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MEMORANDUM TO: Stephen Koenick
Low-Level Waste and Projects Branch
Division of Decommissioning, Uranium Recovery,
and Waste Programs
Office of Nuclear Material Safety
and Safeguards

THROUGH: Christopher McKenney, Chief *Ch McKenney* Signed by McKenney, Christopher
Risk and Technical Analysis Branch on 05/12/21
Division of Decommissioning, Uranium Recovery,
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Office of Nuclear Material Safety
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FROM: Cynthia Barr, Senior Risk Analyst *CBarr* Signed by Barr, Cynthia
Risk and Technical Analysis Branch on 05/14/21
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SUBJECT: TECHNICAL REVIEW: U.S. DEPARTMENT OF ENERGY
DOCUMENTATION RELATED TO ENVIRONMENTAL
MONITORING AND NATURAL ATTENUATION OF KEY
RADIONUCLIDES AT THE F-TANK FARM AND H-TANK FARM
FACILITIES AT THE SAVANNAH RIVER SITE (PROJECT NO.
PROJ0734)

Monitoring is performed on the General Separations Area (GSA) of the Savannah River Site in Aiken, SC. The U.S. Nuclear Regulatory Commission (NRC) has performed a technical review of a collection of documents prepared by the U.S. Department of Energy (DOE) that provide information about recent groundwater monitoring and studies to determine the extent of natural attenuation of key radionuclides in the subsurface at the F-Tank Farm (FTF) and H-Tank Farm (HTF) facilities on the GSA. This technical review report is an update to three previous reports on the same topic dated December 17, 2019, April 20, 2018 and March 31, 2015 (Agencywide Documents Access and Management System [ADAMS] Accession Nos. ML19280A059, ML18051B154, and ML12272A124) with the former reports evaluating the FTF facility and HTF facility monitoring well networks as well as lysimeter and natural attenuation studies.

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This technical review is associated with Monitoring Factors (MFs) 4.1, "Natural Attenuation of Key Radionuclides," and 4.3, "Environmental Monitoring," listed in the NRC's combined F- and H-Tank Farm Facility monitoring plan entitled "U.S. Nuclear Regulatory Commission Plan for Monitoring Disposal Actions Taken by the U.S. Department of Energy at the Savannah River Site (SRS) F-Area and H-Area Tank Farm Facilities in Accordance with the National Defense Authorization Act for Fiscal Year 2005," issued in October 2015 and available using ADAMS Accession No. ML15238A761.

Previous staff conclusions remain valid and include the following:

1. DOE has performed environmental monitoring that provides useful information on the hydrogeological systems at FTF and HTF. This information can also be used to better understand contaminant flow and transport at the tank farm facilities (TFFs) and provide support for DOE Performance Assessment (PA) models.
2. Uncertainty about the source(s) of contaminant plumes detected via the FTF and HTF monitoring well networks exists. A better understanding of contaminant flow and transport processes at the TFFs, and more extensive data analysis, and interpretation could help reduce this uncertainty.
3. PA modeling and analysis should be better integrated with the groundwater monitoring program at the TFFs. For example, FTF and HTF monitoring well placement could be better optimized to detect releases from the tank farm facilities should releases occur in the future. PORFLOW groundwater transport models of the TFFs are available but are not being used to design the monitoring well network, particularly to inform vertical placement of wells. PA modeling assumptions and results could be used to determine key constituents and field monitoring data, which would provide the most useful information for evaluating performance of and to detect early releases from the TFFs.

NRC findings with respect to environmental monitoring report reviews include the following:

1. DOE should provide stronger support for the assumed sources of contaminant plumes to ensure that it is able to detect releases from the TFFs.
2. DOE should leverage monitoring data to obtain information about natural attenuation of key radionuclides at the TFFs.
3. DOE should analyze groundwater monitoring data in greater detail to increase understanding of processes important to contaminant flow and transport and model calibration (e.g., analyze water-level data to better understand water level response to changes in precipitation, to develop calibration targets for PA models, and to better understand tank farm performance).

NRC findings with respect to lysimeter report reviews include the following:

4. Although there are limitations to the lysimeter studies (see enumerated list below), the studies provide useful information regarding natural system performance and should be continued to provide support for key modeling assumptions in DOE's PAs.
5. DOE should clarify its source selections and their importance and relevance to tank farm closure.
6. DOE should clarify the chemical form of Pu reported in SRNL-L3230-2019-00005.
7. DOE should clarify the applicability of the SRRA021685-000012 experiments for tank farm closure (e.g., waste form, differences in environmental conditions during storage, solid/solution ratios, solution chemistry, and potential hysteresis effect).

8. The representativeness of the lysimeter study results presented in SRRA021685-000013, Rev. A, to tank farm closure should be discussed (e.g., chemical forms of key radionuclides, environmental conditions), as well as any data gaps pertinent to tank farm performance.
9. The variability in environmental conditions (e.g., precipitation rates through the system) and results should be analyzed and discussed in more detail.
10. DOE should consider modeling the transport behavior of key radionuclides in the natural system using data from the lysimeter studies to provide support for performance assessment models.
11. The applicability of a single equilibrium K_d model to tank farm closure should be critically evaluated. For example, Pu is known to exist in four different oxidation states with substantial variability in mobility depending on its chemical form. The fact that Pu was measured in effluent, albeit at low concentrations, a few years into the lysimeter study suggests that a simple K_d modeling approach does not adequately represent field conditions (i.e., much lower [single digit] K_d s could be calculated based on travel time for at least a fraction of the source). As stated in MF 4.1 and Appendix E of the FTF and HTF Monitoring Plan (ADAMS Accession No. ML15238A761), DOE should evaluate the modeling approach used to simulate Pu transport in the subsurface, including use of a single, average K_d . Lysimeter studies provide evidence that a more complex model is necessary to simulate the transport of Pu in the SRS subsurface. To date, NRC staff is unaware of any DOE effort to update the modeling treatment of Pu transport in the natural system to address high-priority MF 4.1 from NRC staff's Monitoring Plan. This information is needed, however, to assess whether DOE can meet the performance objectives in 10 CFR Part 61, Subpart C for tank farm closure.

NRC staff will continue to evaluate groundwater monitoring data collected by DOE that provides useful information on contaminant flow and transport at the TFFs. NRC staff will follow-up with DOE to better understand factors influencing water levels at the FTF and HTF that are important to development of calibration targets for the saturated zone flow model, understanding the impact of historical operations on groundwater quality at the TFFs and how that might affect interpretation of groundwater monitoring data, and better understanding the impact of variability on contaminant flow and transport.

NRC staff will continue to evaluate DOE generated lysimeter reports that provide useful information on natural attenuation processes at the TFFs. NRC staff will follow-up with DOE regarding DOE's interpretation of lysimeter data and its potential use in updated TFF PAs.

In this report, there is no significant change to the NRC staff overall conclusions from the NRC Technical Evaluation Report (TER) for the FTF dated October 2011 (ADAMS Accession No. ML112371751) or the NRC TER for the HTF dated June 2014 (ADAMS Accession No. ML14094A496) regarding compliance of the DOE disposal actions with the requirements of the performance objectives in 10 CFR Part 61, Subpart C. There is no change in the priority or status of MFs 4.1, "Natural Attenuation of Key Radionuclides," and 4.3, "Environmental Monitoring" under NRC staff's Tank Farms Monitoring Plan (ADAMS Accession No. ML15238A761) and NRC will continue to monitor DOE activities in this area on an annual basis.

Enclosure:
Technical Review of Environmental
Monitoring Reports for FTF and HTF

Docket No. PROJ0734

Technical Review Report Environmental Monitoring Report PROJ0734 DATE May 14, 2021

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ADAMS Accession No.: ML21119A312; Memo ML21119A316

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