SAFETY EVALUATION REPORT

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

February 1, 2013

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1. INTRODUCTION

On January 16, 2012, Westinghouse Electric Company, LLC (WEC) document HEM-12-2 they requested that the U.S. Nuclear Regulatory Commission (NRC) approve alternate disposal (ADAMS Accession Nos. ML12017A188 – ML12017A190), in accordance with NRC Regulation 10 CFR §20.2002. The disposal would involve of specified low-activity radioactive materials from the Hematite Decommissioning Project (HDP), for certain waste containing source, byproduct, and special nuclear materials (SNM). WEC also requested a specific exemption from NRC Regulations 10 CFR §30.3 and 10 CFR §70.3 pursuant to NRC Regulations 10 CFR §30.11(a) and 10 CFR §70.17(a). Unimportant quantities of source material are exempted from the NRC's 10 CFR Part 40 requirements pursuant to 10 CFR §40.13(a). The NRC's approval of the 10 CFR §20.2002 request, along with the requested exemptions, would allow WEC to transfer the specific waste for disposal at the US Ecology Idaho, Inc. (USEI) Resource Conservation and Recovery Act (RCRA) Subtitle C disposal facility.

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

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. Therefore, on October 4, 2012, USEI submitted a letter (ADAMS Accession No. ML12313A014) to the NRC which indicated that they had collaborated with WEC in the preparation and the submittal of the alternate disposal request and supporting documentation. In this letter USEI also requested exemptions from 10 CFR §30.3 and 10 CFR §70.3. This SER covers the exemptions requested both from WEC and USEI.

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 m^2 (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.

The NRC reviews the safety implications of disposing unimportant quantities of material at disposal facilities that are not licensed by the NRC or an NRC Agreement State, as would be authorized by the NRC's approval of WEC's §20.2002 request.

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 that result in a dose not exceeding a few millirem per year because it is a fraction of the natural radiation dose (approximately one percent of the radiation exposure received by members of the public from background radiation), a fraction of the annual public dose limit, and an attainable objective in the majority of cases (see SECY-07-0060 [ADAMS Accession No. ML070220045] and NUREG-1757 [ADAMS Accession No. 070390074]). The NRC has approved one §20.2002 request that exceeded a few millirem per year, but was less than 25 millirem per year.

The NRC's review of a 10 CFR §20.2002 request for disposal of low-activity waste in 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). Given the quantity of material being disposed and the nature of the disposal facility, a performance period of 1,000 years is considered adequate.

Because this 10 CFR §20.2002 disposal request included SNM, the staff assessed nuclear criticality safety, material control and accounting, and physical security aspects. These assessment areas are atypical for 10 CFR §20.2002 requests. However, they are addressed in this SER in addition to WEC's dose assessment.

The NRC's review of WEC's request resulted in a need for WEC to provide additional information. 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) and July 24, 2012 (ADAMS Accession Nos. ML12209A200 and ML12209A201).

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 reflect a decommissioning scope of 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 Amendment 58 approval covers these burial pits, other undocumented burial pits and other soil associated with the remediation of the Hematite site. This January 16, 2012 alternate disposal 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 expected in the May 2009 alternate disposal request were trash, empty bottles, floor tile, rags, drums, bottles, glass wool, lab glassware, acid insolubles, and filters, the primary waste types in the January 2012 request are expected to be concrete, asphalt, piping and equipment.

The material associated with the January 2012 alternate disposal request may be shipped to the USEI facility 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, shipments may contain diffuse quantities of HEU.

3. DOSE EVALUATION

This chapter evaluates WEC's description of the source material and the 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.

3.1. Source 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 that WEC is permitted to send to USEI under this requested exemption. 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 amount for both requests is approximately 46,000 m^3. The material, associated with the January 2012 request consists of concrete/asphalt, piping, soil and miscellaneous equipment, all with 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 approximatly 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 **Error! No text of specified style in document.Error! No text of specified style in document.**-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	8249	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	142	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 $3.7x10^{10}$ to obtain Bq

WEC based the average expected concentration on the totals in Table **Error! No text of specified style in document.**Error**! No text of specified style in document.**-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 Critera (WAC)).   The bounding concentration was based on 100 percent of the activity being from 3000 pCi/g of total uranium, with the isotopic composition based on existing sample data. Tc-99 was not considered at 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 radiounuclides are at equilibrium) equal the overall WAC of 3,000 pCi/g. The source term estimations are reproduced as Table **Error! No text of specified style in document.**Error**! No text of specified style in document.**-2 in this SER.

Table **Error! No text of specified style in document.Error! No text of specified style in document.**-2 Assumed Concentrations of Radionuclides [(1)]

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
U238	13	0.68	341

[(1)] 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 approximates 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 had been demolished to more precicsely 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 because they contain 87 percent of the Tc-99.

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 U-235 amount using the Monte Carlo N-Particle (MCNP) Transport Code. WEC estimated the U-235 activity concentration (pCi/g) by dividing 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 states 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].”

3.1.4. 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 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 based on the concentration results within these areas and analytical calculations as described in Section 3.2.

3.2. NRC Evalution of Source 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 limits of this exemption. 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 this exemption.

3.2.1. NRC Evaluation of Concrete/Asphalt Characterization

During their review, the NRC staff asked several RAIs pertaining to the existing characterization of the concrete/asphalt. These questions 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 their 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 of HDP-TBD-WM-906 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 (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, WEC is excluding Area 5 and a portion of Area 1 from the request for alternative disposal due to high activity results. The NRC staff asked WEC in RAI CH-10 how they would distinguish between these excluded and the included areas during the revew. In WEC's response to RAI CH-10 they provided a 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 is the same type of identification and control measures (e.g., separate staging areas and containers) for the excluded portions of the concrete slabs as will be used to segregate burial pit soil/debris associated with Amendment 58 of the Hematite license that do not meet USEI criteria (HEM-12-67).

As a result of the review and RAI process, the NRC has concluded that WEC has presented a tractable explaination of the existing characterization data for the concrete and asphalt and how this data was used to determine the estimates reproduced in Table Error**! No text of specified style in document.**Error**! No text of specified style in document.**-1 of this SER. The NRC staff finds the averaging of the data to be appropriate, and thus the values presented in Table Error**! No text of specified style in document.**Error**! No text of specified style in document.**-1 and Table Error**! No text of specified style in document.**Error**! No text of specified style in document.**-2 to be reasonable for the purposes of dose estimation. However, due to the uncertainty in the data and that 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 Evalution 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 conclulded 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).

In summary, 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 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 per 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. Specifcally, 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).

As indicated in Section 8.1 of HDP-TBD-WM-906 and the response to RAI SA-1, while WEC will not be re-evalutating 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 concludes 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

The NRC staff requested in RAI CH-10 that WEC provided additional information regarding the calculations for determining the total curie amount in the sub-slab soils. In response to RAI CH-10, WEC 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 1.44 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 1.69 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.

WEC determined that Ra-226 was present only at background levels, 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. The NRC staff notes that Ra-226 is a radionuclide of concern for the Hematite DP based on characterization data, primarily from the burial pit. 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.

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

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 transuranics 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, they would contribute negligible dose to any member of the public associated with this review.

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 the previously approved §20.2002 request.

WEC estimates 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 site, the gondola railcar will be surveyed and then off-loaded into trucks for transport to the disposal site. 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 disposal site. At the disposal site, 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 containment building prior to disposal.

Table **Error! No text of specified style in document.**Error**! No text of specified style in document.**-3 summarizes the job function scenario assumptions. The times assigned are the times for one person to perform each function once. In this 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 a task as the excavator operator, truck driver, stabilization operator, and cell operator groups. 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 **Error! No text of specified style in document.Error! No text of specified style in document.**-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 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. In this assessment, 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 site so these workers would not be expected to receive an internal dose. However, in the previous request, it was conservatively assumed that these workers received an internal dose.

Table **Error! No text of specified style in document.Error! No text of specified style in document.**-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	1.6×10^{-3}	1.6×10^{-3}
Excavator Operator	1.8×10^{-1}	2.7×10^{-3}	1.9×10^{-1}
Gondola Cleanout	2.0×10^{-2}	1.7×10^{-3}	2.2×10^{-2}
Truck Surveyor	NA	2.1×10^{-3}	2.1×10^{-3}
Truck Driver	NA	1.2×10^{-2}	1.2×10^{-2}
Stabilization Operator	6.1×10^{-3}	1.4×10^{-4}	6.3×10^{-3}
Cell Operator	1.2×10^{-1}	7.8×10^{-3}	1.3×10^{-1}

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

To evaluate the potential dose to the public during transport of the waste 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 1007 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 exposure time of less than 20 hours.

3.3.2 Post-Closure Dose

The appropriateness of the RESRAD model for the Grand View 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," provided in the December 29, 2009 WEC RAI response (HEM-09-146) (ADAMS Accession No. ML100320540) to the May 2009 alternative disposal request For those parameters not described in the report, WEC provided a justification with its March 31, 2010 (HEM-I0-38) submittal (ADAMS Accession No. ML100950397) in support of the May 2009 alternate disposal request.

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 applies for the expected concentration of Tc-99 in the waste shipped to USEI is 7.2 pCi/g (Table **Error! No text of specified style in document.**Error**! No text of specified style in document.**-2). This concentration 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, which results in an approximate 0.3 Ci of Tc-99 as shown in Table **Error! No text of specified style in document.**Error**! No text of specified style in document.**-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 of NUREG-1757. 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 **Error! No text of specified style in document.Error! No text of specified style in document.**-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	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, 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. 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 Error**! No text of specified style in document.**Error**! No text of specified style in document.**-2, but not containing Tc-99.

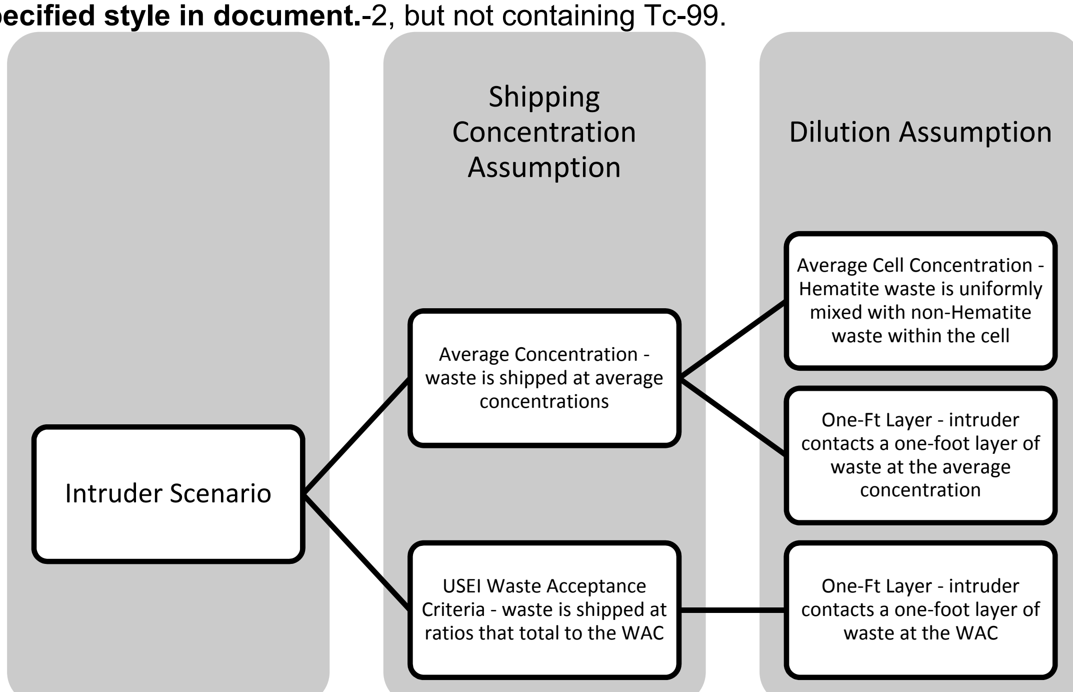

Figure **Error! No text of specified style in document.Error! No text of specified style in document.**-1. Intruder Scenario Waste Concentration Assumptions

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 Table Error**! No text of specified style in document.**Error**! No text of specified style in document.**-2.
Additional Dilution of Contaminated Layer During Exhumation	Concentration of the contaminated layer multipled by the ratio of 0.31/93.1 or $3.3x10^{-3}$, 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 an 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 (1800 hours) or indoors (4380 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 an 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 a duration of 500 working hours, or a construction period of 3 months.
Concentration of Waste to Which	• Average Cell Concentration – Shipping concentration (either Average or WAC) multiplied by 0.053, which is calculated by taking

Intruder is Exposed	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 and the site conditions at USEI. NRC staff performed independent calculations of the external doses using MicroShield and obtained similar results to the licensee. In addition, NRC staff performed independent calculations of the internal dose and obtained similar results to the licensee.

Since the waste disposal from the previous Hematite §20.2002 request is still ongoing, there is some potential for the USEI workers to receive a dose both from the waste associated with the May 2009 alternate disposal §20.2002 request and the current January 2012 alternate disposal request during the same year. However, as seen in Table **Error! No text of specified style in document.**Error**! No text of specified style in document.**-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 mrem. 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 **Error! No text of specified style in document.Error! No text of specified style in document.**-6. Potential Cumulative Dose from Previous and Current §20.2002 Requests*

Job Function	§20.2002 Request Approved in Ammendment 58 (mrem/yr)	This §20.2002 Request (mrem/yr)	Total Dose (mrem/yr)
Gondola Surveyor	$1.1x10^{-01}$	$1.6x10^{-03}$	$1.1x10^{-01}$
Excavator Operator	$4.7x10^{-01}$	$1.9x10^{-01}$	$6.6x10^{-01}$
Gondola Cleanout	$5.9x10^{-02}$	$2.2x10^{-02}$	$8.1x10^{-02}$
Truck Surveyor	$9.3x10^{-02}$	$2.1x10^{-03}$	$9.5x10^{-02}$
Truck Driver	$4.9x10^{-01}$	$1.2x10^{-02}$	$5.0x10^{-01}$
Stabilization Operator	$1.6x10^{-02}$	$6.3x10^{-03}$	$2.2x10^{-02}$
Cell Operator	$3.8x10^{-01}$	$1.3x10^{-01}$	$5.1x10^{-01}$

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

3.4.2 NRC Evalution of Post-Closure Dose

The staff finds that the proposed 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 in **Error! Reference source not found.Error! Reference source not found.**. 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 are 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 (ML100950386), the NRC staff analyzed the cumulative impact of faster shipping schedules by adding the prior estimated of 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 2012 request. Because the cumulative dose in this scenario is still within a 'few millirem', the NRC staff finds the post-closure cumulative doses acceptable.

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 Evalution of Intruder Doses

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.

Staff considers the dilution factor of 0.31 acceptable for the Construction One-Ft Layer scenario after reviewing the standard practices at USEI and 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.

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. Uranium, through the air and direct gamma pathways, is the main contributor to dose for the intruder scenarios.

During the review, the NRC staff requested that WEC provide a discussion of the cumulative intruder doses for the prior §20.2002 request with this request. Table **Error! No text of specified style in document.**Error**! No text of specified style in document.**-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 **Error! No text of specified style in document.Error! No text of specified style in document.**-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	9	15	24
Intruder Acute Well Drilling	2.9	2.7	5.6
Intruder Chronic Well Drilling	2	0.5	2.5

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

3.5 Stability of the Disposal Facility Following Closure

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."

4 HEALTH PHYSICS ASSESSMENT

4.1 WEC's Source Material Characterization

Attachment 1, Characterization Data Summary in Support of Additional USEI Alternate Disposal Request, HDP-TBD-WM-906, to Enclosure 1 of the January 16, 2012, WEC submittal provided the characterization data for the waste to be transmitted to USEI. The staff's review of the Attachment and other supporting documentation to WEC's request resulted in the staff requesting additional information regarding waste characterization. The staff's request for additional information was transmitted to Westinghouse on May 1, 2012. In response to the staff's request, 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 October 2012 letter, WEC indicated 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 shipment of waste materials. The associated characterization plans were reviewed by NRC staff,and the staff's assessment is described in Section 4.3 below.

4.1.1 Soil Characterization

WEC committed in Section 5.2.1 of Revision 2 of HDP-TBD-WM-908 that soils associated with the alternate disposal request will be subject to the same 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 transmittal and was previously approved by the NRC with the issuance of Amendment 58 to the Hematite license, SNM-33 (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 Amendment 58 request, WEC adjusted the mean Tc-99 concentration and standard deviation associated with soils to 13 pCi/g and 36 pCi/g, respectively. Additionally, in Section 5.2.1 of HDP-TBD-WM-908 WEC indicated that a total 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 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, except 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 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, which 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 requests for additional information. A sampling approach was developed 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, at 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 Source Characterization

NRC staff performed a health physics review of the January 16, 2012, Request for Additional Alternate Disposal Approval and Exemptions for Specific Hematite Decommissioning Project Waste at US Ecology Idaho and WEC’s responses (ADAMS Accession Nos. ML 12173A426,

ML12173A428, ML12173A430, ML12173A431, ML12209A200 and ML12209A201) to the NRC's RAIs of May 1, 2012 (ADAMS Accession No. ML120890557). NRC staff determined that the January 16, 2012, submittal did not provide a clearly developed characterization plan nor sufficient justification that characterization performed to date was adequate to dispose 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 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.

The 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 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). This plan was approved as part of the staff's review and approval associated with Hematite 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. 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 utiize 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 in Table 4-1 of this SER.

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 were 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 §§20.2002 alternate disposal request.

WEC is only allowing waste that meets the NCS exempt material limit of 1 gram U-235/10 liters to be shipped to USEI. 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 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 operations at Hematite include the 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 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 described above, the overlying concrete must be removed. Spills during manufacturing operations at the Hematite site may have contaminated the overlying concrete, even though 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.

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 quipment to determine the precise fissile nuclide content. If the U-235 concentration exceeds the limit, WEC may comingled 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 (where was this indicated?) 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 UO_2 holdup.

5.1.4 Miscellaneous Equipment as a Result of Decontamination and Decommission

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 UO_2 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 evalulation 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.

The staff determined that a criticality is not credible at the USEI disposal site for the WEC waste described above because multiple controls related to identifying and segregating waste would have to fail before a criticality event could occur.

5.2.1 Assessment of Concrete

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 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. Therefore, the NRC staff determined that a criticality event is not credible from the disposal of the concrete at USEI.

5.2.2 Assessment of Piping

For subterranean piping, WEC performed in-pipe surveys. The results of these surveys were presented in NSA-TR-09-08, Rev. 1, "*NCSA of the Sub-Surface Structure Decommissioning at the Hematite Site,"* (ADAMS Accession No. ML12293A029). Pipe sampling areas were selected based on operation locations where the most fissile material was handled. 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 todisposal. 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, staff has reasonable assurance that a criticality is not credible from the disposal of the subterranean piping at USEI.

5.2.3 Assessment of Wastes Other Than Concrete/Asphalt and Piping

The other waste areas associated with WEC's request, namely, 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 contamination levels of fissile material which are not a NCS concern. Therefore, the staff has concluded that a criticality event is not credible for these waste.5.3 Staff Conclusion: Based on the information in the WEC submittal, the staff determined that a criticality event is not credible due to the low concentrations of uranium in the waste while in the gondola railcar or at the USEI site.

6. MATERIAL CONTROL AND ACCOUNTABILITY

This section of the SER addresses the material control and accountability (MC&A) aspects of WEC's §20.2002 alternate disposal request.

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 2012 alternate disposal request is similar to their May 21, 2009, request. The difference in this request and the previous one is twofold: (1) The volume, while essentially the same approximate value, is composed of a different type of material; and (2) the total quantity of radionuclides is lower. The staff reviewed WEC's request and determined that additional information was needed to complete the review. As previously noted, on May 1, 2012, the staff issued a RAI to WEC and as also noted, WEC submitted responded to the request on June 19, 2012. Neither the MC&A RAIs nor WEC's response to the RAIs were publicly available because of the sensitive nature of the information.

In WEC's RAI response they 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 they 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).

The NRC staff expects WEC to continue to use DOE/NRC Form 741 to document all transfers of 1 gram or more of SNM to NMMSS. The staff expects USEI to 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 WEC and USEI fulfilling the above noted requirements, the staff has concluded that WEC's alternate disposal request is acceptable with regards to MC&A.

7. PHYSICAL SECURITY

This section of the SER addresses the physical security aspects of WEC's §20.2002 alternate disposal request. The NRC staff has reviewed WEC's January 16, 2012 alternate disposal request and has concluded 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 analysis are presented below and the relationship of the present request to those facts and circumstances.

The SER associated with Amendment 58 assessed the physical security considerations associated with the alternate disposal request for the following actions: (1) shipment of the waste material via gondola cars to USEI; (2) unloading of the waste material from the gondola cars on to trucks for disposal at the USEI burial cell; and (3) disposal of the waste material in the burial cells.

7.1 Transportation Security

WEC will ship the waste to USEI in gondola railcars. The contents of each gondola railcar will be entirely enclosed in form-fitting, sift-proof, and closable wrappers meeting DOT Industrial Type-I Package (IP-1) requirements. The IP-1 package precludes dispersal of waste to the air or loss of material during transport. WEC is responsible for the safe and secure transport of the material in accordance with the provisions of the Transportation, Physical Security and Fundamental Nuclear Material Control Plans. The custody of the SNM-bearing waste remains WEC's until the shipment arrives on-site in Idaho and USEI accepts custody of the waste.

In support of its May 21, 2009, submittal, WEC's Safety Assessment had indicated that the expected concentration of U-235 was 5.5 pCi/g and the enrichment for the estimated 22,809 cubic meters of soil and debris was expected to be at enrichment levels averaging below 10%. In WEC's December 29, 2009, response (ADAMS Accession No. ML100320540) to the staff's RAI, WEC indicated that no HEU material would be shipped to USEI. However, material of intermediate enrichment (greater or equal to 10%, but less than 20%, enrichment) could be shipped to USEI.

For the Amendment 58 SER, the staff performed calculations to assess the need for transportation security. Based upon a single gondola railcar containing approximately 127 tons of soil and debris and assuming the railcar contains SNM at USEI's WAC of 3000 pCi/g for all radionuclides (no other radioactive elements are present) and based upon an average enrichment is 3.8% U-235, the staff calculated that a single railcar could contain approximately 183 kg total U and 6.9 kg U-235. This value represented the maximum amount of U-235 (at the expected enrichment) that can be shipped to USEI in a single railcar. From Table 1 of Appendix A of WEC's March 31, 2010, submittal (ADAMS Accession No. ML100950386), the expected average U-235 concentration is 32.2 pCi/g. At this concentration, a single railcar would contain approximately 1.7Kg U-235. If data from WEC's Safety Assessment in support of its May 21, 2009, submittal is used (5.5 pCi/g U-235), a single railcar would contain approximately 0.3 Kg U-235. From HDP-TBD-WM-906, the expected average U-235 concentration associated with the January 16, 2012 request is 2.8 pCi/g for the building slabs, concrete outside the process buildings and the asphalt; for soil,; for piping and for miscellaneous equipment . At a concentration 2.8 pCi/g and assuming 127 tons in a railcar, a single railcar would contain approximately 0.15 kg U-235. However, WEC has committed to ship material to USEI which has a U-235 concentration of 0.1 pCi/g or less (to meet criticality safety requirements). At a concentration 0.1 pCi/g, a single railcar would contain approximately 5 g U-235.

As noted in Amendment 58's SER, any shipment containing 10 Kg or more of low enriched uranium (LEU) material would result in a situation where the SNM is considered to have low strategic significance (LSS). From the above calculations, WEC would have to ship multiple railcars, at one time, to meet the definition of LSS. As long as the amount of SNM being shipped is less than 10 Kg of LEU, no special security would be required. For this situation, WEC would be required to have a physical security plan but the plan would not have to be submitted to the NRC for approval. However, as stated in the Physical Security Plan (PSP), WEC has committed to implement the transportation security requirements in 10 CFR §73.67(g) for the transport of SNM of LSS.

If WEC shipped a railcar or multiple railcars containing 10 Kg or more of intermediate-enriched uranium, it would be required to have a Transportation Security Plan to address Category II SNM shipments of moderate strategic significance in accordance with 10 CFR §73.67(e). WEC's July 28, 2011, Physical Security Plan (ADAMS Accession No. ML11214A106) contains a Transportation Security Plan that addresses the transportation security of Category III SNM shipments of LSS in accordance with 10 CFR §73.67(g). It does not address railcar shipments containing 10 kg or more of intermediate-enriched uranium. A Transportation Security Plan for shipments of Category II SNM of moderate strategic significance is required by 10 CFR 73.67(c) and must be submitted to the NRC for review and approval. SNM enriched to 10% or more but less than 20% in the amount of more than 1Kg but less than 10Kg is considered to be of low strategic significance or Category III SNM. SNM enriched to 10% or more but less than 20% in amounts less than 1Kg are less than Category III and thus are not covered under 10 CFR §73.67(g). However, since WEC committed to protect all shipments in accordance the transportation security requirements in 10 CFR §73.67(g), there would be no security concerns associated with the shipment of this type and quantity of material.

The staff's review concluded that any gondola railcar(s) shipment involving 10 kg or more of LEU would be transported in accordance with the security requirements of 10 CFR §73.67(g) for the transport of SNM of LSS. If a shipment involved less than 1 kg of LEU, while WEC would be required to have a Physical Security Plan, no special transportation security would be required. WEC has committed to the transportation security requirements in 10 CFR §73.67(g) for the transport of SNM having LSS. Therefore, the staff has concluded that the appropriate security exists for the transportation of LEU material from Hematite.

The staff's review concluded that any railcar shipment involving intermediate-enriched uranium in an amount of 10 kg or greater would constitute a shipment of Category II SNM (of moderate strategic significance). A Transportation Security Plan would be required by 10 CFR 73.67(c) and submittal of the plan to the NRC for review and approval would be required. If the amount was less than 1 kg, there would be no physical security concerns associated with the shipment of this type and quantity of material since WEC committed to protect all shipments in accordance with the transportation security requirements in 10 CFR §73.67(g). Therefore, as noted above, the staff has concluded that the appropriate security exists for the transportation of less than 1 kg of intermediate-enriched uranium material from Hematite but for quantities 10 kg or greater, a Category II Transportation Security Plan will be required and the plan will require NRC review and approval before implementation.

7.2 Security of SNM Prior to Waste Disposal

At the USEI site, SNM-bearing waste is stored in gondola railcars, unloaded from the railcars in a controlled environment to trucks for transport to the burial cell, possibly treated in a controlled environment for volatile organic compounds, and then disposed of in the USEI cell. Waste consignments are routinely emplaced for disposal within a few days of receipt of the waste.

Because of their robust design features and the use of tamper-indicating devices, railcars effectively represent individual SNM-containing structures (areas). A single railcar contains approximately 127 tons of soil and debris. Assuming that the waste contains SNM at the USEI WAC, a single railcar would contain approximately 6.9 kg U-235. However not only is it unlikely that any gondola car would contain only uranium waste at the USEI WAC but WEC has committed to ship material to USEI which has a U-235 concentration of 0.1 pCi/g or less. As noted in the previous section, if the railcar contained 10 Kg or more of LEU, the material in the railcar would be considered as SNM of LLS.

Under the NRC's SNM categorization approach, the amount of potentially recoverable SNM contained in a single railcar is no greater than a Category III SNM quantity (SNM of LSS). Considering credible SNM diversion scenarios, the storage and processing of SNM waste at the USEI site prior to disposal could be considered as no greater than Category III SNM activities. Due to the difficulty, time, and necessary equipment required to separate 10 kg of SNM from 127 tons of waste and due to the additional processing that would be required to make the SNM useful in either an improvised nuclear device (IND) or a radiological dispersal device (RDD), this material would have to be considered as highly unattractive to adversaries. Therefore, the staff has concluded that no additional security steps need to be taken at USEI during the period in which the waste is handled in preparation for burial and during burial.

7.3 SNM Security after Waste Disposal

The difficulty of recovering SNM from waste after disposal would increase considerably compared to the recovering the material prior to disposal. The difficulty would be precipitated by the following. It is anticipated that the Hematite waste would be buried over an area covering 30 acres. The Hematite waste will be intermixed with waste from other sources and those sources will not contain SNM. The cell in which the Hematite waste will be buried will have a soil cover which will vary in depth from 2 feet at the crown to 20 feet at the side slopes. The burial cell has a depth of approximately 49 feet, which would make it more troublesome. Potential adversaries would now have to excavate the waste, identify SNM-bearing materials, and separate these materials from soil and non-SNM-bearing debris. The additional processing that would be required to make the SNM useful in an Improvised Nuclear Device (IND) or a Radiological Dispersion Device (RDD) would make this material highly unattractive to adversaries. The existing industrial security measures at the USEI site are adequate to address credible SNM diversion scenarios. Based upon the above discussion, staff found that there would not be a security issue with the material once it was buried at USEI.

7.4 Summary

The staff has assessed the physical security aspects associated with the shipment of waste material containing SNM in soil and debris. Time periods assessed were from shipment from the Hematite site to receipt at the USEI facility, from offloading of the material from the gondola cars until burial in the USEI cell, and after burial in the cell. With respect to transportation of the material from Hematite to the USEI site, the staff concluded that security aspects are appropriately covered in all cases except for the shipment of 1 kg or more of intermediate-enriched uranium. For this case, a revision to the Physical Security Plan would be required and so would review and approval by the NRC. With respect to the offloading of the material, its handling while at the USEI site, burial and after burial, the staff concluded that the material would have to be considered highly unattractive to adversaries due to the difficulty, time, and necessary equipment required to separate 10 Kg of SNM from the tons of waste and due to the additional processing that would be required to make the SNM useful in either an IND or RDD.

8. POTENTIAL FOR RECONCENTRATON

The staff assessed the potential for reconcentration 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 to include receipt of specified quantities of SNM that were exempt from the NRC regulations. The Idaho Department of Environmental Quality (IDEQ) granted this exemption after a detailed safety evaluation and criticality analysis was performed.

The potential for the generation of leachate is minimized by the site's waste acceptance requirement that the 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 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.

As a result of the above design features and the above noted site conditions, 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.

If the USEI Idaho site were compared to the NRC-licensed low-level radioactive waste disposal facility operated by Energy Solutions at Clive, Utah, one would find that the two facilities share similar site and design characteristics. The Clive facility is located in a desert environment similar to that of USEI's Idaho facility. Precipitation at the Clive facility averages approximately 8.6 inches of precipitation per year with an average evaporation rate of 59 inches per year. The Clive facility is allowed to accept SNM with concentrations up to 1,900 pCi/g of waste. As noted previously, the USEI facility has an overall WAC of up to 3,000 pCi/g. There is no specified limit on SNM. .

The cell and cover design criteria of the Clive facility are comparable to the design criteria for the USEI facility. The Clive cell is underlain by a two-foot clay layer with a 1 x 10^{-6} cm/sec permeability with a leachate collection system. The cap consists of a 24-inch radon barrier, a six-inch filter zone to move water away from the buried waste material, a 12-inch silt loam sacrificial layer, and a second filter zone that is six inches thick. The final layer consists of an 18-inch thick layer of riprap rock. The NRC approved the SNM limits for Clive after performing a detailed safety evaluation and criticality analysis.

9. LICENSE CHANGES

As a result of the approval of Westinghouse's January 16, 2012, alternate disposal request and requested exemptions from the requirements of 10 CFR 30.3 and 10 CFR 70.3, Amendment No. 60 to the Hematite License will be made. This Amendment will make the following changes to Hematite License Conditions.

The first three changes are administrative in nature. The first administrative change is required because License Condition 11 is presently missing. The present license goes from License Condition 10 to License Condition 12. Therefore, after License Condition 10, all License Conditions will be renumbered.

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 (ML112101630) and July 5, 2011, License Application (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 is the inclusion of documents referenced in this 20.2002 SER and Amendment No. 58's SER into the listing of applicable documents pertaining to the Hematite License (License Condition 15).

The fifth change is the inclusion of the volume of concrete/asphalt, piping, soil and miscellaneous equipment allowed to be shipped to USEI and the total amount of Tc-99 which is permited to be to USEI from both of the May 2009 and the January 2012 20.2002 alternate disposal requests (License Condition 17).

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 (ML112101630) and July 5, 2011 License Application (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. (ML111880290 and ML111880292)

b. Documents identified in Chapter 1 of NRC Decommissioning Plan SER. (ML112101630)

c. Westinghouse HEM-11-56, "*Evaluation of Technetium-99 Under the Process Buildings*", May 5, 2011. (ML111260624)

d. Documents identified in the NRC's 10CFR20.2002 SERs associated with Amendment Nos. 58 and 60. (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 95^{th} 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.

10. 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. Granting this request would allow WEC to send up to approximately 23,000 m^3 of concrete/asphalt, piping, soil and miscellaneous equipment with low concentrations of source, SNM and byproduct material contaminants 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 as a part of the review of this 10 CFR §20.2002 application. The staff has determined that WEC has provided an adequate description of the waste containing licensed material 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 the proposed statistical evaluation, sampling plan, QA/QC program, and contingency plans are acceptable and allowed the licensee to 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 milirem". A conservative bounding analysis conducted by the staff yielded doses less than the Part 20 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. Only one issue was identified. If WEC wishes to ship waste to USEI containing 1 kg or more of intermediate-enriched uranium, then a revision to the Hematite Physical Security Plan will be required, which will require NRC review and approval.

In conclusion, there are no concerns that this request will greatly impact the annual cumulative dose from all exempted and naturally occurring radioactive material at the USEI disposal facility as long as actual source term concentrations reflect those applied in this assessment.

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 10 CFR 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 information or 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 material authorized for disposal in this §20.2002 authorization is otherwise licensable, the staff concludes that the site authorized for disposal is exempt from NRC licensing requirements in 10 CFR §30.3 and §70.3.

11. 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 - 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 Reques"t*. 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 Invormation for the Final Response Dated July 24, 2012 to NRC Requests for Additional Information Dated May 1, 2012 on the January 16, 2012, Hematiate 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 Requirments 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 Requestion 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)