UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 19, 2016

Scott T. Anderson, Director
Division of Waste Management
and Radiation Control
P.O. Box 144880
Salt Lake City, UT 84114-4880

Dear Mr. Anderson:

I am writing in response to your letter of May 27, 2016 (ML16183A154), in which the Division of Waste Management and Radiation Control requested clarification regarding averaging of low-level radioactive wastes with potential transuranic (TRU) wastes. The letter requested that the U.S. Nuclear Regulatory Commission (NRC) answer two questions:

1. Does the Concentration Averaging and Encapsulation Branch Technical Position (CA BTP) allow for averaging of TRU waste below the threshold of 100 nanocuries per gram (nCi/g) with Class A low-level waste? We understand that any TRU waste exhibiting alpha emitting isotopes with a concentration above 100 [nCi/g] with half-lives greater than 20 years cannot be considered as a low-level radioactive waste. We also understand that wastes with different physical characteristics (e.g., solid/liquid/gas), or even significantly different particle sizes, cannot be averaged.

2. Does the BTP allow for averaging of TRU wastes in heels of cylinders (notwithstanding certain hot spots above the 100 [nCi/g] threshold), if a methodology can be established to ascertain a reasonable representation of TRU waste concentrations spatially within the heel?

The NRC staff has reviewed your questions and our responses follow.

This letter provides additional clarification regarding the NRC staff's CA BTP, which provides guidance regarding the blending of low-level radioactive waste and certain TRU wastes. The specific application of this guidance to disposal actions at Energy*Solutions*' Clive disposal facility remains the responsibility of the State of Utah under the Agreement between the State and the NRC.

The Atomic Energy Act of 1954 (AEA), as amended, defines TRU waste as: "material contaminated with elements that have an atomic number greater than 92, including neptunium, plutonium, americium, and curium, and that are in concentrations greater than 10 [nCi/g], or in such other concentrations as the NRC may prescribe to protect the public health and safety." This definition differs slightly from the definition of TRU waste offered by the State of Utah in Question One because the AEA definition does not include a 20-year cut-off on half-life and uses a 10 nCi/g threshold for TRU waste. The responses in this letter are based on the definition of TRU waste in the AEA, which is the controlling authority for the NRC.

The CA BTP provides acceptable methods for waste generators, processors, disposal facility operators, Agreement State regulators, and others to average radionuclide concentrations to determine waste class for disposal under 10 CFR § 61.55. The CA BTP is primarily relevant to low-level radioactive waste (LLRW). However, certain wastes that meet the AEA definition of TRU waste may be disposed of as LLRW in accordance with the regulations. Specifically, Table 1 of 10 CFR § 61.55 provides concentrations of radionuclides with atomic numbers greater than 92 in excess of the 10 nCi/g threshold given in the AEA definition that may be treated as LLRW for purposes of disposal. The technical basis for the CA BTP considered the radionuclide concentrations in 10 CFR § 61.55 as container averages,[1] with certain exceptions, as discussed in the response to Question One. The staff also considered localized areas with concentrations greater than these container averages (i.e., hot spots) in the technical basis for the CA BTP. Therefore, because they were considered in the technical basis of the CA BTP, hot spots with transuranic radionuclides greater than 100 nCi/g may be averaged with other waste in the container in some circumstances,[2] as described below.

The positions described in this letter are based on the generic guidance in the CA BTP. The generic guidance is designed to apply to a variety of waste types and disposal sites. However, heels fixed to the inside of a disposal container were not specifically considered in the development of the CA BTP. The responses below reflect the staff's view of how the generic guidance in the CA BTP can be applied to such a waste type. Section 3.8 of the CA BTP, "Alternative Approaches," is intended to facilitate consideration of waste- and site-specific conditions. The guidance on alternative approaches is the most appropriate guidance for a waste stream not specifically considered in the development of the CA BTP, such as heels fixed to the inside of a waste container. Consistent with this guidance in Section 3.8 of the CA BTP, a waste processor or generator could propose an alternative approach to the generic positions in the CA BTP for the appropriate regulator's (in this instance, Utah's) consideration.

In an August 4, 2016 phone call, the State of Utah clarified that its first question refers to averaging TRU radionuclides in the heels with the rest of the waste in the container and the second question refers to averaging radionuclide concentrations only within the heels. The physical form of the heels is key to answering these questions. NRC understands that the heels are fixed to the inside walls of the depleted uranium feed cylinders. Therefore, NRC staff is basing its response on the understanding that the heels cannot be readily mixed with the remaining waste in the cylinders.

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[1] In a waste container with an average concentration meeting the § 61.55 limits, limited volumes of waste (i.e., hot spots) may have concentrations of transuranic radionuclides greater than the AEA threshold or the § 61.55 limits. These hot spots may be averaged with other waste in the container in some circumstances, as described in the technical positions in the CA BTP.

[2] In this case, the circumstances allowing averaging of hot spots with transuranic radionuclides greater than 100 nCi/g are limited, in part, by the class of waste acceptable at *EnergySolutions'* Clive, Utah facility.

NRC staff response to State of Utah; Question One

The NRC staff's understanding is that the majority of the waste in the cylinders is a powder that is easily mixed to form uniform radionuclide concentrations. For the purposes of the CA BTP, this waste is "blendable" instead of "discrete." Section 3.4 of the CA BTP indicates that the radionuclide concentrations in blendable and discrete waste types cannot be averaged with one another. Therefore, regarding Utah's first question, the concentrations in the heels can only be averaged with the concentrations in the remaining waste in the container if the heels are considered blendable. Under the generic positions in the CA BTP, the NRC staff does not consider the heels to be "blendable." Therefore, the generic positions of the CA BTP would not permit averaging the heels with the remaining waste in the containers. As described in Section 3.8 of the CA BTP, a waste processor or generator could propose an alternate approach for averaging to the applicable regulatory authority. In this instance, an alternate approach submitted for Utah's consideration could include a justification for treating the heels as blendable. However, even if Utah accepts an alternative justification for considering the heels to be blendable, the generic guidance for blendable waste in the CA BTP would not apply to the heels. The technical basis for the generic positions on blendable waste in the CA BTP was based in part on the characteristics of commercial LLRW, which vary from the characteristics of the heels, as described. As previously discussed, the NRC staff considered the radionuclide concentrations in § 61.55. However, within the §61.55 Table 1 entry for "alpha emitting transuranic nuclides with half-life greater than 5 years," the staff's analysis was informed by the radionuclides typically present in commercial LLRW[3]. For example, as explained in Section 4.6 of Volume 2 of the CA BTP, the projected dose from Np-237, which could be present in significant concentrations in the heels,[4] was not used as a basis for the generic guidance on blendable waste in the CA BTP because of its very low concentrations in commercial LLRW.

In Question One, the State of Utah also commented that solids, liquids, gasses, or wastes with different particle sizes should not be averaged. This statement appears to reflect the NRC staff position in Section 3.4 of the CA BTP that, if different blendable waste types are mixed, the licensee should document the physical and chemical compatibility of the waste types. In the CA BTP, the NRC staff gave examples of chemical compatibility but did not provide any specific guidance for determining physical compatibility. Based on the underlying purpose of the guidance to help ensure safe waste disposal, physical compatibility should be determined by evaluating whether combining the waste types causes a physical hazard (e.g., increased chance of physical instability in the waste or slumping after disposal). The NRC staff did not specifically address particle size in the CA BTP.

NRC staff response to State of Utah; Question Two

In response to the State of Utah's second question, the heels can be averaged with one another, subject to certain constraints. Although contamination fixed to the inside of a disposal container was not explicitly considered in the development of the CA BTP, the heels are similar to the discrete waste type "contaminated materials," as described in CA BTP Section 3.1.4. If the heels are treated as contaminated materials, they can be averaged with one another (i.e.,

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[3] NRC staff used the DOE Manifest Information Management System (MIMS) database to determine radionuclides typically present in commercial low-level waste.
[4] Hightower J.R., et al. (2000) Strategy for Characterizing Transuranics and Technetium Contamination in Depleted UF6 Cylinders, Oak Ridge National Laboratory, Oak Ridge, TN ORNL/TM-2000/242.

not the remaining waste in the container) if the concentrations in any portion of the heels do not exceed the class limit for disposal by a factor of 10 or more[5] on a sum-of-fractions basis. Since discrete items cannot be averaged with blendable waste under the CA BTP, the waste class of the container would be determined by whichever waste class is higher—either the heels alone or the remaining waste alone. Therefore, for Class A disposal, the average concentration in the heels would need to meet the Class A limit on a sum-of-fractions basis (i.e., 10 nCi/g if no other radionuclides contributed significantly to the sum-of-fractions) and no portion of the heels could exceed 10 times the class limit (i.e., 100 nCi/g if no other radionuclides contributed significantly to the class limit).

Summary

Regarding the State of Utah's first question, the heels do not meet the CA BTP definition of "blendable" waste in the generic guidance, from either physical or radiological characteristics (e.g., the Np-237 concentrations), and therefore cannot be averaged with the remaining waste in the containers under the generic positions of the CA BTP. Regarding Utah's second question, the heels can be averaged among themselves, subject to certain constraints for discrete items, as outlined above. As previously discussed, because heels fixed to the inside of a container were not explicitly considered in the development of the CA BTP, it may be more appropriate for the heels to be considered as part of an alternative approach rather than under the generic CA BTP positions. Section 3.8 of the CA BTP provides examples of factors that the NRC suggests waste generators or processors consider when proposing an alternative approach and regulators consider when reviewing an alternate approach. In addition, NRC staff is available to discuss the issue further with the State of Utah staff.

Should you have any questions or comments concerning this response, please contact Maurice Heath at (301) 415-3137.

Sincerely,

/RA/

John R. Tappert, Director
Division of Decommissioning, Uranium Recovery, and Waste Programs
Office of Nuclear Material Safety and Safeguards

[5] This position is based on the assumption that none of the primary gamma-emitting radionuclides (i.e., Co-60, Ca-137, and Nb-94) control the waste class in the heels. If they do, the appropriate factor would be the Factor of 2 rather than the Factor of 10.

not the remaining waste in the container) if the concentrations in any portion of the heels do not exceed the class limit for disposal by a factor of 10 or more[6] on a sum-of-fractions basis. Since discrete items cannot be averaged with blendable waste under the CA BTP, the waste class of the container would be determined by whichever waste class is higher—either the heels alone or the remaining waste alone. Therefore, for Class A disposal, the average concentration in the heels would need to meet the Class A limit on a sum-of-fractions basis (i.e., 10 nCi/g if no other radionuclides contributed significantly to the sum-of-fractions) and no portion of the heels could exceed 10 times the class limit (i.e., 100 nCi/g if no other radionuclides contributed significantly to the class limit).

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[6] This position is based on the assumption that none of the primary gamma-emitting radionuclides (i.e., Co-60, Ca-137, and Nb-94) control the waste class in the heels. If they do, the appropriate factor would be the Factor of 2 rather than the Factor of 10.