DOE/EIS-0279-SA-07

SUPPLEMENT ANALYSIS FOR THE SPENT NUCLEAR FUEL ACCELERATED BASIN DE-INVENTORY MISSION FOR H-CANYON AT THE SAVANNAH RIVER SITE

MARCH 2022

Prepared by the U.S. Department of Energy
Savannah River Operations Office

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ACRONYMS AND ABBREVIATIONS

AROD	Amended Record of Decision
ASNF	Aluminum spent nuclear fuel
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DU	Depleted uranium
DUF_6	Depleted uranium hexafluoride
DWPF	Defense Waste Processing Facility
EIS	Environmental impact statement
EBR-II	Experimental Breeder Reactor-II
FCA	Fast Critical Assembly
FGR	Federal Guidance Report
FR	Federal Register
FRR	Foreign research reactor
FY	Fiscal Year
gr/m^3	Grams per cubic meter
HEU	Highly enriched uranium
HFIR	High-Flux Isotope Reactor
HLW	High-level radioactive waste
INL	Idaho National Laboratory
IPT	Integrated project team
LCF	Latent cancer fatality
LEU	Low enriched uranium
LLW	Low-level radioactive waste
MAR	Material at risk
MEI	Maximally exposed individual
MFFF	Mixed Oxide Fuel Fabrication Facility
MLLW	Mixed low-level radioactive waste
MTHM	Metric tons of heavy metal
MTR	Material test reactor
NASNF	Non-aluminum spent nuclear fuel
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
PEIS	programmatic environmental impact statement
ROD	Record of Decision
ROI	Region of influence
SA	Supplement Analysis
SNF	Spent nuclear fuel

SRNL	Savannah River National Laboratory
SRS	Savannah River Site
TRU	Transuranic
WIPP	Waste Isolation Pilot Plant

Supplement Analysis for the Spent Nuclear Fuel Accelerated Basin De-inventory Mission for H-Canyon at the Savannah River Site

1.0 Introduction

The U.S. Department of Energy (DOE) has a continuing responsibility for safeguarding and managing existing and projected quantities of spent nuclear fuel (SNF) and target materials (hereafter referred to as SNF) at the DOE Savannah River Site (SRS). To meet that responsibility, DOE is proposing to change the management method for the remaining SNF at SRS from storage to conventional processing[1] without recovery of uranium. DOE would use the processing capabilities within H-Canyon to dissolve the SNF and would immobilize the resulting liquid radioactive waste at the Defense Waste Processing Facility (DWPF) at SRS.

The Council on Environmental Quality (CEQ) regulations for implementing the National Environmental Policy Act (NEPA), 40 Code of Federal Regulations (CFR) § 1502.9(c)(1), direct federal agencies to prepare a supplement to an environmental impact statement (EIS) when "(i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or (ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." DOE regulations for compliance with NEPA, 10 CFR § 1021.314(c), direct that, "[w]hen it is unclear whether or not an EIS supplement is required, DOE shall prepare a Supplement Analysis" to assist in making that determination. This Supplement Analysis (SA) summarizes relevant NEPA reviews and evaluates the potential environmental impacts of processing the inventory of SNF, stored at SRS L-Basin, in H-Canyon. This SA will assist DOE in determining if a Supplemental EIS (environmental impact statement) or a new EIS is required.

1.1 Spent Nuclear Fuel Storage in L-Basin

Part of the need for the continuous SNF processing mission at H-Canyon is driven by the fact that SRS regularly receives SNF from domestic research reactors and foreign research reactors that requires storage and management. The SNF is stored in L-Basin within the L-Area Complex, the only SNF receipt and storage facility at SRS (Savannah River National Laboratory (SRNL) 2011). The SNF stored at L-Basin includes aluminum spent nuclear fuel (ASNF) (i.e., uranium fuel with aluminum cladding/matrix) and non-aluminum spent nuclear fuel (NASNF) (e.g., uranium and thorium fuels with stainless steel, zircaloy, and other metal cladding/matrix [e.g., Hastelloy]). While the ASNF represents about 90 percent of the SNF assembly count at SRS, it

[1] Current conventional processing is a chemical separation process that involves dissolving SNF in nitric acid and separating fission products from uranium using solvent extraction. The Proposed Action would add the option to curtail processing so as not to recover the highly enriched uranium.

represents about one third of the total mass as measured in metric tons of heavy metal (MTHM[2]).

During the late 1990s and early 2000s, several upgrades and general improvements to L-Basin were completed, including better water-chemistry control capabilities. These improvements and continuous maintenance have provided the ability to store the SNF for an extended period of time. Analyses conducted in 2011 (SRNL 2011) indicates that up to 50 years additional storage is feasible, assuming the existing maintenance program, including wet storage at L-Basin, continues to be fully implemented. Nevertheless, if the SNF continues to remain in storage in L-Basin over this 50-year period, some of the materials that are more susceptible to corrosion (e.g., damaged or cut test SNF, stored in sealed underwater storage and in vented oversized storage canisters) will likely degrade and require appropriate actions to mitigate the associated risks. In addition, there are substantial costs and security issues surrounding storage and eventual disposition of SNF containing highly enriched uranium (HEU).

Approximately 25.9 MTHMASNF that was to be managed via conventional processing under the preferred alternative identified in the 2000 *Savannah River Site, Spent Nuclear Fuel Management Final Environmental Impact Statement* (SRS SNF EIS) has been processed. In addition, a portion of the 3.3 MTHM of ASNF addressed in the 2013 Amended Record of Decision (2013 AROD) (78 FR 20625, April 5, 2013) for the SRS SNF EIS has already been dissolved. An option was considered to transfer the remainder of the SNF currently stored or planned for receipt at SRS from wet storage at L-Basin to dry storage for direct disposal in a repository, based on the previous life-cycle planning.[3] These comprise the bulk of the SNF for which this SA evaluates the potential environmental impacts associated with a change to conventional processing in H-Canyon, without recovery of uranium. Any remaining SNF not processed under the ABD mission could be transferred to a smaller-scale dry storage capability, if DOE decides in the future such capability is needed.

1.2 Spent Nuclear Fuel Processing in H-Canyon

As described in the *Future of H-Canyon Operations and Management Options for Spent Nuclear Fuel and Nuclear Material at the Savannah River Site, Analysis of Alternatives* (DOE 2019a), H-Canyon was constructed during the early 1950s and became operational in 1955 as a back-up capability to F-Canyon, which was an almost identical facility constructed simultaneously with H-Canyon. F-Canyon has been deactivated, and H-Canyon is currently the only operating production-scale, nuclear chemical separation facility in the United States. When originally constructed, the mission for both F- and H-Canyons was to dissolve ASNF and targets to

[2] MTHM is a commonly used measure of the mass of "heavy metal" present in nuclear fuel. Heavy metal refers to elements with an atomic number greater than 89 (e.g., thorium, uranium, and plutonium). The masses of other constituents of the fuel, such as cladding, alloy materials, structural materials, as well as fission products, are not included in this measure.

[3] DOE issued the *SRS SNF EIS* ROD in March 2000 (65 FR 48224), to implement the Melt-Dilute technology for the majority of the SRS material test reactor ASNF, rather than move it from wet storage to dry storage. Thus, at this time, the official disposition for the material not covered in the 2013 AROD (78 FR 20625) is melt and dilute; however, limited technology development was funded and the 2013 AROD stated that the technology was never developed due to "…technical issues involving the off-gas system and funding limitations." The dry storage approach as an alternative to melt and dilute is reflected in Fiscal Year 2018 Project Baseline Summary 11C Nuclear Material Independent Lifecycle Cost Estimate and supporting documents.

separate plutonium-239 for nuclear weapons applications. Subsequently, the Plutonium Uranium Extraction (PUREX) process within H-Canyon was modified to more effectively recover uranium-235, essentially separating the plutonium and uranium missions between F-Canyon and H-Canyon, respectively. Since that time, the H-Canyon mission has changed multiple times, driving modifications to process equipment, chemistry, and capabilities. While the original dissolution system included only the capability to process ASNF and targets using nitric acid, the versatility of H-Canyon allowed introduction of an electrolytic dissolver, such that stainless steel and zircaloy-clad SNF (NASNF) could also be processed, although this capability has not been operated for almost 40 years.

More recently, the mission for H-Canyon primarily focused on conventional processing or processing of ASNF and other nuclear materials of U.S. origin[4] that were subsequently down-blended with natural uranium, to produce a low-enriched, uranyl nitrate liquid product (i.e., uranyl nitrate liquid that is 4.95 percent uranium-235). **Figure 1** provides a simplified flowchart showing conventional processing with uranium recovery at H-Canyon, which is a more complex process than the Proposed Action. The steps in the conventional processing flowchart are described in the following paragraphs. This description is from Appendix A of the SRS SNF EIS (DOE 2000), modified to reflect recent conditions.

The SNF stored in L-Basin was transported in a cask on a rail car to H-Canyon. Inside the airlock doors to the hot canyon, the SNF was unloaded and placed in lag storage to await processing or fed into the top of a dissolver tank. The SNF was then dissolved in hot nitric acid, producing a solution of uranium, fission products, aluminum, and small amounts of transuranic (TRU) materials, such as neptunium and plutonium.

[4] This includes the Canadian HEU target residue material solutions, as described in the *Supplement Analysis for the Savannah River Site Spent Nuclear Fuel Management Environmental Impact Statement* (DOE 2013) (DOE/EIS-0279-SA-01 and DOE/EIS-0218-SA-06).

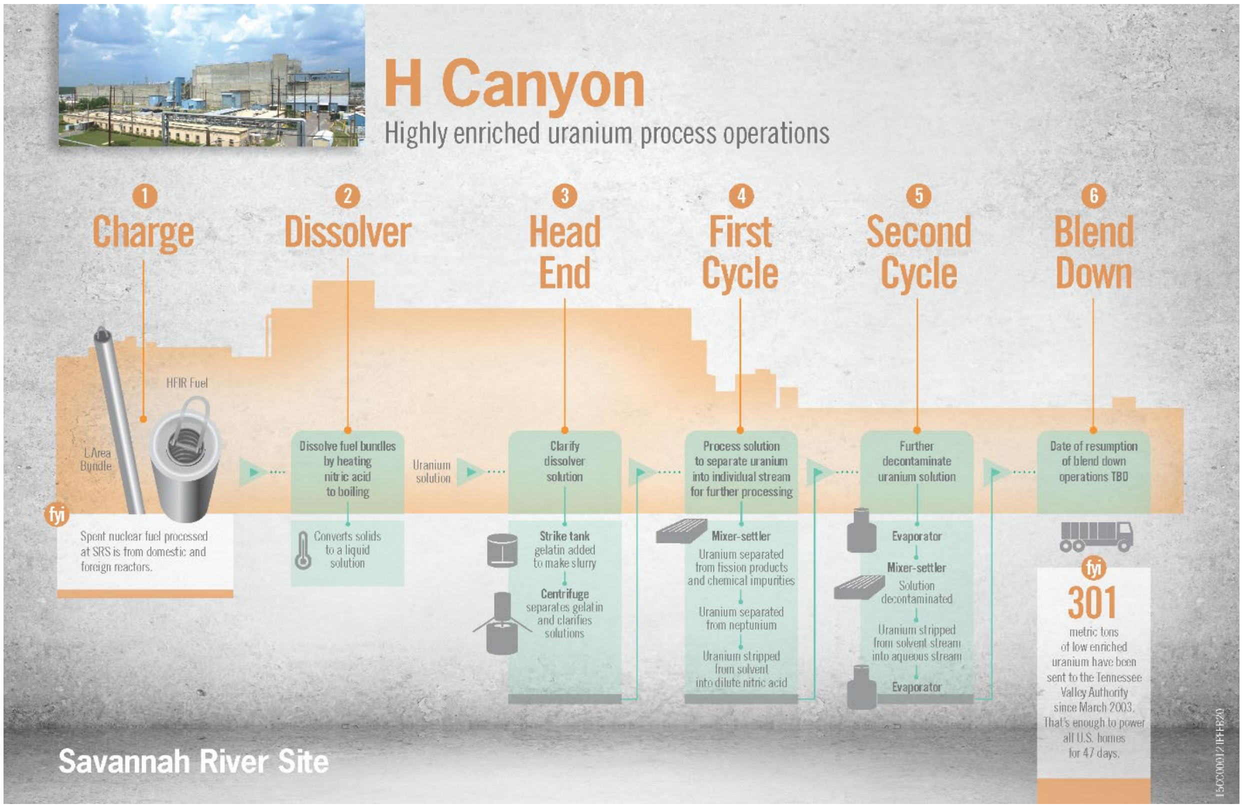

Figure 1. Flowchart for Conventional Processing of SNF in H-Canyon

Head-end processing used two clarification steps to remove undesirable contaminants that could impede the subsequent solvent extraction process. Gelatin was added to precipitate silica and other impurities. The clarified solution was adjusted with nitric acid and water in preparation for the first-cycle solvent extraction. The waste stream generated from the head-end process was chemically neutralized and sent to the storage tanks.

The first-cycle solvent extraction in the hot canyon removed the fission products and other impurities, and then separated the uranium from the other actinides. If necessary, a second-cycle solvent extraction was used to further purify the uranium solution. The solvent was recovered for reuse, the acid solution containing the fission products was neutralized and transferred to the storage tanks, and the uranium in a uranyl nitrate solution was transferred to H-Area tanks to be down-blended to about 5 percent uranium-235. This material was previously transported to commercial fuel fabricators where it was converted to low enriched uranium (LEU) fuel for use in the Tennessee Valley Authority nuclear power plants. These activities were conducted in accordance with the 2013 AROD. The 2013 AROD provided for the processing of approximately 1,000 material test reactor (MTR) bundles and 200 cores from the Oak Ridge National Laboratory High-Flux Isotope Reactor (HFIR), as well as the Canadian target residue material solutions, for a total of up to 3.3 MTHM. The contract to supply LEU to the Tennessee Valley Authority has been canceled and there is currently no customer for LEU.

Almost 40 years ago, DOE performed electrolytic dissolution of NASNF in H-Canyon (DOE 2019a). DOE is updating the existing outmoded electrolytic dissolver (DOE 2019c). Based on the *Supplement Analysis Disposition of Fast Critical Assembly Plutonium* (DOE 2021) (DOE/EIS-

0283-S2-SA-02), DOE issued an AROD (86 FR 13359, March 8, 2021) announcing its decision to restore the electrolytic dissolver capability at H-Canyon in support of the disposition of Fast Critical Assembly (FCA) NASNF, discussed in more detail in Section 3.0, below. Therefore, the capability to process NASNF is being restored to H-Canyon and should be functional in 2024.

2.0 Purpose and Need and Supplemental Proposed Action

The purpose and need are described in Section 2.1, and a description of the Supplemental Proposed Action (hereinafter referred to as the Proposed Action) is provided in Section 2.2. A comparison of the Proposed Action to activities evaluated in the SRS SNF EIS is presented in Section 2.3.

2.1 Purpose and Need

As stated in the SRS SNF EIS (DOE 2000), *"[u]ntil a [permanent] repository is available, the Department needs to develop and implement a safe and efficient SNF management strategy that includes preparing aluminum-based SNF stored at SRS or expected to be shipped to SRS for disposition offsite. DOE is committed to avoiding indefinite storage at the SRS of this nuclear fuel in a form that is unsuitable for final disposition. Therefore, DOE needs to identify management technologies and facilities for storing and treating this SNF in preparation for final disposition."*

In evaluating management and disposition alternatives for SNF and target materials at SRS, DOE has explored various scenarios to address storage capacity limitations and technical issues associated with these materials (DOE 2019a). DOE understands that it must address known long-term storage capacity issues and technical issues with drying some of the ASNF for disposal or find another management method. Due to the vast variety of ASNF at SRS, implementing the previously considered dry storage program (as discussed in section 1.1) that would be effective for all SNF, may be technically challenging. In addition, consideration of the future availability of processing capabilities (H-Canyon) and liquid high-level radioactive waste (HLW) systems (DWPF and Tank Farms) at SRS must factor into any DOE decisions. Therefore, DOE has reevaluated the management approach for SNF at SRS, utilizing existing capabilities.

2.2 Supplemental Proposed Action

The DOE Office of Environmental Management chartered an integrated project team (IPT) to conduct an Analysis of Alternatives to evaluate options related to management of SNF and nuclear material currently or anticipated to be stored in L-Basin at SRS. The work of the IPT resulted in the report: *Future of H-Canyon Operations and Management Options for Spent Nuclear Fuel and Nuclear Material at the Savannah River Site, Analysis of Alternatives* (DOE 2019a). The IPT identified 14 alternatives. Alternative 11, *Processing of All SRS ASNF and NASNF in H-Canyon without Recovery*, received the highest overall score and rank[5], and is the Proposed Action evaluated in this SA.

[5] The IPT screened 14 alternatives on the basis of ability to achieve DOE mission completion, implement within a realistic funding scenario, support the Liquid Waste system schedule, leverage non-DOE funding, and support the Foreign Reactor Receipt (FRR)

Pursuant to the Proposed Action, the SNF would be placed in aluminum bundle sleeves. For MTR-like fuel elements, the SNF would be stacked three to five elements in the bundle sleeve. The storage racks in L-Basin use bundle sleeves to maximize storage space. Before shipment to H-Canyon, the bundle sleeves would be assembled into larger arrays for cask loading. The size of the array would be determined by the shipping cask, the size of the dissolver, the amount of lag storage (temporary storage of dissolved SNF awaiting discard in next available sludge batch transfer window) in H-Canyon, and by criticality concerns. Bundling the SNF facilitates handling and maintaining a non-critical geometry, as the fuel is placed into the dissolver. Other SNF elements are uniquely shaped and cannot be bundled (e.g., HFIR cores), therefore, some cores might be transferred to H-Canyon unbundled.

Processing without uranium-235 recovery involves the same dissolution steps as described in Figure 1 for ASNF. However, in the non-recovery scenario, the head-end clarification and the first and second uranium cycles are not utilized. Systems that would not be utilized in conventional processing without uranium-235 recovery include Head-End, First Uranium Cycle, Second Uranium Cycle, Low Activity Waste Evaporation, Solvent Recovery, and Acid Recovery. Additionally, no blending down of HEU to LEU would occur. All dissolved SNF solutions (including uranium-235) would be transferred to the SRS liquid waste system and processed for disposal directly into a sludge batch. This has been done in the past for limited amounts of SNF (DOE 2000). The flowchart for processing SNF without uranium recovery is presented in **Figure 2**. The key benefit of the non-recovery scenario is that it requires only a single-unit process step, in addition to neutralization, greatly simplifying the processing required in H-Canyon. Potentially 75 percent of the H-Canyon's current conventional processing systems would not be needed under the Proposed Action as they are related to uranium recovery (SRS 2020a).

and Domestic Reactor Receipt (DRR) programs. This resulted in the evaluation of seven alternatives on the criteria of regulatory compliance, mission need, safeguards and security, technical aspects, operability and maintainability, implementation of cost and schedule, and stakeholder acceptance.

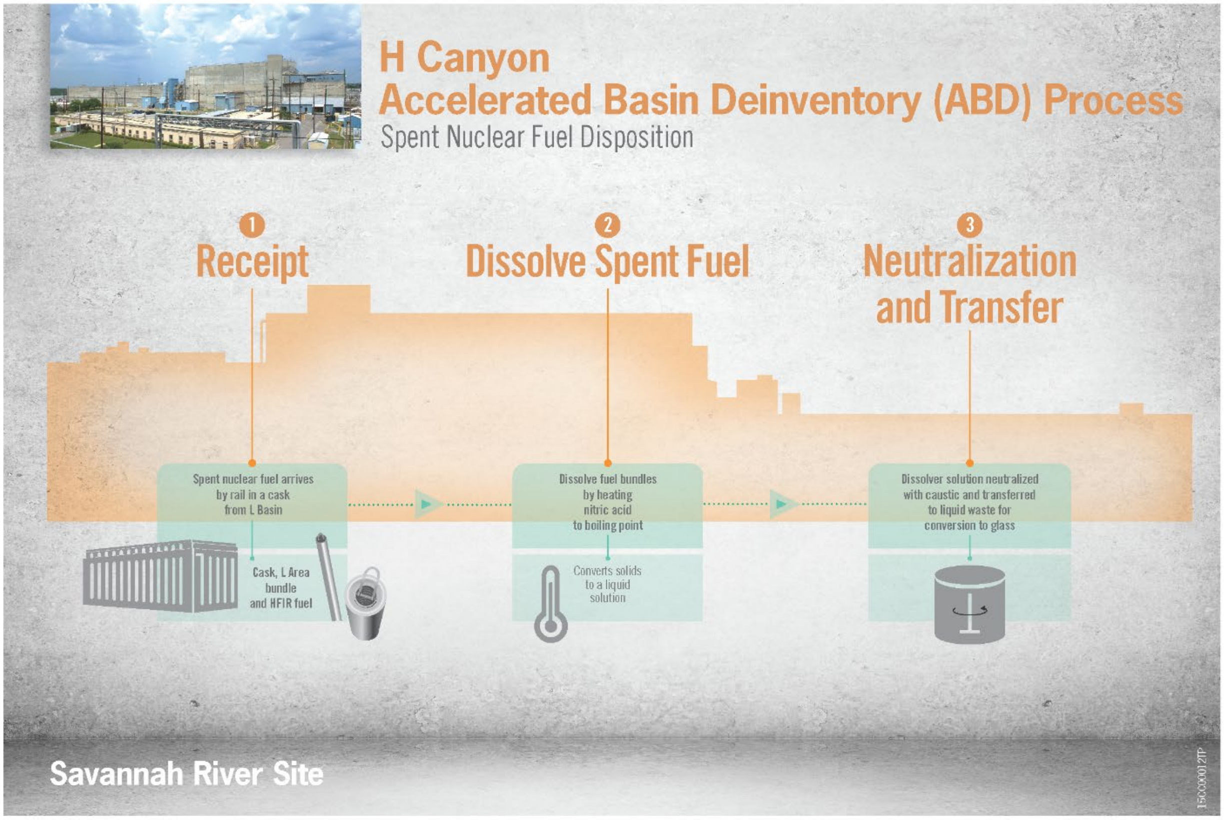

Figure 2. Flowchart for Processing of SNF in H-Canyon without Uranium Recovery

In addition, processing without uranium recovery ultimately results in an inert, stable, glass waste form that would experience very limited degradation during extended storage and would require minimal monitoring. The Proposed Action would result in an increased fissile concentration in the resulting HLW glass that would be produced in DWPF. By increasing the concentration up to 2,500 grams of fissile material per cubic meter of borosilicate glass in a "no recovery" scenario, waste transfers from H-Canyon can be maximized. The HLW glass produced by the Proposed Action would be substantially similar to previously produced DWPF glass.

Currently, the only proposed repository acceptance criteria for HLW glass is Yucca Mountain. The Yucca Mountain Repository License Application (DOE 2008) identified a value of 897 grams of fissile material per cubic meter of borosilicate glass for SRS canisters. Increasing the amount of fissile material to 2,500 grams per cubic meter of borosilicate glass would result in minimizing the total number of SRS glass canisters produced. Preliminary analyses indicate that increasing the fissile material content in the glass to 2,500 grams per cubic meter can be implemented safely and would not impact the immobilization process (SRNL 2020; SRR 2020).

Depleted uranium (DU) oxide may be added after dissolving the SNF in H-Canyon and before the liquid is sent to the storage tanks. The DU oxide would be used to bring down the SNF enrichment levels to 5 percent, to meet the requirements of the liquid waste system. The DU oxide would be supplied by a combination of the 9,400 kilograms of DU oxide currently in storage at SRS and the 30,000 kilograms of DU oxide that would be produced at the depleted uranium hexafluoride (DUF_6) conversion facilities located at the DOE Paducah, Kentucky or Portsmouth, Ohio sites (Maxted 2020).

Conversion of DUF_6 to DU oxide at Paducah and Portsmouth is an ongoing process. The potential environmental impacts of conversion were analyzed in the *Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky Site* (DOE 2004a) and *Final Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio Site* (DOE 2004b). The impacts of transportation of DU oxide to potential disposal facilities was analyzed in the *Supplemental Environmental Impact Statement for Disposition of Depleted Uranium Oxide Product Generated from DOE's Inventory of Depleted Uranium Hexafluoride* (DU Oxide SEIS) (DOE 2020a). The decisions related to these EISs were published in Records of Decision (ROD) at 69 FR 44654 (July 27, 2004), 69 FR 44649 (July 27, 2004), and 85 FR 34610 (June 5, 2020). The use of DU oxide for processing of SNF at SRS would not change the decisions made in these previous RODs. The potential impacts of transportation of DU oxide to SRS are discussed in Section 4.5.

The Proposed Action includes processing up to 18 Dissolver 6.4D[6] equivalent batches of SNF in H-Canyon per year, over a 12- to 13-year period,[7] composed of the following:

- ASNF (about 8.7 MTHM)[8] including:
  - 3,500 MTR bundles (about 7.0 MTHM)
  - 275 HFIR cores (about 1.7 MTHM)
- NASNF (about 20.5 MTHM), which includes target materials (about 0.2 MTHM)

The proposed amount of batches equals about 29.2 MTHM SNF. If processed over 12 to 13 years, this equates to about 2.3 to 2.5 MTHM SNF per year. All of the ASNF and NASNF material currently in L-Basin, or projected to be received by 2033, with the exception of about 350 kilograms of stainless-steel clad plutonium SNF from Japan's FCA[9], is included in the scope of the Proposed Action. Future additional receipts beyond the 2033 timeframe are not part of the scope of this SA;[10] DOE would need to prepare additional NEPA analyses if there was a proposal to process SNF and target materials received after 2033 in H-Canyon.

Of the three H-Canyon dissolvers, Dissolvers 6.1D and 6.4D (conventional dissolvers) would be operated to dissolve ASNF, and Dissolver 6.3D (electrolytic dissolver) would be operated to dissolve NASNF. Only two of the three dissolvers in H-Canyon can be simultaneously because of

[6] H-Canyon contains three dissolvers: Dissolver 6.1D, Dissolver 6.3D (electrolytic dissolver), and Dissolver 6.4D.

[7] Eighteen dissolutions per year are dictated by planned sludge batches to DWPF, 500-kilogram fissile mass per sludge batch, and safe H-Canyon storage capacity.

[8] The total amount of ASNF to be processed under the 2000 SRS SNF EIS, 2013 AROD and this Proposed Action is less than the total amount of ASNF that was estimated (47.7 MTHM) through 2035 under the more conservative assumptions of the 2000 SRS SNF EIS.

[9] This material is addressed in *Supplement Analysis Disposition of Fast Critical Assembly Plutonium* (DOE 2021) (DOE/EIS-0283-S2-SA-02).

[10] DOE plans to stop receipts at DWPF in 2034 in accordance with the current SRS *Liquid Waste System Plan* (SRR 2021). The current plan indicates the liquid HLW System can receive flushes (use of water to remove maximum amount of residual material from processing vessels) through 2034, which accommodates H-Canyon operations through 2033.

the way the off-gas system is configured. Dissolvers 6.1D and 6.3D cannot operate simultaneously with the existing off-gas system. To process NASNF, the off-gas system can be switched from Dissolver 6.1D (conventional dissolver) to Dissolver 6.3D (electrolytic dissolver).

The processing rate, and therefore the duration of processing, assumes greater than 75 percent availability of the H-Canyon dissolvers. The remaining approximately 25 percent comprises downtime for scheduled maintenance and unscheduled outages (DOE 2019a).

3.0 Related NEPA Documents

DOE has prepared four important NEPA documents related to SNF management at SRS:

1) P*rogrammatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (DOE/EIS-0203; DOE 1995a),
2) *Final Environmental Impact Statement on a* P*roposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel* (DOE/EIS-0218; DOE 1996),
3) *Savannah River Site, Spent Nuclear Fuel Management Final Environmental Impact Statement* (DOE/EIS-0279; DOE 2000), and
4) *Supplement Analysis Disposition of Fast Critical Assembly Plutonium* (DOE/EIS-0283-S2-SA-02; DOE 2021a).

These documents are described in more detail below.

***Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement* (SNF PEIS) (DOE/EIS-0203; DOE 1995a) –** The SNF PEIS evaluated the range of reasonable programmatic alternatives for safely, efficiently, and responsibly managing existing and projected quantities of SNF until the year 2035. The programmatic alternatives were as follows: decentralization, where most SNF would be stored and stabilized near the generation site; regionalization, where existing and projected SNF would be distributed among alternative DOE sites, based on SNF type or geographic location (e.g., an eastern site and a western site); and centralization, where existing and projected SNF would be consolidated at one DOE site. Of the alternatives considered, all (except the No Action Alternative) contain an option that would use conventional processing (F- and H-Canyon) for existing ASNF stored at SRS; NASNF would continue to be stored or shipped to Idaho National Laboratory (INL). DOE used actual emissions from F- and H-Areas during 1985 and 1986, a period when the SRS was processing material through the separations facilities at close-to-maximum capacity, to evaluate potential releases of radionuclides from SNF management activities. This SNF PEIS did not differentiate between processing in F- and H-Canyons. The amount of SNF processed in each facility is not identified, but the separations processes in each canyon are similar, and as a result, the potential releases of radionuclides are assumed to be roughly the same.

In the 1995 ROD (60 FR 28680, June 1, 1995), DOE decided to regionalize SNF management for DOE-owned SNF by fuel type at three DOE sites: Hanford production reactor SNF would remain at the Hanford Site, ASNF would be consolidated at SRS, and NASNF would be consolidated at INL. The regionalization would involve shipping ASNF from INL to SRS and shipping NASNF from SRS to INL. A total of 184.4 MTHM of ASNF was identified for processing over a 40-year period, resulting in an average processing rate of 4.6 MTHM per year. The Proposed Action evaluated in this SA would not change the decision made in the 1995 ROD, including eventual consolidation of the SNF. However, the decision to consolidate SNF by fuel type has not been fully implemented. DOE's inventory of ASNF has not been completely consolidated at SRS, and the NASNF has not been completely consolidated at INL.

P*roposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel Environmental Impact Statement* (*FRR EIS*) (DOE/EIS-0218; DOE 1996) –In the FRR EIS (DOE 1996), tiered from the SNF PEIS, DOE evaluated reasonable alternatives for the return of SNF containing uranium (enriched in the U.S. and supplied to foreign countries) to the U.S. The FRR EIS includes an alternative (Management Alternative 1 Implementation Alternative 6: Near Term Conventional Chemical Separation in the U.S.) that addresses using F- and H-Canyons for the processing of up to 51 MTHM of ASNF. This quantity includes 18.2 MTHM of FRR ASNF and a larger quantity of SNF than stored at SRS, consisting of 0.56 MTHM of target material, 28.8 MTHM of other ASNF stored at SRS, and 3.4 MTHM of ASNF that could be transported to SRS. Processing 51 MTHM of ASNF over the 13-year period analyzed in the FRR EIS results in an average processing rate of 3.9 MTHM per year.

The FRR EIS adopted the impact analyses from the *Final Environmental Impact Statement for Interim Management of Nuclear Materials at the Savannah River Site, Aiken, SC* (DOE/EIS-0220) (DOE 1995b) and the SNF PEIS (DOE 1995a), where possible. Therefore, most of the analysis has its origins in those other documents.

In the FRR EIS ROD (61 FR 25092, May 17, 1996), DOE decided, consistent with the programmatic decision to consolidate storage by SNF type, to transport to and store FRR ASNF and target material at SRS.

***Savannah River Site, Spent Nuclear Fuel Management Final Environmental Impact Statement* (*SRS SNF EIS*) (DOE/EIS-0279; DOE 2000) –** DOE evaluated the potential environmental impacts of reasonable alternatives for management of SNF and target material stored at SRS, or that would be transported to SRS in the future (e.g., SNF and target material), in the SRS SNF EIS (DOE 2000). The SRS SNF EIS is tiered from the SNF PEIS (DOE 1995a) and the FRR EIS (DOE 1996).

In order to facilitate the identification of appropriate processing technologies in the SRS SNF EIS, DOE grouped the SNF based on characteristics such as size, physical and chemical properties, and radionuclide inventory. DOE identified seven technologies that could be used to prepare the SNF for disposition. The applicability of the conventional processing technology to the fuel groups is described on page 2-17 of the SRS SNF EIS. Taking into consideration the technologies applicable to the fuel groups, DOE developed five reasonable alternatives that could be used to manage SNF: No Action, Minimum Impact, Direct Disposal, Maximum Impact, and the Preferred Alternative. The action alternatives represent combinations of technologies applied to fuel groups. The alternatives are described in Table 2-8 (page 2-36) and on page 2-35 of the SRS SNF EIS.

Under the Preferred Alternative, DOE would prepare about 97 percent by volume (about 60 percent by mass) of the ASNF for disposition, using a melt and dilute process. The remaining 3 percent by volume (about 40 percent by mass) would be managed using chemical a separation process referred to as "conventional processing." More specifically, under the Preferred Alternative, DOE stated it would use the melt and dilute technology to process all Group B[11] fuel (up to about 20 MTHM of MTR ASNF from foreign and domestic reactors); all Group C fuel (about 8 MTHM oxide and silicide foreign and domestic reactor SNF and target material), except failed SNF, which DOE would manage by conventional processing; and most Group D fuel (about 0.6 MTHM of FRR targets). These fuels total about 28.6 MTHM, based on quantities already stored at SRS and estimated quantities located at domestic and foreign reactor locations, which were scheduled or eligible to ship SNF to SRS when the SRS SNF EIS was prepared. Also, as part of the Preferred Alternative, conventional processing would be used to manage Group A fuel, consisting of about 19 MTHM of various materials. HEU separated during conventional processing would be blended down to create LEU feedstock for use in the manufacture of fuel for commercial nuclear reactors. Under the Preferred Alternative, Group E fuel, consisting of less than 0.1 MTHM of special isotope targets, would continue to be stored. Group F fuel, consisting of 20.4 MTHM of NASNF, would be repackaged and shipped to INL.

Under the Maximum Impact Alternative, the SRS SNF EIS provided an assessment of the potential environmental impacts of conventional processing in F- and H-Canyons of all of the SNF (except Group F NASNF). In addition, DOE provided an analysis of the potential environmental impacts of transporting the material to SRS by reference to the analysis found in the SNF PEIS and the FRR EIS. Under this alternative, DOE would process 47.7 MTHM of ASNF over a period of up to 38 years (almost 25 dissolver processing years, exclusive of downtime). The fuel types that would be processed under this alternative include the following: Group A – uranium and thorium metals (mainly Experimental Breeder Reactor-II [EBR-II] and Sodium Reactor Experiment material), Group B – MTR-like SNF, Group C – HEU/LEU oxides and silicides, and Group D – loose uranium oxide. Roughly 19 MTHM of this material, EBR-II and Sodium Reactor Experiment material, would be processed in F-canyon; the remainder, 28.7 MTHM, would be processed in H-Canyon. NASNF would continue to be stored or packed and shipped to INL.

In the assessment of the potential impacts of the Maximum Impact Alternative, the impacts were presented by fuel group. Since the SNF processed at F-Canyon comprised most of the fuel in Fuel Group A, the potential environmental impacts represent impacts from operating that facility. The combined impacts from processing Groups B through D are associated with H-Canyon operation. Impacts were presented assuming only one dissolver was in operation in each canyon at one time; however, the document states that annual impacts would double if

[11] The quantity of Group B fuel analyzed in the SRS SNF EIS (DOE 2000) was based in part on the projected receipt of about 19.2 metric tons of FRR SNF.

two dissolvers were used, and the duration of the processing effort would effectively be cut in half. Cumulative program total impacts would not change.

The radiological impacts evaluated in the SRS SNF EIS for normal operations at F- and H-Canyons were assumed to be directly proportional to the fissile mass processed. Groups B, C and D made up 70, 19, and 4 percent, respectively, of the total fissile mass at the time of the EIS. Group F, the NASNF, had 5 percent of the total fissile mass (SRS SNF EIS, Table E-8).

DOE issued the Final SRS SNF EIS in March 2000, and in its ROD, issued on August 7, 2000 (65 FR 48224, August 7, 2000), DOE selected the Preferred Alternative, as described above. DOE has not implemented the ROD.

The *Supplement Analysis Savannah River Site Spent Nuclear Fuel Management* (DOE 2013) (DOE/EIS-0279-SA-01, DOE/EIS-0218-SA-06) analyzes the potential environmental impacts of switching the processing of 3.3 MTHM of ASNF using the melt and dilute process to conventional processing, at the same time one of two dissolvers in H-Canyon was dedicated to the processing of plutonium in support of the surplus plutonium disposition program. The 2013 SA analyzes the potential environmental impacts of using a additional dissolver in H-Canyon for ASNF processing. This SA concludes that an additional dissolver dedicated to ASNF would bring the H-Canyon dissolution capacity to the capacity that was evaluated in the SRS SNF EIS, and that the impacts of operating both dissolvers would not be significantly different from those reported in the SRS SNF EIS. This SA also added an intentional destruction acts evaluation, using the accident analysis of the SRS SNF EIS as a starting point for the assessment. In the 2013 AROD for the SRS SNF EIS, DOE decided to implement the action analyzed in the 2013 SA.

***Supplement Analysis Disposition of Fast Critical Assembly Plutonium* (DOE 2021a) (DOE/EIS-0283-S2-SA-02) –** In the 2021 SA, the National Nuclear Security Administration (NNSA) assessed the potential environmental impacts of processing in H-Canyon up to 350 kilograms of stainless-steel-clad FCA plutonium fuel from Japan. Specifically, the 2021 SA assessed the potential impacts of changing the processing of FCA fuel from decladding and down-blending for disposition at the Waste Isolation Pilot Plant (WIPP), to dissolution in an electrolytic dissolver at H-Canyon and immobilizing the resultant solution in borosilicate glass at DWPF. Previously, in 2019, DOE applied categorical exclusion B1.3 to the proposal to upgrade the electrolytic dissolution unit in H-Canyon.[12]

The 2021 SA evaluated operation of the electrolytic dissolver to dissolve the FCA fuel and send the liquid waste to DWPF for immobilization. The 2021 SA concluded that the impacts from activities related to the disposition of FCA fuel have been evaluated in the *Surplus Plutonium Disposition Supplemental Environmental Impact Statement* (DOE 2015). NNSA concluded that the proposed change analyzed in the 2021 SA and new information are not a substantial change relevant to environmental concerns. No further NEPA review was required to implement disposition of the FCA fuel via electrolytic dissolution in H-Canyon, subsequent immobilization at DWPF, and storage at the Glass Waste Storage Building pending shipment to a geologic

[12] In accordance with DOE regulations at 10 CFR 1021.410, DOE determined that upgrading the dissolver was the subject of categorical exclusion B1.3 (OBU-H-2019-0006, January 14, 2019). Available at https://www.energy.gov/nepa/downloads/cx-019585-electrolytic-dissolution-fast-critical-assembly-material.

repository. NNSA issued an Amended ROD (86 FR 13359) for the H-Canyon/HB-Line Alternative as the disposition path for FCA fuel.

3.1 Comparison of Proposed Action to Activities Evaluated in the SRS SNF EIS

This SA compares the Proposed Action to the activities evaluated in the SRS SNF EIS (DOE 2000).[13] This comparison was performed to determine whether the Proposed Action would result in a substantial change to the environmental consequences reported in the SRS SNF EIS or if there were significant new circumstances or information relevant to environmental concerns related to the Proposed Action.

Alternatives considered in the SRS SNF EIS were reviewed to determine the types of materials considered, the total amount of SNF processed, and the maximum annual rate of processing. The review was not limited to the Proposed Action or Preferred Alternative analyzed in the SRS SNF EIS, nor to the alternatives selected in the associated RODs. **Table 1** summarizes the key results of review of the Proposed Action compared to SNF already processed and conventional processing evaluated in the SRS SNF EIS.

Based on consideration of the above information, the Proposed Action is similar to, or bounded by, the analyses in the SRS SNF EIS in the following areas:

- The annual impacts of operating H-Canyon to dissolve the SNF without uranium recovery under the Proposed Action would be bounded by the annual impacts of conventional processing, including uranium recovery, in H-Canyon, as evaluated in the SRS SNF EIS (DOE 2000). Figures 1 and 2 clearly show that not recovering the uranium would eliminate a number of processing systems, all of which would consume resources, generate wastes, and contribute to emissions and doses to workers and the public. As described in Section 2.2, potentially 75 percent of the current conventional processing systems (i.e., those associated with uranium recovery) would not be required under the Proposed Action. Therefore, the analyses in the SRS SNF EIS for annual operation of H-Canyon with uranium recovery would bound the impacts of operation of H-Canyon without uranium recovery, as analyzed in this SA.
- The SNF processing rate (about 2.3 to 2.5 MTHM per year) for the concurrent operation of two dissolvers under the Proposed Action would be bounded by the 3.4 to 3.8 MTHM per year SNF processing rate for operation of two dissolvers in the SRS SNF EIS.

The paragraphs below describe the remaining circumstances where the relationship of the Proposed Action to the analyses in the SRS SNF EIS need to be examined in more detail.

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[13] The SNF PEIS (DOE 1995) and the FRR EIS (DOE 1996) are discussed in Section 3.0, because the SRS SNF EIS tiers from, and relies on, some of the analyses originally presented in these documents. Likewise, this SA relies on the analyses contained in the *Supplement Analysis Disposition of Fast Critical Assembly Plutonium* (DOE 2021) and the ROD (86 FR 13359).

Table 1. Comparison of the Proposed Action to SNF Already Processed and Conventional Processing Evaluated in the SRS SNF EIS

Impact Indicator	*Proposed Action*	*SNF Already Processed*	*Conventional Processing in SRS SNF EIS, Maximum Impact Alternative (DOE 2000)*
SNF Types	ASNF and NASNF	ASNF	ASNF
Facilities Used	H-Canyon	F- and H-Canyons [a]	F- and H-Canyons [a]
Number of Dissolvers Operating Concurrently	2 [b]	1 to 2	1 to 2 [c]
SNF Quantity (MTHM)	29.2	25.9 [d]	47.7 [e]
Processing Duration (years)	12 to 13	21	24.8 to 28 for 1 dissolver; 12.4 to 14 for 2 dissolvers [f]
Average Annual Processing Rate (MTHM SNF)	2.3 to 2.5 for 2 dissolvers	1.2	1.7 to 1.9 for 1 dissolver; 3.4 to 3.8 for 2 dissolvers [g]
Uranium Recovered	No	Yes	Yes
Fissile Material Concentration in HLW Glass (gr/m^3)	<2,500 [h]	<897 [h]	<897 [h]
HLW Glass Canisters Required	505[i]	80 [j]	150 [k]

ASNF = aluminum SNF; EIS = environmental impact statement; gr/m^3 = grams per cubic meter; HLW = high-level radioactive waste; MTHM = metric tons of heavy metal; NASNF = non-aluminum spent nuclear fuel; SNF = spent nuclear fuel; SRS = Savannah River Site.

[a] Historically, F-Canyon primarily recovered plutonium-239 and uranium-238 from irradiated natural or depleted uranium, and H-Canyon primarily recovered plutonium-238, neptunium-237, and uranium-235 from SNF and targets. F-Canyon's production mission was completed in March 2002.

[b] Three dissolvers would be used, including one electrolytic dissolver. Only two of the three dissolvers in H-Canyon can be operated at any one time because of the way the off-gas system is configured. The capacities of the H-Canyon dissolvers vary. The 6.1D dissolver has about one half the capacity of the 6.4D dissolver. The assumed processing rate, and therefore the duration of processing, assumes greater than 75 percent availability of the H-Canyon dissolvers.

[c] The SRS SNF EIS states that the annual impacts for conventional processing are based on operating one dissolver. The EIS also states that impacts would double if a canyon was operated at full capacity (i.e., two dissolvers) (DOE 2000: p 4-8).

[d] Source: Watson 2020. This amount is inclusive of the 3.3. MTHM ASNF to be processed via conventional processing under the 2013 AROD. Dissolution of all 3.3 MTHM of ASNF under the 2013 AROD is ongoing.

[e] Source: DOE 2000: Table 1-1.

[f] The analysis covers the environmental impacts of actions over a 38-year period of analysis (DOE 2000: page E-1). The 38 total years of analysis includes up to 10 years of storage. Therefore, it was assumed that conventional processing could occur over a 28-year period. The 24.8-year conventional processing duration represents active processing time and does not include downtimes normally associated with processing activities. The conventional processing duration was based on operating one dissolver in a canyon. If two dissolvers were used (full capacity), the processing duration would be decreased by one half (DOE 2000: Table E-8).

[g] Rate calculated by dividing 47.4 MTHM of SNF by the 24.8 to 28 years of processing time, using one dissolver. The annual processing rate would be double if two dissolvers were used.

[h] Source: SRNL 2020.

[i] Combination of estimated glass canisters contributed from SNF to date (Table 1: SNF Already Produced) and the projected additional cans resulting from Accelerated Basin De-Inventory (ABD) (SRS 2021).

[j] Processing 47.7 MTHM SNF would result in 150 canisters or 3.14 canisters per MTHM. The 25.9 MTHM of SNF processed to date equates to approximately 80 canisters (25.9 MTHM X 3.14 canisters per MTHM = 81.3 canisters).

[k] Source: DOE 2000: Table 4.1-14.

Amount of SNF Analyzed – Under the Proposed Action, about 29.2 MTHM of additional SNF would need to be processed in H-Canyon, for a total of about 55.1 MTHM of SNF (see Table 1). The SRS SNF EIS evaluated processing a total of 47.7 MTHM of SNF. After completion of the Proposed Action, about 7.4 MTHM (16 percent) more SNF would be processed than the amount of SNF analyzed in the SRS SNF EIS. This additional amount of SNF that would need to be processed is due to a proposed change in the types and amounts of materials proposed for processing from the SRS SNF EIS in the management method for the NASNF that was previously planned for transfer to INL. The impacts of processing this additional SNF are discussed in Section 4.

Processing in H-Canyon – The Proposed Action would employ three dissolvers in H-Canyon, although only two dissolvers could be operated simultaneously, because of the way the off-gas system is configured. The SRS SNF EIS analysis assumed one operating dissolver . Operating two dissolvers in H-Canyon, versus one dissolver in F-Canyon and one dissolver in H-Canyon, would result in no increase in total resource use, staffing, worker dose, waste generation, and emissions, because of the efficiencies involved in operating one facility rather than two similar facilities.

The SRS SNF EIS evaluated processing four different SNF groups in either F- or H-Canyons. The SNF group identified for F-Canyon processing (Group A, consisting of EBR-II SNF and Mark-42 targets) required very little processing time. F-Canyon operations were estimated to require about 0.2 years of dissolver operations compared to almost 25 dissolver years of H-Canyon operation. Most of the impacts of conventional processing described in the SRS SNF EIS were associated with H-Canyon operation. Therefore, most of the environmental impacts of processing SNF in H-Canyon under the Proposed Action would be bounded by the impacts evaluated in the SRS SNF EIS.

Impacts on human health to the offsite population and maximally exposed individual (MEI) would be expected to be different because F- and H-Canyon are about 2 miles apart. F-Canyon is about 5.5 miles from the nearest site boundary and H-Canyon is about 8 miles from the nearest site boundary. The impacts of this difference on doses to the public are discussed in Section 4.2.

Processing ASNF and NASNF – The Proposed Action would process ASNF and NASNF at SRS. The SRS SNF EIS only addressed the processing of ASNF at SRS.

While processing NASNF in F- and H-Canyons is not specifically addressed in the SRS SNF EIS, the impacts analyses for the SRS SNF EIS are based on use of a "Reference Fuel Assembly[14]" that encompasses the characteristics of all of the SRS SNF, including NASNF (DOE 2000: page 4-3 and Appendix C).

Under the Proposed Action, NASNF would be dissolved in the H-Canyon electrolytic dissolver and ASNF in the H-Canyon conventional dissolvers. As described in the *Supplement Analysis Disposition of Fast Critical Assembly Plutonium* (DOE 2021), the electrolytic dissolution process for NASNF would be substantially similar to the conventional dissolution process for ASNF , with the exception of the application of an electric current to the acid solution in the electrolytic dissolver to aid in dissolving the metal cladding, a process that has been performed at SRS in the past. The resulting solution would be similar to that resulting from chemical dissolution and would be compatible with transfer to the H-Area Tank Farm, pending immobilization at DWPF.

[14] The "Reference Fuel Assembly" provides a conservative estimate of the radionuclide and curie content for an SNF assembly and was designed to encompass the characteristics of all SNF assigned to SRS. This assembly is a composite of depleted uranium, highly enriched uranium, and special target radionuclides.

The differences in electricity use, and the resulting differences in impacts, are discussed in Section 4.5. Based on that assessment, there would be little difference in operations and environmental impacts.

Number of HLW Canisters – Processing SNF under the Proposed Action would not include recovery of uranium. Instead, the liquid generated by dissolution of the 29.2 MTHM of SNF would be transferred to DWPF for immobilization in glass. Immobilization of the additional liquid HLW at DWPF would be expected to generate about 505 HLW glass canisters, in addition to approximately 80 canisters generated prior to implementation of the Proposed Action, for a total of about 585 canisters (see Table 1).

Conventional processing of 47.7 MTHM of SNF with recovery of uranium, as evaluated in the SRS SNF EIS*,* was expected to generate about 150 HLW glass canisters (DOE 2000: Table 4.1-14). The HLW glass canisters would be stored in S-Area at SRS until eventually transferred to a permanent repository for SNF and HLW. The impacts of this difference in HLW canister generation are discussed in Section 4.4.

Change in Fissile Material Limit – Under the Proposed Action, the fissile material concentration in the HLW glass needs to be as much as 2,500 grams per cubic meter to maximize H-Canyon transfers to HLW sludge batches, because the uranium would not be recovered (see Table 1). Preliminary analyses indicate that increasing the fissile material content in the glass to 2,500 grams per cubic meter can be implemented safely and would not impact the immobilization process (SRNL 2020; SRR 2020). This is discussed in more detail in Section 4.4.

4.0 Comparison of Environmental Consequences

The Proposed Action would be implemented in existing facilities at SRS. There would be no construction and no land disturbance under the Proposed Action. Therefore, construction impacts are not discussed further.

This SA evaluates the same environmental resource areas that were considered in the SRS SNF EIS. **Table 2** describes any new circumstances or information relevant to environmental concerns, and the potential effects on each resource area.

Table 2. New Circumstances or Information Relevant to Environmental Concerns

Resource Area	*New Circumstances or Information Relevant to Environmental Concerns*	*Effect of the Proposed Action* [a]
Geology	Based on the description of the affected environment in Chapter 3, Section 3.2 of the *Final Environmental Impact Statement for Plutonium Pit Production at the Savannah River Site in South Carolina* (Pit Production EIS) (DOE 2020b),[15] there are no significant new circumstances or information relevant to environmental concerns for geology and soils.	Operation of H-Canyon under the Proposed Action would not disturb any land and would not use any geologic resources. Therefore, the impacts of the Proposed Action on geology would be similar to, or bounded by, the impacts described in the SRS SNF EIS and are not discussed further.
Water Resources	Water use at SRS was 4 million gallons per day in the SRS SNF EIS (DOE 2000: p 3-17) and was 2.49 million gallons per day as reported in the Pit Production EIS	Operation of H-Canyon under the Proposed Action would not disturb any land, and annual water use and effluent levels would be similar

[15] The Pit Production EIS is the most recent major NEPA document prepared for SRS and includes an evaluation of the affected environment at SRS as well as an analysis of cumulative impacts, including the management of SNF.

Resource Area	***New Circumstances or Information Relevant to Environmental Concerns***	***Effect of the Proposed Action*** [a]
	(DOE 2020b: page 3-20). The difference in water use is likely due to water conservation measures, fewer activities at SRS, and fewer employees at SRS (see Socioeconomics). Based on the description of the affected environment in Chapter 3, Section 3.3 of the Pit Production EIS (DOE 2020b), there are no significant new circumstances or information relevant to environmental concerns for water resources.	to those evaluated in the SRS SNF EIS. Therefore, the impacts of the Proposed Action on water resources would be similar to, or bounded by, the impacts described in the SRS SNF EIS and are not discussed further.
Air Resources	The SRS SNF EIS (DOE 2000: page 3-24) described areas around SRS as being in compliance with National Ambient Air Quality Standards for criteria pollutants. As of 2019, the areas around SRS were in attainment for all criteria pollutants (DOE 2020b: page 3-24). Based on the description of the affected environment in Chapter 3, Section 3.4 of the Pit Production EIS (DOE 2020b), there are no significant new circumstances or information relevant to environmental concerns for meteorology, air quality, and noise.	Operation of H-Canyon under the Proposed Action would not disturb any land, and annual air emissions would be similar as those evaluated in the SRS SNF EIS (including greenhouse gases). Therefore, the impacts of the Proposed Action on air resources would be similar to, or bounded by, the impacts described in the SRS SNF EIS and are not discussed further.
Ecological Resources	The SRS SNF EIS (DOE 2000: page 3-32), stated that no Federal threatened or endangered species are known to occur on or near F- or H-Areas. Similarly, the Pit Production EIS (DOE 2020b: page 3-35 to 3-38) stated that no Federal or South Carolina threatened or endangered species are known to occur on or near F-Area. Based on the description of the affected environment in Chapter 3, Section 3.5 of the Pit Production EIS (DOE 2020b), there are no significant new circumstances or information relevant to environmental concerns for ecological resources.	Operation of H-Canyon under the Proposed Action would not disturb any land. As discussed elsewhere in this table, annual impacts to other resources that may affect ecological resources (e.g., water effluents, air emissions, noise) would be similar to, or bounded by, the impacts on ecological resources described in the SRS SNF EIS. Therefore, the impacts of the Proposed Action on ecological resources would be similar to, or bounded by, the impacts described in the SRS SNF EIS and are not discussed further.
Socioeconomics	The population in the 6-county ROI was 466,222 (1998) in the SRS SNF EIS (DOE 2000: page 3-33) and was 532,786 (2017) in a 4-county ROI as reported in the Pit Production EIS (DOE 2020b: page 3-47). Employment in the 6-county ROI was 243,854 (1994) in the SRS SNF EIS (DOE 2000: page 3-32) and was 233,921 (2018) in a 4-county ROI as reported in the Pit Production EIS (DOE 2020b: page 3-47). The number of SRS employees was 14,014 (1998) in the SRS SNF EIS (DOE 2000: page 3-33) and was 11,093 (2018) as reported in the Pit Production EIS (DOE 2020b: page 3-46). The differences in population and ROI employment are likely related to differences in the 6-county versus 4-county ROI, as modified by population growth during that period.	Operation of H-Canyon under the Proposed Action would not require any additional employment over current levels and would be similar to the levels evaluated in the SRS SNF EIS. Therefore, the impacts of the Proposed Action on socioeconomics would be similar to, or bounded by, the impacts described in the SRS SNF EIS and are not discussed further.
Cultural Resources	Based on the description of the affected environment in Chapter 3, Section 3.6 of the Pit Production EIS (DOE 2020b), there are no significant new circumstances or information relevant to environmental concerns for cultural and paleontological resources.	Operation of H-Canyon under the Proposed Action would not disturb any land or cultural resources. Therefore, the impacts of the Proposed Action on cultural resources would be similar to, or bounded by, the impacts described in the SRS SNF EIS and are not discussed further.
Worker and Public Health	The population in the 50-mile ROI was 620,100 (1990) in the SRS SNF EIS (DOE 2000: page 3-40) and was 781,060 (2010) as reported in the Pit Production EIS	Impacts to human health for normal operations and accidents are discussed in more detail in Sections 4.1 and 4.2.

Resource Area	*New Circumstances or Information Relevant to Environmental Concerns*	*Effect of the Proposed Action* [a]
	(DOE 2020b: page 3-62). The dose conversion factors were 0.0005 LCF per person-rem for the general public, 0.0004 LCF per person-rem for workers in the SRS SNF EIS (DOE 2000: page D-4) and is now 0.0006 LCF per person-rem for both workers and the public as reported in the Pit Production EIS (DOE 2020b: page A-12).	
Waste Generation	The SRS SNF EIS listed the average annual generation of TRU waste, LLW, MLLW, and hazardous waste at SRS as 260 cubic yards, 7,800 cubic yards, 160 cubic yards, and 270 cubic yards, respectively (DOE 2000: page 3-43). The Pit Production EIS listed the annual generation of TRU waste, LLW, MLLW, and hazardous waste at SRS as 460 cubic yards, 13,100 cubic yards, 520 cubic yards, and 76 cubic yards, respectively (DOE 2020b: page 3-55 to 3-59). Although the annual waste generation rates are somewhat different, the infrastructure at SRS is sized to manage the current waste generation.	Operation of H-Canyon under the Proposed Action would produce similar waste streams and annual volumes as evaluated in the SRS SNF EIS. The point of generation for the waste streams would not change. Therefore, most of the annual impacts of the Proposed Action on waste management would be similar to, or bounded by, the impacts described in the SRS SNF EIS and are not discussed further. The only areas that would be different result from not recovering the uranium. This would generate liquid HLW that would exceed the previous fissile material limit for the HLW glass and would result in the generation of additional HLW glass canisters. These topics are discussed in more detail in Section 4.4.
Traffic and Transportation	The number of SRS employees was 14,014 (1998) in the SRS SNF EIS (DOE 2000: page 3-33) and was 11,093 (2018) as reported in the Pit Production EIS (DOE 2020b: page 3-46). The difference in employees is due to fewer activities at SRS. Based on this information, there are no significant new circumstances or information relevant to environmental concerns for traffic and transportation.	Operation of H-Canyon under the Proposed Action would not require any additional employment over current levels and would have similar levels of annual transportation and traffic as evaluated in the SRS SNF EIS. The Proposed Action would result in the generation of about 505 HLW glass canisters, for a total of about 585 canisters from SNF processing (including approximately 80 already generated); a total of 150 canisters would have been generated under the SRS SNF EIS conventional processing option. Eventually, the 585 canisters would be transported to an SNF and HLW repository. The impacts of transportation of the 585 HLW glass canisters would be more than offset by the approximate 1,000 fewer SNF canisters that would be transported. The transportation of DU oxide to SRS is discussed in Section 4.5.
Utilities and Energy	Annual SRS ground water usage was 1.3 billion gallons (5×10^9 liters) as reported in the SRS SNF EIS (DOE 2000: page 4-30) and was 0.758 billion gallons as reported in the Pit Production EIS (DOE 2020b: page 3-20). Annual SRS electricity usage was 660,000 megawatt-hours as reported in the SRS SNF EIS (DOE 2000: page 4-33) and was 310,000 megawatt-hours as reported in the Pit Production EIS (DOE 2020b: page 3-43). The differences in utility use are likely due to conservation measures, fewer activities at SRS, and fewer employees at SRS (see Socioeconomics). Based on the description of the affected environment in Chapter 3, Section 3.7 of the Pit Production EIS (DOE 2020b), there are no	Operation of H-Canyon under the Proposed Action would produce similar annual utility and energy use as those evaluated in the SRS SNF EIS. The annual impacts of the Proposed Action on the water supply would be similar to or bounded by the impacts described in the SRS SNF EIS and are not discussed further. Operation of the electrolytic dissolver would use more electricity than operation of a conventional dissolver. This topic is discussed in more detail in Section 4.5.

Resource Area	New Circumstances or Information Relevant to Environmental Concerns	Effect of the Proposed Action [a]
	significant new circumstances or information relevant to environmental concerns for infrastructure.	
Environmental Justice	The minority population in the Region of Influence (ROI) was 375,795 (1990) in the SRS SNF EIS (DOE 2000: page 3-34) and was 369,699 (2017) as reported in the Pit Production EIS (DOE 2020b: page 3-52). The low-income population in the ROI was 169,017 (1990) in the SRS SNF EIS (DOE 2000: page 3-34) and was 174,165 (2017) as reported in the Pit Production EIS (DOE 2020b: page 3-52).	Environmental justice impacts are discussed in more detail in Section 4.3.

DU = depleted uranium; EIS = environmental impact statement; HLW = high-level radioactive waste; LCF = latent cancer fatality; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; ROI = region of influence; SNF = spent nuclear fuel; SRS = Savannah River Site; TRU = transuranic.

[a] As described in the introduction to Section 4, there would be no construction and no land disturbance required under the Proposed Action. Therefore, construction impacts are not discussed further.

As described in Section 3.1, the 29.2 MTHM of SNF that would be processed under the Proposed Action, combined with the 25.9 MTHM of SNF that has already been processed, would total 55.1 MTHM or 7.4 MTHM (16 percent) more than the 47.7 MTHM evaluated for conventional processing in the SRS SNF EIS. This would indicate that combined impacts that include the Proposed Action could be up to 16 percent higher than the impacts analyzed in the SRS SNF EIS. Annual combined impacts would be expected to be similar or less, because the annual processing rates under the Proposed Action would be less than those analyzed in the SRS SNF EIS under the Maximum Impact Alternative, and therefore bounded by that analysis.

As discussed in Section 2.2, processing without uranium-235 recovery would not utilize the Head End, First Uranium Cycle, Second Uranium Cycle, Low Activity Waste Evaporation, Solvent Recovery, and Acid Recovery. Additionally, no uranium recovery would be required. Thus, potentially 75 percent of the conventional processing systems associated with uranium recovery would not be required under the Proposed Action. Eliminating those steps would substantially reduce resource use and worker exposure, and related impacts. This reduction in impacts in many resource areas, as discussed in detail below, would offset all or part of the additional impacts produced by processing 16 percent more SNF.

As described in Table 2, the resource areas that were evaluated in the SRS SNF EIS, but require further review and discussion in this SA, are: (1) worker and public health - normal operations, (2) worker and public health – facility accidents, (3) waste generation, (4) transportation, (5) utilities and energy - electricity, and (6) environmental justice. These resource areas are addressed below.

4.1 Worker and Public Health – Normal Operations

In the SRS SNF EIS (DOE 2000), DOE estimated radiation doses and impacts (in terms of latent cancer fatalities [LCFs] to workers and the public) from conventional processing of SNF in F- and H-Canyons. Worker doses were estimated to be less than the SRS administrative limit of 500 millirem per year, resulting in no LCFs on an annual basis. Over the life of the H-Canyon operations (estimated to be 38 years when the SRS SNF EIS was published), DOE estimated that operations could result in about one LCF. In addition, DOE estimated in the SRS SNF EIS that the small radiation doses to the public would result in no LCFs in the population surrounding SRS, and the maximum exposed individual (at the nearest SRS boundary) would have a less than one-in-one-million chance of developing an LCF.

The human health analyses have been updated to incorporate more recent population projections and updated dose conversion factors. In addition, this section evaluates the differences in processing all SRS SNF in H-Canyon under the Proposed Action, versus splitting the activities between F- and H-Canyons, as evaluated in the SRS SNF EIS.

Overall, five items were considered in assessing differences between the Maximum Impact Alternative (the use of conventional processing at F- and H-Canyons) of the SRS SNF EIS and the Proposed Action: material processed, use of H-Canyon versus F- and H-Canyons, population growth, dose conversion factors, and maximum annual impacts. Possible changes to the impacts stated in the SRS SNF EIS are discussed below and impacts of the Proposed Action are provided in **Table 3.**

Material Processed: The SRS SNF EIS evaluated an alternative to use conventional processing for up to 47.7 MTHM. As noted above, the Proposed Action would process up to 29.2 MTHM over a 12- to 13-year period. Impacts associated with the processing of the total amount of SNF under the Proposed Action have been scaled based on the reduced quantity of material processed (i.e., 29.2 MTHM instead of 47.7 MTHM). Annual average impacts were quantified assuming a 12-year[16] program. With the elimination of some process steps, lower radiological emissions would be expected. However, the extent of that reduction has not been quantified (the SRS SNF EIS did not provide information on the distribution of emissions between processing systems). Assuming unchanged emissions in this analysis is thus conservative, resulting in higher stated impacts than if the elimination of the processing steps had been considered.

Use of H-Canyon versus F- and H-Canyons: The conventional processing considered in the SRS SNF EIS could take place in both F-Canyon and H-Canyon.[17] In the Proposed Action, all processing would occur in H-Canyon. As stated in the SRS SNF EIS, "the canyon facilities are nearly identical and use similar radiochemical processes for the separation and recovery of plutonium, neptunium, and uranium isotopes." In addition, the canyons have similar systems for the prevention of the release of radionuclides during normal operations. In both facilities, the ventilation discharges pass through sand filters that remove 99.5 percent of the particulate radioactivity. The use of one facility versus the other would not meaningfully impact the normal operational emissions from the processing of SNF.

The location of the two facilities, relative to the location of the MEI, would impact the dose received by that individual. F-Canyon is located about 2 miles west of H-Canyon and 2 miles closer to the western boundary of SRS. The SRS SNF EIS identified the location of the MEI as being at the site boundary in the west-southwest direction. Therefore, the MEI would be

[16] Should the program be extended to 13 years, average annual impacts would be reduced by about 8 percent. Total impacts would not change.

[17] F-Canyon has been deactivated and H-Canyon is currently the only operating production-scale, nuclear, chemical separation facility in the United States.

farther from H-Canyon than F-Canyon. As a result, the dose to the MEI from H-Canyon air emissions would be less than that from air emissions from F-Canyon. This analysis conservatively did not adjust (lower) the MEI dose from air emissions, due to the relative location of F- and H-Canyon with respect to the MEI. The impacts of liquid emissions (e.g., cooling liquid) from the two facilities would be the same, as the discharges from both facilities are monitored and treated, if appropriate, before ultimately going to the Savannah River. The MEI for liquid emissions is a user of the Port Wentworth and Beaufort-Jasper public water supplies that are supplied by the Savannah River and would have a similar dose.

The total populations within 50 miles of each facility differ slightly, with estimates for H-Canyon being slightly higher than for F-Canyon. Based on population projections provided in the *Surplus Plutonium Disposition Supplemental Environmental Impact Statement* (DOE 2015), there would be a less than 3 percent difference between the two populations. Also, a greater percentage of the H-Canyon population lives in the outermost areas of the 50-mile area. As shown in the environmental justice section below, on average, this section of the population receives a lower dose than the average member of the population within the 50-mile area. Because the effect on impacts of a larger but further population would largely cancel each other out, the population dose estimate was not adjusted for these minor differences in population distribution.

Population Growth: The potential population doses for normal operations reported in the SRS SNF EIS were based on the 1990 population of 620,100 people within a 50-mile radius of H-Canyon. Current estimates show that the population will grow to 862,957 people by 2030 (Pit Production EIS, DOE 2020b: Table A-1). The analysis in this SA assumes the estimated 2030 population over the life of the Proposed Action. Therefore, for the collective population dose within 50 miles, a revised estimate of the person-rem and LCFs for normal operations would increase by the factor of projected population growth. This factor would be about 1.4. Population growth would not impact estimates of average individual doses and MEI doses.

Dose Conversion Factors: The dose-to-LCF-risk conversion factors for both workers and the public have been updated since the publication of the SRS SNF EIS. The updated conversion factors produce higher LCFs than the conversion factors used in the SRS SNF EIS. For worker doses, the SRS SNF EIS used the then preferred dose-to-LCF-risk conversion factor of a probability of 0.0004 LCFs per rem of exposure (up to 20 rem). More current dose conversion calculations use a factor of 0.006 LCF per rem of exposure (DOE 2003). Thus, for worker exposures, the LCF estimates would increase by 50 percent (0.006/0.004) from those in the SRS SNF EIS, due to the updated dose conversion factor.

For public doses, including the MEI and the collective population within 50 miles, the SRS SNF EIS used the then-preferred dose-to-LCF-risk conversion factor of a probability of 0.0005 LCFs per rem of exposure (up to 20 rem). More current does conversion calculations use a factor of 0.006 LCF per rem of exposure (DOE 2003). Thus, for public exposures and exposures to the MEI, the LCF estimates would increase by 20 percent (0.006/0.005) from those in the SRS SNF EIS, due to the updated dose conversion factor.

Maximum Annual Impacts: The SRS SNF EIS provided estimates of the maximum annual impacts to the MEI and to the offsite population (as well as to a noninvolved worker). These estimates were about three to four times the average annual impacts. These maximum values were developed based on the processing of multiple SNF types at the same time and using multiple dissolvers at the same time. The Proposed Action anticipates the use of two dissolvers at a time to accelerate SNF processing. However, the SRS SNF EIS maximum annual impacts from air and water emissions would bound the maximum annual impact of the Proposed Action.

Table 3 summarizes the radiological impacts to the public for three processing scenarios. The table shows the impacts for the Proposed Action of processing 29.2 MTHM of SNF over a 12-year period at H-Canyon. Should the SNF be processed over a 13-year period, the average annual impacts would be about 8 percent lower than those presented in the table. Information on the impacts of conventional processing of 47.7 MTHM of SNF, as provided in the SRS SNF EIS Maximum Impact Alternative, is included for comparison. As noted in Table 1, 25.9 MTHM of the SNF analyzed in the SRS SNF EIS has been processed to date. Combining this amount with the 29.2 MTHM of SNF that would be processed under the Proposed Action results in the processing of 55.1 MTHM of SNF, 7.4 MTHM more than analyzed in the SRS SNF EIS Maximum Impact Alternative. The values under 'Combined' in Table 3, show the impacts associated with processing a total of 55.1 MTHM of SNF.

Table 3. Impacts to Individuals and the Surrounding Population from Normal Operations

	Proposed Action		***SRS SNF EIS Maximum Impact Alternative*** [a]		***Combined*** [b]	
Maximally Exposed Individual	***Dose (millirem)***	***LCF Risk*** [c]	***Dose (millirem)***	***LCF Risk*** [c]	***Dose (millirem)***	***LCF Risk*** [c]
Annual						
Maximum from radiological air emissions	0.015	9.0×10^{-9}	0.015	7.5×10^{-9}	0.015	9.0×10^{-9}
Maximum from radiological liquid emissions	0.057	3.4×10^{-8}	0.057	2.9×10^{-8}	0.057	3.4×10^{-8}
Total Maximum Annual	0.072	4.3×10^{-8}	0.072	3.6×10^{-8}	0.072	4.3×10^{-8}
Average Annual	0.034	2.1×10^{-8}	(d)	(d)	(d)	(d)
Program Total	0.41	2.5×10^{-7}	0.67	3.4×10^{-7}	0.83	4.5×10^{-7}
Population	***Dose (person-rem)***	***LCF*** [c]	***Dose (person-rem)***	***LCF*** [c]	***Dose (person-rem)***	***LCF Risk*** [c]
Annual						
Maximum from radiological air emissions	0.56	3.4×10^{-4}	0.56	2.8×10^{-4}	0.86	4.9×10^{-4}
Maximum from radiological liquid emissions	0.19	1.1×10^{-4}	0.19	9.5×10^{-5}	0.29	1.6×10^{-4}
Total Maximum Annual	0.75	4.5×10^{-4}	0.75	3.8×10^{-4}	1.2	6.5×10^{-4}
Average Annual	0.62	3.7×10^{-4}	(d)	(d)	(d)	(d)
Program Total	7.4	4.5×10^{-3}	8.7	4.4×10^{-3}	12	6.8×10^{-3}
Average Individual [e]	***Dose (millirem)***	***LCF Risk*** [c]	***Dose (millirem)***	***LCF Risk*** [c]	***Dose (millirem)***	***LCF Risk*** [c]
Annual						
Maximum from radiological air emissions	0.00090	$< 1 \times 10^{-10}$	(d)	(d)	(d)	(d)
Maximum from radiological liquid emissions	0.00031	$< 1 \times 10^{-10}$	(d)	(d)	(d)	(d)
Total Maximum Annual	0.0012	$< 1 \times 10^{-10}$	(d)	(d)	(d)	(d)
Average Annual	0.00071	4.3×10^{-10}	(d)	(d)	(d)	(d)
Program Total	0.0086	5.2×10^{-9}	0.014	7.0×10^{-9}	0.016	9.0×10^{-9}

EIS = environmental impact statement; LCF = latent cancer fatality; MTHM = metric tons of heavy metal; SNF = spent nuclear fuel; SRS = Savannah River Site.

[a] Data is derived from Table 4.1-26 of the SRS SNF EIS. The SRS SNF EIS (DOE 2000) calculations assumed operation of multiple dissolvers at the same time to generate the annual maximum impacts. Program durations were developed based on the operation of one dissolver at a time. However, the EIS indicated that if two dissolvers were used, the processing time would be cut in half, but the total program impacts would be unaffected.

[b] Combined impacts are the sum of the impacts from the Proposed Action and scaled results of the SRS SNF EIS Maximum Impact Alternative. The results are scaled by the quantity of SNF already processed, versus the total quantity of SNF analyzed in the SRS SNF EIS (25.9 MTHM/47.7 MTHM).

[c] Values are based on a conversion factor of 0.0006 LCF per rem or person-rem for the Proposed Action and 0.0005 LCF per rem for the SRS SNF EIS.

[d] The SRS SNF EIS did not calculate average maximally exposed individual, average population, or average individual doses.

[e] The average individual dose is the total population dose divided by the projected 2030 population of 862,967.

Impacts from the Proposed Action

Under the Proposed Action, the doses to the average individual and the MEI are all well below limits established in federal regulations and DOE orders. 40 CFR Part 61, Subpart H, establishes an annual limit of 10 millirem via the air pathway to any member of the public from DOE operations, and DOE Order 458.1 establishes an annual limit of 100 millirem from all sources of ionizing radiation and exposure pathways. As in the SRS SNF EIS, radiation doses to the public would result in no LCFs (calculated value 0.0045) in the population surrounding SRS, and the average individual and maximum exposed individual (at the nearest SRS boundary) would have a less than one-in-one-million chance of developing an LCF.

Worker impacts were estimated for both the involved worker and a noninvolved worker. To protect workers from impacts from radiological exposure, 10 CFR Part 835 imposes an annual individual dose limit of 5,000 millirem. In addition, SRS maintains controls to limit the annual individual worker dose below an administrative limit of 500 millirem. No single worker would receive a dose above 500 millirem per year.

Worker population doses associated with processing the SNF addressed in the Proposed Action were scaled from the 2,100 person-rem dose identified for the Maximum Consequence Alternative (conventional processing) in the SRS SNF EIS (DOE 2000). The scaling factor was based on the two total amounts of SNF to be processed (47.7 MTHM in the SRS SNF EIS and 29.2 MTHM in the Proposed Action). The conventional processing identified in the SRS SNF EIS includes more processing steps and systems than that of the Proposed Action (processing steps not used under the Proposed Action are identified in Section 2.2). The simplified processing steps used by the Proposed Action would require fewer workers than conventional processing and result in lower collective doses. Nevertheless, this analysis has not taken credit for the reduction in worker dose from the simpler processing under the Proposed Action. This results in a collective worker dose of about 1,300 person-rem with one LCF (calculated value of 0.8).

All SNF proposed to be processed in H-Canyon would first need to be transferred from its current storage location in L-Area (L-Reactor Disassembly Basin). An estimated 36 shipments per year would be required to transfer the 29.2 MTHM of SNF from the L-Reactor Disassembly Basin to H-Canyon (Yazzie 2020). The SRS SNF EIS calculated a dose of 0.0038 person-rem per shipment to the crew transporting SNF from L-Area to H-Area. Assuming 36 trips per year for the 12-year duration of the Proposed Action, this results in a total crew (worker) dose of 1.6 person-rem.

The combined worker dose of those workers involved in the processing of the SNF through H-Canyon and in the shipment of the SNF from L-Area to H-Area) of 1,300 person-rem, results in one possible LCF (calculated value of 0.8). Based on a program duration of 12 years, the estimated average annual workforce dose would be 110 person-rem with no LCFs (calculated value of 0.06). Should the program extend through 13 years, the total worker dose would not be expected to change, but the annual average dose would be reduced by about 8 percent.

A maximum annual dose and a program total dose to a noninvolved worker[18] from air emissions associated with conventional processing was estimated in the SRS SNF EIS. The maximum annual dose was based on air emissions associated with the operation of one dissolver processing the SNF, resulting in the highest noninvolved worker dose. The Proposed Action anticipates the simultaneous use of two dissolvers. To estimate the noninvolved worker maximum annual dose from the Proposed Action, the SRS SNF EIS value (0.12 millirem) was doubled. The maximum annual dose to the noninvolved worker would be 0.24 millirem,

[18] A noninvolved worker is a worker not directly involved in the Proposed Action, but located at SRS. For the analysis in the SRS SNF EIS, this worker was assumed to be located 640 meters from the point of release, in the direction of the plume with the greatest concentration.

resulting in a 1-in-7-million chance of an LCF. The noninvolved worker dose for the Proposed Action was estimated using the same method as the involved worker dose, scaling the SNS SRS EIS value (1.53 millirem) by the amount of SNF processed. This results in a total dose to a noninvolved worker of 0.93 millirem, with risk of 1-in-1.8-million chance of a fatal cancer. The noninvolved worker average annual dose of 0.078 millirem per year, based on a program duration of 12 years, would result in a less than 1-in-20-million chance of an LCF.

Combined Impacts from Processing 55.1 MTHM

For the processing of 55.1 MTHM of SNF, the doses to the average individual and the MEI would remain well below limits established in federal regulations and DOE orders. 40 CFR § Part 61, Subpart H, establishes an annual limit of 10 millirem via the air pathway to any member of the public from DOE operations, and DOE Order 458.1 establishes an annual limit of 100 millirem from all sources of ionizing radiation and exposure pathways.

Population and MEI doses were calculated by combining the full impacts from the Proposed Action with impacts scaled from the SRS SNF EIS. The SRS SNF EIS impacts were scaled based on the amount of SNF that has been processed, versus the amount analyzed in the Maximum Impact Alternative of that EIS (25.9 MTHM/47.7 MTHM). As in the SRS SNF EIS and the Proposed Action, radiation doses to the public in the population surrounding SRS would result in no LCFs (calculated value 0.0068), and the average individual and MEI (at the nearest SRS boundary) would have a less than one-in-one-million chance of developing an LCF.

Total worker impacts were adjusted in the same manner as was used to develop population estimates. The worker dose from the SRS SNF EIS Maximum Consequence Alternative was adjusted to reflect only the SNF that has been processed, resulting in a worker dose of 1,100 person-rem. This worker dose was added to the total worker dose from the Proposed Action (1,300 person-rem), resulting in a combined worker dose of 2,400 person-rem (one LCF [calculated value of 1.4]).

Total noninvolved worker impacts were adjusted in the same manner as was used to develop population estimates. The noninvolved worker dose from the SRS SNF EIS Maximum Consequence Alternative was adjusted to address only the SNF that has been processed to date, resulting in a noninvolved worker dose of 0.83 millirem. This dose was added to the total noninvolved worker dose from the Proposed Action (0.93 millirem), resulting in a noninvolved worker dose of about 1.8 millirem.

Combined Impacts Increases over SRS SNF EIS

In summary, the SRS SNF EIS evaluated the conventional processing of 47.7 MTHM of SNF. As shown in Table 1, about 25.9 MTHM of this SNF has been processed. The 25.9 MTHM of SNF that has been processed, combined with the 29.2 MTHM of SNF proposed to be processed under the Proposed Action, results in the processing of about 7.4 MTHM (16 percent) more SNF than the 47.7 MTHM analyzed in the SRS SNF EIS.

Based on the information provided earlier in this section (Table 3 and the worker impact discussions), the impacts from the processing of this additional 7.4 MTHM of SNF would be:

- A 0.16-millirem increase in MEI dose and a 9 x 10^{-8} increase in MEI LCF risk, with a total MEI risk that remains less than one in one million;
- A 3.3-person-rem increase in population dose and a 0.0024 increase in the expected number of LCFs, with the total number of expected LCFs remaining zero;
- A 0.002-millirem increase to the average individual dose and a 2 x 10^{-9} increase in average individual risk, with a total average individual risk that remains well below one in one million;
- A 330-person-rem (16 percent) increase in total worker dose, with an equal increase (0.4) in the likelihood of one LCF, and where the expected number of LCFs does not increase beyond a single LCF; and
- A 0.24-millirem increase to the noninvolved worker dose and a 3 x 10^{-7} increase in LCF risk, with total noninvolved worker risk of an LCF remaining less than 1 x 10^{-6} (one chance in one million).

The incremental impacts of processing the additional SNF do not materially change the expected impacts presented in the SRS SNF EIS.

4.2 Worker and Public Health – Accidents and Intentional Destructive Acts

The Proposed Action would not introduce new radiological or chemical accident scenarios for H-Canyon operations, but because a significant amount of time has passed, the accident analyses have been updated to incorporate more recent population projections and updated dose conversion factors. In addition, this section evaluates the differences in processing all SRS SNF in H-Canyon under the Proposed Action, versus dividing the activities between F- and H-Canyons, as evaluated in the SRS SNF EIS.

The potential accident probabilities, consequences if an accident occurred, and accident risks associated with implementation of the Proposed Action would be substantially reduced from those projected in the SRS SNF EIS, due to the simplification of the processing activities in H-Canyon. Under the Proposed Action, several key process steps in processing SNF in H-Canyon, including Head End, First Cycle Solvent Extraction, and Second Cycle Solvent Extraction would not occur. Only the dissolving, neutralizing, and transfer operations would occur. These simplifications of H-Canyon processing activities are anticipated to both reduce the likelihood of several types of accidents and reduce the radiological materials at risk for some of the potential accidents. Previous safety analyses for H-Canyon have evaluated the accident potential for each of these major operations and found the dominant accident risks to be those identified in Table D-3 of the SRS SNF EIS, reproduced below as **Table 4**. The impacts in the SRS SNF EIS (DOE 2000) were based on the 1990 offsite population within 50 miles of H-Canyon and the then-current dose conversion factors. Potential future impacts would be increased relative to the values in Table 4 due to population growth and differences in the dose conversion factors (see Section 4.1), but would also be lowered in many instances for the reasons discussed below.

Table 4. H-Canyon Radiological Accidents and Impacts

Accident	*Maximum Curies Released*	*Accident Frequency*	*Noninvolved Worker (rem)*	*MEI (rem)*	*Offsite Population (person-rem)*	*LCF*
Ruthenium volatilization	140	Once in 11 years	0.13	0.013	770	0.39
Fire	0.57	Once in 1,600 years	0.53	0.055	3.300	1.6
Design-basis earthquake	800	Once in 5,000 years	1.8	0.246	14,000	7.0
Coil and tube, cooling tower circulated	13	Once in 14,000 years	13	1.3	78,000	39
Transfer error to Building 211-H	3,700	Once in 14,000 years	1.5	0.16	9,200	4.6
Hydrogen deflagration	1.1	Once in 18,000 years	1.0	0.11	6,400	3.2
Criticality	47,000	Once in 77,000 years	0.029	0.0012	18	0.009

EIS = environmental impact statement; LCF = latent cancer fatality; MEI = maximally exposed individual; SNF = spent nuclear fuel; SRS = Savannah River Site.

Source: DOE 2000 (SRS SNF EIS): Table D-3.

The accident analyses for H-Canyon presented in the SRS SNF EIS are based on the H-Canyon safety analyses at the time of the EIS was prepared and include the then current and projected inventory of materials that might be processed. For most of the accidents postulated in the safety analyses and SRS SNF EIS, the potential material at risk (MAR) and releases from the dissolution process were only a fraction of the overall H-Canyon source term.

The addition of dissolution of NASNF in an electrolytic dissolver would not introduce any new accident scenarios and would not increase the accident frequency or the potential consequences if an accident occurred. The isotopic content of the NASNF is similar to that of the other SNF evaluated in the SRS SNF EIS and summarized in Table C-7 of that EIS. In fact, the accident impacts for the SRS SNF EIS were based on the current H-Canyon safety analyses at the time, which evaluated the bounding accidents for each H-Canyon process using a bounding isotopic mix, based on past and projected future missions. Based on Table C-7, the NASNF would be bounded by the assumed isotopic mix in the H-Canyon safety analyses. As illustrated in Table E-1 of the SRS SNF EIS, Group F, the NASNF, makes up 5 percent of the total fissile mass of SNF identified. Other types, including Group B, the MTR-like SNF, and Group C, the HEU/LEU oxides, make up 70 and 19 percent of the total fissile mass, respectively. In addition, the NASNF identified in Table C-6 of the SRS SNF EIS are mostly from the 1970-1980 timeframe and have hence decayed for four or more decades. As such, the potential radiological consequences of an accident involving NASNF would be substantially reduced from the consequences projected in the SRS SNF EIS. The potential changes in accident probabilities, MAR, accident impacts, and accident risks for each of these major types of accidents is discussed below.

Ruthenium Volatilization: The SRS SNF EIS indicated in Table D-3 a maximum source term of about 140 curies released. The safety analyses develop a source term for this accident, assuming the maximum ruthenium content of the remaining five fuel charges has been estimated and used to calculate a worst-case accident involving volatilization. Based on a cooling time of 3,232 days and a batch size of 12 assemblies in the dissolver, and assuming a 1.0 release fraction, 136 curies of ruthenium-106 may be released.

For the Proposed Action, the remaining ruthenium content in the SNF inventory identified in the SRS SNF EIS is expected to be much smaller due to radioactive decay. The half-life of ruthenium-106 is 1.020 years. The SRS SNF EIS reference fuel assembly contains 21,100 curies of ruthenium-106 (SRS SNF EIS, Table C-7). The remaining ruthenium-106 inventory per reference fuel assembly would be 2.36E+1, 2.65E-2 and 2.97E-5 curies after 10, 20, and 30 years of decay, respectively. Thus, any releases from the SNF inventory, identified in the SRS SNF EIS, due to ruthenium volatilization, would be much smaller than that projected in the SRS SNF EIS due to the multiple half-lives of decay. Some future SNF receipts, especially the HFIR SNF, would not have substantial time to allow for radioactive decay. Therefore, the ruthenium volatilization accident would still be relevant.

Fires: The primary fires considered in the SRS SNF EIS, and the H-Canyon safety analyses, are associated with large quantities of organics and solvents, primarily associated with the solvent extraction processes. These solvents are the primary source of flammable materials in association with process materials. Under the Proposed Action, the primary and secondary solvent extraction processes would not occur. Thus, the radiological risks of radioactive material releases due to fires are substantially reduced or eliminated.

Earthquakes: The SRS SNF EIS evaluated the potential impacts from a design-basis earthquake, with an estimated accident frequency of once in 5,000 years. During this large earthquake, the SRS SNF EIS and the H-Canyon safety analyses assume that there would be widespread spillage of process liquids from the tanks and piping associated with the full H-Canyon processes. The largest tank in each unit operation is assumed to be spilled onto the process cell floor. Subsequent fires among the flammable materials might also be expected. More recent safety analyses, including the current documented safety analysis (SRNS 2014), have concluded that the earlier assumptions on the extent of tank and piping spillage during design-basis earthquakes were unrealistic and less spillage was more likely.

Since most of the H-Canyon processes, including the first and second cycle solvent extraction processes, would not occur under the Proposed Action, less radioactive material would be in the tanks and piping. Remaining materials from previous operation would still be at risk in a severe earthquake. In addition, under the Proposed Action, some of the liquids could be temporarily stored in some of these tanks. It is expected that the total amount of radioactive liquids at risk, including those associated with dissolution and transfers outside of H-Canyon, would be less than those normally present during the periods of full H-Canyon operation evaluated in the SRS SNF EIS. Most of the flammable materials, solvents, and organics would not be a part of the MAR under the Proposed Action. Thus, the seismic source term would be less than that reported in the SRS SNF EIS, and the impacts to individuals and the public would be proportionally less.

Coil and Tube Failures with Releases to the Environment: Cooling water for various H-Canyon process systems is circulated from the H-Canyon building process areas to outside of the building for cooling. This material can be radioactive. Under the Proposed Action, some of the processes that rely on cooling water would not be operating. The dissolver operations would continue and have the potential for cooling water leaks outside of the H-Canyon building confinement. The source term would be no greater under the Proposed Action than that evaluated in the SRS SNF EIS. With fewer operations in H-Canyon, the probability of this accident would be reduced.

Transfer Errors to the Outside Facilities: One of the potential pathways for release of highly radioactive liquids from the H-Canyon building is through an inadvertent transfer of highly radioactive liquids to one of the processing facilities immediately adjacent to H-Canyon that is only intended to receive low-activity radioactive materials. The inadvertent transfer could occur from any of the H-Canyon process operations. Under the Proposed Action, most of the processes that have the potential for transfer of highly radioactive liquids to the outside tanks would not be operating. The dissolver operations would continue and have the potential for inadvertent transfers. The source term would be no greater under the Proposed Action than that evaluated in the SRS SNF EIS. With fewer operations in H-Canyon, the probability of this accident would be reduced.

Hydrogen Deflagration: Hydrogen can be generated in the dissolver and by radiolysis of water. A hydrogen explosion can thus be postulated through several means. This is one of several types of explosions postulated and evaluated in the H-Canyon safety documents. More serious explosion concerns are present with the solvent extraction process and evaporations where "red oil" explosions associated with Tri-Butyl Phosphate are evaluated. Under the Proposed Action, most of the processes (including solvent extraction) that have the potential to pose a risk of explosions involving highly radioactive liquids (including the "red oil" explosions) would not be operating. The dissolver operations would continue and have the potential for a hydrogen explosion, although the probability of other types of explosions in H-Canyon would be reduced. The source term would be no greater under the Proposed Action than that evaluated in the SRS SNF EIS. With fewer operations in H-Canyon, the probability of this accident would be reduced.

Criticality: The H-Canyon safety documents and the SRS SNF EIS evaluate the potential consequences of an inadvertent criticality involving solutions of fissile materials. The H-Canyon processes are designed to maintain concentrations of fissile materials sufficiently low, so that a criticality is not possible. Failures of controls, however, could lead to an accident. Under the Proposed Action, most of the processes that have the potential to pose a risk of criticality involving highly radioactive liquids would not be operating. The dissolver operations would continue and have the potential for a criticality, although the potential for other types of explosions in H-Canyon would be reduced. The source term would be no greater under the Proposed Action than that evaluated in the SRS SNF EIS. In addition, with fewer operations in H-Canyon, the probability of this accident would be reduced.

Implementation of "no uranium recovery" under the Proposed Action would result in a higher concentration of fissile materials in the solution sent to tank farm storage and ultimately placed into the DWPF HLW glass canisters. The increased fissile material inventory in the HLW glass could increase from the current assumed level of 897 grams per cubic meter to as much as 2,500 grams per cubic meter. Preliminary criticality analyses indicate that increasing the fissile material content in the glass up to 2,500 grams per cubic meter can be implemented safely (SRR 2020). Additional analyses would be conducted prior to implementing the increased fissile mass. Processing NASNF would not increase the criticality risks in H-Canyon, H-Tank Farm, or DWPF.

Effects of Changes since the 2000 SRS SNF EIS on Postulated Accident Impacts

Since publication of the SRS SNF EIS (DOE 2000), several changes have occurred that would cause the estimated radiological impacts identified in that EIS to be lower under the Proposed Action. These changes are reduction of MAR for accident scenarios, updated dose conversion factors, population growth, and dose modeling.

Reduction of MAR for Accident Scenarios: The MAR would be reduced for most accidents, since major processes in H-Canyon would not operate under the Proposed Action. Major fire accident scenarios would be eliminated with the elimination of the solvent extraction processes. In addition, many radionuclides important to offsite dose would have decayed substantially in the 20 years since the SRS SNF EIS evaluations. Most importantly, a ruthenium volatilization accident would be substantially reduced due to radioactive decay.

Dose Conversion Factors: Dose conversion factors for workers and the public have changed as described in Section 4.1.

Population Growth: The expected population over the life of the Proposed Action within a 50-mile radius of H-Canyon has changed as described in Section 4.1. Thus, for a collective population dose within 50 miles, the estimate of person-rem and LCFs for each accident identified in the SRS SNF EIS would increase by the 1.4 factor of projected population growth.

Dose Modeling: The radiological dose consequence modeling in the 2000 SRS SNF EIS was performed using the then Federal Guidance Report (FGR)-11 dose models for each radioisotope. Since then, more complex models have been developed and reported in FGR-13. The changes in estimated radiological dose per curie inhaled or ingested vary with radioisotope. For the key isotopes affecting dose from aged SNF, the difference in overall individual and population dose between estimates in the SRS SNF EIS with FGR-11 and the newer FGR-13 are small, with the FGR-13 rem/curie values for the key radionuclides generally being even smaller. Radioactive decay would likely result in even lower dose estimates taking into account the radiological decay that has occurred since the 2000 SRS SNF EIS. The net effect of using current dose modeling parameters from FGR-13 and adjusting dose estimates for radioactive decay would result in overall impact estimates lower than those in the 2000 SRS SNF EIS.

Changes in Accident Frequencies: Based solely on the processing of the additional 7.4 MTHM of SNF, cumulative accident probabilities for these accident scenarios would be expected to be slightly higher (about 16 percent) than estimated in the SRS SNF EIS. However, as indicated above, elimination of many of the processes in H-Canyon with the Proposed Action would reduce the probability of some of the accidents, including ruthenium volatilization, fires, coil and tube failures, transfer errors, and hydrogen deflagration. Since more SNF would ultimately be processed, the operations would continue for a longer period of time and, hence, increase the cumulative probability of accidents specifically associated with dissolution, including accidental criticalities and transfer errors.

Combined Effects of Changes on Accident Consequence Projections:

- **Reduction of MAR for SRS SNF EIS Accident Scenarios**: MAR is reduced for most accidents, since major processes in H-Canyon would not operate under the Proposed Action. Major fire accident scenarios would be eliminated with the elimination of the solvent extraction processes. The ruthenium volatilization accident would be eliminated due to radioactive decay for inventory identified in the SRS SNF EIS, but would still present an accident risk for new shipments of short-cooled SNF.
- **LCFs per Person Rem**: There would be a factor of 1.5 increase for workers and a factor of 1.2 increase for the public.
- **Population Growth from 1990 SRS SNF EIS to 2030**: There would be a factor of 1.4 increase for population doses.
- **Dose Modeling**: Dose would be lower by varying amounts, depending on the isotope.
- **Accident Frequencies**: Processing of the additional 7.4 MTHM of SNF would increase some cumulative accident scenario probabilities by about 16 percent over those estimated in the SRS SNF EIS. However, elimination of 75 percent of the processes in H-Canyon would reduce the frequency of accidents associated with implementation of the Proposed Action.

Conclusion: Implementation of the Proposed Action in H-Canyon would not introduce any new accident scenarios, and the accident consequences and risks would be lower for most accidents than those presented in the SRS SNF EIS. Expected population growth and updated dose conversion factors would result in increased potential consequences of a given accident scenario of approximately 1.7 times for the population and 1.5 times for workers.

Intentional Destructive Acts

As noted above, the *Supplement Analysis Savannah River Site Spent Nuclear Fuel Management* (DOE 2013), added an intentional destruction acts evaluation, using the accident analysis of the SRS SNF EIS as a starting point. In that SA, DOE found that while it was "not possible to predict whether or where intentional acts of destruction would occur, or the nature or types of attacks the consequences of a terrorist attack on the SNF storage and processing facilities are not likely to be greater than the consequences of the severe accidents DOE evaluated." This determination continues to be valid with the changes analyzed in this SA.

4.3 Environmental Justice

Executive Order 12898, *"Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,"* requires DOE to identify and address *"disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."* In the SRS SNF EIS, DOE identified population sectors based on 22.5-degree arcs centered on SRS and concentric distance rings from 10 to 50 miles out from the center at 10-mile intervals. DOE then calculated a fraction of the total population dose for each sector. Minority and low-income communities were identified (using 1990 census data), and the highest population dose

As expected, the populations located closer to SRS received higher average individual doses than those located further away. **Figure 3** (reproduced from the SRS SNF EIS) shows the relationship between per capita (average individual) doses and distance for the non-low-income, low-income, minority, and non-minority communities.

The doses shown in this figure are based on a hypothetical dose to the total population within 50 miles of SRS of 1 person-rem. As the figure shows, there was relatively little difference between the per capital doses, especially within the same distance ring. Average individual doses based on the population dose for conventional processing in F- and H-canyons can be obtained by multiplying the per capita doses by the analyzed population dose of 8.7 person-rem identified in the SRS SNF EIS.

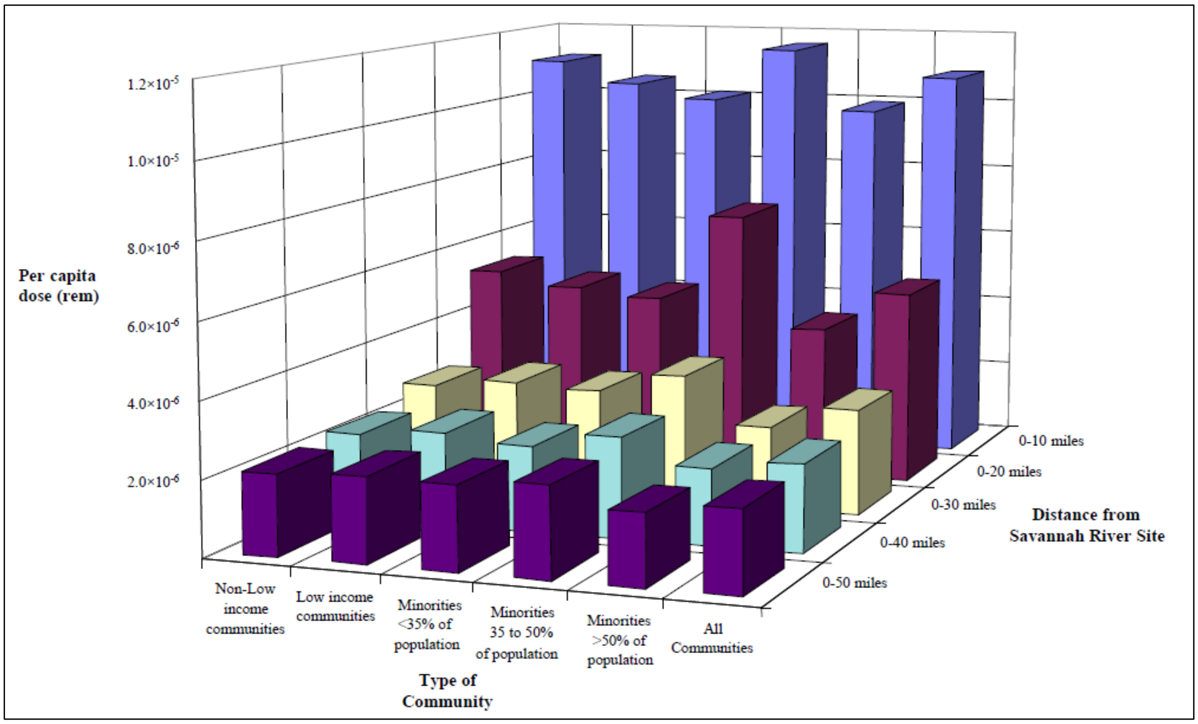

Figure 3. Distribution of a Hypothetical Unit Population Dose Among SRS Communities

While the population estimated for 2030 (862,957) has increased from the 1990 population estimate used in the SRS SNF EIS (620,100), the per capita doses within each distance ring associated with a 1 person-rem population exposure would not change. As shown in Table 3, the total population dose associated with the combined impacts from processing 55.1 MTHM SNF (12 person-rem) is more than that for the Maximum Impact Alternative (conventional processing) (8.7 person-rem) in the SRS SNF EIS. As in the SRS SNF EIS, radiation doses to the public would result in no LCFs in the population surrounding SRS, and the average individual and MEI (at the nearest SRS boundary) would have a less than one-in-one-million chance of developing an LCF.

Similar to the analysis in the SRS SNF EIS of the potential impacts on low-income and minority populations of conventional processing, there would be no disproportionally high or adverse impacts to the minority and low-income populations from the Proposed Action of processing an additional 29.2 MTHM of SNF and the combined impacts from processing 55.1 MTHM of SNF.

4.4 Waste Generation

SNF processing at H-Canyon under the Proposed Action would result in the generation of ancillary waste such as discarded containers, cleaning solutions, and personal protective equipment. Wastes and the point of generation for those wastes would be the same as those historically generated by H-Canyon. These wastes are expected to be classified either as TRU waste, low-level radioactive waste (LLW), some small quantities of hazardous and mixed wastes, and nonhazardous waste. The wastes would be managed using a combination of onsite and offsite facilities, as is typically done for these waste types. TRU waste packages would be stored in the SRS E-Area Solid Waste Facility prior to shipment to WIPP. LLW would be disposed of onsite in E-Area or at offsite DOE (i.e., Nevada National Security Site) and commercial disposal facilities. Mixed TRU waste would be disposed of at WIPP, and mixed LLW would be treated and disposed of at offsite DOE (i.e., Nevada National Security Site) and commercial facilities. Hazardous waste would be treated and disposed of at offsite commercial facilities, and nonhazardous solid waste would be disposed of at the Three Rivers Landfill at SRS.

The annual generation of wastes (with the exception of liquid HLW) associated with processing the additional 29.2 MTHM of SNF (without uranium recovery) under the Proposed Action, are expected to be within the quantities of waste analyzed in the SRS SNF EIS (with uranium recovery). The quantities of wastes associated with the total of 55.1 MTHM of SNF to be processed could be 16 percent higher than the quantities analyzed in the SRS SNF EIS. This is likely to be mitigated because about 75 percent of the H-Canyon conventional processing systems would not be operated under the Proposed Action, resulting in less waste generation. DOE expects that waste generation under the Proposed Action would be within the capacity of existing SRS waste management facilities for storage, treatment, and disposal.

Liquid HLW Management and Immobilization at DWPF The dissolved SNF would be sent to storage tanks and then most dispositioned as sludge batches to DWPF. The resulting liquid waste would be sent to DWPF for immobilization into glass. A small quantity of low-activity liquid waste would be sent to the Salt Waste Processing Facility and eventually disposed of in grout at the Saltstone Disposal Facility at SRS. This quantity would be within the bounds of the SRS SNF EIS, and would not affect the impacts described in that document. The HLW glass-filled, stainless-steel canisters from DWPF would be stored in the Glass Waste Storage Buildings in S-Area, until a disposal repository becomes available.

H-Canyon processing of SNF would produce dissolved SNF that would be transferred to the tank farm and managed as liquid HLW. The liquid HLW system has the capacity to manage up to 300,000 gallons per year from H-Canyon (SRNS 2018: page 38). The SRS *Liquid Waste System Plan* (SRR 2021) includes the receipt of 210,000 gallons of liquid HLW per year in Fiscal Year 2021 and 300,000 gallons of liquid HLW per year in FY22–FY30, for a total of 2,910,000 gallons for the period of 2021 through 2030. The Proposed Action (processing without uranium recovery) will produce about 200,000 gallons of liquid HLW per year starting in 2022 and ending in 2033, for a total of 2,400,000 gallons of HLW. This is a decrease in liquid HLW volume when compared to about 2,770,000 gallons described in the SRS SNF EIS (DOE 2000).

Under the Proposed Action, about 505 HLW glass filled stainless-steel canisters would be produced, for a total of about 585 canisters produced from SNF (see Table 1). The SRS SNF EIS evaluated producing a total of 150 canisters in H-Canyon. After completion of the Proposed Action, about 435 more canisters would be produced than analyzed for H-Canyon in the SRS SNF EIS. This additional number of canisters would represent less than 7 percent of the approximately 8,400 HLW glass-filled stainless-steel canisters that DOE most recently estimated would be produced at DWPF (SRR 2021). SRS's total expected canisters would still be within the 10,000 canisters DOE evaluated in the DWPF EIS (DOE 1982) and no additional storage capacity would be needed.

Although a national repository for SNF is not yet licensed, DOE remains committed to meeting its obligations to safely dispose of SNF and HLW. The estimated additional 505 HLW glass canisters that would eventually require disposal, would be more than offset by the estimated 1,000 SNF storage canisters that would have needed disposal if the SNF was not processed in H-Canyon.

Under the Proposed Action, the fissile material concentration in the HLW glass needs to be as much as 2,500 grams per cubic meter to maximize H-Canyon transfers to HLW sludge batches, because the uranium would not be recovered. This change would not represent a change in how DWPF is operated. Analyses indicate that increasing the fissile material content in the glass up to 2,500 grams per cubic meter would not be a criticality issue in DWPF and would have minimal impact on key properties related to durability of the glass (SRNL 2020; SRR 2020). The HLW glass produced under the Proposed Action would be substantially similar to previously processed DWPF glasses.

4.5 Other Resource Areas

Implementing the Proposed Action would entail activities at H-Canyon that are similar to recent operations and historical operations. As described in Section 4.0, the overall annual volume of activities related to the processing of SNF (without uranium recovery) under the Proposed Action would be similar to, or less than, those activities analyzed in the SRS SNF EIS for processing SNF (with uranium recovery). Because the annual impacts of the Proposed Action would be no greater than those evaluated in the SRS SNF EIS, the impacts on geology, water resources, air resources, ecological resources, socioeconomics, cultural resources, traffic, and utilities and energy (except for electricity) are not revisited in this SA (see Table 2).

NASNF would be dissolved in the electrolytic dissolver and ASNF in the conventional dissolvers. The electrolytic dissolution process is very similar to the conventional dissolution process. The only substantive difference would be the application of electric current to the acid solution to enhance dissolution of the metal cladding, a process that has been used in H-Canyon in the past. The chemicals are generally the same chemicals used in conventional processing, are standard industrial chemicals, and the use of them would be within historical levels for operations in H-Canyon. Therefore, it is expected that resource use under the Proposed Action would be similar to, or bounded by, that described in the SRS SNF EIS.

The electrical use to run the electrolytic dissolver would be within historic levels for operations in H-Canyon, and would likely be more than offset by the disuse of 75 percent of that needed for the processing systems associated with uranium recovery (i.e., Head End, First Uranium Cycle, Second Uranium Cycle, Low Activity Waste Evaporation, Solvent Recovery, Acid Recovery, and Down-Blending) under the Proposed Action (see Section 2.2 and Figures 1 and 2). Therefore, it is expected that electricity use under the Proposed Action would be similar to, or bounded by, that described in the SRS SNF EIS.

As described in Section 2.2, DU oxide may be added after dissolving the SNF in H-Canyon and before the liquid is sent to the HLW storage tanks. A portion of the DU oxide (30,000 kilograms) would be produced at the DUF_6 conversion facilities at the Paducah or Portsmouth sites and shipped to SRS. About 60 drums of DU oxide would be needed (30,000 kilograms at 520 kilograms per drum) over the duration of the Proposed Action. The 60 drums would be transported in two to three truck shipments (Maxted 2020).

The SNF processing technologies (including conventional processing) analyzed in the SRS SNF EIS (DOE 2000) also require DU. Transportation of DU to SRS was not specifically analyzed in the SRS SNF EIS. The impacts of transport of DU would be minor, when compared to the impacts of transportation of SNF, and would not substantially add to the potential impacts evaluated under the SRS SNF EIS.

The risks from transporting DU oxide approximately 600 miles from the Paducah Site or 500 miles from the Portsmouth Site to SRS would be very low. The transportation of DU oxide to potential disposal facilities was analyzed in the *Final Supplemental Environmental Impact Statement for Disposition of Depleted Uranium Oxide Conversion Product Generated from DOE's Inventory of Depleted Uranium Hexafluoride* (DU Oxide SEIS) (DOE 2020a). As described in Table B-4 of the DU Oxide SEIS, shipment via truck from the Paducah Site in Kentucky to the Waste Control Specialists disposal facility in Texas, a distance of about 1,050 miles (about twice the distance from Paducah or Portsmouth to SRS), would result in a crew dose of 0.002 person-rem with zero (1.20×10^{-6}) LCFs and a population dose of 0.005 person-rem with zero (3.15×10^{-6}) LCFs for one truck shipment. The radiological risks from a transportation accident during one truck shipment would be 3×10^{-9}, with zero (0.0001) fatalities expected from a traffic accident. Adjusting the effects to reflect two or three truck shipments would still result in minor impacts.

4.6 Cumulative Impacts

As part of the process of preparing this SA, DOE has reviewed past, present, and reasonably foreseeable future actions that may not have been considered in the SRS SNF EIS (DOE 2000). Activities that could be considered "new circumstances or information relevant to environmental concerns" are listed in **Table 5** for consideration in this SA. After reviewing these activities, five activities could add to the potential environmental impacts and, therefore, are considered in the cumulative impacts analysis.

As described in Chapter 5 of the SRS SNF EIS (DOE 2000: page 5-1), cumulative impacts for the following resource areas were dismissed, because impacts from SNF management activities were determined to be so small that their potential contribution to cumulative impacts would be negligible: geologic resources, ecological resources, aesthetic and scenic resources, cultural resources, and traffic. There is no new information to indicate that this has changed, so these resource areas are not discussed further.

Cumulative impacts for air resources, water resources, public and worker health, waste generation, utilities and energy, and socioeconomics were evaluated in Chapter 5 of the SRS SNF EIS (DOE 2000: page 5-1). The *Final Environmental Impact Statement for Plutonium Pit Production at the Savannah River Site in South Carolina* (Pit Production EIS) (DOE 2020b: p 2-29) provides the most recent cumulative impacts analysis for SRS. As summarized in Table 2-6 in the Pit Production EIS, there would be no notable additional cumulative impacts to water resources and air quality, and cumulative waste generation would be within the capacities of the disposal facilities. Cumulative electricity power consumption and water usage would be well within the site-wide capacities, and cumulative socioeconomic impacts would be small.

Maximum cumulative annual worker and public doses would be within all regulatory limits. The maximum cumulative annual offsite population dose is not expected to result in any LCFs to the population within a 50-mile radius of SRS. The maximum cumulative annual SRS worker doses could result in up to one (0.6) LCF.

Table 5. Past, Present and Reasonably Foreseeable Future Actions that may not have been Considered in the SRS SNF EIS

Year	*Activity*	*Discussion*	*Additional Impacts*
2002	F-Canyon and FB-Line complete last production run	Shutdown would result in decreased resource use, employment and emissions, and, therefore, decreased environmental impacts.	
2003	Receiving Basin for Offsite Fuels prepares for closure	Closure would result in decreased resource use, employment and emissions, and, therefore, decreased environmental impacts.	
	Construction of Salt Waste Processing Facility begins	Evaluated in the *Savannah River Site Salt Processing Alternatives Final Supplemental Environmental Impact Statement* (DOE/EIS-0082-S2)	X
2007	Operation of Tritium Extraction Facility begins	Evaluated in the *Final Environmental Impact Statement: Construction and Operation of a Tritium Extraction Facility at the Savannah River Site* (DOE/EIS-0271)	X
	Construction of Mixed Oxide Fuel Fabrication Facility (MFFF) begins	See 2019	
2009	Construction of Plant Vogtle Units 3 and 4 begins	Construction is ongoing.	X
2012	Operation of Ameresco 20-megawatt-capacity, biomass-fueled, steam cogeneration plant and two smaller biomass-fueled plants begins	These efficient new cogeneration plants replaced old inefficient coal- and oil-fired plants, resulting in lower emissions and environmental impacts.	
2016	DOE decides to dilute 6 metric tons of surplus non-pit plutonium at SRS and dispose at WIPP	Some plutonium has been processed in K-Area; facility processing throughput is currently being increased.	X
2019	NRC terminates Construction Authorization for MFFF	Termination of construction would result in decreased resource use, employment, and emissions and, therefore, decreased environmental impacts.	

Year	***Activity***	***Discussion***	***Additional Impacts***
2020	Pit Production Facility	Evaluated in *Final Environmental Impact Statement for Plutonium Pit Production at the Savannah River Site in South Carolina* (DOE/EIS-0541)	X

Sources: AMERESCO 2017; DOE 1999; DOE 2001; DOE 2020b; NRC 2019; Southern Company 2020; SRNS undated; SRS 2020a.

As described in Sections 2 and 3 of this SA, implementing the Proposed Action would entail activities at H-Canyon that are the same as or comparable to existing or historic operations, and are bounded by activities evaluated in the SRS SNF EIS. Therefore, the Proposed Action is not expected to result in substantial increases to the range of cumulative impacts described in the SRS SNF EIS*,* and as updated in the Pit Production EIS.

5.0 Conclusion

DOE proposes to use conventional processing without uranium recovery to disposition 29.2 MTHM of ASNF and NASNF at H-Canyon. DOE would implement the proposed action evaluated in this SA by transferring the SNF from storage at L-Basin to H-Canyon where the SNF would be dissolved using three dissolvers. Rather than recovering the uranium, the dissolved SNF would be sent to storage tanks and then most as sludge batches to DWPF. The HLW glass-filled, stainless-steel canisters from DWPF would be stored in S-Area until sent to a repository for disposal.

Because the Proposed Action would be similar to conventional processing evaluated in the SRS SNF EIS (DOE 2000), the potential environmental consequences of the Proposed Action would be similar to those evaluated in the SRS SNF EIS. This SA updates the principal potential environmental impacts that could result from the Proposed Action. These impacts were determined to be small, and would not result in releases to the environment, or radiation doses or risks to members of the public or workers that would be significantly larger than those evaluated in the SRS SNF EIS.

6.0 Determination

In accordance with the NEPA and Council on Environmental Quality's (40 CFR 1502.9(c)) and DOE's (10 CFR 1021.314) implementing NEPA regulations, DOE prepared this SA to evaluate whether the proposed change and new information requires supplementing the existing SRS SNF EIS (DOE 2000) or preparing a new EIS. DOE concludes that the proposed change and new information is not a substantial change relative to the proposal analyzed in the SRS SNF EIS. Therefore, no further NEPA analysis is required. DOE will amend the ROD for the SRS SNF EIS to reflect the decision with respect to management of SNF at SRS.

______________________________   04/08/2022

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7.0 References

60 FR 28680, June 1, 1995, U.S. Department of Energy, Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs, Record of Decision.

61 FR 25092, May 17, 1996, U.S. Department of Energy, Record of Decision for the Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel.

65 FR 48224, August 7, 2000, U.S. Department of Energy, Record of Decision for the Savannah River Site Spent Nuclear Fuel Management Final Environmental Impact Statement, Aiken, SC.

78 FR 20625, April 5, 2013, U.S. Department of Energy, Amended Record of Decision for Spent Nuclear Fuel Management at the Savannah River Site.

86 FR 13359, March 8, 2021, U.S. Department of Energy, Amended Record of Decision for the Disposition of Fast Critical Assembly Plutonium.

AMERESCO, 2017, *Case Study Department of Energy – Savannah River Site, SC*, factsheet (available at ameresco.com).

DOE (U.S. Department of Energy), 1982, *Final Environmental Impact Statement, Defense Waste Processing Facility, Savannah River Plant, Aiken, SC,* Assistant Secretary for Defense Programs, Office of Defense Waste and Byproducts Management, February.

DOE (U.S. Department of Energy), 1995a, *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement*, DOE/EIS-0203, Office of Environmental Management, Idaho Operations Office, April.

DOE (U.S. Department of Energy), 1995b, *Final Environmental Impact Statement for Interim Management of Nuclear Materials at the Savannah River Site, Aiken, SC,* DOE/EIS-0220, Savannah River Site, Aiken, South Carolina, October.

DOE (U.S. Department of Energy), 1996, *Final Environmental Impact Statement on a Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel*, DOE/EIS-0218, Assistant Secretary for Environmental Management, Washington, DC, February.

DOE (U.S. Department of Energy), 1999, *Final Environmental Impact Statement: Construction and Operation of a Tritium Extraction Facility at the Savannah River Site*, DOE/EIS-0271, Savannah River Operations Office, Aiken, South Carolina, March.

DOE (U.S. Department of Energy), 2000, *Savannah River Site, Spent Nuclear Fuel Management Final Environmental Impact Statement*, DOE/EIS-0279, Savannah River Operations Office, Aiken, South Carolina, March.

DOE (U.S. Department of Energy), 2001, *Savannah River Site Salt Processing Alternatives Final Supplemental Environmental Impact Statement,* DOE/EIS-0082-S2, Savannah River Operations Office, Aiken, South Carolina, June.

DOE (U.S. Department of Energy), 2003, *Estimating Radiation Risk from Total Effective Dose Equivalent (TEDE), ISCORS Technical Report No. 1,* DOE/EH-412/0015/0802, Rev. 1, Office of Environmental Policy and Guidance, Washington, DC, January

DOE (U.S. Department of Energy) 2004a, *Final Environmental Impact Statement for Construction and Operation of Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site*, DOE/EIS-0359, Office of Environmental Management, June.

DOE (U.S. Department of Energy) 2004b, *Final Environmental Impact Statement for Construction and Operation of Depleted Uranium Hexafluoride Conversion Facility at the Portsmouth, Ohio, Site*, DOE/EIS-0360, Office of Environmental Management, June.

DOE (U.S. Department of Energy), 2008, *Yucca Mountain Repository License Applicatio*n, DOE/RW-0573, Rev. 0, Office of Civilian Radioactive Waste Management, Las Vegas, Nevada, June.

DOE (U.S. Department of Energy), 2013, *Supplement Analysis Savannah River Site Spent Nuclear Fuel Management*, DOE/EIS-0279-SA-01 and DOE/EIS-0218-SA-06, Savannah River Operations Office, March.

DOE (U.S. Department of Energy), 2015, *Surplus Plutonium Disposition Supplemental Environmental Impact Statement*, DOE/EIS-0283-S2, Savannah River Operations Office, Aiken, South Carolina, April.

DOE (U.S. Department of Energy), 2019a, *Future of H-Canyon Operations and Management Options for Spent Nuclear Fuel and Nuclear Material at the Savannah River Site, Analysis of Alternatives*, Office of Environmental Management, Integrated Project Team Final Report, August.

DOE (U.S. Department of Energy), 2019c, *Electrolytic Dissolution of Fast Critical Assembly Material*, Categorical Exclusion Determination Form, OBU-H-2019-0006, Rev. 0, January 14.

DOE (U.S. Department of Energy), 2020a, *Final Supplemental Environmental Impact Statement for Disposition of Depleted Uranium Oxide Conversion Product Generated from DOE's Inventory of Depleted Uranium Hexafluoride*, DOE/EIS–0359–S1 and DOE/EIS–0360–S1, Office of Environmental Management Washington, DC, April.

DOE (U.S. Department of Energy), 2020b, *Final Environmental Impact Statement for Plutonium Pit Production at the Savannah River Site in South Carolina*, DOE/EIS-0541, National Nuclear Security Administration, Savannah River Site, September.

DOE (U.S. Department of Energy), 2021, *Supplement Analysis Disposition of Fast Critical Assembly Plutonium*, DOE/EIS-0283-S2-SA-02, January 2021.

Maxted, M., 2020, Savannah River Operations Office, Personal communication (email) to J. DiMarzio, Leidos, Re: Bounding DUO Amounts from PPPO, July 16.

NRC (U.S. Nuclear Regulatory Commission), 2019, *Mixed Oxide Fuel Fabrication Facility Licensing (*accessed May 22, 2020, at https://www.nrc.gov/materials/fuel-cycle-fac/mox/licensing.html), May 2.

Southern Company, 2020, *Plant Vogtle 3 and 4* (accessed May 22, 2020, at https://www.southerncompany.com/innovation/nuclear-energy/plant-vogtle-3-and-4.html).

SRNL (Savannah River National Laboratory), 2011, *Demonstration of Long-Term Storage Capability for Spent Nuclear Fuel in L Basin*, SRNL-STI-2011-00190, April.

SRNL (Savannah River National Laboratory), 2020, Memorandum from F. Johnson to M. Maxted and P. Suggs, *Supporting Information to Increase the Fissile Mass Loading in the DWPF Glass Waste Form Above 897 g/m^3*, SRNL-L3300-2020-00017, Rev. 0, April 21.

SRNS (Savannah River Nuclear Solutions), 2014, *Savannah River Site, H-Canyon & Outside Facilities, H-Area, Documented Safety Analysis*, S-DSA-H-0001, Rev. 9., Aiken, South Carolina, May.

SRNS (Savannah River Nuclear Solutions), 2018, *Environmental Management Operations System Plan, Volume 1 – Spent Nuclear Fuel, Enriched Uranium, Heavy Water & Supporting Facilities*, SRNS-RP-2018-00384, Rev. 0, Savannah River Site, Aiken, South Carolina, March 26.

SRNS (Savannah River Nuclear Solutions), 2020, *Accelerated Basin De-inventory (ABD) Program Plan*, SRNS-RP-2019-00651, Rev. 1, August.

SRNS (Savannah River Nuclear Solutions), undated, *Facts from the Savannah River Site, Plutonium Down-blend Process at SRS* (accessed May 22, 2020, at https://www.srs.gov/general/news/factsheets/ srs_plutonium_blend_down.pdf.

SRR (Savannah River Remediation), 2021, *Liquid Waste System Plan*, Revision 22, SRR-LWP-2009-00001, Savannah River Site, Aiken, South Carolina, September 21.

SRR (Savannah River Remediation), 2020, *Savannah River Remediation LLC (SRR) Response to Direction to Evaluate Increasing the Fissile Loading in the Defense Waste Processing Facility (DWPF) Glass Canisters*, letter G. D. Westbury to C. Smith, February 13.

SRS (Savannah River Site), 2020a, *H-Canyon Potential Changes under ABD*, Aiken, SC, from Waste Management Symposia, Phoenix, Arizona, March 8-12.

SRS (Savannah River Site), 2020b, *SRS History Highlights*, (accessed May 22, 2020, at https://www.srs.gov/general/about/history1.htm), February 2.

Watson, H., 2020, Savannah River Nuclear Solutions, Personal communication (email) to M. Maxted, Savannah River Operations Office, Re: *NEPA Data Call*, Aiken, South Carolina, June 11.

Yazzie, S., (Savannah River Nuclear Solutions), 2020, *Accelerated Basin De-inventory (ABD)*, email to Katie Davis (Savannah River Nuclear Solutions), Aiken, SC, August 18.