Department of Energy
Washington, DC 20585

November 7, 2016

WM-00048

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Deputy Director
Mail Stop T8-F5
Washington, DC 20555-0001

Subject: U.S. Department of Energy Office of Legacy Management (DOE-LM) Response to U.S. Nuclear Regulatory Commission (NRC) Staff Comments on DOE-LM Report Entitled *Durango Transient Drainage System Closure and Evaporation Pond Removal Planning Documents*, Dated June 3, 2016

To Whom It May Concern:

In reference to the U.S. Nuclear Regulatory Commission's (NRC) letter dated August 17, 2016, regarding "U.S. Nuclear Regulatory Commission Staff Comments on U.S Department of Energy Draft Report Titled *Durango Transient Drainage System Closure and Evaporation Pond Removal Planning Documents*," (WM-00048), the U.S. Department of Energy Office of Legacy Management (DOE-LM) is providing the following information in response to NRC's comments.

NRC's August 17, 2016, comments requested that DOE-LM provide NRC with threshold values, and the dose modeling and environmental parameters used to develop the threshold values, in support of removal of the evaporation pond at the Durango, Colorado, disposal site. DOE-LM has evaluated three different approaches for determining screening threshold values for supplemental soil sampling, as discussed below.

- NRC's guidance for the Radium Benchmark Dose (RBD) approach in determining threshold concentrations for radionuclides other than radium, as described in Appendix H of U.S. Nuclear Regulatory Commission Regulation (NUREG) 1620, *Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978* (NRC 2003).
- The NRC guidance for cleanup found in the *Final Standard Review Plan for the Review and Remedial Action of Inactive Mill Tailings Sites under Title I of the Uranium Mill Tailings Radiation Control Act* (NRC 1993).
- U.S. Environmental Protection Agency (EPA)-developed soil screening values for the protection of groundwater.

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RBD Criteria

The exposure scenario considered for the RBD involves DOE-LM and LMS contractor employees performing an annual inspection of the site, during which the onsite exposure time would be a few hours (a maximum of 1 work day of 8 hours was used). This scenario accounts for the fact that the site is on DOE-LM property. It was assumed that the contaminated zone always has a concentration of 15 picocuries per gram (pCi/g) radium-226 with no mobilization of radium out of this contaminated area. It was also assumed that the only credible exposure pathways are the inhalation of resuspended soil and radon or radon progeny, incidental soil ingestion, and external gamma radiation exposure. Because there is no plausible resident scenario, or any form of extended occupancy associated with this exposure scenario, traditional exposure pathways involving ingestion of locally obtained foodstuffs or water are not considered relevant. It was assumed that the inspector is onsite and exposed for one 8-hour day per year.

The general approach to establishing decommissioning criteria using the concept of the RBD is a multiple-step process and was executed for this evaluation by completing the following steps:

[1] Determining the radium standard doses: RESRAD was applied to the site exposure scenario to estimate the dose that would result from the radium-226 reclamation criteria. This is referred to as the Radium Benchmark Dose.

[2] Calculating the dose from uranium (or thorium-230) using the RESRAD model.

[3] Scaling of the RBD to uranium or thorium-230 concentrations.

[4] Applying the unity rule to measured soil concentrations: As the total dose should not exceed the RBD for the soil concentration of radium-226 + natural uranium + thorium-230, the measured soil concentrations of each would need to be considered. The resultant dose from the combination of all three nuclides in soil was determined and compared to the RBD.

The results of this analysis are as follows:

1. The total effective dose equivalent the inspector receives from 15 pCi/g radium-226 in a 15 cm soil horizon under 15 cm of clean fill = 0.018 millirem per year. This is the RBD.
2. The equivalent natural uranium concentration, that is the concentration of uranium in the 15 cm soil horizon under 15 cm of clean fill that results in the RBD (i.e., same dose as from the 15 pCi/g radium-226), is 2787 pCi/g, and similarly the thorium-230 equivalent concentration = 3.3×10^4 pCi/g.

Because the RBD approach requires the application of the unity rule, some assumptions must be made for the establishment of a uranium standard and about the residual concentrations of both radium-226 and thorium-230. Sampling results for sediment from the Durango pond indicated that thorium-230 was below detection, and the radium-226 concentration was 3.57 pCi/g. Assuming the absence of thorium, and conservatively assuming that residual radium concentrations could be as high as 5 pCi/g, an appropriate value for uranium would be 1389 pCi/g (about 2720 milligrams per kilogram [mg/kg]).

NRC Guidance for Title I Sites

The NRC guidance for cleanup found in the *Final Standard Review Plan for the Review and Remedial Action of Inactive Mill Tailings Sites under Title I of the Uranium Mill Tailings Radiation Control Act* (NRC 1993) presents guidance for elevated levels of uranium expected to remain after the radium-226 criteria has been met. In this guidance, an acceptable cleanup standard for total uranium is 10 pCi/g in the top 15 cm and 30 pCi/g in subsequent 15 cm layers (these values correspond to concentrations of approximately 15 mg/kg and 44 mg/kg, respectively). This standard is based on the amount of uranium that would decay to radium levels meeting the EPA standard. However, this guidance is based on releasing an area for unrestricted use and the cited standards are lower than needed for a disposal site where public access is restricted and controlled.

EPA Risk-Based Values

EPA has developed risk-based soil screening levels for use in evaluating whether soils at a site require further investigation or cleanup (EPA 2016). These levels have been adopted by the Colorado Department of Public Health and Environment for use at Colorado sites. For uranium, the residential and industrial soil screening values are 230 and 3500 mg/kg (approximately 155 pCi/g and 2365 pCi/g), respectively. EPA has also developed soil screening values for the protection of groundwater. The EPA default groundwater protection values are based on conservative estimates of contaminant leaching from soil with no subsequent dilution. The groundwater protection soil screening level to meet a hazard quotient of 1.0 for uranium in tap water is 27 mg/kg; the maximum contaminant level (MCL)–based groundwater screening level is 14 mg/kg. For small source areas (up to 0.5 acre) where dilution of leachate is likely, EPA indicates that a dilution factor of 20 may be appropriate, resulting in groundwater protection soil screening values 20 times higher than default values (e.g., risk-based and MCL-based values of 540 mg/kg and 280 mg/kg, respectively, for uranium).

Summary

Because uranium is the only contaminant of concern that is observed in well 0618, downgradient of the evaporation pond, and since the RBD concentrations exceed the concentrations for uranium detected in the evaporation pond sediments, DOE-LM will use the EPA risk-based, groundwater protection soil screening value of 540 mg/kg as a screening threshold for uranium in soils collected after verification that the radium-226 cleanup criteria has been achieved.

Please contact me at (970) 248-6016 if you have any questions. Please address any correspondence to:

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Sincerely,

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