DOE/EIS-0303-SA-02

HIGH-LEVEL WASTE TANK CLOSURE FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE SAVANNAH RIVER SITE

SUPPLEMENT ANALYSIS

U.S DEPARTMENT OF ENERGY
SAVANNAH RIVER SITE OPERATIONS OFFICE
AIKEN, SOUTH CAROLINA
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Acronyms and Abbreviations

ALARA	As Low As Reasonably Achievable
BOA	Bulk Oxalic Acid
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
ECC	Enhanced Chemical Cleaning
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FMB	Fourmile Branch
FTF	F-Area Tank Farm
HLW	High-Level Waste
HTF	H-Area Tank Farm
LTAD	Low Temperature Aluminum Dissolution
MCL	Maximum Contaminant Level
MEPAS	Multimedia Environmental Pollutant Assessment System
NDAA	Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
OA	Oxalic Acid
ROD	Record of Decision
SA	Supplement Analysis
SCDHEC	South Carolina Department of Health and Environmental Control
SRR	Savannah River Remediation, LLC
SRS	Savannah River Site
USCA	University of South Carolina at Aiken
UTR	Upper Three Runs

1.0 INTRODUCTION AND PURPOSE

The Department of Energy (DOE) has a continuing responsibility to safely manage and close radioactive waste tanks at the Savannah River Site (SRS). In 2002, DOE issued the *High-Level Waste Tank Closure Final Environmental Impact Statement* (DOE 2002a, DOE/EIS-0303), hereafter referred to as the 2002 EIS, and subsequently issued a Record of Decision (ROD) (DOE 2002b). DOE selected the preferred alternative, stabilize tanks and fill with grout, as the method for closing the radioactive waste tanks.

In 2012 DOE issued the *High Level Waste Tank Closure Final Environmental Impact Statement for the Savannah River Site Supplement Analysis* (DOE 2012f, DOE/EIS-0303-SA-01), hereafter referred to as the 2012 SA, to determine if there were substantial changes or new information relevant to environmental concerns regarding the tank closure process as implemented in the F-Area Tank Farm (FTF), as described in the 2002 EIS, that would require a new or supplemental EIS. Based on the 2012 SA, DOE determined that a supplemental or new EIS was not required; DOE posted the 2012 SA on the SRS website (http://www.srs.gov/general/pubs/envbul/DOE-EIS-0303-SA-01.pdf) and published an environmental bulletin announcing the determination (Volume 24, Number 4, April 4, 2012). Since that time DOE has closed four radioactive waste tanks at the SRS.[1]

Now, DOE proposes to make certain changes to the tank closure process as applied to the FTF and H-Area Tank Farm (HTF) at SRS. The changes, which are described in detail in subsequent sections of this SA, involve projects and technical proposals evaluated in the 2002 EIS and the 2012 SA that have been modified or suspended, and new processes that have been developed based on lessons learned from previous tank closures. Most importantly, new performance assessments have been prepared for the FTF and HTF. In this SA, DOE will describe the new information and compare it to previous analyses.

The Council on Environmental Quality regulations for implementing the National Environmental Policy Act (NEPA), 40 CFR 1502.9(c)(1), direct Federal agencies to prepare a supplement to an EIS when "(i) [t]he agency makes substantial changes in the proposed action that are relevant to environmental concerns, or (ii) [t]here are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." DOE regulations for compliance with NEPA, 10 CFR 1021.314(c), direct that when it is unclear whether a supplement to an EIS is required, DOE must prepare an SA to assist in making that determination. The analysis in this SA will help DOE to determine if the proposed changes are substantial changes relevant to environmental concerns or if there is significant new information concerning the impacts of the proposed action such that a new or supplemental EIS is required.

[1] DOE closed Tanks 17 and 20 in the FTF in 1997 prior to the 2002 EIS. Since publication of the 2002 EIS and the 2012 SA, DOE has closed Tanks 18 and 19 in 2012, and Tanks 5 and 6 in 2013 in the FTF.

2.0 SUMMARY OF EXISTING EIS ANALYSES

DOE published the 2002 EIS in May 2002. In the 2002 EIS, DOE assessed the human health and environmental impacts of alternatives for closing waste tanks in FTF and HTF at SRS using a deterministic model. DOE evaluated the environmental impacts of three alternatives for closure of the waste tanks: (1) Stabilize tanks; (2) Clean and remove tanks; and (3) No action. In the 2002 EIS, under the option to stabilize tanks, DOE considered three options for Tank Stabilization: Fill with Grout (the preferred alternative); Fill with Sand; or Fill with Saltstone. DOE explained that each alternative would begin after bulk waste removal[2] from each of the tanks had been completed.

The radiation dose to a future human receptor was calculated by fate and transport deterministic modeling using the computer code called Multimedia Environmental Pollutant Assessment System (MEPAS[3]). Radionuclide activity levels (i.e., concentrations) at various locations were estimated and compared to potential water quality criteria (e.g., drinking water maximum contaminant level (MCL) of 4 millirem-per-year) established for the protection of human health and aquatic life. The option under the alternative to stabilize tanks that showed the lowest long-term radiological impact at all exposure points and met the drinking water MCL for groundwater at the seepline location was the Fill with Grout option (DOE 2002a, page 4-40). Likewise, none of the chemical contaminants exceeded MCLs at any point of exposure, for either the Fill with Grout or Fill with Sand options (DOE 2002a, page 4-40).

On August 19, 2002, DOE published a ROD (DOE 2002b) to select the preferred alternative identified in the 2002 EIS, Stabilize Tanks – Fill with Grout. The ROD discussed DOE's confidence in the tank stabilization method due to the expected performance of the reducing grout and the successful waste removal and operational closure process employed for Tanks 17 and 20. The 2002 EIS described the characteristics of reducing grout as a pumpable, self-leveling backfill material, designed to prevent future subsidence of the tank, and able to fill voids to the extent practical, including equipment and secondary containment (DOE 2002a, page 2-4). Reducing grout would immobilize waste residuals in the tanks following tank cleaning and reduce leaching of contaminants out of the tanks once stabilized because the grout would be formulated to retard the movement of radionuclides and chemical constituents from the closed tank. This grout material would have a high pH to be compatible with the carbon steel of the tank.

[2] Bulk waste removal in the 2002 EIS is defined as a process where DOE must remove the waste stored in the tanks by pumping out all of the waste that is possible with existing equipment, leaving behind residual contamination on the tank walls and internal hardware such as cooling coils. A heel of liquid, salt, sludge or other material remains in the bottom of the tank and cannot be removed without special means. Removal of this residual material is part of the cleaning stage of the proposed action (e.g., mechanical or chemical cleaning methods) (DOE 2002a, Page 1-13 and 2-1).

[3] MEPAS is software used in the 2002 EIS that integrates a suite of environmental parameters assessing transport and exposure pathways for chemical and radioactive releases to determine their potential impact on the surrounding environment, individuals and populations.

The ROD described that waste removal and tank cleaning would be performed by spray water washing, and if necessary other cleaning techniques would be employed. These techniques included mechanical methods, oxalic acid (OA) cleaning, or other chemical cleaning methods (DOE 2002b). DOE indicated that additional cleaning would be employed when bulk waste removal and water washing would not satisfy the closure criteria (DOE 2002a, page 2-1). The 2002 EIS indicated that some tanks would be cleaned with OA because these tanks have obstructing cooling coils or support columns, which make mechanical cleaning less effective.

3.0 NEW INFORMATION SINCE THE TANK CLOSURE ROD

In summary, the 2012 SA reviewed the cleaning methods proposed for FTF, the criteria under Section 3116(a) of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 (NDAA), and the drinking water impacts analyzed in the FTF performance assessment (PA); and determined that the cleaning methods and new information did not require a supplemental or new EIS. The FTF PA showed lower doses and demonstrated compliance with applicable performance objectives; Section 3116(a) criteria are similar to the Waste Incidental to Reprocessing criteria and process under the DOE Manual 435.1-1 which the ROD described; and lastly, the 2012 SA indicated and discussed DOE improved cleaning techniques to continue safe removal of residual waste. The 2012 SA emphasized that the decision to stabilize by filling the tanks and associated equipment with grout, as described in the ROD, had not changed. The new information listed in the 2012 SA did not change the proposed action analyzed in the 2002 EIS or the alternative selected in the ROD. An amended ROD was not required; however a Federal Register notice was published (Federal Register/Vol.77, No.65, April 4, 2012/Notices).

These pieces of new information apply to the HTF as well. DOE will continue to use the criteria specified in section 3116(a) of the NDAA to determine whether the residual waste at the time of closure is not high level waste, and can be managed as low level waste. DOE also continues to apply lessons learned to cleaning technologies in order to achieve removal of highly radioactive radionuclides[4] to the maximum extent practical. DOE has also published an HTF PA (DOE 2012c) to demonstrate compliance with applicable performance objectives.

4.0 PROPOSED ACTION

Since publication of the 2012 SA, DOE is continuing to apply the provisions of Section 3116(a) discussed in the 2012 SA and now has a Secretarial *Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site* (DOE 2012e). The FTF PA (DOE 2010) and supplemental special analysis (DOE 2012d) provided part of the technical justification for the determination that the Secretary of Energy made under Section 3116(a). In like manner, the HTF

[4] Highly radioactive radionuclides is a term from Section 3116(a) of the NDAA and are described by DOE in Section 5.1 of the *Basis for Section 3116 Determination for Closure of F-Tank Farm at the Savannah River Site* (DOE 2012a) and the *Draft Basis for Section 3116 Determination for Closure of the H-Tank Farm at the Savannah River Site* (DOE 2013a).

PA (DOE 2012c) will also provide part of the justification for a determination that the Secretary may make under Section 3116(a).

The 2012 SA discussed Enhanced Chemical Cleaning (ECC) as a new alternative cleaning technology to be used in place of Bulk Oxalic Acid (BOA); however the ECC alternative was never matured as a technology as the testing phases were never completed and the project has been unfunded since 2012. Another cleaning technique called Low Temperature Aluminum Dissolution (LTAD) has been proven effective in dissolving waste in tanks with high aluminum content before slurrying and removal from the tank.

This SA evaluates both qualitatively and quantitatively whether there would be significant environmental impacts resulting from implementation of the proposed action as described in this section. Specifically, this SA examines the potential human health impacts described in the 2002 EIS compared to new information from the FTF and HTF PAs using an impact indicator (i.e., drinking water standards) and any impacts to the environmental resources discussed in the 2002 EIS as a result of additional cleaning techniques.

4.1 Performance Assessments

Since the 2002 EIS and ROD were issued, DOE has developed new PAs for the FTF (DOE 2010) and the HTF (DOE 2012c). The 2012 SA evaluated the new information presented in the FTF PA (DOE 2010) in determining that existing NEPA documentation was adequate. DOE has also prepared special analyses (DOE 2012d and DOE 2013b) to supplement the performance assessment utilizing the final residual characterization information for tanks in FTF with known actual inventories to date. The special analysis process is consistent with DOE Manual 435.1-1 and DOE Guide 435.1-1 and is a systematic process for determining the impact on the results and conclusions of a performance assessment when parameter values, such as radionulclide inventory, change.[5]

The PAs and special analyses that supplement the PAs are key risk assessment tools used to inform closure and disposal decisions. They model the fate and transport of contaminants over long periods of time utilizing informed assumptions to determine potential consequences including the most likely consequences of planned actions. These analyses include sensitivity and uncertainty analyses. Uncertainty analyses provide information regarding the range of possible results under varying scenarios while sensitivity analyses provide information about the aspects of the system most critical to the decision to be made, such as the importance of engineered barriers, e.g., grout and a closure cap. PAs and supplemental special analyses are required under DOE Manual 435.1-1, and meet the requirements of applicable State of South Carolina requirements for risk assessments (SCDHEC R.61-58, SCDHEC's "State Primary Drinking Water Regulation" (SCDHEC 2009)). The FTF PA and HTF PA have been reviewed

[5] For each waste tank and ancillary structure, DOE will prepare a special analysis to evaluate the known actual inventories to date for waste tanks and ancillary structures which have had final residual characterization completed, and projected future inventories for waste tanks and ancillary structures yet to be cleaned, to determine the impacts of the final residual characterization values on the conclusions of the PA.

by the U.S. Nuclear Regulatory Commission (NRC), the Environmental Protection Agency (EPA), the South Carolina Department of Health and Environmental Control (SCDHEC), and the public, and have undergone revision in response to those comments.

Similar to the FTF PA discussed in the 2012 SA, the HTF PA includes both deterministic and probabilistic modeling. This HTF PA also analyzes the characteristics of the reducing grout. DOE is using the FTF PA, HTF PA and supplemental special analyses to provide reasonable expectation that dose limits for the protection of the public and the hypothetical human intruder will not be exceeded.[6]

4.2 Waste Removal and Tank Cleaning

DOE evaluated both mechanical and chemical cleaning after bulk waste removal in the 2002 EIS but did not specify types of mechanical cleaning techniques or chemical cleaning techniques other than spray washing and acid cleaning. DOE is currently performing waste removal and tank cleaning (i.e., mechanical and/or chemical) based on each tank's unique waste physical and chemical properties, tank infrastructure system interference, and nuclear safety control [SRR-CWDA-2014-00003]. DOE's proposal is in alignment with the 2002 EIS and associated ROD, which indicated that over the 30-year period of tank closure activities, DOE expected to use newly developed technologies for tank cleaning. These new developments are based on lessons learned, complex-wide technology sharing, and engineering evaluations. There are two broad categories of cleaning technologies that are deployed for waste removal activities. These are mechanical and chemical cleaning technologies.

4.2.1 Mechanical Removal

As discussed in the 2012 SA, mechanical methods include technology and equipment that are typically remotely operated, including mixer pumps, transfer pumps and agitators. The ROD did not specify types of mechanical cleaning methods or devices to be used, and indicated that over the 30-year period of tank closure activities, DOE expected to use newly developed technologies for tank cleaning. Mechanical cleaning is primarily performed through the use of long shaft mixing pumps installed through existing risers in the tank. Currently, there are two main types of mixing pumps that are used, Standard Slurry Pumps and Submersible Mixer Pumps. Based on past success in performing waste removal from six tanks at SRS, Tanks 5, 6, 7, 8, 11, and 12, a number of slurry or mixer pumps would typically be used in determined configuration to perform waste removal in a tank in order to attack any mounds or heels in the tank. A mechanical feed-and-bleed process supports the reuse of liquid and the minimization of secondary waste streams. Other options such as lances, sluicers and indexing (agitating) techniques are sometimes employed to dislodge hard mounds or hard-to-reach deposits. [SRR-CWDA-2012-00071] [SRR-

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[6] The FTF PA, HTF PA and supplemental special analyses evaluate a period of 1,000 years after closure of the respective tank farm, and provide additional data for 10, 000 years and beyond for the purposes of making risk-informed decisions related to closure. As required by DOE Manual 435.1-1, maintenance of the FTF PA and HTF PA will include future updates (e.g., Special Analyses or Revisions) to incorporate new information, updated model codes, analysis of actual residual inventories, etc., as appropriate.

CWDA-2014-00003] Additionally, the 2012 SA discussed the use of the Mantis, a commercial, remotely operated, tethered crawler outfitted with a high pressure/low flow eductor for lifting (vacuuming) solids. The crawler uses highly pressurized water nozzle(s) to create an adequate vacuum to remove material from a tank and propel the material to a receipt tank through a waste discharge line and transfer hoses. (DOE 2012f) DOE successfully deployed this technique in Tanks 18 and 19 in the FTF, as discussed in the 2012 SA. This Mantis technology is more suitable for Type IV tanks (also located in the HTF) which are free of obstructions, such as cooling coils and tank support columns.

4.2.2 Chemical Removal

In addition to mixing (mechanical) operations, processes have been developed for the removal of residual (heel) from SRS tanks using solutions containing chemicals to dissolve the remaining material following bulk waste removal. Chemical cleaning with BOA can be utilized to treat the residual solids remaining after mechanical waste removal campaigns. As discussed in the 2012 SA, BOA is a mature chemical cleaning technique that has been successfully used to chemically remove residual waste in Tanks 5 and 6 in the FTF and Tanks 12 and 16 in the HTF [SRR-CWDA-2011-00033, SRR-CWDA-2011-00005, and SRR-CWDA-2014-00003]. In general, oxalic acid (OA) has proven effective in dissolving iron-based compounds in sludge, and in removing some highly radioactive radionuclides such as cesium, technetium and uranium isotopes.

Lessons learned from OA cleaning have led to other chemical cleaning techniques to target certain compounds found in some sludge in the waste tanks facilitating removal. OA is less effective in dissolving aluminum-based sludge compounds. Plutonium is only sparingly soluble in OA, and is not removed effectively from tank heels by OA cleaning. [SRR-CWDA-2014-00003] The use of BOA has downstream effects on the rest of the liquid waste system as it generates hundreds of thousands of gallons of spent acid that must be managed in the storage and treatment system. In addition to the volume of spent acid requiring management, spent OA forms sodium oxalates, for which an effective pathway for removal has not been identified. Each tank cleaned with OA generates approximately 32,000 kg of spent oxalate. With the generation of these oxalates there is an increase in the volume of water required to wash the sludge, which thereby increases the volume of Saltstone grout that is produced. [XESR-G-00037]

As mentioned earlier, OA is less effective in dissolving the aluminum-based sludge compounds. Aluminum-based compounds are prevalent in the sludge composition of most of the tanks in the HTF. Further, nuclear safety requirements for OA cleaning require significant facility modifications to the tank if OA were to be used as occurred in Tank 12 in HTF prior to chemical cleaning with BOA. [SRR-CWDA-2014-00003] As a result, the consideration of using OA cleaning for one of the heel removal steps for future tanks will include a cost-benefit evaluation in the decision process. With the lessons learned from the operational closure of Tanks 5 and 6, as well as from waste removal in Tank 12, the inputs and assumptions for future tank waste removal and closure activities will be performed in a structured approach to identify and compare alternatives to meet the defined functions and requirements. These limitations with BOA allowed for the use of LTAD, a chemical cleaning technique that has been implemented to remove waste high in aluminum content.

Tanks high in aluminum content can undergo LTAD with caustic chemical additions or high caustic supernate to dissolve aluminum species. LTAD uses sodium hydroxide to dissolve aluminum from the sludge solids. Once aluminum compounds are dissolved and removed, LTAD allows more effective residuals suspension and mixing and has negligible impact on other metals. LTAD was successfully performed during waste removal in Tank 12 and this has demonstrated that LTAD is a viable treatment step for tanks with similar type sludges. [SRR-CWDA-2014-00003]

As mentioned in the 2012 SA, transfer pumps are used throughout bulk waste removal and tank cleaning process for removal of slurried waste. (DOE 2012f) These pumps are vertically mounted, long-shafted, single-stage, centrifugal pumps. The pump motor is located on top of the tank, and is connected to the impeller via the long shaft. [SRR-CWDA-2014-00003]

Effectively, with the lessons learned in both mechanical and chemical cleaning, DOE is proposing to use cleaning techniques on a case-by-case scenario on each tank based on the following:

- Each tank's waste properties (physical and chemical)
- Tank infrastructure system interference
- Nuclear Safety Controls.

5.0 IS A SUPPLEMENTAL EIS NEEDED?

This section evaluates the current proposed action and new information for potential relevance to environmental impacts associated with the proposed action and preferred alternative in the 2002 EIS.

5.1 Environmental Resources

This SA evaluates the following environmental resources previously evaluated in the 2002 EIS for impacts: geology, air resources, ecological resources, land use, socioeconomics, environmental justice, cultural resources, water resources, and worker and public health impacts.

Geology (Soil)

The 2002 EIS analyzed geologic resources and concluded that no detrimental effect on surface soils, topography, or to the structural or load-bearing properties of the geologic deposits would occur from stabilizing the tanks with grout. Understanding of the geologic conditions of the SRS, specifically the FTF and HTF, remains essentially unchanged since the 2002 EIS. Therefore, the conclusions of the 2002 EIS are confirmed that no detrimental effect on surface soils, topography, or to the structural or load-bearing properties of the geologic deposits would occur from stabilizing the tanks with grout.

Air Resources

The 2002 EIS states that routine radiological air emissions that would be associated with tank closure activities were assumed to be equivalent to the current level of releases from the FTF and HTF and would not exceed any regulatory limits. Modeling results in the FTF PA indicate the maximum potential airborne pathway radiological dose to a member of the public from FTF releases would be less than 0.2mrem/yr. Modeling results in the HTF PA indicate the corresponding maximum potential airborne pathway radiological dose from HTF releases would be less than 0.0001mrem/yr. Operations in the tank farms follow procedures that control airborne radiological releases. The FTF and HTF PAs support the conclusions of the 2002 EIS that no impacts on air quality will result from enhanced tank cleaning technologies and tank closure beyond those previously identified in the 2002 EIS. Therefore, no further analysis of effects on air resources is necessary at this time.

Ecological Resources

The 2002 EIS analyzed the natural communities of the Savannah River Site and indicated that SRS comprised of a variety of diverse habitat types that support terrestrial and semi-aquatic wildlife species. The *Savannah River Site Land Use Plan* [SRNS-RP-2013-00162, Figure 3-2] also illustrates the typical environmental/ecological management areas where the endangered species and research set-aside areas are located. Figure 3-2 also shows that the FTF and HTF are not in the vicinity around the ecological management areas therefore none of the proposed actions pertaining to tank closure (i.e., LTAD cleaning techniques), and new information (e.g., performance assessments) affects the ecological resource analysis performed in the 2002 EIS.

Land Use

The 2002 EIS discussed the *Savannah River Future Use Plan* (DOE 1998) which stated the land around the FTF and HTF will be considered in the industrial use category, assumed institutional control for the next 100 years, and after that, the area would be zoned as industrial for an indefinite period, with deed restrictions on the use of groundwater. The 2012 SA indicated that DOE did not expect any land use changes or impacts beyond those previously identified in the 2002 EIS and no further analysis was necessary.

The *Savannah River Site Land Use Plan* [SRNS-RP-2013-00162] indicates that SRS will maintain its current physical boundary under the ownership of the federal government in perpetuity, except where lease or transfer to the public/private sector aligns with DOE objectives and enhances economic development in the surrounding region. No land is to be used for residential use and the land surrounding the FTF and HTF will continue to be production/industrial use category. No further analysis is necessary to support implementation of the proposed action or new information.

Socioeconomics

The 2002 EIS indicated that all options under the stabilize tank alternative would require less than 1 percent of the existing SRS workforce. Given the size of the economy in the six-county region of influence (as described in Section 3.6 of the 2002 EIS), the estimated SRS workforce in 1995 was 16,625 workers with a total payroll of slightly over $625 million, and in September 1997, DOE had reduced the total workforce to 15,112. Even with the reduction in force, the regional population and workforce dynamics, tank closure activities were not expected to result in any measurable socioeconomic impacts. According to the *Economic Impact of the Savannah River Site on Five Adjacent Counties in South Carolina and Georgia* (USCA 2011), SRS has a huge economic impact on the local area. In addition, the Site's 10,967 highly skilled, technical professional workers have had direct and indirect impacts with ripple effects throughout the

South. During Fiscal Year 2010, the SRS budget was $2.353 billion. Out of that amount, SRS spent $1.191 billion within the five-county region, thus greatly and positively stimulating local economies. The proposed action, including deployment of LTAD cleaning techniques as appropriate, will not result in measureable socioeconomic impacts. No further analysis is required.

Environmental Justice

Environmental justice issues in the 2002 EIS were assessed based in part on analyses in the *Interim Management of Nuclear Materials EIS* (DOE, 1995). The 2002 EIS concluded that there were no disproportionately high and adverse impacts to minority or low-income populations for SRS tank closure activities. There has been no substantial change in minority or low income demographics since issuance of the 2002 EIS. Accordingly, in view of the very small potential for adverse environmental impacts, the current proposed action would not result in disproportionately high and adverse impacts to minority or low-income populations near the SRS. No further analysis is required.

Cultural Resources

The 2002 EIS addressed impacts to historic cultural resources as limited. The potential for the presence of a prehistoric site in the FTF and HTF vicinity is limited as the likelihood of historic resources surviving the construction of the tank farms in the early 1950s, before the enactment of regulations to protect such resources, would be small. Tank closure activities were not expected to further impact historic or prehistoric resources in the 2002 EIS. According to the *Savannah River Site Land Use Plan* [SRNS-RP-2013-00162], there would be no impacts on cultural resources above the 2002 EIS from the proposed action and new information in this SA as the FTF and HTF lie in a previously disturbed, highly industrialized area of the SRS.

Water Resources

The 2002 EIS discusses surface water impacts and groundwater impacts. Based on the development of the FTF PA (DOE 2010) as supplemented by special analyses (DOE 2012d and 2013b) and the HTF PA (DOE 2012c), further analyses were conducted for impacts to water resources. The impacts to water resources, both groundwater and surface water, are evaluated against the drinking water standards as further described below. These areas were evaluated to establish whether the potential impacts were likely to remain within the bounds of the 2002 EIS, and, if not, whether any differences were significant. The findings in these areas are summarized below.

DOE guidance for preparing a supplement analysis (DOE 2005) discusses the impact indicator approach to comparing results between supplement analysis and EIS analysis. Impact indicators are the most important parameters used to estimate impacts for an environmental resource. After all media and pathways have been evaluated in the PAs, the groundwater concentrations of contaminants were found to be by far the most limiting exposure pathway, contributing approximately 92% of the all-pathways dose to a hypothetical member of the public located 100 meters from the edge of a tank in FTF (DOE 2010, Section 5.5) and contributing approximately

100% of the all-pathways dose to a hypothetical member of the public located 100 meters from the edge of a tank in HTF (DOE 2012c, Section 5.5)[7]. The all-pathways dose includes impacts associated with using contaminated water sources (groundwater or surface water) for drinking, showering, gardening, watering livestock, and recreational activities (fishing, boating, and swimming) as further described within the 2002 EIS (DOE 2002a Section C.2.1.2) and FTF PA (DOE 2010 Section 4.2.4) and HTF PA (DOE 2012c Section 4.2.3).

As described in the 2002 EIS, the regulations governing closure of the tanks specify that the average concentrations of manmade radionuclides in drinking waters shall not produce a dose equivalent to the total body or an internal organ dose above 4 millirem-per-year (beta-gamma activity), i.e., the combined contribution from contaminants from all tanks and associated equipment will not exceed the 4 millirem-per-year limit. Additionally, the concentrations of alpha radionuclides in drinking water shall not exceed a concentration of 15 picocuries per liter (not including uranium isotopes), i.e., the combined contribution from all tanks and associated equipment will not exceed the 15 picocuries per liter limit[8]. The drinking water beta-gamma dose and water alpha concentration are used as the impact indicators for this analysis since these limits are the primary performance objective for the SRS radioactive waste tank system closures in the 2002 EIS, ROD and Closure Plans per SCDHEC Drinking Water Regulation 61-58 (SCDHEC 2009). Table 1 below is a comparison of drinking water doses associated with beta-gamma radionuclides and concentrations for alpha radionuclides from the 2002 EIS (DOE 2002a), the FTF supplemental special analysis (DOE 2013b), and the HTF PA (DOE 2012c) at various locations around the FTF and the HTF.

The FTF and HTF Base Cases show lower drinking water doses associated with beta-gamma radionuclides at all three points of assessment in comparison to the 2002 EIS. During the 10,000 year period after closures, the FTF and HTF deterministic (Base Case) models indicate that the drinking water dose at 100 meters peaks at 1.6 millirem-per-year and 13.6 millirem-per-year, respectively, which is significantly lower than the drinking water peak dose modeled in the 2002 EIS for the FTF (51 millirem-per-year) and HTF (300 millirem-per-year), respectively. The analysis in this SA shows that the drinking water dose modeled in the FTF Base Case is below the regulatory standard (4 millirem-per-year) at 100 meters and at the seepline versus only at the seepline in the 2002 EIS. The analysis in this SA also shows that the drinking water peak dose modeled in the HTF Base Case is below the regulatory standard (4 millirem-per-year) at the seepline as does the 2002 EIS.

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[7] The air pathway analysis in the HTF PA was updated to remove very conservative assumptions regarding air emissions included in the FTF PA air pathway analysis which accounts for the increased groundwater contribution in the HTF PA compared to the FTF PA.

[8] It should also be noted that a total radium concentration limit of 5 picocuries-per-liter is also required. However, the 2002 EIS did not report the radium concentrations so a comparison of these results between the 2002 EIS and FTF and HTF PAs was not performed.

Table 1: Modeled Drinking Water Results for the 2002 EIS and the FTF and HTF Base Cases

Drinking Water Points of Assessment[1]	2002 EIS FTF	Current FTF Base Case[2,4]	2002 EIS HTF	Current HTF Base Case[2,4]
Beta-gamma dose limit (millirem-per-year)	4	4	4	4
1 meter (millirem-per-year)	130	7.7	100,000	31.8
100 meters (millirem-per-year)	51	1.6	300	13.6
Seepline (millirem-per-year)[3]	1.9	0.03	2.5	0.16
Alpha concentration limit (15 picocuries-per liter)	15	15	15	15
1 meter (picocuries-per-liter)	13	39.4	24	51
100 meters (picocuries-per-liter)	4.8	4.7	7	4.6
Seepline (picocuries-per-liter)[3]	0.04	0.12	0.15	0.063

Notes:

1. The drinking water doses and concentrations compared between the 2002 EIS and the FTF PA supplemental special analysis and HTF PA are based on peak modeling results for 10,000 years.
2. The Base Case (Case A) results are from deterministic modeling, which represents the expected (most likely) peak dose consequences during the 10,000 year period after FTF and HTF closure.
3. All modeling calculated the seepline radionuclide concentration in the water as it seeps from the ground prior to mixing in the stream. For simplicity, all contaminants from FTF were modeled as flowing toward FMB in the 2002 EIS. For HTF 2002 EIS analysis, the contaminants were modeled as flowing to both FMB and UTR, separated by the groundwater divide. Groundwater flow in FTF and HTF is modeled in the PAs and supplemental special analyses to two streams, UTR and FMB, based on the existing groundwater divide at both the FTF and HTF. The UTR seepline results are reported in the above table for the FTF since these results are higher than those calculated for FMB. The UTR seepline results are reported in the above table for the HTF since these results are higher than those calculated for FMB.
4. The dose results provided are not to be considered limits. As required by DOE Manual 435.1-1, maintenance of the PAs will include future updates (e.g., Special Analyses or Revisions) to incorporate new information such as actual residual inventories and update model codes, as appropriate.

A comparison of the alpha radionuclide concentration results for the three points of assessment identify very little difference between the 100 meter and seepline concentrations, but an increase in concentration at the 1 meter location for both the FTF and HTF Base Case results versus the 2002 EIS. This variance is due largely to different source terms evaluated between the 2002 EIS and FTF and HTF Base Cases, predominately in alpha emitting radionuclides. To demonstrate, the FTF Pu-238 source term evaluated in the 2002 EIS was 0 Ci while the FTF Base Case evaluated 8,200 Ci, and the HTF Pu-238 source term evaluated in the 2002 EIS was 1680 Ci while the HTF Base Case evaluated 182,000 Ci. The inventories assumed in the FTF and HTF Base Case evaluations are more up to date taking into account actual cleaned tank residual waste analyses results. As discussed under the Land Use Section, use of groundwater at 1 meter from the closed tanks in FTF and HTF as a drinking water source is deemed improbable due to planned continued Federal ownership of the SRS consistent with the Site's designation as a National Environmental Research Park, prohibited residential use of all SRS land, and designated industrial use of the areas.

A supplement to the 2002 EIS is not needed because the impacts of closure of the FTF and HTF tanks and associated equipment identified in the new performance assessment analyses are not significantly different from the impacts identified in the 2002 EIS based on a comparison using the drinking water standards for beta-gamma dose and alpha concentrations as an impact indicator.

Worker and Public Health Impacts

The projected human health (worker and public) impacts during tank cleaning and closure operations from the proposed action and alternatives identified in the 2002 EIS would not change. The 2002 EIS states that DOE would exercise "as low as reasonably achievable" (ALARA) principles to minimize individual worker doses. DOE implements a Radiation Protection Program at SRS (SRS Radiation Protection Program), which meets all regulatory limits. The SRS Radiation Protection Program continues to apply ALARA principles beyond the specific regulatory limits during tank farm closure activities so as to minimize the potential impacts to workers and members of the public during cleaning and closure operations.

6.0 CONCLUSIONS

Section 5 of this SA evaluated a set of the environmental and health impacts based upon new information and proposed actions under chemical cleaning technologies and concluded that no supplementation is needed for any factor. A review of the cleaning methods for FTF and HTF, and a comparison of the results of the FTF PA and HTF PA, including supplemental special analyses, to the 2002 EIS model results shows that while there is new information relevant to the environmental concerns, it is not significant and does not bear on the impacts analyzed in the 2002 EIS. DOE has improved its cleaning techniques to continue effective removal of residual waste. There is no proposal to change the decision to stabilize the tanks and associated equipment by filling with grout. The new information does not warrant a change to the proposed action analyzed in the 2002 EIS or the fill with grout alternative selected in the ROD.

This review concludes that the impacts from closure of the FTF and HTF are within the scope of potential impacts evaluated in the 2002 EIS. The Tank Closure program still follows the process laid out in the ROD to: (1) address the performance objectives for each tank that allows the cumulative closure of each tank to meet the overall performance standards, (2) address the regulatory status of the residual waste in the tanks through a waste determination, and (3) use cleaning methods (such as spray water washing or chemical cleaning), if needed.

DOE still plans to grout the tanks as it was considered the appropriate option to stabilize the tanks and certain associated equipment, and minimize human health and environmental risks. DOE stated in the ROD that it "will evaluate and consult with SCDHEC on closure methods and regulatory compliance revisions that will allow accelerated closure and reduction of risk associated with the HLW tanks" (DOE 2002b). According to the ROD, the decision to close a tank and proceed through the closure process is initiated through regulatory requirements and approved Closure Plans under the South Carolina Regulation 61-82, *Proper Closeout of Wastewater Treatment Facilities* (SCDHEC, 1980) of the South Carolina Pollution Control Act. DOE is required to close tanks and associated equipment in accordance with a SCDHEC approved Closure Plan, thus meeting a Section 3116(a) criterion. SCDHEC approved both the *Industrial Wastewater General Closure Plan for F-Area Waste Tank Systems* (DOE, 2011) and the *Industrial Wastewater General Closure Plan for H-Area Waste Tank Systems* (DOE 2012b), typically called the FTF and HTF General Closure Plans. Therefore, DOE is still proceeding with its decisions and plans for closure of the waste tanks at SRS. DOE has not identified any significant new information that would affect the basis for its original decision as documented in the ROD. DOE will publish a notice, as appropriate, based on the final determination, to inform stakeholders of this analysis.

7.0 DETERMINATION

DOE has prepared a Supplement Analysis to determine whether the *Savannah River Site High-Level Waste Tank Closure Final Environmental Impact Statement* (DOE 2002a) adequately addresses the current programmatic operations or whether additional documentation is necessary under NEPA. The Supplement Analysis compares potential impacts to key resources analyzed in the 2002 EIS with potential impacts under the current regulatory environment and the proposed actions for tank closure.

Based on this Supplement Analysis, DOE has determined that the proposed actions in the FTF and HTF tank closure program do not constitute substantial changes from those evaluated in the original 2002 EIS that are relevant to environmental concerns; or significant new circumstances or information relevant to environmental concerns and bearing on the proposed action, within the meaning of 40 CFR 1502.9 (c). Therefore, pursuant to 10 CFR 1021.314(c)(2), no further NEPA documentation is necessary.

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