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April 8, 2011

Mr. Dominick Orlando
Materials Decommissioning Branch
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SUBJECT: Response to 10 March 2011 Letter from the U.S. Nuclear Regulatory Commission SUBJECT: U.S. NUCLEAR REGULATORY COMMISSION STAFF REVIEW OF U.S. ARMY SEQUENTIAL EXTRACTION PROCEDURE FOR SOIL LEACHABILITY AT THE JEFFERSON PROVING GROUND (NRC LICENSE SUB-1435)

Dear Mr. Orlando:

This letter includes responses to your 10 March 2011 letter regarding the Army's proposed sequential extraction testing procedure. Before responding to specific questions, it is essential for the Nuclear Regulatory Commission (NRC) to understand that the Army is proposing to utilize soils remaining after the leachability testing. This testing involved emplacing six short segments cut from depleted uranium (DU) penetrators (526 to 702 grams) in approximately 1 kilogram of soil collected from Jefferson Proving Ground (JPG) in six different environmental test chambers or cells. These soil/penetrator segments then were subjected to 22 consecutive 3-week accelerated weathering cycles using 0.6 to 0.7 liter of rainwater (collected at JPG) for each cycle. The testing started with an initial 3 days of flooding that was followed by 9 days of dry air being passed thru each cell, 9 days wet air being passed thru each cell, 3 days flooding, and collection of leachate. These cycles started on 29 June 2009 and ended on 4 October 2010. Since the conclusion of testing, the soil samples have been stored in the laboratory's refrigeration system. The proposal is to conduct sequential extraction testing on the remaining soils before they are discarded. The NRC's letter included 3 comments provided below:

Comment 1:

NRC Comment: In general we have concluded that the proposed extraction procedure is appropriate, as long as the extraction results are not interpreted as an actual indicator of states in which depleted uranium (DU) is held.

Army Response: Agreed. The main reason for performing the sequential extraction testing is to determine the total environmentally available uranium inventory in the test soil specimens after retrieval of the penetrator dart segment. Currently, we have the gross weight of penetrator, before and after induced weathering from the laboratory leachability testing, and we have estimates of the total uranium found in the drained leachate. The soil inventory will complete the mass balance estimates, confirming the measurements made on the retrieved penetrator segments, which still have some small amounts of strongly-adherent corrosion products and other mineral phases. The difference between the total uranium inventory (source term) and the uranium extracted by the different lixivants is regarded as the "refractory" fraction. It represents near-field uranium that is effectively "fixed" (immobilized) by incorporation into poorly-soluble mineral phases. Mineralization is the dominant mechanism for natural attenuation of long-lived radionuclides, which are not biodegraded, which creates the need to better understand the nature of the fractions present in soils remaining after the leachability tests.

Comment 2.

NRC Comment: JPG has not indicated how it plans to use the data collected from the procedures. While we agree that sequential extraction may be useful in supporting predictions of uranium

mobility, the appropriateness of the procedures specified cannot be determined without a more specific understanding of how the results will be used.

Army Response: The previous response provides some information about how the Army plans to use the results of the sequential extraction testing. In addition, the sequential selective extraction method provides information to distinguish among trace element fractions of different solubilities related to mineral phases through the determination of the proportions of total environmentally available uranium. For example, the sequential extraction will provide insight into potential surface complexation reactions of uranyl with iron-containing minerals that has been used in modeling subsurface migration. While the Army is not proposing to conduct surface complexation modeling at this point, it is desirable to collect this information in the event more information is needed to support additional modeling or sensitivity analyses in the future.

In addition, the sequential extraction results will be used to support the comparison of species-specific K_d values documented in literature to the site-specific values determined by the JPG K_d study. The review of K_d values available in literature will be a qualitative comparison to support the identification of K_d values used in the Residual Radiation (RESRAD) OFFSITE computer code as well as other fate and transport modeling codes. Finally, the sequential extraction results provide useful information for the geochemical modeling (e.g., specifying minerals presumed present at equilibrium, interpreting saturation indices for minerals). The comparison and selection of K_d values as well as results from geochemical modeling will be documented and available for NRC's review and comment.

Comment 3.

NRC Comment: Some of the procedures specify sample refrigeration after collection and short holding times. Our understanding is that JPG plans to use samples that have been held for approximately 2 years at ambient temperatures. Detailed concerns about the potential changes in sample characteristics were described in our comments on JPG's response to our concerns on the development of partition coefficients [ML 110190306]. JPG should explain how this deviation with the written procedures will be addressed and indicate whether there will be other deviations from the written procedures.

Army Response: The issues referenced in ML 110190306 are not directly applicable to the soils that the Army proposes to use for the sequential extraction testing. While these soils also were collected in October 2008, they have been used actively in environmental test chambers for leachability testing for most of the time. Before and after the leachability testing, the soils have been stored in the laboratory's refrigerator under controlled temperatures.

Dr. Robert Cherry, Jefferson Proving Ground (JPG) License Radiation Safety Officer for JPG has seen this response and has authorized us to send it directly to you. He can be contacted at (210)424-8547 or email robert.cherry@us.army.mil should you have any questions or concerns.

Sincerely,

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