Hayes, John

From: Hayes, John
Sent: Friday, May 07, 2010 8:27 AM
To: 'Couture, Gerard F.'; 'Michelsen, Mark A'
Subject: 05062010 - RAI Building.docx
Attachments: 05062010 - RAI Building.docx

Gerry,

Attached is the clarifying information which Mark indicated might assist Westinghouse in providing a response to the NRC's questions. We also included the other items discussed during our calls last week. Hope this helps.

Jack

RAI for Hematite Building Debris 20.2002 Exemption Request
May 6, 2010

1. **Comment**: Assumptions related to the source term require further justification.

Basis: Site-specific parameters require justification.

Radionuclide	Table 1 Building Debris Average Concentration pCi/g	Table 2 "Assessed Concentration pCi/g	RESRAD Input Building 20.2002 pCi/g
Th-230	0.013	3.50E-01	3.20E-03
Np-237+D	0.002	5.40E-02	4.60E-04
Tc-99	0.210	5.50E+00	5.06E-02
Th-232+C	0.002	4.00E-02	3.70E-04
U-234	46.000	1.20E+03	1.14E+01
U-235 +D	2.600	6.90E+01	6.34E-01
U-238 +D	7.600	2.00E+02	1.87E+00
Sr-90 +D	0.038	1.00E+00	9.19E-03

Path Forward:
(1) Explain how you derived the concentration values used as input to RESRAD, and how these relate to the values in Table 1 and Table 2, including the basis for this relationship.
(2) Explain how you derived values used as input to RESRAD for the contaminated zone, contaminated zone thickness, and explain the relationship of these parameters to the concentrations of the radionuclides, and the dimensions of the USEI disposal cell.
(3) Describe the minimum duration of time in which all the rubble material can be sent to USEI, and how this impacts assumptions regarding the concentrations of the radionuclides and the contaminated zone area and contaminated zone thickness.

2. **Comment:** Assumptions about the density of the source term should be clarified.

Basis: Pg 5 of the Exemption Request states that the density of the waste at time of shipment is 0.64 g/cm^3 (40 lbs/ft^3). Pg 5 also states the density of concrete is assumed to be 0.96 g/cm^3 (60 lbs/ft^3) and the installed density of other materials is assumed to be 0.8 g/cm^3 (50 lbs/ft^3). The density of the waste assumed in RESRAD is 1.5 g/cm^3 (93.6 lbs/ft^3).

Path Forward: Review the different assumptions made regarding density of the waste, and how these assumptions impact the dose analysis.

3. **Comment:** Methods applied during the 2009 characterization require further explanation.

Basis: On pg 5 of the 20.2002 Exemption Request, the 2009 characterization is summarized as follows:

> An estimate of collective ^{235}U mass and areal density associated with the surfaces of the buildings (floors, walls, ceilings and roofs) was obtained based on a correlation of the observed count rate of a sodium iodide (NaI) detector positioned in close proximity to building surfaces and the amount of ^{235}U per unit surface area as measured using a high-purity germanium (HPGe) detector. The response of the HPGe detector was in turn calibrated to areal density based on a high-fidelity computational analysis of the detector response to a known and specified contamination source term using the Monte Carlo N-Particle (MCNP) code. For example, a calibration factor of 1E-9 gram/cm^2/cpm when applied to an area of 10,000 cm^2 with surface activity of 10,000 cpm as measured with the NaI was assigned a gram value as follows:
> (1 x 10-9 g/cm^2/cpm)(10,000 cpm)(10,000cm^2) = 0.1 gram ^{235}U

Pg 2 of the 2009 Characterization Report (HEM-09-121):

> The radiological surveys were performed using a sodium iodide gamma survey meter and a micro-Rem gamma dose meter for most items. A high-purity germanium detector was also used for building surfaces.

These two descriptions differ in that the micro-Rem gamma dose meter is not mentioned in the 20.2002 Exemption Request, and therefore it is unclear if the readings from this meter were used to calculated the source term for the 20.2002 Request. It is unclear from this description, what the assumptions were regarding depth of contamination. It is also unclear what, if any, samples from the building surfaces were taken to verify the accuracy of the detector readings. These samples would be taken after a reading and the results would be compared to those of the HPGe or NaI detector.

Path Forward: (1) Describe how the presence or absence of volumetric contamination was determined during the 2009 characterization, and to what depth the instrument was calibrated. (2) Explain if the readings from the micro-Rem gamma dose meter were applied in calculating the source term. (2) Discuss if any sampling was completed to verify the instrument readings, and provide results of such samples. If no samples were taken, describe the plan for sampling and verification of the 2009 ^{235}U Characterization.

4. Comment: Additional basis is needed to the scaling factors used for soluble isotopes.

Basis: In the Technical Basis Document NDP-TBD-WM-901, Scaling Factors for Radioactive Waste Associated with the Process Buildings, Section 6.2 states, “For soluble isotopes of concern such as Sr-90 and Tc-99, the selection of ^{235}U for scaling will result in underestimation or overestimation of activity for any particular sample. On average the reported activity is expected to be within a factor of 10 of the true activity.” It is not apparent how this information was used in the application of the scaling factors for Sr-90 and Tc-99 to determine the average concentration in Table 1.

Path Forward: Describe how the adequacy of the soluble isotope scaling factor was assessed, or how the adequacy of the concentration estimation was ensured through conservative assumptions.

5. **Comment**: Plans for additional characterization as waste is prepared for shipment should be included.

Basis: In addition to assuming the average concentration of each radionuclide that was calculated from the ^{235}U mass estimates, Hematite analyzes a bounding scenario for the source term by assuming that each shipment contains a total of 2,000 pCi/g. The 2,000 pCi/g is distributed among the individual radionuclides based on the scaling factors and individual concentrations are listed in Table 2. Since these scaling factors were derived from 8 samples taken in 2004, the appropriateness of applying these scaling factors to all materials sent to USEI will need to be revisited as waste is prepared for shipment.

Path Forward: (1) Provide the sampling plan for characterization of the waste that will confirm the maximum concentration of each radionuclide in each shipment does not exceed the specific value labeled the Assessed Concentration in Table 2 or the March 3, 2010 Exemption Request.

6. **Comment**: An appropriate scenario for the intruder should be analyzed.

Basis: In the March 31, 2010 response to RAIs regarding the Exemption Request for soil debris, WEC analyzed the acute and chronic doses to inadvertent human intruder who constructs a house with a basement, or digs a well that intrudes into the disposal cell and then lives on the site. WEC completed one scenario for the construction intruder which included an exposure factor of 0.057, corresponding to an exposure duration of 500 hours. In the intruder-agriculture scenario, an inadvertent intruder is assumed to occupy a dwelling located on the disposal facility and ingest food grown in contaminated soil. (This scenario is assumed to be possible only if the waste has been degraded to an unrecognizable form.) Since the “chronic” exposure scenario assumes a future resident lives on the site following a breakdown in institutional controls, and exposure duration of only 500 hours does not constitute a chronic scenario.

Path Forward: Provide an analysis of the chronic intruder-agriculture scenario for the intruder who may live on the land after construction of a home. Alternatively, if this scenario is considered unreasonable, discuss why it is inappropriate due to site-specific conditions such as climate, or passive systems to protect from inadvertent intrusion. This could include engineered barriers (caps, rock layers) or waste system placement and burial (e.g., depth to waste) to reduce the potential for inadvertent intrusion. Some scenarios many not be credible if the waste is generally inaccessible or if the waste is in a recognizable form.