

August 3, 2006

Mr. Jamnes L. Cameron  
 United States Nuclear Regulatory Commission  
 Region III  
 2443 Warrenville Road, Suite 210  
 Lisle, IL 60532-4352

Re: Response to Comments  
 Revised Dose Assessment Methodology  
 Breckenridge Disposal Site, St. Louis, Michigan

Dear Mr. Cameron:

This letter has been prepared by ENVIRON International Corporation (ENVIRON) in response to your May 12, 2006 comment letter regarding ENVIRON's Revise Dose Assessment submitted on April 25, 2006. The responses below have been prepared in accordance with our discussions during the June 22, 2006 meeting at United States Nuclear Regulatory Commission's (NRC's) office in Lisle, Illinois. To facilitate your review, the NRC's comments are shown below in *italics*; ENVIRON's responses to the comments are shown in normal font.

*Comment 1. Equilibrium of Decay Chain of Natural Uranium*

*The assessment methodology used an assumption of 50 percent equilibrium of the natural uranium decay chain for the dose assessment. A significant dose contribution may come from Ra-226, depending on the percentage of the equilibrium. Based on the analytical results from the Breckenridge Disposal Site Characterization Report, dated March 5, 2002, the concentration of Ra-226 may exceed U-238 in some of the contaminated soils. Because of that, the isotopic analyses of a representative number of contaminated soils from the site will be required to determine the average activity ratio of Ra-226 to U-238. Please provide the isotopic analytical results.*

Response: The table below summarizes the results of U-238 and Ra-226 activity data collected during the filter cake characterization investigation completed in November 2001.

**Table: Historical U-238 and Ra-226 Sample Results**

Sample Name	Collection Date	U-238 (pCi/g)	Ra-226 (pCi/g)	Percent Equilibrium
BR-COMP-1	11/28/2001	288	66.1	23%
BR-COMP-2	11/28/2001	62.2	14.2	23%
BR-COMP-3	11/28/2001	48	118	246%
BR-COMP-4	11/28/2001	95.2	7.08	7%
BR-COMP-5	11/28/2001	39.9	9.03	23%
BR-COMP-6	11/28/2001	166	15.5	9%
BR-COMP-7	11/28/2001	49.3	25.4	52%

Notes:

Data from March 5, 2002 Report titled Buried Filtercake Waste Characterization Report, prepared by Scientech

All but one sample suggest that U-238 and Ra-226 are not in equilibrium. In fact, excluding the one outlier, BR-COMP-3, the average level of equilibrium is 23%. This level of equilibrium is consistent with the type of the material placed and its placement date. As previously submitted in ENVIRON's Work Plan for Supplemental Site Characterization dated June 2005, the Breckenridge Disposal Site was used as disposal site for the process waste from an yttrium recovery operation from 1967 to 1970. The process waste, or filter cake, was a claylike material containing elevated levels of naturally occurring uranium and thorium. For uranium decay chain, the time to reach secular equilibrium is more than 75,000 years. For these reasons, the sample BR-COMP-3, is not consistent with available Site information and the results are questionable. As submitted in ENVIRON's July 11, 2006 letter, ENVIRON agreed to recollect this sample to the extent practicable on July 14, 2006. Should the results of the new sample show a level of equilibrium similar to the other samples, ENVIRON will use 50% equilibrium in the dose assessment as a conservative estimate of U-238 and Ra-226 equilibrium level at the Site.

*Comment 2. Distribution coefficient (Kd)*

*The dose from the ground water pathway is sensitive to the variation of the Kd, especially for the Ra-226, Pa-231. The values of Kd depend strongly on the chemical compound of the radionuclides and the pH value in the soil solution due to geochemical species in the contaminated soil. The specific Kd based on laboratory analysis of the soil collected from the site should be used to perform the dose assessment. Otherwise, the conservative default values from RESRAD should be used for the dose assessment. Please indicate whether you intend to use the specific Kd value or the default values from RESRAD.*

Response: As discussed at the June 22, 2006 meeting, the NRC requested the Custodial Trust justify the use of the Sheppard and Thibault  $K_d$  values provided in NUREG 6697. As part of this justification, ENVIRON examined information in NUREG 6697 regarding the appropriateness of Sheppard and Thibault's  $K_d$  values. A study that was also reference in NURGE 6697 was completed in 1998 which evaluated the conclusions by Sheppard and Thibault<sup>1</sup> and found no direct correlation between the soil texture and the  $K_d$  values. NUREG 6697 goes onto rank the priority given to each source when developing the distribution values. Beyeler et al, 1998 was given the top priority as it is the most recent assessment and builds upon the data from the other sources, specifically Sheppard and Thibault. Therefore, ENVIRON will modify the radiation dose assessment to use the Beyeler 1998  $K_d$  values provided in NUREG 6697. With the NRC's agreement on the use of the values, ENVIRON will revise the dose assessment using Beyeler's et al, 1998  $K_d$  values. The revised dose assessment will be provided with the Revised Supplement Site Characterization Work Plan.

At the meeting the NRC also requested that the Custodial Trust examine if any discussion of pH effects on  $K_d$  values were included in Sheppard and Thibault. Neither Sheppard or Thibault nor NUREG 6697 provided a detailed review of the effects of pH and as such does not provide a comparison for the conditions that exist at the Breckenridge site.<sup>2</sup>

*Comment 3. Derived Concentration Guidelines (DCGLs)*

*Your methodology indicates that you plan to backfill the excavation with excavated soil with activity levels at the subsurface DCGLs and covered with clean soil from off-site. Once the site is*

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<sup>1</sup> Beyeler, W.E., et al, *Review of Parameter Data for the NUREG/CR-5512 Residential Farmer Scenario and Probability Distributions for the DandD Parameter Analysis*, Letter Report, prepared by Sandia National Laboratory for the U.S. Nuclear Regulatory Commission, January, 1998.

<sup>2</sup> It was reported by Sheppard and Thibault that the change in pH did not correlate to a change in the  $K_d$  for any element, except Neptunium.

*released, the subsurface soil could be disturbed and brought to the surface. If that occurs, the dose may exceed the release criteria due to the dominant external exposure pathway. Please confirm that the concentrations of the subsurface soil, when brought to the surface, will not exceed the surface DCGLs.*

*For the ground water pathway, the dose increases as the thickness of the contaminated zone increases. The depths of the excavation may vary from location to location. Please describe the method to ensure the thickness of the backfilled soil with activity levels at the subsurface DCGLs will not exceed 2 feet as stated in the Revised Dose Assessment Methodology.*

Response: As discussed at the June 22, 2006 meeting, the Custodial Trust agreed to show that any subsurface material that is brought to the surface under reasonable scenario, would not result in a dose exceeding 25 mrem/year. ENVIRON developed the following conceptual model of a future resident farmer building a house with a 10-foot basement. It is assumed that during construction, a 10-foot basement will be excavated and the soils spread across the Site. During excavation the soil will be mixed such that the resulting activity of the soil mixture is the weighted average of the 0- to 10-foot soil column. As such, in order to be protective of the 25 mrem/year limit, the 0- to 10-foot weighted average activity level of the soil placed back in the waste pit excavations must have an activity level less than the surface DCGLs.

*Comment 4. Underestimation of the Doses*

*In the Revised Dose Assessment Methodology, there is no dose contribution from a water dependent pathway, due to the higher values of the selected Kd. All the doses come from the water independent pathway. The values of selected input parameters are 112 kg/yr for fruits, vegetables and grain consumption, 21.4 kg/yr for leafy vegetable consumption, and 233 L/yr for milk consumption. But, the actual values of the input parameters used in the dose assessment were 42.7 kg/yr for fruits, vegetables and grain consumption, 4.66 kg/yr for leafy vegetable consumption, and 92 L/yr for milk consumption. Therefore, the doses were underestimated due to the inconsistent input parameters. Because of that, the DCGLs with the above selected input parameters will be about 33 percent of the proposed subsurface DCGLs and 88 percent of the proposed surface DCGLs. Please revise your input values or provide justification for use of the lower values.*

Response: The input parameters for the ingestion pathways for the Breckenridge dose modeling were consistent with the recommendations of the USNRC and NUREG 6697; the parameters were selected from the USEPA Exposure Factor Handbook published in 1997.<sup>3</sup> It was observed that the values provided by the USEPA were lower than the defaults provided in the RESRAD code, Version 3.2.<sup>4</sup> The RESRAD defaults were selected from NCRP Report 123 and Argonne Report ANL/EAIS/TM-103.<sup>5,6</sup> As described in NUREG 6697, the USEPA Exposure Factor Handbook is a conservative reference to establish the ingestion pathways for radiation dose

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<sup>3</sup> U.S. Environmental Protection Agency, *Exposure Factors Handbook, Volume I, General Factors*, EPA 600/P-95-002Fa, August, 1997.

<sup>4</sup> Yu, C, Zielen, A.J, et al, *User's Manual for RESRAD Version 6*, ANL/EAD-4, Argonne National Laboratory, Argonne, Illinois, July, 2001.

<sup>5</sup> National Council on Radiation Protection and Measurements, *Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground*, NCRP 123, Volume 1 and 2, 1996.

<sup>6</sup> Argonne National Laboratory, *A Compilation of Radionuclide Transfer Factors for Plant, Meat, Milk, and Aquatic Food Pathways and the Suggested Default Values for the RESRAD Code*, ANL/EAIS/TM-103, 1993.

modeling. It represents the most recent compilation of ingestion parameters and is applicable for the Breckenridge site.

ENVIRON hopes that the above information satisfies the NRC's questions regarding the dose assessment. As stated previously, with the NRC's agreement on these issues, ENVIRON will submit a revised dose assessment with the Supplemental Site Investigation Work Plan. If you have any questions and additional comments, please do not hesitate to contact me at (312) 853-9430.

Sincerely,

ENVIRON International Corporation



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The Custodial Trust