Technical Evaluation Report for Non-High-Level Radioactive Waste (Non-HLW) Determination under the HLW Interpretation:

Commercial Disposal of Contaminated Process Equipment from the Savannah River Site

U.S. Department of Energy
Office of Environmental Management

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Executive Summary

This report evaluates whether certain contaminated process equipment at the Savannah River Site (SRS) in South Carolina meets the Department of Energy's (DOE) interpretation of the statutory term "high-level radioactive waste" (HLW), as set forth in the Atomic Energy Act of 1954, as amended (AEA, 42 U.S.C. 2011 et seq.) and the Nuclear Waste Policy Act of 1982 as amended (NWPA, 42 U.S.C. 10101 et seq.) (HLW interpretation). The process equipment consists of Tank 28F salt sampling drill string, glass bubblers, and glass pumps utilized during the on-site storage and treatment of reprocessing wastes, which resulted in the equipment's contamination. The HLW interpretation provides that "some reprocessing wastes may be classified as … non-HLW … and may be disposed of in accordance with their radiological characteristics."[1]

In 2023, DOE issued the *Final Environmental Assessment for the Commercial Disposal of Savannah River Site Contaminated Process Equipment*, DOE/EA–2154 (Final SRS Contaminated Process Equipment Environmental Assessment (EA)), which analyzed the potential impacts of the Proposed Action to dispose of the SRS contaminated process equipment at a commercial low-level radioactive waste (LLW) disposal facility outside of South Carolina, licensed by a U.S. Nuclear Regulatory Commission (NRC) Agreement State; disposal under the Proposed Action would be in accordance with the Agreement State's regulations, which are equivalent to NRC's regulations for land disposal of radioactive waste (10 Code of Federal Regulations (CFR) Part 61), and other requirements. DOE also concurrently issued a Finding of No Significant Impact, finding that implementation of any of the action alternatives analyzed in the Final SRS Contaminated Process Equipment EA would entail minor impacts and low risks, and would not constitute a major federal action significantly affecting the quality of the human environment in accordance with DOE's National Environmental Policy Act (NEPA) implementing procedures, 10 CFR Part 1021, and the regulations promulgated by the Council for Environmental Quality for implementing NEPA, , 40 CFR 1500-1508. Therefore, the preparation of an environmental impact statement is not required. Based on the analysis of alternatives in the Final SRS Contaminated Process Equipment EA, DOE intends to ship the contaminated process equipment to the Waste Controls Specialists LLC (WCS) Federal Waste Facility (FWF) located in Andrews County, Texas, for disposal.

This report demonstrates that the contaminated process equipment meets DOE's HLW interpretation for disposal as non-HLW. This information includes sampling results, waste characterization data, and other supporting information collected under SRS's quality assurance (QA) protocols, which indicates that the waste may be disposed at the WCS FWF as LLW or

[1] On June 10, 2019, DOE published a Federal Register supplemental notice concerning the availability of the US DOE Interpretation of high-level radioactive waste (84 FR 26835).

mixed LLW (MLLW)[2] in accordance with the facility's waste acceptance criteria, license conditions, environmental permits, and all other applicable requirements. The Tank 28F salt sampling drill string[3] would be classified as Class B LLW, and the Defense Waste Processing Facility (DWPF) glass bubblers and glass pumps would be classified as Class C LLW based on a comparison of the radionuclide concentrations to the limits in 10 CFR 61.55 and the NRC Agreement State compatible limits in 30 Texas Administrative Code §336.362 Appendix E. The calculated radionuclide data is based on the greatest radionuclide concentration from any feed material to date; therefore the results also apply to future glass bubblers that are anticipated to be produced in the future up until the facility operations are completed**.** The waste acceptance process for shipping waste to the WCS FWF will include confirmation that the waste continues to remain within the bounds analyzed in this report (i.e., does not exceed Class C concentration limits and meets the performance objectives of the disposal facility). SRS will ensure proper record-keeping practices and QA processes are maintained documenting that the glass bubblers continue to meet the conditions for disposal at the WCS FWF as LLW under the HLW interpretation.

[2] MLLW is LLW that also contains components that are chemically hazardous according to the Resource Conservation and Recovery Act. The Tank 28F salt sampling drill string would be MLLW due to lead concentrations.

[3] The Tank 28F salt sampling drill string is comprised of the salt sampling drill string, contaminated lead blankets used for shielding, and the B-36 disposal container that holds the drill string and blankets.

Acronyms

AEA	Atomic Energy Act of 1954, as amended
BTP	Branch Technical Position
CEQ	Council on Environmental Quality
Ci	curies
CFR	Code of Federal Regulations
cm	centimeters
DOE	U.S. Department of Energy
DWPF	Defense Waste Processing Facility
EA	environmental assessment
FONSI	finding of no significant impact
FR	*Federal Register*
ft.	feet
ft^3	cubic feet
FWF	WCS Federal Waste Facility
g	gram
HLW	high-level radioactive waste
LLW	low-level radioactive waste
m	meters
m^3	cubic meters
MCC	Modular Concrete Canister
nCi	nanocuries
NEPA	National Environmental Policy Act
NRC	U.S. Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act of 1982, as amended
MLLW	mixed low-level radioactive waste
QA	quality assurance
RCRA	Resource Conservation and Recovery Act
SOF	sum of fractions
SRMC	Savannah River Mission Completion, LLC
SRS	Savannah River Site
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
USDOT	U.S. Department of Transportation
WAC	waste acceptance criteria
WCS	Waste Control Specialists LLC

1. Introduction

The purpose of this report is to demonstrate that certain contaminated process equipment at the Savannah River Site (SRS) in South Carolina, which is currently managed as if it were high-level radioactive waste (HLW), meets the U.S. Department of Energy's (DOE) HLW interpretation and can be disposed as non-HLW at the Waste Control Specialists LLC (WCS) Federal Waste Facility (FWF) in Andrews County, Texas. The HLW interpretation provides that "some reprocessing wastes may be classified as not HLW (non-HLW) and may be disposed of in accordance with their radiological characteristics." The contaminated process equipment is comprised of the following items, with a more detailed description of these items provided in Chapter 2:

- Tank 28F salt sampling drill string together with lead shielding blankets currently in storage in a B-36 disposal container[4] at an SRS radioactive material area;
- Glass bubblers currently in storage at the Defense Waste Processing Facility (DWPF) and additional bubblers forecasted to be generated from DWPF melter operations; and
- Glass pumps currently in storage at the DWPF canyon building (the glass pumps have been replaced by the glass bubblers in DWPF melter operations).

The SRS contaminated process equipment has been utilized during the on-site storage and treatment of reprocessing waste at SRS, which resulted in the equipment's contamination. There is no current disposal pathway for the SRS contaminated process equipment. This contaminated process equipment is not HLW as demonstrated in this report and the disposal of this non-HLW waste complies with all applicable regulations as well as the WCS FWF waste acceptance criteria (WAC), including any applicable requirements for management of the waste prior to disposal and applicable U.S. Department of Transportation (USDOT; 49 Code of Federal Regulations [CFR] Parts 171-180), U.S. Nuclear Regulatory Commission (NRC) regulations (10 CFR Part 61), and Texas Administrative Code (TAC) regulations (30 TAC Chapter 336). Disposal of the non-HLW process equipment will mitigate on-site storage constraints, improve worker safety, and support accelerated completion of the environmental cleanup mission at SRS.

In 2023, DOE issued the *Final Environmental Assessment for the Commercial Disposal of Savannah River Site Contaminated Process Equipment*, DOE/EA–2154 (Final Environmental Assessment (EA)), which analyzed the potential impacts of the proposed action to dispose of certain SRS contaminated process equipment at a commercial low-level radioactive waste (LLW) disposal facility outside of South Carolina, licensed by an NRC Agreement State; disposal would comply with the Agreement State's regulations, equivalent to the NRC's regulations for land disposal of radioactive waste (10 CFR Part 61), and other requirements. At that time and based on the information and analysis in the Final EA, DOE also issued a Finding

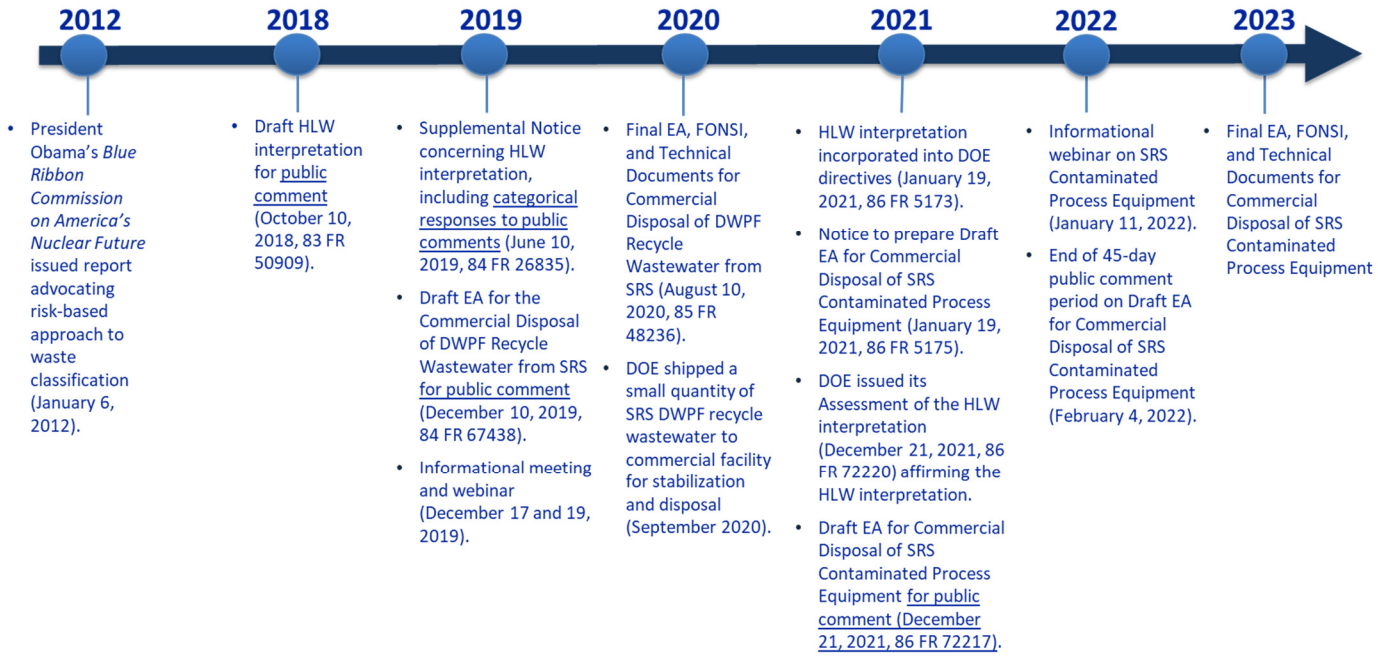
[4] The disposal container is the container that is emplaced in the disposal facility while the transportation container houses the disposal container during transport to the LLW facility.

of No Significant Impact (FONSI). The FONSI indicated that implementation of any of the action alternatives analyzed in the Final EA would entail minor impacts and low risks, and would not constitute a major Federal action significantly affecting the quality of the human environment in accordance with DOE's National Environmental Policy Act (NEPA) implementing procedures, 10 CFR Part 1021, and the regulations promulgated by the Council for Environmental Quality (CEQ) for implementing NEPA, 40 CFR 1500-1508. Therefore, the preparation of an environmental impact statement is not required. A timeline of key events for the HLW interpretation and the NEPA evaluation for the SRS contaminated process equipment is presented in Figure 1.

Packaging, shipment, and disposal of the SRS contaminated process equipment would be in accordance with all applicable licenses and permits. The WCS FWF is licensed by the Texas Commission on Environmental Quality (TCEQ) for the disposal of Class A, B, and C LLW and mixed LLW.

Based on representative sampling and analyses, as discussed in Chapter 3 of this report, the Tank 28 F salt sampling drill string in a B-36 disposal container would be classified as Class B LLW, and the glass bubblers and glass pumps in a disposal container would be classified as Class C LLW under the NRC waste classification tables in 10 CFR 61.55 and TAC waste classification tables in 30 TAC §336.362 Appendix E. The TAC waste classification tables mirror the NRC waste classification tables except that TAC adds an additional radionuclide (radium-226) to the waste classification table for long-lived radionuclides.

Figure 1. Timeline of Key Events



2. Background

This chapter provides background information supporting the classification of the SRS contaminated process equipment as non-HLW waste and planned disposal in an authorized near-surface facility. It presents an overview of DOE's HLW interpretation (Section 2.1) and NEPA analysis (Section 2.2); describes the SRS contaminated process equipment and associated packaging and transportation from SRS to WCS FWF for disposal (Section 2.3); and describes the WCS FWF (Section 2.4).

2.1 Overview of High-Level Radioactive Waste Interpretation

On October 10, 2018, DOE published a notice in the *Federal Register* (83 FR 50909) 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, as amended (AEA, 42 U.S.C. 2011 et seq.) and the Nuclear Waste Policy Act of 1982 as amended (NWPA, 42 U.S.C. 10101 et seq.). In that notice, DOE explained the history and basis for its interpretation of classifying reprocessing waste based on its radiological contents and not on the origin of the reprocessing waste.

Subsequently, on June 10, 2019, DOE published the *Supplemental Notice Concerning U.S. Department of Energy Interpretation of High-Level Radioactive Waste* (Supplemental Notice), 84 FR 26835, that provided additional explanation of DOE's interpretation as informed by public review and comment and further consideration by DOE. In the Supplemental Notice, DOE explained its interpretation of the term HLW, as defined in the AEA and the NWPA. As discussed in the Supplemental Notice, DOE has the long-standing authority and responsibility under the AEA to ensure that all radioactive waste from the United States' defense program—including reprocessing waste—is managed and disposed of in a safe manner. The AEA and NWPA define HLW as:

> (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. [42 U.S.C. 10101(12); *see* 42 U.S.C. 2014(dd)]

This definition of HLW makes clear that not all radioactive wastes from spent nuclear fuel reprocessing are HLW. DOE has the legal authority to interpret the term HLW in these statutes to determine that certain of its reprocessing wastes are non-HLW based on their radiological characteristics. Accordingly, DOE interprets those statutes to provide that reprocessing wastes are properly classified as non-HLW where the radiological characteristics of the waste, in combination with appropriate disposal facility requirements for safe disposal, demonstrate that

disposal of such waste is fully protective of human health and the environment. Under DOE's interpretation, a reprocessing waste may be determined to be non-HLW if the waste meets either of the following two criteria:

> "(I) does not exceed concentration limits for Class C low-level radioactive waste as set out in section 61.55 of title 10, Code of Federal Regulations, and meets the performance objectives of a disposal facility; or
>
> (II) 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." [84 FR 26836]

Reprocessing waste meeting either of the above criteria is non-HLW, and—pursuant to appropriate processes—may be classified and disposed in accordance with its radiological characteristics in an authorized facility provided all applicable requirements of the disposal facility are met.[5]

The Supplemental Notice states that: "Each reprocessing waste stream has unique radiological characteristics and, accordingly, the interpretation will be implemented in subsequent actions on a site-specific basis, following consideration of: evaluation and characterization of specific reprocessing waste streams in conjunction with the WAC and requirements of a specific waste disposal facility; input from affected stakeholders (e.g., federal, state, local and tribal officials; and members of the public); and compliance with applicable federal and state laws, regulations, and agreements."

DOE's January 19, 2021, FR Notice (86 FR 5173) announced a limited change to DOE M 435.1–1, *Radioactive Waste Management Manual* (Manual), to formally incorporate the Department's interpretation of the statutory definition of HLW. The revised Manual includes DOE's interpretation of the statutory term HLW as defined in the AEA and NWPA. Specifically, Chapter II of the Manual was revised to include a new Section C that sets forth the HLW interpretation and provides a basis for its use by DOE. The Manual also was revised to set forth the roles and responsibilities of Field Managers and the Deputy Assistant Secretary for Waste and Materials Management with respect to the application of the HLW interpretation.[6]

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[5] In a December 21, 2021, FR Notice (86 FR 72220), DOE affirmed that its interpretation of the statutory term ''high-level radioactive waste''(HLW) as defined in the AEA and NWPA is consistent with the law, guided by the best available science and data, and that the views of members of the public and the scientific community were considered in its adoption.

[6] Under Chapter I-2.F.(21), DOE Field Managers are responsible for ensuring that applications of the HLW interpretation are made and documented in a manner that supports a determination that one of the two HLW interpretation criteria described in Chapter II of the Manual is met and recommending the approval of such determinations to the DOE Office of Environmental Management's Deputy Assistant Secretary for Waste and Materials Management. Under Chapter I-2.E.(1), the Deputy Assistant Secretary for Waste and Materials Management is responsible for approving recommendations of the responsible Field Element Manager and identifying appropriate paths forward for the disposition of each waste stream determined not to be HLW.

The HLW interpretation limited change to the Manual does not affect DOE's current policies and practices relating to Chapter II.B, *Waste Incidental to Reprocessing*, of the Manual or under Section 3116 of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005.[7]

The SRS contaminated process equipment is the second waste stream analyzed consistent with the Department's HLW interpretation. In August 2020, DOE completed NEPA analysis of up to 10,000 gallons of SRS DWPF recycle wastewater, technical documents, and a non-HLW determination applying the HLW interpretation to eight gallons of the recycle wastewater, which was shipped to WCS for stabilization and disposal as Class B LLW in September 2020.[8]

2.2 National Environmental Policy Act

NEPA requires federal agencies to consider potential environmental impacts before making a decision regarding a proposed major Federal action. It also provides a mechanism for public review and input and the consideration of reasonable alternative actions for major federal actions. As summarized below, DOE has completed the appropriate NEPA analysis for the disposal of the SRS contaminated process equipment at a licensed commercial facility, in accordance with CEQ and DOE NEPA implementing regulations at 40 CFR Parts 1500 through 1508 and 10 CFR Part 1021, respectively.

DOE's Final EA analyzed the potential environmental impacts of the proposed action to dispose of certain SRS contaminated process equipment (Tank 28F salt sampling drill string, glass bubblers, and glass pumps) at a commercial LLW disposal facility outside of South Carolina, licensed by an Agreement State;[9] disposal would be pursuant to the Agreement State's regulations, which are equivalent to the NRC's regulations for land disposal of radioactive waste (10 CFR Part 61), and other requirements. DOE's characterization data on the contaminated process equipment and the analysis in this report demonstrates the waste is not HLW. In addition, coordination with disposal facility (WCS) representatives indicates the waste will meet the WCS waste acceptance requirements. DOE and WCS are following the process and procedures established to ensure compliance with waste disposal requirements at the WCS FWF as discussed in Section 2.4. DOE would demonstrate compliance with the WAC 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

[7] Public Law 108–375.
[8] Related documents can be found at: https://www.energy.gov/em/high-level-radioactive-waste-hlw-interpretation.
[9] 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 NRC 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. (Section 274b of the AEA, as amended).

waste prior to disposal and applicable USDOT requirements for packaging and transportation from SRS to the commercial disposal facility.[10]

The Final EA was informed by a 45-day public comment period (December 21, 2021, through February 4, 2022) on the Draft SRS Contaminated Process Equipment EA, issued on December 21, 2021 (86 FR 72217). DOE received comments from three organizations: the State of Nevada Division of Environmental Protection, U.S. Environmental Protection Agency (EPA), and the Savannah River Site Community Reuse Organization. DOE considered all comments received in preparing the Final SRS Contaminated Process Equipment EA. The comment documents and DOE's responses to the individual comments are provided as an appendix in the Final EA. In addition, during the public comment period, DOE held an informational internet webinar on January 11, 2022, to provide the public and stakeholders with an overview of the Draft SRS Contaminated Process Equipment EA and HLW interpretation.[11]

Based on the analyses in the Final EA, DOE determined the proposed action would have no significant impacts on human health and the environment, does not constitute a major federal action within the context of NEPA, and thus does not require preparation of an environmental impact statement. In the FONSI, DOE announces its intention to implement the proposed action, specifically, Alternative 1, which is the disposal of the SRS contaminated process equipment at the WCS FWF commercial LLW disposal facility located in Texas and licensed by an Agreement State; disposal would be in accordance with the Agreement State's regulations, which are equivalent to NRC's regulations in 10 CFR part 61 for land disposal of radioactive waste , and other requirements.

In 2023, DOE intends to initiate the first truck shipment of SRS contaminated process equipment to the WCS FWF for disposal as LLW in accordance with the facility's WAC, license conditions, environmental permits, and all other applicable requirements. Approximately 31 truck shipments (30 glass bubbler/pump shipments and 1 Tank 28F salt sampling drill string shipment)—each with one waste container—would be required until DWPF operations are completed in the 2034 timeframe for an average of about two shipments per year.

2.3 Description of Savannah River Site Contaminated Process Equipment

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 if it were HLW. The waste was placed into underground storage

[10] 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 packages.
[11] The presentation given by DOE at the informational meeting is available online at: https://www.energy.gov/em/program-scope/high-level-radioactive-waste-hlw-interpretation.

tanks at SRS and consists primarily of three physical forms: sludge, saltcake, and liquid supernatant.[12]

Storage and treatment of reprocessing waste at the SRS 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. The waste evaluated in the Final EA and in this report is comprised of Tank 28F salt sampling drill string (pipe), glass bubblers, and glass pumps. Each of these waste items is discussed in more detail below and summarized in Table 1.

Table 1. SRS Contaminated Process Equipment

Waste	Original Purpose of Equipment	Quantity
Tank 28F Salt Sampling Drill String	Used to collect reprocessing waste samples from the waste storage tank in F-Area	1
Glass Bubblers	Currently used to increase efficiency of SRS DWPF melter operations	~76 in storage as of December 16, 2022; ~4 expected every 6 months until 2034
Glass Pumps	Previously used to support DWPF melter efficiency but have been replaced by the glass bubblers	10 in storage

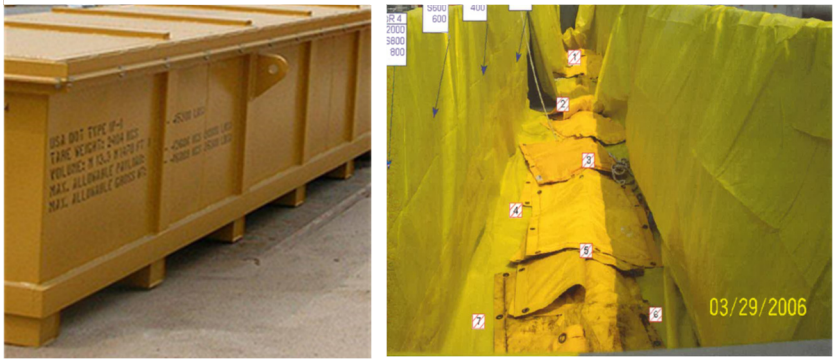
2.3.1 Tank 28F Salt Sampling Drill String

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.) (5.7 centimeters [cm]) in outer diameter by 41 feet (ft.) (12.5 meters [m]) long,[13] contaminated with reprocessing waste (supernatant) from Tank 28F. Contaminants include a mixture of radionuclides (e.g., cesium-137 and plutonium-238). The Tank 28F salt sampling drill string is currently stored in a large container in a high radiation area south of the H-Area Tank Farm. The container is approximately 36 ft. (11 m) 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 disposal container was placed in its current storage location in March 2006 (Figure 2). The Tank 28F salt sampling drill string is covered with lead blankets inside the B-36 disposal container to lower the external radiological dose rate outside of the container. The Tank

[12] 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 and saltcake is the insoluble salts formed by supernatant evaporation. The combination of supernatant and saltcake is referred to as salt waste.
[13] The Tank 28F salt sampling drill string in the B-36 disposal container consists of two sections with a combined length of approximately 41 ft. (12.5 m).

28F salt sampling drill string, contaminated lead blankets (used for shielding while in storage and will be disposed along with equipment), and B-36 disposal containers are part of the waste form for waste characterization, classification, and disposal because supernatant from the Tank 28F salt sampling drill string has contaminated the interior of the B-36 disposal container and lead blankets.[14]

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



As part of the preparation for packaging and transportation of the Tank 28F salt sampling drill string and to meet the offsite disposal facility void space requirements,[15] DOE would drill two or more holes in the B-36 disposal container and fill the void space in the container to less than 10% of the volume of the container. The lower portion of the B-36 disposal container would be filled with a cementitious grout sufficient to stabilize the Tank 28F salt sampling drill string and shielding lead blankets, fill remaining void space within the disposal container, and to provide necessary radiation shielding for the top and sides of the container. This process is standard practice when disposing of loose solid materials in a disposal container to meet WAC. Visual inspection of the B-36 disposal container has determined that it is no longer a suitable shipping container for Class 7 radioactive material. Therefore, DOE would place the B-36 disposal container in a hazardous material freight (transportation) container that meets the applicable USDOT requirements[16] for transportation of hazardous (radiological) materials. 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 are within USDOT guidelines in 49 CFR 173.441(b) (2-4) 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 WCS FWF. Once at the commercial disposal facility, the B-36 disposal container would be removed from the transportation container for disposal in accordance with WCS procedures. Due to the presence of the lead shielding blankets, the

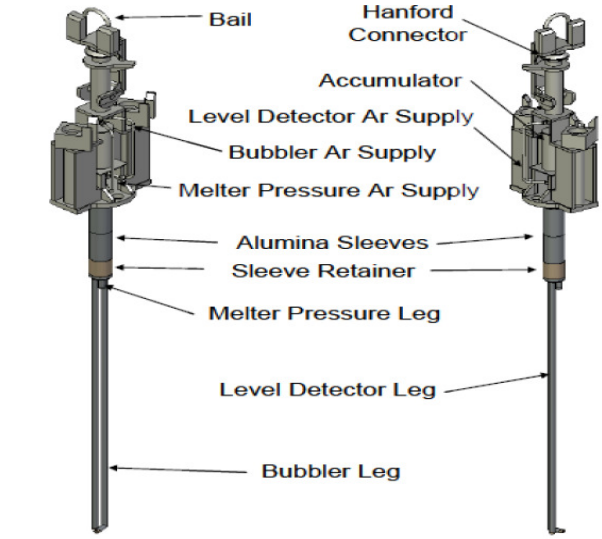
[14] The plastic sleeving surrounding the Tank 28F salt sampling drill string is considered to have failed from embrittlement due to the length of time (approximately 16 years) that the drill string has been in storage.
[15] Void space is the amount of empty space in the waste container. This includes the space between the top of the waste and the top of the waste package, as well as the interlayer space within the waste. The goal is to reduce the amount of empty space within the waste matrix and package to avoid underutilizing the facility's disposal capacity. The WCS' Federal Waste Disposal Facility Generator Handbook delineates void space requirements for containerized waste and must be reduced to the extent practicable. LLW can have no more than 15% void space while mixed LLW can have no more than 10% void space.
[16] Per WCS' Radioactive Material License (R041000), "Each shipment of low-level radioactive waste shall meet all applicable regulatory requirements for transportation in … U.S. DOT regulations (49 CFR Parts 171-180)..."

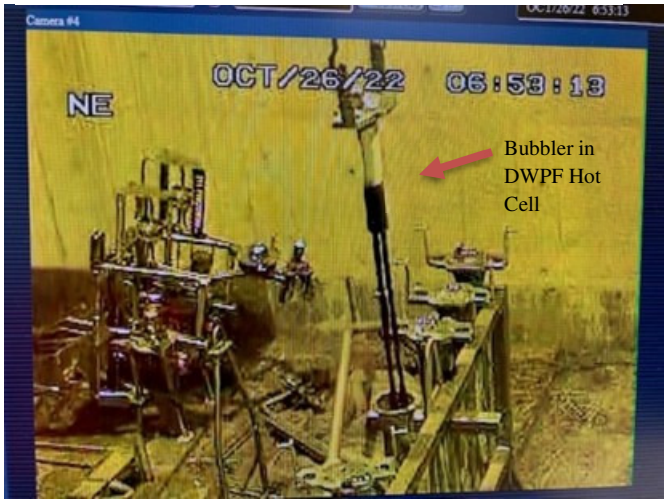
disposal container will be macro-encapsulated to meet RCRA land disposal restriction requirements (40 CFR Part 268).

2.3.2 Glass Bubblers

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-in. (1.9 cm) Inconel[17] pipe, which is inserted into the DWPF melter and through which an inert gas is introduced to increase melter efficiency. During operations, approximately 3 ft. (0.9 m) 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). The total length of each complete bubbler assembly is between 8.8 ft. (2.7 m) and 9.4 ft. (2.9 m), as there are four design lengths based on the bubbler location in the melter. SRS has approximately 76 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 3 provides a sample drawing and a photograph of a glass bubbler assembly.

Figure 3. Drawing (top) and Photograph (bottom) of Glass Bubbler





The glass bubblers would be placed in an industrial disposal container, pre-loaded with shielding and stabilization material prior to introduction of the contaminated equipment, properly sized for disposal of up to six glass bubblers (or pumps). This shielding and stabilization material could be steel plates, grout, or concrete blocks, depending on the configuration and amount of shielding required to ensure worker protection and meet applicable USDOT transportation requirements, provided in 49 CFR Parts 171-180. Approximately six bubbler assemblies, pumps, or a combination thereof, would be placed in the container. The contaminated process equipment would be covered in grout for stabilization, elimination of void spaces, and shielding purposes. After curing, the loaded disposal container

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

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 ft. (6.1 m) long, 8 ft. (2.4 m) wide, and 4 to 6 ft. (1.2 to 1.8 m) tall. The disposal container would be stabilized as necessary to prevent movement within the transportation container during shipment. The transportation container would be loaded onto a standard semi-truck and trailer for transportation to WCS FWF. Once at WCS, the disposal container would be removed from its associated transportation container for disposal in accordance with WCS procedures. The glass bubblers and glass pumps are not hazardous wastes under RCRA and therefore do not require treatment to meet RCRA land disposal restriction standards prior to disposal.

2.3.3 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. Each glass pump includes a section of Inconel pipe (right photo in Figure 4), measuring approximately 3.625 in. (9.2 cm) in outer diameter; only the lower portion (2 ft. [0.6 m]) of which was in the melt pool and contains contaminated glass. The overall glass pump (left photograph in Figure 4) is about 11 ft. (3.4 m) long. The glass pumps are contaminated with various radionuclides (e.g., cesium-137 and plutonium-238) similar to the glass bubblers. There are 10 glass pumps in storage at SRS requiring final disposal. The glass pumps are currently stored inside the DWPF canyon building. The glass pumps would be prepared for transportation and disposal in a similar manner as the glass bubblers, as described above.

Figure 4. Glass Pump (close-up of Inconel pipe on right).

2.4 Waste Control Specialists Federal Waste Facility

WCS is a treatment, storage and disposal company dealing in radioactive, hazardous, and mixed wastes. Its primary facilities are located on 1,338 acres (540 hectares) of land that is 35 miles (56 km) west of Andrews, Texas, and 5 miles (8 km) east of Eunice, New Mexico. WCS has three separate disposal facilities for radioactive waste, which includes the FWF. DOE plans to dispose of the SRS contaminated process equipment evaluated in this report at the WCS FWF. The FWF, which was designed, licensed, and constructed for federal waste disposal, is licensed by the state of Texas (an NRC Agreement State) for the disposal of Class A, B, and C LLW and mixed low-level waste (MLLW)[18] that meets the facility's WAC. Texas and other NRC Agreement States use state regulations that are equivalent to 10 CFR Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste," standard for licensing LLW disposal facilities, which divides LLW into "classes" (Class A, B, and C).

Disposal of the stabilized waste at the WCS FWF would be conducted in accordance with the facility's operating license, Radioactive Material License #R04100, Amendment Number 39 (February 2, 2023) (TCEQ RML) and permits.[19] The FWF was constructed for the sole purpose of disposing waste that is the responsibility of the Federal government as defined by the Low-Level Radioactive Waste Policy Act, as amended (42 U.S.C. 2021b et seq.). All MLLW and LLW at the FWF is disposed at least 25 ft. (7.6 m) up to 120 ft. (37 m) below the land surface in a disposal cell with a robust liner and multi-layered cover system up to 45 ft. (13.7 m) thick, and a RCRA compliant geosynthetic layer. The SRS contaminated process equipment would be placed in the FWF, as discussed in Section 3.2. In addition, all the waste is buried within the highly impermeable red-bed clay formation that extends hundreds of feet beneath the deepest layer of waste.[20]

The FWF is licensed for up to 26,000,000 cubic feet (ft^3) (736,000 cubic meters [m^3]) and 5,600,000 total curies (Ci) of wastes and the term of the current license is through September 2024, with provision for 10-year renewals thereafter. WCS is planning to submit a renewal application to TCEQ by September 2023 for the first 10-year renewal. DOE has signed an agreement to take ownership of the FWF after its closure, in accordance with Texas regulations (30 TAC §336.909). In post-closure, DOE will be responsible for long-term stewardship of the waste disposed of at the FWF.[21]

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[18] MLLW is LLW that also contains components that are chemically hazardous according to RCRA.
[19] WCS licenses and permits are available online at: https://www.wcstexas.com/customer/licenses-permits/
[20] *See* https://www.wcstexas.com/about/our-facilities/facilities/
[21] Information on the WCS facility was obtained from Savannah River National Laboratory, *Report of Analysis of Approaches to Supplemental Treatment of Low-Activity Waste at the Hanford Nuclear Reservation*, SRNL-RP-2018-00687, October 18, 2019, Section F.5. Available at: https://www.nationalacademies.org/event/10-31-2019/docs/DA2B03AEA4BDE0F1EC6AB3E4D6284EBFA4D856507E2E

The *WCS FWF Generator Handbook*[22] provides guidance and the specific criteria for waste acceptance at the FWF in compliance with WCS licenses, permits, and procedures. The WAC include limits on free liquids (<1 percent of the volume of containerized waste), maximum void space limits, transportation requirements, and prohibited waste types. Prohibited wastes include HLW, waste capable of generating toxic gases (excluding radioactive gases), and waste readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures or of explosive reaction with water.

The general waste acceptance process that DOE will follow is described below and shown in Figure 5. Steps 1-4 of that process will be completed before the contaminated process equipment is shipped from SRS and the incoming shipments will be verified by WCS once the shipments are received at WCS as shown in Step 5. As shown under the waste profile approval process (Step 2) and waste shipment request process (Step 3), WCS would review the waste profile and all shipment requests for accuracy before each shipment of the SRS contaminated process equipment to WCS.

Figure 5. Overview of WCS FWF Waste Acceptance Process

- **Generator certification (Step 1)** – All generators must be certified by WCS to be in accordance with its Quality Assurance (QA) Generator Certification Program prior to sending waste to WCS for disposal. Elements of the certification include the waste classification/characterization program (e.g., sampling and analytical procedures), waste packaging and shipping, personnel training program, and other requirements as described in the WCS FWF Generator Handbook. As part of the certification process, WCS conducts an on-site audit of the generator classification, characterization, and other program elements. DOE's management and operations contractor, Savannah River Nuclear Solutions, has been certified by WCS to ship acceptable waste to WCS FWF for treatment and/or disposal (Appendix A).
- **Waste profile approval (Step 2)** – A waste profile must be completed by the generator and approved by WCS for each authorized waste stream or appropriate combination of authorized waste streams that a generator intends to ship for disposal at the FWF. The completed waste profile and supporting documentation must allow WCS to demonstrate that the waste is compliant with regulatory requirements, along with license and permit conditions applicable to the WCS FWF. Analytical data and/or documentation of process knowledge are submitted with the waste profile. The data must be accompanied by an

[22] The *WCS FWF Generator Handbook* is available online at: https://www.wcstexas.com/wp-content/uploads/2020/11/Federal-Waste-Disposal-Facility-FWF-Generator-Handbook-.pdf

identification of the analytical method used for each parameter or constituent reported, and by QA/quality control results. The generator must demonstrate reasonable assurance that the waste is correctly classified as Class A, Class B, or Class C LLW in accordance with the waste classification tables in 30 TAC §336.362.

Savannah River Mission Completion, LLC (SRMC) will submit the waste profiles for the SRS contaminated process equipment to WCS for approval prior to any shipment request. Once the final reviews are complete and the waste is found to comply, the waste stream is considered "approved."[23]

- **Waste shipment request, approval, and verification (Steps 3, 4, and 5) –** Each shipment of waste to WCS must be pre-approved by WCS. Once a generator has completed generator certification and has an approved profile from WCS, then the generator can request to make a shipment to WCS. WCS will provide the generator with a Waste Shipment Request form and the generator shall complete and submit the applicable form along with an advance copy of the shipment manifest. WCS will review all associated shipping documentation. Once WCS has reviewed the shipping documentation and is satisfied that it complies with the WAC and the waste profile, WCS will approve the delivery of the shipment. The Waste Shipment Request form will contain the proposed scheduled date and time for delivery of the shipment. WCS approval of the Waste Shipment Request form is WCS's indication to the generator that it is authorized to ship the waste for disposal to the FWF on the proposed date and time. Waste verification will be performed by WCS on incoming shipments. The method and frequency will depend on the type of waste. DOE's contractor would satisfactorily complete this process with WCS before any of the SRS contaminated process equipment is sent to WCS for treatment and disposal. Because the SRS contaminated process equipment disposal packages are considered a large component under the TCEQ RML, WCS will submit a Large Component Disposal Plan to TCEQ for review and approval 90-days prior to shipment pursuant to TCEQ RML, License Condition 149, and TCEQ RML, Attachment C, Section 10.3. The Large Component Disposal Plan will include the waste profile for the SRS contaminated process equipment, packaging configuration and how it meets stability requirements, the waste classification, disposal placement plan, and other information specified in TCEQ RML, Attachment C, Section 10.3. TCEQ approval of the Large Component Disposal Plan is required before the waste can be disposed at WCS.

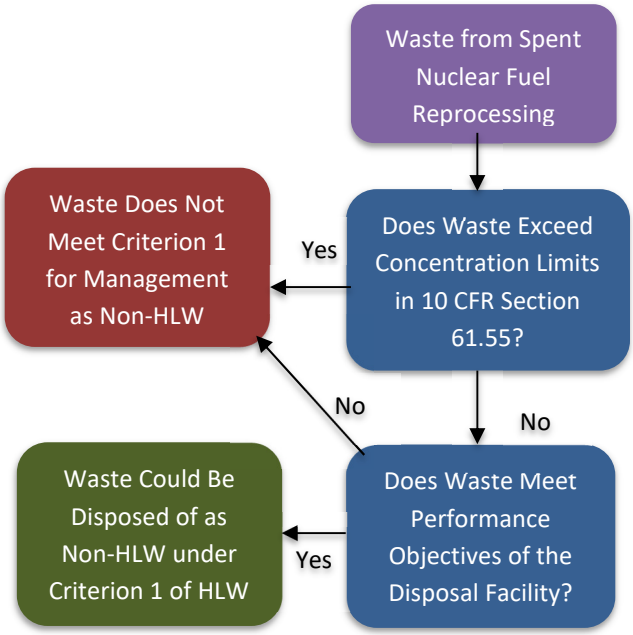
[23] http://www.wcstexas.com/wp-content/uploads/2016/01/Waste-Acceptance-Plan.pdf

3. Technical Information for Disposal as Non-High-Level Radioactive Waste

As discussed in Section 2.1, DOE's HLW interpretation provides that a reprocessing waste can be determined to be non-HLW if it meets either of two criteria. For the SRS contaminated process equipment, the discussion in this section demonstrates that the waste meets Criterion 1 of the HLW interpretation.

Figure 6 illustrates the decision process for Criterion 1. The two requirements contained in Criterion 1 (as shown in the blue decision boxes) are discussed individually in Sections 3.1 and 3.2. The process to classify the contaminated equipment is discussed in Section 3.1. Once the waste classification is determined, Section 3.2 provides assurance that the waste will meet the performance objectives applicable to the WCS FWF.

Figure 6. Criterion 1 of HLW Interpretation



3.1 HLW Interpretation Criterion 1, Part 1: "Waste Does Not Exceed Concentration Limits for Class C Low-Level Radioactive Waste as Set Out in Section 61.55 of Title 10, Code of Federal Regulations"

This section demonstrates that the SRS contaminated process equipment does not exceed Class C limits in 10 CFR 61.55. Section 3.1.1 provides an overview of the NRC waste classification system. Section 3.1.2 summarizes the waste characterization for the Tank 28F salt sampling drill string and the glass bubblers/pumps. Section 3.1.3 provides a detailed explanation of the resulting 10 CFR 61.55 waste classification.

3.1.1 Low-Level Radioactive Waste Classification System

For disposal at an Agreement-State licensed LLW disposal facility, LLW is segmented into waste categories of Class A, Class B, and Class C pursuant to NRC waste classification requirements at 10 CFR 61.55. The classes of LLW are based on the concentration of specific radionuclides and the potential hazards to public health and safety from facility operations and long-term disposal. Class A waste contains the least radioactivity, most of which comes from relatively short-lived radionuclides (half-lives less than 100 years), which decay to background levels within a few decades. Class B waste is also relatively short-lived, but contains larger concentrations of short-lived radionuclides than Class A. Class C waste can contain larger

concentrations of both short-lived and long-lived radionuclides (half-lives generally greater than 100 years). Class A, B, and C are considered suitable for near-surface disposal provided their characteristics meet NRC's characterization requirements specified in 10 CFR 61.56. Waste characteristics for disposal are discussed in Section 3.1.2. Classes of LLW apply to disposal at commercial facilities regulated by the NRC or an NRC Agreement State (such as the WCS FWF) and are relevant when DOE sends its waste to a commercial facility for disposal.

Under 10 CFR 61.55, classification is determined against two radionuclide tables: Table 1 (replicated in Table 2 of this report) includes concentration limits of long-lived radionuclides. Table 2 (replicated in Table 3 of this report) consists of concentration limits of short-lived radionuclides. Waste classification can be derived directly from the appropriate table if the waste stream contains only the radionuclides listed on the applicable table. However, for waste streams that contain both long-lived and short-lived radionuclides, as is the case for SRS contaminated process equipment, the classification requirements of 10 CFR 61.55(a)(5) specify:

> " (i) If the concentration of a nuclide listed in Table 1 does not exceed 0.1 times the value listed in Table 1, the class shall be that determined by the concentration of nuclides listed in Table 2.
>
> (ii) If the concentration of a nuclide listed in Table 1 exceeds 0.1 times the value listed in Table 1 but does not exceed the value in Table 1, the waste shall be Class C, provided the concentration of nuclides listed in Table 2 does not exceed the value shown in Column 3 of Table 2."

Further, 10 CFR 61.55(a)(7) describes the sum of fractions (SOF) rule for mixtures of radionuclides in relevant part as follows:

> "(7) *The sum of the fractions rule for mixtures of radionuclides*. For determining classification for waste that contains a mixture of radionuclides, it is necessary to determine the sum of fractions by dividing each nuclide's concentration by the appropriate limit and adding the resulting values. The appropriate limits must all be taken from the same column of the same table. The sum of the fractions for the column must be less than 1.0 if the waste class is to be determined by that column."

It should be noted that 30 TAC §336.362 Appendix E, Table I, is identical to NRC Table 1 but adds a limit for radium-226 to the classification determination. Since radium-226 is not present in the SRS contaminated process equipment, it does not affect classification. Also, 30 TAC §336.362 Appendix E, Table II, is identical to NRC Table 2.

Table 2. TCEQ Waste Classification Table for Long-Lived Radionuclides

Concentration Units are either Curies per Cubic Meter (Ci/m^3) or Nanocuries per Gram (nCi/g)

Radionuclide	Concentration	Concentration Units
Carbon-14	8	Ci/m^3
Carbon-14 in activated metal	80	Ci/m^3
Nickel-59 in activated metal	220	Ci/m^3

Radionuclide	Concentration	Concentration Units
Niobium-94 in activated metal	0.2	Ci/m^3
Technetium-99	3	Ci/m^3
Iodine-129	0.08	Ci/m^3
Alpha-emitting transuranic nuclides with half-life greater than 5 years (1)	100	nCi/g
Plutonium-241	3,500	nCi/g
Curium-242	20,000	nCi/g
Radium-226	100	nCi/g

Notes:
1. Alpha-emitting transuranic nuclides evaluated include Neptunium-237, Plutonium-238, Plutonium-239, Plutonium-240, and Plutonium-242, Americium-241, Americium-242m, Americium-243, Curium-244, Curium-245, Curium-246, Curium-247, Curium-248, Californium-249, and Californium-251

Table 3. TCEQ Waste Classification Table for Short-Lived Radionuclides

Radionuclide	Concentration (Ci/m^3)		
	Column 1	Column 2	Column 3
Total of all nuclides with less than 5-year half-life	700	(1)	(1)
Tritium	40	(1)	(1)
Cobalt-60	700	(1)	(1)
Nickel-63	3.5	70	700
Nickel-63 in activated metal	35	700	7000
Strontium-90	0.04	150	7000
Cesium-137	1	44	4600

Notes:
1. There are no limits established for these radionuclides in Class B or C waste.

The classification tables establish concentration limits for Class A, B and C LLW, calculated by using the measured radionuclide activities in the waste divided by the average volume and mass of the waste form. Concentration averaging is permissible in determining waste class (30 TAC §336.362(a)(8)).

A key objective of classification is to limit radioactivity concentrations in LLW to protect an inadvertent intruder from radiological exposures after the disposal facility is closed.

The NRC has issued guidance on acceptable methods to classify certain wastes based on waste concentrations for certain waste forms through a Branch Technical Position on Concentration

Averaging and Encapsulation,[24] Rev. 1, February 2015 (NRC BTP).[25] The NRC BTP allows for either a generic method (NRC BTP, Section 3.3.4, Encapsulation of Discrete Items) or an alternative method (NRC BTP, Section 3.8, Alternative Approaches for Averaging) for concentration averaging of encapsulated discrete items. The generic method specifies the amount of credit allowed for the encapsulation volume and mass in the averaging of radionuclide concentrations to determine the classification of waste. Larger volumes for encapsulation may be proposed on a case-by-case basis under Section 3.8 provided it is protective of an inadvertent intruder.[26] Information provided to the regulatory authority under Section 3.8 should include, as applicable:

- An overview of the proposed alternative approach (e.g., depth of burial or other factors) and how it will protect an inadvertent intruder.
- A detailed description of the waste form(s) covered by the alternative averaging approach.
- An identification of the BTP's existing position for which an alternative is requested.
- For proposals based on inadvertent intruder exposure scenarios different from those in the BTP, a discussion of how they were selected should be provided.
- A description of site characteristics pertinent to the proposal.
- An analysis of the effects of degradation on packaging and engineered barriers over the period that the waste remains hazardous to an intruder.

The purpose of this guidance is to ensure that extreme measures (e.g., using large encapsulation volumes) cannot be taken solely for the purposes of lowering waste classification.

As defined in Attachment C, *Definitions*, of the TCEQ RML "Equipment and large items that will not fit into a Modular Concrete Canisters [MCC]" would be a large component. In accordance with the TCEQ RML requirements (see license requirements 148 and 149), "Large components must be filled with sand, or grout, if necessary, to ensure voids are filled."

3.1.2 Waste Characterization of Contaminated Process Equipment

Under its waste characterization requirements in 10 CFR 61.56, NRC has established minimum requirements for all classes of LLW which are intended to a) facilitate safe handling at the disposal site, b) provide protection of health and safety and c) provide stability of the waste to ensure no structural degradation which could affect the disposal site's performance. Of the 11

[24] Encapsulation is the process of surrounding discrete items of radioactive waste in a non-binding matrix, where the activity remains within the dimensions of the original item of waste. The SRS contaminated process equipment is encapsulated, and furthermore, meets the BTP's definition of discrete items. A discrete item is defined as contaminated material expected to remain intact during an intrusion. Encapsulated discrete items are acceptable for disposal as per TCEQ RML.

[25] Available online at: https://www.nrc.gov/waste/llw-disposal/llw-pa/llw-btp.html

[26] An inadvertent intruder is a person who might occupy the disposal site after closure and engage in normal activities such as agriculture and dwelling construction, or other pursuits in which the person might unknowingly be exposed to radiation from the waste (10 CFR 61.2).

waste characteristic requirements in 10 CFR 61.56, the following have informed the design of the SRS contaminated process equipment waste forms to support safe disposal:

- Waste must not be packaged for disposal in carboard or fiberboard boxes.
- Solid waste containing liquid [as in the case of the drill string] shall contain as little free standing and noncorrosive liquid as is reasonably achievable, but in no case shall the liquid exceed 1 percent of the volume.
- Waste must have structural stability. A structurally stable waste form will generally maintain its physical dimensions and its form, under the expected disposal conditions. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.
- Void spaces within the waste and between the waste and its package must be reduced to the extent practicable.

3.1.2.1 Quality Assurance for Waste Characterization

The characterization of the contaminated process equipment followed established procedures, guidance, and requirements. The SRS waste characterization program is certified by WCS in accordance with WCS's Quality Assurance Generator Certification Program (Appendix A). This certification includes WCS review of SRS's waste characterization program (e.g., sampling and analytical procedures), process control program, waste packaging and shipping program, personnel training program, records, and other program elements as described in WCS FWF Generator Handbook, Section 4.[27] The TCEQ Resident Inspector may inspect waste shipments and manifests received at the disposal facility for proper characterization prior to waste acceptance. In addition, prior to waste acceptance, TCEQ will review for approval the WCS Large Component Disposal Plan for the SRS contaminated process equipment (discussed in Section 2.4 of this Report). This established system assures that waste disposed of at WCS meets the TCEQ RML and the FWF WAC.

DOE Manual 435.1-1, Chapter II.C.(2) states "Proper record-keeping practices and quality assurance processes will be applied to ensure adequate supporting documentation for any determinations that either of the criteria in subsection (1) is met." The waste characterization reports and analyses (Appendices B and C) were prepared in accordance with SRS QA program, which complies with DOE Order 414.1D, *Quality Assurance*; American Society of Mechanical Engineers Nuclear Quality Assurance; and 10 CFR 830, Nuclear Safety Management.

[27] The WCS FWF Generator Handbook is available at: https://www.wcstexas.com/wp-content/uploads/2020/11/Federal-Waste-Disposal-Facility-FWF-Generator-Handbook-.pdf

3.1.2.2 Characterization of Tank 28F Salt Sampling Drill String

SRMC has documented the radiological and chemical characteristics of the Tank 28F salt sampling drill string in the report titled *Waste Characterization of the Tank 28 LM-75 Drill String* (FT14005196) [Calculation Number Q-CLC-F-00372, Rev. 0, January 2022]. This report is included as Appendix B. The report also documents assays and analyses performed to record the radionuclide concentrations used for classification. The concentrations for each key radionuclide are shown in Tables 5 and 6 of Section 3.1.3.1. The waste characterization is based on the following information, detailed in Section 2.3 of this Report.

Characterization of Supernatant Contamination and Waste Disposal Form

- Due to supernatant contamination within the B-36 disposal container during storage, the Tank 28F salt sampling drill string, the contaminated lead blankets, plastic sleeving, and B-36 disposal container comprise the waste form for disposal.[28]
- The Tank 28F salt sampling drill string is in two sections with a total length of 41.67 ft. (12.7 m) (Appendix B, Section 4.0.A.2).
- The B-36 disposal container will be filled with grout to a height of 9 in. (Appendix B Section 5.2).
- The waste form volume equals 13.32 m^3 (470.4 ft^3) based on the internal volume of the B-36 disposal container. The waste form mass is 7,000 pounds (lbs.) (3,175 kilograms [kg]), based on the weight of the Tank 28 F salt sampling drill string (173 lbs. or 78 kg), lead blankets (1,527 lbs. or 693 kg), and B-36 disposal container (5,300 lbs. or 2,404 kg). For conservatism, the weight of the grout (10,969 lbs. or 4,978 kg) is not included in the radionuclide concentration calculations (Appendix B, Section 5.3.3 and Appendix B, Attachment 1).
- Since the longest dimension of the B-36 disposal container exceeds the length of a WCS FWF MCC, the waste is considered a large component under the TCEQ RML.
- The waste is RCRA hazardous for lead (waste code D008) due to the presence of the lead shielding blankets in the B-36 disposal container. The container will be macro-encapsulated at WCS to meet RCRA land disposal restrictions (Appendix B, Table A7-1).

Radionuclide Concentrations of Tank 28F Salt Sampling Drill String Contamination

- The drill string is conservatively assumed to have contained a maximum of 6.8 gallons (0.0257 m^3) of Tank 28F supernatant when it was placed into the B-36 disposal container, based on the drill string's maximum capacity and dimensions (Appendix B, Section 4.0.A.1).

[28] Throughout this section, the term "Tank 28F salt sampling drill string" includes the drill string, plastic sleeving, lead blankets, and the interior of the B-36 disposal container. All these components are assumed to be contaminated with supernatant.

- The radionuclide activities in the drill string are documented in *Analysis of Tank 28F Saltcake Core Samples FTF-456–467*, Rev. 0, February 28, 2007.[29]
- Radionuclide activities were decayed to September 2021 (15.6 years) for purposes of waste classification (Appendix B, Table A3-2).

3.1.2.3 Characterization of Glass Bubblers and Glass Pumps

SRMC has documented the radiological and chemical characteristics of the glass bubblers/pumps in the report titled *Radiological Distribution of the DWPF Melter Bubblers/Glass Pumps* [Calculation Number Q-CLC-S-00144, Rev. 0, October 2022] and is included as Appendix C. The report also documents assays and analyses performed to document the radionuclide concentrations used for classification. The concentrations for each key radionuclide are shown in Tables 7 and 8 of Section 3.1.3.2. As further discussed in Appendix C, the waste characterization is based on the following information.

Characterization of Glass Contamination and Waste Disposal Form

- A thin layer of glass is adhered to the lower 3 ft. of each bubbler and pump[30] from contact with the DWPF melt pool during operation. It is conservatively assumed to weigh 0.10 kg (0.23 lbs.) using the larger surface area of a glass pump.
- The inside of the bubblers/pumps does not contain glass due to the continuous flow of argon/air during operations that prevented internal buildup of glass.
- Each glass bubbler and pump, including adhered glass, weighs on average 63.1 kg (140.2 lbs.) and is relatively small compared to the weight of the encapsulation material (11,267 kg [24,840 lbs.]). Therefore, only the weight of the encapsulation material was used for the waste weight.
- A specially designed disposal container will minimize the volume to encapsulate the waste while keeping surface doses within acceptable levels. The waste volume of about 6.1 m^3 (216 ft^3) was determined using the internal disposal container dimensions.
- Since the longest dimension of the disposal container exceeds the length of a WCS FWF MCC, the waste form is considered a large component.
- The glass bubblers and glass pumps are not hazardous wastes under RCRA and do not require treatment to meet RCRA land disposal restriction standards.

Radionuclide Concentrations of Glass Contamination

- The DWPF glass bubblers/pumps were generated during various phases of processing and each pump or bubbler exhibits different levels of radionuclide contamination. Consequently, correlating a specific sludge batch to a distinct pump or bubbler is not possible. While the tank waste processed at DWPF in the future may vary in

[29] Available on-line at: https://sti.srs.gov/fulltext/WSRC-STI-2006-00151.pdf
[30] Only the lower 2 ft. of the glass pump was in the melt pool, but 3 ft. was used for conservatism in waste characterization.

concentration, the SOF is dominated by Pu-238 and Cs-137 concentrations. Therefore, waste classification is conservatively based on the highest concentration of these radionuclides measured in any processing batch.

- A conservative radionuclide distribution was applied by using the maximum concentration of each radionuclide over all sludge batches that have been processed through DWPF to date. This analysis is documented in *Reporting the Radionuclide Inventory for Macrobatch 11 Canisters* [Calculation Number X-CLC-S-00464, Revision 0, October 2022].
    - DWPF has produced approximately half of the glass canisters projected over its operating life. Many of the historical Pu-238 concentrations in the glass are at least two to three times lower than the conservative concentration used in determining waste class.
    - A recent sludge batch (SB9) has the highest Cs-137 concentration due to the addition of cesium removed from Salt Waste Processing Facility feed. This bounds the Cs-137 concentration analyzed.
- DOE would verify that radionuclide concentrations adhered to future glass bubblers are consistent with those used in this report. If not, DOE would update the equipment waste profiles and work with WCS to ensure continued compliance with the WCS FWF WAC.

3.1.3 Overview of Waste Classification Approach for the SRS Contaminated Process Equipment

The waste classification approach presented in this section was discussed with representatives from the licensee of the proposed disposal facility (WCS), which included providing the waste characterization reports in Appendices B and C. As specified in the BTP (Section 3.8, page 36), the licensee provided a draft copy of this report to the regulator (TCEQ) and had discussions on its merits before DOE finalized this report. DOE representatives also discussed the waste characterization approach and results with TCEQ.

The SRS contaminated process equipment was classified following TCEQ RML, the NRC BTP, and SRS Manual 1S, *Radioactive Waste Requirements*, Chapter 3, *Waste Characterization Program*, Revision 5, January 28, 2021 (SRS Manual 1S) (Appendix D). As discussed earlier, concentration averaging is permissible in determining waste class (10 CFR 61.55(a)(8)). For purposes of concentration averaging, the SRS contaminated process equipment is considered a large component comprised of encapsulated discrete items under the TCEQ RML.[31]

[31] Encapsulation is the process of surrounding discrete items of radioactive waste in a non-radioactive binding matrix, where the activity remains within the dimensions of the original item of waste. The advantages of encapsulation are that it can mitigate waste dispersion to the general environment after disposal, provide additional shielding to limit external radiation, and satisfy applicable stability and technical requirements for land disposal facilities.

TCEQ RML provides that: (1) waste classification of encapsulated discrete items disposed of at the WCS FWF shall be packaged and characterized using concentration averaging in accordance with the NRC BTP (TCEQ RML, License Condition 140) and (2) WCS FWF is authorized to accept for disposal waste that is handled, treated, packaged, or characterized in accordance with DOE orders, policies, and procedures (TCEQ RML, License Condition 142.C.). Waste characterization and classification of the SRS contaminated process equipment followed these TCEQ RML requirements, as discussed below.

- Tank 28F Salt Sampling Drill String: The waste volume and mass for calculating the concentration of radionuclides equals 13.32 m^3 (470.4 ft^3), based on the internal volume of the B-36 box, and 7,000 lbs. [3,175 kg], based on the weight of the drill string, lead blankets, and B-36 box, respectively. Due to the uncertain distribution of the wastes inside the B-36 disposal container (i.e., supernatant from the Tank 28F salt sampling drill string has contaminated the interior of the B-36 disposal container, the plastic sheeting, and lead blankets), the entire volume of the disposal container is considered to be part of the waste form for the purpose of waste classification. Therefore, use of the B-36 disposal container waste volume and mass listed above to calculate average radionuclide concentrations for determining the waste classification is justified.
- DWPF Glass Bubblers/Pumps: As discussed in Section 3.1.1, the NRC BTP allows for either a generic method (NRC BTP, Section 3.3.4, Encapsulation of Discrete Items) or an alternative method (NRC BTP, Section 3.8, Alternative Approaches for Averaging) for concentration averaging of encapsulated discrete items. DOE's classification of the glass bubblers and pumps) applies NRC BTP Section 3.8 (Table 4), which allows for site- and waste-specific methods for concentration averaging. DOE's classification of the bubblers/pumps includes the following waste mass and waste volume numerical values in the concentration averaging calculations:
    - Waste volume equals 6.1 m^3 (216 ft^3) based on the internal waste container dimensions.
    - Waste mass equals 11,267 kg (24,840 lbs.) based on the weight of the encapsulation material.

  The benefits of this approach include sufficient encapsulating material to stabilize the glass pumps/bubblers (large components) within the waste container; shielding to meet USDOT dose rate limits for transportation; and minimizing the number of shipments from SRS to WCS to reduce occupational exposures from packaging/loading at SRS and unloading/emplacement at WCS, as well as radiation exposure to the public.

Table 4. Crosswalk to BTP 3.8 Criteria

NRC BTC Section 3.8.1 Criteria	Satisfaction of Criteria
An overview of the proposed disposal approach (e.g., depth of burial or other factors and how it will protect an inadvertent intruder).	The bubblers/pumps, in their disposal package, will be placed on the floor of the WCS FWF on a reinforced concrete pad, resting on top of the existing concrete barrier, at the WCS FWF disposal cell at a depth up to 120 ft. (37 m). The depth of disposal will protect against inadvertent intruders. A 2-ft. thick minimum reinforced concrete barrier will be placed on the sides and top of the containers. These barriers would be designed to protect against an inadvertent intrusion for at least 500 years in accordance with 30 TAC §336.730(b)(3). The disposal containers will be filled with grout to minimize void space, provide shielding and waste stability, and protect against inadvertent intrusion. [*See* Section 3.2 of this Report]
A detailed description of the waste form(s) covered by the alternative concentration averaging approach:	A detailed description of the waste form for the bubblers/pumps is described in Section 2 and Appendix C of this report. This information will be included in the waste profile submitted by SRS to WCS for approval. The waste profile will be included in the Large Component Disposal Plan submitted by WCS to TCEQ for approval.
An identification of the BTP's existing position for which an alternative averaging approach is requested.	The concentration averaging approach for the bubblers/pumps (large components) uses larger volumes for encapsulation as compared to waste loading per the BTP Section 3.3.4 (see above discussion on concentration averaging approach).
For proposals based on inadvertent intruder exposure scenarios different from those in the BTP, a discussion of how they were selected should be provided. The following criteria are applicable: (1) the scenario should be reasonably foreseeable in that it is based on the intruder performing normal activities consistent with regional social customs; current well drilling, excavation and construction practices; and land uses similar to land uses in the region currently or reasonably foreseeable in the near future (i.e., approximately 100 years or during the operational lifetime of a facility) and (2) the time period for intrusion should be appropriate for the class of the waste (e.g., 100, 300, or 500 years) as discussed in 10 CFR 61.7(b). In some cases, averaging approaches based on depth of burial, or the use of intruder barriers or durable waste forms or containers, may be proposed.	The WCS performance assessment considers several onsite intruder exposure scenarios, including a ranch worker, an oil field worker, a recreational hunter, a dry-land farmer, and an onsite resident during periods under institutional control (100 years) and after institutional control.

NRC BTC Section 3.8.1 Criteria	Satisfaction of Criteria
A description of the site characteristics pertinent to disposal.	WCS FWF is constructed in accordance with TCEQ RML, Land Disposal Facility: Site Design and Construction Requirements (Sections 66 through 88). The facility is located in a semi-arid climate and a low-population density. Net infiltration through waste in the FWF is negligible due to the semi-arid climate of the area. The FWF includes a 7-ft. (2.1 m) thick multi-barrier liner and will include a multi-barrier cap of the disposal cell (minimum of 25 ft (7.6 m) upon closure. Natural barriers include no drinking water aquifer and thick red clay beds such that groundwater is not a viable pathway at the facility. Engineered barriers include the multi-barrier liners and reinforced concrete barrier emplaced around the disposal packages. [*See* Section 3.2 of this Report]
An analysis of the effects of degradation on packaging and engineered barriers over the period that the waste remains hazardous to an intruder.	Analysis is covered by the WCS performance assessment that is periodically updated by WCS and by TCEQ in accordance with TCEQ RML, Section 89.

3.1.3.1 Detailed Explanation of Radionuclide Concentration Limits for Tank 28F Salt Sampling Drill String

The Tank 28F salt sampling drill string contains a mixture of radionuclides, some of which are listed in NRC 10 CFR 61.55 Table 1 (Long-Lived Radionuclides), and some of which are listed in Table 2 (Short-Lived Radionuclides) (Appendix E). As discussed in Section 3.1.1, the SOF is calculated separately for long- and short-lived radionuclides.

Tank 28F Salt Sampling Drill String—Long-Lived Radionuclide Limits

Table 5 below summarizes the results for each long-lived radionuclide and the SOF. For the concentration of a mixture of radionuclides to exceed 0.1, the sum of all Nuclide Fractions (column 4) would need to exceed 0.1. This number is the Tank 28F salt sampling drill string concentration (column 2) divided by the NRC classification limit (column 3) summed for each measured radionuclide. As indicated in the table, the SOF for all nuclides is 0.0107. Because 0.1 is not exceeded for the SOF of all Table 1 radionuclides, the classification of the Tank 28F salt sampling drill string is determined by the concentrations and SOF of nuclides listed in the Table for Short-Lived Radionuclides (Table 6 below).

Table 5. Tank 28F Salt Sampling Drill String: Limits for Long-Lived Radionuclides

Radionuclide (Column 1)	Tank 28F Salt Sampling Drill String Concentration (Column 2)	NRC Classification Limit (Column 3)	Nuclide Fraction (Column 4)
Carbon-14	3.01×10^{-5} Ci/m^3 (1)	8 Ci/m^3	3.76×10^{-6}
Carbon-14 in activated metal	NA	80	NA
Nickel-59 in activated metal	NA	220	NA
Niobium-94 in activated metal	4.31×10^{-7} Ci/m^3	0.2	2.15×10^{-6}
Technetium-99	0.000448 Ci/m^3	3 Ci/m^3	0.000149
Iodine-129	2.63×10^{-7} Ci/m^3	0.08 Ci/m^3	3.28×10^{-6}
Alpha-emitting transuranic nuclides with half-life greater than 5 years	1.04 nCi/g	100 nCi/g	0.0104
Plutonium-241	0.44 nCi/g	3,500 nCi/g	0.000126
Curium-242	4.57×10^{-14} nCi/g	20,000 nCi/g	2.29×10^{-18}
		SOF for Long-Lived Radionuclides	**0.0107**

Notes:
The radionuclide concentrations were obtained from SRMC report *Waste Characterization of the Tank 28 LM-75 Drill String* (FT14005196) [Calculation Number Q-CLC-F-00372, Rev. 0, January 2022] at Appendix B, Table A6-1.

1. To keep the table compact, very low concentrations (as shown in column 2) or nuclide fractions (as shown in column 4) are shortened to smaller values by using scientific notation. The general format of these values is # x 10^{-n}, where "n" means to move the decimal point "n" places to the left. For example, 6×10^{-9} (six times ten raised to the negative ninth power) would represent a number that is 6 divided by one billion. So 6×10^{-9} is the same as 0.000000006. Common exponents of "n" include n = -6 (the same as one millionth), n = -9 (the same as one billionth), and n= -12 (the same as one trillionth).

Tank 28F Salt Sampling Drill String—Short-Lived Radionuclide Limits

As the Tank 28F salt sampling string exceeded Class A limits but did not exceed Class C limits for long-lived radionuclides, the waste class for the Tank 28F salt sampling drill string is determined by the concentration of short-lived radionuclides listed in Table 6 below. The SOF is determined by calculating the fractions for each radionuclide present (the radionuclide concentration divided by the NRC Classification concentration limit) in the waste stream, then adding them together, resulting in the SOF. SOF is calculated, first, by using the Class A concentrations; if needed (i.e., the Class A SOF exceeds 1), the SOF is calculated using the Class B concentrations and, if needed, the SOF is calculated using the Class C concentrations.

For the short-lived radionuclides in the Tank 28F salt sampling drill string, the SOF using the Class A limits is greater than 1 (the SOF equals 1.8). This is greater than 1, so the SOF using Class B concentrations is calculated. That SOF is 0.0407 (less than 1), so the waste is Class B LLW.

Table 6. Tank 28F Salt Sampling Drill String: Limits for Short-Lived Radionuclides

All concentrations and NRC Limits are in units of Ci/m^3

Radionuclide	Tank 28F Salt Sampling Drill String Concentration	Class A Limit	Class A SOF	Class B Limit	Class B SOF	Class C Limit	Class C SOF
All very short half-life nuclides (1)	1.7	700	0.0024	Unlimited	NA	Unlimited	NA
Tritium	NA	40	NA	Unlimited	NA	Unlimited	NA
Cobalt-60	$7.02x10^{-8}$ (2)	700	$1x10^{-10}$	Unlimited	NA	Unlimited	NA
Nickel-63	NA	3.5	NA	70	NA	700	NA
Strontium-90	$8.52x10^{-6}$	0.04	0.000213	150	$5.68x10^{-8}$	7000	$1.22x10^{-9}$
Cesium-137	1.79	1	1.79	44	.0407	4600	0.00039
SOF for Short-Lived Radionuclides			1.8		**0.0407**		0.00039

Notes:
The radionuclide concentrations were obtained from SRMC report *Waste Characterization of the Tank 28 LM-75 Drill String* (FT14005196) [Calculation Number Q-CLC-F-00372, Rev. 0, January 2022] at Appendix B, Table A6-1

1. Very-short-lived nuclides comprise those isotopes with half-lives less than 5 years, most of which have decayed to insignificant levels.
2. To keep the table compact, very low values are shorted by using scientific notation. See Note 1 of Table 5.

Conclusion for HLW Interpretation Criterion 1, Part 1, "Does Not Exceed Concentration Limits for Class C LLW:" Based on the sampling analysis, the Tank 28F salt sampling drill string disposal container would not exceed Class C limits, and therefore meets the first part of Criterion 1: "*does not exceed concentration limits for Class C low-level radioactive waste as set out in section 61.55 of title 10, Code of Federal Regulations*."

3.1.3.2 Detailed Explanation of Radionuclide Concentration Limits for Bubblers/Pumps

The SRS contaminated glass bubblers and glass pumps contain a mixture of radionuclides, long-lived and short-lived. Similar to the Tank 28F drill string, the SOF is calculated separately for long- and short-lived radionuclides.

Bubblers/Pumps—Long-Lived Radionuclide Limits

Table 7 below summarizes the results for each long-lived radionuclide and the SOF. For the concentration of a mixture of radionuclide to exceed 0.1, the sum of all Nuclide Fractions (column 4) would need to exceed 0.1. This number is the glass bubbler/glass pump waste form concentration (column 2) divided by the NRC classification limit (column 3). As indicated in Table 7, the SOF for all nuclides is 0.145. Since the long-lived radionuclides SOF exceeds 0.1

but does not exceed 1, the waste is Class C provided the SOF of short-lived radionuclides does not exceed 1 using the Class C limits shown in Table 8.

Table 7. Glass Bubblers/Pumps: Limits for Long-Lived Radionuclides

Radionuclide (Column 1)	Contaminated Glass Bubblers/Pumps Concentration (Column 2)	NRC Classification Limit (Column 3)	Nuclide SOF (Column 4)
Carbon-14	1.72×10^{-7} Ci/m^3 (1)	8 Ci/m^3	2.15×10^{-8}
Nickel-59	NA	220 Ci/m^3	NA
Technetium-99	1.83×10^{-5} Ci/m^3	3 Ci/m^3	6.1×10^{-6}
Iodine-129	1.88×10^{-7} Ci/m^3	0.08 Ci/m^3	2.35×10^{-6}
Alpha-emitting transuranic nuclides with half-life greater than 5 years	14.4 nCi/g	100 nCi/g	0.144
Plutonium-241	2.72 nCi/g	3,500 nCi/g	0.00078
Curium-242	NA	20,000 nCi/g	NA
		SOF for Long-Lived Radionuclides	**0.145**

NOTES:
The radionuclide concentrations were obtained from the SRMC report *Radiological Distribution of the DWPF Melter Bubblers/Glass Pumps* [Q-CLC-S-00144, Rev. 0, October 2022] at Appendix C, Table A4-1.
1. To keep the table compact, very low values are shorted by using scientific notation. See Note 1 of Table 5.

Glass Bubblers/Pumps—Short-Lived Radionuclide Limits

As discussed above, based on the concentration of long-lived radionuclides, the glass bubblers and glass pumps waste form would be classified as Class C LLW, provided the concentration of short-lived radionuclides does not exceed Class C limits.

The SOF of short-lived nuclides is shown in Table 8. The SOF using the Class C limits is 0.000407 (i.e., less than 1). Therefore, the glass bubblers and glass pumps are Class C LLW based on their concentration of long-lived radionuclides.

Table 8. Glass Bubblers/Pumps: Limits for Short-Lived Radionuclides

Concentration and Class Limit values in Ci/m^3

Radionuclide	Contaminated Glass Bubblers/Pumps Concentration	Class A Limit	Class A SOF	Class B Limit	Class B SOF	Class C Limit	Class C SOF
All very short half-life nuclides (1)	2.0808	700	0.00297	Unlimited	NA	Unlimited	NA
Tritium	NA	40	NA	Unlimited	NA	Unlimited	NA
Cobalt-60	NA	700	NA	Unlimited	NA	Unlimited	NA
Nickel-63	0.00712	3.5	0.00203	70	0.000102	700	0.0000102
Strontium-90	0.925	0.04	23.11	150	0.00617	7000	0.000132
Cesium-137	1.22	1	1.22	44	0.0276	4600	0.000264
SOF for Short-Lived Radionuclides			NA		NA		**0.000407**

Notes:
The radionuclide concentrations were obtained from SRMC report *Radiological Distribution of the DWPF Melter Bubblers/Glass Pumps* [Q-CLC-S-00144, Rev. 0. October 2022] at Appendix C, Table A4-1.
1. Very-short-lived nuclides comprise those isotopes with half-lives less than 5 years and include Ba-137m and Y-90.

Conclusion for HLW Interpretation Criterion 1, Part 1, "Does Not Exceed Concentration Limits for Class C LLW:" Based on the sampling analysis, the DWPF glass bubblers/pumps waste form would be Class C LLW, and therefore meet the first part of Criterion 1: "*does not exceed concentration limits for Class C low-level radioactive waste as set out in section 61.55 of title 10, Code of Federal Regulations*."

3.2 HLW Interpretation Criterion 1, Part 2: Waste "Meets the Performance Objectives of the Disposal Facility"

This section discusses the second part of Criterion 1 of the HLW interpretation as to whether the Tank 28F salt sampling drill string and the DWPF glass bubbler and glass pump disposal containers meet the performance objectives of the disposal facility. Performance objectives are the health and safety standards set by the disposal facility regulator to ensure protection of individuals and the environment from radiological exposure during operation, and after permanent closure of the disposal facility. Commercial licensees have the responsibility for demonstrating that the disposal facility complies with all performance objectives, including all specified dose limits. Texas, through TCEQ, is an NRC Agreement State and is the regulator of the WCS FWF.

TCEQ regulations include LLW disposal facility performance objectives from 10 CFR Part 61, which are specified in 30 TAC §336.723 and incorporated as conditions in the FWF license.[32] They require protection of the general population from releases of radioactivity, protection of individuals from inadvertent intrusion, protection of individuals during facility operations, and stability of the disposal site after closure. For the general public performance objective, doses from ingestion of groundwater and home-grown produce irrigated with groundwater are not considered because groundwater is not a viable transport pathway at WCS and is not used for compliance by TCEQ. Therefore, the intruder pathway is the primary pathway of concern (e.g., intrusion as a consequence of oil or gas drilling for exploration or production).

The WCS FWF current license has demonstrated compliance with TCEQ performance objectives by presenting information on eleven specific items of technical information required by 30 TAC §336.707. All this information and analyses, which are reviewed by the facility regulator, focus primarily on the robust waste isolation features of the WCS FWF and additional measures provided by the waste itself. Measures to protect individuals and the environment, in particular against inadvertent intrusion, will show that the second part Criterion 1would be met. These include:

Protective Measures of the WCS FWF

- The WCS FWF is constructed in accordance with TCEQ licensing requirements (TCEQ RML, Site Design and Construction Requirements, Sections 66 through 88).
- The facility is located in a semi-arid climate and a low-population density. Net infiltration of surface water into the FWF is negligible due to the semi-arid climate of the area. Natural barriers include no drinking water aquifer and thick red clay beds such that groundwater is not a viable pathway at the facility.
- The FWF's engineered barriers include a reinforced concrete container or barrier emplaced around the disposal packages; a 7-ft. (2.1 m) thick multi-barrier liner; and a multi-barrier cap emplaced upon FWF closure over the disposal cell with a minimum thickness of 25 ft. (7.6 m) and maximum thickness of 45 ft. (13.7 m).
- The WCS performance assessment considers several onsite intruder exposure scenarios, including a ranch worker, an oil field worker, a recreational hunter, a dry-land farmer, and an onsite resident during periods under institutional control (100 years) and after institutional control.
- In accordance with TCEQ RML, Section 89, WCS will periodically update its analyses of the effects of degradation on all engineered barriers over the period the waste remains hazardous to an intruder.

[32] The performance objectives in the TAC applicable to the WCS FWF mirror the performance objectives in 10 CFR 61, Subpart C. The TAC performance objectives can be found at: https://texreg.sos.state.tx.us/public/readtac$ext.ViewTAC?tac_view=5&ti=30&pt=1&ch=336&sch=H&rl=Y

- DOE has signed an agreement to take ownership of the FWF after its closure. In post-closure, DOE will be responsible for long-term stewardship of the waste forms disposed of at the FWF.

Additional Protective Measures of the SRS Waste Form

As noted in Section 3.1.1, the Tank 28F salt sampling drill string, glass bubbler, and glass pump waste forms are considered large components under the TCEQ RML.

- The SRS contaminated process equipment is composed of corrosion-resistant stainless steel. Each disposal container will be filled with grout to minimize internal void space. This stable waste form is not expected to significantly change in size and shape over an extended time period.
- The disposal containers will be placed at the lowest elevation available at the time of disposal within the WCS FWF on a reinforced concrete pad, resting on top of the existing concrete barrier. A 1 to 2-ft. thick minimum reinforced concrete barrier will be placed on the sides, top, and bottom of the containers. These barriers would be designed to protect against an inadvertent intrusion for at least 500 years in accordance with 30 TAC §336.730(b)(3).
- The depth of disposal on the floor of the FWF is approximately 120 ft. [37 m] below surface and would eliminate some intruder scenarios (e.g., house construction) and the overlying lower activity waste and/or overburden would reduce the concentration of radionuclides in any exhumed higher activity waste (Class C LLW).
- The amount of encapsulating material (volume and weight) and disposal container design is based on safety considerations for transportation to WCS and disposal in the WCS FWF (e.g., minimize worker dose, reduce number of shipments, provide waste stability, protect against inadvertent intrusion).

Criterion 1, Part 2, "Meets the Performance Objectives:" In consideration of the license limitations (e.g., volume and curie limits) and WAC, disposal of the stabilized SRS contaminated process equipment at WCS FWF meets the second part of Criterion 1: "*meets the performance objectives of the disposal facility.*"

The SRS contaminated process equipment, when stabilized in its disposal containers, would constitute a negligible inventory contribution to the authorized waste inventory (i.e., approximately 0.03 percent (7,200 ft^3 [204 m^3]) of the WCS FWF licensed capacity and about 0.004 percent (approximately 232 Ci) of the WCS FWF licensed curie limit; and therefore, would not negatively impact WCS FWF's continued compliance with the performance objectives. Because the stabilized waste is generically considered as part of the assessed inventory of LLW planned to be disposed of in the FWF, as long as the SRS contaminated process equipment meets the WCS FWF WAC requirements, it will not affect any of the facility's performance objectives.

The WAC contains the technical and administrative requirements a waste must meet to be accepted at a disposal facility (e.g., waste characterization, waste form acceptability, and QA), and are established to ensure the disposal facility meets its safety-based performance objectives.[33] Appendix F provides a crosswalk showing that the SRS contaminated process equipment would meet the WCS WAC. For example:

- The SRS contaminated process equipment disposal containers would not exceed Class C limits (*see* Section 3.1);
- The SRS contaminated process equipment would constitute an extremely small percentage of the volumetric and radioactivity limits for the WCS FWF;
- Void spaces within the waste and between the waste and its package would be reduced to the extent practicable in accordance with 30 TAC §336.362(b)(2)(C); and
- Disposal will comply with RCRA land disposal restriction requirements in 40 CFR Part 268 (i.e., B-36 disposal container for the Tank 28F salt sampling drill string will be macro-encapsulated at WCS due to the presence of the lead shielding blankets in the container).

Conclusion: Because the waste does not exceed Class C limits (Section 3.1) and disposal of the waste at WCS FWF meets the facility's performance objectives (Section 3.2), stabilized SRS contaminated process equipment meets DOE's HLW Interpretation, Criterion 1, for disposal as non-HLW at the WCS FWF.

4. Coordination with Regulatory Agencies and Stakeholders

The WCF FWF is licensed by the TCEQ under its Agreement State authority with NRC. The TCEQ provides oversight of the facility through every phase of LLW management and disposal to ensure compliance with the license conditions for protection of human health and the environment. As the licensee of the FWF, WCS representatives discussed the waste characterization approach and results with TCEQ. DOE representatives also discussed the waste characterization approach and results with TCEQ. In addition, because the SRS contaminated process equipment is considered a large component as discussed in the TCEQ RML, WCS will submit a Large Component Disposal Plan to TCEQ for approval before the SRS contaminated process equipment can be shipped to WCS for disposal.

5. Conclusion

Based on this evaluation, DOE has determined that the SRS contaminated process equipment (Tank 28F salt sampling drill string, glass bubblers, and glass pumps) disposal containers would

[33] Each disposal facility has its own WAC, which is dictated in part by the physical characteristics of a site and is tightly integrated with the site's performance assessment.

meet DOE's HLW interpretation under Criterion 1 and be non-HLW. Hence, this LLW could be disposed of at the WCS FWF consistent with the TCEQ RML, WCS FWF WAC, TCEQ regulations, and all other applicable requirements. The results of this report also apply to future glass bubblers expected to be generated until DWPF operations as the calculated radionuclide data is based on the maximum radionuclide concentration of a radionuclide from any feed material processed to date. The waste acceptance process for shipping waste to the FWF will include confirmation that the waste continues to remain within the bounds analyzed in this report (i.e., do not exceed Class C concentration limits and meet the performance objectives of the disposal facility). SRS will ensure proper record-keeping practices and QA processes are maintained documenting that the glass bubblers continue to meet the conditions for disposal at the WCS FWF as LLW under the HLW interpretation.

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