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Regulatory Requirmements for Pollution Prevention for the Salt Waste Processing Facility at Savannah Rive Site

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Introduction

Savannah River Site (SRS) is a Department of Energy (DOE) facility for production of nuclear materials located near Aiken, South Carolina that is operated by the Westinghouse Savannah River Company (WSRC). Waste sludges and salts generated from the processing of nuclear materials have been stored in underground storage tanks since operations began in the 1950s. These sludges and salts contain high levels of long-lived and short-lived radionuclides. To ensure the long-term protection of human health and the environment, some tanks that do not comply with current regulatory requirements are to be emptied and closed per the SRS Federal Facilities Agreement (FFA)[1]. Sludge generated from these tanks is being immobilized in borosilicate glass through vitrification at the Defense Waste Processing Facility (DWPF) at SRS. The remaining radioactive liquids have a high concentration of salts. For economic and practical purposes, the approach for processing salts is to separate the radionuclides from the non-radioactive salts and incidental wastes. The radionuclides are processed at the DWPF, while the salts and incidental wastes are disposed of as low level waste.

To separate the Cesium (Cs) and transuranic wastes from non-radioactive salts, the In-Tank Precipitation (ITP) facility was designed and constructed at SRS. The ITP utilized sodium tetraphenylborate (TPB) to precipitate cesium from the wastes. During the start up of ITP, the rate of benzene release due to breakdown of the TPB exceeded predicted values. The process could not be modified to limit the risk associated with the facility to acceptable levels, and it was abandoned in 1998. WSRC then initiated a comprehensive technology assessment process to identify alternate technologies for salt waste processing. The two most promising alternative technologies identified were (a) the Small Tank TPB Precipitation, and (b) the Non-Elutable Ion Exchange Process. A brief description of these processes is given below:

Small Tank TPB Facility

This technology utilizes a two step process similar to the ITP process, but utilizes small tanks in a continuous process rather than a large volume, batch process[2]. Soluble radioactive ions, including strontium (Sr), uranium (U), and plutonium (Pu) are first adsorbed by striking with monosodium titanate (MST). Sodium TPB is then used to precipitate the cesium (Cs), resulting in formation of an insoluble salt. The resulting precipitate, which will contain virtually all the remaining radionuclides, will be filtered to concentrate the solids. The resultant slurry will be sent to the DWPF for vitrification in borosilicate glass. The decontaminated salt solution, or filtrate, containing primarily sodium salts of hydroxide, nitrate, and nitrite, will be transferred to the Saltstone

Facility at SRS. The filtrate is then formulated into concrete grout, which is disposed of in vaults at the Salstone Facility.

CST Non-Elutable Ion Exchange Facility:

This proposed process also uses a two step process[3]. Sr, Pu, and U are removed first by striking with MST. The process then employs crystalline silicotitanate (CST) resin to remove cesium from the salt solution. Cesium cannot be eluted from the CST; therefore loaded resin would be transferred to the DWPF to be combined with the sludge and frit for vitrification into borosilicate glass. The decontaminated salt solution would be transferred to the Saltstone facility for making a Class A grout after removing mercury (Hg).

The DOE will make a final selection following further assessment of these two technologies. The regulatory requirement baseline being established is generic, however, and is designed to fit the needs of any technology selected. All Federal, state and local regulatory environmental requirements will be implemented for the construction and operation of the proposed facility, hereinafter referred to as the Salt Waste Processing Facility (SWPF). These requirement baselines are established and will be factored in at the conceptual design stage.

Regulatory Requirements Baseline

WSRC has developed a set of necessary and sufficient requirements for operation of the Savannah River Site in the form of a Standards/ Requirement Identification document (S/RID)[4]. All requirements applicable to the SRS facilities have been extracted from Federal, State, and local regulations and DOE Orders and Directives. Requirements contained in the S/RID ensure protection of the environment and the safety of workers and public. For the design and construction of the proposed Salt Waste Processing Facility, a regulatory requirement baseline has been established for environmental protection, pollution prevention, and safety of the workers and public. These requirements have been derived from the WSRC S/RID and are grouped into four categories based on their functions. A brief overview of the environmental requirement classification and sub-functional categories is given in Figure 1. Each function is described in detail below.

NEPA Documentation

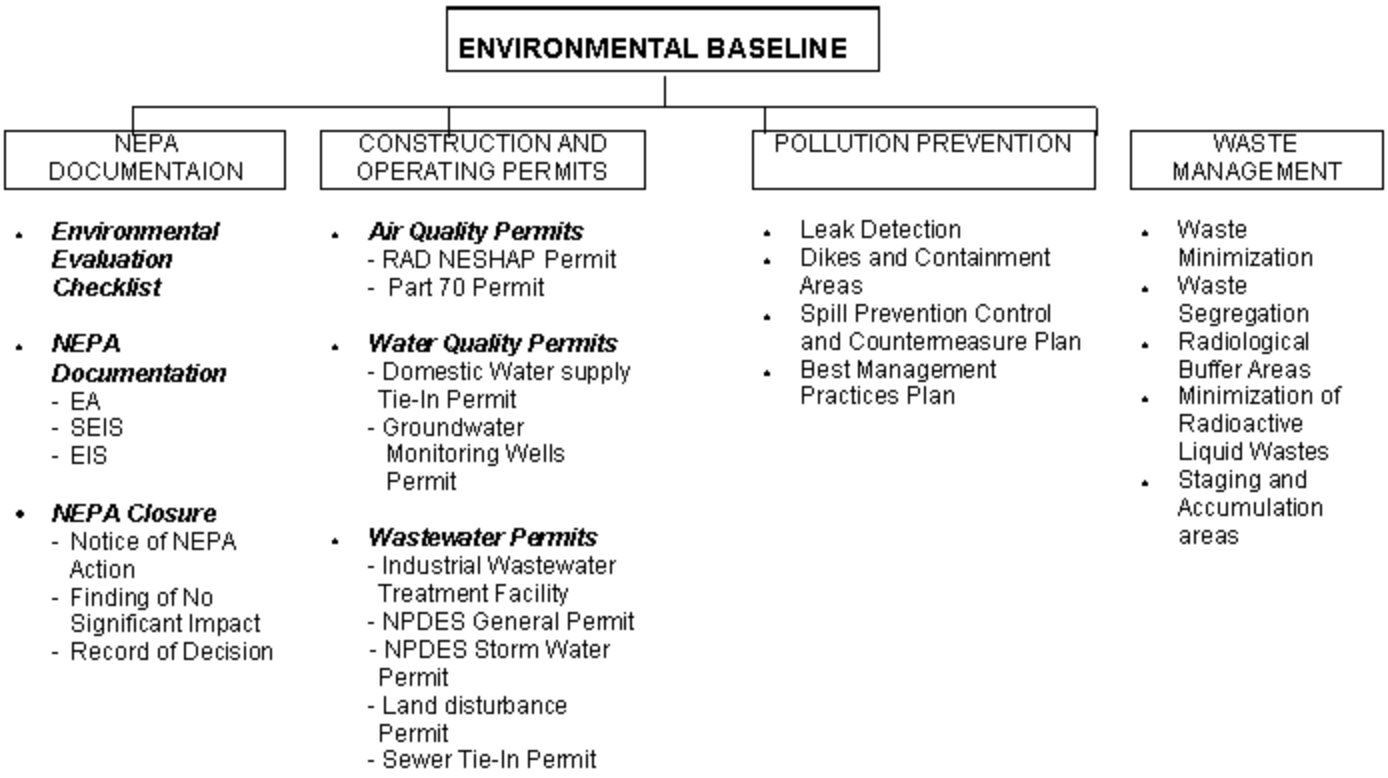
10 CFR 1021[5] describes the policy of DOE " to follow the letter and spirit of NEPA." This regulation requires DOE to apply NEPA review process in the planning stages for all DOE projects. At SRS, the contractor is to ensure that accurate and complete NEPA documentation is prepared (DOE-SR Directive DII5440.1A)[6]. These documents could include an Environmental Evaluation Checklist (EEC), Environmental Assessment (EA), Supplemental Environmental Impact Statement (SEIS), or Environmental Impact statement (EIS). For the SWPF, NEPA documentation is prepared to assess the impact of construction, operation, and decommissioning of the facility on the environment. DOE-SR Directive DII5440.1A requires that a NEPA checklist be prepared at SRS for a new facility to determine any effects on environmentally sensitive resources (threatened / endangered species, flood plains, wetlands, and archeological resources). A NEPA checklist (EEC) is prepared by the project team and submitted to DOE for review and approval prior to Title II design, procurement or construction of the project. DOE-SR review will establish if further NEPA documentation (i.e. EA or SEIS/EIS) is required. DOE issues a Record of Decision (ROD) upon completion of the NEPA process in accordance with 10 CFR 1021.

Construction and Operating Permits

"It is DOE policy to conduct its operations in an environmentally safe and sound manner. Accordingly, it is DOE policy to conduct the Department's operations in compliance with the letter and spirit of applicable environmental statutes, regulations, and standards," DOE Order 5400.1[7]. Environmental protection standards applicable at DOE facilities include Federal, State, and local statutes, regulations, and requirements. A permit plan will be developed to identify the required environmental permits for the construction and operation of the

SWPF. This plan also identifies the reliance of the project on site infrastructure at the SRS. The plan identifies the key project schedule interfaces and is used for establishing cost estimates. Environmental activities associated with this facility shall be constructed in accordance with the established guidelines in WSRC Manual 3Q[8] and the "HOW" Manual[9]. All permits that require inspection of constructed facilities are required prior to construction. Permits shall be required for the following categories of environmental issues: Air Quality Permits, Water Quality Permits, and Wastewater Permits.

Figure 1: Environemental Baseline Requirments for the Pollution Prevention



Air Quality Permits

All industrial air emissions in the State of South Carolina are regulated through the Bureau of Air Quality (BAQ) of the South Carolina Department of Health and Environmental Control (DHEC). The BAQ also has the delegated authority from the Environmental Protection Agency (EPA) to enforce Federal air regulations. The EPA issues all permits related to radioactive emissions. The BAQ requires that for all stationary sources in South Carolina, owners of industrial facilities must comply with the permitting requirements specified by DHEC prior to construction of the facility[10]. The BAQ also imposes permit limits for gaseous (point source and fugitive) emissions and particulate matter (PM). Based upon the potential emissions from the SWPF, two types of air permits shall be required, the RAD NESHAPs permit and the Part 70 permit under Title V of the Clean Air Act (CAA).

RAD NESHAP Permit

Federal Regulation 40 CFR 61[11] (Subpart H) requires that evaluation must be performed for any new construction in which radioactive material will be handled. To comply with this requirement, WSRC will be required to monitor and test air emissions from the SWPF. 40 CFR 61 requires that the dose to members of the public from multiple sources of radiation not exceed 10 mrem effective dose equivalent (EDE) per year. During the design of the facility, the EDE shall be estimated and identified in the permit application. The EPA issues this permit. A typical monitoring scheme utilizes isokineitic sampling or shrouded probe devices.

PART 70 Permit under Title V of CAA

This regulation applies to those facilities with the potential to emit over 100 tons of air pollutants, 10 tons or more of any single hazardous air pollutant (HAP), or any combination of HAPs totaling 25 tons per year. DOE Order 5400.1 requires that DOE facilities comply with the requirements for Part 70 Permits for airborne effluent monitoring and testing. Currently, the first Part 70 permit for the entire SRS site has been submitted to DHEC for approval. The DHEC BAQ issues this permit. This permit would be revised to include the anticipated emissions of HAPs from the construction and operations of the SWPF. The applicable regulations related to this permit application are found in SC R. 61-62.5[12]. The permit revision must be obtained prior to the construction of the facility. The permit application must include a list of all toxic air pollutants that may be emitted from the facility. Monitoring of these pollutants shall be in accordance with the approved EPA and DHEC methods as specified in the permit. Expected emissions from the Small Tank TPB Technology are nitrous oxides, carbon monoxide from operation of portable diesel generators, and volatile organic materials including benzene, biphenyl, methanol, and 2-propanol. The CST Non-Elutable Ion Exchange Technology is expected to emit nitrous oxides and carbon monoxide from operation of portable diesel generators.

Water Quality Permits

South Carolina has been granted authority by the EPA to administer the Safe Drinking Water Act. The South Carolina Pollution Control Act (PCA)[13] authorizes DHEC to develop regulations for the protection of drinking water. Under this authority, DHEC is also chartered to issue permits for the construction and operations of facilities for the protection of water resources, as described below.

Domestic Water Tie-In Permit

South Carolina Primary Drinking Water Regulation R.61-68[14] requires a permit for the construction of domestic water distribution systems. DHEC has granted permission to WSRC to construct extensions of water lines owned, designed and operated by WSRC at SRS. Approval by the Environmental Protection Department (EPD) of WSRC is required for such extensions prior to initiating construction, expansion or modification of the existing systems. Any extension of the site Domestic Water System to the SWPF will require EPD approval.

Groundwater Monitoring Wells

DOE Order 5820.2A[15] requires that groundwater monitoring wells be installed at and around the radioactive facilities. DOE Order 5400.1 requires that groundwater that has any potential of being contaminated due to DOE Operations should be monitored to determine the extent of contamination and impacts on quality of the groundwater. South Carolina Regulation R.61-71[16] defines the requirements for obtaining permits for drilling and construction of groundwater monitoring wells.. WSRC specifications for the construction and operation of monitoring wells are contained in the WSRC 3Q5 Manual[17]. For the construction of the SWPF, groundwater monitoring wells will be installed within the footprint of the building to assist with assessment of the risk of future decommissioning and decontamination, as well as those required by DOE Order 5820.2A around the facility.

Wastewater Permits

40 CFR 110[18] and 40 CFR 112[19] and the South Carolina Pollution Control Act (Sections 48-1-90 and 48-1-110[20]) specify that a permit must be obtained prior to the construction of any industrial wastewater treatment facility. These permits are required for discharges of cooling water, cooling tower blowdown, laboratory wastewater, and process wastewater to the environment, as well as storm water management as described below.

Industrial Wastewater Treatment Facility Permit

This permit is required for industrial facilities that treat wastewaters before construction begins. SC DHEC issues the construction and operating permits. SC R.61-9[21] provides details on the requirements for obtaining construction and operations permits. The SWPF is expected to be considered an industrial wastewater treatment facility by DHEC.

National Pollution Discharge Elimination System (NPDES) General Permit

NPDES permits place restrictions on effluent limits, discharge rates, and/or the concentration of pollutants in discharges from industrial facilities. SC DHEC requires that all wastewater discharges to the waters of the State be in compliance with NPDES permitting limits. The NPDES discharge limits are a major factor in determining the extent of wastewater treatment required in a facility.
At SRS, wastewater is generated from a number of facilities, including cooling tower blowdown, steam condensate, non-contact cooling water, and effluents from sanitary and industrial wasteewater treatment facilities. These discharges are routed to the nearest NPDES outfall. Each outfall is permitted under a consolidated site NPDES permit SC0000175[22]. For the construction of the SWPF, a modification of the existing permit would be required to define the quantities and qualities of the wastewater to be generated from this facility and discharged to the outfall. NPDES Permits are issued by the SC DHEC Industrial and Agriculture Wastewater Division.

Industrial Storm water General Permit

The Clean Water Act (CWA) provides that storm water discharges associated with industrial activities from a point source to waters of the United States are unlawful, unless authorized by a National Pollution Discharge Elimination System (NPDES) Permit. SC DHEC promulgated the NPDES General Permit[23] under SC R.61-9 regulation. This permit accommodated the storm water discharges with all new and existing point source discharges of storm water associated with industrial activities. For storm water associated with construction activities, SC DHEC has issued a separate NPDES General Permit[24]. This permit may authorize all discharges of storm water associated with industrial activity from construction site. The regulation (SC R.61-9) requires that all-new industrial facilities develop a Pollution Prevention Plan (PPP) prior to obtaining coverage under NPDES general permit. For the construction of the SWPF, the NPDES General Permit will be modified and a Notice of Intent (NOI) will be given to DHEC. Additionally a Pollution Prevention Plan will be developed for the area encompassing the facility.

Land Disturbance Activities

A storm water management and sedimentation reduction permit is required for any new project involving land disturbance greater than five (5) acres (SC R.72, Article 3) [25]. However, SC DHEC requires that a formal NOI be submitted by the owner of the facility for construction at any site where more than two acres of land is to be disturbed. Construction and operations for the SWPF are expected to result in disturbing more than two (2) acres of land. Therefore, an NOI will be submitted to SC DHEC for obtaining authorization for discharging storm water, under SC DHEC Permit SCR100000, during the construction activities

Sewer System Tie-In

SC R.61-9 requires construction permit for sanitary wastewater collection systems. The SWPF is expected to tie in to the existing sanitary wastewater collection system at SRS. This will require a construction permit from DHEC.

Pollution Prevention

At DOE facilities a Pollution Prevention Awareness Program is required, including a specific statement on the need for environmental protection. All mission statements and project plans shall recognize a requirement for pollution prevention, where appropriate (DOE Order 5400.1). A Spill Prevention Control and Countermeasure Plan (SPCCP) (40 CFR 110 and 40 CFR 112) and Best Management Practices Plan (BMPP) (40 CFR 125) [26] are required for the facility. SPCCP and BMPP are prepared as dictated by the Site NPDES General Permit requirements under the Clean Water Act. However, there are a number of additional requirements for pollution prevention that would be factored into the design for pollution controls, prior to the acquisition of the equipment. These requirements are as follows:

Leak Detection

DOE Order 5820.2A requires that leak detection systems be designed and operated for radioactive transfer lines and storage tanks. The leak detection system is installed to detect failure of the primary containment boundary; occurrence of release, and accumulation of liquids in the secondary containment systems. Therefore, the design of the SWPF will provide a leak detection system for the transfer lines and storage tanks containing radioactive wastes, and containment areas for the double wall transfer lines. Leak detection shall be a valuable tool in reducing the risk of release of radioactive materials to the environment.

Dikes and Containment Areas

40 CFR 125 requires developing and implementing a Best Management Practices (BMP) program in accordance with Sec.125.104. This program prevents free flow of pollutants to the environment, provides protection from uncontrolled releases, prevents inadvertent mixing of chemicals, and minimizes the potential for the release of toxic or hazardous pollutants from ancillary activities to waters of the United States. Containment areas and or dikes will be provided around each of the chemical storage tanks at the SWPF to fulfil these functions. The size of dikes and containment areas will be established during the conceptual design phase of the project.

Spill Prevention Control and Countermeasure Plan

40 CFR 110 requires the preparation of Spill Prevention Control and Countermeasure Plan (SPCCP). The SPCCP will be prepared as required by the Site NPDES General permit. The Site SPCCP[27] will be updated to incorporate the SWPF.

Best Management Practices Plan

40 CFR 125 requires the development and implementation of a Best Management Practices (BMP) program. This requirement is part of the NPDES General permit. The site BMP[28] plan will be updated to include SWPF.

Waste Management

At SRS, the waste management program includes the management of solid, radioactive, mixed, infectious and hazardous waste. The Savannah River Site is committed to minimizing the generation of waste by giving preference to source reduction, material substitution, and environmentally sound practices[29]. The SWPF design will include provisions for waste minimization and waste segregation and management of radioactive liquid wastes.

Waste Minimization

Traditionally waste management for reducing the volume has been done by best management practices. The Hazardous and Solid Waste Amendments Act of 1984 requires implementation of waste minimization policies, procedures and practices.. DOE Order 5400.1 and DOE Order 5820.2A require a focused effort in reducing wastes by adopting regulatory and reporting requirements. DOE Order 5400.1 requires that the management of wastes and other pollutants be accomplished in a manner that minimizes the waste generation. This Order also establishes guidelines for environmental protection and responsibilities for assessing compliance with the environmental laws. DOE Order 5820.2A states waste minimization practices shall be applied for the generation, treatment, storage, transportation, and or disposal of radioactive wastes and other hazardous wastes and pollutants. DOE Order 5820.2A requires that low-level waste generator preparing a design for a new process shall incorporate principles into the design that waste will be segregated and minimized. The design and construction of the SWPF design will provide provisions for waste volume reduction / waste minimization.

Waste Segregation

DOE 5820.2A describes how solid radioactive waste is treated, packaged, stored, transported and disposed. Radiological operations generating radioactive waste should promote minimization and permit segregation of radioactive waste from non-radioactive waste (clean waste). Hazardous wastes, such as solvent rags, and chemicals will be stored separately from general waste streams to prevent cross contamination of non-hazardous materials and or wastes. Therefore, waste segregation provisions will be included in the design of the SWPF.

Radiological Buffer Areas

DOE 5820.2A describes how solid radioactive waste is treated, packaged, stored, transported and disposed. Radiological Buffer Areas (RBA) and storage are provided to prevent inadvertent radioactive contamination of other materials. For the SWPF, the design will provide for Radiological Buffer Areas. The entry of radiological materials in a Radiological Buffer Area will be restricted to control the spread of contamination.

Minimization of Liquid Radioactive Waste

DOE Order 5820.2A provides criteria for minimizing the generation of radioactive liquid wastes. A water management program is required to identify, trend and eliminate unnecessary sources of radioactive liquid waste and liquid mixed waste. This program should include aggressive measures to identify and repair leaks. DOE Order 5400.5[30] provides radioactive liquid waste discharge requirements. Guidance for minimizing the generation of radiological waste and discharges to the environment, controlling contamination at its source and reducing radiation exposure to workers and the public are contained in DOE manual DOE/EH-0256T[31], Part 121.11. The design of the SWPF will include provisions for waste minimization and volume reduction of radioactive liquid waste. Minimization will include evaluation of operational requirements to reduce liquid usage and maximize recycling activities. Radioactive liquid waste discharges shall be controlled on a batch basis to enhance monitoring capability and to reduce the potential for inadvertent release.

Satellite and Staging Area

SC R. 61-79.262[32] governs the management of hazardous wastes. This regulation allows that 55-gallon drums used for temporary storage of hazardous wastes can be stored at Staging Area, located at or near the facility prior to shipment to an Accumulation area. The design of a facility should provide space for a Satellite Area near each point of generation for two (2) 55-gallon drums for receiving hazardous wastes. Additionally, Staging Areas near each point of generation for 3 to 5 55-gallon drums for 90 days storage of hazardous wastes shall also be included in the design. SC R. 61-79.262.34 requires that 55-gallon drums can be stored at Staging Area, located at or near the facility prior to shipment to the Accumulation area. These drums are used for storing hazardous wastes until full. At the SWPF chemicals will be used for laboratory analyses, and therefore, the drums would be used for storing hazardous wastes until full. At SRS, the waste management program includes the management of solid, radioactive, mixed, infectious and hazardous waste. The Savannah River Site is committed to

minimizing the generation of waste by giving preference to source reduction, material substitution, and environmentally sound practices[33]. The SWPF design will include provisions for waste minimization and waste segregation and management of radioactive liquid wastes.

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Conclusion

The Savannah River Site is proceeding with development of a process for treating highly radioactive salt waste utilizing a technology assessment process. The two alternative technologies proposed are Small Tank TPB Precipitation and CST Non-Elutable Ion Exchange. Following further technology development, a final technology selection will be made. Construction and safe operation of a Salt Waste Processing Facility will require compliance with all Federal, State and local environmental regulatory requirements for pollution control. To ensure that regulatory requirements are factored into the project, a regulatory requirement baseline has been established and identified at the conceptual design phase. The regulatory requirement baseline established is not dependent on the final technology selected, but can be applied to either technology option. This approach will ensure that regulatory compliance is incorporated at the earliest stages of design and construction, which is expected to ensure that the full intent of the regulatory requirements are met in a cost effective manner.

Acknowledgement

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