DOE/EA-2154

DRAFT ENVIRONMENTAL ASSESSMENT FOR THE COMMERCIAL DISPOSAL OF SAVANNAH RIVER SITE CONTAMINATED PROCESS EQUIPMENT

December 2021

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ACRONYMS AND ABBREVIATIONS

AEA	*Atomic Energy Act of 1954*
ALARA	as low as reasonably achievable
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
CO	carbon monoxide
DOE	U.S. Department of Energy
DWPF	Defense Waste Processing Facility
DWPF Final EIS	*Final Environmental Impact Statement for the Defense Waste Processing Facility, Savannah River Plant, Aiken, South Carolina*
EA	environmental assessment
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FMCSA	Federal Motor Carrier Safety Administration
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FWF	WCS Federal Waste Facility
FY	fiscal year
HEPA	high-efficiency particulate air
HLW	high-level radioactive waste
IP-2	Industrial Package-2
LCF	latent cancer fatality
LLW	low-level radioactive waste
MLLW	mixed low-level radioactive waste
mrem	millirem
NAAQS	National Ambient Air Quality Standards
NEPA	*National Environmental Policy Act of 1969*
NO_x	nitrogen oxides
NRC	Nuclear Regulatory Commission
NWPA	*Nuclear Waste Policy Act of 1982*
PCB	polychlorinated biphenyl
PM_n	particulate matter less than or equal to n microns in aerodynamic diameter
ppb	parts per billion
ppm	parts per million
RCRA	*Resource Conservation and Recovery Act*
RWP	radiation work plan
SEIS	supplemental environmental impact statement
SNF	spent nuclear fuel
SO_x	sulfur oxides
SRNL	Savannah River National Laboratory
SRNS	Savannah River Nuclear Solutions
SRR	Savannah River Remediation LLC
SRS	Savannah River Site
SRS Contaminated Process Equipment EA	*Environmental Assessment for the Commercial Disposal of SRS Contaminated Process Equipment*

SWM	solid waste management
TAC	*Texas Administrative Code*
TFF	Tritium Finishing Facility
TRU	transuranic
U.S.C.	United States Code
USDOT	U.S. Department of Transportation
VOC	volatile organic compounds
WCS	Waste Control Specialists LLC
WIPP	Waste Isolation Pilot Plant
WIPP LWA	*Waste Isolation Pilot Plant Land Withdrawal Act*
WM PEIS	*Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste*

1 INTRODUCTION

1.1 Introduction

The Savannah River Site (SRS) occupies approximately 310 square miles primarily in Aiken and Barnwell counties in South Carolina (Figure 1-1). Over the years, a primary SRS mission has been the production of special radioactive isotopes to support national defense programs, including the reprocessing of spent nuclear fuel (SNF) and target materials. More recently, the SRS mission has also emphasized waste management, environmental restoration, and the decontamination and decommissioning of facilities that are no longer needed for SRS's traditional defense activities. SRS generated large quantities of liquid radioactive waste as a result of reprocessing activities associated with its nuclear materials production mission. This liquid radioactive waste has historically been managed as high-level radioactive waste (HLW). The waste was placed into underground storage tanks at SRS and consists primarily of three physical forms: sludge, saltcake, and liquid supernatant.[1] The sludge portion in the underground tanks is being transferred to the on-site Defense Waste Processing Facility (DWPF) for vitrification in borosilicate glass to immobilize the radioactive constituents, as described in the *Final Supplemental Environmental Impact Statement—Defense Waste Processing Facility* (DOE/EIS-0082-S) (DOE 1994) and subsequent Record of Decision (Volume 60 of the *Federal Register*, page 18589 [60 FR 18589]). The resulting vitrified waste form is poured as molten glass into production canisters where it cools into a solid glass-waste and is securely stored at SRS until the U.S. Department of Energy (DOE) establishes a disposal pathway.

The on-site storage and treatment of reprocessing waste has and will continue to generate contaminated process equipment. Historically, certain contaminated equipment has been stored in various configurations at SRS awaiting a potential disposal pathway. This environmental assessment (EA) evaluates the potential environmental impacts associated with the commercial disposal of the following SRS contaminated process equipment: (1) Tank 28F salt sampling drill string (pipe) used for salt sampling in a waste tank, (2) glass bubblers currently used in the DWPF vitrification process, and (3) glass pumps previously used in the DWPF vitrification process. Chapter 2 provides more specific details on the contaminated process equipment.

[1] Sludge components of radioactive liquid waste consist of the insoluble solids that have settled to the bottom of the waste storage tanks. Radionuclides present in the sludge include fission products (such as strontium-90) and long-lived actinides. Supernatant is the liquid portion of the waste stored with the sludge and saltcake. The combination of supernatant and saltcake is referred to as salt waste.

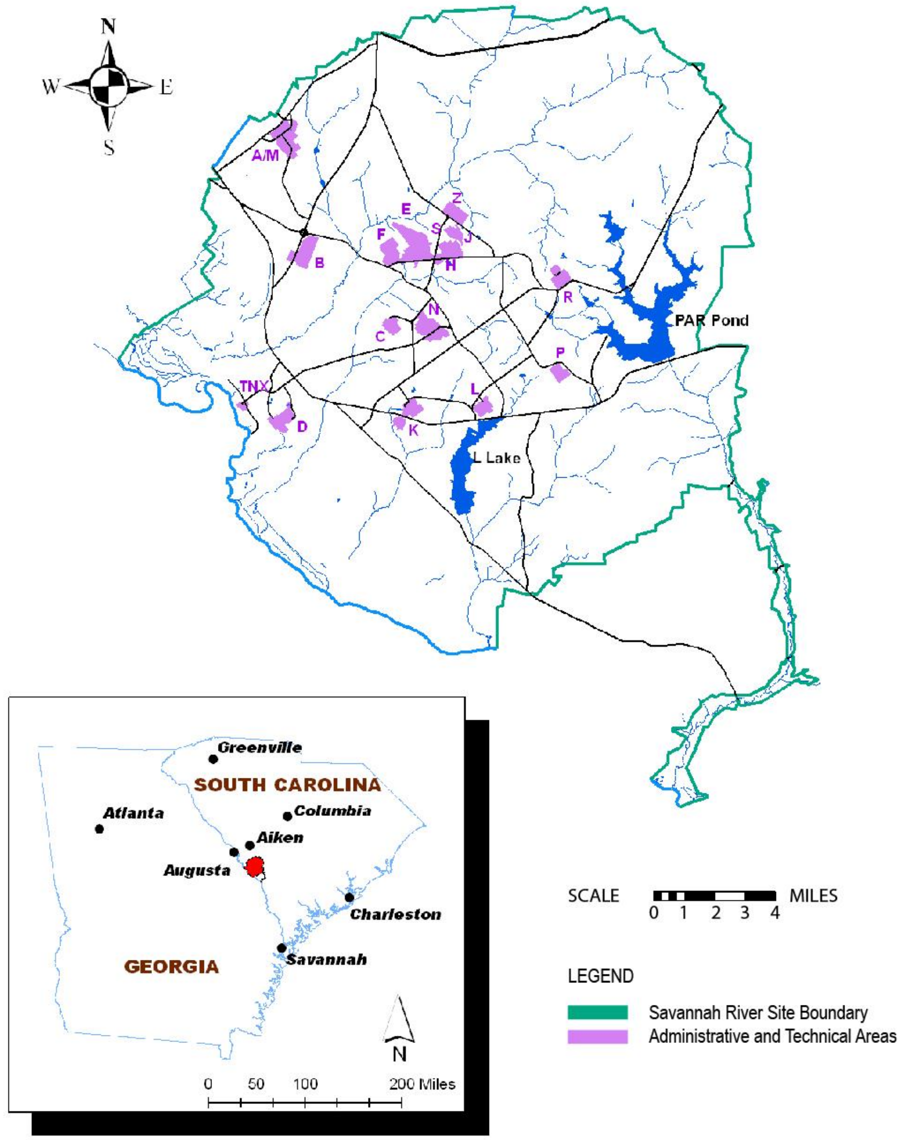

Figure 1-1. Location of Savannah River Site

1.2 Background

On October 10, 2018, DOE published a notice in the *Federal Register* (FR) requesting public comment on its interpretation of the definition of the statutory term, "high-level radioactive waste," as set forth in the *Atomic Energy Act of 1954* (AEA; Title 42 of the United States Code (U.S.C.), Section 2011 [42 U.S.C. § 2011], et seq), as amended, and the *Nuclear Waste Policy Act of 1982*, as amended (NWPA; 42 U.S.C. § 10101 et seq) (83 FR 50909). In that notice, DOE explained the history and basis for the HLW interpretation that enables some reprocessing waste to be disposed of in accordance with its radiological characteristics and not solely where it came from. Subsequently, on June 10, 2019, DOE published a supplemental notice in the *Federal Register* that provided additional explanation of DOE's interpretation as informed by public review and comment and further consideration by DOE (84 FR 26835). DOE revised the HLW interpretation after consideration of public comments, which included comments from the U.S. Nuclear Regulatory Commission (NRC), affected states, Tribal Nations, and other stakeholders, in order to clarify its meaning and import. According to the HLW interpretation, defense reprocessing waste may be determined to be non-HLW if the waste meets either of the following two criteria:

1. Does not exceed concentration limits for Class C low-level radioactive waste (LLW) as set out in Title 10 of the *Code of Federal Regulations* (CFR) 61.55 and meets the performance objectives of a disposal facility, or

2. Does not require disposal in a deep geologic repository and meets the performance objectives of a disposal facility as demonstrated through a performance assessment conducted in accordance with applicable requirements.

NRC's performance objectives for commercial LLW disposal facilities are specified in 10 CFR Part 61, Subpart C, "Performance Objectives." Performance objectives are the quantitative radiological standards set by the NRC or DOE to ensure protection of the health and safety of individuals and the environment during operation and after permanent closure of the disposal facility. Performance assessments quantitatively evaluate a disposal facility's ability to protect human health and the environment by evaluating potential radiological human exposure after disposal facility closure. Performance assessments evaluate risk by analyzing the long-term evolution of the waste forms and engineered features and the effect such changes could have on the performance of a waste disposal system. As part of its normal process for analyzing waste for management, stabilization, and disposition, sampling and characterization of the waste is performed, which provides DOE with the necessary assurance that the waste would meet the commercial disposal facility requirements. DOE would apply this process to the disposal of the SRS contaminated process equipment.

As stated in the supplemental notice, DOE will continue its current practice of managing all of its reprocessing wastes as if they were HLW unless and until a specific waste is determined to be another category of waste based on detailed assessments associated with criteria one or two above.

This is the second *National Environmental Policy Act* (NEPA; 42 U.S.C. § 4321 et seq.) analysis involving the proposed application of the HLW interpretation. The *Final Environmental Assessment for the Commercial Disposal of Defense Waste Processing Facility Recycle Wastewater from the Savannah River Site* was the first EA and waste stream evaluated under DOE's HLW interpretation. On August 10, 2020, DOE published a Finding of No Significant Impact (FONSI) and notified the public of DOE's intent to dispose of eight gallons of SRS DWPF recycle wastewater at a commercial LLW disposal facility located outside of South Carolina and licensed by either the NRC or an Agreement State (85 FR 48236).[2] In September

[2] Congress authorized the NRC to enter into agreements with states that allow the states to assume, and the NRC to discontinue, regulatory authority over source, byproduct, and small quantities of special nuclear material. The states, known as Agreement States, can then regulate byproduct, source, and small quantities of special nuclear materials that are covered in the agreement, using its own legislation, regulations, or other legally binding provisions (see AEA Section 274b).

2020, DOE shipped eight gallons of SRS DWPF recycle wastewater to the Waste Control Specialists LLC (WCS), facility in Andrews County, Texas, for stabilization and disposal.

1.3 Purpose and Need for Agency Action

Certain SRS process equipment (i.e., Tank 28F salt sampling drill string, glass bubblers, and glass pumps) is contaminated with reprocessing waste and is currently conservatively managed as HLW, which is required to be disposed of in a geologic repository. Because the NRC has not licensed a repository in the United States, there is no current disposal pathway for the SRS contaminated process equipment. Portions of the Tank 28F salt sampling drill string, glass bubblers, and glass pumps are comprised of hazardous components (e.g., lead) or are contaminated with hazardous constituents. Because there are no permitted facilities at SRS for the disposal of mixed LLW (MLLW), this contaminated process equipment cannot be disposed of on-site. Therefore, the purpose and need for DOE's action is to identify a disposal pathway for the SRS contaminated process equipment to mitigate on-site storage constraints, improve worker safety, and support accelerated completion of the environmental cleanup mission at SRS.

1.4 Proposed Action Evaluated in this Environmental Assessment

This *Draft Environmental Assessment for the Commercial Disposal of SRS Contaminated Process Equipment* (Draft SRS Contaminated Process Equipment EA) analyzes DOE's Proposed Action of disposing of the SRS contaminated process equipment at a commercial LLW disposal facility outside of South Carolina licensed by either the NRC or an Agreement State under 10 CFR Part 61. Prior to a disposal decision, DOE would characterize the contaminated process equipment to verify with the licensed off-site commercial LLW disposal facility whether the waste meets the DOE HLW interpretation Criterion 1 for disposal as non-HLW, in accordance with DOE Manual 435.1-1, *Radioactive Waste Management Manual*.[3] DOE would demonstrate compliance with the waste acceptance criteria and all other requirements of the disposal facility, including any applicable regulatory requirements (e.g., *Resource Conservation and Recovery Act*; [RCRA] 42 U.S.C. § 6901) for management of the waste prior to disposal and applicable U.S. Department of Transportation (USDOT) requirements for packaging and transportation from SRS to the commercial disposal facility.[4] DOE has identified two action alternatives for this Proposed Action.

- **Alternative 1:** If determined to be Class B or Class C LLW,[5] DOE would stabilize and package the waste at SRS and ship the waste packages to WCS in Andrews County,

[3] On January 19, 2021, DOE published a *Federal Register* notice announcing the availability of a limited change to DOE Manual 435.1-1, *Radioactive Waste Management Manual*, to formally incorporate the Department's HLW interpretation, as described in Section 1.2 of this EA (86 FR 5173).
[4] Regulating the safety of nuclear materials shipments is the joint responsibility of the NRC and the USDOT. NRC establishes requirements for the design and manufacture of packages for radioactive materials. The USDOT regulates the shipments while they are in transit and sets standards for labeling and smaller quantity packages.
[5] In its 10 CFR Part 61 regulations, NRC has identified classes of LLW—Class A, B, or C—for which near-surface disposal is safe for public health and the environment. This waste classification regime is based on the concentration levels of a combination of specified short-lived and long-lived radionuclides in a waste stream, with Class C LLW having the highest concentration levels.

Texas, for disposal.[6] Implementation would be dependent upon the waste meeting the facility's waste acceptance criteria, among other requirements.

- **Alternative 2:** If determined to be Class A LLW, DOE would stabilize and package the waste at SRS and ship the waste packages to either Energy*Solutions*[7] in Clive, Utah, or WCS in Andrews County, Texas, for disposal. Implementation would be dependent upon the waste meeting the facility's waste acceptance criteria, among other requirements.

The analyzed alternatives are discussed in more detail in Sections 2.2 and 2.3 of this Draft SRS Contaminated Process Equipment EA. DOE also evaluates a No-Action Alternative, as required by 10 CFR 1021.321(c).

1.5 National Environmental Policy Act Documents Related to the Proposed Action

This section identifies and discusses other NEPA documents that are relevant to this Draft SRS Contaminated Process Equipment EA. Decisions resulting from these other NEPA analyses have affected operations/activities related to radioactive waste management at SRS.

- **Final Environmental Impact Statement for the Defense Waste Processing Facility, Savannah River Plant, Aiken, South Carolina (DWPF Final EIS)** (DOE/EIS-0082; DOE 1982). This EIS provided environmental input into both the selection of an appropriate strategy for the permanent disposal of HLW stored at SRS and the subsequent decision to construct and operate the DWPF. Following the Record of Decision (47 FR 23801, June 1, 1982), construction of DWPF began in late 1983, and radioactive operations began in March 1996. The EIS provides estimates for the annual volumes of wastes generated at DWPF, including replacement process equipment, some of which is the subject of the Proposed Action in this Draft SRS Contaminated Process Equipment EA.

- **Final Supplemental Environmental Impact Statement for the Defense Waste Processing Facility, Savannah River Site, Aiken South Carolina** (DOE/EIS-0082-S; DOE 1994). This supplemental EIS (SEIS) evaluated DWPF design changes that occurred since the DWPF Final EIS (DOE 1982) evaluated potential impacts of DWPF construction and operation. This SEIS is relevant because it contains the most recent evaluation of potential environmental impacts associated with operation of DWPF, which includes the disposition of contaminated process equipment.

- **Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (WM PEIS)** (DOE/EIS-0200; DOE 1997). In the 1990s, DOE anticipated a need for managing wastes at locations other than where the waste was generated. In order to address this need, DOE conducted analyses for management of radioactive and hazardous

[6] Because the SRS contaminated process equipment would most likely result in Class B or Class C LLW, this has been identified as the first alternative.
[7] Energy*Solutions* is currently licensed to only dispose of Class A LLW and mixed LLW; WCS is licensed to dispose of Class A, Class B, and Class C LLW and MLLW.

wastes, including LLW. The WM PEIS analyzed the transportation of large volumes of LLW across the country for treatment and disposal. This Draft SRS Contaminated Process Equipment EA summarizes and incorporates by reference some of the analyses used to determine potential health and safety impacts from transportation of LLW on the Nation's highways.

- **High-Level Waste Tank Closure Final Environmental Impact Statement, Aiken South Carolina (HLW Tank Closure EIS)** (DOE/EIS-0303; DOE 2002). DOE prepared this EIS to evaluate the proposed action to close the tanks at SRS in accordance with applicable laws and regulations, DOE orders, and the *Industrial Wastewater General Closure Plan for F-Area Waste Tank Systems* (Savannah River Remediation LLC (SRR) 2011) (approved by the South Carolina Department of Health and Environmental Control), which specifies the management of residuals as waste incidental to reprocessing. The EIS evaluated three alternatives regarding the tanks at SRS: the Stabilize Tanks Alternative, the Clean and Remove Tanks Alternative, and the No-Action Alternative. Under the Stabilize Tanks Alternative, the EIS considered three options for tank stabilization: Fill with Grout (Preferred Alternative), Fill with Sand, and Fill with Saltstone. The HLW Tank Closure EIS also evaluated disposal of equipment contaminated with tank wastes, which is applicable to the Proposed Action in this EA.

- **Final Environmental Assessment for the Commercial Disposal of Defense Waste Processing Facility Recycle Wastewater from the Savannah River Site** (DOE/EA-2115; DOE 2020a). This EA and associated FONSI evaluated the disposal of up to 10,000 gallons of DWPF recycle wastewater from the SRS H-Area Tank Farm at a commercial LLW facility located outside of South Carolina and licensed by either the NRC or an Agreement State under 10 CFR Part 61. Based on implementation of the HLW interpretation, small quantities of the SRS DWPF recycle wastewater were shipped from SRS for stabilization and disposal at WCS.

1.6 Scope of this Environmental Assessment and Organization

In accordance with NEPA and the Council on Environmental Quality's (CEQ's) and DOE's implementing procedures at 40 CFR Parts 1500 to 1508 and 10 CFR Part 1021, respectively "National Environmental Policy Act Implementing Procedures," DOE prepared this Draft SRS Contaminated Process Equipment EA to assess whether the potential environmental impacts of the Proposed Action and alternatives would be significant to human health and the environment and thus determine whether to prepare an EIS or a FONSI. As such, this Draft SRS Contaminated Process Equipment EA:

- Provides an introduction and background discussion of the Proposed Action and the purpose and need for the DOE action (Chapter 1);

- Describes details associated with the Proposed Action and the alternatives analyzed (Chapter 2);

- Describes the existing environment relevant to potential impacts of the alternatives and analyzes the potential environmental impacts that could result from the alternatives (Chapter 3);
- Presents a list of the agencies consulted in the preparation of this Draft SRS Contaminated Process Equipment EA (Chapter 4);
- Presents a bibliographic listing of the references cited in this Draft SRS Contaminated Process Equipment EA (Chapter 5); and
- Provides estimated radionuclide concentrations for the contaminated process equipment (Appendix A).

Certain aspects of the Proposed Action and alternatives have a greater potential for creating adverse environmental impacts than others. For this reason, CEQ regulations (40 CFR 1502.1 and 1502.2) recommend that agencies "focus on significant environmental issues and alternatives," and discuss impacts "in proportion to their significance." Section 3.2 of this Draft SRS Contaminated Process Equipment EA presents the resource screening review that DOE used to determine which resources required the most detailed analysis.

Any proposal to dispose of additional SRS process equipment contaminated with reprocessing waste, other than those identified and analyzed in this Draft SRS Contaminated Process Equipment EA, would be evaluated in separate NEPA documentation.

1.7 Public Involvement

On January 19, 2021, DOE published a *Federal Register* notice to announce its intent to prepare this Draft SRS Contaminated Process Equipment EA (86 FR 5175). DOE did not receive any comments or other communications in response to the *Federal Register* notice. DOE has released this Draft SRS Contaminated Process Equipment EA for public review. DOE will consider public comments received on the Draft SRS Contaminated Process Equipment EA during the preparation of the Final SRS Contaminated Process Equipment EA.

2 DESCRIPTION OF SRS CONTAMINATED PROCESS EQUIPMENT AND OVERVIEW OF THE PROPOSED ACTION ALTERNATIVES

As documented in Section 1.4, the DOE Proposed Action is to dispose of the SRS contaminated process equipment at a commercial LLW facility outside of South Carolina licensed by either the NRC or an Agreement State under 10 CFR Part 61. Section 2.1 of this Draft SRS Contaminated Process Equipment EA provides a description of the specific contaminated process equipment. As discussed in Sections 2.2 and 2.3, DOE has identified two alternatives for implementing the Proposed Action.

2.1 Contaminated Process Equipment

The SRS contaminated process equipment continues to be generated during the on-site treatment of reprocessing waste. The Draft SRS Contaminated Process Equipment EA addresses a Tank 28F salt sampling drill string, glass bubblers, and glass pumps. Portions of the Tank 28F salt sampling drill string, glass bubblers, and glass pumps are comprised of hazardous components (e.g., lead) or are contaminated with hazardous constituents. Because there are no permitted facilities at SRS for the disposal of MLLW, this contaminated process equipment cannot be disposed of on-site. Each of these waste items is discussed in more detail below:

- **<u>Tank 28F salt sampling drill string</u>:** This piece of equipment was used to collect reprocessing waste samples from the waste storage tank in F-Area. The Tank 28F salt sampling drill string consists of steel piping measuring 2.25 inches in outer diameter by 41 feet long, contaminated with reprocessing waste (supernatant) from Tank 28F. Contaminants include a mixture of radionuclides (e.g., cesium-137 and plutonium-238). Appendix A to this Draft SRS Contaminated Process Equipment EA includes a description of the specific radionuclide inventory on the Tank 28F salt sampling drill string. The Tank 28F drill string is currently stored in a large container in a high-radiation area south of the H-Area Tank Farm until a disposal path can be established. The container is approximately 36 feet long and is referred to as a "B-36" disposal container. The Tank 28F salt sampling drill string was cut into two pieces before storage. The B-36 was placed in its current storage location in March 2006 (Figure 2-1). The Tank 28F salt sampling drill string is covered with lead blankets inside the B-36 to lower the external radiological dose rate outside of the container.

  Details related to how the Tank 28F salt sampling drill string would be prepared for transportation and disposal are provided in Section 2.2.1.1.

Figure 2-1. Exterior of B-36 Disposal Container and Actual Tank 28F Salt Sampling Drill String and Lead Blankets in B-36

- **<u>Glass bubblers</u>:** These pieces of equipment are currently used to increase efficiency of DWPF melter operations, where high-activity tank waste is vitrified into glass under high temperature. Each glass bubbler is made up of a ¾-inch Inconel[8] pipe, which is inserted into the DWPF melter and through which an inert gas is introduced to increase melter efficiency. During operations, approximately three feet of the lower portion of the bubbler is submerged in the melt pool and becomes contaminated with various radionuclides (e.g., cesium-137 and plutonium-238). Appendix A to this Draft SRS Contaminated Process Equipment EA includes a description of the estimated radionuclide inventory associated with the glass bubblers. The total length of each complete bubbler assembly is between 8.8 feet and 9.4 feet, as there are four design lengths based on the bubbler location in the melter. SRS currently has approximately 60 contaminated bubblers in storage and is expected to generate four contaminated glass bubblers every six months until DWPF operations are completed in the 2034 timeframe. Based on the glass bubbler replacement rate of eight bubblers annually, DOE projects a need to dispose of approximately 172 bubblers by the forecasted end of DWPF operations. The bubblers are currently stored inside the DWPF canyon building. Figure 2-2 provides a sample drawing of a glass bubbler assembly.

  Details related to how the glass bubblers would be prepared for transportation and disposal are provided in Section 2.2.1.2.

[8] Inconel is a metal alloy of nickel containing chromium and iron and is corrosion resistant at high temperatures.

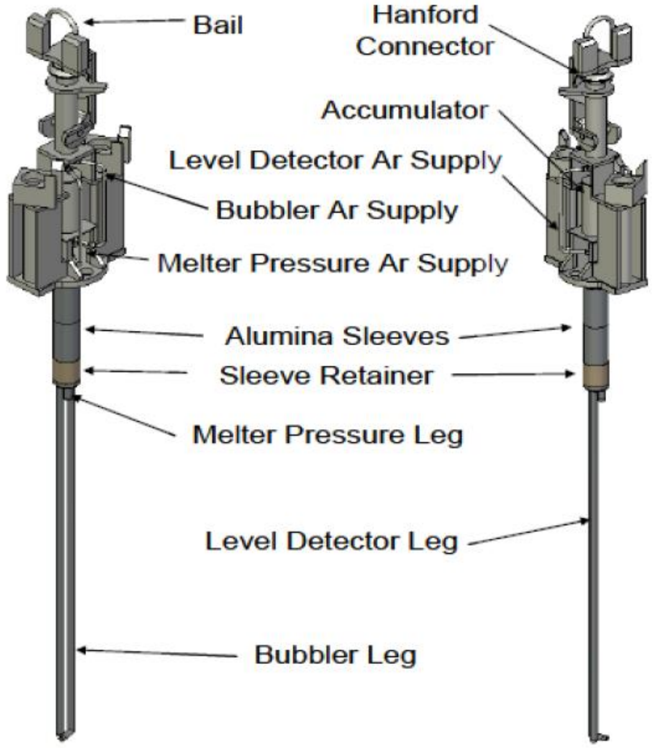

Figure 2-2. Glass Bubbler

- **Glass pumps:** These pieces of equipment were previously used to support melter efficiency but have been replaced by the glass bubblers and therefore are no longer generated at SRS (Figure 2-3). Each glass pump includes a section of Inconel pipe (upper photo in Figure 2-3), measuring approximately 3.625 inches in outer diameter; only the lower portion (two feet) of which was in the melt pool and contains contaminated glass. The overall glass pump (lower photo in Figure 2-3) is about 11 feet long. Appendix A to this Draft SRS Contaminated Process Equipment EA includes a description of the estimated radionuclide inventory on the glass pumps. There are approximately 10 glass pumps in storage at SRS requiring final disposal. Similar to the glass bubblers, the glass pumps are currently stored inside the DWPF canyon building and would be remotely handled in the canyon as part of DWPF operations.

  The glass pumps would be prepared for transportation and disposal in a similar manner as the glass bubblers; details are provided in Section 2.2.1.2.

Based on data presented in Appendix A, the radiological profile of the disposal containers proposed for all three waste items would not exceed Class C LLW limits, in accordance with NRC waste classification tables (10 CFR 61.55).[9]

[9] *Texas Administrative Code* (30 TAC 336.362) and *Utah Administrative Code* (R313-15-1009) include radium-226 as an additional radionuclide for determining LLW classification. A waste stream must meet all regulatory requirements (NRC and state) prior to disposal in that state. The Texas concentration limits are found at https://texreg.sos.state.tx.us/fids/30_0336_0362-1.html, and the Utah concentration limits are found at https://rules.utah.gov/publicat/code/r313/r313-015.htm#T47.

Figure 2-3. Close-up of Inconel Pipe (a) and Glass Pump (b)

Each disposal facility has its own waste acceptance criteria, which are dictated in part by the physical characteristics of a site. The performance objectives (10 CFR Part 61, Subpart C) are central to the level of health and safety and environmental protection that a commercial LLW disposal facility must satisfy. These objectives address protection from releases of radioactivity, operations, inadvertent intrusion, and long-term stability. Prior to packaging and shipment of any specific container, DOE would also determine (and validate with the licensee of the disposal facility) that the contaminated process equipment would meet the facility's waste acceptance criteria, that is, the technical and administrative requirements a waste must meet to be accepted at a disposal facility (e.g., waste characterization, waste form acceptability, quality assurance) and established to ensure the disposal facility, in total, meets its performance objectives.

2.2 Alternative 1: Stabilize and Package Class B or Class C LLW at SRS and Ship to WCS

Under Alternative 1, if it is determined that the contaminated process equipment would be Class

B or Class C LLW,[10] DOE would stabilize and package the waste at SRS and ship the waste packages[11] to the WCS Federal Waste Facility (FWF) in Andrews County, Texas, for disposal. Implementation of Alternative 1 would be dependent upon waste characteristics and facility waste acceptance criteria. Alternative 1 includes the following activities:

- Prepare Tank 28F salt sampling drill string for transport
  - Prepare the B-36 disposal container with the Tank 28F salt sampling drill string to ensure that the package would satisfy the WCS waste acceptance criteria.
  - Load the B-36 into a USDOT-certified container that meets appropriate packaging and transportation requirements.[12]
- Prepare glass bubblers and glass pumps for transport
  - Prepare the disposal containers containing the glass bubblers and/or glass pumps and load each disposal container into a transportation container that meets appropriate USDOT-certified packaging and transportation requirements. Ensure that the disposal container would satisfy the WCS waste acceptance criteria.
- Transport the USDOT-certified transportation containers by truck to the WCS site.
- Dispose of the waste and disposal containers in accordance with final waste classification and waste acceptance criteria.
- Return the USDOT-certified transportation containers (and any temporary shielding) from WCS to SRS for re-use.

2.2.1 On-Site Waste Preparation

The on-site waste preparation differs slightly between the contaminated process equipment. Therefore, each equipment type is discussed individually below.

2.2.1.1 Tank 28F Salt Sampling Drill String

As part of the preparation for packaging and transportation of the Tank 28F salt sampling drill string, DOE would drill two or more holes in the B-36 and fill the void space in the container. The lower portion of the B-36 container would be filled with a cementitious grout to stabilize the Tank 28F salt sampling drill string and lead blankets and to provide necessary radiation shielding for the top and sides of the container. The balance of the void space in the B-36 above the grout would be filled with an inert, stabilizing foam.[13] The foam expands and cures (hardens) within minutes. The relative amounts of grout and foam would be determined based on the container-specific radiation doses at the time of waste preparation. This process is standard practice when

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[10] In its 10 CFR Part 61 regulations, NRC has identified classes of LLW—Class A, B, or C—for which near-surface disposal is safe for public health and the environment. This waste classification regime is based on the concentration levels of a combination of specified short-lived and long-lived radionuclides in a waste stream, with Class C LLW having the highest concentration levels.

[11] Also referred to throughout this EA as disposal containers. The waste package or disposal container is the container that is emplaced in the disposal facility while the transportation container houses the disposal container(s) during transport to the LLW facility.

[12] Packages intended for transport of radiological materials must meet USDOT requirements provided in 49 CFR Subchapter C, "Hazardous Materials Regulations."

[13] Stabilizing foam would be Dow Chemical Froth-Pak Foam Insulation, or equivalent, which has been used previously at SRS (Savannah River Nuclear Solutions (SRNS) 2014b).

disposing of loose solid materials in a disposal container to meet waste acceptance criteria and eliminate void spaces in the disposal container.

After the stabilizing foam has cured, DOE would use a crane to place the B-36 in a hazardous material freight (transportation) container that meets the applicable USDOT requirements for transportation of hazardous (radiological) materials. (SRNS [2014a] provides an example of current specifications.) An example transportation container would be four to six feet tall and approximately 40 feet long (Figure 2-4). During the loading process, DOE would ensure that the transportation container did not become radiologically contaminated. As needed, temporary shielding would be placed inside the transportation container (under and around the B-36 disposal container) to ensure that dose rates outside of the transportation container were within guidelines for transport and the container stabilized as necessary to prevent movement during transportation. The transportation container would be loaded onto a standard semi-truck and trailer for transportation to the disposal facility. Once at the commercial disposal facility, the B-36 would be removed from the transportation container for disposal in accordance with site-specific procedures. DOE does not expect that the temporary shielding and transportation container would be radiologically contaminated and assumes that they would be returned to SRS for re-use.

The waste preparation activities would likely take a few weeks of field work with only several partial days of hands-on work with the B-36 container. The hands-on work would include drilling holes in the B-36, grouting setup and operations, foaming setup and operations, and container hole closure. Most of the remaining time would be associated with staging the contaminated equipment, materials, packages, and truck. The analysis also assumes additional time to load the B-36 into the certified transportation container (including placement of temporary shielding).

Figure 2-4. Typical Hazardous Freight (Transportation) Container with Removable Top

2.2.1.2 Glass Bubblers and Glass Pumps

Because the preparation of glass bubblers and glass pumps would follow the same processes, they are jointly discussed in this section. As mentioned in Section 2.1, the bubblers and pumps are currently stored in the SRS DWPF canyon.

DOE would procure an industrial disposal container properly sized for disposal of up to six glass bubblers (or pumps). The empty disposal container would be placed in the DWPF railroad well and would be pre-loaded with shielding material prior to introduction of the contaminated equipment. This shielding material could be steel plates, grout, or concrete blocks, depending on the configuration and amount of shielding required to ensure worker protection and USDOT transportation requirements. The bubblers (or pumps) would then be remotely handled by the overhead canyon crane, brought (via the crane) out of the canyon, and placed in the disposal container waiting in the railroad well. After up to six bubbler assemblies, pumps, or a combination thereof, are placed in the container, the contaminated process equipment would be covered in grout for stabilization and shielding purposes and then the balance of the container would be filled with inert stabilizing foam. The relative amounts of grout and foam would be determined based on the container-specific radiation doses at the time of waste preparation.

After curing, the loaded disposal container would be placed inside a transportation container that meets the applicable USDOT requirements for transportation of hazardous (radiological) materials. The transportation container would be a standard, industrial-grade container approximately 20 feet long, eight feet wide, and four to six feet tall (SRNS 2014a). During the placement of the loaded disposal container into the transportation container, operations personnel would drape the transportation container to ensure that potential external radiological contamination from the disposal container is not transferred to the transportation container (similar to draping shown in Figure 2-1). Operations personnel would stabilize the disposal container as necessary to prevent movement within the transportation container during shipment. Once at the commercial disposal facility, the disposal container would be removed from its associated transportation container for disposal in accordance with site-specific procedures.

The waste preparation activities for a batch of six glass bubblers and/or pumps are assumed to require three days. The majority of the waste preparation activities are done remotely and do not require worker contact with the containers. Most of that time would be associated with staging the contaminated equipment, materials, and containers. The actual movement of the equipment by crane, loading and grouting of the disposal container, and foaming of the remaining void space would likely be done over several partial shifts. The analysis also assumes additional time to load the disposal container into the transportation container.

2.2.2 Transportation and Disposal

2.2.2.1 Tank 28F Salt Sampling Drill String

Under Alternative 1, the stabilized B-36 containing the Tank 28F salt sampling drill string would be shipped in a transportation container approved for transport under USDOT requirements, as provided in 49 CFR Subchapter C, “Hazardous Materials Regulations,” to WCS.

The shipment would be made by truck in accordance with USDOT requirements. A semi-truck would be able to carry the loaded transportation container without any additional overweight permitting requirements. The approximate highway distance between SRS and the WCS site is 1,400 miles.

The B-36 disposal container would be evaluated while still at SRS to determine whether its radiological and hazardous constituents are within the bounds of the WCS waste acceptance criteria.

Once received at WCS, the B-36 container would be removed from the transportation container and disposed of directly in the WCS FWF.[14] Disposal would be conducted in accordance with WCS' operating license. WCS operates the FWF in accordance with Radioactive Material License No. R04100 (TCEQ 2020).

The analysis in this Draft SRS Contaminated Process Equipment EA assumes that the transportation container (and any temporary shielding) would be returned to SRS to be used for other activities. DOE does not expect that the transportation container or the shielding would contain any radiological contamination.

2.2.2.2 Glass Bubblers and Glass Pumps

Under Alternative 1, each disposal container containing up to six glass bubbler and/or pumps would be shipped to WCS in a transportation container approved for transport under USDOT requirements, as provided in 49 CFR Subchapter C.

As identified in Section 2.1, DOE projects a need to dispose of approximately 172 bubblers by the forecasted end of DWPF operations in 2034. Combined with the approximately ten existing glass pumps, this Draft SRS Contaminated Process Equipment EA assumes 30 shipments of disposal containers from SRS to WCS (about 180 pieces of equipment, about six pieces per disposal container, one disposal container per transportation container, and one transportation container per shipment). The shipments would be made by truck in accordance with USDOT requirements. A semi-truck would be able to carry each loaded transportation container without any additional overweight permitting requirements. The approximate highway distance between SRS and the WCS site is 1,400 miles.

Each disposal container would be evaluated while still at SRS to determine whether its radiological and hazardous constituents are within the bounds of the WCS waste acceptance criteria.

Once received at WCS, each disposal container would be removed from its associated transportation container and disposed of directly in the WCS FWF. Disposal would be conducted in accordance with WCS' operating license.

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[14] Because the B-36 would contain lead blankets, the WCS disposal practices would likely require the disposal container to be placed in a macro-encapsulation bag by WCS FWF personnel prior to disposal. Technical information about these bags can be found at https://www.pactecinc.com/

The analysis in this Draft SRS Contaminated Process Equipment EA assumes that the transportation containers would be returned to SRS to be used for additional shipments of glass bubblers and/or pumps. DOE does not expect that the returned transportation containers would contain any radiological contamination.

2.3 Alternative 2: Stabilize and Package Class A LLW at SRS and Ship to a Commercial LLW Disposal Facility

Under Alternative 2, if it is determined that the contaminated process equipment would be Class A LLW, DOE would stabilize and package the waste at SRS and ship the waste packages to either Energy*Solutions*[15] in Clive, Utah, or WCS in Andrews County, Texas, for disposal. Implementation would be dependent upon waste content and facility waste acceptance criteria. Alternative 2 includes the same activities as Alternative 1; however, under Alternative 2, shipments of Class A LLW could be transported to Clive, Utah, in addition to Andrews County, Texas.

2.3.1 On-Site Waste Preparation

The activities associated with Alternative 2 on-site waste preparation would be identical as described under Alternative 1 in Section 2.2.1. Because the Class A LLW would contain lower concentrations of radionuclides than the Class B or Class C LLW evaluated in Alternative 1, potential impacts associated with Alternative 2 waste preparation activities would be bounded by those identified under Alternative 1.

2.3.2 Transportation and Disposal

The activities associated with Alternative 2 transportation and disposal would be identical to those described for Alternative 1 in Section 2.2.2, with the exception of transportation destination and disposal facility. In addition to shipping the waste to WCS, Alternative 2 evaluates the transportation of the LLW to the Energy*Solutions* LLW disposal facility in Clive, Utah. Once received at Energy*Solutions*, each disposal container would be removed from the transportation container and disposed of directly in the existing LLW facility. Disposal would be conducted in accordance with Energy*Solutions*' operating license (Radioactive Material License No. UT 2300249; Utah Department of Environmental Quality (UDEQ) 2020).

The shipments would be made by truck in accordance with USDOT requirements. A semi-truck would be able to carry each loaded transportation container without any additional overweight permitting requirements. The approximate highway distance between SRS and the Energy*Solutions* site is 2,200 miles.

2.4 No-Action Alternative

Under the No-Action Alternative, the contaminated process equipment would remain at SRS until another disposal path was identified. The Tank 28F salt sampling drill string would remain in a remote area in its current B-36 container. The glass bubblers and glass pumps would remain in the DWPF canyon until the end of the DWPF mission. Since glass bubblers continue to be

[15] Energy*Solutions* is currently licensed to only dispose of Class A LLW and mixed LLW.

generated, the amount of space required to store this contaminated equipment would continue to increase, potentially impacting DWPF operations in the future.[16] After the DWPF mission is complete, the contaminated process equipment associated with the facility (including the glass bubblers and glass pumps) would be dispositioned as part of the decommissioning of the facility. As stated in the DWPF SEIS (DOE 1994), decommissioning of the DWPF would be addressed by the SRS Decontamination and Decommissioning Program, which would include environmental and public review as part of the planning and decision-making process.

2.5 Alternatives Considered but Eliminated from Detailed Analysis

There are two additional commercial LLW disposal facilities in the United States—the Barnwell, South Carolina, facility and the U.S. Ecology facility near Richland, Washington. However, these facilities were eliminated from detailed NEPA analysis because these facilities only accept waste from their approved state compact members and SRS is not a member of those compacts.[17]

DOE on-site (i.e., E Area) facilities are not evaluated because if determined to be non-HLW, the SRS contaminated process equipment would not meet the criteria for disposal at these facilities because of their waste form, radionuclide inventory, dose rates, and internal lead shielding. Off-site DOE radioactive waste disposal facilities (i.e., Nevada National Security Site [NNSS]) were also considered out of scope. DOE on-site and off-site disposal of LLW have been analyzed in previous NEPA documents (e.g., SRS Salt Processing Alternatives SEIS, WM PEIS, NNSS Sitewide EIS).

Because the transportation containers are capable of being transported on a legal-weight truck and the 31 shipments over the duration of the Proposed Action would require an average of about two shipments per year, DOE is not considering rail transportation because it would be more efficient (e.g., logistics, costs) to ship the relatively small number of containers by truck. Therefore, rail transportation was not evaluated in detail in this Draft SRS Contaminated Process Equipment EA.

2.6 Contaminated Process Equipment Disposal under the HLW Interpretation

This Draft SRS Contaminated Process Equipment EA analyzes the disposal of contaminated process equipment as non-HLW under DOE's HLW interpretation referenced in Section 1.2.

As shown in Appendix A, sample analyses indicate the contaminated process equipment would meet the HLW interpretation's Criterion 1 requirement that radionuclide concentrations "not exceed limits for Class C LLW as set out in 10 CFR 61.55." Under Criterion 1, DOE will also evaluate whether disposal of the contaminated process equipment "meets the performance objectives of a disposal facility." In this regard, commercial licensees of the LLW disposal

[16] The glass pumps and glass bubblers are stored on cell covers in the DWPF canyon building. Periodically, DWPF operations requires access to these cell covers. When that occurs, the pumps and bubblers have to be temporarily relocated and then replaced after the cell covers are returned. As the amount of this contaminated equipment increases, the time and space required for temporary relocation will increase.

[17] The *Low-Level Radioactive Waste Policy Act of 1980* (as amended in 1986) gives the states the responsibility for the disposal of LLW generated within their borders (except for certain waste generated by the Federal Government). The Act authorized the states to enter into compacts that would allow them to dispose of LLW at a common disposal facility.

facility have the responsibility for health and safety of the public, workers, and the environment by demonstrating that the disposal facility complies with specified dose limits and performance objectives. Performance objectives of a commercial LLW disposal facility are the quantitative radiological standards set by the NRC to ensure protection of the health and safety of individuals and the environment during operation and after permanent closure of the disposal facility. Commercial LLW disposal facilities are located in and licensed and regulated by Agreement States. Agreement States have incorporated compatible 10 CFR Part 61, Subpart C, LLW disposal performance objectives into their corresponding regulations and as conditions for LLW disposal facility licenses.

The technical means to demonstrate compliance with performance objectives is via a modeling and analytical tool commonly referred to as a performance assessment. A performance assessment is an internationally accepted, risk-informed approach to evaluating whether a waste disposal facility protects human health and the environment.

The waste acceptance criteria are the technical and administrative requirements a waste must meet to be accepted at a disposal facility (e.g., waste characterization, waste form acceptability, quality assurance), and are established to ensure the disposal facility, in total, meets its safety-based performance objectives. Waste acceptance criteria are required by all regulators as part of the licensing process for a facility. Waste acceptance criteria identify the requirements, terms, and conditions under which the facilities will accept wastes for disposal. The criteria specify, among other things, the allowable types and quantities of radioactive materials; the types of containers required; and any restrictions on specific wastes, materials, or containers. The technical criteria define the physical, chemical, and radiological characteristics of an acceptable waste form, integrated closely with the performance assessment for the entire facility, to ensure that the performance objectives and measures to protect the public and workers will be met.

DOE would work within the NRC and/or Agreement State regulatory framework for commercial LLW disposal and specific licensing conditions of the disposal site destination. DOE would work closely with the disposal site licensee and the NRC and/or Agreement State regulator to ensure compliance with disposal requirements. Figure 2-5 illustrates the general steps in this process followed by a brief general summary.

Figure 2-5. General Overview of Waste Acceptance Process for Disposal at LLW Facility

Waste generator certification: Waste generators are required to obtain certification from the disposal facility prior to shipping waste to the facility. Elements of the certification include the waste classification/characterization program (e.g., sampling and analytical procedures), personnel training program, and other requirements.

Waste profile approval: Waste generators prepare a waste profile to demonstrate that the waste is compliant with regulatory requirements, the facility's waste acceptance criteria, and other applicable requirements. As part of the waste profile process, the disposal facility will review the waste profile and verify waste profile compliance with the facility's waste acceptance plan, the LLW license, and applicable regulations. This review will focus on ensuring that the waste profile, supporting documentation, and disposal plans are complete and compatible, and that there are no discrepancies. Once the final reviews are complete and the waste is found to be in compliance, the waste stream is considered approved.

Waste shipment request, approval, and verification: After generator certification and waste profile approval, the waste generator must submit shipping documentation to the disposal facility for approval prior to shipment. Once the disposal facility is satisfied with the shipping documentation, the disposal facility will provide authorization to ship the waste for disposal. The disposal facility then performs waste verification steps (e.g., inspection) on the incoming shipments.

3 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 Introduction

This chapter includes an analysis of the potential environmental consequences or impacts that could result from the Proposed Action and reasonable alternatives. The affected environment is the result of past and present activities and provides the baseline from which to compare potential impacts from the Proposed Action and alternatives.

Section 3.2 identifies the environmental resource areas that were considered and eliminated from further analysis. Sections 3.3 through 3.7 discuss the affected environment and potential environmental consequences for each of the resource areas analyzed in detail. Section 3.8 provides an evaluation of reasonably foreseeable environmental trends and planning actions and discusses potential cumulative impacts.

3.2 Resource Screening Review

DOE prepared the potential impact analyses in this Draft SRS Contaminated Process Equipment EA specifically for this project to provide sufficient information to support a decision regarding the potential environmental impacts of the Proposed Action. In further effort to reduce excessive paperwork (in accordance with 40 CFR 1500.4 [j]) and consistent with CEQ and DOE NEPA implementing regulations and guidance, the analysis in this Draft SRS Contaminated Process Equipment EA focuses on the resources that are relevant to the Proposed Action and its potential impacts. As stated in the CEQ regulations regarding EISs:

> "Impacts shall be discussed in proportion to their significance. There shall be only brief discussion of other than significant issues. As in a finding of no significant impact, there should be only enough discussion to show why more study is not warranted (40 CFR 1502.2[b])."

Table 3-1 presents the rationale for resource areas eliminated from further analysis.

Table 3-1. Resource Areas Not Requiring Further Analysis

Resource Area	Rationale
Land	The Proposed Action and alternatives would not involve any land disturbance activities and would not affect current land uses. Waste preparation activities in the SRS H-Area or DWPF would occur within industrialized areas. Waste disposal at WCS or Energy*Solutions* would occur within existing licensed disposal footprint.
Visual	The Proposed Action and alternatives would only involve temporary work areas or would be within existing facilities. None of these activities would be visible from off-site locations nor would they be any different than typical activities in the SRS H-Area or DWPF. Waste disposal at WCS or Energy*Solutions* would occur within existing licensed disposal footprint.
Geology and soils	The Proposed Action and alternatives would not involve any land disturbance activities and therefore would not affect geology or soils in the area. There would be no potential for contamination of soils through the release of liquids. Waste disposal at WCS or Energy*Solutions* would occur within existing licensed disposal footprint.
Water resources (surface, groundwater, wetlands)	The Proposed Action and alternatives would not involve any land disturbance activities and would not affect any surface waters, groundwater, or wetlands. Waste preparation activities in the SRS H-Area or DWPF would not include contaminated

Resource Area	Rationale
	liquids that could be released to contaminate water resources. Waste disposal at WCS or Energy*Solutions* would occur within existing licensed disposal footprint and no free liquids would be inside the disposal containers.
Cultural and paleontological resources	The Proposed Action and alternatives would not involve any land disturbance activities and therefore would not affect any potential cultural or paleontological resources. The SRS H-Area and DWPF are industrial areas and have been actively used since the 1950s and 1980s, respectively. Waste disposal at WCS or Energy*Solutions* would occur within existing licensed disposal footprint.
Ecological resources (biota, threatened and endangered species)	The Proposed Action and alternatives would not involve any land disturbance activities and would not affect any ecological resources. The SRS H-Area and DWPF are industrial areas and have been actively used since the 1950s and 1980s, respectively. Waste disposal at WCS or Energy*Solutions* would occur within existing licensed disposal footprint.
Noise	The SRS (H-Area and DWPF) are highly industrialized areas with ongoing noise sources. The Proposed Action and alternatives would not substantively contribute to the current noise profile at the site. The SRS H-Area is approximately seven miles and the DWPF is approximately six miles from the closest site boundary at the Savannah River; therefore, noise from these areas is not noticeable from off-site locations. Waste disposal at WCS or Energy*Solutions* would occur within existing licensed disposal footprint and follow existing operations practices.
Socioeconomics and environmental justice	The Proposed Action and alternatives would be a temporary activity using existing on-site personnel. No new jobs or workers would be required at SRS or either of the LLW disposal facilities. There would be no disproportionately high and adverse human health impacts on minority or low-income populations. Transportation routes would follow the most efficient routes from SRS to the LLW disposal facilities and would maximize use of the U.S. Interstate highways. Because the Proposed Action would involve an average of two truck shipments per year, follow USDOT requirements regarding shipment of radiological materials, and be a small fraction of existing truck shipments on these highways, the transportation activities associated with the Proposed Action would not result in disproportionately high and adverse impacts on minority or low-income populations.
Infrastructure and utilities	The Proposed Action and alternatives would not result in any measurable infrastructure and utility changes compared to existing requirements at SRS or the LLW disposal facilities. The increase in truck traffic for the Proposed Action would be negligible.
Industrial safety	The Proposed Action and alternatives would not require additional workers or introduce new types of operations that would result in additional occupational injuries at SRS or the LLW disposal facilities.

As a result of the screening review presented in Table 3-1, this Draft SRS Contaminated Process Equipment EA analyzes the following resource areas in detail: (1) air quality, (2) human health (normal operations), (3) human health (accidents and intentional destructive acts), (4) waste management, and (5) radiological transportation. Sections 3.3 through 3.7 present these analyses.

Under the No-Action Alternative, the potential impacts identified for the Proposed Action related to these five resource areas may not be realized as analyzed in this Draft SRS Contaminated Process Equipment EA because the contaminated process equipment would continue to be stored on site. However, the contaminated process equipment would require disposition at some point in the future. Therefore, there would be impacts associated with treatment and disposition of the contaminated process equipment; these impacts would occur at a future date and would be similar to the impacts evaluated in the DWPF Final EIS (DOE 1982). Additionally, over the remaining operational life of DWPF, the amount of glass bubblers will continue to accumulate and require storage in the DWPF canyon building. As described in Section 2.4, this continued accumulation of glass bubblers could result in potential radiological exposures associated with increased storage and handling. The glass pumps and glass bubblers are stored on cell covers in the DWPF canyon building. Periodically, DWPF operations requires access to these cell covers. When that occurs, the pumps and bubblers have to be temporarily relocated and then replaced after the cell covers are returned. As the amount of this contaminated equipment increases, the time and space required for temporary relocation will increase; this impact would increase with the number of glass bubblers that accumulate.

3.3 Air Quality

3.3.1 Affected Environment

SRS is near the center of the Augusta (Georgia)–Aiken (South Carolina) Interstate Air Quality Control Region Code No. 53. None of the areas within SRS or the surrounding counties is designated as nonattainment with respect to the National Ambient Air Quality Standards (NAAQS) for criteria air pollutants (U.S. Environmental Protection Agency (EPA) 2019). The nearest areas with nonattainment status (eight-hour ozone) are in counties surrounding Atlanta, Georgia, approximately 150 to 250 miles west of SRS (EPA 2021a).

The primary sources of non-radiological air pollutants at SRS are the biomass boilers in A, L, and K Areas, diesel-powered equipment throughout SRS, DWPF, soil vapor extractors, groundwater air strippers, the Biomass Cogeneration Facility and back-up oil-fired boiler on Burma Road, and various other processing facilities. Other sources of emissions include vehicle traffic and controlled burning of forested areas, as well as temporary emissions from various construction-related activities. SRS operates under a Title V operating permit (SRNS 2020a).

The *Clean Air Act* Prevention of Significant Deterioration regulations (40 CFR 51.166) designate the Augusta–Aiken Air Quality Control Region as a Class II area. The Prevention of Significant Deterioration regulations were developed to manage air resources in areas that are in attainment of the NAAQS. Class II areas have sufficient air quality to support industrial growth. Class I areas are areas in which very little increase in air pollution is allowed due to the pristine nature of the area. There are no Prevention of Significant Deterioration Class I areas within approximately 60 miles of SRS (South Carolina Department of Health and Environmental Control (SCDHEC) 2019a).

3.3.1.1 Non-Radiological Air Emissions

Table 3-2 presents the applicable regulatory ambient standards and ambient air pollutant concentrations attributable to sources at SRS. Concentrations shown in Table 3-2 attributable to SRS are in compliance with applicable guidelines and regulations. Data from nearby ambient air monitors in Aiken, Barnwell, and Richland counties in South Carolina are presented in Table 3-3. The data indicate that the NAAQS for particulate matter, lead, ozone, sulfur dioxide, and nitrogen dioxide are not exceeded in the area around SRS.

Table 3-2. Comparison of Ambient Air Concentrations from Existing Savannah River Site Sources with Applicable Standards or Guidelines

Criteria Pollutant	Averaging Period	More Stringent Standard or Guideline (micrograms per cubic meter)[a]	Ambient Air Concentration (micrograms per cubic meter)[b]
Carbon monoxide	8 hours	10,000[c]	292
	1 hour	40,000[c]	1,118.2
Nitrogen dioxide	Annual	100[c]	42.1
Ozone	8 hours	0.07 ppm[c]	(d)
PM_{10}	24 hours	150[c]	50.7
$PM_{2.5}$	24 hours	35[c]	(d)
	Annual	12[c]	(d)
Sulfur dioxide	3 hours	1300[c]	723
	1 hour	75 ppb	(d)
Lead	Rolling 3-month	0.15[c]	0.11

PM_n = particulate matter less than or equal to n microns in aerodynamic diameter; ppm = parts per million; ppb = parts per billion.

a. The more stringent of the Federal or state standard is presented if both exist for the averaging period. The computations for determining if the applicable standard is met are found in appendices to 40 CFR Part 50. Source: EPA 2019.
b. Source: NNSA 2020.
c. Federal and state standard.
d. No concentration reported.

Table 3-3. Ambient Air Quality Standards and Monitored Levels in the Vicinity of the Savannah River Site

Criteria Pollutant	Averaging Period	More Stringent Standard or Guideline (micrograms per cubic meter)[a]	Ambient Air Concentration (micrograms per cubic meter)	Location (South Carolina)
Carbon monoxide	8 hours	10,000	2,863[b]	Richland County
	1 hour	40,000	3,350[b]	Richland County
Nitrogen dioxide	Annual	100	6.6[b]	Aiken County
Ozone	8 hours	0.070 ppm	0.059 ppm[c]	Aiken County
PM_{10}	24 hours	150	61[b]	Aiken County
$PM_{2.5}$	24 hours	35	17[c]	Richland County
	Annual	12	8.10[c]	Richland County
Sulfur dioxide	3 hours	1300	39.3[b]	Barnwell County
	1 hour	75 ppb	4 ppb[c]	Richland County
Lead	Rolling 3-month	0.15	0.002[b]	Richland County

PM_n = particulate matter less than or equal to n microns in aerodynamic diameter; ppm = parts per million; ppb = parts per billion.

a. Source: SCDHEC 2019b.
b. 2007 data; source NNSA 2020.
c. 2017 data; source NNSA 2020.

The EPA's National Emissions Inventory tracks the national on-road emissions associated with heavy-duty diesel vehicles (EPA 2021b). These data are not associated with any specific air quality control region. These national emissions are presented in Table 3-4.

Table 3-4. National Annual On-Road Heavy-Duty Vehicle Emissions

Emissions (tons/year)					
CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	VOC
651,760	2,115,494	126,680	91,948	3,436	162,334

CO = carbon monoxide; NO_x = nitrogen oxides; PM_n = particulate matter less than or equal to *n* microns in aerodynamic diameter; SO_x = sulfur oxides; VOC = volatile organic compounds.
Source: EPA 2021b

3.3.1.2 Radiological Air Emissions

Atmospheric radionuclide emissions from SRS are limited under the EPA's National Emissions Standards for Hazardous Air Pollutants regulations in 40 CFR Part 61, Subpart H. The EPA annual effective dose equivalent limit to members of the public is 10 millirem (mrem) per year. The total effective dose for 2019 at SRS was 0.0178 mrem per year; more than two orders of magnitude below the 10-mrem-per-year limit (SRNS 2020b).

3.3.2 Alternative 1 Impacts

The Tank 28F salt sampling drill string and other materials in the B-36 disposal container are all solid materials (contaminated steel piping and lead blankets). The Tank 28F salt sampling drill string was previously extracted from Tank 28F in two sections and is currently stored in a stable, shielded state. DOE would use typical radiological containment measures during the waste preparation activities (as described in Section 2.2.1.1). The combination of these measures and a solid waste form would limit the potential to emit airborne radiological materials. The only non-radiological criteria pollutants released as part of the Proposed Action would be those associated with the minor emissions from diesel-powered equipment (crane and truck), which would only be used for a short period of time.

Similarly, the glass bubblers and glass pumps consist entirely of solid metal and glass materials that are currently stored in the DWPF canyon building. The bubblers and pumps would be remotely handled as part of DWPF canyon operations as described in Section 2.2.1.2. Manipulation of these solid waste forms, along with standard containment practices would result in a negligible potential for airborne releases of radionuclides. Any airborne contaminants within DWPF canyon would be captured in the existing high-efficiency particulate air (HEPA) or sand filters and would be within potential releases estimated for DWPF. Additional waste preparation activities in the DWPF railroad well would consist of adding grout and/or foam around the waste forms, which would be unlikely to release any radionuclides that would not be captured by the DWPF filtration systems. Air sampling is performed as part of routine operating procedures at the SRS and would be used to monitor and verify conditions during implementation of the Proposed Action. Similar to the Tank 28F salt sampling drill string, the only non-radiological criteria pollutants released as part of the waste preparation activities for the glass bubblers and pumps would be those associated with the minor emissions from diesel-powered equipment (crane and truck), which would only be used for a short period of time.

The loaded transportation containers would be shipped by semi-truck from SRS to WCS (approximately 1,400 miles). There would be a single truck shipment for the Tank 28F salt sampling drill string (see Section 2.2.2.1). Shipment of the glass bubblers and pumps would require approximately 30 shipments to WCS over the life of the disposal operation (see Section 2.2.2.2). These 31 truck shipments would produce negligible air emissions, including greenhouse gases (carbon dioxide equivalent), relative to the overall vehicle emissions associated with interstate trucking and other private and commercial vehicles on the highways. These estimated emissions for the 31 shipments are presented in Table 3-5. Emissions were derived using emission factors for heavy-duty diesel vehicles in EPA (2020). These emissions are small in comparison to the annual emissions from heavy trucks on a national scale. While the minimal emissions would contribute to overall greenhouse gas emissions, they would have a small overall contribution to climate change.

Table 3-5. Estimated Emissions from Shipment of Disposal Containers under Alternative 1

Emissions (tons)				
CO	NO_x	$PM_{2.5}$	THC	CO_2eq
0.069	0.119	0.0038	0.0065	71

CO = carbon monoxide; CO_2eq = carbon dioxide equivalent; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in aerodynamic diameter; THC = total hydrocarbons.

Disposal of the contaminated process equipment within their respective containers at the WCS site near Andrews, Texas, would not cause any additional air emissions beyond those already expected and evaluated from ongoing disposal operations at the site. Texas Commission on Environmental Quality (TCEQ) evaluated potential environmental impacts of WCS' operations (TCEQ 2008).

3.3.3 Alternative 2 Impacts

The potential air quality impacts at SRS associated with handling, stabilizing, and packaging the contaminated process equipment would be the same as discussed under Alternative 1 in Section 3.3.2. Under Alternative 2, however, the disposal containers would be transported from SRS to WCS or Energy*Solutions* for disposal following a determination that the contaminated process equipment is Class A LLW.

The highway distance between SRS and the Energy*Solutions* facility in Clive, Utah, is approximately 2,200 miles. The air emissions associated with the transportation of the 31 shipments to Utah would be slightly greater than that expected for Alternative 1 due to the greater distance; however, the shipments would still result in negligible vehicle air emissions, including greenhouse gases, relative to the overall vehicle emissions associated with interstate trucking and other private and commercial vehicles on the highways. These estimated emissions for the 31 shipments are presented in Table 3-6. These emissions are small in comparison to the annual emissions from heavy trucks on a national scale. While the minimal emissions would contribute to overall greenhouse gas emissions, they would have a small overall contribution to climate change.

Table 3-6. Estimated Emissions from Shipment of Disposal Containers under Alternative 2

Emissions (tons)				
CO	NO_x	$PM_{2.5}$	THC	CO_2eq
0.11	0.19	0.00026	0.01	111

CO = carbon monoxide; CO_2eq = carbon dioxide equivalent; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in aerodynamic diameter; THC = total hydrocarbon.

The containers of stabilized waste would be disposed of at the WCS site or the Energy*Solutions* site. Similar to Alternative 1, this disposal would not cause any additional air emissions beyond those already expected and evaluated from the respective ongoing treatment and disposal operations at each site. The Utah Department of Environmental Quality (UDEQ) considered air emissions as part of its review of Energy*Solutions*' license and amendments (Radioactive Material License No. UT 2300249; UDEQ 2020).

3.3.4 No-Action Alternative Impacts

Under the No-Action Alternative, DOE would not conduct the Proposed Action. Instead, DOE would maintain the status quo, which is represented by the continued management of the contaminated Tank 28F salt sampling drill string, glass bubblers, and glass pumps. The contaminated process equipment would require disposition at some point in the future, and over the remaining operational life of DWPF, the amount of glass bubblers would continue to accumulate and require storage in the DWPF canyon building

3.4 Human Health – Normal Operations

3.4.1 Affected Environment

Primary sources and levels of background radiation exposure to individuals in the vicinity of SRS are assumed to be the same as those to an average individual in the U.S. population. These exposures are shown in Table 3-7. Background radiation doses are unrelated to SRS operations.

Table 3-7. Radiation Exposure of Individuals in the Savannah River Site Vicinity Unrelated to Savannah River Site Operations[a]

Source	Effective Dose (mrem per year)
Natural background radiation	
Cosmic and external terrestrial radiation	54
Internal terrestrial radiation	29
Radon-220 and -222 in homes (inhaled)	228
Other background radiation	
Diagnostic x-rays and nuclear medicine	300
Occupational	0.5
Industrial, security, medical, educational, and research	0.3
Consumer products	13
Total (rounded)	**620**

a. An average for the United States.
Source: NCRP 2009

Releases of radionuclides to the environment from SRS operations provide another source of radiation exposure to individuals in the vicinity of SRS. Types and quantities of radionuclides released from SRS operations are listed in the SRS Environmental Report that is published each year (SRNS 2016a, 2017, 2018, 2019, 2020b). The annual doses to the public from recent releases of radioactive materials (2015–2019) and the average annual doses over this 5-year period are presented in Table 3-8. These doses fall within radiological limits established per DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and are much lower than background radiation.

Table 3-8. Annual Radiation Doses to the Public from Savannah River Site Operations for 2015–2019 (total effective dose)

Members of the Public	Year	Atmospheric Releases[a]	Total Liquid Releases[b] (all liquid + irrigation)	Total[c]
Representative person living near the SRS boundary (mrem)	2015	0.032	0.15	0.18
	2016	0.038	0.15	0.19
	2017	0.027	0.22	0.25
	2018	0.082	0.19	0.27
	2019	0.018	0.16	0.18
	2015–2019 average	0.039	0.17	0.20
Population within 50 miles of H Area (person-rem)[d]	2015	1.1	2.6	3.7
	2016	1.4	3.5	4.9
	2017	0.97	3.4	4.4
	2018	2.6	3.4	6.0
	2019	0.70	2.1	2.8
	2015–2019 average	1.4	3.0	4.4
Typical person within 50 miles[e] (mrem)	2015	0.0014	0.0027	0.0041
	2016	0.0018	0.0036	0.0054
	2017	0.0012	0.0035	0.0047
	2018	0.0033	0.0035	0.0068
	2019	0.0009	0.0022	0.0031
	2015–2019 average	0.0017	0.0031	0.0048

a. DOE Order 458.1 and *Clean Air Act* (42 U.S.C. § 7401 et seq.) regulations in 40 CFR Part 61, Subpart H, establish a compliance limit of 10 mrem per year to a maximally exposed individual for airborne releases.
b. Includes all water pathways, not just the drinking water pathway. Though not directly applicable to radionuclide concentrations in surface water or groundwater, an effective dose equivalent limit of four mrem per year for the drinking water pathway only is frequently used as a measure of performance.
c. DOE Order 458.1 establishes an all-pathways dose limit of 100 mrem per year to individual members of the public.
d. About 781,060 persons, based on 2010 Census data (U.S. Census Bureau (USCB) 2010). For liquid releases occurring from 2015 through 2019, respectively for each year, additional 182,100, 183,500, 183,500, 183,500 and 183,500 water users in Port Wentworth, Georgia, and Beaufort, South Carolina (about 98 river miles downstream), are included in the assessment.
e. Typical person is a hypothetical person receiving a dose that is typical of the population group; established at the 50th percentile (or median) level of national radiation exposure data. Obtained by dividing the population dose by the number of people living within 50 miles of SRS for atmospheric releases; for liquid releases, the number of people includes water users who live more than 50 miles downstream of SRS (as described in note "d" above).

Note: Sums and quotients presented in the table may differ from those calculated from table entries due to rounding.
Sources: SRNS 2016a, 2017, 2018, 2019, 2020b.

Using a risk estimator of 600 latent cancer fatalities (LCFs) per 1 million person-rem (or 0.0006 LCF per rem) (DOE 2003), the annual average LCF risk to the maximally exposed member of the public due to radiological releases from SRS operations from 2015 through 2019 is negligible (0.0000001). That is, the estimated probability of this hypothetical person developing a fatal cancer at some point in the future from radiation exposure associated with one year of SRS operations is about 1 in 10 million.

LATENT CANCER FATALITY

A death resulting from cancer that has been caused by exposure to ionizing radiation. For exposures that result in cancers, the generally accepted assumption is that there is a latent period between the time an exposure occurs and the time a cancer becomes active.

RADIATION DOSE UNITS

Individual doses from radiation are most often expressed in "mrem." Collective doses, which represent more than one person, are most often expressed in "person-rem." One person-rem equals 1,000 person-mrem.

No excess fatal cancers are projected in the population living within 50 miles of SRS from one year of normal operations from 2015 through 2019. To put this number in perspective, it may be compared with the number of fatal cancers expected in the same population from all causes. The average annual mortality rate associated with cancer for the entire U.S. population from 2013 through 2017 (the last five years for which final data are available) was 185 per 100,000 (U.S. Department of Health and Human Services (HHS) 2016a, 2016b, 2017, 2018, 2019). Based on this national mortality rate, the number of fatal cancers expected to occur in 2019 in the 2010 Census population of 781,060 people living within 50 miles of SRS would be 1,445.

SRS workers receive the same dose as the general public from background radiation, but they also receive an additional dose from working in facilities with nuclear materials. Table 3-9 presents the annual average individual and collective worker doses from SRS operations from 2015 through 2019. These doses fall within the regulatory limits of 10 CFR Part 835, "Occupational Radiation Protection Program." Statistically, the average total worker dose of 131.5 person-rem per year translates to a worker population LCF risk of 0.079.

Table 3-9. Radiation Doses to Savannah River Site Workers from Operations 2015–2019 (total effective dose equivalent)

Occupational Personnel	From Outside Releases and Direct Radiation by Year					
	2015	2016	2017	2018	2019	Average
Average radiation worker dose (mrem)[a]	50	40	39	31	34	39
Total worker dose (person-rem)	95	111	173	135	143[b]	131
Number of workers receiving a measurable dose	1,882	2,799	4,411	4,415	4,198	3,541

a. No standard is specified for an "average radiation worker"; however, the maximum dose to a worker is limited as follows: the radiological limit for an individual worker is 5,000 mrem per year (10 CFR Part 835). However, DOE's goal is to maintain radiological exposure as low as reasonably achievable. DOE has, therefore, established the administrative control level of 2,000 mrem per year; the site contractor sets facility administrative control levels below the DOE level (DOE 2017a).

b. The increase in dose from 2018 was primarily due to the implementation of system upgrades and lab modifications at the Savannah River National Laboratory (SRNL). SRNL completed the transuranic (TRU) Waste Assay System upgrade, which includes increased efficiency in handling TRU (transuranic) waste drums, decreased dose exposure to workers, elimination of the use of liquid nitrogen, and uninterrupted power supply, and compliance with SRNL Documented Safety Analysis upgrades (DOE 2020c).

Sources: DOE 2016, 2017b, 2018a, 2020b, 2020c

3.4.2 Alternative 1 Impacts

If determined that the contaminated process equipment would be Class B or Class C LLW, DOE would stabilize and package the contaminated process equipment at SRS and ship the waste to

WCS in Andrews County, Texas, for disposal. Because there would be no off-site radiological air emissions or effluents associated with Alternative 1, and no off-site direct radiation associated with waste stabilization and packaging, there would be no radiological exposure to the public. Public health impacts associated with transportation to WCS are addressed in Section 3.7.2.

The on-site waste preparation activities are described in Section 2.2.1. Prior to initiation of these activities, the H-Area Tank Farm contractor, SRR, would prepare a radiation work plan (RWP) in accordance with the DOE 5Q Radiological Control Manual (DOE 2020d). The RWP would implement guidance in Chapter 3 of the 5Q Manual and address planning and execution of work, physical design features and administrative controls, and efforts to implement work controls commensurate with the radiological hazards.

The RWP would include job-specific plans and procedures to implement "As Low as Reasonably Achievable" (ALARA) principles and would ensure that personnel exposure was kept to a minimum. Additional measures to be implemented could consist of the use of shielding, personal protective equipment, and training mock-ups to improve the efficiency of operations and reduce exposure times. The RWP would include details related to staging the equipment and materials. The waste preparation activities (e.g., grouting, foaming, loading the B-36 into a transportation container) are typical of work processes that occur in the H-Area Tank Farm. Based on Post-Job ALARA Reviews of RWPs for similar activities (SRR 2020), the expected collective worker dose (all exposed personnel) would be approximately 700 person-mrem.[18] There would be approximately 12 workers involved in the operation (e.g., riggers, grouting/foaming personnel, crane operator, and radiation control personnel). The maximally exposed worker would not be expected to receive more than 100 mrem during the activity. Table 3-10 presents the LCF risk associated with these projected worker doses. All doses would be well within the current administrative control level for SRS workers (500 mrem per year).

Table 3-10. Worker Radiological Risk from Waste Preparation Activities; Alternative 1

Receptor	Dose for Project	Radiological Risk (LCF)[a]
Single Transportation Container (Tank 28F salt sampling drill string or glass bubblers/pumps)		
Maximally exposed worker	100 mrem	0.00006
Collective workers	0.7 person-rem	0.00042
Total Proposed Action (31 shipments)		
Maximally exposed worker	100 mrem	0.00006
Collective workers	21.7 person-rem	0.013

LCF = latent cancer fatality.

a. The LCF risk is based on a dose-to-risk conversion factor of 0.00060 per rem (DOE 2003).

Similar to the Tank 28F salt sampling drill string, the waste preparation activities for the glass bubblers and/or glass pumps (e.g., pre-staging shielding in the disposal container, crane-loading bubblers/pumps in the railroad well, grouting/foaming the disposal container, and placing the disposal container into the transportation container) would involve the preparation of a job-specific RWP. Because much of the handling of the waste items would be done remotely, DOE expects that the collective worker dose for loading a single transportation container with six

[18] SRR 2020 is a Post-Job ALARA Review for the removal of a transfer pump and loading that pump into a transportation container for shipment. The complexity and the dose rates for this example are similar to those expected for the Tank 28F salt sampling drill string. The collective worker dose for the job was 685 person-mrem and the highest individual dose was 68 mrem.

bubblers and/or pumps would be lower than that of the single Tank 28F salt sampling drill string package. However, this analysis conservatively assumes that the maximally exposed worker and collective worker dose would be the same as for the Tank 28F salt sampling drill string.

As presented in Section 2.2.2.2, there would be one transportation container for the Tank 28F salt sampling drill string and 30 transportation containers of glass bubblers and/or glass pumps generated through 2034. Therefore, Table 3-10 presents potential worker risks from on-site preparation of a single transportation container and the full complement of 31 potential transportation containers.

Under Alternative 1, each disposal container would be shipped inside a transportation container approved for transport under USDOT requirements, as provided in 49 CFR Subchapter C, "Hazardous Materials Regulations," to WCS in Andrews County, Texas. Section 3.7.2 of this Draft SRS Contaminated Process Equipment EA presents the potential radiological impacts associated with this transport. Each disposal container would be evaluated while at SRS to determine whether its radiological constituents are within the bounds of the waste acceptance criteria for the WCS disposal facility.

Because each disposal container would be verified to meet the waste acceptance criteria prior to transport, there would be no additional radiological exposures to the off-site public around WCS or the WCS workforce than expected under the WCS existing license for LLW disposal. Each disposal container would meet the DOE HLW interpretation discussed in Section 1.2 of this Draft SRS Contaminated Process Equipment EA. This would ensure that its disposal would not cause an increase to the long-term radiological health impacts at the disposal facility beyond those identified during the licensing process.

3.4.3 Alternative 2 Impacts

The potential human health impacts from normal operations at SRS associated with handling, stabilizing, and packaging the contaminated process equipment would be the same as discussed under Alternative 1 in Section 3.4.2. Under Alternative 2, however, the disposal containers would be transported from SRS to WCS or Energy*Solutions* for disposal following a determination that the contaminated process equipment is Class A LLW. The human health impacts would be bounded by Alternative 1, because in the event that the contaminated process equipment were determined to be Class A LLW, the corresponding direct radiation rates could be less than those assumed for a disposal container with Class B or Class C LLW. Each disposal container would be verified to meet the waste acceptance criteria prior to transport to either the WCS or Energy*Solutions* facility. There would be no additional radiological exposures to the off-site public at the disposal facility or the disposal facility workforce than already considered under their existing licenses for LLW disposal.

3.4.4 No-Action Alternative Impacts

Under the No-Action Alternative, DOE would not conduct the Proposed Action. Instead, DOE would maintain the status quo, which is represented by the continued management of the contaminated Tank 28F salt sampling drill string, glass bubblers, and glass pumps. The contaminated process equipment would require disposition at some point in the future, and over the remaining operational life of DWPF, the number of glass bubblers would continue to accumulate and require storage in the DWPF canyon building. Continued storage of the Tank 28F drill string would require DOE to sustain restricted access to the area where the 28F salt sampling drill string is stored because of its higher radiation levels (as is currently done). Personnel accessing this area would continue to receive radiation dose from the B-36 disposal container until the Tank 28F salt sampling drill string is dispositioned. Because the glass bubblers and glass pumps would continue to be stored inside the DWPF canyon, dose to personnel during this continued storage would be minimal. The worker doses attributable to handling and stabilization resulting from the Proposed Action would be partially or completely offset by worker doses resulting from similar activities under the No-Action Alternative. As described in Section 2.4, after the DWPF mission is complete, the contaminated process equipment associated with the facility (including the glass bubblers and glass pumps) would be dispositioned as part of the decommissioning of the facility. As stated in the DWPF SEIS (DOE 1994), decommissioning of the DWPF would be addressed by the SRS Decontamination and Decommissioning Program, which would include environmental and public review as part of the planning and decision-making process.

3.5 Human Health – Accidents and Intentional Destructive Acts

3.5.1 Background

An accident is a sequence of one or more unplanned events with potential outcomes that endanger the health and safety of workers or the public. An accident can involve a combined release of energy and hazardous substances (radiological or non-radiological) that might cause prompt or latent health effects. The sequence begins with an initiating event, such as human error, equipment failure, or earthquake, followed by a succession of other events that could be dependent or independent of the initiating event and that dictate the accident progression and extent of materials released.

The DWPF Final EIS and Final SEIS (DOE 1982, 1994) evaluated potential accident scenarios involving operations in the DWPF canyon building. As identified in the Final EIS (DOE 1982), minor incidents could occur during DWPF operation because of operator error or failure of a plant component or system. Such events would result in the release of little or no radioactivity to the environment. This is primarily due to the filtration (HEPA and sand filters) of exhausts from the DWPF canyon building.

3.5.2 Alternative 1 Impacts

3.5.2.1 Accidents

The potential accident scenarios that could occur during the Proposed Action would be limited to a drop of the disposal container or transportation container. The potential consequences associated with a drop of the B-36 containing the Tank 28F salt sampling drill string and the disposal container with the glass bubblers and/or pumps are discussed separately. Potential health impacts from accidents or intentional destructive acts associated with transportation to WCS are addressed in Section 3.7.2.

The waste items would be verified to meet the WCS waste acceptance criteria prior to shipment; therefore, disposal of the waste items at the WCS FWF would not result in any increases to the accident impacts previously evaluated at WCS as compared to their ongoing disposal operations.

3.5.2.1.1 Tank 28F Salt Sampling Drill String

As identified in Section 2.2.1.1, the on-site waste preparation activities would include filling the void space in the B-36 disposal container with both grout and a stabilizing foam. These activities would occur before lifting the B-36 for placement in the transportation container. The B-36 would be lifted with a crane using straps that would be placed around and under the B-36. Because the Tank 28F salt sampling drill string within the B-36 would be grouted and foamed, there would be no dispersion of radiological materials that could occur from a drop during the lifting maneuver. The maximum reasonably foreseeable result of this drop would include damage to the B-36 that would require repackaging or release of the Tank 28F salt sampling drill string and separation from the grout and lead blankets. If this were to occur, operations personnel would move away from the event and develop a plan to cover the Tank 28F salt sampling drill string (to prevent direct radiation effects) and repackage the Tank 28F salt sampling drill string in a replacement disposal container. These recovery actions would be planned in accordance with the 5Q Manual (DOE 2020d) under ALARA principles.

3.5.2.1.2 Glass Bubblers and Glass Pumps

As discussed in Section 2.2.1.2, the glass bubblers and glass pumps would be picked up remotely (via crane) inside the SRS DWPF canyon and transferred to a waiting disposal container in the railroad well. At any time during the crane operation, if the equipment were dropped, there could be shards of contaminated glass that break off of the bubblers or pumps. These shards or slivers of contaminated glass would fall either into the canyon building or the railroad well. If they fell into the canyon building, they would remain there unless removed by other remote operations (if they interfered with ongoing DWPF operations or maintenance activities). If they fell into the railroad well, DWPF operations personnel would plan for their removal based on the specific radiation risk. RWP planning would ensure that these recovery actions were conducted in accordance with ALARA principles, and worker doses would be kept to a minimum.

If the drop accident occurred after the glass bubblers and glass pumps were grouted and foamed inside the disposal container, there would be no expected releases of radioactive material. The disposal container would only be lifted high enough to be placed inside the transportation container and be highly unlikely to breach if dropped from this height. If the container did breach, there would not be any radioactive material released because the grout and foam would stabilize any loose contamination. Any pieces of grout or foam that broke free during a potential breach would be collected and handled as potentially contaminated LLW in accordance with SRS waste management and radiation protection procedures.

Any minor releases of radiological materials inside the railroad well would be removed via filtration prior to release to the environment. Therefore, DOE would not expect any off-site consequences from this accident scenario.

3.5.2.2 Intentional Destructive Acts

With regard to intentional destructive acts (i.e., acts of sabotage or terrorism), security at its facilities is a major priority for DOE. Following the terrorist attacks of September 11, 2001, DOE has implemented measures to minimize the risk and consequences of potential terrorist attacks on its facilities and continues to identify and implement measures to defend and deter attacks. The safeguards applied to protecting SRS involve a dynamic process of enhancement to meet threats; these safeguards will evolve over time. DOE maintains a system of regulations, orders, programs, guidance, and training that form the basis for maintaining, updating, and testing site security to preclude and mitigate any postulated terrorist actions.

There is no accepted basis for determining the probability of intentional attacks at any site, or the nature or types of such attacks. In general, the potential consequences of intentional destructive acts are highly dependent on distance to the site boundary and size of the surrounding population—the closer and higher the surrounding population, the higher the consequences. Impacts from intentional destructive acts are also largely based on the amount of material that could be released (i.e., the material at risk) in the event of such an act. The contaminated process equipment evaluated would not make an attractive target for intentional destructive acts; however, for the purpose of analysis, the potential impacts would be expected to be similar to those of the accident scenarios.

3.5.3 Alternative 2 Impacts

Under Alternative 2, the disposal containers of contaminated process equipment would be determined to be Class A LLW. Under that scenario, the potential human health impacts to the public and workers at SRS associated with accidents and intentional destructive acts from handling, stabilizing, and packaging the contaminated process equipment would be no more than the potential impacts discussed under Alternative 1 in Section 3.5.2.

3.5.4 No-Action Alternative Impacts

Under the No-Action Alternative, DOE would not conduct the Proposed Action. Instead, DOE would maintain the status quo, which is represented by the continued management at SRS of the contaminated Tank 28F salt sampling drill string, glass bubblers, and glass pumps. The contaminated process equipment would require disposition at some point in the future.

The Tank 28F drill string would remain in storage in H Area and would eventually be dispositioned during closure of the H Area Tank Farm. The accident risk associated with the eventual disposition of the drill string would be similar to that described for Alternative 1 in Section 3.5.2.1.1.

The glass bubblers and glass pumps would periodically be moved within the DWPF canyon using remote manipulators. Eventually, the pumps and bubblers would be dispositioned as part of the decontamination and decommissioning of DWPF. The accident risk associated with the remote movement or the eventual disposition of the pumps and bubblers would be similar to those discussed as part of Alternative 1 in Section 3.5.2.1.2.

3.6 Waste Management

This section presents waste management activities for the Proposed Action and alternatives. This section also describes the management and disposal of the secondary waste streams from the Proposed Action.

Transportation of wastes would include only solid LLW under both implementing alternatives and would be conducted using standard, regulated, and approved truck transport of approved packages. Under normal conditions, the temporary shielding and transportation containers would not be radiologically contaminated and would be returned to SRS for re-use. Therefore, there would be no additional wastes generated from these transportation activities.

3.6.1 Affected Environment

3.6.1.1 Savannah River Site

SRS generates and manages the following waste types:

- HLW
- TRU waste (including mixed TRU waste)
- LLW
- MLLW
- Hazardous waste
- Solid (sanitary) waste

HLW: As defined in the AEA and the NWPA, HLW is (A) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (B) other highly radioactive material that the Commission, consistent with existing law, determines by rule requires permanent isolation. At SRS, reprocessing waste is managed as HLW in the H-Area and F-Area waste tank farms. If waste is determined to be HLW, it will remain in storage until a geologic repository is available. Regarding the SRS contaminated process equipment in this Draft SRS Contaminated Process Equipment EA, prior to a disposal decision, DOE would characterize the waste to verify with the licensee of the commercial LLW disposal facility whether the waste meets DOE’s HLW interpretation for disposal as non-HLW. No HLW is expected to be generated from the Proposed Action or alternatives.

TRU Waste: In accordance with the *Waste Isolation Pilot Plant Land Withdrawal Act* (WIPP LWA; Public Law 102-579), TRU waste is radioactive waste containing more than 100 nanocuries (3,700 Becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) HLW; (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the EPA, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste that the NRC has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61. TRU waste generated at SRS typically consists of items with trace amounts of plutonium, such as clothing, tools, rags, residues, and debris. SRS packages its TRU waste for transport to the WIPP facility near Carlsbad, New Mexico, for disposal. The WIPP facility is DOE's deep geologic repository established for permanent disposal of TRU waste resulting from atomic energy defense activities and was established under the WIPP LWA. No TRU waste is expected to be generated from the Proposed Action or alternatives.

LLW: In accordance with the AEA, LLW is radioactive waste that is not HLW, SNF, TRU waste, byproduct material (as defined in Section 11e.(2) of the AEA), or naturally occurring radioactive material. At SRS, LLW produced by most generators typically consists of miscellaneous job control waste, equipment, plastic sheeting, gloves, and soils contaminated with radioactive materials. The LLW category also includes several waste streams from large-scale waste management operations. Miscellaneous job control waste incidental to the contaminated process equipment waste stream could include personal protective equipment (e.g., gloves, booties) and is expected to be generated from the Proposed Action. These waste quantities would be negligible compared with existing LLW quantities generated by existing operations at SRS and would be disposed of in existing facilities in E-Area.

The SRS Solid Waste Management (SWM) group is responsible for receiving LLW from site generators and, in some cases, from off-site generators, primarily the Naval Reactors Program. SWM is also responsible for verifying the waste received is as characterized by the generator and that the waste meets the receiving facility's waste acceptance criteria. In most cases, newly generated LLW accepted by SWM is taken directly to one of the disposal units shown in Table 3-11. In general, trenches are opened as needed, and there could be more than one trench of a single type open at any given time. Over the five-year period from fiscal year (FY) 2011 through FY 2015, LLW managed by the SRS SWM group averaged about 19,000 cubic yards per year

Table 3-11. Types of Solid LLW Disposal Units Used at SRS

Disposal Unit Type	Typical Capacity per Unit[a]	Description
Engineered trench	Total: 61,200 yd^3 Effective: 46,200 yd^3	Used primarily for disposal of LLW in B-12 and B-25 boxes and other disposal containers. Once full, it is backfilled and covered with a minimum of four feet of clean soil.
Slit trench	Total: 37,800 yd^3 per set of five segments Effective: 21,500 yd^3 per set of five segments	Designated for construction/decontamination and decommissioning debris, contaminated vegetation, and contaminated soil disposal. Once full, it is backfilled and covered with a minimum of four feet of clean soil.
Component-in-grout trench	Total: 21,600 yd^3 Effective: 8,500 yd^3	Similar to slit trenches, but once waste components are in place, they are encapsulated in grout. Used to dispose of bulky and containerized LLW that has higher radioactive inventories than LLW going to standard slit trenches.
Low-activity waste vault	Total: 40,000 yd^3	The at-grade concrete structure's capacity is equivalent to about 12,000 B-25 boxes. It is designed to receive, store, and dispose of LLW radiating less than or equal to 200 mrem per hour at five centimeters from the box surface.
Intermediate level vault	Total: 5,600 yd^3	Subsurface concrete structure designed for LLW that radiates greater than 200 mrem per hour at five centimeters from the unshielded container, or LLW that contains significant amounts of tritium. The vault has a removable cover to allow top loading, and the cells are encapsulated with grout as the waste is placed for disposal.

Disposal Unit Type	Typical Capacity per Unit[a]	Description
Naval reactor component disposal area	Total: 4,400 yd^3	At-grade laydown area designed for permanent disposal of activated metal or surface-contaminated Naval reactor program components (e.g., care barrels, adapter flanges, closure heads, and pumps). There are two Naval reactor component disposal areas, each with capacity shown, but one has been closed to further component placement.

yd^3 = cubic yard.

a. Typical trench capacities are presented with two values: total and effective. The "total" value represents the typical design size of the trench, and the "effective" value represents an approximate value for the maximum volume of waste and waste containers that can be disposed of in the trench.

Source: SRNS 2016b, pp. 21–25

(SRNS 2016b, p. 14). In addition to the solid LLW disposal units listed in Table 3-11, SRS also operates saltstone disposal units, which are disposal units to contain solidified (grouted) liquid LLW at SRS. A total of 13 saltstone disposal units are planned, ranging in size from approximately 2.8 million gallons of grout capacity to over 32 million gallons of grout capacity (SRR 2019).

Mixed Waste: As defined by DOE Manual 435.1-1, mixed waste is waste that contains source, special nuclear, or byproduct material subject to the *Atomic Energy Act of 1954*, as amended, and a hazardous component subject to RCRA. MLLW is generated by various SRS activities and operations, including environmental cleanup, decontamination and decommissioning, and construction. This waste typically includes materials such as solvent-contaminated wipes, cleanup and construction debris, soils from spill remediation, RCRA metals, and laboratory samples. MLLW is sent off-site to RCRA-regulated treatment, storage, and disposal facilities, such as those operated by WCS or Energy*Solutions*, but may first be held in one of several SRS on-site storage facilities that have the necessary permits to accept the waste. One of the permitted storage sites at SRS for both MLLW and hazardous waste is a section of the TRU waste storage pads, which has a storage capacity of 390 cubic yards. The disposal facility at NNSS in Nevada is also authorized to accept MLLW and would be considered an option for disposal of any MLLW generated as secondary waste from the Proposed Action.

Over the five-year period from FY 2011 through FY 2015, MLLW managed by the SRS SWM group averaged about 210 cubic yards per year (DOE 2015, p. 3-51). No additional MLLW is expected to be generated from the Proposed Action or alternatives.

Hazardous Waste: Hazardous waste is generated by multiple SRS activities and operations, including those noted above for MLLW. Typical hazardous waste at SRS includes materials such as RCRA metals, solvents, paints, pesticides, and hydrocarbons. Polychlorinated biphenyl (PCB) wastes, though regulated under the *Toxic Substances Control Act* (15 U.S.C. § 2601–2629) rather than RCRA, are managed under the hazardous waste program. As with MLLW, hazardous waste is generally sent off site to commercial RCRA-regulated treatment, storage, and disposal facilities, but may first be held in one of several SRS on-site storage facilities that have the necessary permits to accept the waste. Certain hazardous wastes are recycled, including metals, excess chemicals, solvents, and chlorofluorocarbons. PCB wastes are generally sent off site for commercial treatment and disposal, but some meet regulatory standards to be disposed of in the local Three Rivers Landfill.

Over the five-year period from FY 2011 through FY 2015, hazardous waste managed by the SRS SWM group averaged about 52 cubic yards per year (SRNS 2016b, p. 14). No hazardous waste is expected to be generated from the Proposed Action or alternatives.

Solid (sanitary) Waste: Solid waste refers to waste that is neither hazardous nor radioactive and consists of two categories: (1) municipal and (2) construction and demolition. Municipal waste is generally referred to as sanitary waste on SRS and is commonly disposed of in municipal sanitary landfills. Construction and demolition waste consists of bulky debris- and rubble-type wastes. No substantial quantities of solid waste are expected to be generated from the Proposed Action or alternatives.

3.6.1.2 Waste Control Specialists

The WCS facility in Andrews County, Texas, is located just off U.S. Highway 385 about 40 miles north of West Odessa, Texas, and 38 miles east of Eunice, New Mexico. The facility is licensed by the TCEQ for the disposal of Class A, Class B, and Class C LLW that meet specified waste acceptance criteria. Disposal of the stabilized waste at the WCS FWF would be conducted in accordance with the facility's operating license (Radioactive Material License No. R04100; TCEQ 2020). The potential impacts at WCS were considered as part of the WCS licensing process (TCEQ 2008).

The FWF opened on June 6, 2013, and has a current licensed capacity of up to 26,000,000 cubic feet and 5,600,000 curies. The FWF footprint evaluated as part of the current license is approximately 80 acres. The design and license allow the disposal facility to be developed in phases consistent with the need to dispose of the volume of LLW received. Additional phases of the disposal facility will be constructed as needed and within the licensed capacity requirements. The contaminated process equipment and disposal containers, when stabilized, would represent approximately 7,300 cubic feet of waste, or 0.03 percent of the WCS FWF licensed capacity. It would also represent approximately 232 curies, or about 0.004 percent of the WCS FWF licensed curie limit.

3.6.1.3 Energy*Solutions*

Energy*Solutions* operates a LLW disposal facility west of the Cedar Mountains in Clive, Utah. Clive is located along Interstate-80, about 60 miles west of Salt Lake City, Utah. The Clive LLW disposal facility is licensed by the UDEQ for the disposal of Class A LLW that meets specified waste acceptance criteria. Disposal of the stabilized waste in the existing LLW facility at the Energy*Solutions* site would be conducted in accordance with the facility's operating license (Radioactive Material License No. UT 2300249; UDEQ 2020). The currently licensed waste disposal capacity is about 5.04 million cubic yards (136 million cubic feet). The contaminated process equipment and containers, when stabilized, would represent approximately 7,300 cubic feet of waste, or 0.005 percent of the Energy*Solutions* licensed capacity.

3.6.2 Alternative 1 Impacts

The packaging and stabilization of the contaminated process equipment over the life of the disposal operation would produce up to an estimated 31 containers of stabilized LLW. If it is determined that the contaminated process equipment would be Class B or Class C LLW, the waste would be shipped to WCS in Andrews County, Texas. The transport of the loaded transportation containers to WCS would not generate any additional waste quantities. The temporary shielding and transportation containers would be protected from contamination and would be returned to SRS for re-use.

Based on sample data (see Appendix A to this Draft SRS Contaminated Process Equipment EA), DOE has a reasonable basis to anticipate that the waste stream would meet the first criterion of the HLW interpretation. At the time of implementing any of the alternatives, DOE would follow the waste acceptance process described in Section 2.6. The wastes would only be accepted for disposal if the volume and radiological constituents fell within the bounds of WCS' existing license. As a result, the LLW would result in negligible waste management impacts for WCS.

The NRC and/or the Agreement State regulator must complete an environmental analysis as part of the licensing process for commercial disposal facilities. This process was completed as part of the licensing process for the WCS disposal facility (TCEQ 2008, 2020). Because analysis of the potential environmental impacts of the commercial facilities are analyzed by the cognizant regulators, DOE incorporates those analyses by reference. DOE relies upon the determinations made by the appropriate regulators.

The waste preparation activities at SRS would also generate standard job control waste that would include items such as personal protective equipment (e.g., gloves, booties). This job control waste would be classified as LLW and would be disposed of on site in E-Area. These waste quantities would be negligible compared with LLW quantities generated by existing operations at SRS.

3.6.3 Alternative 2 Impacts

The potential waste management impacts at SRS from handling, stabilizing, and packaging the contaminated process equipment would be the same as discussed under Alternative 1 in Section 3.6.2. Under Alternative 2, however, the disposal containers would be transported from SRS to WCS or Energy*Solutions* for disposal following a determination that the contaminated process equipment is Class A LLW.

Based on sample data (see Appendix A to this Draft SRS Contaminated Process Equipment EA), DOE has a reasonable basis to anticipate that the waste stream would meet the first criterion of the HLW interpretation. At the time of implementing any of the alternatives, DOE would follow the waste acceptance process described in Section 2.6. The wastes would only be accepted for disposal at Energy*Solutions* if the waste volume and radiological constituents fell within the bounds of Energy*Solutions'* existing license (UDEQ 2020). As a result, the LLW would result in negligible waste management impacts for Energy*Solutions*.

The NRC and/or the Agreement State regulator must complete an environmental analysis as part of the licensing process for commercial disposal facilities. This process was completed as part of the licensing process for the existing Energy*Solutions* disposal facility (UDRC 2007). Because analyses of the potential environmental impacts of the commercial facilities are analyzed by the cognizant regulators, DOE incorporates those analyses by reference. DOE relies upon the determinations made by the appropriate regulators.

The transport of the transportation containers to WCS or Energy*Solutions* would not generate any additional waste quantities.

3.6.4 No-Action Alternative Impacts

Under the No-Action Alternative, DOE would not conduct the Proposed Action. Instead, DOE would maintain the status quo, which is represented by the continued interim storage and management of the contaminated process equipment. The contaminated process equipment would require disposition at some point in the future, and over the remaining operational life of DWPF, the amount of glass bubblers would continue to accumulate and require storage in the DWPF canyon building. The glass pumps and glass bubblers would continue to be stored on cell covers in the DWPF canyon building. Periodically, DWPF operations requires access to these cell covers. When that occurs, the pumps and bubblers have to be temporarily relocated and then replaced after the cell covers are returned. As the amount of this contaminated equipment increases, the time and space required for temporary relocation would increase.

3.7 Radiological Transportation

3.7.1 Affected Environment and Background

Transportation of LLW is strictly regulated. USDOT regulates packaging, labeling, preparation of shipping papers, handling, marking, and placarding of shipments and establishes standards for personnel as well as conveyance (e.g., truck and train) performance and maintenance (49 CFR Part 173). USDOT and the NRC set radioactive material packaging requirements (49 CFR 173.401 through 477 and 10 CFR Part 71, respectively).[19] In addition, in accordance with DOE Order 460.2A, "Departmental Materials Transportation and Packaging Management," DOE LLW shipments must comply with all internal DOE requirements.

Proper packaging is a key element in transportation safety. LLW must be packaged to protect workers, the public, and the environment during transport. Often, the same container is used for both transport and disposal. In this case, the B-36 container housing the Tank 28F salt sampling drill string would be transported within a certified industrial package (IP-2) transportation container that is about six feet high and 40 feet long. The glass bubblers and glass pumps would be housed within a specifically designed industrial disposal container (approximately 14 feet long by 4 feet wide by 4 feet high) and shipped inside an IP-2 freight container that is between four feet and six feet high and 20 feet long. Following arrival and disposal at an off-site facility, the transportation containers and any temporary shielding would be returned to SRS for other uses.

The SRS contaminated process equipment would be transported by truck. Vehicles and loads would be inspected by DOE and state inspectors (where required) before shipment. States may also inspect shipments to confirm regulatory compliance. The shipments would use the most

[19] Regulating the safety of nuclear materials shipments is the joint responsibility of the NRC and the USDOT. NRC establishes requirements for the design and manufacture of packages for radioactive materials (10 CFR Part 71). The USDOT regulates the shipments while they are in transit and sets standards for labeling and smaller quantity packages (49 CFR Part 173).

direct routes that minimize radiological risk. The shipments to and from the LLW disposal facilities would utilize the Interstate highway system for the majority of the route.

Data from the Federal Motor Carrier Safety Administration (FMCSA) for 2017 indicate that large trucks are involved in 35.9 accidents per 100 million miles traveled (FMCSA 2019). DOE has an outstanding transportation safety record. In FY 2020, DOE safely transported more than 3,200 hazardous materials shipments over 6 million miles with no USDOT recordable accidents (DOE 2020e). In the event an accident involving a shipment of LLW occurs, a response system is in place. DOE supports training and emergency planning through its Transportation Emergency Preparedness Program. State, Tribal, and local government officials respond to any such accident within their jurisdictions. DOE also responds to transport emergencies at the request of states and Tribal Nations. Radiological assistance program teams are available to provide field monitoring, sampling, decontamination, communications, and other related services.

The impacts of transporting LLW have been analyzed in numerous NEPA documents. The WM PEIS (DOE 1997) includes a comprehensive analysis of LLW transportation impacts and found that transporting the large volumes of LLW analyzed in the WM PEIS has the potential to affect the health of the truck crew and the public along the transportation route. These health effects include both radiological and non-radiological impacts. The radiological impacts are the result of radiation received during normal operations and accidents in which the disposal containers are assumed to fail. Non-radiological impacts could occur from exposure to vehicle exhaust and physical injury from vehicle accidents. In the WM PEIS, DOE determined that the impacts of transporting approximately 25,000 shipments of LLW (over a distance of approximately 9 million miles) would be as follows (DOE 1997, Section 7.4.2):

- Less than 0.5 fatality from radiological doses to either the truck crews or the public along the transportation route;[20]
- Less than 0.5 fatality from vehicle emissions; and
- One fatality resulting from physical injuries from traffic accidents.

Consistent with the CEQ's instruction to discuss potential impacts "in proportion to their significance" (40 CFR 1502.2[b]), DOE determines the appropriate level of detail of impact analysis, including transportation impact analysis, on a case-by-case basis. This determination is based on the nature of the proposed action and alternatives and the potential significance of potential impacts as discussed in 40 CFR 1508.27.

DOE analyses have consistently shown that the impacts of the transportation of radioactive materials are generally small and often far exceeded by the non-radiological impacts of that same transportation. For DOE actions where minimal impacts are expected from the transportation of radioactive materials, completely new quantitative analyses may not be necessary to assess the potential impacts of transporting radioactive materials or waste. Instead, DOE may use a simple screening analysis with appropriately conservative estimates to identify an upper bound on

[20] The WM PEIS (DOE 1997) analyses reflect a lower dose-to-LCF risk factor than DOE uses today. The updated factor reflects an increase of approximately 20 percent over the impacts calculated in 1997.

potential impacts, show whether potential impacts would be significant, and determine the need for further analysis.

Similar analyses (e.g., similar material, packaging, start points, and end points) may be incorporated by reference (40 CFR 1502.21) and used to develop an estimate for use in a screening analysis. Combining aspects of previously existing analysis and new analysis can help reduce duplicative effort and paperwork (40 CFR 1506.4).

The results of this screening approach can be used to determine if more substantial analysis is necessary. If the results of this analysis show that the potential risk is small or nonexistent, further analysis may not be helpful to decisionmakers or the public. In such cases, DOE may include a negative declaration of significant impact, accompanied by a brief explanation of the methodology and sources relied upon in arriving at conclusions regarding potential risks (see 40 CFR 1502.24).

Considering the potential impacts identified in the WM PEIS to the public along the route for 25,000 shipments of LLW, the potential incident-free impacts to the public from approximately 31 shipments under Alternative 1 in this Draft SRS Contaminated Process Equipment EA would be small. The majority of the potential incident-free transportation-related impacts to health and safety would be borne by the workers involved in the transportation activities.

3.7.2 Alternative 1 Impacts

The projected 31 shipments (1 Tank 28F salt sampling drill string shipment and 30 glass bubbler/pump shipments) containing the stabilized contaminated process equipment would be shipped from SRS to WCS (approximately 1,400 miles) over the proposed disposal operation. The packages (49 CFR 178.350) would meet all appropriate USDOT requirements for the transport of the stabilized waste to an off-site disposal facility, in accordance with 49 CFR Subchapter C, "Hazardous Materials Regulations." In FY 2020, DOE safely transported more than 3,200 hazardous materials shipments over 6 million miles with no USDOT recordable accidents (DOE 2020e).

The incident-free analysis summarized in Table E-5 of the WM PEIS assumed an external dose rate from LLW packages of one mrem per hour at 1 meter (3.3 feet). This represented the average dose rate for over 2,500 historical shipments that reported external dose rates (DOE 1997, p. E-41). Historically, there would have been shipments with higher and lower dose rates; however, all shipments are subject to the requirements in 49 CFR 173.441. This regulation requires that external dose rates for radioactive shipments be limited to 10 mrem per hour at 2 meters (6.6 feet) from the truck. Similarly, the regulation stipulates an external dose rate limit of two mrem per hour for any normally occupied space (i.e., truck cab). For the purpose of conservative analyses, this Draft SRS Contaminated Process Equipment EA uses the regulatory limits for external dose rates.

The driver would be the only worker close to the transportation container for any substantial length of time during the transport. Additional shielding could easily be added between the transportation container and the cab; however, this analysis does not credit such mitigation, which would likely be implemented to comply with ALARA principles.

The distance from SRS to WCS in Andrews County, Texas, is approximately 1,400 miles. The analysis assumes a 28-hour duration per shipment. It is unlikely that a single driver would perform all of the trips over a period in excess of 13 years. The total worker dose to a driver for a single shipment would be less than 56 mrem. The collective worker dose for the 31 trips would be approximately 1.74 person-rem under Alternative 1. The potential for an LCF associated with this level of radiation exposure is 0.001. DOE could use a backup driver in some instances, which would increase the number of crew members exposed to two. Conservatively, if a backup driver were used for every one of the 31 shipments, the collective worker dose would double (3.48 person-rem); as would the potential for an LCF (0.002).

With respect to accidents, according to FMCSA statistics (FMCSA 2019), the probability that a crash would occur during the 43,400 miles (1,400 miles times 31 trips) would be about 1 chance in 64. Since the WM PEIS (DOE 1997) determined that one non-radiological fatality could occur from LLW shipments of approximately 9 million miles, there would be less than 0.47-percent chance of a traffic fatality associated with Alternative 1. In the event an accident did occur, release of radiological material also would be unlikely. IP-2 packages must pass various tests, and only one percent of those involved in accidents has failed; of those, only 39 percent have released their contents (NRC 2003). In the very unlikely event the transportation container failed, the contents would be a solid waste form that would be contained within the disposal container. Because the solid form would not be dispersible, impacts to water and ecological resources would be extremely unlikely. Consistent with DOE's studies of LLW transportation impacts (DOE 1997), the transportation of the LLW in an IP-2 package would result in negligible impacts.

3.7.3 Alternative 2 Impacts

The potential transportation-related impacts at SRS from handling, stabilizing, and packaging the contaminated process equipment would be the same as discussed under Alternative 1 in Section 3.7.2. Under Alternative 2, however, the disposal containers would be transported from SRS to WCS (approximately 1,400 miles) or Energy*Solutions* (approximately 2,200 miles) for disposal following a determination that the contaminated process equipment is Class A LLW. The packages would be demonstrated suitable for transportation of the specific waste forms in accordance with USDOT requirements.

Considering the potential impacts identified in the WM PEIS to the public along the route for 25,000 shipments of LLW, the potential incident-free impacts to the public from 31 shipments under Alternative 2 in this Draft SRS Contaminated Process Equipment EA would be negligible. The majority of the potential incident-free, transportation-related impacts to health and safety would be borne by the workers involved in the transportation activities.

The potential dose rate to the driver from transportation of the packages to WCS was discussed under Alternative 1 in Section 3.7.2. The potential dose rate to the driver for transport to Energy*Solutions* in Clive, Utah, would be similar to that described for Alternative 1. Under Alternative 2, each 2,200-mile trip is assumed to take 44 hours. The total worker dose to a driver for a single shipment would be less than 88 mrem. The collective worker dose for the 31 trips would be approximately 2.73 person-rem under Alternative 2. The potential for an LCF for this level of radiation exposure to anyone on the transportation crew is 0.0016. DOE could use a backup driver in some instances, which would increase the number of crew members exposed to two. Conservatively, if a backup driver were used for every one of the 31 shipments, the collective worker dose would double (5.46 person-rem); as would the potential for an LCF (0.0032).

With respect to accidents, according to FMCSA (2019), the probability that a crash would occur during the 68,200 miles (2,200 miles times 31 trips) would be about 1 chance in 41. Since the WM PEIS (DOE 1997) determined that one non-radiological fatality could occur from LLW shipments of approximately 9 million miles, there would be less than 0.74-percent chance of a traffic fatality under Alternative 2. As described in Alternative 1, in the event an accident did occur, the probability of a release of radiological material also would be extremely unlikely.

3.7.4 No-Action Alternative Impacts

Under the No-Action Alternative, DOE would not conduct the Proposed Action. Instead, DOE would maintain the status quo, which is represented by the continued interim storage and management of the contaminated process equipment. The contaminated process equipment would require disposition at some point in the future, and over the remaining operational life of SRS DWPF, the amount of glass bubblers would continue to accumulate and require storage in the SRS DWPF canyon building. Eventual disposition would require transportation of all of the contaminated process equipment to an off-site disposal location, which would likely result in similar potential transportation impacts as the Proposed Action.

3.8 Reasonably Foreseeable Environmental Trends and Planned Actions

This EA identifies trends and planned actions in the regions of influence in order to fully evaluate potential impacts. The regions of influence for this SRS Contaminated Process Equipment EA includes SRS and the LLW disposal facilities at WCS in Andrews County, Texas, and Energy*Solutions* in Clive, Utah. Section 3.8.1 identifies these trends and actions for the regions of influence. Section 3.8.2 presents potential impacts from these trends and actions that could be cumulative when considering the potential impacts from the Proposed Action, as described in Sections 3.3 through 3.7.

3.8.1 Trends and Actions Within the Region of Influence

3.8.1.1 Savannah River Site

The primary region of influence for the Proposed Action at SRS includes the H Area Tank Farm and the DWPF in S Area. The off-site disposal of SRS contaminated equipment would occur periodically over the next 15 years. During that same timeframe, the following planned actions are expected to occur in this region:

- Ongoing liquid waste management and tank closure activities in the H Area Tank Farm;
- Ongoing HLW vitrification and glass waste storage at the DWPF;
- Construction and operation of the Tritium Finishing Facility (TFF) in H Area, and
- Operations of the Salt Waste Processing Facility approximately 0.25 mile from the DWPF.

3.8.1.2 Waste Control Specialists

The primary region of influence for the Proposed Action at WCS includes the FWF on the WCS site in Andrews County, Texas. WCS is licensed as a LLW disposal facility by the State of Texas (TCEQ 2020). In addition to the ongoing receipt and disposal of LLW at the FWF, the following actions could occur at this facility:

- Potential interim storage of commercial SNF. Interim Storage Partners, which includes WCS as a partner, has applied to the NRC for a license to provide interim storage services for commercial SNF. The license application is under review. The NRC published a Draft EIS for public review on May 8, 2020 (85 FR 27447);

- Potential acceptance of Greater-Than-Class C LLW. DOE prepared the Environmental Assessment for the Disposal of Greater-Than-Class C (GTCC) Low-Level Radioactive Waste and GTCC-Like Waste at Waste Control Specialists, Andrews County, Texas (DOE/EA-2082; DOE 2018b) to evaluate potential disposal of GTCC LLW and GTCC-Like waste at the FWF. The NRC has developed and issued a draft regulatory basis to support the development of a potential rulemaking for the disposal of certain types of GTCC waste in a LLW land disposal facility (NRC 2020); and

- Potential long-term management and storage of elemental mercury. DOE has previously evaluated the use of an existing building at WCS for long-term management and storage of elemental mercury. On May 24, 2021, DOE published a Notice of Intent to prepare a supplemental EIS to evaluate management and storage of mercury at an existing facility at WCS among other sites (86 FR 27838).

3.8.1.3 Energy*Solutions*

The primary region of influence for the Proposed Action at Energy*Solutions* includes the LLW disposal site in Clive, Utah. Energy*Solutions* is licensed as a LLW disposal facility by the State of Utah (UDEQ 2020). The following planned actions may or are expected to occur at this facility:

- Ongoing receipt and disposal of LLW at the EnergySolutions facility in Clive, Utah; and

- Potential development of a Federal Cell Facility at the Energy*Solutions* facility. In April 2021, Energy*Solutions* submitted a license application to the UDEQ to allow permanent disposal of concentrated depleted uranium from DOE (UDEQ 2021).

3.8.2 Potential Cumulative Impacts

This section describes the potential cumulative impacts that could occur from the Proposed Action of off-site disposal of SRS contaminated process equipment when considered with reasonably foreseeable environmental trends and planned actions within the region of influence. The three potential regions of influence potentially affected by the Proposed Action are addressed below.

3.8.2.1 Savannah River Site

As noted in the previous section, the primary environmental trends and planning actions that would occur concurrently with the Proposed Action include ongoing operations at H Area Tank Farm, the DWPF, and the Salt Waste Processing Facility. These facilities are currently operating. Additionally, the National Nuclear Security Administration is planning to construct and operate the TFF in the SRS H Area.

DOE has addressed the potential impacts of the ongoing actions (DOE 2002, 1994, 2001). The National Nuclear Security Administration prepared an EA and FONSI to evaluate the potential impacts of the TFF (NNSA 2021). Construction of the TFF would last about three years and result in minor impacts. Operations of TFF would likely begin before the last glass bubblers were shipped to a LLW disposal facility. Considering that the potential impacts of the Proposed Action (Sections 3.3 through 3.7) would be negligible to small, they would not measurably contribute to the impacts analyzed in these earlier NEPA documents.

3.8.2.2 Waste Control Specialists

Disposal of 31 disposal containers within the WCS FWF would represent about 0.03 percent of the licensed capacity of the WCS FWF. These disposal operations were considered during the licensing of the WCS LLW disposal facility (TCEQ 2020). The potential impacts at WCS were considered as part of the WCS licensing process (TCEQ 2008).

The NRC evaluated the potential environmental impacts of an interim SNF storage facility at the WCS site.[21] The NRC determined that impacts for the proposed interim SNF storage facility would be none too small, with potentially moderate socioeconomic benefits. The SNF would be stored in a newly constructed consolidated interim storage facility licensed by NRC, which would not affect WCS LLW disposal capacity.

DOE (2011) evaluated the potential impacts of long-term management and storage of elemental mercury at WCS, which would involve the potential receipt and storage of up to 10,000 metric tons of mercury from across the United States. DOE issued a Notice of Intent in the *Federal Register* to announce DOE's intent to prepare a new supplemental EIS that would, among other things, reduce the amount of mercury to up to 7,000 tons (86 FR 27838; May 24, 2021). The mercury would be stored in an existing, onsite, RCRA-permitted building and would not affect WCS LLW disposal capacity. In accordance with DOE (2011), the storage of this mercury would result in negligible to minor environmental impacts at WCS.

Considering that the disposal of the SRS contaminated process equipment would be a small percentage of the licensed capacity at WCS and other reasonably foreseeable actions in the region would result in small or minor potential impacts across all resource areas, DOE's Proposed Action would not measurably contribute to cumulative impacts in the WCS region of influence.

[21] Information regarding the NRC licensing process can be found at https://www.nrc.gov/waste/spent-fuel-storage/cis/waste-control-specialist.html

3.8.2.3 Energy*Solutions*

Disposal of 31 disposal containers within the Energy*Solutions* disposal facility would represent about 0.005 percent of the licensed capacity of that facility. These disposal operations were considered during the licensing of the facility (UDEQ 2020).

UDEQ has not completed its evaluation of the Energy*Solutions* license application for the Federal Cell Facility for disposal of concentrated depleted uranium. During this review, the State of Utah would consider potential impacts of both the existing licensed disposal capacity and the Federal Cell Facility.

Considering that the disposal of the SRS contaminated process equipment would be a small percentage of the licensed capacity at Energy*Solutions* and other reasonably foreseeable actions in the region would be collectively evaluated during the State's licensing process, DOE's Proposed Action would not measurably contribute to cumulative impacts in the Energy*Solutions* region of influence.

4 AGENCIES CONSULTED

Consultations with other agencies (e.g., State Historic Preservation Officer, U.S. Fish and Wildlife Service) were not required or undertaken in connection with this Draft SRS Contaminated Process Equipment EA because the Proposed Action would not impact cultural resources, historic properties, or threatened or endangered species. The following regulatory agencies were notified of the preparation of this Draft SRS Contaminated Process Equipment EA:

- NRC
- Idaho Department of Environmental Quality
- Nevada Division of Environmental Protection
- New York State Energy Research and Development Authority
- EPA
- SCDHEC
- TCEQ
- UDEQ
- Washington State Department of Ecology

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Appendix A: Estimated Radionuclide Concentrations

The Tank 28F salt sampling drill string was contaminated in 2006 with radiological materials contained in Tank 28F. The radionuclide concentrations in Tank 28F were analyzed and documented in WSRC-STI-2006-00151 (SRNL 2007).

Table A-1 presents the expected radionuclide concentrations for the Tank 28F salt sampling drill string B-36 disposal container and compares these concentrations to Class A, Class B, and Class C limits from 10 CFR Part 61 to demonstrate that DOE expects to dispose of the stabilized waste form as non-HLW. Additionally, Table A-1 also compares these concentrations within the disposal container to the activity limits for each radionuclide (A_2 values)[22] from 49 CFR Part 173 to demonstrate that the stabilized waste form should be able to be shipped as low specific activity (LSA)-II material.

Table A-1 demonstrates that the Tank 28F salt sampling drill string B-36 disposal container would be significantly below the Class B limits (per 10 CFR Part 61.55, Table 2, the Class B sum of fractions is approximately 0.042) but above Class A limits (per the same reference, the Class A sum of fractions is approximately 1.9). Therefore, the preliminary assessment indicates that the stabilized waste form would likely be Class B LLW.[23] Table A-1 also demonstrates that the stabilized waste form could be shipped as LSA-II material (LSA-II sum of fractions is approximately 0.0037).

The glass bubblers and glass pumps were generated during various phases of processing and thus represent a varied set of waste radionuclide concentrations. For purposes of analysis, this Draft SRS Contaminated Process Equipment EA uses the highest concentrations of each radionuclide from any feed material processed to date as documented in SRNL-STI-2012-00017, SRNL-STI-2013-00462, and SRNL-STI-2018-00699 (SRNL 2012, 2013, 2019) to demonstrate the potential final disposal container concentrations and 10 CFR Part 61.55 waste class. Table A-2 presents concentrations for the bubbler and pump disposal container compared to Class A, Class B, and Class C limits from 10 CFR Part 61 and transportation A_2 values from 49 CFR Part 173. The preliminary assessment in Table A-2 demonstrates that each glass bubbler and glass pump disposal container would be below the Class C limits (per 10 CFR Part 61.55, the Class C sum of fractions is approximately 0.4) but above Class A limits (per the same reference, the Class A sum of fractions is approximately 4) and would therefore be considered Class C LLW. Table A-2 also demonstrates that the stabilized waste form could be shipped as LSA-II material (LSA-II sum of fractions is approximately 0.015).

[22] The A_2 value is the radionuclide activity limit (per package) from 49 CFR Part 173. There are specific A_2 limits for each radionuclide. The A_2 values provide a relative measure of the potential health impact of the radionuclide; the higher the health risk of a particular radionuclide, the lower the A_2 radionuclide activity limit.

[23] Note: The Texas Administrative Code (30 TAC 336.362) and the Utah Administrative Code (R313-15-1009) include radium-226 as an additional radionuclide for determining LLW classification. A waste stream must meet all regulatory requirements (NRC and Agreement State) prior to disposal in that state. The Texas concentration limits are found at https://texreg.sos.state.tx.us/fids/30_0336_0362-1.html, and the Utah concentration limits are found at https://rules.utah.gov/publicat/code/r313/r313-015.htm#T47. Therefore, in addition to the Table A-2 radionuclides, the SRS contaminated process equipment would be evaluated for radium-226. Based on the initial characterization of the equipment, DOE does not expect any measurable radium-226 in the waste.

While the material processed at the DWPF in the future may vary in concentration, the sum of fractions is dominated by plutonium-238 concentration, and Table A-2 uses the highest concentration measured in any processing batch to date. DWPF has already generated approximately half of the glass canisters[24] expected in its operating life and many historical plutonium-238 concentrations are at least two to three times lower than the concentration utilized in Table A-2. In addition, the mass used for the concentration calculations is considered conservative, as more shielding and foam mass may be used in the final container. These points provide confidence that the future material would remain Class C LLW and LSA-II for transportation. If, in the future, DOE prepares future glass bubblers for disposal, the Department would verify that radionuclide concentrations of the DWPF feed material were not inconsistent with the values in Table A-2 and that disposal container contents could be disposed of under 10 CFR Part 61.

These results provide reasonable assurance that the waste classification and shipment package types this Draft SRS Contaminated Process Equipment EA assumes are appropriate.

[24] DWPF vitrifies HLW and pours the glass mixture into stainless steel canister for ultimate disposal as HLW.

Table A-1.Tank 28F Salt Sampling Drill String B-36 Disposal Container

Tank 28 Drill String in B-36 Container

	Total	Solid		Class A	Class A	Class B	Class B	Class C	Class C				LSA-II	Fraction
Radionuclide	Ci	Ci/m^3*	nCi/g**	Limit	Fraction	Limit	Fraction	Limit	Fraction	Total Ci	Ci/g**	A_2	1E-4 A_2/g	LSA-II
10CFR61 Table 1														
C-14	<4.01E-04	3.01E-05		0.8	3.76E-05	N/A	N/A	8	3.76E-06	4.01E-04	8.75E-11	8.10E+01	8.10E-03	1.08E-08
Nb-94	<5.74E-06	4.31E-07		0.02	2.15E-05	N/A	N/A	0.2	2.15E-06	5.74E-06	1.25E-12	1.90E+01	1.90E-03	6.59E-10
Tc-99	5.97E-03	4.48E-04		0.3	1.49E-03	N/A	N/A	3	1.49E-04	5.97E-03	1.30E-09	2.40E+01	2.40E-03	5.43E-07
I-129	3.50E-06	2.63E-07		0.008	3.28E-05	N/A	N/A	0.08	3.28E-06	3.50E-06	7.64E-13	N/A	N/A	N/A
Np-237	<2.28E-06		4.98E-04	10	4.98E-05	N/A	N/A	100	4.98E-06	2.28E-06	4.98E-13	5.40E-02	5.40E-06	9.22E-08
Pu-238	<6.78E-05		1.48E-02	10	1.48E-03	N/A	N/A	100	1.48E-04	6.78E-05	1.48E-11	2.70E-02	2.70E-06	5.48E-06
Pu-239	<2.01E-04		4.39E-02	10	4.39E-03	N/A	N/A	100	4.39E-04	2.01E-04	4.39E-11	2.70E-02	2.70E-06	1.62E-05
Pu-240	<7.35E-04		1.60E-01	10	1.60E-02	N/A	N/A	100	1.60E-03	7.35E-04	1.60E-10	2.70E-02	2.70E-06	5.94E-05
Pu-242	<1.24E-05		2.71E-03	10	2.71E-04	N/A	N/A	100	2.71E-05	1.24E-05	2.71E-12	2.70E-02	2.70E-06	1.00E-06
Am-241	<1.51E-04		3.30E-02	10	3.30E-03	N/A	N/A	100	3.30E-04	1.51E-04	3.30E-11	2.70E-02	2.70E-06	1.22E-05
Am-242m	<8.63E-04		1.88E-01	10	1.88E-02	N/A	N/A	100	1.88E-03	8.63E-04	1.88E-10	2.70E-02	2.70E-06	6.98E-05
Am-243	<6.30E-05		1.38E-02	10	1.38E-03	N/A	N/A	100	1.38E-04	6.30E-05	1.38E-11	2.70E-02	2.70E-06	5.09E-06
Cm-243	<1.69E-04		3.69E-02	10	3.69E-03	N/A	N/A	100	3.69E-04	1.69E-04	3.69E-11	2.70E-02	2.70E-06	1.37E-05
Cm-244	4.49E-05		9.80E-03	10	9.80E-04	N/A	N/A	100	9.80E-05	4.49E-05	9.80E-12	5.40E-02	5.40E-06	1.81E-06
Cm-245	<1.93E-04		4.21E-02	10	4.21E-03	N/A	N/A	100	4.21E-04	1.93E-04	4.21E-11	2.40E-02	2.40E-06	1.76E-05
Cm-247	<3.01E-04		6.57E-02	10	6.57E-03	N/A	N/A	100	6.57E-04	3.01E-04	6.57E-11	2.70E-02	2.70E-06	2.43E-05
Cf-249	<2.98E-04		6.50E-02	10	6.50E-03	N/A	N/A	100	6.50E-04	2.98E-04	6.50E-11	2.20E-02	2.20E-06	2.96E-05
Cf-251	<2.20E-04		4.80E-02	10	4.80E-03	N/A	N/A	100	4.80E-04	2.20E-04	4.80E-11	1.90E-02	1.90E-06	2.53E-05
Pu-241	<1.49E-03		3.25E-01	350	9.29E-04	N/A	N/A	3500	9.29E-05	1.49E-03	3.25E-10	1.60E+00	1.60E-04	2.03E-06
Cm-242	<1.80E-15		3.93E-13	2000	1.96E-16	N/A	N/A	20000	1.96E-17	1.80E-15	3.93E-22	2.70E-01	2.70E-05	1.46E-17
				SOF Table 1	7.50E-02	N/A	N/A	SOF Table 1	7.50E-03					
10CFR61 Table 2														
Sr-90	1.18E-04	8.86E-06		0.04	2.21E-04	150	5.91E-08	7000	1.27E-09	1.18E-04	2.58E-11	8.10E+00	8.10E-04	3.18E-08
Cs-137	2.48E+01	1.86E+00		1	1.86E+00	44	4.23E-02	4600	4.05E-04	2.48E+01	5.41E-06	1.60E+01	1.60E-03	3.38E-03
				SOF Table 2	1.86E+00	SOF Table 2	4.23E-02	SOF Table 2	4.05E-04					
Transportation														
U-233	<3.14E-05									3.14E-05	6.85E-12	1.60E-01	1.60E-05	4.28E-07
U-234	<2.02E-05									2.02E-05	4.41E-12	1.60E-01	1.60E-05	2.76E-07
U-235	<6.98E-09									6.98E-09	1.52E-15	N/A	N/A	N/A
U-236	<2.09E-07									2.09E-07	4.56E-14	1.60E-01	1.60E-05	2.85E-09
U-238	1.35E-08									1.35E-08	2.95E-15	N/A	N/A	N/A
Th-232	<8.85E-10									8.85E-10	1.93E-16	N/A	N/A	N/A
													SOF LSA-II	3.67E-03

* - Uses a B-36 volume of 13.32 m^3.

** - Uses a combined mass of the B-36 container, drill string and lead blanket of 4.581E+6 grams.

Table A-2. Glass Bubblers and Glass Pumps in a Disposal Container

DWPF Bubblers/Pumps in Disposal Container

	Total	Solid		Class A	Class A	Class B	Class B	Class C	Class C				LSA-II	Fraction
Radionuclide	Ci*	Ci/m^3**	nCi/g***	Limit	Fraction	Limit	Fraction	Limit	Fraction	Total Ci	Ci/g***	A_2	1E-4 A_2/g	LSA-II
10CFR61 Table 1														
C-14	<1.05E-06	1.66E-07		0.8	2.07E-07	N/A	N/A	8	2.07E-08	1.05E-06	2.58E-13	8.10E+01	8.10E-03	3.18E-11
Ni-59	<7.08E-04	1.12E-04		22	5.07E-06	N/A	N/A	220	5.07E-07	7.08E-04	1.73E-10	N/A	N/A	N/A
Tc-99	1.12E-04	1.77E-05		0.3	5.89E-05	N/A	N/A	3	5.89E-06	1.12E-04	2.74E-11	2.40E+01	2.40E-03	1.14E-08
I-129	2.60E-07	4.11E-08		0.008	5.13E-06	N/A	N/A	0.08	5.13E-07	2.60E-07	6.38E-14	N/A	N/A	N/A
Np-237	<1.74E-05		4.26E-03	10	4.26E-04	N/A	N/A	100	4.26E-05	1.74E-05	4.26E-12	5.40E-02	5.40E-06	7.89E-07
Pu-238	<1.04E-01		2.55E+01	10	2.55E+00	N/A	N/A	100	2.55E-01	1.04E-01	2.55E-08	2.70E-02	2.70E-06	9.43E-03
Pu-239	<5.13E-03		1.26E+00	10	1.26E-01	N/A	N/A	100	1.26E-02	5.13E-03	1.26E-09	2.70E-02	2.70E-06	4.65E-04
Pu-240	<1.82E-03		4.45E-01	10	4.45E-02	N/A	N/A	100	4.45E-03	1.82E-03	4.45E-10	2.70E-02	2.70E-06	1.65E-04
Pu-242	<2.39E-06		5.86E-04	10	5.86E-05	N/A	N/A	100	5.86E-06	2.39E-06	5.86E-13	2.70E-02	2.70E-06	2.17E-07
Am-241	<1.00E-02		2.45E+00	10	2.45E-01	N/A	N/A	100	2.45E-02	1.00E-02	2.45E-09	2.70E-02	2.70E-06	9.09E-04
Am-242m	<6.13E-05		1.50E-02	10	1.50E-03	N/A	N/A	100	1.50E-04	6.13E-05	1.50E-11	2.70E-02	2.70E-06	5.57E-06
Am-243	<1.13E-03		2.76E-01	10	2.76E-02	N/A	N/A	100	2.76E-03	1.13E-03	2.76E-10	2.70E-02	2.70E-06	1.02E-04
Cm-244	4.01E-02		9.81E+00	10	9.81E-01	N/A	N/A	100	9.81E-02	4.01E-02	9.81E-09	5.40E-02	5.40E-06	1.82E-03
Cm-245	<5.32E-06		1.30E-03	10	1.30E-04	N/A	N/A	100	1.30E-05	5.32E-06	1.30E-12	2.40E-02	2.40E-06	5.43E-07
Cm-247	<7.95E-06		1.95E-03	10	1.95E-04	N/A	N/A	100	1.95E-05	7.95E-06	1.95E-12	2.70E-02	2.70E-06	7.21E-07
Cm-248	<8.33E-06		2.04E-03	10	2.04E-04	N/A	N/A	100	2.04E-05	8.33E-06	2.04E-12	8.10E-03	8.10E-07	2.52E-06
Cf-249	<5.50E-06		1.35E-03	10	1.35E-04	N/A	N/A	100	1.35E-05	5.50E-06	1.35E-12	2.20E-02	2.20E-06	6.12E-07
Cf-251	<1.56E-05		3.83E-03	10	3.83E-04	N/A	N/A	100	3.83E-05	1.56E-05	3.83E-12	1.90E-02	1.90E-06	2.02E-06
Pu-241	<3.06E-02		7.50E+00	350	2.14E-02	N/A	N/A	3500	2.14E-03	3.06E-02	7.50E-09	1.60E+00	1.60E-04	4.69E-05
				SOF Table 1	3.99E+00	N/A	N/A	SOF Table 1	3.99E-01					
10CFR61 Table 2														
Ni-63	<4.35E-02	6.87E-03		3.5	1.96E-03	70	9.81E-05	700	9.81E-06	4.35E-02	1.07E-08	8.10E+02	8.10E-02	1.32E-07
Sr-90	5.66E+00	8.92E-01		0.04	2.23E+01	150	5.95E-03	7000	1.27E-04	5.66E+00	1.39E-06	8.10E+00	8.10E-04	1.71E-03
Cs-137	1.06E+00	1.68E-01		1	1.68E-01	44	3.81E-03	4600	3.65E-05	1.06E+00	2.61E-07	1.60E+01	1.60E-03	1.63E-04
				SOF Table 2	2.25E+01	SOF Table 2	9.86E-03	SOF Table 2	1.74E-04					
Transportation														
Cl-36	<2.45E-04									2.45E-04	6.01E-11	1.60E+01	1.60E-03	3.76E-08
U-233	<4.38E-05									4.38E-05	1.07E-11	1.60E-01	1.60E-05	6.71E-07
U-234	<2.63E-05									2.63E-05	6.44E-12	1.60E-01	1.60E-05	4.03E-07
U-235	<2.29E-07									2.29E-07	5.61E-14	N/A	N/A	N/A
U-236	<3.94E-07									3.94E-07	9.66E-14	1.60E-01	1.60E-05	6.04E-09
U-238	6.76E-06									6.76E-06	1.66E-12	N/A	N/A	N/A
Th-232	<6.26E-07									6.26E-07	1.53E-13	N/A	N/A	N/A
													SOF LSA-II	1.48E-02

* - Uses mass per bubbler/pump of 0.23 lbs (0.104 kg) of glass and six items per container.
** - Uses an assumed container volume of 6.343 m^3 (14ftx4ftx4ft).
*** - Uses an assumed mass of the equipment and shielding of 9000 lbs (4.082E+6 g).

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