Savannah River Remediation
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INTEROFFICE MEMORANDUM

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ASSESSMENT OF IODINE-129 DISPOSITION IN THE NORTHERN PORTION OF THE SALTSTONE DISPOSAL FACILITY

Background

The purpose of this memorandum is to assess risks of disposing iodine-129 (I-129) in specific northern locations of the Saltstone Disposal Facility (SDF) and recommend actions to mitigate those risks.

The *Performance Assessment for the Saltstone Disposal Facility at the Savannah River Site*, SRR-CWDA-2009-00017, (hereinafter referred to as the SDF PA) was prepared to assess whether there is reasonable expectation/assurance that the applicable performance objectives in the U. S. Department of Energy (DOE) Manual (M) 435.1-1, Change 1, *Radioactive Waste Management Manual* and Title 10 of the Code of Federal Regulations (CFR) Part 61, *Licensing Requirements for Land Disposal of Radioactive Waste,* Subpart C, as required by the *Ronald W. Reagan National Defense Authorization Act (NDAA) for Fiscal Year 2005,* Section 3116 will be met. [DOE M 435.1-1, 10 CFR 61, NDAA_3116] Requirements in DOE M 435.1-1 and 10 CFR 61 stipulate that there must be reasonable expectation/assurance that low-level waste (LLW) disposal facility operations and closure conditions comply with specified performance objectives. Performance objectives include evaluation of impacts to hypothetical future members of the public as well as inadvertent human intruders. DOE M 435.1-1 also requires assessments for impacts to water resources. The SDF PA and Special Analysis (SA) evaluations are based on a 1,000-year compliance period and a 10,000-year performance period. As required, the SDF PA and SA models evaluate impacts well beyond the performance period to provide further information in assessing compliance with performance objectives and making risk-informed disposal decisions.

The current layout of SDF is based on *Siting of Future Saltstone Disposal Units*, hereinafter referred to as the Siting Plan. [SRR-SDU-2011-00002] This 2012 Siting Plan evaluated 13 site locations (Figure 1) and recommended the placement of each future Saltstone Disposal Unit (SDU) needed to complete the Liquid Waste mission, assuming the SDU design is the same as SDU 6 and the disposal projections reflected in *Liquid Waste System Plan* Revision 16. [SRR-LWP-2009-00001 Rev. 16] From weighted criteria for each site, the Siting Plan determined the optimal locations of SDU 6 through 12 (Figure 2). SDU 6 through 9 are located in the northern portion of the SDF and SDU 10 through 12 are located in the southern portion of the SDF. The Siting Plan recommends reconfirming the optimal location of the next SDU construction prior to project initiation. Currently, SDU 6 is the only 35 million gallon SDU constructed and is located at Site 5 (Figure 1). For the purpose of this memorandum only SDU sites in the northern portion of the SDF are assessed for SDU 7 construction, which includes Site 1, 2, 3, 4, 6, and 7 from Figure 1.

The *FY2014 Special Analysis for the Saltstone Disposal Facility at the Savannah River Site*, hereinafter referred to as the Fiscal Year (FY) 2014 SDF SA, evaluates the current and planned SDU designs and the SDF layout presented in Figure 2, consistent with the Siting Plan. [SRR-CWDA-2014-00006] The results from the FY2014 SDF SA indicate that, within the performance period, I-129 is the radionuclide driving peak doses in SDF and that these peak doses are approaching the respective performance objectives.

Figure 1: Evaluated Sites for Saltstone Disposal Units (SDUs)

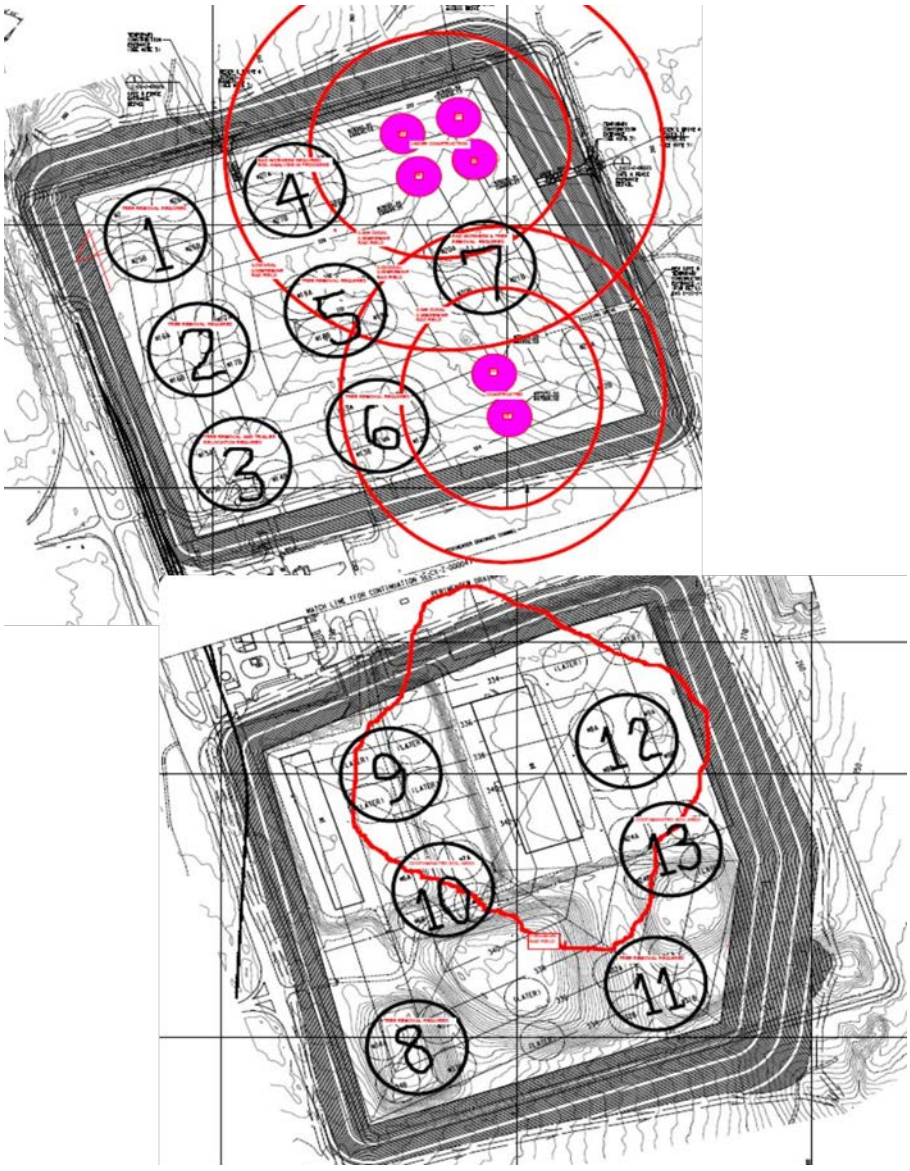


Figure 2: SDF 100-Meter Boundary and Groundwater Flow for Modeled SDUs

Discussion

I-129 in the Fiscal Year (FY) 2014 SDF Special Analysis (SA)

The SDF PA and subsequent SAs are tools to model the fate and transport of contaminants in emplaced saltstone and to evaluate against associated LLW disposal facility performance objectives. It is expected that this information will be used to optimize SDF operation, including the design and locations of SDUs and tactical emplacement of the contaminants. Such optimization ensures maximum flexibility for the overall Liquid Waste mission to mitigate uncertainty associated with the tank farm inventory of key radionuclides and chemical contaminants.

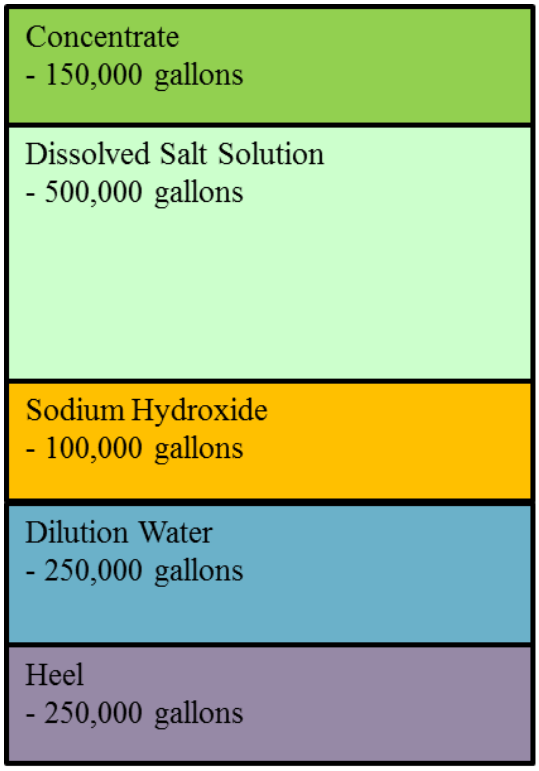
Modeling for performance objectives include a 100-meter boundary and groundwater flow around the current and planned SDUs. Both the 100-meter boundary around SDUs and general direction of groundwater flow are represented in Figure 2 by green/blue dots and blue lines, respectively. Figure 2 also illustrates the SDF groundwater divide by observing the change in groundwater flow direction from SDU 6 to SDU 7.

The FY2014 SDF SA indicates that the relative importance of a specific SDU location is influenced by 1) distance to 100-meter boundary, 2) direction of groundwater flow, and 3) radionuclide inventory. Iodine-129 is highly soluble under the saltstone matrix conditions and in groundwater. Although there is a relatively small inventory of I-129 in the tank farms, the FY2014 SDF SA shows that I-129 drives the peak doses during the performance period. [SRR-CWDA-2015-00077] Modeling indicates that SDU 8 and 9 are the most sensitive locations and SDU 6 and 7 locations are least sensitive to I-129 inventory based on the 100-meter boundary results (Figure 2). To optimize waste disposal, the preference is to place higher amounts of I-129 further away from SDF boundaries.

I-129 in the Liquid Waste System Plan

The *Liquid Waste System Plan*, hereinafter referred to as the System Plan, is a tool that summarizes activities supporting the Liquid Waste mission at the Savannah River Site. [SRR-LWP-2009-00001 Rev. 20] Future salt batching in the current System Plan is based on a generic salt batch recipe that is illustrated in Figure 3. [SRR-LWP-2014-00006]

Figure 3: Generic Salt Waste Processing Batch Recipe



Salt Batch Total: 1,250,000 gallons

Salt batches from the System Plan are compiled for facility Waste Acceptance Criteria (WAC) desired hydroxide and cesium-137 concentrations. The salt batch recipe also balances volume and space to create Hub and Blend Tanks necessary to support the Liquid Waste mission. The current System Plan salt batch process does not evaluate for individual radionuclide limits, such as I-129, in each SDU.

Facility Risk

The FY2014 SDF SA results show a significant risk associated with placement of I-129 near SDF boundaries relative to meeting facility performance objectives. Risk reduction could be possible by minimizing uncertainty of the I-129 inventory. [SRR-CWDA-2015-00077] Uncertainty concerning I-129 inventory stems from limited tank farm sample data. This also relates to uncertainty within the System Plan and salt batch preparation. As salt batches are blended to support Salt Waste Processing Facility (SWPF) production, there will be an expected increase in sampling frequency due to increased salt processing volume and salt batch qualification, thus reducing uncertainty later in the Liquid Waste mission.

Initial SWPF processed salt batches are planned to fill SDU 6 and 7. Based on FY2014 SDF SA modeling, there is a significant facility risk related to SDU locations and I-129 inventories. Modeling projects higher allowable I-129 inventory limits for SDU 6 and 7 compared to SDU 8 and 9 based on their location (Figure 2).

The FY2014 SDF SA only evaluates SDU locations in Figure 2, which also illustrates general direction of groundwater flow represented by blue lines. There is associated risk to locations outside of those analyzed in the FY2014 SDF SA, such as SDU Site 1, 2, and 3 in Figure 1. Changes to the planned SDU locations (Figure 2) will require additional groundwater flow model development to determine peak dose effects at the 100-meter boundary as influenced by the groundwater divide in SDF.

As previously mentioned, the relative location of an SDU site to the 100-meter boundary is a significant factor and sites that are further from the 100-meter boundary hold preference. SDU Site 2, 3, and 6 are comparable to Site 5 in terms of distance from the 100-meter boundary (Figure 1). Therefore, SDU Site 2, 3, and 6 are likely to reduce risk and optimize waste disposal for I-129 inventory. Similarly, due to their proximity to the 100-meter boundary and the general direction of the groundwater flow, SDU Site 1, 4, and 7 are not recommended for the sitting of SDU 7.

Recommendations

1) To mitigate the near term risk associated with disposal of I-129 in the northern portion of the SDF, the construction of the next SDU should not be at SDU Site 1, 4, or 7 (Figure 1). It is recommended the next SDU should at SDU Site 2, 3, or 6 (Figure 1). SDU sites other than Site 6 require modeling development (Figure 1).

2) To minimize risk of approaching performance objectives, it is recommended to maximize I-129 material in future salt batching for emplacement in SDU 6 and 7, to the extent practical.

3) To minimize risk and uncertainty in future disposal, it is recommended to analyze the I-129 inventory in more salt batch feed source tanks and better inform the salt batching process. It is recommended to evaluate I-129 inventory limits for SDU locations and incorporate results for an SDU-specific WAC.

References

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Distribution (electronic)

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