet USEI criteria (HEM-12-67).

3.2.1.1. NRC Findings

The NRC has concluded that WEC has presented a reasonable explanation of the existing characterization data for the concrete and asphalt and how this data was used to determine the estimates reproduced in Table 3 1 of this SER. The NRC staff finds the averaging of the data to be appropriate, and thus the values presented in Table 3 1 and Table 3 2 to be reasonable for the purposes of dose estimation. However, due to the uncertainty in the data and the fact that some areas were not previously sampled for Tc-99, the NRC staff has requested WEC to perform additional characterization to verify that amounts sent to USEI do not exceed those assumed in the dose analysis. The adequacy of the future systematic grid sampling plans for concrete/asphalt is discussed in the Health Physics Evolution section of this report found in Section 4 of this SER.

3.2.2. NRC Evaluation of Piping Characterization

Since the samples collected from the pipes in 2010 were targeted at elevated gamma areas or from areas with debris buildup, the NRC staff has concluded that WEC's uranium results for piping are likely to be conservative. However, since Tc-99 contamination may not have been discovered using this approach, the NRC has requested WEC to perform additional surveys or inspections of the piping. During the review of WEC's response to RAI SA-7, NRC asked for additional graphics or tables to clearly segregate and identify the location of piping to which additional surveys and inspections would apply. WEC included this information in Appendix F of the revision of HDP-TBD-WM-906.

WEC is excluding piping from Building 240 and Building 260 from this alternate disposal request based on high Tc-99 activity results for these piping systems. WEC will not send piping from these buildings to USEI. WEC clarified in their June 19, 2012, response to RAI CH-10 that the same type of identification and control measures (e.g., separate staging areas and containers) used to segregate burial pit soil/debris that do not meet USEI criteria will be employed for the excluded portions of the piping and miscellaneous equipment (HEM-12-67).

3.2.2.1. NRC Findings

As detailed in Section 7.2 of HDP-TBD-WM-906, WEC will perform additional systematic characterization of the piping prior to shipment, and will also perform biased sampling based on uranium content as detailed in response to RAI CH-8 (HEM-12-67). The NRC evaluation of the additional sampling to be performed on piping is presented in Section 4 of this SER.

The NRC staff finds the existing characterization of piping to be adequate for the purposes of dose analysis given that WEC has excluded the known high Tc-99 areas from the request. Since the piping material makes up a small relative volume of the disposal material, it contributes a relatively small proportion of the dose. In addition, WEC will has committed to future systematic and biased sampling to ensure that any areas with Tc-99 contamination were not overlooked in the existing characterization.

3.2.3. NRC Evaluation of Miscellaneous Equipment Characterization

The NRC staff reviewed the technical basis for the surrogate factors provided by WEC (HDP TBD-WM-901). The scaling factors were based on smear samples obtained from the various process building areas. In October 2004, ten smears were collected from each building area and were composited to a single sample for each area. In April 2010, nine biased concrete samples were obtained from the process building walls. While these samples were not of the equipment themselves, WEC stated that the scaling factors are appropriate since the samples were obtained from surfaces that were exposed to the same radionuclide mixture as the equipment. Specifically, the ventilation system would have drawn air from the same facility conditions that resulted in surface contamination identified in the swipe samples. WEC cited the common facility conditions as justification for the use of the same scaling factors. Since the scaling factors are based on average concentrations, WEC also pointed out that even if the maximum ratio of Tc-99 to U-235 were used, the total Tc-99 associated with the ventilation equipment would only change from 0.962 MBq (2.6x10-5 Ci) to 5.55 MBq (1.5x10-4 Ci), which is insignificant in relation to the total quantity of Tc-99 associated with the application of 11,840 MBq (0.32 Ci) (HEM-12-67).

3.2.3.1. NRC Findings

As indicated in Section 8.1 of HDP-TBD-WM-906 and the response to RAI SA-1, while WEC will not be re-evaluating the inventory of uranium for the equipment listed in Table 8.1 of HDP TBD WM-906, WEC will collect swipe samples of the miscellaneous equipment to verify the Tc-99 scaling factor prior to shipment to USEI (HEM-12-67). The NRC staff has concluded that this approach is acceptable given that WEC will verify Tc-99 scaling factors and will adjust the associated inventory accordingly.

3.2.4. NRC Evaluation of Sub-Slab Soil Characterization

In RAI CH-10, the NRC staff requested that WEC provide additional information regarding the calculations for determining the total curie amount in the sub-slab soils. WEC's response provided additional details on the methods of calculating soil volumes and curie amounts (HEM-12-67). WEC derived contours, which were presented in Figure H-1 in Appendix H of HDP-TBD-WM-906, using a Geographical Information System (GIS) program based upon the data from the 94 samples. These contours represented the volume of soil that is expected to be above the DCGLs. WEC calculated the in-situ volume based on a soil density of 1.69 g/cm^3 using the same GIS program. The volume of each depth layer was multiplied by the average concentration for that layer to calculate a curie amount. The in-situ volume was then multiplied by 1.69/1.44 to obtain the post-excavation volume that would be shipped. (The density of the soil post-excavation is assumed to be 1.44 g/cm^3.) The NRC staff concluded that the methods used to calculate the volumes and total curie amount for the sub-slab soil to be acceptable based on the information provided in the RAI responses.

Given the low activity levels in the characterization data provided, and the knowledge that the transuranic were not significant radionuclides for the Hematite DP, the NRC staff finds it reasonable to exclude Am-241, Np-237, and Pu-239 from the list of radionuclides of concern for this analysis.

3.2.4.1. NRC Findings

Based on the characterization data provided, and the historical knowledge of the facility, the NRC staff finds it acceptable to exclude Ra-226, Th-232, as well as the transuranic Am-241, Np-237, and Pu-239 from the list of radionuclides of concern for this analysis. NRC staff notes that even if these radionuclides were assumed to be present at their maximum concentration reported in the characterization data, the disposal of this material at USEI would contribute negligible dose to any member of the public either at the USEI facility or in transportation to the USEI facility.

3.3. WEC Assessment of Doses

3.3.1. Transportation and USEI Worker Doses

WEC analyzed the dose to USEI workers as well as the potential dose during transportation of the waste to USEI. The USEI workers included a gondola surveyor, an excavator operator, gondola cleanout worker, truck driver, stabilization operator, and cell operator. These dose assessments were similar to those provided by WEC in its 2009 alternate disposal request. WEC estimated that 352 gondola railcars will be used to transport the waste from the Hematite site to USEI. The contents of the gondola railcar will be enclosed in wrappers meeting the U.S. Department of Transportation (DOT) Industrial Type-1 Package (IP-1) requirements, which preclude dispersal of waste to the air or loss of material during transport. Once the waste is received at the USEI site, the gondola railcar will be surveyed and then off-loaded into trucks for transport to the USEI disposal cell. Once the waste is off-loaded, USEI personnel will remove any residual material in the railcar using shovels and brooms. The truck is surveyed prior to being driven to the USEI disposal cell, where the waste is spread and compacted in the cell. A fraction of the waste (less than 5%) is expected to contain hazardous constituents that require stabilization. This waste will be treated inside the USEI containment building prior to disposal.

Table 3 3 summarizes the job function scenario assumptions. The times assigned are the times for one person to perform each function once. In WEC's analysis, it is assumed that a specific number of workers per year will be available to carry out each of the job functions, and the total dose for the job function is divided equally among all workers within a job function group. Job functions are not shared among employees tasked as an excavator operator, truck driver, stabilization operator, or cell operator. These workers' responsibilities are not assumed to overlap. However, the groups performing tasks as gondola surveyors, gondola clean-out crews, and truck surveyors may involve the same individual employees.

Table 3-3: Job Function Scenario Assumptions

Job Function	Number of Workers in Group	Minutes to Perform Task	Type of Conveyance (count)
Gondola Surveyor	8	20	Gondola (352)
Excavator Operator	4	45	Gondola (352)
Gondola Cleanout	8	10	Gondola (352)
Truck Surveyor	8	5	Truck (1056)
Truck Driver	14	45	Truck (1056)
Stabilization Operator	6	45	Gondola (18)
Cell Operator	2	15	Gondola (352)

The MicroShield 7.02 code was used to calculate the external doses for the workers. The parameters used to estimate the external dose were identical to those used in the previous Hematite §20.2002 request except for the shielding thickness assumed in the calculation of potential dose to the gondola surveyor and the size and shape of the stabilization tank used in the calculation of dose for the stabilization worker. WEC stated that the changes in these assumptions were made in order to more accurately reflect the actual conditions for the gondola surveyor and stabilization operator. WEC also recalculated the dose to these workers for the prior request and found that these changes in assumptions only result in a slight increase to the calculated dose for these workers. The method and parameters used by WEC to calculate the internal dose for the excavator operator, gondola cleanout worker, stabilization operator, and cell operator are the same as those used in the previously approved §20.2002 request. The internal dose from the inhalation of contaminated dust was calculated based on an assumed concentration of dust in the building of 0.23 mg/m^3, an assumed inhalation rate of 1.2 m^3/hr, the concentrations of radioactivity in Table 3-2, and the FGR 11 Inhalation Dose Conversion Factors (DCFs). The assumed dust concentration was based on a study that found that the respirable dust concentrations at the USEI facility ranged from 0.17 to 0.23 mg/m^3. WEC did not take credit for the respiratory protection program at USEI, so the actual inhalation dose would likely be smaller than what was calculated. Unlike in the previously approved §20.2002 request, an internal dose was not calculated for the gondola surveyor, truck surveyor, or the truck driver. WEC clarified that internal doses were not assigned to these workers because the truck bed and gondola railcar remains covered while they are being surveyed and the truck bed remains covered during the trip to the disposal cell, so these workers would not be expected to receive an internal dose.

Table 3-4: Annual Dose per Person for Individual Job Function*

Job Function	*Internal Dose (mrem/yr.)*	*External Dose (mrem/yr.)*	*Total Dose (mrem/yr.)*
Gondola Surveyor	NA	$1.6x10^{-3}$	$1.6x10^{-3}$
Excavator Operator	$1.8x10^{-1}$	$2.7x10^{-3}$	$1.9x10^{-1}$
Gondola Cleanout	$2.0x10^{-2}$	$1.7x10^{-3}$	$2.2x10^{-2}$
Truck Surveyor	NA	$2.1x10^{-3}$	$2.1x10^{-3}$
Truck Driver	NA	$1.2x10^{-2}$	$1.2x10^{-2}$
Stabilization Operator	$6.1x10^{-3}$	$1.4x10^{-4}$	$6.3x10^{-3}$
Cell Operator	$1.2x10^{-1}$	$7.8x10^{-3}$	$1.3x10^{-1}$

*multiply mrem/yr. by .01 to obtain mSv/y

To evaluate the potential dose to the public during transport of the waste by rail to USEI, the maximum external dose at 1 m and 1 ft from a loaded gondola railcar was calculated by WEC using Microshield. It was found that the maximum dose at 1 m is 0.18 μR/hr and at 1 ft is 0.25 μR/hr. WEC stated that based on these dose rates, an individual would have to spend 1,007 hours at 1 m from the gondola railcar or 793 hours at 1 ft from the railcar to receive a higher dose than a site worker. WEC stated that these exposure times are orders of magnitude higher than the expected worker exposure time of less than 20 hours.

3.3.2. Post-Closure Dose

The appropriateness of the RESRAD model for the USEI site was reviewed by USEI staff upon USEI purchasing the site from Envirosafe in 2001. The USEI staff concluded that the code was appropriate for the site conditions. In 2005, USEI hired consultants to review the input values used for RESRAD, and determine site-specific inputs that should be used with the code to more accurately reflect the site environmental conditions. Most of the site-specific parameters are explained in the 2005 report titled "Site-specific RESRAD Water Pathway Parameters for the Contaminated Soil, Vadose Zone, and Saturated Zone". This report was provided in WEC's December 29, 2009 RAI response noted as HEM-09-146 (ADAMS Accession No. ML100320540) to the May 2009 alternative disposal request. For those parameters not described in the report, WEC provided additional justification with its March 31, 2010 (HEM-I0-38) submittal (ADAMS Accession No. ML100950397.)

Since Tc-99 is the primary contributing radionuclide, the total quantity of Tc-99 (as opposed to the concentration) will drive the dose consequences. RESRAD applies the concentration of Tc 99 and the volume of soil in the contaminated zone to determine the total quantity of Tc 99 that is available in uptake pathways. The value that WEC applied for the expected concentration of Tc-99 in the waste shipped to USEI was 7.2 pCi/g (Table 3 2). This concentration spread over approximately 23,000 m^3 yields an expected total Tc-99 inventory of approximately 0.2 Ci, to which WEC has multiplied an uncertainty factor of 1.5 to account for the potential to encounter more material than estimated based on existing data. This results in an approximate 0.3 Ci of Tc-99 as shown in Table 3 1.

WEC plans to treat the material identified in this request cumulatively with the material from the previous request. To ensure that the inventory calculated from the mean activity concentrations (derived from the mass-weighted concentrations of each stockpile) remains below the cumulative limit, WEC plans to sample the outgoing shipments of material. The sampling plan and associated contingency limits, which are discussed in Section 4 of this SER, will ensure that the cumulative mean and 95th percentile upper confidence limit (UCL) of the mean will not be exceeded. WEC selected the UCL of the mean in order to maintain the dose at the UCL within the 'few mrem' criterion. Table 3-5 shows the Tc-99 mean and UCL inventory limits for the prior request, and the current request, as well as the cumulative limit.

Table 3-5: Cumulative Tc-99 Limits for §20.2002 Requests*

	Prior §20.2002 Request	This §20.2002 Request	Cumulative Action Threshold
Total Quantity ofTc-99 shipped to USEI (Mean)	1.0 Ci	0.3 Ci	1.3 Ci
Equivalent Dose for Mean	1.9 mrem/yr	0.8 mrem/yr	2.7 mrem/yr
95% UCL of the Mean of Tc-99 shipped to USEI	1.6 Ci	0.45 Ci	2.05 Ci
Equivalent Dose for the 95% UCL of the Mean	3 mrem/yr	1.2 mrem/yr	4.2 mrem/yr

*multiply mrem/yr by .01 to obtain mSv/y

WEC included a long-term post-closure analysis assuming a resident farmer scenario. WEC used the RESRAD code Version 6.4, applying site-specific parameters where appropriate, to calculate the long-term post-closure dose.

WEC estimated the post-closure long-term dose for the material associated with this request to be approximately 0.008 mSv (0.8 mrem). The dose is delivered through the groundwater pathway, and Tc-99 is the primary contributing radionuclide. WEC provided an estimate of the cumulative long term post closure dose, adding the long term dose of 0.019 mSV (1.9 mrem) associated with the previous request to the current predicted 0.008 mSv (0.8 mrem), or a total of 0.027 mSv (2.7 mrem).

WEC also performed a sensitivity analysis to evaluate the impact of a shorter project duration and therefore a decrease in the volume of non-Hematite waste that is available for mixing with Hematite waste. WEC analyzed a scenario in which the waste is sent over the shortest possible duration of 13 weeks, which resulted in a post-closure dose of approximately 0.016 mSv (1.6 mrem) as compared to 0.008 mSv (0.8 mrem).

3.3.3. Inadvertent Intruder Dose

To calculate dose to the intruder post-burial, WEC used the methods from NRC Guidance NUREG/CR 4370, Volume 2 (ADAMS Accession No. ML100250917). WEC performed inadvertent intruder analyses similar to those performed in their March 31, 2010 analysis performed in support of the May 2009 §20.2002 alternate disposal request (ADAMS Accession No. ML100950386). The analyses included variations on assumptions about the concentration of the material as it is shipped and the extent to which the shipping concentrations are diluted once it has been disposed of in the cell as detailed in Figure 3-1. WEC did not evaluate the Average Cell Concentration scenario for material shipped at the WAC for all radionuclides because the volume of material and concentration limits for Tc-99 are such that it would not be possible for WEC to ship the total volume of waste under this request at the WAC. Instead, WEC did a sensitivity analysis assuming that the total volume was shipped at the WAC containing uranium at values listed in Table 3 2, but not containing Tc-99.

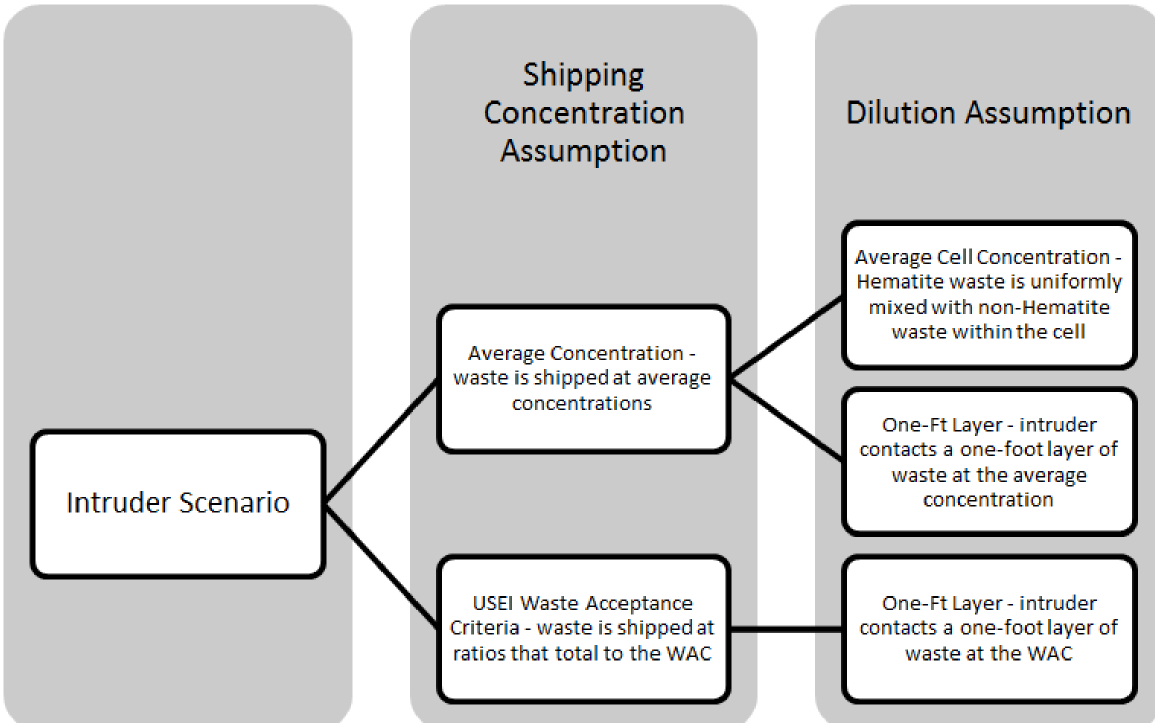

Figure 1: Intruder Scenario Waste Concentration Assumptions

3.3.4. Intruder Well-Driller Scenario

WEC evaluated two intruder well-driller scenarios (acute and chronic) as detailed below.

Acute Well-Driller	
Description	Intruder digs a well by drilling through the waste disposal cell to reach the underlying aquifer at a depth of 93.1 m. The total period of exposure is 40 hours, 8 of which occur during the drilling through the contaminated layer.
Concentration of Contaminated Layer	Concentration of the contaminated layer of Hematite waste, which is either the Average Cell Concentration, or the WAC Concentration as shown in **Error! Reference source not found.Error! Reference source not found.**.
Additional Dilution of Contaminated Layer During Exhumation	Concentration of the contaminated layer multiplied by the ratio of 0.31/93.1 or 3.3×10^{-3}, which is the ratio of a 1-ft contaminated layer (0.31 m) to the total well depth (93.1 m).
Dose	0.029 mSv/yr (2.9 mrem/yr) based upon the intruder drilling through a 1-ft layer at the WAC.

Chronic Well-Driller	
Description	Intruder spreads the exhumed drill cuttings around the residence and grows a garden in soil containing the drill cuttings over the course of one year. His time for the year is spent either gardening (100 hours), outdoors (1,800 hours) or indoors (4,380 hours).
Concentration of the Waste	Maximum concentration resulting from the acute well-drilling (based on the soil disposed at the WAC in 1-ft layer).
Dose	3.0 mrem/yr based upon the intruder drilling through a 1-ft layer at the WAC.

3.3.5. Intruder Construction Scenario

WEC evaluated the intruder construction scenario as detailed below.

Construction Intruder	
Description	Intruder is assumed to excavate or construct a building on a disposal site following a breakdown in institutional controls. The intruder is exposed to dust particles through the inhalation pathway, and may also be exposed to direct gamma radiation resulting from airborne particulates and by working directly in the waste-soil mixture. The dose from the inhalation and from external gamma exposure is evaluated for duration of 500 working hours, or a construction period of 3 months.
Concentration of Waste to Which Intruder is Exposed	• Average Cell Concentration – Shipping concentration (either Average or WAC) multiplied by 0.053, which is calculated by taking the ratio of Hematite waste to total waste received (38,710 tons/ 725,000 tons). • 1-Ft Layer – Shipping Concentration (WAC) multiplied by a factor of 0.31 (12 in/39 in) to account for USEI's practice of layering waste into pits in 1-ft layers and an assumption that 1 meter (39 in) of waste is excavated.
Dose	Results range from 0.1 mrem - 16 mrem, with the highest value assuming the intruder encounters a 1 ft. layer at the WAC values.

3.4. NRC Assessment of Doses

3.4.1. Evaluation of Transportation and USEI Worker Dose

The NRC staff finds that the scenarios selected for the transportation and USEI worker dose assessment are consistent with the manner in which the waste will be transported to and handled at USEI. Additionally, the NRC staff finds that the parameter values selected appropriately represent the job functions and the site conditions at USEI. NRC staff performed independent calculations of the external doses using MicroShield and obtained similar results to those obtained by WEC. In addition, NRC staff performed independent calculations of the internal dose and obtained similar results to those obtained by WEC.

3.4.1.1. NRC Findings

Since the waste disposal covered by the approved 2009 §20.2002 request is still ongoing, there is some potential for the USEI workers to receive -- during the same year -- a dose both from that action and the current January 16, 2012 request.. However, as seen in Table 3 6, even if the workers were to receive the total expected annual dose from both sets of waste during the same year, the cumulative dose would still be less than one millirem. Therefore, the results of the dose assessment for the USEI workers indicate that the dose to these individuals will be within the "few millirem" criteria.

Table 3-6: Potential Cumulative Dose from Previous and Current §20.2002 Requests*

Job Function	§20.2002 Request Approved in Amendment 58 (mrem/yr)	Current §20.2002 Request (mrem/yr)	Total Dose (mrem/yr)
Gondola Surveyor	1.1×10^{-01}	1.6×10^{-03}	1.1×10^{-01}
Excavator Operator	4.7×10^{-01}	1.9×10^{-01}	6.6×10^{-01}
Gondola Cleanout	5.9×10^{-02}	2.2×10^{-02}	8.1×10^{-02}
Truck Surveyor	9.3×10^{-02}	2.1×10^{-03}	9.5×10^{-02}
Truck Driver	4.9×10^{-01}	1.2×10^{-02}	5.0×10^{-01}
Stabilization Operator	1.6×10^{-02}	6.3×10^{-03}	2.2×10^{-02}
Cell Operator	3.8×10^{-01}	1.3×10^{-01}	5.1×10^{-01}

*multiply mrem/yr by .01 to obtain mSv/y

3.4.2. NRC Evalution of Post-Closure Dose

The staff finds that approval of the January 16, 2012 request will not yield a post closure long-term dose that is more than a few mrem/yr provided the total inventory of Tc-99 remains within the limits of 2.05 Ci. The staff finds this upper confidence limit to be acceptable because the dose resulting from the total inventory is also within a few mrem. A detailed discussion of the review of the sampling plan and contingency limits is contained in Section 4 of this SER.

Regarding cumulative post-closure doses, the staff agrees that it is acceptable in this case to treat the material cumulatively and to calculate a cumulative long term post-closure dose given that Tc-99 (through the groundwater pathway) is the primary contributor to dose. The staff finds the expected cumulative dose of 0.027 mSv (2.7 mrem) to be within the acceptable range of 'a few millirem'. The staff notes that while WEC separately analyzed impacts of shipping schedules on this and the prior request, WEC did not analyze the combined impacts of a faster shipping schedule for both requests. In absence of an assessment provided by WEC of a combined effect of a fast shipping schedule for both this request and the prior request (ADAMS Accession No. ML100950386), the NRC staff analyzed the cumulative impact of faster shipping schedules by adding the prior estimated 0.041 mSv (4.1 mrem) dose for the May 2009 request (ADAMS Accession No. ML110560334) assuming a 20 railcar/week shipping rate to the 0.016 mSv (1.6 mrem) estimate for the January 16, 2012 request. Because the cumulative 4.1 millirem dose in this scenario is still within a 'few millirem', the NRC staff finds the post-closure cumulative doses acceptable.

3.4.2.1. NRC Findings

NRC staff finds the parameter values and assumptions used in calculating the post-closure dose acceptable based on review of the USEI 2005 report and the RAI responses (HEM-09-146 and HEM-10-38). NRC staff performed independent assessments of WEC's calculations for post-closure dose and finds the post-closure doses submitted by WEC within the criteria of 'a few millirem'.

3.4.3. NRC Evaluation of Intruder Doses

The NRC staff considered the assumptions and pathways for the intruder scenarios to be reasonable based on comparison to the guidance in Appendix G of NUREG-0782 and NUREG/CR–4370 Volume 1.

Staff considers the dilution factor of 0.31 acceptable for the Construction One-Ft Layer scenario after reviewing the standard practices at USEI. They also considered the dilution factor of 0.53 acceptable for the Average Cell Concentration scenario after reviewing historical data for waste volumes sent to USEI. The staff notes the following conservatisms were presented in Section 7.2 of Enclosure 1 WEC's January 2012 submittal:

- No credit taken for the mixing of the waste with the cover material as noted in the RAI Response to Performance Assessment RAI No. 9, (ADAMS Accession No. ML100320540).
- USEI restriction of the emplacement of any radioactive waste to within 3.6 meters of the surface of the finished cap of the cell, which could rule out the construction scenario as not a feasible scenario.
- No credit taken credit for decay up to the intrusion event, for waste form, or solidification.

During the review, the NRC staff requested that WEC provide a discussion of the cumulative intruder doses for the prior §20.2002 request and this request. Table 3 7 shows the cumulative intruder doses, which are simply the sum of the doses assumed for the prior and current requests (HEM-12-67). The NRC staff notes that assuming an arithmetic sum for the cumulative intruder dose is conservative given that the intruder is not likely to encounter waste from both requests in the same location.

Table 3-7: Cumulative Intruder Doses

Scenario	Max Dose for Prior §20.2002 Request (mrem/yr)	Max Dose for this §20.2002 Request (mrem/yr)	Max Cumulative Dose (mrem/yr)
Intruder Construction	10	16	26
Intruder Acute Well Drilling	2.9	2.9	5.8
Intruder Chronic Well Drilling	2	3.0	5.0

*multiply by 0.01 to convert mrem/yr to mSv/yr

3.4.3.1. NRC Findings

The NRC staff finds the assumptions and pathways considered for the intruder scenarios to be reasonable based on comparison to the guidance in Appendix G of NUREG-0782 and NUREG/CR–4370 Volume 1. The NRC staff finds the intruder doses acceptable, given the conservative approach. The staff notes that the time for the intruder construction scenario was limited to 500 hours. The intruder construction scenario that WEC analyzed does not account for the chance that the intruder could subsequently live and grow food onsite due to the site's remote location and arid environmental conditions. The staff agrees with the technical basis for why intruder agricultural practices at the site are highly improbable. The NRC staff find the concentration assumptions for the WAC (that the 3,000 pCi/g is attributable fully to uranium and not Tc-99) in the sensitivity analyses performed by WEC acceptable because Tc-99 is not a significant radionuclide for the intruder scenarios and because uranium, through the air and direct gamma pathways, is the main contributor to dose for the intruder scenarios.

3.5. Stability of the Disposal Facility Following Closure

3.5.1. Westinghouse Assessment

Site-stability can be impacted by natural surface and subsurface processes, and is also impacted by the stability of the waste and engineered barriers of the disposal facility. In WEC's March 31, 2010 submittal associated with the prior alternative disposal request, WEC provided a technical basis for the stability of the USEI site stating that the facility was "constructed in compliance with the Resource Conservation and Recovery Act (RCRA) standards and the applicable Minimum Technology Requirements (MTRs). These requirements provide conservative criteria for cell construction to insure long-term stability and are consistent with the erosion design requirements in 10 CFR Part 61, and the joint NRC/EPA guidance document with guidelines on drainage and processes impacting stability."

3.5.2. NRC Evaluation and Findings

The NRC has noted that site-stability can be impacted by natural surface and subsurface processes and by the stability of the waste and engineered barriers of the disposal facility. The NRC staff has evaluated WEC's technical basis for the stability of the USEI site. The NRC staff has concluded that construction of the USEI facility to the Resource Conservation and Recovery Act (RCRA) standards and to the applicable Minimum Technology Requirements (MTRs) sufficient to provide long-term stability and to be consistent with the erosion design requirements in 10 CFR Part 61 and the joint NRC/EPA guidance document with guidelines on drainage and processes impacting stability.

4. HEALTH PHYSICS ASSESSMENT

4.1. WEC's Waste Material Characterization

WEC provided the characterization data for the waste to be shipped by rail to USEI in Attachment 1, Characterization Data Summary in Support of Additional USEI Alternate Disposal Request, HDP-TBD-WM-906, to Enclosure 1 of its January 16, 2012 request.

4.1.1. Soil Characterization

In Section 5.2.1 of Revision 2 of HDP-TBD-WM-908, WEC committed to following the same soil sampling plan described in the "Technical Basis for Characterization of Decommissioning Soils Waste That is Subject to the Alternate Disposal Request for US Ecology Idaho, Inc., Revision 1 (ADAMS Accession No. ML110530155)." This sampling plan was transmitted to the NRC in WEC's February 18, 2011 submittal and was previously approved by the NRC with the issuance of Amendment 58 to the Hematite license (ADAMS Accession No. ML112560105). Sampling protocols, detection capabilities, and activity limits for U-234, U-235, U-238, Th-232, Ra-226, and Tc-99 were provided by WEC in the aforementioned technical basis document and remain the same for the current request, with the exception of the Tc-99 limits. In order to reflect the lower quantity of Tc-99 in the current alternate disposal request, as compared to the quantity associated with the License Amendment 58 request, WEC adjusted the mean Tc-99 concentration to 13 pCi/g and standard deviation associated with soils to 36 pCi/g. Additionally, in Section 5.2.1 of HDP-TBD-WM-908, WEC indicated that a total TC-99 inventory will be maintained by combining the soil and debris concentrations from this request to the inventory approved with Amendment 58. Accordingly, Section 13.4 of the previously approved "Waste Characterization Plan" for soils (provided as Attachment A to the "Revised Technical Basis for Characterization of Decommissioning Soils Waste That is Subject to the Alternate Disposal Request for US Ecology Idaho, Inc.") was updated to indicate that, if it is determined that the mean Tc-99 activity of 0.30 Ci and 95% UCL of 0.45 Ci are within the established limits, the material will be authorized for rail shipment to USEI. An updated listing of action levels and associated contingencies was provided in Appendix R (Contingency Plan Table) of HDP-TBD-WM-906 and is provided as Table 4-1 of this SER.

4.1.2. Piping Characterization

WEC committed in Section 5.2.2 of HDP-TBD-WM-908 to perform additional characterization of piping prior to disposal at USEI. WEC intends to quantify uranium and gamma emitting radionuclides using High Resolution Gamma Spectroscopy (HRGS). Tc-99 concentrations will be determined through laboratory sampling. Further details were provided in Attachment 11 to HDP-TBD-WM-908 (Sampling Plan for Piping Destined for USEI). WEC considered two sampling approaches using the Visual Sampling Plan software package. The first approach was to compare a true average to a fixed threshold using data from the four nuclides: Tc-99, U 234, U-235, and U-238. The Tc-99 data required the most number of samples (at a rate of one sample per 7.1 m^3 of material). The second approach determined the number of samples required to define the confidence interval on the mean activity, where the half-width of the confidence interval was set to half of the mean concentration. This approach resulted in a sampling frequency of one sample per 12.1 m^3 of piping. WEC decided to use the more conservative approach of one sample per 7.1 m^3. Since prior sampling did not indicate a relationship between Tc-99 and uranium in piping, WEC will utilize random sampling for piping that is eligible for disposal at USEI. The exception will be for piping that is segregated for criticality safety evaluation at a Material Assay Area/Waste Evaluating Area. In the case of piping that segregated for criticality safety evaluation, one sample of such piping --consisting of 4 aliquots -- will be taken from each batch of segregated material. These samples will be biased since they represent a smaller batch which has been removed from a larger randomly sampled population. As noted in Attachment 11 to HDP-TBD-WM-908 (Sampling Plan for Piping Destined for USEI), this represents one sample for each container that was segregated for criticality safety analysis. This will still maintain a sampling frequency of at least one sample per 7.1 m^3 of material.

4.1.3. Concrete/Asphalt Characterization

WEC committed in Section 6.6 of HDP-TBD-WM-906 to perform additional characterization of concrete and asphalt prior to disposal at USEI and provided a "Sampling Plan for Concrete and Asphalt" as Enclosure 3 in the July24, 2012 final responses to the NRC's RAIs. WEC developed a sampling approach using the Visual Sampling Plan software to determine the confidence interval on a mean specific to the Hematite decommissioning project. The half-width of the confidence interval was set to half of the mean Tc-99 concentration outside the five elevated areas identified in HDP-TBD-WM-906, and the standard deviation of the same data set was used. The resultant sampling frequency was 20 samples per area, and buildings 240, 253, 254, 255, 256, 260, and 235/252 were each designated as 7 separate sampling areas. WEC has committed to taking concrete samples on a systematic grid, to depths of 0.75 inches and 1.5 inches, as shown in Appendix A of Enclosure 3 of the July 24, 2012 WEC RAI response. Samples from the 0.75 to 1.5 inch depth will be used to assess the contamination within the remaining thickness of the concrete slab since existing characterization data indicates that radioactivity of concern is located in the upper 0.75 inch layer of concrete. Asphalt will be sampled at a rate of 20 samples per area throughout five areas adjacent to the process building slab, as shown in Appendix B of Enclosure 3 of the July 24, 2012, WEC RAI response. A 100% beta contamination scan will be performed on the accessible designated asphalt sampling areas, and core samples will be biased toward elevated beta areas followed by random samples within each area in order to meet the 20 sample per area frequency. For both concrete and asphalt, uranium will be measured via gamma spectroscopy and Tc-99 will be measured via laboratory analysis.

4.2. NRC Assessment of WEC's Waste Material Characterization

In response to the staff's RAIs, WEC provided Revision 2 to HDP-TBD-WM-908, "Safety Assessment for Additional Hematite Project Waste at USEI," via an October 17, 2012, letter (ADAMS Accession No. ML12293A029). In Enclosure 1 to this letter, WEC stated that Section 5.2 of HDP-TBD-WM-908 would be modified to indicate that additional characterization of soils, piping, concrete, and asphalt would be completed prior to their shipment by rail to USEI. The associated characterization plans were reviewed by NRC staff, and the staff's assessment follows..

NRC staff performed a health physics review of WEC's January 16, 2012 request, and WEC's RAI responses. NRC staff determined that WEC's January 16, 2012 request did not provide a clearly developed characterization plan nor sufficient justification to demonstrate that the characterization performed to date was adequate to justify the disposal of wastes at a non NRC licensed facility. The staff recommended that Revision 0 of WEC document HDP TBD-WM-906, Characterization Data Summary in Support of Additional USEI Alternate Disposal Request, be revised to present a clear discussion of quantifiable characterization objectives followed by a description of how WEC would demonstrate if and how their characterization activities achieved those goals. The staff also noted that while historical data may be acceptable for use, there are numerous data gaps that require WEC to perform additional investigations and sampling. The staff's May 1, 2012, RAIs enumerated specific areas requiring additional characterization and recommended that WEC develop a formal characterization plan that includes additional systematic probabilistic sampling based on the Data Quality Objectives (DQO) process.

4.2.1.1. NRC Findings

The NRC staff has reviewed WEC's plans for additional soil, piping, concrete, and asphalt sampling and finds that WEC's plans represent acceptable sampling protocols and frequencies to adequately characterize materials prior to shipment to USEI.

4.3. Quality Assurance and Contingency Plans

4.3.1. WEC Quality Assurance and Contingency Plans

WEC developed several quality assurance and contingency plans in order to assess the additional soil, piping, concrete, and asphalt characterization results. Sampling data quality objectives were also provided as Appendix P in Revision 1 to HDP-TBD-WM-906. Associated with the May 2009 §20.2002 alternate disposal request, WEC had provided a detailed quality assurance plan for soils. This plan was described in the "Technical Basis for Characterization of Decommissioning Soils Waste That is Subject to the Alternate Disposal Request for US Ecology Idaho, Inc." (ADAMS Accession No. ML110530155), and was approved as part of the staff's review and approval associated with Hematite License Amendment 58. It was noted in the plan that WEC intends to implement field duplicate samples, field blanks, and laboratory control samples throughout the excavation process at its Hematite site. WEC will collect field duplicates at a frequency of 1 per 20 samples and the results will be evaluated to determine the relative difference or relative percent difference between two data sets. WEC intends to utilize guidance from the Multi Agency Radiological Laboratory Analytical Protocols Manual (MARLAP) to compare results to pre-determined warning and control limits. Field blanks will be collected at a frequency of 1 per 100 samples and these results will be used to evaluate bias. Laboratory control samples, matrix spikes (if applicable), and replicate counts will be performed at a frequency of 1 per 20 samples in order to assess overall laboratory performance.

WEC provided a contingency plan for piping in Section 7.2 of Revision 1 of HDP-TBD-WM-906. WEC indicated that post-collection data analysis will be performed to determine whether the results are adequate in both quality and quantity to support the primary sampling objectives.

Accordingly, WEC indicated that they would review the dataset to ensure that the requisite sampling frequency is met. WEC also committed to compare the Tc-99 results to the action levels provided in Appendix R of Revision 1 of HDP-TBD-WM-906. These action levels are presented below in Table 4-1..

Table 4-1: Pre-Shipment Contingency Plans Proposed by WEC

Parameter	Action Level	How Monitored	Actions
Total Quantity of Tc-99 shipped to USEI (mean)	>1.3 Ci	Running total activity (both shipped and pending shipment), based on laboratory sample results prior to shipment	• Reanalyze composite sample and/or analyze individual aliquots used to create the composite sample; • Resample stockpile and re-evaluate; and • Ship material to alternate facility.
95% Upper Confidence Level of the mean Tc-99 shipped to USEI [UCL(0.95)]	>2.05 Ci	Running confidence interval (both shipped and pending shipment) based on laboratory sample data prior to shipment	• Reanalyze composite sample and/or analyze individual aliquots used to create the composite sample; • Resample stockpile and re-evaluate; and • Ship material to alternate facility.
Total activity contribution from all radionuclides within individual railcar	>3000 pCi/g > 40 μR/hr	Laboratory sample results for stockpile evaluated at 95% UCL prior to shipment Gamma radiation levels on railcars prior to shipment	• Analyze additional aliquot of composite sample; • Unload railcar (at HDP) and re-load with material containing lower concentration (either blended or alternate material from onsite waste stream); and • Ship material to alternate facility.
Unexpected Tc-99 results for stockpile samples (soil)	>99th percentile of the site wide dataset (573 pCi/g)	Laboratory sample results for stockpile evaluated prior to shipment	• Analyze additional aliquot of composite sample; • Resample stockpile and re-evaluate; • Blend with less contaminated material, resample stockpile and re-evaluate; and • Ship material to alternate facility.
Unexpected Tc-99 results for stockpile samples (concrete)	>99th percentile of the site wide dataset (1590 pCi/g)	Laboratory sample results for stockpile evaluated prior to shipment	• Analyze additional aliquot of composite sample; • Resample stockpile and re-evaluate; • Blend with less contaminated material, resample stockpile and re-evaluate; and • Ship material to alternate facility.

Parameter	Action Level	How Monitored	Actions
Unexpected Tc-99 results for stockpile samples (piping internal debris / residue)	>99th percentile of the dataset (162 pCi/g)	Laboratory sample results for stockpile evaluated prior to shipment	• Analyze additional aliquot of composite sample; • Resample stockpile and re-evaluate; • Blend with less contaminated material, resample stockpile and re-evaluate; and • Ship material to alternate facility.
Unexpected Tc-99 results for stockpile samples (piping average concentration)	>99th percentile of the dataset (125 pCi/g)	Laboratory sample results for stockpile evaluated prior to shipment	• Analyze additional aliquot of composite sample; • Resample stockpile and re-evaluate; • Blend with less contaminated material, resample stockpile and re-evaluate; and • Ship material to alternate facility.
Maximum average concentration of Ra-226 and Th-232 within individual railcar	Ra-226 >13 pCi/g Th-232 >16 pCi/g	Laboratory sample results for each railcar evaluated prior to shipment	• Analyze additional aliquot of composite sample; • Resample stockpile and re-evaluate; Blend with less contaminated material, resample stockpile and re-evaluate; and • Ship material to alternate facility.

Section 6.6 of Revision 1 of HDP-TBD-WM-906 describes a contingency plan for concrete and asphalt which includes a retrospective analysis of the data results to verify that a sufficient number of samples were collected to meet the data quality objectives. If an insufficient number of samples are collected, WEC will review the data to determine the cause of the insufficiency. WEC will review the data from each sampling area to determine if it is normally distributed. Data sets which are not normally distributed will be reviewed to identify areas of elevated results. If elevated areas are identified, additional samples will be collected as needed to bound the area, and the results will be compared to the action levels provided in Appendix R of Revision 1 of HDP-TBD-WM-906 and Table 4-1 of this SER.

4.3.2 NRC Assessment of WEC Quality Assurance and Contingency Plans

The staff has reviewed WEC's quality assurance/quality control programs, data quality objectives, and contingency plans. The staff has found them acceptable and their implementation should permit WEC to demonstrate that the NRC's alternate disposal dose requirement (of not more than "a few millirem per year" to any member of the public) can be met.

5. NUCLEAR CRITICALITY SAFETY

This section of the SER addresses the nuclear criticality safety aspects of WEC's January 16, 2012 request, which addresses the shipment of waste to USEI and its disposal there. Disposal at USEI must be done in a manner which ensures that any U-235 in the waste is not placed in a configuration which could result in a criticality safety event. In this regard, WEC has committed that each gondola car of shipped waste to USEI will be below an average concentration of 1 gram of U-235 per10 liters of waste. WEC identifies this limit as its "NCS exempt material limit."

At this concentration limit, this permits the handling of fissile material without any additional NCS controls since the limit is conservatively set well below the NRC-endorsed minimum critical infinite sea concentration of 1.4 g U-235/liter. The latter value is based upon the data in NUREG/CR-6505, Vol. 1, "The Potential for Criticality Following Disposal of Uranium at Low Level Waste Facilities."

5.1. WEC Criticality Assessment

The decommissioning operations at the Hematite site include the excavation, recovery and collection of contaminated waste, waste characterization, waste treatment, and off-site shipping preparation. WEC performed an NCS assessment to demonstrate that the NCS exempt material limit will be met for waste disposal at USEI and therefore the risk of criticality is not credible (NCSA of the US Ecology Idaho (USEI) Site, NSA-TR-HDP-11-11, Rev. 0, dated December, 2011). WEC's assessment describes the process conditions used at the Hematite site and the characterization of the uranium concentration in the waste streams which are relied upon to ensure that the NCS exempt material limit is met.

5.1.1. Concrete/Asphalt Removal

In order to excavate the subterranean structures, the overlying concrete must be removed. Spills during past manufacturing operations at the Hematite site may have contaminated the overlying concrete, even though such spills were cleaned up (either scrubbed clean or scabbled and then re-surfaced). WEC performed an extensive radiological non-destructive surface assay during 2009 to quantify the residual mass of U-235 associated with the concrete surfaces. This survey was complemented by destructive analysis of cored concrete during 2010 and 2011. Based upon the sampling and assay of the concrete slabs, WEC determined that the total amount of U-235 present in the floor regions of all Hematite facility buildings is less than 4,565 g U-235. With the exception Building 252, the U-235 concentration that was confined in the upper ½" of the floor regions is well below the NCS Exempt Material limit of 0.1 g U 235/liters (or 1 g U-235/10 liters).

Once the concrete is removed, WEC will remove any soil and other overlying material (i.e., gravel and stones) that covers the subterranean structures. Since the soil/material of concern was covered by the concrete slabs, the only mechanisms for any non-trivial amount of contamination of the underlying soil are fissile solution spills that reached the soil via a seam or crack in the concrete. Operations that involved fissile solutions were confined to Buildings 240 and 260. Therefore these are the only areas where WEC will assay the underlying soil. Excavation of areas that are found to be below the NCS Exempt Material limit will be performed without any additional NCS controls. However, if an area of soil is found to exceed the NCS Exempt Material limit, then WEC will remove the material and package it in a field container that will be assayed to determine radiological content. Once the contaminated soil is exhumed, two independent surface assays will be performed over the uncovered soil regions. WEC will perform this sequence of operations until soil is determined to be below the NCS Exempt Material limit.

For the disposal of the concrete slab waste, the licensee performed in-situ assays (dual independent measurements) and took core samples that were destructively assayed to determine the U-235 mass present. Based upon these actions and the utilization of a scaling factor of 1.7 to account for the attenuation of gamma rays through the concrete substrate, WEC estimated that the total U-235 mass contained in all the slabs is approximately 4,600 grams. This results in an average concentration of 0.039 grams U-235/liter assuming a ½ inch cut depth which is conservative since the cut depth is typically greater than ½ inch (Table 1.6 of NSA-TR-HDP-11-11) [(ADAMS Accession No. ML12209A200)]. Since a small amount of underlying soil may also be inadvertently excavated with the concrete, WEC took core samples of the soil around seams to verify that the concentration in these areas will not contribute significantly to the amount of U-235 in the concrete slab debris. While two slabs were identified to have a slightly higher concentration (0.105 grams U-235/liter and 0.171 grams U-235/liter), these concentrations are still well below the minimum critical infinite sea concentration for a bounding soil/U-235 medium of 1.4 g U-235/liters. WEC has also implemented a requirement to inspect the concrete during excavation to ensure that any attached debris is characterized.

5.1.2. Subterranean Piping and Sewage Septic Treatment Tank and Drain Field and Drain Line Removal

In 2010, WEC conducted an in-pipe survey to quantify the residual mass of U-235 in subsurface piping that resides mainly beneath the former process buildings. Over one thousand feet of subsurface piping was surveyed. Because the assayed pipe length is a significantly large sample, and the assayed pipes represent pipes with drains that were in the vicinity of the fuel manufacturing operations, results of the in-pipe radiological surveys are assumed to be a bounding representation of all the subterranean piping.

WEC will perform a set of independent measurements on the subterranean piping to ensure the U-235 concentration does not exceed the NCS Exempt Material limit. If the independent assays confirm the pipe meets the NCS Exempt Material limit, the pipe may be transferred to a waste handling area for potential shipment to USEI. Subterranean piping that exceeds the NCS Exempt Material limit will be re-assayed using HRGS equipment to determine the precise fissile nuclide content. If the U-235 concentration exceeds the limit, WEC may comingle the material with a lesser contaminated waste so that it meets the NCS Exempt Material Limit. The resultant debris will be subject to two independent assays to ensure the resultant debris meets the NCS Exempt Material limit. Some of the piping system may be constructed of concrete or vitrified clay, which may be crushed during decommissioning operations. Prior to exhuming the debris (i.e., mixture of pipe contents, piping material, and any soil/stones/gravel), a set of two independent surface assays will be performed on the debris. If the surface assays establish that the crushed debris meets the NCS Exempt Material limit, the material may be transferred to a waste handling area for potential shipment to USEI. However, if it exceeds the NCS Exempt Material limit, then the associated portion will be removed and packaged per NCS limits.

The Hematite site contains two sewage treatment systems and a concrete septic tank which were connected to the lavatories within the former process buildings. Only one sewage treatment system and the associated sanitation lines and drain lines remain in service. The older sewage treatment tank and concrete septic tank were previously abandoned in place. Prior to exhuming the contents of the current sewage treatment tank, sanitation lines leading to the treatment tank will be exhumed and disposed of following the process used for the subterranean piping as discussed above. If the sanitation lines leading to the current sewage treatment tank meet the NCS Exempt Material limit, and the U-235 activity linearly decreases as the sanitation lines approach the sewage treatment tank, then WEC assumes that the sewage treatment tank meets the NCS Exempt Material limit. WEC indicated in NSA-TR-09-08, Rev. 1, NCSA of the Sub-Surface Structure Decommissioning at the Hematite Site, (ADAMS Accession No. ML12293A029) that this assumption is supported by results of the in-pipe radiological surveys of the subterranean piping beneath the former process buildings. The results of the in-pipe radiological survey demonstrated that the highest observed dose rates were at the elbow section of the pipes. WEC found that as measurements were taken downstream from the elbow sections, the measured dose rates decreased. However, should WEC find sanitation lines which are demonstrated to contain material exceeding the NCS Exempt limit, or U-235 activity which does not decline as the sanitation lines approach the current sewage treatment tank, the treatment tank will then be assumed to contain fissile material. WEC is assuming that soil surrounding the current sewage treatment tank potentially contains U-235 concentrations above the NCS Exempt Material limit. If WEC determines that the soil does not exceed the NCS Exempt Material limit, the soil will be treated as waste and the sewage tank will be assumed to meet the NCS Exempt Material limit. If WEC finds that any of the soil exceeds the NCS Exempt Material limit, then the soil will be removed and packaged in a field container, and subjected to two independent assays. If the soil is found to be contaminated it is most likely due to a leak from the sewage tank. Therefore WEC will assume that the sewage tank also contains fissile material.

Since solids or solutions denser than water settle or layer in the bottom of a treatment tank, any uranium (solids or solutions) discarded into sanitation lines during fuel manufacturing operations could have settled to the tank bottom. Because of this, WEC will require two independent surface assay measurements of the current sewage treatment tank targeted for exhumation. If the content of the current sewage treatment tank is determined to meet the NCS Exempt Material limit, then WEC will assume that the associated drain line will also meet the NCS Exempt Material limit and the lines may be transferred to a waste handling area for potential shipment to USEI. If WEC determines that the current sewage treatment tank contents contain non-NCS Exempt Material then the associated drain line and the sewage treatment tank structure will be assumed to also contain non-NCS Exempt Material and the drain line will be excavated in accordance with the soil exhumation and subterranean piping removal procedures described above. WEC will subject the resultant debris to two independent assays.

For the decommissioned sewage treatment tank or concrete septic tank, the material residing within the treatment tanks cannot be interpreted as representative of the material in the associated common drain field (i.e., filled with gravel). Thus, WEC will dispose of the common drain field in accordance with the soil exhumation and subterranean piping removal procedures.

5.1.3. Components Remaining as a Result of Building Demolition Operations

WEC performed a radiological survey in 2009 on the components that remained from the building demolition operations. WEC performed Monte Carlo N-Particle (MCNP) calculations to estimate the U-235 mass on components that may be disposed of at the USEI site. WEC performed decontamination and demolition (D&D) operations for the remaining equipment, piping, ventilation ducts, and miscellaneous items/components to prepare these items for removal and decontaminate select items to ensure they meet the limit for transportation and disposal at the USEI site. Following decontamination, WEC applied additional fixative to the contaminated surfaces of these items, as necessary, any material collected during these decontamination activities is not intended to be shipped to USEI. Based on the results of site characterization work, WEC determined that the remaining equipment, piping, ventilation ducts, and miscellaneous items/components have little to no loose UO2 holdup.

5.1.4. Miscellaneous Equipment as a Result of Decontamination and Decommission

Decontamination and Decommissioning (D&D) efforts may result in contamination of equipment. However, due to the types of equipment used for D&D operations and the nature of the decommissioning waste materials, it is expected that only surface contamination of D&D equipment will occur. WEC will survey this equipment for potential UO2 contamination.

5.1.5. Waste Generated as a Part of Demolition of Select Auxiliary Building Operations

The three auxiliary buildings remaining at the Hematite site are buildings 235, 115, and the Sanitary Waste Treatment Plant (SWTP) shed. Building 235 was used for storage of Special Nuclear Material (SNM) during plant operations, and is currently empty. Building 115, the Fire Pump House, had a generator and a fire pump. Building 115 has no history of radioactive material use. Buildings 115 and 235 may be used during future decommissioning operations. Any operations conducted in these buildings will only involve material contained within approved containers, and the operations will be conducted using controlled processes, therefore minimizing the potential for contamination. Prior to demolition, WEC will remove any contaminated materials from these buildings.

The SWTP shed received discharges from sinks, toilets, showers and drinking fountains. The SWTP was also used to receive laundry water (after the water was filtered and held for sampling) and waste water from the former process water demineralizer system and laboratory sinks. The SWTP shed consists of a series of settling and aeration tanks and an adjacent building that contains data logging and electronic instrumentation, floor drains and an open work area. The portions that have been impacted by licensed activities are limited to the process components that came in contact with waste water, and that have the potential to collect solids that would have settled. Prior to demolition of the SWTP shed, WEC will remove the equipment described above and will separately disposition it.

The above noted buildings were surveyed as a part of the 2009 site radiological characterization program. The radiological survey results estimated that there was a combined total of 55 grams of U-235 on the surfaces of all three of these buildings.

5.2. NRC Staff's Criticality Assessment

The NRC staff's review focused on whether WEC had adequately evaluated NCS risks associated with the proposed waste streams for both normal and credible abnormal conditions. The staff relied upon information in NUREG/CR-6505, Vol. 1,"The Potential for Criticality Following Disposal of Uranium at Low Level Waste Facilities." In NUREG/CR-6505, Vol. 1 the potential for low levels of uranium to concentrate in soil by hydrogeochemical processes such that a criticality event could occur was evaluated. Based upon that evaluation the minimum critical infinite sea concentration for a bounding soil/U-235 medium is 1.4 g U 235/liter. The limit for disposal at USEI is 0.1 gram U-235/liter which is below the minimum critical concentration.

WEC's sample size of the piping surveyed is large. Even if the amount of material has been underestimated, WEC has committed to performing a set of independent measurements to determine the U-235 concentration prior to disposal. Because of the comprehensive sampling performed prior to removal of the piping, the independent sampling performed during the decommissioning operations, and the margin in the NCS limits for the material shipped to USEI, the NRC staff has reasonable assurance that a criticality is not credible from the disposal of the subterranean piping at USEI.

The other waste areas associated with WEC's request, namely, concrete/asphalt, soil underneath the slabs, components remaining after building demolition, miscellaneous equipment as a result of decontamination and decommissioning, and wastes generated as a part of demolition of selected auxiliary building operations generally involve very low contamination levels of fissile material, and thus are not a NCS concern. Therefore, the staff has concluded that a criticality event is not credible for these wastes.

5.1.6. NRC Findings

The NRC staff determined that a criticality event is not credible at the USEI disposal site for the WEC waste described above, because multiple controls related to identifying and segregating waste, as identified in Section 5.1 above, would have to fail before a criticality event could occur. In addition, the NRC staff determined that a criticality event is not credible during the proposed rail shipments, due to the low concentrations of uranium in the waste to be shipped in the gondola railcars.

MATERIAL CONTROL AND ACCOUNTABILITY

5.2. Westinghouse Assessment

This section of the SER addresses the material control and accountability (MC&A) aspects of WEC's January 16, 2012 request. The staff conducts such a review due to the general reporting and record keeping requirements of subpart B of 10 CFR Part 74, which are applicable to those who possess SNM of 1 g or more of U-235.

WEC Hematite maintains a MC&A program in accordance with the NRC-approved Fundamental Nuclear Material Control Plan (FNMCP) per 10 CFR Part 74, Material Control and Accounting of Special Nuclear Material. The FNMCP contains the reporting requirements of 10 CFR §74.15 associated with DOE/NRC Form 741, Nuclear Material Transaction Report, for the WEC Hematite facility.

WEC's January 16, 2012 request is similar to its May 21, 2009, alternate disposal request. The differences between the two requests are twofold : (1) the type of material; and (2) the total quantity of radionuclides. License Amendment 58 was primarily for soil. The January 16, 2012 request involves concrete/asphalt, piping, miscellaneous equipment and soils. License Amendment 58 involved an average concentration of U-235 of 5.5 pCi/g of while the January 16, 2012 request involved an expected concentration of less than 2.8 pCi/g.

The staff reviewed WEC's January 16, 2012 request and determined that additional information was needed to complete the review, as documented in the staff's RAIs. WEC's RAI responses included its June 19 submittal, which along with the MC&A RAIs are not publicly available because of the sensitive nature of the information.

In its RAI response, WEC confirmed that the proposed waste to be disposed of at USEI is diffuse material as defined in Hematite's Fundamental Nuclear Material Control Plan, dated February 18, 2011. WEC's response also confirmed that it will continue to meet 10 CFR 74.15 requirements to document the transfers of 1 gram or more of SNM to the disposal facility through use of DOE/NRC Form 741, and that USEI will report SNM receipts using its existing account with the Nuclear Material Management & Safeguards System (NMMSS).

5.3. NRC Evaluation and Findings

As noted above WEC will continue to use DOE/NRC Form 741 to document all transfers of 1 gram or more of SNM to NMMSS and USEI will report all SNM receipts, including SNM contained in waste, to NMMSS. Once all of the WEC material is received and disposed of below ground at the USEI facility, USEI may request that its NMMSS account be de-activated, as previously approved. Based upon the above-noted WEC and USEI commitments, the staff has concluded that WEC's alternate disposal request is acceptable with regards to MC&A.

6. PHYSICAL SECURITY

6.1. Assessment

This section of the SER addresses the physical security aspects of WEC's January 16, 2012 request. Based upon the quantity of U-235 associated with this alternate disposal request, the transportation of the materials to USEI and its disposal at USEI has been assessed in accordance with the physical security requirements of 10 CFR Part 73. Section 5.1 of Enclosure 1 to WEC's January 16, 2012 request states that approximately 0.1 Ci of U-235 in total would be shipped to USEI for disposal. This curie amount equates to approximately45 Kg of U-235.

The NRC staff finds that, from a physical security perspective, the physical security section (Chapter 7) of the SER associated with Hematite Amendment No. 58 presents a bounding analysis for the January 16, 2012 request. The elements of that conclusion are presented below as well as the relationship of the present request to the request associated with Amendment 58.

The physical security issues associated with Amendment 58 remain relevant, and regard: (1) rail shipment of waste that may contain SNM of average enrichment less than 10% U-235 to USEI; (2) transferring such SNM from the gondola cars to trucks for transport to the USEI burial cell; and (3) disposal of the SNM in the burial cells. From a physical security standpoint, any assessment needs to consider the concentration and the enrichment of the SNM being shipped to USEI and handled there, the attractiveness of the form of the SNM being disposed, and the ability of an adversary to efficiently and timely segregate such material after disposal.

In License Amendment 58, the average concentration of U-235 estimated to be shipped to USEI was 5.5 pCi/g. For the U-235 associated with the January 16, 2012 request, the average expected concentration is less than 2.8 pCi/g. The volume of waste associated with the disposal in Amendment 58 and this §20.2002 request is about the same, about 23,000 m^3. Therefore, approximately half as much U-235 will be disposed at USEI in this §20.2002 request compared to Amendment 58.

While some of the SNM going to USEI will be HEU, WEC will not be shipping to USEI any HEU that is in a discrete form. Rather, the HEU will be dispersed throughout the waste material being shipped.

In terms of the attractiveness of the SNM for malicious use and its form, the SER for Hematite Amendment No. 58 bounds the analysis here. In neither case is the SNM in a useful form, because it is mixed with dirt found on concrete slabs and asphalt, or is on or in piping and miscellaneous equipment. Thus, the timely and efficient removal of the SNM by an adversary for unauthorized purposes is improbable. The combination of the existing physical security at the USEI site and the effort to identify SNM under such conditions would effectively prevent any opportunities for extracting SNM from its disposal cell.

6.2. NRC Findings

The NRC staff has reviewed the physical security aspects of the January 16, 2012 request. The staff has concluded that there are no physical security concerns associated with the disposal of the Hematite material at the USEI facility. The average U-235 activity levels are low. While SNM will be disposed at USEI, WEC has committed to removing discrete forms of HEU. The SNM will be dispersed throughout the waste material, thereby not lending itself for efficient and timely removal for unauthorized purposes.

7. POTENTIAL FOR RECONCENTRATON

7.1. Assessment

The staff assessed the potential for reconcentration of U-235 in the leachate system at the USEI facility given the half-lives of the SNM and the impact of leachate control system.

In 2008, USEI's permit was modified by the Idaho Department of Environmental Quality (IDEQ) to authorize receipt of specified quantities of SNM, provided that the SNM was made exempt from NRC regulations and licensing requirements. The potential for the generation of leachate is minimized by the site's acceptance requirement that any incoming waste contain no free liquids. Further reducing the potential for leachate generation is the site's location in a desert environment that averages approximately 7.3 inches of precipitation per year with an evaporation rate of approximately 42 inches per year.

The potential to generate leachate is further reduced by the USEI facility's design to completely encapsulate the waste in a low permeability (1 x 10-7 cm/sec) cover system. Requirements for the construction of a waste cell include a base layer of compacted clay three-feet thick overlain by a composite liner with a sump to collect any leachate that might be generated. The composite liner is overlain by a 30-inch soil layer as a protection barrier for the liner. Waste placed in the cell is compacted to minimize the potential for future subsidence and when the cell is full is overlain by a low permeability multi-layer cap 11.8 feet thick that includes nine feet of non-radiological material.

7.2. NRC Findings

As a result of design features such as a low permeability cover, the base layer of compacted clay with a composite liner as an overlay and the compaction of the waste upon burial, the staff has concluded that reconcentration in the leachate system should not be an issue with respect to the disposal of the SNM at USEI.

8. LICENSE CHANGES

Approval of WEC's January 16, 2012 request will be effectuated by issuing License Amendment No. 60 to the Hematite License including the following changes to Hematite License Conditions.

The first three changes are administrative in nature. The first administrative change arises from a previous numbering error (the present license goes from License Condition 10 to License Condition 12). Therefore, after License Condition 10, all License Conditions will be renumbered accordingly.

The second administrative change involves Item 9 of the Hematite License. Presently, the Authorized Uses involve Items A through E as described in the August 12, 2009 Decommissioning Plan and associated supporting documents noted in Hematite Decommissioning Plan SER (ADAMS Accession No. ML112101630) and July 5, 2011, License Application (ADAMS Accession No. ML111880290). When the Decommissioning Plan was approved in Amendment 57 to the Hematite License, Item 9 should have indicated that Authorized Use was for Items A through H. This license amendment corrects that omission.

The third administrative change more definitively defines the appropriate Westinghouse License Application and the July 5, 2011 Westinghouse letter by referring to the Westinghouse document number and providing the NRC's ADAMS numbers associated with the documents. Since both documents are part of the same submittal and have the same ADAMS number, they were listed as one reference.

The fourth change to the Hematite license revises License Condition 15 to list the documents referenced in this SER and the SER for License Amendment 58.

The fifth change is revises License Condition 17 to include the total volume of waste material that WEC is authorized to ship to USEI for disposal there and the total amount of Tc-99. This includes the 22,809 m^3 of soils and associated debris covered by the approval of WEC's May 2009 alternate disposal request, and the 23,000 m^3 of concrete/asphalt, piping, soil and miscellaneous equipment covered by the approval of WEC's January 16, 2012 request. Therefore, the revisions to Item 9 and to License Conditions 15 and 17 would be as follows:

9. Authorized Use: Items A through H. Uses as described in August 12, 2009 Decommissioning Plan and associated supporting documents noted in Hematite Decommissioning Plan SER (ADAMS Accession No. ML112101630) and July 5, 2011 License Application (ADAMS Accession No. ML111880290).

15. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents, including any enclosures, listed below. The NRC's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

a. Westinghouse HEM-11-96, "Final Supplemental Response to NRC Request for Additional Information on the Hematite Decommissioning Plan and Related Revision to a Pending Licensing Action", July 5, 2011. (ADAMS Accession Nos. ML111880290 and ML111880292)

b. Documents identified in Chapter 1 of NRC Decommissioning Plan SER. (ADAMS Accession No. ML112101630)

c. Westinghouse HEM-11-56, "Evaluation of Technetium-99 Under the Process Buildings", May 5, 2011. (ADAMS Accession No. ML111260624)

d. Documents identified in the NRC's 10CFR20.2002 SERs associated with Amendment Nos. 58 and 60. (ADAMS Accession Nos. ML111441087 and ML12158A401)

17. Pursuant to 10 CFR 20.2002, the licensee may dispose of solid materials (22,809 m^3 of soils and associated debris and 23,000 m^3 of concrete/asphalt, piping, soil and miscellaneous equipment) provided the total inventory of Tc-99 based on the average concentration and total mass shipped remains below 1.3 Ci or 2.05 Ci based upon the 95th upper confidence limit as waste at the U.S. Ecology Idaho facility in Grand View, ID. Pursuant to 10 CFR 30.11 and 10 CFR 70.17, this material is exempt from the requirements in 10 CFR 30.3 and 10 CFR 70.3.

9. CONCLUSIONS

On January 16, 2012, WEC requested that the NRC approve alternate disposal, in accordance with 10 CFR §20.2002, of specified low-activity radioactive materials from the HDP. These waste materials total approximately 23,000 m^3 of concrete/asphalt, piping, soil and miscellaneous equipment, and contain low concentrations of source, SNM and byproduct material contaminants. WEC plans to ship these materials by rail to USEI RCRA Subtitle C disposal facility near Grand View, Idaho.

Activities and potential doses associated with transportation, waste handling and disposal have been evaluated in reviewing this 10 CFR §20.2002 application. The staff has determined that WEC has provided an adequate description of the waste to be disposed of, including the physical and chemical properties important to risk evaluation, and the proposed manner and conditions of waste disposal.

The staff has determined that WEC's proposed statistical evaluation, sampling plan, QA/QC program, and contingency plans are acceptable, and demonstrate that its proposed disposal will not result in a dose to individual members of the public exceeding a few millirem per year.

Independent review of the post-closure and intruder scenarios using RESRAD estimated that the maximum projected dose per year over a period of 1,000 years is within "a few millirem". A conservative bounding analysis conducted by the staff yielded doses less than the Part 20 annual dose limit of 1.0 mSv/yr (100 mrem/yr) to members of the public. The projected doses to individual USEI workers have been conservatively estimated and demonstrate that the proposed disposal will not result in a dose to members of the public exceeding a few millirem per year.

In addition, because this 10 CFR §20.2002 application involves SNM, nuclear criticality safety, material control and accounting, and physical security assessments were performed.
The staff finds that this proposed action will not significantly impact the annual cumulative dose from all exempted and naturally occurring radioactive material at the USEI disposal facility. This finding is based upon the dose evaluations discussed in Section 3 above.

Further, in accordance with the provisions of 10 CFR §30.11 and 10 CFR §70.17, the NRC may, upon application by an interested person or upon its own initiative, grant such exemptions from the requirements of the regulations in those parts of Title 10, Chapter 1 of the Code of Federal Regulations as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest. Based on the above analyses, the staff concludes that: (1) this material authorized for disposal poses no danger to public health and safety; (2) the authorized disposal does not involve activities that could potentially impact the common defense and security of the United States; and (3) it is in the public interest to dispose of wastes in a controlled environment, such as that provided by the US Ecology Idaho facility located in Grand View, ID. Therefore, to the extent that the waste authorized for disposal contains byproduct material and SNM that would otherwise be licensable, the staff concludes that the receipt and possession of this material by USEI is exempt from NRC licensing requirements in 10 CFR §30.3, and §70.3, respectively.

10. REFERENCES

For convenience, the references have been organized according to their WEC, LLC identification number.

HDP-TBD-WM-906. "Characterization Data Summary in Support of Additional USEI Alternate Disposal Request, Revision 0, Westinghouse Electric Company LLC, Hematite Decommissioning Project. January 19, 2012. (ADAMS Accession No. ML12017A188)

HDP-TBD-WM-906. "Characterization Data Summary in Support of Additional USEI Alternate Disposal Request, Revision 1, Westinghouse Electric Company LLC, Hematite Decommissioning Project. July 24, 2012. (ADAMS Accession No. ML12209A201)

HDP-TBD-WM-908. "Safety Assessment for Additional Hematite Project Waste at USEI, Revision 2," Westinghouse Electric Company LLC, Hematite Decommissioning Project October 17, 2012. (ADAMS Accession No. ML12293A029)

HEM-09-94. "Decommissioning Plan and Revision to License Application,". Westinghouse Electric Company LLC, Hematite Decommissioning Project. August 12, 2009. (ADAMS Accession No. ML092330136)

HEM-09-52. "Westinghouse Electric Company, LLC - Request for Alternate Disposal Approval and Exemptions for Specific Hematite Decommissioning Project Waste,". . Westinghouse Electric Company LLC, Hematite Decommissioning Project, May 21, 2009. (ADAMS Accession No. ML091480071)

HEM-09-94. Hematite Decommissioning Project Report DO-08-005, Rev. 0, "Historical Site Assessment.," Westinghouse Electric Company LLC, Hematite Decommissioning Project. July 2009. (ADAMS Accession Nos. ML092870417 and ML092870418)

HEM-12-2. "Request for Additional Alternate Disposal Approval and Exemptions for Specific Hematite Decommissioning Project Waste at US Ecology Idaho," Westinghouse Electric Company LLC, Hematite Decommissioning Project, January 16, 2012. (ADAMS Accession Nos. ML12017A188, ML12017A189, ML12017A190)

HEM-12-67. "Partial Response to NRC Requests for Additional Information Dated May 1, 2012 on the January 16, 2012 Hematite 20.2002 Alternate Disposal Request. Westinghouse Electric Company LLC, Hematite Decommissioning Project. June 19, 2012. (ADAMS Accession No. ML121740265)

HEM-12-88. "Final Responses to NRC Requests for Additional Information Dated May 1, 2012 on the January 16, 2012 Hematite 20.2002 Alternate Disposal Request." Westinghouse Electric Company LLC, Hematite Decommissioning Project. July 24, 2012. (ADAMS Accession Nos. ML12209A200 and ML12209A201)

HEM-12-121. “Further Information for the Final Response Dated July 24, 2012 to NRC Requests for Additional Information Dated May 1, 2012 on the January 16, 2012, Hematite Alternate Disposal Request,” October 17, 2012. (ADAMS Accession No. ML12293A029)

HDP-TBD-WM-901. “Scaling Factors for Radioactive Waste Associated with the Above Slab Portion of the Process Buildings. Westinghouse Electric Company LLC Hematite Decommissioning Project. March 28, 2012. (ADAMS Accession No. ML12090A191)

HEM-09-146. “WEC Response to Request for Additional Information - Alternate Waste Disposal,” Westinghouse Electric Company LLC, Hematite Decommissioning Project, December 29, 2009. (ADAMS Accession No. ML100320540)

HEM-I0-38. “Additional Information for Alternate Waste Disposal Authorization and Exemption,” Westinghouse Electric Company LLC, Hematite Decommissioning Project, March 31, 2010 (ADAMS Accession No. ML100950397)

Nuclear Criticality Safety Associates, NSA-TR-09-08, Rev. 1, “NCSA of the Sub-Surface Structure Decommissioning at the Hematite Site”, November 2011. (ADAMS Accession No. ML12293A029)

Nuclear Criticality Safety Associates, NSA-TR-HDP-11-11, Rev. 1, “Nuclear Criticality Safety Assessment of the US Ecology Idaho (USEI) Site for the Land Fill Disposal of Additional Decommissioning Waste from the Hematite Site”, July 2012. (ADAMS Accession No. ML12209A200)

U. S. Environmental Protection Agency, Federal Guidance Report No. 11, “Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion,” September 1988.

U.S. Nuclear Regulatory Commission, NUREG/CR-6505, Vol. 1, “The Potential for Criticality Following Disposal of Uranium at Low Level Waste Facilities.” June 1997. U.S. Nuclear Regulatory Commission, NUREG/CR-0782, Volume 4, “Draft Environmental Impact Statement on 10 CFR Part 61 Licensing Requirements for Land Disposal of Radioactive Waste: Appendices G-Q,” September 1981. (ADAMS Accession No. ML052590354)

U.S. Nuclear Regulatory Commission, NUREG/CR-4370, “Update of Part 61 Impacts Analysis Methodology, Vol. 2”. January 1986. (ADAMS Accession No. ML100250917)

U.S. Nuclear Regulatory Commission, Hematite Amendment No. 58. “US NRC Safety Evaluation Report Request for Alternate Disposal Approval and Exemptions for Specific Hematite Decommissioning Project Waste at US Ecology’s Idaho Facility,” October 27, 2011. (ADAMS Accession No. ML111441087)

U.S. Nuclear Regulatory Commission, "Hematite Amendment No. 58 Transmittal Letter and License," October 27, 2011. (ADAMS Accession Nos. ML112560105 and ML112560193)

U.S. Nuclear Regulatory Commission, SECY-07-0600, "Basis and Justification for Approval Process for 10 CFR 20.2002 Authorizations and Options for Change," March 27, 2007. (ADAMS Accession No. ML070220045)

U.S. Nuclear Regulatory Commission, NUREG-1757, Vol. 1, Rev. 2 "Consolidated Decommissioning Guidance: Decommissioning Process for Material Licensees," September 2006. (ADAMS Accession No. ML070390074)

U.S. Nuclear Regulatory Commission, NUREG-1757, Vol. 2, Rev. 1 "Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria," September 2006

U.S. Nuclear Regulatory Commission, "R. Copp Letter Requesting Additional Information on Hematite 20.2002 Alternate Disposal Request," May 1, 2012

U.S. Nuclear Regulatory Commission, "NRC Request for Additional Information during 6/21/10 Teleconference between NRC and WEC Regarding Westinghouse Electric Corporation Hematite Project 20.2002 Soil Exemption Request," Westinghouse Electric Company LLC, Hematite Decommissioning Project, Jun 25, 2010. (ADAMS Accession No. ML110560334)

U.S. Ecology Idaho, "Request for Exemptions under 10CFR30.11 and 10CFR70.17 for Alternate Disposal of Wastes from Hematite Decommissioning Project under 10CFR20.2002," October 4, 2012. (ADAMS Accession No. ML12313A014)