DOE/EIS-0541

Final Environmental Impact Statement for Plutonium Pit Production at the Savannah River Site in South Carolina

September 2020

U.S. Department of Energy
National Nuclear Security Administration
Savannah River Site

Volume 1

CONVERSION CHART

To Convert Into Metric			To Convert Into English		
If You Know	**Multiple By**	**To Get**	**If you Know**	**Multiple By**	**To Get**
Length					
Inch	2.54	Centimeter	Centimeter	0.3937	Inch
Foot	30.48	Centimeter	Centimeter	0.0328	Foot
Foot	0.3048	Meter	Meter	3.281	Foot
Yard	0.9144	Meter	Meter	1.0936	Yard
Mile	1.60934	Kilometer	Kilometer	0.62414	Mile
Area					
Square inch	6.4516	Square centimeter	Square centimeter	0.155	Square inch
Square foot	0.092903	Square meter	Square meter	10.7639	Square foot
Square yard	0.8361	Square meter	Square meter	1.196	Square yard
Acre	0.40469	Hectare	Hectare	2.471	Acre
Square mile	2.58999	Square kilometer	Square kilometer	0.3861	Square mile
Volume					
Fluid ounce	29.574	Milliliter	Milliliter	0.0338	Fluid ounce
Gallon	3.7854	Liter	Liter	0.26417	Gallon
Cubic foot	0.028317	Cubic meter	Cubic meter	35.315	Cubic foot
Cubic yard	0.76455	Cubic meter	Cubic meter	1.308	Cubic yard
Weight					
Ounce	28.3495	Gram	Gram	0.03527	Ounce
Pound	0.45360	Kilogram	Kilogram	2.2046	Pound
Short ton	0.90718	Metric ton	Metric ton	1.1023	Short ton
Force					
Dyne	0.00001	Newton	Newton	0.00001	Dyne
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5th then add 32	Fahrenheit

METRIC PREFIXES

Prefix	Symbol	Multiplication factor
exa-	E	1,000,000,000,000,000,000 = 10^{18}
peta-	P	1,000,000,000,000,000 = 10^{15}
tera-	T	1,000,000,000,000 = 10^{12}
giga-	G	1,000,000,000 = 10^{9}
mega-	M	1,000,000 = 10^{6}
kilo-	k	1,000 = 10^{3}
deca-	D	10 = 10^{1}
deci-	d	0.1 = 10^{-1}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	µ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}

COVER SHEET

Responsible Federal Agency: U.S. Department of Energy (DOE) / National Nuclear Security Administration (NNSA)

Title: Final Environmental Impact Statement for Plutonium Pit Production at the Savannah River Site in South Carolina (SRS Pit Production EIS) (DOE/EIS-0541)

Location: Savannah River Site, South Carolina

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Abstract: NNSA, a semi-autonomous agency within DOE, is responsible for meeting the national security requirements established by the President and Congress to maintain and enhance the safety, reliability, and performance of the U.S. nuclear weapons stockpile. NNSA prepared this SRS Pit Production EIS to evaluate the potential environmental impacts of repurposing the Mixed-Oxide Fuel Fabrication Facility (MFFF) to produce a minimum of 50 war reserve pits per year at SRS and to develop the ability to implement a short-term surge capacity to enable NNSA to meet the requirements of producing pits at a rate of not less than 80 war reserve pits per year beginning during 2030 for the nuclear weapons stockpile.

Repurposing the MFFF would require internal modifications and installation of manufacturing and support equipment directly associated with the pit production mission. In addition to internal modifications of the MFFF, additional requirements for establishing pit production at SRS include: (1) removal of some existing facilities; (2) construction of new facilities and modification of some existing support facilities; and (3) construction of a Perimeter Intrusion Detection and Assessment System. Together, these changes would comprise the new Savannah River Plutonium Processing Facility (SRPPF) complex. Under the No-Action Alternative, NNSA would not proceed with the SRPPF, which might limit the ability to maintain, long-term, the nuclear deterrent that is a cornerstone of U.S. national security policy.

Preferred Alternative: For this SRS Pit Production EIS, NNSA's preferred alternative is the Proposed Action of repurposing the MFFF into the SRPPF, based on national policy and considerations of environmental, economic, technical, and other factors.

Public Comments: In preparing this Final SRS Pit Production EIS, NNSA considered comments received during the scoping period (June 10, 2019 through July 25, 2019), during the public comment period on the Draft SRS Pit Production EIS (April 3, 2020 through June 2, 2020), and late comments received after the close of the public comment period. In light of the Coronavirus Disease 2019 (COVID-19) national emergency and guidance from the Centers for Disease Control and Prevention on public gatherings, NNSA held an internet-based (with telephone access) virtual public hearing in place of an in-person hearing. The virtual public hearing was held on April 30, 2020.

This Final SRS Pit Production EIS contains revisions and new information based in part on comments received on the Draft SRS Pit Production EIS. Volume 3 contains summaries of the comments received, images of the comment documents, and NNSA's responses to the comments. NNSA will use the analysis presented in this SRS Pit Production EIS, as well as other information, in preparing a Record of Decision regarding the pit production at SRS.

CONTENTS

VOLUME 1—CHAPTERS

Chapter 1—Introduction

Chapter 2 —Proposed Action and Alternatives

Chapter 3—Affected Environment

Chapter 4—Environmental Impacts

Chapter 5—Cumulative Impacts

Chapter 6—Index

Chapter 7—References

Chapter 8—List of Preparers

Chapter 9—Glossary

LIST OF FIGURES

LIST OF TABLES

VOLUME 2—APPENDICES

VOLUME 3—COMMENT RESPONSE DOCUMENT

ABBREVIATIONS AND ACRONYMS

°F	Fahrenheit
ALARA	as low as reasonably achievable
Ameresco	Ameresco Federal Solutions, Inc.
AOA	analysis of alternatives
ARP	Actinide Removal Process
ATSDR	Agency for Toxic Substances and Disease Registry
Augusta-Aiken AQCR	Augusta, Georgia, Aiken, South Carolina, Interstate Air Quality Control Region
BCF	Biomass Cogeneration Facility
BMP	best management practice
CD	critical decision
CEQ	Council on Environmental Quality
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFR	*Code of Federal Regulations*
Complex Transformation SPEIS	*Final Complex Transformation Supplemental Programmatic Environmental Impact Statement*
CRD	Comment Response Document
CSWTF	Central Sanitary Wastewater Treatment Facility
D&D	decontamination and decommissioning
DHS	U.S. Department of Homeland Security
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DWPF	Defense Waste Processing Facility
E. Coli	*Escherichia Coli*
ECF	entry control facility
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERPG	Emergency Response Planning Guide
ETF	Effluent Treatment Facility
FEMA	Federal Emergency Management Agency
FFA	Federal Facility Agreement
FY	fiscal year
g	the acceleration due to gravity
HC	hazard category
HEU	highly enriched uranium
HEPA	high-efficiency particulate air (filter)
HLW	high-level radioactive waste
HUC	hydrographic unit code
I	Interstate
LANL	Los Alamos National Laboratory
LCF	latent cancer fatality
LLW	low-level radioactive waste
LOS	level of service
MCU	Modular Caustic Side Solvent Extraction Unit

MEI	maximally exposed individual
MFFF	Mixed-Oxide Fuel Fabrication Facility
MLLW	mixed low-level radioactive waste
NAAQS	National Ambient Air Quality Standards
NAGPRA	*Native American Graves Protection and Repatriation Act of 1990*
National Register	*National Register of Historic Places*
NEPA	*National Environmental Policy Act*
NESHAP	National Emission Standards for Hazardous Air Pollutants
NHPA	*National Historic Preservation Act*
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPR	Nuclear Posture Review
NPT	Nuclear Non-Proliferation Treaty
NRC	U.S. Nuclear Regulatory Commission
NRF	National Response Framework
NRIA	nuclear/radiological incident annex
NWPA	*Nuclear Waste Policy Act*, as amended
NWSM	Nuclear Weapons Stockpile Memorandum
NWSP	Nuclear Weapons Stockpile Plan
OSHA	Occupational Safety and Health Administration
pCi/ml	picocuries per milliliter
Pantex	Pantex Plant
PCBs	polychlorinated biphenyl
PEIS	programmatic environmental impact statement
PGA	peak ground acceleration
PIDAS	Perimeter Intrusion Detection and Assessment System
PMOA	programmatic memorandum of agreement
PM_n	particulate matter less than or equal to *n* microns in aerodynamic diameter
PSD	Prevention of Significant Deterioration
RCRA	*Resource Conservation and Recovery Act of 1976*
RIMS II	Regional Input-Output Modeling System
ROD	Record of Decision
ROI	region of influence
SA	supplement analysis
SCDHEC	South Carolina Department of Health and Environmental Control
SCSHPO	State Historic Preservation Office of the South Carolina Department of Archives and History
SDU	saltstone disposal units
SNF	spent nuclear fuel
SPCC	spill prevention, control, and countermeasure
SPD SEIS	*Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement*
SPEIS	supplemental programmatic environmental impact statement

SPF	Saltstone Production Facility
SRARP	Savannah River Archaeological Research Program
SREL	Savannah River Ecology Laboratory
SRPPF	Savannah River Plutonium Processing Facility
SRS	Savannah River Site
SSM	Stockpile Stewardship and Management
SWEIS	sitewide environmental impact statement
SWPF	Salt Waste Processing Facility
SWPPP	stormwater pollution prevention plan
Three Rivers Landfill	Three Rivers Solid Waste Authority Regional Landfill on SRS
TMDL	total maximum daily load
TRU	transuranic (waste)
TSCA	*Toxic Substances Control Act of 1976*
USDOT	U.S. Department of Transportation
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
WIPP	Waste Isolation Pilot Plant
Y-12	Y-12 National Security Complex
yd^3	cubic yard

CHAPTER 1

Introduction

1 INTRODUCTION

The National Nuclear Security Administration (NNSA), a semi-autonomous agency within the U.S. Department of Energy (DOE), is responsible for meeting the national security requirements established by the President and Congress to maintain and enhance the safety, reliability, and performance of the U.S. nuclear weapons stockpile, including the ability to design, produce, and test (Public Law 106-65, as amended). *Plutonium pits*[1] are critical components of every nuclear weapon; nearly all current stockpile pits were produced from 1978 to 1989 (DoD 2018a, p. 62). Today, the United States' capability to produce plutonium pits is limited.

Pit

A pit is the central core of a nuclear weapon, principally containing plutonium or enriched uranium.

As explained in the *Supplement Analysis of the Complex Transformation Supplemental Programmatic Environmental Impact Statement* (2019 SPEIS SA) (NNSA 2019a, Sec. 1.0), to meet Federal law and national security requirements, NNSA is pursuing a two-prong (two-site) approach to the production of plutonium pits—produce a minimum of 50 pits per year at the Savannah River Site (SRS) near Aiken, South Carolina (Figure 1-1) and a minimum of 30 pits per year at Los Alamos National Laboratory (LANL) in New Mexico. This approach would provide an effective, responsive, and resilient nuclear weapons infrastructure with the flexibility to adapt to shifting requirements. NNSA has prepared this *Environmental Impact Statement for Plutonium Pit Production at the Savannah River Site in South Carolina* (DOE/EIS-0541) (SRS Pit Production EIS) to evaluate the potential environmental impacts of producing a minimum of 50 pits per year at SRS. Apart from this EIS, NNSA also prepared a separate analysis of increasing production activities at LANL (see Section 1.5 below).

Pit Production

Pit production is a term used to describe a complex process that involves three main areas: (1) material receipt, unpacking, and storage; (2) feed preparation; and (3) manufacturing. The production of pits includes the activities needed to fabricate new pits, to modify the internal features of existing pits, and to certify new pits or requalify existing pits. Intrusive pit modification reuse requires handling and processing of the plutonium internal to the pit. Conservatively, intrusive pit reuse is assumed to require the same basic capabilities as new pit production.

1.1 RELEVANT HISTORY—PIT PRODUCTION

From 1952 to 1989, plutonium pits for the nuclear weapons stockpile were manufactured at the Rocky Flats Plant in Golden, Colorado, at a rate of 1,000 to 2,000 pits per year. In December 1989, pit production at Rocky Flats ceased and DOE decided not to restart production at the facility. During the mid-1990s, DOE conducted a comprehensive analysis of the capability and capacity needs for the entire nuclear weapons complex (Complex) in a post-Cold War era and evaluated alternatives for maintaining the Nation's nuclear stockpile, including pit production. In 1999, DOE decided to increase pit production at LANL in a limited capacity of no more than 20 pits per year (DOE 1999c), although the actual number of pits produced has been less than 20 per year.

[1] Single words or short phrases in italics indicate definitions are provided in the document Glossary, Chapter 9.

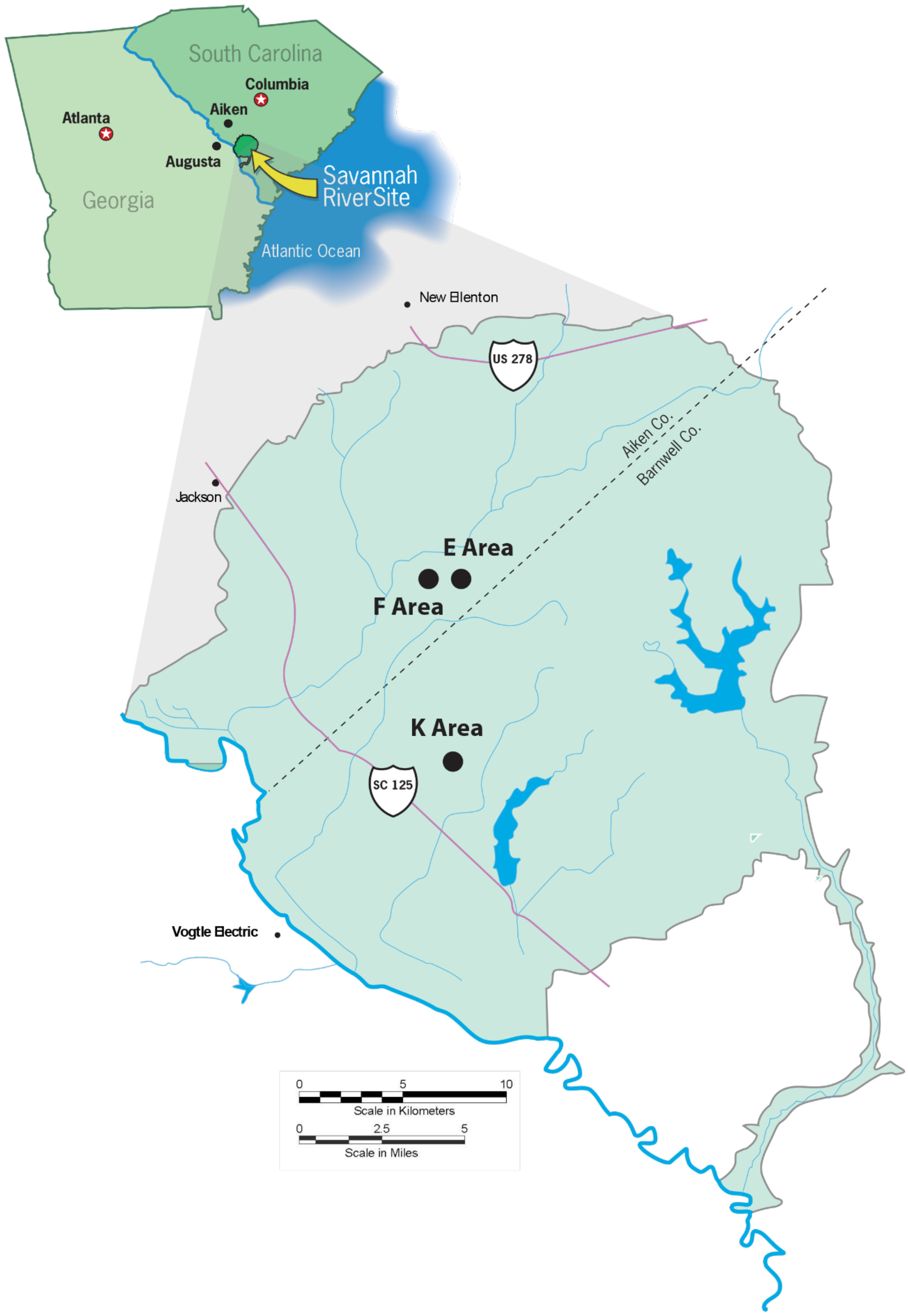


Figure 1-1—Location of Savannah River Site (Source: NNSA 2019a)

Subsequent to deciding on this level of pit production at LANL, NNSA has continued to evaluate pit production needs and alternatives. Nonetheless, the United States has emphasized the need to eventually produce 80 pits per year. The joint U.S. Department of Defense (DoD)–DOE white paper *National Security and Nuclear Weapons in the 21st Century* cataloged the need and justification for pit production rates (DoD and DOE 2008). Since 2014, Federal law has required the nuclear security enterprise to produce not less than 30 war reserve plutonium pits during 2026. Federal law now requires that the nuclear security enterprise produce not less than 80 war reserve plutonium pits during 2030 (Volume 50 of the *United States Code*, Section 2538a [50 U.S.C. § 2538a], as amended). The 2018 Nuclear Posture Review (2018 NPR) reinforces this pit production requirement by stating that NNSA must produce at least 80 plutonium pits per year beginning during 2030 and must sustain the capacity for future life extension programs[2] and follow-on programs (DoD 2018a, p. 62). As a result, the United States is pursuing an initiative to provide the enduring capability and capacity to produce plutonium pits at a rate of no fewer than 80 pits per year beginning during 2030 (DoD 2018a, pp. 62–63). To these ends, the DoD Under Secretary of Defense for Acquisition and Sustainment and the NNSA Administrator issued a Joint Statement on May 10, 2018, describing NNSA's recommended alternative to pursue a two-prong approach—a minimum of 50 pits per year produced at SRS and a minimum of 30 pits per year produced at LANL (DoD 2018b). This approach would provide an effective, responsive, and resilient nuclear weapons infrastructure with the flexibility to adapt to shifting requirements. Figure 1-2 (located in Section 1.5) provides a visual representation of the relevant pit production history and more details concerning DOE/NNSA's analyses of pit production in relevant documents prepared under the *National Environmental Policy Act of 1969* (NEPA), as amended (42 U.S.C. § 4321 et seq.).

1.2 NATIONAL SECURITY CONSIDERATIONS

Decisions concerning whether the United States should possess nuclear weapons and the type and number of those weapons are made by Congress and the President. Since 2014, Congress and the President have set explicit requirements for pit production levels. The scope of this SRS Pit Production EIS is restricted to an analysis of those limited aspects of implementing national policy where NNSA has discretion. However, to aid in public understanding, there are several principal national security policy overlays and related treaties that are potentially relevant to the Proposed Action of this SRS Pit Production EIS (see Section 1.4 of this EIS), such as the NPR, the Nuclear Weapons Stockpile Memorandum (NWSM) and the corresponding Nuclear Weapons Stockpile Plan (NWSP), the Nuclear Non-Proliferation Treaty (NPT), and the Comprehensive Test Ban Treaty. Each of these is discussed below.

1.2.1 Nuclear Posture Review

The NPR is a legislatively mandated, comprehensive review of the U.S. nuclear deterrence policy, strategy, and force posture. NPRs have been prepared in 1994, 2002, and 2010. On January 27, 2017, the President directed the DoD to conduct a new NPR to ensure a safe, secure, and effective nuclear deterrent that protects the homeland, assures allies, and, above all, deters adversaries. The

[2] Life extension programs include pit reuse activities. The Complex Transformation SPEIS (NNSA 2008a) provides the following description of pit reuse, which is taken from the SSM PEIS (DOE 1996a, p. S-20): "Intrusive pit modification reuse requires handling and processing of the plutonium internal to the pit. Non-intrusive pit modification reuse involves the external features of the pit and does not require an extensive plutonium infrastructure; the risk of contamination and generation of radioactive waste is very low for non-intrusive modification activities."

President also emphasized both the long-term goal of eliminating nuclear weapons and the requirement that the United States have modern, flexible, and resilient nuclear capabilities that are safe and secure until such a time as nuclear weapons can prudently be eliminated from the world. With respect to the Proposed Action in this SRS Pit Production EIS (see Section 1.4), the 2018 NPR states that the United States will pursue initiatives to ensure the necessary capability, capacity, and responsiveness of the nuclear weapons infrastructure and the needed skills of the workforce, including providing the enduring capability and capacity to produce plutonium pits at a rate of no fewer than 80 pits per year beginning during 2030 (DoD 2018a, pp. 62–63).

1.2.2 Nuclear Weapons Stockpile Memorandum and Nuclear Weapons Stockpile Plan

The size and composition of the U.S. nuclear weapons stockpile is determined annually by the President. The secretaries of Defense and Energy jointly prepare the NWSM, which includes the NWSP as well as a long-range planning assessment. DoD prepares the NWSP based on military requirements and coordinates the development of the plan with NNSA concerning its ability to support this plan. The President approves the NWSM and NWSP, and the President and the Congress approve funding for the NNSA to carry out the requirements of the NWSP and NWSM.

Although the NWSM and NWSP are classified documents, their effect in shaping the proposed action in this SRS Pit Production EIS can be explained in an unclassified context. The NWSM specifies the number and types of weapons required to support the stockpile. The NWSP covers the current year and a five-year planning period. It specifies the types and quantities of weapons required and sets limits on the size and nature of stockpile changes that can be made without additional approval of the President. As such, the NWSM and NWSP are the basis for all NNSA stockpile support planning, and pit production requirements are derived from the NWSM and NWSP.

1.2.3 Nuclear Non-Proliferation Treaty

The NPT was ratified by the Senate in 1969 and officially entered into force as a Treaty of the United States in 1970. Today, the United States continues to view the NPT as the cornerstone of the nuclear nonproliferation regime (DoD 2018a, p. 70). Article VI of the NPT obligates the parties "to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament, and on a treaty on general and complete disarmament under strict and effective international control." The United States takes this obligation seriously and the President has emphasized both the long-term goal of eliminating nuclear weapons and the requirement that the United States have modern, flexible, and resilient nuclear capabilities that are safe and secure until such a time as nuclear weapons can prudently be eliminated from the world (DoD 2018a, p. V). It must be noted that the NPT does not provide any specific date for achieving the ultimate goal of nuclear disarmament nor does it preclude the maintenance of nuclear weapons until their disposition. For this SRS Pit Production EIS, speculation on the terms and conditions of a "zero level" U.S. stockpile goes beyond the bounds of the reasonably foreseeable future consistent with the 2018 NPR. The Proposed Action in this EIS, which would enable NNSA to maintain the safety, reliability, and performance of the U.S. nuclear weapons stockpile until the ultimate goals of the NPT are attained, is consistent with the NPT.

1.2.4 Comprehensive Test Ban Treaty

The United States signed the Comprehensive Test Ban Treaty, which bans all nuclear explosions for civilian or military purposes, on September 24, 1996, but the Senate has never ratified it. Nonetheless, the United States has been observing a moratorium on nuclear testing since 1992, and the NPR strategy discussed in Section 1.2.1 above reflects this policy. The stated policy of the United States is to not resume nuclear explosive testing unless necessary to ensure the safety and effectiveness of the U.S. nuclear arsenal (NNSA 2018a, p. 72). The Proposed Action in this EIS would be consistent with a continuing U.S. moratorium or a Comprehensive Test Ban Treaty.

1.3 PURPOSE AND NEED FOR THE PROPOSED ACTION

Under Federal law and to meet national security requirements, NNSA must implement a strategy to provide the enduring capability and capacity to produce not less than 80 war reserve pits per year beginning during 2030 (50 U.S.C. § 2538a). NNSA's current pit production capacity cannot meet this requirement; NNSA needs to establish additional pit production capability and capacity to (1) mitigate against the risk of plutonium aging (see Section 1.3.1); (2) produce pits with enhanced safety features to meet NNSA and DoD requirements (see Section 1.3.2), (3) respond to changes in deterrent requirements driven by growing threats from peer competitors (see Section 1.3.3); and (4) improve the resiliency, flexibility, and redundancy of the nuclear security enterprise (see Section 1.3.4).

> **Pit Production Using Existing Pits as Feedstock**
>
> From 1944 to 1992, DOE produced plutonium in government-owned nuclear reactors and extracted the plutonium from *spent nuclear fuel* to produce plutonium pits. NNSA can store up to 20,000 pits at Pantex. Because those pits would provide the feedstock for pit production activities at LANL and SRS, there is no need for NNSA to produce any new plutonium; rather, NNSA is remanufacturing existing, but aged, pits into new pits using the process shown in Chapter 2, Figure 2-3, of this SRS Pit Production EIS.

1.3.1 Pit Aging and Pit Lifetime

Modern nuclear weapons have a primary, or trigger, that contains a central core, called the "pit." Over time as materials age, their fundamental properties change; these age-related changes affect a nuclear weapon's plutonium pit. The reliability of a nuclear weapon is directly dependent on the plutonium. Although U.S. nuclear weapons are presently safe and reliable, they are undoubtedly aging; most of the pits in the enduring stockpile were produced in the mid to late 1970s and 1980s.

Considerable research has been dedicated to understanding how long plutonium pits will remain effective. Results thus far show that uncertainty in the performance of older plutonium increases over time, resulting in decreasing confidence. At some age, the properties will change sufficiently to warrant replacement. NNSA continues to research the life expectancy of plutonium pits. This is scientifically challenging and will require many years to fully understand. Implementing a moderate pit manufacturing capability now is a prudent approach to provide *mitigation* against age-related risk.

As recently as April 6, 2020, NNSA provided Congress with the findings, observations, and recommendations of the JASON Defense Advisory Group Phase One report, *Pit Aging* (JASON

2019). In that report, JASON urged "that pit manufacturing be re-established as expeditiously as possible in parallel with the focused program to understand Pu [Plutonium] aging, to mitigate potential risks posed by Pu aging on the stockpile. The reuse of aged pits in rebuilt primaries can address certain issues but cannot change the aged pits themselves. A significant period of time will be required to recreate the facilities and expertise needed to manufacture Pu pits. Given the number and age distribution of weapons in the stockpile, it will then include some eighty-year-old pits, even under most favorable circumstances" (JASON 2019).

Based on the current information, there is no conclusive evidence to rule out concerns of pit aging. Delaying pit production and discovering that pit aging is a concern would leave the Nation in a very difficult position with respect to the effectiveness of the deterrent and would jeopardize the ability to meet capacity requirements in a timely manner. For the foreseeable future, NNSA will rely on a combination of newly manufactured pits and judicious reuse of existing pits to modernize the U.S. nuclear stockpile. This judicious reuse is an element of pit production analyzed in this SRS Pit Production EIS. This approach enables NNSA to implement a moderately sized pit manufacturing capability of not less than 80 pits per year beginning during 2030. This capability allows for:

- Enhanced warhead safety and security to meet DoD and NNSA requirements;
- Deliberate, methodical replacement of older existing plutonium pits with newly manufactured pits as risk mitigation against plutonium aging; and
- Response to changes in deterrent requirements driven by renewed great power competition.

1.3.2 Enhanced Safety Features

The Stockpile Stewardship Program enables NNSA to address aging and performance issues, enhance safety features, improve security, and meet today's military and national security requirements (DoD 2018a). Each different weapon type in the U.S. nuclear stockpile requires routine maintenance, periodic repair, replacement of limited life components, and surveillance (i.e., a thorough examination of a weapon) to ensure continued safety, security, and effectiveness. The pit capacity requirements analyzed in the 2019 SPEIS SA and this EIS account for producing pits with enhanced safety features to meet NNSA and DoD requirements. In some instances, these enhanced safety features could be incorporated into a pit through modifications associated with pit reuse.

1.3.3 Deterrent Requirements by Growing Threats

Nuclear weapons have played, and will continue to play, a critical role in deterring nuclear attack and in preventing large-scale conventional warfare between nuclear-armed states for the foreseeable future. U.S. nuclear weapons not only defend our allies against conventional and nuclear threats, they also help them avoid the need to develop their own nuclear arsenals. This, in turn, furthers global security (DoD 2018a, p. III). While the United States has continued to reduce the number and salience of nuclear weapons, others, including Russia and China, have moved in the opposite direction. They have added new types of nuclear capabilities to their arsenals, increased the salience of nuclear forces in their strategies and plans, and engaged in increasingly aggressive behavior, including in outer and cyber space. North Korea continues its illicit pursuit of nuclear weapons and missile capabilities in direct violation of United Nations Security Council resolutions (DoD 2018a, p. V).

An effective, responsive, and resilient nuclear weapons infrastructure is essential to the U.S. capacity to adapt flexibly to shifting requirements. Such an infrastructure offers tangible evidence to both allies and potential adversaries of U.S. nuclear weapons capabilities and thus contributes to deterrence, assurance, and hedging against adverse developments. It also discourages adversary interest in arms competition. Providing the enduring capability and capacity to produce plutonium pits at a rate of not less than 80 pits per year beginning during 2030 is an integral part of this strategy (Public Law 116-92, Section 3116(a); DoD 2018a, p. XIV).

1.3.4 Dual Pit Production Sites

Using two pit production sites would improve the resiliency, flexibility, and redundancy of the nuclear security enterprise by not relying on a single production site and is considered the best way to manage the cost, schedule, and risk of such a vital undertaking (DoD 2018b). According to NNSA testimony, "Even though this approach will require NNSA to fund activities at two sites, any interruption or delay to pit production in the future due to the lack of resiliency will have huge cost increases across the entire Nuclear Security Enterprise" (DOE 2019i). A two-site pit production strategy, in which each site would have the capability to produce 80 pits per year, would enable NNSA to meet national security requirements if one facility became unavailable.

1.4 PROPOSED ACTION, EIS SCOPE, AND ALTERNATIVES

NNSA's Proposed Action (described in detail in Chapter 2 of this SRS Pit Production EIS) is to repurpose the Mixed-Oxide Fuel Fabrication Facility (MFFF) to produce a minimum of 50 war reserve pits per year at SRS and to develop the ability to implement a short-term surge capacity to enable NNSA to meet the requirements of producing pits at a rate of not less than 80 war reserve pits per year beginning during 2030 for the nuclear weapons stockpile. Production of pits includes the activities needed to fabricate new pits, modify the internal features of existing pits, and certify new pits or requalify existing pits. The Proposed Action also includes activities across the Complex associated with transportation, waste management, and ancillary support (e.g., staging and testing) for the pit production mission at SRS.

In this SRS Pit Production EIS, NNSA evaluates the potential environmental impacts of producing 50, 80, and 125 pits per year at SRS. This approach provides a conservative analysis and affords NNSA the flexibility to adapt to shifting requirements or changed circumstances in the future if SRS must produce more than 50 pits per year. For example, if pit production at LANL were paused for some reason, overall pit production requirements could be satisfied at SRS. This EIS also includes an analysis of producing 125 pits per year at SRS. That analysis affords NNSA greater flexibility if requirements were to change in the future. The higher value of 125 pits per year was chosen to be consistent with the value used in the previous analysis contained in the *Final Complex Transformation Supplemental Programmatic Environmental Impact Statement* (Complex Transformation SPEIS) (NNSA 2008a).

This SRS Pit Production EIS also includes an analysis of the No-Action Alternative, in which NNSA would not repurpose the MFFF or produce any pits at SRS. Under the No-Action Alternative, the existing MFFF would remain unused and NNSA would utilize the capabilities at LANL to meet the Nation's long-term needs for pit manufacturing. DOE has re-evaluated the impacts of the pit production capacity at LANL in the Complex Transformation SPEIS and 2019 SPEIS SA (NNSA 2008a, 2019a) and the LANL SWEIS and 2020 Final LANL SA (NNSA 2008c, 2020a).

1.5 NEPA History and Relevant Documents

NEPA ensures that environmental information is available to public officials and citizens before decisions are made and actions are taken. This SRS Pit Production EIS has been prepared in accordance with Section 102(2)(C) of NEPA, regulations promulgated by the *Council on Environmental Quality* (CEQ) (Title 40 of the *Code of Federal Regulations* [40 CFR] Parts 1500–1508), and DOE's NEPA implementing procedures (10 CFR Part 1021).

1.5.1 NEPA History—Pit Production

Following the cessation of pit production at Rocky Flats, DOE/NNSA has evaluated alternatives for pit production in several NEPA documents. During the mid-1990s, DOE prepared the *Stockpile Stewardship and Management Programmatic Environmental Impact Statement* (SSM PEIS) (DOE 1996a), which evaluated alternatives for maintaining the safety and reliability of the nuclear weapons stockpile and preserving competencies in nuclear weapons in the post-Cold War era. The SSM PEIS evaluated reasonable alternatives for reestablishing interim pit production capability on a small scale. It analyzed a production level of 80 pits per year at SRS and LANL at a programmatic level and associated impacts across the Complex. As a result of the SSM PEIS, DOE decided to reestablish a pit fabrication capability at LANL on a small scale.

In 1999, DOE prepared the *Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory, Los Alamos, New Mexico* (1999 LANL SWEIS) (DOE 1999a), which considered the environmental impacts of ongoing and proposed activities at LANL. With respect to pit production, the 1999 LANL SWEIS analyzed a production level of 80 pits per year. The *Record of Decision* (ROD) for the 1999 LANL SWEIS limited pit production to a capacity that could be accommodated within the limited space set aside for that activity in the plutonium facility (estimated at nominally 20 pits per year) (64 FR 50797) (DOE 1999c).

In 2008, NNSA prepared the Final Complex Transformation SPEIS (NNSA 2008a), which is a supplement to the SSM PEIS. This SPEIS evaluated, among other things, constructing a new pit production facility ("Greenfield") to produce 125 to 200 pits per year at one of five site alternatives: LANL; SRS; the Pantex Plant (Pantex) near Amarillo, Texas; the Y-12 National Security Complex (Y-12) in Oak Ridge, Tennessee; and the Nevada National Security Site (NNSS) northwest of Las Vegas, Nevada. At SRS, the SPEIS also evaluated a pit production facility that would use the MFFF and Pit Disassembly and Conversion Facility infrastructure (NNSA 2008a,

p. 5-236). In the SPEIS ROD, NNSA did not make any new decisions related to pit production capacity beyond 20 pits per year at LANL (DOE 2008a).[3]

In 2008, NNSA also prepared the *Site-Wide Environmental Impact Statement for Continued Operation of the Los Alamos National Laboratory, Los Alamos, New Mexico* (2008 LANL SWEIS) (NNSA 2008c), which evaluated alternatives for the continued operation of the Laboratory. The 2008 LANL SWEIS Expanded Operations Alternative analyzed production of 80 pits per year. In the ROD, NNSA did not change pit production at LANL, which was set at 20 pits per year in the ROD for the 1999 LANL SWEIS.

In 2019, NNSA prepared the 2019 SPEIS SA (NNSA 2019a), which analyzed NNSA's pit production approach at a programmatic level. Based on the 2019 SPEIS SA, NNSA determined that the proposed approach for pit production does not constitute a substantial change from actions analyzed previously and there are no significant new circumstances or information relevant to environmental concerns. As identified in that SA, NNSA committed to preparing two site-specific documents: (1) this site-specific SRS Pit Production EIS for the proposal to repurpose the MFFF at SRS to produce a minimum of 50 pits per year and to develop the ability to implement a short-term surge capacity to meet the requirements of producing pits at a rate of no fewer than 80 pits per year beginning during 2030; and (2) a site-specific SA for the proposal to produce a minimum of 30 pits per year at LANL and to develop the ability to implement a short-term surge capacity to meet mission needs, if necessary. The site-specific SA at LANL, *Draft Supplement Analysis of the 2008 Site-Wide Environmental Impact Statement for the Continued Operation of Los Alamos National Laboratory* (DOE/EIS-0380-SA-06) (2020 Draft LANL SA) (NNSA 2020) was issued for public comment in March 2020. In August 2020, NNSA issued the 2020 Final LANL SA (NNSA 2020a), in which NNSA determined that no additional NEPA documentation was required to implement the proposal to produce a minimum of 30 pits per year at LANL and to develop the ability to implement a short-term surge capacity to meet mission needs, if necessary. On September 2, 2020, NNSA published an Amended ROD for the 2008 LANL SWEIS to announce the decision to implement this proposal (85 FR 54544). Also on September 2, 2020, NNSA published the Amended ROD for the Complex Transformation SPEIS to announce its programmatic decision to implement elements of a Modified Distributed Centers of Excellence Alternative, whereby LANL will produce a minimum of 30 war reserve pits per year for the national pit production mission during 2026 and implement surge efforts to exceed 30 pits per year as needed (85 FR 54550).

[3] To date, NNSA has issued two RODs for the Complex Transformation SPEIS, both published December 19, 2008: (1) Record of Decision for the Complex Transformation Supplemental Programmatic Environmental Impact Statement—Operations Involving Plutonium, Uranium, and the Assembly and Disassembly of Nuclear Weapons (Programmatic Alternatives ROD) (DOE 2008a); and (2) Record of Decision for the Complex Transformation Supplemental Programmatic Environmental Impact Statement—Tritium Research and Development, Flight Test Operations, and Major Environmental Test Facilities (Project-Specific Alternatives ROD) (DOE 2008b). When this EIS references the "SPEIS ROD," it is referencing the Programmatic Alternatives ROD. On September 2, 2020, NNSA issued an Amended ROD for the Complex Transformation SPEIS to announce its programmatic decision to implement elements of a Modified Distributed Centers of Excellence Alternative, whereby LANL will produce a minimum of 30 war reserve pits per year for the national pit production mission during 2026 and implement surge efforts to exceed 30 pits per year as needed (85 FR 54550).

This SRS Pit Production EIS tiers from the Complex Transformation SPEIS. Figure 1-2 provides a visual representation of the relevant pit production history and more details concerning DOE/NNSA's analyses of pit production in relevant NEPA documents.

For preparation of this SRS Pit Production EIS, NNSA incorporates by reference and tiers from previous NEPA documents to succinctly present the analysis. Information from these documents provides a context for understanding the current status of NEPA compliance, which forms the foundation for preparing this EIS. The following documents, presented in order of highest relevance within each of five sub-categories (e.g., programmatic NEPA documents, site-wide NEPA documents, *Waste Isolation Pilot Plant* (WIPP)-related NEPA documents, site-specific plutonium-related NEPA documents, and other relevant documents) are key references relevant to this EIS proposed action.

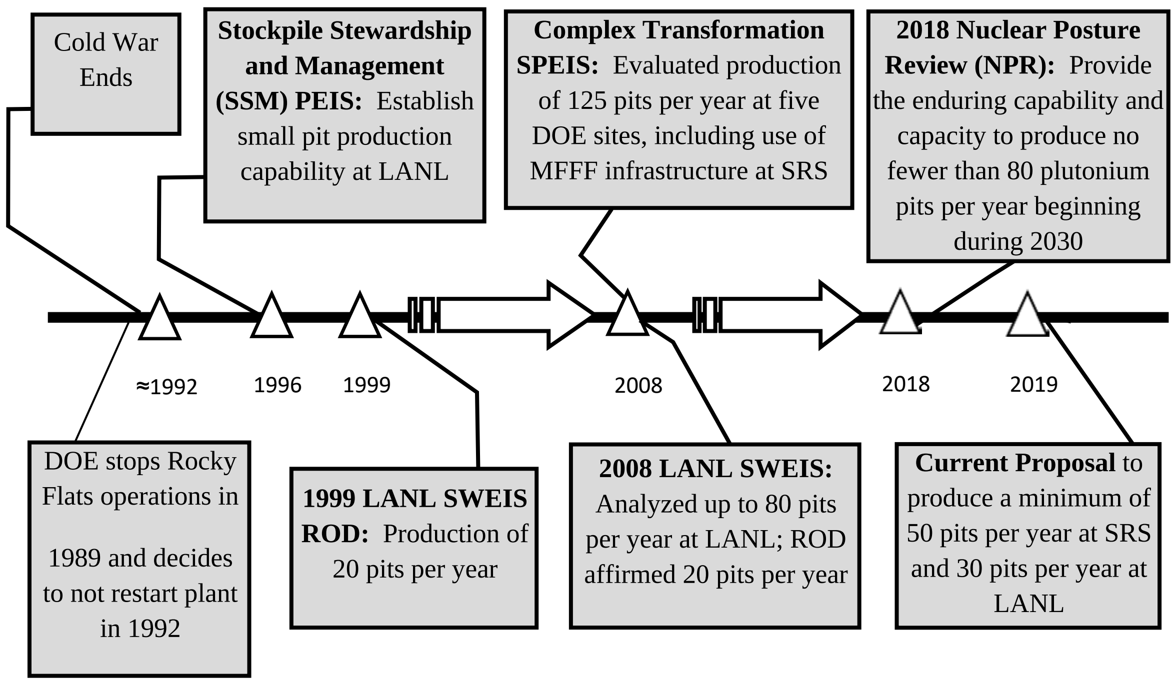


Figure 1-2—Relevant Historical Events and NEPA Documents Associated with Pit Production

1.5.2 Programmatic NEPA and Other Relevant Documents

SSM PEIS (DOE 1996a): See Section 1.5.1.

Complex Transformation SPEIS (NNSA 2008a): See Section 1.5.1.

2019 SPEIS SA (NNSA 2019a): See Section 1.5.1.

Surplus Plutonium Disposition Final Environmental Impact Statement (DOE 1999b) analyzed the environmental impacts of alternatives for disposition of 50 metric tons of surplus plutonium using both immobilization and mixed-oxide fuel technologies. This EIS addressed the potential impacts of constructing, operating, and decommissioning the MFFF. In the ROD (DOE

2000a), DOE announced its decision to construct and operate three new facilities at SRS, including the MFFF, which NNSA is now proposing to repurpose for pit production.

Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement (SPD SEIS) (NNSA 2015) analyzed the environmental impacts of alternatives for the disposition of 13.1 metric tons of surplus plutonium for which a disposition path is not assigned, including 7.1 metric tons of surplus pit plutonium and 6 metric tons of surplus *non-pit plutonium*. In the ROD (DOE 2016a), DOE announced its decision to prepare and package the 6 metric tons of surplus non-pit plutonium using facilities at SRS to meet the WIPP waste acceptance criteria and ship the surplus non-pit plutonium *transuranic* (TRU) *waste* to the WIPP facility for disposal (the WIPP Disposal Alternative). NNSA prepared the *Supplement Analysis for Disposition of Additional Non-Pit Surplus Plutonium* (NNSA 2020c) to consider whether the proposal to prepare and dispose of 7.1 metric tons of additional non-pit plutonium (rather than the pit plutonium described in the 2015 SPD SEIS) using the WIPP Disposal Alternative represented significant new circumstances or information relevant to environmental concerns. NNSA concluded that the 2015 SPD SEIS addressed the impacts of the proposed preparation of an additional 7.1 metric tons of non-pit plutonium for disposal at the WIPP facility, and that no additional NEPA review was required. On August 28, 2020, NNSA published an Amended ROD to announce its decision to dispose of an additional 7.1 metric tons of non-pit plutonium using the WIPP Disposal Alternative (85 FR 53350).

Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste (DOE/EIS-0200; DOE 1997a). In the 1990s, DOE anticipated a need for managing wastes at locations other than where the waste was generated. In order to address this need, DOE conducted analyses for management of radioactive and hazardous wastes, including *low-level radioactive waste* (LLW). The Waste Management PEIS included a detailed analysis of the potential impacts of transporting *radioactive wastes* across the nation's highways and rail lines.

1.5.3 Site-Wide NEPA and Other Relevant Documents

1999 LANL SWEIS (DOE 1999a): See Section 1.5.1.

2008 LANL SWEIS (NNSA 2008c): See Section 1.5.1.

The **2018 SA of the 2008 LANL SWEIS** (NNSA 2018e) evaluated projects and impacts of activities conducted since publication of the LANL SWEIS and projects being proposed from 2018 through 2022. NNSA determined that ongoing operations, new and modified projects, and modifications in site operations at LANL do not constitute a substantial change in the actions previously analyzed in the 2008 LANL SWEIS.

The **2020 Final LANL SA of the 2008 LANL SWEIS** (NNSA 2020a) evaluates NNSA's proposed action to implement elements of the 2008 LANL SWEIS Expanded Operations Alternative as needed to produce a minimum of 30 war reserve pits per year beginning during 2026 for the national pit production mission and to implement surge efforts to exceed 30 pits per year to meet NPR and national policy. The 2020 Final LANL SA was issued in August 2020.

Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components (Pantex SWEIS) analyzed the potential environmental impacts of ongoing and future operations and activities at Pantex. In the ROD (DOE 1997b), DOE decided to (1) continue assembly and disassembly of nuclear weapons; (2) implement facility projects, including upgrades and construction consistent with conducting these operations; and (3) continue providing interim pit staging and increasing the storage capacity to 20,000 pits. Pantex would support the pit production mission by storing pits and providing feedstock to SRS for use in pit production.

Four Supplement Analyses for the Pantex SWEIS (NNSA 2003a, 2008b, 2012a, 2018c) evaluated changes since the issuance of the Pantex SWEIS to determine if the EIS should be supplemented or if a new Pantex EIS was needed. These analyses indicated that the identified and projected resource area impacts, including *cumulative impacts*, were not substantially changed from those identified in the Pantex SWEIS, nor did they represent significant, new circumstances or information relative to environmental concerns.

Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada (NNSA 2013) discussed ongoing and reasonably foreseeable future operations and activities for support of the NNSA mission. The NNSS SWEIS included an analysis of the transportation and disposal of LLW from various NNSA sites, including SRS, to NNSS. The ROD (NNSA 2014) documented DOE's decision to enable LLW from SRS to be disposed of at NNSS.

Final Site-Wide Environmental Impact Statement for the Y-12 National Security Complex (Y-12 SWEIS) (NNSA 2011a) analyzed the potential environmental impacts of ongoing and future operations and activities at Y-12. In the ROD (NNSA 2011b), NNSA decided to construct and operate a capability-sized Uranium Processing Facility at Y-12 next to the Highly Enriched Uranium Materials Facility. Y-12 supports the pit production mission by providing any required uranium to the pit production facility.

Two Supplement Analyses for the Y-12 SWEIS[4] (NNSA 2016, 2018d) evaluated changes since the issuance of the Y-12 SWEIS to determine if the SWEIS should be supplemented or if a new Y-12 SWEIS was needed. These analyses indicated that the identified and projected environmental impacts, including cumulative impacts, were not substantially changed from those identified in the Y-12 SWEIS, nor did they represent significant, new circumstances or information relative to environmental concerns.

[4] The Y-12 2016 SA, associated 2016 Amended ROD, and 2018 SA have been subject to litigation in a case filed in United States District Court for the Eastern District of Tennessee. In September 2019, the Court issued a Memorandum Opinion and Order that rejected plaintiffs' arguments that NNSA is required to conduct a new EIS in light of changed circumstances related to plans for Y-12's uranium facility. However, the Court declared the Amended ROD and SAs "in violation of NEPA," remanding to NNSA and directing it to conduct, at a minimum, a supplement analysis using "an unbounded accident analysis of earthquake consequences at the Y-12 site, performed using updated seismic hazard analyses that incorporate the 2014 USGS seismic hazard map." NNSA's evaluations of the Court's decision and Y-12 seismic issues are ongoing. On October 4, 2019, NNSA issued an Amended ROD in which it decided to separate the single-structure Uranium Processing Facility design concept into a new design consisting of multiple buildings, each constructed to safety and security requirements appropriate to the building's function. This revised approach combined elements of the two alternatives previously analyzed in the Final Y-12 SWEIS (84 FR 53133). In June 2020, NNSA completed the Y-12 earthquake accident supplement analysis directed by the Court (NNSA 2020b).

1.5.4 WIPP-Related NEPA and Other Relevant Documents

Waste Isolation Pilot Plant (WIPP) Final Environmental Impact Statement (1980 WIPP EIS) (DOE 1980) analyzed the environmental impacts of initial construction and operation of the WIPP facility. The ROD (DOE 1981) documented DOE's decision to proceed with the phased construction and operation of the WIPP facility. The WIPP facility receives defense-related TRU waste for permanent disposal.

Final Supplement Environmental Impact Statement for the Waste Isolation Pilot Plant (WIPP SEIS-I) (DOE 1990a) evaluated the environmental impacts associated with new information and changes since the issuance of the 1980 WIPP EIS and 1981 ROD. WIPP SEIS-I included an analysis of changes in the TRU waste inventory, consideration of the hazardous chemical constituents in the TRU waste, modification and refinement of the system for the transportation of TRU waste to the WIPP facility, modification of the Test Phase, and changes in the understanding of the hydrogeological characteristics of the WIPP site. The ROD for WIPP SEIS-I (DOE 1990b) documented DOE's decision to continue the phased development of the WIPP facility by instituting an experimental program to further examine WIPP's suitability as a TRU waste *repository*.

Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement (WIPP SEIS-II) (DOE 1997c) analyzed the potential environmental impacts associated with disposing of TRU waste at the WIPP facility and polychlorinated biphenyl (PCB)-commingled TRU waste in the DOE inventory at the time. DOE's proposed action was to open the WIPP facility and dispose of up to 175,564 cubic meters of TRU waste generated from defense activities. The ROD (DOE 1998) documented DOE's decision to authorize the disposal of up to 175,564 cubic meters of TRU waste (except PCB-commingled TRU waste) at the WIPP facility.

Supplement Analysis for the WIPP SEIS-II (DOE 2016b) evaluated the restart of operations at the WIPP facility following two accidents that occurred at the WIPP facility in February 2014. Following this SA, DOE restarted WIPP operations in January 2017.

1.5.5 Site-Specific Plutonium-Related NEPA Documents

Environmental Impact Statement on the Construction and Operation of a Proposed Mixed Oxide Fuel Fabrication Facility at the Savannah River Site, South Carolina (NRC 2005a) evaluated use of the MFFF for conversion of 34 metric tons of surplus weapons-grade plutonium into mixed-oxide fuel, operating at a maximum annual throughput of 3.5 metric tons of plutonium. The analysis included the transport of feedstock from other sites and the operation of two SRS facilities (the Pit Disassembly and Conversion Facility and the Waste Solidification Building) required to support operation of the MFFF.

1.5.6 Other Relevant Documents

Fiscal Year 2020 Stockpile Stewardship and Management Plan, a Report to Congress (NNSA 2019e) describes NNSA's plans to ensure the safety, security, and effectiveness of the U.S. nuclear weapons stockpile mission to carry out national security responsibilities by maintaining a safe, secure, and effective nuclear deterrent; preventing, countering, and responding to the threats of nuclear proliferation and terrorism worldwide; and providing naval nuclear propulsion.

Nuclear Posture Review (2018 NPR) (DoD 2018a) assessed previous nuclear policies and requirements and focused on identifying the nuclear policies, strategy, and corresponding capabilities needed to protect the Nation in the deteriorating threat environment that confronts the United States, its allies, and partners. The 2018 NPR provides guidance for the nuclear force posture and policy requirements needed now and in the future.

2018 Joint DoD/NNSA Statement on the Recapitalization of Plutonium Pit Production (DoD 2018b) announced the two-prong approach to produce a minimum of 50 pits per year at SRS and a minimum of 30 pits per year at LANL.

Final Report for the Plutonium Pit Production Analysis of Alternatives (AOA Report) (NNSA 2017) identified and assessed alternatives across DOE sites that could deliver the infrastructure to meet the sustained plutonium pit requirements of 80 pits per year beginning during 2030. To achieve the required annual pit production rate, the AOA Report considered the construction of new facilities and the refurbishment of existing facilities. The AOA Report identified LANL and SRS as the two preferred locations to accomplish this enduring mission (NNSA 2017, p. 1).

Pit Production Engineering Assessment Report (Parsons 2018) conducted an engineering assessment of a 50-pit-per-year capability in support of pre-Critical Decision-1 activities to support decision making and conceptual design of preferred alternatives for enduring pit production and related plutonium operations. The Pit Production Engineering Assessment Report determined the engineering feasibility of alternatives, developed schedule and cost estimate ranges, and assessed qualitative risks. Together, the Pit Production Engineering Assessment Report and AOA Report provided analyses related to cost, schedule, risk, and feasibility for the pit production alternatives.

John S. McCain National Defense Authorization Act for Fiscal Year 2019 (Public Law 115-232). In Section 3120 of this Authorization Act, Congress enacted as formal policy of the United States that LANL will produce a minimum of 30 pits per year for the national production mission and will implement surge efforts to exceed 30 pits per year to meet 2018 NPR and national policy.

National Defense Authorization Act for Fiscal Year 2020 (Public Law 116-92). In Section 3116 of this Authorization Act, Congress stated that (1) rebuilding a robust plutonium pit production infrastructure is critical to maintaining the viability of the nuclear weapons stockpile; (2) that effort will require cooperation from experts across the nuclear security enterprise; and (3) any further delay to achieving a plutonium sustainment capability to support the planned stockpile life extension programs will result in an unacceptable capability gap to our deterrent posture. Public Law 116-92 also amended the Atomic Energy Defense Act to require production of not less than 80 pits per year beginning during 2030.

Atomic Energy Defense Act (50 U.S.C. § 2538a). The Secretary of Energy is charged with ensuring that the nuclear security enterprise produces not less than 80 war reserve plutonium pits beginning during 2030 and submitting an annual certification to Congress and the Secretary of Defense that the programs and budget of the Secretary of Energy will enable the nuclear security enterprise to meet these requirements.

1.6 PUBLIC PARTICIPATION PROCESS

1.6.1 Public Scoping

Scoping is a process in which the public and stakeholders provide comments directly to the Federal agency on the scope of an EIS. This process begins with the publication of a *Notice of Intent* (NOI) in the *Federal Register*. On June 10, 2019, NNSA published an NOI to prepare this SRS Pit Production EIS (84 FR 26849) and announced a 45-day EIS scoping period that ended on July 25, 2019. The NOI also provided information regarding DOE's overall NEPA strategy related to fulfilling national requirements for pit production. NNSA held a public scoping meeting in North Augusta, South Carolina, on June 27, 2019, to discuss the SRS Pit Production EIS and to receive comments on the potential scope. In addition, the public was encouraged to provide comments via U.S. postal mail and email.

An independent moderator facilitated the scoping meeting to direct and clarify discussions and comments. A court reporter was also present to provide a transcript of the proceedings and record formal comments. Forty-four people spoke at the scoping meeting. NNSA received 161 unique documents with scoping comments, as well as more than 300 postcards that were part of a campaign. NNSA considered all comments received during the scoping process for the Draft EIS, including comments received after the close of the scoping period.[5]

1.6.2 Public Comment on the Draft EIS

On April 3, 2020, NNSA electronically published the Draft SRS Pit Production EIS and published a Notice of Availability (NOA) in the *Federal Register* announcing a 45-day public comment period for the Draft EIS (85 FR 18947). The comment period was scheduled to end on May 18, 2020. On April 23, 2020, NNSA notified the U.S. Environmental Protection Agency (EPA) that it was extending the comment period until June 2, 2020. On May 1, 2020, the EPA published a notice in the *Federal Register* that announced the extension to the public comment period (85 FR 25436). NNSA also notified members of the public and participants of the extension at the virtual public hearing discussed below.

In addition to publishing the NOA in the *Federal Register*, NNSA posted the Draft EIS on the NNSA NEPA Reading Room at https://www.energy.gov/nnsa/nnsa-nepa-reading-room and the DOE NEPA website at https://www.energy.gov/nepa/doeeis-0541-plutonium-pit-production-savannah-river-site-aiken-south-carolina.

In light of the Coronavirus Disease 2019 (COVID-19) national emergency and guidance from the Centers for Disease Control and Prevention on public gatherings, NNSA held an internet-based (with telephone access) virtual public hearing in place of an in-person hearing. The virtual public hearing was held on April 30, 2020. Notice of the date and time and information related to the virtual public hearing, including internet and telephone access details and instructions on how to participate, were sent via email to individuals and groups that participated in scoping for the EIS,

[5] NNSA published the Notice of Availability for the Draft 2019 SPEIS SA on June 28, 2019 (84 FR 31055) and provided a 45-day public comment period for that document, which ended on August 12, 2019. Because of the overlap in issues and the public review periods between the Draft 2019 SPEIS SA and this SRS Pit Production EIS, NNSA considered all comment documents received by August 12, 2019, as well as comment documents received after the August 12, 2019, deadline for the Draft 2019 SPEIS SA.

had indicated a preference to be notified concerning the pit production program, or were on the SRS mailing list for the *Environmental Bulletin*. The same information was posted in the local newspapers and on the NNSA NEPA Reading Room website on April 15, 2020. A 60-second radio spot also aired on local radio stations to solicit comments and notify individuals of the virtual public hearing. Copies of all public notices and the radio script are included in Appendix C of this Final EIS.

In addition to the public hearing, the public was encouraged to provide comments via U.S. postal mail or electronically via email. Comments received by mail were date stamped when received by the DOE mail distribution center. Comments received by email have the date automatically included. NNSA considered all comments received.

Approximately 400 comment documents (including approximately 190 comment documents submitted as one of seven email campaign letters) were received from individuals, interested groups, and Federal, State, and local agencies during the public comment period on the Draft EIS. In addition, 44 commenters spoke at the virtual public hearing, and their comments were recorded in formal transcripts. The majority of the comments focused on policy issues related to the appropriateness or the need for nuclear weapons or the need for additional pits. The primary topics identified in the public comments include:

- Requests for a programmatic EIS for pit production,
- Requests to consider pit reuse as a reasonable alternative,
- Requests for an extension to the comment period due to the COVID-19 pandemic,
- Disagreement with the two-prong (two-site) approach to pit production,
- General opposition to, or support for, the proposal,
- Comments about nuclear weapon policies or new weapon design,
- Comments about the need for pits and the lifetime of current pits,
- Comments about waste management,
- Comments about TRU waste storage at the WIPP facility,
- Comments about impacts to human health,
- Comments about potential environmental justice impacts, and
- Comments about budget priorities and the need to clean up SRS.

The Comment Response Document (CRD) (Volume 3 of this Final EIS) includes NNSA responses to the primary topics identified above and others raised in public comments.

1.7 PRIMARY CHANGES FROM THE DRAFT SRS EIS

NNSA revised the Draft SRS Pit Production EIS to incorporate changes after considering public comments. Additionally, NNSA updated the Final EIS to describe and analyze the evolution of details associated with the Proposed Action. All changes are indicated by vertical lines in the page margins. The primary changes to the EIS that resulted from public comments include:

- Updated information related to pit aging,
- Clarification of NNSA's expectations for pit reuse,
- Clarification on the management of potential liquid TRU waste streams,

- Clarification of the information on seismic hazards, including capable faults and the probabilistic seismic hazards analysis,
- Information related to monitoring radiological air emissions, and
- Updated accident information to address potential impacts to first responders.

Since publication of the Draft EIS, NNSA made minor changes to the overall layout of the facilities inside and adjacent to the Protected Area and has updated information related to operational parameters for the Savannah River Plutonium Processing Facility (SRPPF[6]), including:

- Increase in estimated total worker numbers for SRPPF operations,
- Reduction in the estimated annual volumes of TRU waste generated and the associated number of TRU waste shipments to the WIPP facility,
- Reduction in estimated annual volumes of solid LLW, and
- Increase in liquid LLW generation rates.

Chapter 2, Section 2.1, of the Draft EIS described the proposed SRPPF based on the best available design information that existed at the time of publication. Since publication of the Draft EIS, NNSA has continued to refine/optimize the conceptual design documentation for the SRPPF. This Final EIS identifies potential design changes that reflect that refinement. These potential design changes are identified and discussed in Section 2.1.5.2 and include an option to: (1) retain the existing administration building; (2) use a sand filter system; and (3) change gloveboxes and the aqueous recovery process. Any changes to potential environmental impacts that might result from such design changes are presented in Chapter 4 of this Final EIS.

1.8 ORGANIZATION OF THIS EIS

Volume 1 of this Final SRS Pit Production EIS contains nine chapters, which include the following information:

- **Chapter 1, Introduction—**Contains background information and reasons why NNSA needs to take action and purposes to be achieved.

- **Chapter 2, Proposed Action and Alternatives—**Describes the way NNSA proposes to meet the specified need and achieve the objectives. This chapter also describes operational variations and design optimizations that are analyzed in Chapter 4 to evaluate potential variation in how the SRPPF could be designed, constructed, or operated. Chapter 2 also includes a summary comparison of the potential environmental impacts of the EIS alternatives and identifies the preferred alternative.

- **Chapter 3, Affected Environment—**Discusses aspects of the environment that might be affected by the proposed action.

[6] Throughout this SRS Pit Production EIS, the repurposed MFFF is referred to as the SRPPF to reflect the reconfiguration of the existing MFFF to perform plutonium-related processing to support NNSA missions.

- **Chapter 4, Environmental Impacts**—Presents analyses of the potential impacts on the environment that could result from the Proposed Action. Impacts are compared to the projected environmental conditions that would be expected if no action were taken.
- **Chapter 5, Cumulative Impacts—**Provides analyses of the potential cumulative impacts on the environment from the proposed action and other past, present, and reasonably foreseeable actions.
- **Chapters 6–9—**Comprise an index, list of references cited, list of preparers, and a glossary of terms.

Volume 2 of this Final EIS contains four appendices that support the environmental analyses presented in the main body of the EIS: (1) information on the methodologies used in this EIS (Appendix A); (2) details related to the analyses for human health and accidents (Appendix B); (3) public notices (Appendix C); and (4) contractor disclosure statements (Appendix D).

Volume 3 of this Final EIS contains the CRD.

CHAPTER 2

Proposed Action and Alternatives

2 PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action and the reasonable alternatives considered in this EIS. The Proposed Action is described in Section 2.1 and the No-Action Alternative is described in Section 2.2. Section 2.1 also includes a description of the pit production process. Alternatives considered and subsequently eliminated from detailed evaluation are discussed in Section 2.3. The chapter also identifies NNSA's preferred alternative (Section 2.4) and discusses the planning assumptions and basis for the EIS analyses (Section 2.5). The chapter concludes with a summary comparison of the environmental impacts associated with the alternatives (Section 2.6).

2.1 PROPOSED ACTION—REPURPOSE THE MFFF INTO THE SAVANNAH RIVER PLUTONIUM PROCESSING FACILITY

The Draft EIS described the proposed SRPPF based on the best available design information that existed at the time of publication. Since publication of the Draft EIS, NNSA has continued to prepare conceptual design documentation for the SRPPF in accordance with the DOE Order 413.3B, "Program and Project Management for the Acquisition of Capital Assets." A primary objective of the conceptual design process is to optimize facility design to maximize operational performance and minimize costs and environmental impacts. Such optimization has the potential to change the SRPPF layout, construction approach, and operations compared to the information that was presented in Sections 2.1.1, 2.1.2, and 2.1.3 of the Draft EIS. This Final EIS identifies design changes currently being considered by NNSA in the CD-1 process. These potential design changes are identified and discussed in Section 2.1.5.2. In addition, any effects on potential environmental impacts that might result from such optimization options are presented in Chapter 4. The CD-1 documentation is scheduled to be finalized by the end of calendar year 2020, with NNSA evaluation and approval to follow.

NEPA and the Design Process

The design process for a major facility such as the SRPPF is carried out in accordance with DOE Order 413.3B. Within DOE, projects typically progress through five critical decisions (CDs), which serve as major milestones. Following approval of the first milestone, CD-0 (Mission Need), conceptual design activities and NEPA evaluations begin. CD-1 approval marks the completion of the project definition and the conceptual design. Following CD-1, a project enters the execution phase, which includes preliminary design. The NEPA evaluation is generally completed between CD-0 and CD-2 and must be completed before CD-3 (Approve Start of Construction/Execution). After completion of CD-4, the project is ready to start operations. Conducting NEPA review early in the CD process provides environmental input into the design.

The potential changes in design and layout of the SRPPF complex do not change the Proposed Action, which is to repurpose the MFFF to produce a minimum of 50 war reserve pits per year at SRS and to develop the ability to implement a short-term surge capacity to enable NNSA to meet the requirements of producing pits at a rate of not less than 80 war reserve pits per year beginning during 2030 for the nuclear weapons stockpile. Additionally, as shown in Chapter 4, the potential environmental impacts associated with these changes would not be notably different from those presented for the Proposed Action.

2.1.1 Construction of the Savannah River Plutonium Processing Facility

In order to produce a minimum of 50 pits per year at SRS and to develop the ability to implement a short-term surge capacity to enable NNSA to meet the requirements of producing pits at a rate of not less than 80 pits per year beginning during 2030 for the nuclear weapons stockpile, NNSA proposes to repurpose the existing MFFF and the administrative and support facilities. The MFFF is in F Area (see Figure 1-1). DOE began construction of the MFFF in August 2007 and construction ceased on October 10, 2018, when DOE terminated the contract for the facility. The MFFF (labeled "226-F" on Figure 2-1) was designed to safety and *security* standards (including seismic performance category 3+ to meet U.S. Nuclear Regulatory Commission [NRC] requirements), with walls of reinforced concrete (NNSA 2017, p. A-29). NNSA would verify that the facility meets all relevant requirements for the pit production mission. The exterior walls and roofs were designed and constructed to resist all credible manmade and natural phenomena hazards. Standing approximately 73 feet tall above grade, the MFFF contains three floors and more than 400,000 square feet of available Hazard Category (HC)-2 space,[7] which would be more than sufficient to meet the pit production requirements (NNSA 2017, pp. 79–80). Interior walls of the MFFF are reinforced concrete to provide personnel shielding and durability in the 50-year facility design life. The MFFF also was designed to have safe havens (e.g., safety areas for personnel in the event of an accident) constructed in accordance with applicable safety requirements.[8]

Repurposing the MFFF would require internal modifications and installation of manufacturing and support equipment directly associated with the pit production mission. Internal modifications to the MFFF required for pit production could include:

- Removing equipment and utility commodities intended for fuel fabrication that had been previously installed in the existing MFFF building; making facility modifications to support the new mission processes; and installation of pit production and process support equipment and utilities;
- Modifying existing support facilities as required to provide the personnel support functions for the pit production mission;
- Installing an analytical chemistry and materials characterization laboratory in the SRPPF; and
- Installing fire water supply equipment and the backup diesel generators in or adjacent to the SRPPF.

In addition to internal modifications of the MFFF, as discussed below, additional requirements for establishing pit production at SRS include: (1) removal of some existing facilities; (2) construction of new facilities and modification of some existing support facilities; and (3) construction of a

[7] Under 10 CFR Part 830, DOE assigns hazard categories to nuclear and radiological facilities in accordance with the potential consequences of a radiological accident. Facilities with at least 2,610 grams of plutonium-239 are assigned HC-2 (NNSA 2014, Attachment 2, Table 1).
[8] The SRPPF design refers to these safe havens as areas of refuge.

Perimeter Intrusion Detection and Assessment System (PIDAS). This EIS refers to the SRPPF and its support facilities as the SRPPF complex.

Removal of Existing Facilities. Figure 2-1 shows the existing facilities in F Area and Figure 2-2 depicts the layout of the proposed SRPPF complex, showing the major buildings and their relationships to each other. A comparison of those two figures demonstrates that the following existing facilities would be removed/relocated:

- The existing administration building, located north of the MFFF (labeled "706-5F" on Figure 2-1), could be demolished to accommodate the PIDAS.[9]
- The Construction Administration Complex (labeled "706-2F" on Figure 2-1) would be demolished and provide a possible location for a cafeteria.
- The Mixed-Oxide Administration Complex (labeled "706-1F" and "706-8F" on Figure 2-1) would be demolished and provide a possible location for the new administration building.
- The current maintenance facility (labeled "706-7F" on Figure 2-1) would be used during initial construction then demolished and a new maintenance facility would be constructed inside the PIDAS.
- Temporary trailers and support buildings east of the MFFF would be removed to provide a possible location for ancillary support facilities.

Construction of New Facilities and Modification of Existing Support Facilities. Figure 2-2 shows that the following facilities would be constructed or modified to support SRPPF operations:

- A new administration building (labeled "706-5F" on Figure 2-2) would be constructed south of the existing MFFF. The new administration building would be the same size and design of the existing administration building (approximately 56,100 square feet). Parking would be provided adjacent to the administration building. (Note: The conceptual design also includes a cafeteria that would be located on the site of the demolished 706-2F. However, as explained in Section 2.5, although the ultimate layout of SRPPF complex may change compared to the notional layout presented in Figure 2-2, NNSA would not expect any notable changes in key construction and operational parameters from layout changes. This conclusion is largely because any SRPPF construction activities are expected to occur on previously disturbed land.)
- The replacement maintenance facility (designated "Replacement 706-7F" on Figure 2-2) would be constructed within the PIDAS.
- A vehicle inspection facility would be constructed outside of the PIDAS. The protective force would inspect the vehicles and occupants prior to the vehicles being allowed into the

[9] This EIS also analyzes an option in which the existing administration building could be retained (see Section 2.1.5.2.1).

Protected Area. After the inspection, the vehicles would proceed through an entry control facility (ECF) for vehicles.

- Environmental storage facilities would be constructed for managing wastes. Two of the environmental storage facilities would be within the PIDAS and would support TRU waste operations. The storage facilities would be capable of staging approximately 2,500 to 3,000, 55-gallon drums of TRU waste within the PIDAS. Existing Building 731-2F is planned to house the TRU waste WIPP characterization process and also be used for packaged waste storage.
- The existing Training Building (labeled “706-4F” on Figure 2-1), which currently houses offices, training rooms, and computer support, would be repurposed as a security force support facility. The facility would include lockers, an arms room, and offices.
- The existing Training and Operations Center (Building 226-2F) would be modified to provide office space and include equipment that would support pit production training using surrogate materials that mimic the characteristics of plutonium operations. No radioactive material would be used in the Training and Operations Center.
- Existing facilities 221-21F, 221-22F, and 221-12F are metal buildings on concrete slabs that are currently used for storage. They would be repurposed to provide storage for the SRPPF complex.
- The annexes on the north and south faces of the SRPPF would be constructed exterior to the existing MFFF and would provide protection for electrical and ventilation equipment servicing the building.
- Ancillary support facilities would be constructed near or inside the PIDAS, depending on the final layout of the SRPPF complex. Examples of these support facilities include:
  - Chiller building and cooling tower to support the SRPPF heating, ventilation, and air conditioning systems (which would have a combined footprint of approximately 26,000 square feet),
  - Nitrogen generators to support the SRPPF glovebox inerting system (which would have a footprint of about 3,100 square feet),
  - A 300,000-gallon fire water storage tank and pumphouse, which would support the fire protection system, and
  - An unloading and storage pad for receipt and storage of bottled gasses required for SRPPF operations (about 12,000 square feet).

Any additional new facilities for the SRPPF complex would be constructed on land previously disturbed by the construction of the MFFF, MFFF support facilities, or earlier SRS operations. All construction would comply with State and Federal permitting requirements (see Section 4.18 of this EIS).

Figure 2-1—Existing F Area Facilities (Source: SRNS 2020)

Figure 2-2—Notional Layout of the SRPPF Complex (Source: SRNS 2020a)

Construction of a PIDAS. NNSA did not construct a PIDAS for the MFFF (NNSA 2017, p. A-29). To provide security for the SRPPF, NNSA would construct a PIDAS around the facility to enclose all operations involving Security Category I quantities of *special nuclear material*. The area inside the PIDAS would be referred to as the Protected Area. The PIDAS would be a multiple-sensor system within a 30-foot-wide zone enclosed by two parallel fences that would surround the entire Protected Area. In addition, there would be clear zones on either side of the PIDAS. Without encompassing the administration building, the PIDAS would be approximately 4,700 linear feet in length, and the enclosed area (i.e., Protected Area) would be approximately 25 acres. A buffer area beyond the external clear zone would provide an unobstructed view of the area surrounding the PIDAS. As shown on Figure 2-2, there would be at least one vehicle ECF through the PIDAS and a pedestrian ECF (labeled “Vehicle ECF” and “Ped ECF,” respectively). These would be the locations through which personnel and vehicles could gain access to the SRPPF through the PIDAS. An emergency ECF for vehicles could also be installed through the PIDAS. Table 2-1 lists the construction parameters for the SRPPF complex, including the associated waste values.

Table 2-1—Key Construction Parameters for the SRPPF Complex

Parameter	50, 80, or 125 Pits Per Year[a]
Resources	
Additional land disturbance on previously disturbed land (acres)	48
Additional land disturbance on previously undisturbed Land (acres)	0
Construction duration (years)	6
Peak electricity (megawatts-electric/year)	2–3
Diesel fuel (gallons/year)	700,000
Peak water use (gallons/year)	16,600,000
Peak construction workforce (persons)	1,800[b]
Wastes	
Nonhazardous solid waste (cubic yards/year)	1,700
Hazardous waste (cubic yards/year)	6
LLW	0
MLLW	0
TRU waste	0

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; TRU = transuranic.
a. Construction parameters for the SRPPF would be essentially the same regardless of production capacity.
b. Peak construction activities would occur during 2023 and 2024.
Source: SRNS 2020

2.1.2 Pit Production Process

The following discussion is a summary of the pit production process that would be performed in the SRPPF. A simplified illustration of the pit production process for the SRPPF is depicted in Figure 2-3. As shown on that figure, and described below, pit production would involve three major processes: (1) material receipt and storage; (2) feed preparation and purification; and (3) manufacturing. Pit reuse involves a subset of these processes, but does not include plutonium purification, furnace, or casting steps.

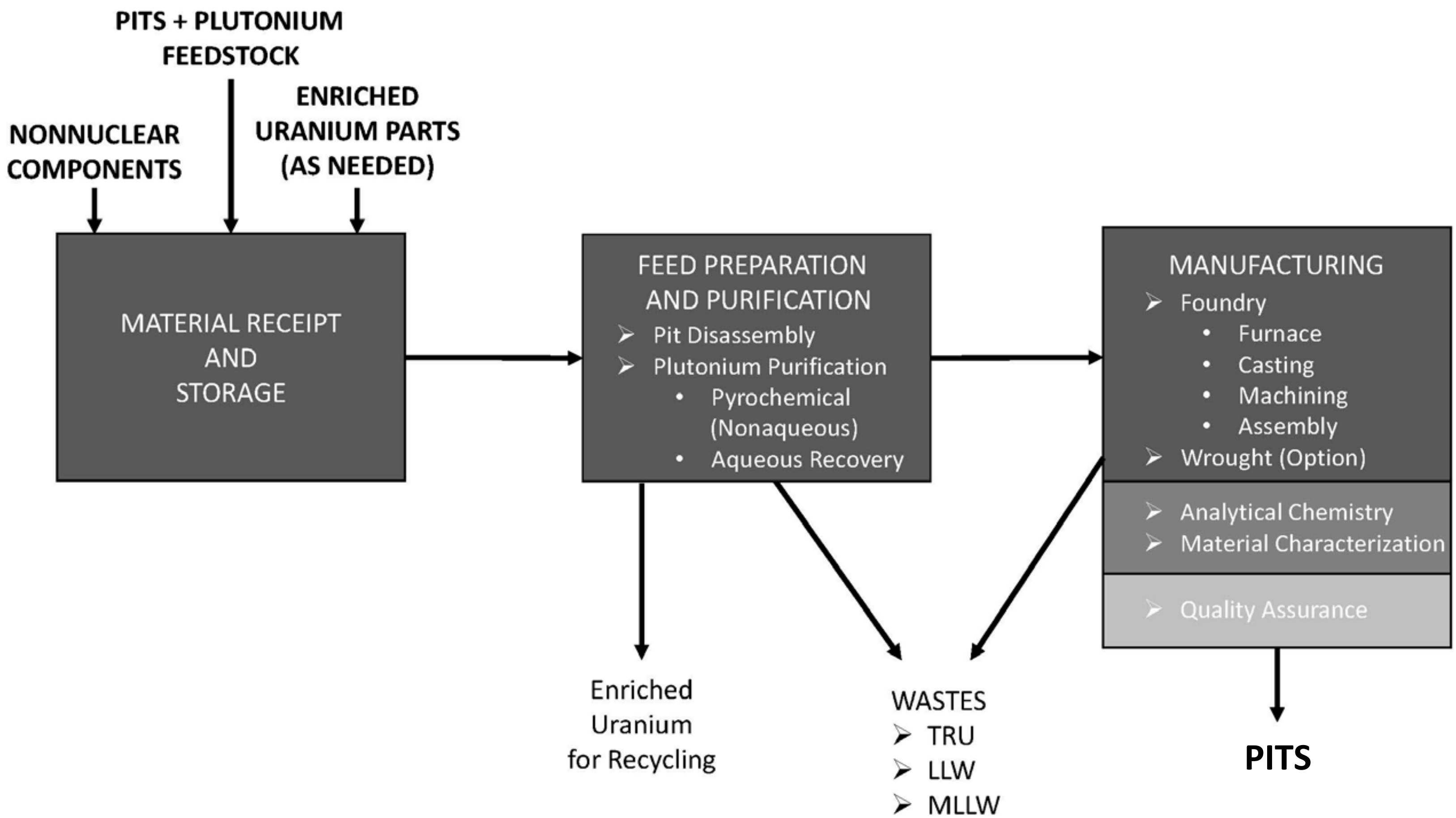


Figure 2-3—Simplified SRPPF Operating Process (Source: SRNS 2020)

2.1.2.1 Material Receipt and Storage

Existing plutonium feedstock would be delivered from Pantex near Amarillo, Texas, in DOE/U.S. Department of Transportation (USDOT)-approved shipping containers via NNSA's safe, secure transport system. The bulk of the feedstock material would be in the form of pits from retired weapons, although some plutonium from other locations, such as LANL, Pantex, and SRS, could also be used. The shipping containers would be unloaded from the truck within the SRPPF and the shipping packages unpacked. Each shipment would be measured to confirm the plutonium content, entered into the facility's material control and accountability database, and placed into temporary storage in vaults or safes until transferred to the Feed Preparation Area.

2.1.2.2 Feed Preparation and Purification

Pits and/or plutonium would be transferred through a secure transfer corridor to an adjacent Feed Preparation Area to process the existing plutonium metal to meet metal specifications of new pits. Activities involving pits would be conducted in *gloveboxes* that would be interconnected by a contained conveyor system to move materials from one process step to the next. Gloveboxes would remain completely sealed and operate independently, except during material transfer operations. Built-in safety features would limit the temperature and pressure inside the gloveboxes and ensure that operations are conducted safely. An inert atmosphere would be maintained in gloveboxes. The exhaust from the gloveboxes would be monitored continuously for radioactive contamination. The atmosphere in the gloveboxes would be kept at a lower pressure than that of the surrounding areas so that any leaks of gaseous or suspended particulate matter would be contained and filtered appropriately. The building ventilation system would include *high-efficiency particulate air* (HEPA) filters and would be designed to maintain confinement, thus precluding the spread of airborne radioactive particulates or *hazardous chemicals* within the facility or to the outside environment. Both intake and exhaust air would be filtered, and exhaust gases would be monitored for radioactivity. Section 2.1.5.2.2 describes the option to include a sand filter for exhausts to the environment.

Plutonium recovery would be accomplished using mechanical disassembly. For pits whose components would not separate easily, thermal or chemical means could also be used. As necessary, enriched uranium parts would be disassembled from the pit assemblies, converted to *oxide*, and shipped to another NNSA site (currently Y-12) for recycling. All other disassembled components that could not be reused would be decontaminated to the maximum extent possible and then disposed of as either LLW or TRU waste, as appropriate (NNSA 2019c).

Beryllium may be a component in both pit disassembly and assembly operations. Because inhalation of beryllium dust and particles can cause adverse health effects, beryllium is of special interest. The disassembly operations are expected to generate only larger, non-respirable turnings and pieces of metal, and all work would be performed in gloveboxes. No operations are expected to cause beryllium to become airborne. The beryllium in solid form would be disposed of as LLW or TRU waste and is included in the waste estimates presented in this EIS.

In general, the pit-derived plutonium would not be suitable for new manufacturing—it would contain plutonium radioactive decay products (uranium, americium-241, and neptunium-237) and other undesirable characteristics. Therefore, the plutonium would be purified using pyrochemical (nonaqueous) recovery techniques, which would generate plutonium-bearing residues that must be recovered using aqueous techniques or disposed of as TRU waste. The proposed purification techniques are well known and have been successfully used at DOE sites for many years (NNSA 2019c).

Nonaqueous plutonium metal purification operations could include a combination of three primary processes: (1) direct oxide reduction, which uses calcium metal to reduce plutonium oxide to plutonium metal; (2) molten salt extraction, which uses chloride salts to remove americium-241 from the plutonium; and (3) electrorefining, which uses sodium, potassium, and calcium chloride salts to remove other key impurities from the plutonium metal (NNSA 2019c). In aqueous recovery, plutonium-bearing residues would be recovered using techniques in which nitric acid and hydrochloric acid are used to chemically dissolve feed material.[10] Use of the aqueous process to recover plutonium would reduce the overall quantities of TRU wastes needing disposal at the WIPP facility (NNSA 2019c). Pit production could continue without aqueous recovery; however, TRU waste generation would increase.

Solid waste would be generated throughout the feed preparation and purification process and would consist of TRU waste, LLW, and uncontaminated waste (e.g., waste that can be assayed and certified for disposal as commercial waste). Liquids would be neutralized and solidified for disposal as LLW or TRU waste depending on their radiological characteristics (NNSA 2019c).

2.1.2.3 Manufacturing

The plutonium metal resulting from the purification process would be transferred to the manufacturing area, where it would be melted and cast in a foundry operation.[11] Some plutonium metal from other sources may be used to supplement the plutonium recovered from the purification operations, including from internal process metal recycle (NNSA 2019c). These castings would then be machined to proper dimensions, combined with other non-plutonium parts, which could include beryllium and enriched uranium components, and would be assembled into pits.

Analytical chemistry capabilities would be installed in the SRPPF. Plutonium-bearing samples from all aspects of the pit production process would be tested to ensure they are within specified limits. Analytical chemistry requires rigorous quality controls, including National Institute of Standards and Technology traceability for key analytes. Materials characterization operations analyze plutonium metal and pit-derived samples for physical properties, validate results from key manufacturing steps, and support process troubleshooting. A materials characterization laboratory would perform analyses to ensure that commercial materials used in process operations meet specifications, and do not adversely affect product performance or quality.

Throughout the manufacturing operations, certification and inspection would be conducted to ensure that components meet specifications. New pits would be inspected and prepared for storage and eventual shipment.

[10] Section 2.1.5.2.3 identifies the option in which hydrochloric acid would not be used in aqueous recovery.
[11] Casting is the baseline process proposed for the SRPPF, and the environmental impacts presented in this EIS are based on that process. However, plutonium pits could also be formed by a wrought process (see Section 2.1.5.1.2).

2.1.3 SRPPF Operations

The SRPPF would be operated as described in Section 2.1.2 above. The SRPPF would include plutonium processing and manufacturing support areas; analytical chemistry and materials characterization support; waste handling; control rooms; support facilities for operations personnel; utilities such as heating, ventilation, and air conditioning systems; HEPA filters; breathing/plant/instrument air compressor rooms; electrical rooms and backup diesel generators; process support equipment rooms; and miscellaneous support space. Normal electrical power would be supplied to the SRPPF by two independent, offsite power supplies. An uninterruptible power supply and backup diesel generators would provide power for critical systems. This arrangement would ensure continued operation of critical systems during any interruption of offsite power.

Table 2-2 presents the key operational parameters associated with producing 50, 80, and 125 pits per year at the SRPPF.[12] The current estimate of the number of workers required for operations of SRPPF has increased since the Draft SRS Pit Production EIS. This revised estimate reflects the current design and operational expectations. Operation of the SRPPF would generate radiological emissions and wastes and would result in radiological *doses* to workers. Existing waste management facilities at SRS would be used to support SRPPF operations. These facilities are described and discussed in Section 3.9.

To ensure special nuclear material is adequately protected, NNSA would utilize physical barriers; access control systems; detection and alarm systems; procedures, including the two-person rule (requiring at least two people to be present during work with special nuclear material in the facility); and personnel security measures, including security clearance investigations and access authorization levels. Nuclear *material control and accountability* are ensured through a system for monitoring storage, processing, and transfers. At any time, the total amount of special nuclear material in the SRPPF would be known. As appropriate, closed-circuit television, intrusion detection, motion detection, and other automated methods would be used as part of the overall security strategy. A material control and accountability program is also a key part of that strategy specifically focused on nuclear material management. Physical measurements and inspections of material would be used to verify inventory records.

[12] This EIS also includes an analysis of producing up to 125 pits per year at SRS (see Section 2.1.5) to be consistent with the value used in the Complex Transformation SPEIS (NNSA 2008a).

Table 2-2—Key Annual Operational Parameters and Wastes for the SRPPF Complex

Parameter	50 Pits Per Year	80 Pits Per Year	125 Pits Per Year
Resources			
Electrical consumption (megawatt-hours)[a]	≤30,000	≤30,000	30,000
Peak electrical (megawatts-electric)	≤11	≤11	11
Diesel fuel (gallons)[b]	15,000	15,000	15,000
Nitrogen (cubic yards)[c]	36,000	57,000	90,000
Argon (cubic yards)[c]	900	1,400	2,200
Domestic water (gallons)	12,100,000	13,300,000	19,000,000
Steam[d]	within existing capacity	within existing capacity	within existing capacity
Radiological air emissions (curies)[e]	8.4×10^{-5}	1.3×10^{-4}	2.1×10^{-4}
Total SRPPF workers (persons)[f]	1,590	1,775	2,660
Security workforce	240	240	290
Radiation workers (persons)[g]	1,190	1,330	1,995
Average radiation worker dose (millirem)	150	150	150
Maximum radiation worker dose (millirem)	500	500	500
Wastes			
TRU waste (cubic yards)	600	880	1,000
LLW solid (cubic yards)	2,200	2,840	3,460
LLW liquid (gallons)[h]	600,000	740,000	1,154,000
MLLW (cubic yards)	10	15	20
Hazardous (cubic yards)	20	27	43

LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; TRU = transuranic.

a. Based on 24 hours per day, 365 days per year.
b. Based on diesel generator testing, one hour per week.
c. Nitrogen and argon: Annual consumption is based on one percent makeup.
d. Facility heating (comfort and process) could be electrical or steam. If steam is used, the existing steam infrastructure in F Area would be extended to the SRPPF. No new land disturbance would be required to extend the infrastructure. Steam would be supplied by the existing 684-G Biomass Cogeneration Facility, which currently produces approximately 85,000 pounds of steam per hour and has adequate capacity to supply steam to the SRPPF.
e. See Chapter 4, Tables 4-7 and 4-8, of this EIS for a breakdown of the radionuclides.
f. Does not include security personnel.
g. Radiation workers are a subset of the "Total SRPPF workers" presented above.
h. The estimated volume of liquid LLW increased from the values presented in the Draft EIS to account for larger estimates that could result from laboratory wastes from analytical chemistry and material characterization.

Source: SRNS 2020, 2020a

2.1.4 Transportation Activities Associated with Pit Production at the SRPPF

Pit production at the SRPPF would require transportation activities as described in this section. Plutonium pit assemblies would be shipped from Pantex to the SRPPF and would be used as material feedstock. Enriched uranium parts would be disassembled from the pit assemblies, converted to oxide, and shipped to Y-12. Y-12 would provide new enriched uranium parts to the SRPPF, as required. During startup, and potentially at other infrequent times, additional plutonium metal could be used in the pit production process. This additional plutonium could be shipped to the SRPPF from other locations, such as LANL and/or Pantex.

Both TRU waste and LLW would be generated at the SRPPF. TRU waste would be disposed of at the WIPP facility near Carlsbad, New Mexico. SRS has existing LLW disposal facilities (as discussed in Section 3.9 of this EIS) that would typically be used for LLW disposal; however, LLW could also be disposed of at NNSS northwest of Las Vegas, Nevada, or a commercial facility (e.g., Waste Control Specialists near Andrews, Texas, or Energy*Solutions* near Clive, Utah). *Mixed low-level radioactive waste* (MLLW) (LLW that contains *hazardous waste*) could be disposed of at either NNSS or one of the aforementioned commercial facilities. Table 2-3 provides a matrix depicting the origins, destinations, and materials shipped.

Table 2-3—Shipments that Support Pit Production at SRS

Shipment Type	Origin ⇒ Destination
Existing pits	Pantex ⇒ SRS
Plutonium	LANL and/or Pantex ⇒ SRS
Enriched uranium	Y-12 ⇒ SRS SRS ⇒ Y-12
Quality assurance sample	SRS ⇒ LANL or another DOE site[a]
Beryllium	LANL or commercial manufacturer ⇒ SRS
Nonnuclear parts	KCNSC ⇒ SRS
New or recertified pits	SRS ⇒ Pantex
TRU waste	SRS ⇒ WIPP
LLW	Onsite disposal at SRS, or SRS ⇒ commercial facility, or SRS ⇒ NNSS (classified LLW)
MLLW	SRS ⇒ commercial facility, or SRS ⇒ NNSS (classified MLLW)

KCNSC = Kansas City National Security Campus; LANL = Los Alamos National Laboratory; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NNSS = Nevada National Security Site; SRPPF = Savannah River Plutonium Processing Facility; SRS = Savannah River Site; TRU = transuranic; WIPP = Waste Isolation Pilot Plant; Y-12 = Y-12 National Security Complex.

a. Some quality assurance samples could also be returned to SRS.

2.1.5 Analyses of Operational Variations and Design Optimizations

Because there could be variations in the implementation of the Proposed Action, this EIS also includes analyses of operational variations and design optimizations. The Draft EIS referred to three of these as sensitivity analyses. Operational variations are defined as potential changes to internal processes of the SRPPF that are analyzed to provide flexibility in the NEPA coverage to address uncertainties in this early stage of review. Design optimizations are options that are being considered early in the design process that have the potential to affect construction of the SRPPF complex and the internal facility layout.

2.1.5.1 Operational Variations

2.1.5.1.1 Production of 125 Pits Per Year (Operational Variation #1)

The exact size and composition of the enduring nuclear weapons stockpile is determined on an annual basis, as explained in Section 1.2 of this EIS. Therefore, the annual requirement for pits could change over time. The annual pit requirement could be achieved through a combination of new pit production and pit reuse. If national security requirements ever demand, pit production capacity increases could be supported using multiple shifts and/or expansion into available space within the SRPPF. In order to analyze the potential environmental impacts from producing up to

125 pits per year at SRS, this EIS analyzes expansion into available space with multiple-shift production. Although no additional facilities would be required to support production of up to 125 pits per year, additional equipment (e.g., pyrochemical furnaces, lathes, and heat treat equipment) would need to be installed in available space within the SRPPF. Table 2-2 includes the key operational parameters associated with producing 125 pits per year at the SRPPF.

2.1.5.1.2 Wrought Production Process (Operational Variation #2)

The wrought process is a potential manufacturing alternative to casting that could be used in the SRPPF. If implemented, some gloveboxes would be modified to support the wrought process to supplement, not replace, the casting process. In the wrought process, plutonium metal is annealed in a furnace and fed to a rolling mill to produce a flat sheet for further processing. Because the wrought process could be used in the SRPPF, this EIS includes an analysis of that process. That analysis, which is included in Chapter 4 of this EIS, identifies and characterizes any notable changes in the potential environmental impacts between the casting (see Section 2.1.2.3) and wrought processes.

2.1.5.2 Design Optimizations

The following options have the potential to change the SRPPF layout, construction requirements, and operations compared to the information presented in Sections 2.1.1 through 2.1.4. Because the CD-1 approval process would not be completed until after publication of this Final EIS, the optimization options discussed below may not be approved and thus, have not been integrated into the SRPPF baseline. Consequently, for purposes of describing the Proposed Action in this EIS, the SRPPF baseline information presented in Sections 2.1.1 through 2.1.4 remains valid and forms the basis for the environmental impacts analyzed in Chapter 4 of this EIS. However, Chapter 4 also addresses the potential changes in environmental impacts that could occur if the design changes discussed below were implemented. Three optimization options are discussed: (1) retain the existing administration building, (2) use a sand filter system, and (3) implement changes to gloveboxes and the aqueous recovery process.

2.1.5.2.1 Option to Retain Existing Administration Building (Design Optimization #1)[13]

As identified in Section 2.1, this EIS analyzes an option in which the existing administration building could be retained. If the existing administration building were retained, it would be located within the expanded PIDAS. Such a situation would require administrative personnel to work within the Protected Area, which could be costly and inefficient. Consequently, NNSA would likely still build the new administration building outside of the Protected Area, as identified under the Proposed Action. Figure 2-4 depicts the larger PIDAS layout for this option. Notable differences in this PIDAS layout versus the proposed layout discussed in Section 2.1.1 (and shown in Figure 2-2) would be as follows:

- The existing culvert north of the existing administration building would be partially filled in using a “cut and fill” design in which the higher slopes would be removed, and the lower

[13] The Draft EIS referred to this option as “Sensitivity Analysis #3.” This Final EIS refers to it as “Design Optimization #1” to more accurately characterize it as an option that has evolved during the SRPPF design process.

elevations would be filled in. A reinforced earth retaining wall would be constructed. The wall would be about 800 feet long, up to 30 feet high, approximately one foot thick, and rest atop a five-foot-wide foundation. Construction of the wall would require approximately 22,350 cubic yards of suitable soils. Less than one acre of land would be disturbed by the construction work along the culvert. Because the culvert runs beneath an existing utility corridor, the land was previously disturbed when the utility corridor was constructed.

- The PIDAS would be approximately 320 feet longer than the PIDAS described in Section 2.1.1. This would increase the size of the Protected Area by approximately 30 percent.

- The new administration building (labeled "706-5F" on Figure 2-2) would still be constructed to provide office and administrative capacity outside of the Protected Area. Not demolishing the existing administration building would reduce the key construction parameters and wastes presented in Table 2-1; however, those reductions would be offset by the additional construction associated with the culvert fill, earthen retaining wall, and PIDAS expansion. Consequently, NNSA does not expect any notable change in the construction parameters for this option, with the exception of nonhazardous construction and demolition waste, which would be reduced from 1,700 cubic yards per year to 700 cubic yards per year. This reduction is associated with not demolishing the existing administration building.

- Figure 2-4 also includes a potential sand filter and associated fan house, electrical, and generator facilities. These features could be included within the Protected Area for this layout; however, they are discussed further in Design Optimization #2 in Section 2.1.5.2.2.

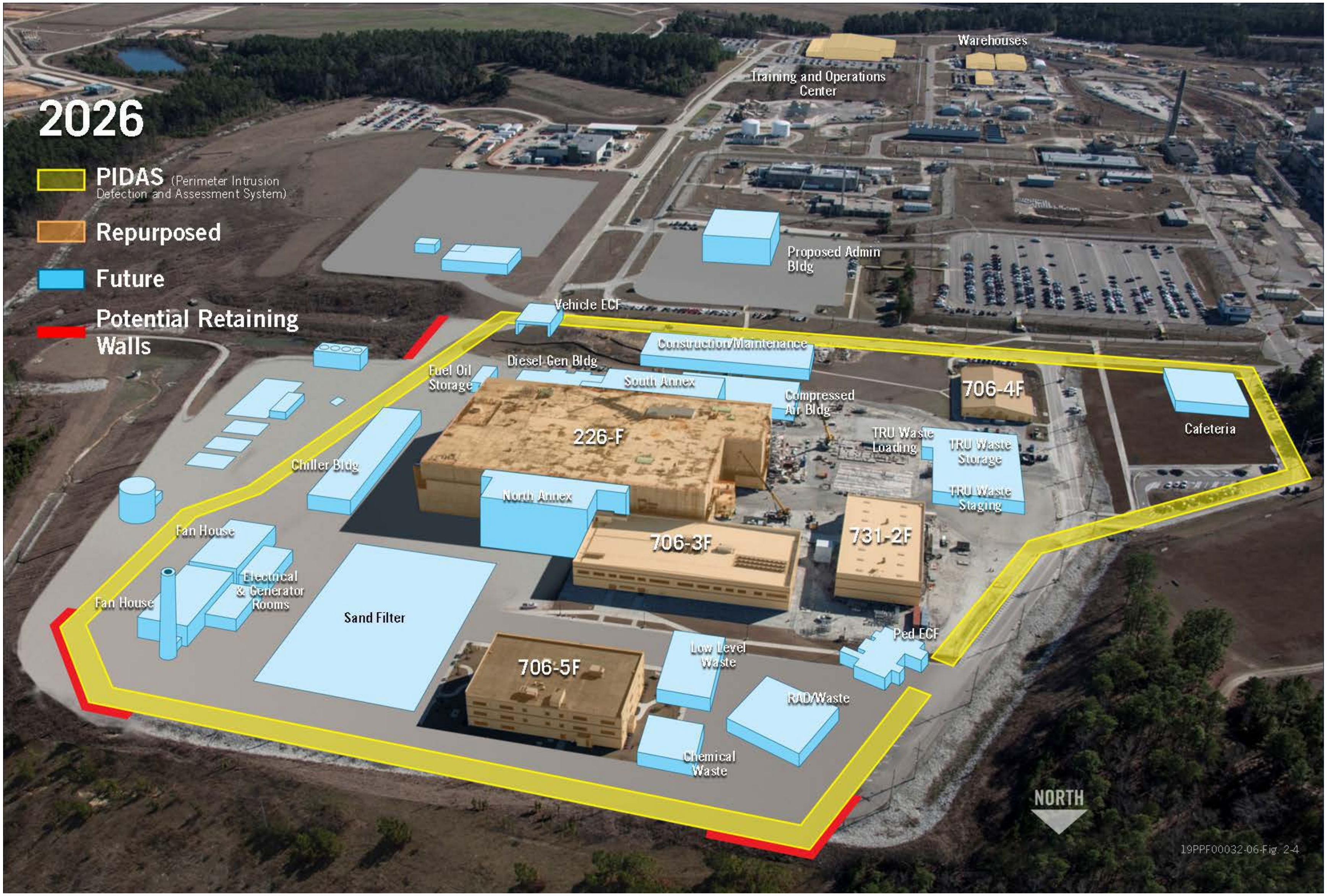


Figure 2-4—Notional PIDAS Configuration for Option of Retaining Existing Administration Building (Source: SRNS 2020a)

2.1.5.2.2 Option to Use Sand Filter (Design Optimization #2)

This section discusses the option to use a sand filter system for SRPPF ventilation/filtration/exhaust. Such a system would be similar to other sand filters used at SRS for processing and material storage facilities and would consist of deep (several feet thick) beds of rock, gravel, and sand, constructed in layers, with the smallest granule size at the top. The sand filter system would be located within the PIDAS (see Figure 2-4). Conceptually, the sand filter system would require an area of approximately 260 feet by 360 feet, with a depth of approximately 35 feet.

If the sand filter option is used for the SRPPF, a total of three retaining walls would be constructed. All three walls would be outside the PIDAS. The first wall would be at the northeast corner of the PIDAS and would be about 455 feet long. The second would be at the northwest corner of the PIDAS and would be about 239 feet long. The third wall would be along the east service road and would be about 121 feet long. The total length of the walls would be 815 feet (see Figure 2-4). Soils excavated from the construction of the sand filter would be stockpiled until an evaluation of their stability and suitability for other purposes is completed. If suitable, some of the soils would be placed as backfill around the perimeter of the sand filter. The topography of the area would be graded and contoured to facilitate surface water drainage (SRNS 2020b).

Because airflow direction through the sand filter system would be upward, exhaust from Building 226-F would be routed through a safety-class, seismically qualified annex (on top and adjacent to Building 226-F, as shown in Figure 2-4) into an underground tunnel with a cross section of approximately 23 feet by 23 feet. The underground tunnel would connect to the sand filter. An additional duct or tunnel would take the discharge of the sand filter to a fan house (also containing diesel generators and electrical switchgear) and then release the air to a single stack, as shown in Figure 2-5. The fan house would be a steel reinforced concrete structure. The rock, gravel, and sand layers would be positioned and sized for structural strength, cleaning ability, dirt-holding capacity, and long life. The sand filter would replace the final set of HEPA filters in the SRPPF prior to release to the atmosphere. The sand filter would not replace the HEPA filters on Zone 1 areas (inlets and outlets of gloveboxes containing plutonium).

Figure 2-6 shows the cross section of a typical sand filter. Ideally, the layers of larger granules, through which the ventilated air passes first, remove most of the larger particles and particulate mass, and the layers of finer sands provide high-efficiency removal. Below the fixed bed of sand and gravel is a course of hollow tile that forms the air distribution passages. The filter would be enclosed in a concrete-reinforced, seismically qualified structure.

The sand filter would provide greater simplicity in design, operation, and maintenance than the HEPA filter system and would last throughout the life of the SRPPF with minimal maintenance. Radiation levels near the sand filter boundary would be undetectable compared to background levels. At the project's end of life, the sand filter would likely be left in place for in situ decommissioning (i.e., grouting in place) (SRNS 2020b).

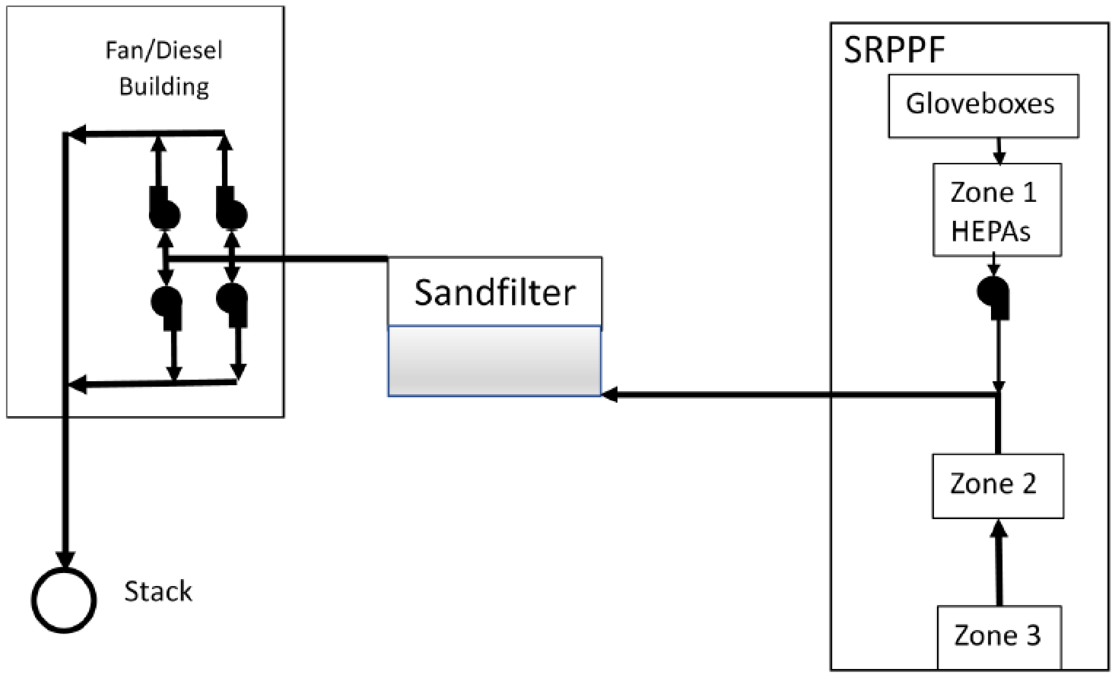


Figure 2-5—Ventilation Flow in Sand Filter System (Source: SRNS 2020b)

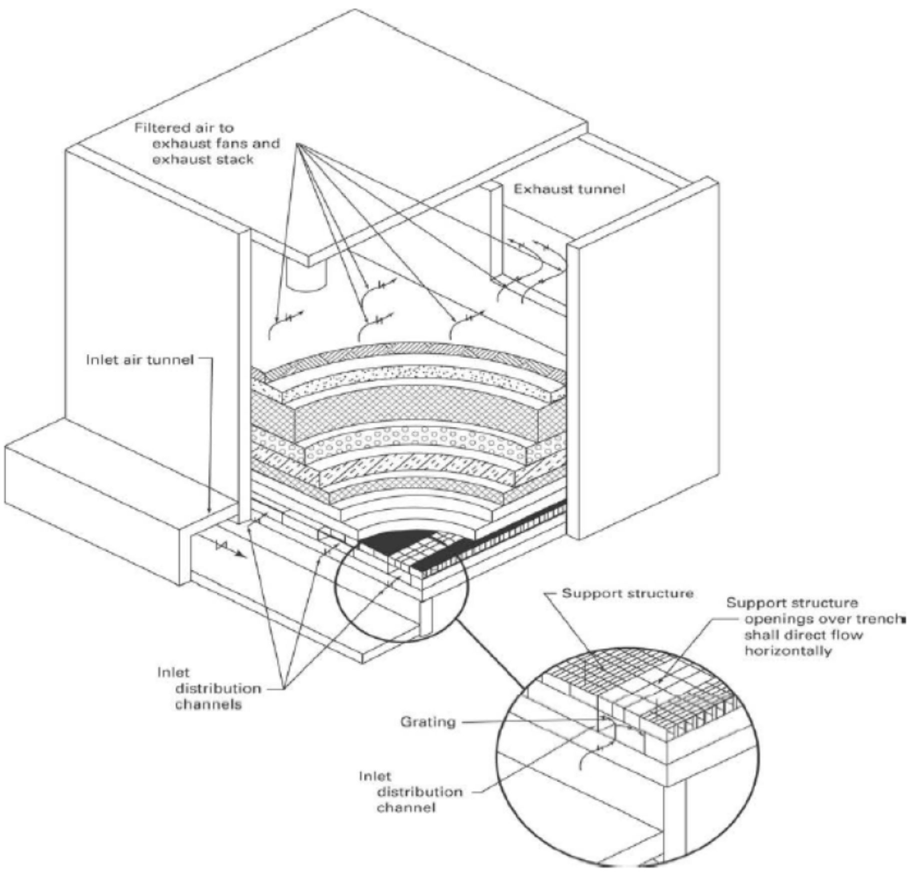


Figure 2-6—Sand Filter Cross Section (Source: SRNS 2020b)

The sand filter would enable NNSA to eliminate two-thirds of the exhaust fans and HEPA filters in Building 226-F, which would free up space in the facility. Use of a sand filter would result in an insignificant reduction in filtration efficiency (sand filter is 99.89 percent effective for 0.3-micron particulates versus HEPA efficiency of 99.99 percent for 0.3-micron particulates). Because HEPA filters require a safety class fire protection system and cease to filter once they become wet, the sand filter system would be more reliable and provide an improvement in safety related to some accident scenarios. Additionally, the sand filter system would reduce the need for periodic replacement of HEPA filters and associated wastes. Five sand filters are currently in use at SRS, in F-Canyon, H-Canyon, the Defense Waste Processing Facility (DWPF), Building 235-F, and at Savannah River National Laboratory (SRNS 2020b). Table 2-4 presents changes to key construction parameters associated with the sand filter system.

Table 2-4—Key Construction Parameters for Sand Filter System

Parameter	Value
Resources	
Additional land disturbance on previously disturbed land (acres)	2.9
Additional land disturbance on previously undisturbed land (acres)	0
Excavated soil during construction (cubic yards)	127,222
Additional water use during construction (gallons/year)	120,000

Source: SRNS 2020b

2.1.5.2.3 Option to Change Gloveboxes and Aqueous Recovery Process (Design Optimization #3)

As listed below, NNSA has identified several changes in the SRPPF design that would reduce the number of gloveboxes in the SRPPF and modify the aqueous recovery process while not adversely affecting facility operational throughput, including (SRNS 2020a):

- Installing two furnaces per glovebox in the pyrochemical processing, heat treatment, and casting process steps;
- Reducing the number of waste staging gloveboxes;
- Combining the cleaning and density operations into single gloveboxes;
- Combining furnace gloveboxes in foundry and machining operations;
- Reducing the nitrate recovery to a single line; and
- Eliminating the chloride recovery line.

These design changes would free up space in the facility, reduce required quantities of nitric acid in the SRPPF at any one time, and eliminate the use of hydrochloric acid in the SRPPF. Chapter 4 discusses the potential environmental effects of this optimization option.

2.2 No-Action Alternative

Under the No-Action Alternative, NNSA would not proceed with the SRPPF, which might limit the ability to maintain, long-term, the nuclear deterrent that is a cornerstone of U.S. national security policy. Under the No-Action Alternative, the existing MFFF would remain unused and NNSA would utilize the capabilities at LANL to meet the Nation's long-term needs for pit manufacturing. DOE has re-evaluated the impacts of the pit production capacity at LANL in the Complex Transformation SPEIS and 2019 SPEIS SA (NNSA 2008a, 2019a) and the LANL SWEIS and 2020 Final LANL SA (NNSA 2008c, 2020a).

2.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

2.3.1 Utilize Other Savannah River Site Facilities

The *canyon* facilities in F Area and H Area at SRS were designed to recover plutonium (F-Canyon) and uranium (H-Canyon) from reactor fuel. Only the New Special Recovery Facility in F-Canyon is set up to purify plutonium material from recycled pits. Because F-Canyon is in a cold standby status after de-inventory and partial decommissioning in the early 2000s, extensive modifications, with significant costs, would be required to generate an adequate capacity for the length of the pit production mission. Major deficiencies associated with utilizing the canyons to support the pit production mission include:

- Project risks are increased when using existing facilities due to the higher number of unknown conditions that may be encountered during the project, and the challenges of coordinating construction activities with any ongoing facility operations.
- The service life of the renovated facility may not meet the 50-year SRPPF design requirement.
- The existing robust canyon structures cannot be modified significantly and would therefore result in inefficient equipment arrangement, material handling, and storage locations.
- Imbedded infrastructure such as shielding, ventilation systems, electrical cable/switchgear, and process piping/drains would likely not be suitable for a revised facility mission.

Based on these factors, NNSA determined that the canyon facilities are not reasonable alternatives for supporting the pit production mission.

2.3.2 Construct a New Greenfield Pit Production Facility at SRS

NNSA considered the alternative of building a new Greenfield pit production facility at SRS. The mean acquisition cost of such a new facility was determined to be approximately $1.8 billion more than the cost of repurposing the MFFF (NNSA 2017, Figure 6-2). Additionally, a new facility would introduce significant schedule risk compared to repurposing the MFFF. The operational date for a new facility was projected to be 2034 (NNSA 2017, Figure 7-1). Consequently, this alternative was eliminated from detailed analysis.

2.3.3 Redesign of Weapons to Require Less or No Plutonium

The pits in the enduring nuclear weapons stockpile were designed and built with plutonium in an era when underground nuclear testing was being conducted to verify these designs. Replacing these pits with new pits that would use little or no plutonium (i.e., using *highly enriched uranium* (HEU) instead of plutonium) for the sole reason of not building a long-term, assured pit production facility would not be feasible. Underground nuclear testing would likely be required to verify performance of any new designs that use uranium instead of plutonium. In addition, these new pits would require costly changes in the weapon delivery systems. Finally, the *Atomic Energy Defense Act* also requires plutonium pits, so this alternative would not support the purpose and need for agency action (50 U.S.C. § 2538a). Consequently, this alternative is considered unreasonable.

2.3.4 Only Reuse Existing Pits

NNSA currently stages plutonium pits at Pantex. Like the pits in the active stockpile, those pits are aging and would not mitigate plutonium aging risks or enable NNSA to implement enhanced safety features to pits to meet NNSA and DoD requirements. As identified in Sections 1.3.1 and 1.4 of this SRS Pit Production EIS, the EIS analyzes judicious reuse of pits from the existing stockpile; however, the *Atomic Energy Defense Act* requires the production of new pits, so this alternative would not support the purpose and need for agency action (50 U.S.C. § 2538a). Consequently, an alternative that relies only on reused pits was eliminated from detailed analysis.

2.3.5 Locate the Pit Production Mission at Other DOE/NNSA Sites

The Complex Transformation SPEIS evaluated all reasonable sites for the pit production mission and explained why other sites were eliminated from detailed analysis (NNSA 2008a, Section 3.15). In the 2019 SPEIS SA, NNSA considered whether any new sites should be evaluated for the pit production mission and explained the reasons why additional DOE/NNSA sites were not added (NNSA 2019a, Sec. 2.3.7). NNSA is not revisiting that programmatic decision in this tiered EIS. Consequently, sites other than SRS were eliminated from detailed analysis.

2.4 PREFERRED ALTERNATIVE

The CEQ regulations require an agency to identify its preferred alternative to fulfill its statutory mission (40 CFR 1502.14[e]). For this SRS Pit Production EIS, the Proposed Action of repurposing the MFFF into the SRPPF is the preferred alternative based on national policy and considerations of environmental, economic, technical, and other factors.

2.5 PLANNING ASSUMPTIONS AND BASIS FOR ANALYSIS

The following are some of the more specific assumptions and considerations that form the basis of the analyses and impact assessments in this EIS.

1. The exact size and composition of the enduring nuclear weapons stockpile is determined on an annual basis, as explained in Section 1.2 of this EIS. Based on Federal law and current national policy and long-range planning consistent with the 2018 NPR, NNSA must implement a strategy to provide the enduring capability and capacity to produce not less than 80 war reserve plutonium pits per year beginning during 2030 (50 U.S.C. § 2538a). As discussed in Section 1.1, this EIS evaluates the impacts of repurposing the MFFF at SRS to produce a minimum of 50 pits per year, with additional surge capacity, if needed, to meet the requirements of producing pits at a rate of not less than 80 pits per year beginning during 2030. Additionally, as explained in Section 2.1.5, this EIS also includes an analysis of producing up to 125 pits per year at SRS to be consistent with the value used in the previous analysis in the Complex Transformation SPEIS (NNSA 2008a).

2. The proposed SRPPF would be a refurbishment of the existing MFFF; no major structural renovations are expected, and the current layout of the MFFF would support the internal design expectations for the SRPPF.

3. The proposed SRPPF is in a conceptual design stage. As such, the analysis of this EIS is based on best available design information. For the analysis of environmental impacts presented in this EIS, NNSA has used conservative assumptions that may overestimate the potential impacts. Thus, the potential impacts from the implementation of any SRPPF final designs are expected to result in lesser impacts than those presented in this EIS. Although the ultimate layout of SRPPF facilities may change compared to the preliminary layout presented in Figure 2-2 (which was updated between the Draft and Final SRS Pit Production EIS), NNSA would not expect notable changes in key construction and operational parameters from any potential layout changes. This would include the future identification and siting of ancillary support facilities within the SRPPF Complex. This conclusion is largely because any SRPPF construction activities are expected to occur on previously disturbed land.

4. The SRPPF would be capable of manufacturing plutonium components and assembling pit types that support the enduring nuclear weapons stockpile, as well as any future newly designed pits. Manufacturing a pit is defined as the suite of operations needed to receive and purify plutonium metal, form plutonium components, assemble them into a certifiable pit, inspect the pit, and ship it so that it can be incorporated into a functional nuclear weapon (NNSA 2019c). As identified in Section 2.1.2 of this SRS Pit Production EIS, pit reuse would involve modifications to an existing pit and consists of a subset of the processes required for manufacturing a new pit.

5. This EIS evaluates the environmental impacts associated with single-shift pit production operations (e.g., disassembly, recovery, casting, machining, and assembly) five days per week because this represents the currently projected normal operating scenario for the SRPPF. Most waste operations and maintenance activities would occur on night shifts and weekends, but could also occur on the main shift, depending on the operation. If national security requirements ever demand, potential pit production capacity increases could be supported using multiple shifts and/or expansion into available space. This EIS analyzes expansion into available space with multiple-shift production to allow for production of up to 125 pits per year. Section 2.1.5.1.1 discusses production of 125 pits per year.

6. If NNSA decides to repurpose the MFFF into the SRPPF, the primary construction activities would last approximately six years. Construction activities would follow issuance of a ROD, as appropriate. Minor construction activities in the SRPPF complex could also continue during startup of the SRPPF, which would be accomplished by the end of 2026 when NNSA would begin to produce pits to for the qualification process. Fifty certified pits would be delivered to the stockpile beginning during 2030. The post-2026 construction activities are accounted for in operational data estimates presented in Table 2-2. Because the SRPPF would be designed for an operational service life of at least 50 years, this EIS assesses the environmental impacts associated with the operation of the SRPPF for a period of 50 years, at which time the structures would be evaluated for potential life extension or undergo *decontamination* and *decommissioning* (D&D).

7. Both construction and operational impacts are considered for all environmental resource areas. Construction impacts are generally short term (i.e., most would occur over the six-year construction period), while operational impacts are expected to be long term (i.e., would occur annually over the 50-year operating period).

8. The proposed SRPPF would be designed with the goal of developing a safe, secure, and environmentally compliant facility based on existing pit manufacturing practices, and with the ability for limited reconfiguration and expansion as new technologies and requirements are developed (NNSA 2019c). The design goal of the SRPPF considers waste minimization and pollution prevention, as practicable, to reduce potential facility and equipment contamination, and to make future D&D as simple and inexpensive as possible. This EIS includes a general discussion of the environmental impacts from future D&D, including a discussion of the D&D process, the types of actions associated with D&D, and the general types of impacts associated with D&D (see Section 4.14). Any discussion of specific D&D impacts is more appropriate for later NEPA documents because the extent of contamination, the degree of decontamination, and the environmental impacts associated with performing D&D cannot be known without performing a detailed study of the SRPPF at the appropriate time.

9. Generated wastes would be managed in accordance with applicable Federal, State, and local laws, regulations, and requirements, as well as NNSA's waste management orders and pollution prevention and waste minimization policy. Liquids would be solidified as part of SRPPF operations (i.e., the SRPPF would not generate any liquid TRU waste that requires disposition). The solidified forms would meet applicable waste acceptance criteria prior to leaving the SRPPF. Any TRU waste generated by the SRPPF would be processed and packaged in accordance with the WIPP waste acceptance criteria and transported to the WIPP facility for disposal. All other wastes would be managed in accordance with applicable site procedures and prior DOE waste management decisions.

10. The operation of the SRPPF would require transporting existing pits from Pantex to the SRPPF and transporting pits from the SRPPF to Pantex, where they would be assembled into weapons.[14] In addition, small quantities of plutonium from other locations, such as SRS, LANL, and Pantex, could also be used. All transportation of pits and plutonium would occur via NNSA's safe, secure transport system over Federal and State highways to the extent practicable.

11. A modern nuclear weapon consists of many components, most of which are nonnuclear. In general, any needed pit-related components not produced at the SRPPF would be produced and shipped to the SRPPF for assembly into the pit. Additionally, much of the specialty tooling and equipment required for the SRPPF would be produced and shipped to the SRPPF for use. The environmental impacts associated with producing these components and/or supplying this tooling/equipment were addressed in previous NEPA documents (see specifically the *Environmental Assessment for the Modernization of*

[14] Various quality control pits and pit samples may also be sent to other NNSA sites.

Facilities and Infrastructure for the Non-Nuclear Production Activities Conducted at the Kansas City Plant [GSA and NNSA 2008]) and/or are ongoing commercial operations.

12. Beryllium is a material used to support pit production, though the quantity needed depends on the systems being manufactured. NNSA has reviewed current beryllium inventories against anticipated mission needs and found that the availability of beryllium is adequate for forecasted SRPPF operations at SRS. NNSA does not anticipate the need for beryllium production capabilities at the proposed SRPPF. Any beryllium needed for pits would not be produced, but instead secured from current quantities or acquired from other locations, such as LANL and/or commercial domestic suppliers (SRNS 2020).

13. The current design of the SRPPF includes excess HC-2 space that NNSA could use to support other missions, including surplus plutonium disposition. The SRPPF would be designed to include a pit disassembly capability (see Section 2.1.2 of this EIS), and excess space could be used for equipment for other processing steps. Therefore, SRPPF space and capabilities could be used to support the dilute and dispose process for plutonium disposition, or other NNSA missions. NNSA evaluated the impacts of installing and operating equipment to prepare plutonium for disposal at the WIPP facility in the SPD SEIS (NNSA 2015). For purposes of the cumulative impacts analysis in Chapter 5 of this SRS Pit Production EIS, NNSA assumes the WIPP Disposal Alternative data from the SPD SEIS represents impacts at least as great as those that could result from installing and operating the necessary equipment in the SRPPF. That equipment would include pit disassembly, furnaces for conversion of plutonium metal to oxide, gloveboxes for dilution operations, and associated systems and equipment.

2.6 Comparison of Alternatives

To aid the reader in understanding the differences between the Proposed Action and No-Action Alternative, this section presents a summary comparison of the associated potential environmental impacts. The information in this section is compiled in Table 2-5 and summarizes the environmental impacts presented in Chapter 4 of this EIS. Table 2-6 summarizes the cumulative environmental impacts presented in Chapter 5 of this EIS.

Table 2-5—Summary Comparison of Environmental Impacts of the Alternatives

Proposed Action	No-Action Alternative
Land Use	
Construction activities would involve approximately 48 acres and occur on previously disturbed land. Once construction is complete, the area inside the PIDAS (about 25 acres) would be restricted to authorized personnel. Construction and operation of the SRPPF complex would be consistent with current industrial land use within F Area.	The MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. Land use at SRS would continue to reflect a mix of forest/undeveloped, water/wetlands, and developed facilities.
Visual Resources	
Construction activities would result in temporary changes to the visual appearance of F Area due to the presence of cranes, construction equipment,	SRS visual appearance would not change. Facilities are scattered throughout SRS and are generally not visible off site, as views are limited by rolling

Proposed Action	No-Action Alternative
demolition, new buildings in various stages of construction, and possibly increased dust. Because the SRPPF complex is in the interior of the SRS, construction activities and the operational facilities would not be noticeable at or beyond the SRS boundary (approximately six miles away).	terrain and heavy vegetation. Visual resource conditions reflect an industrialized area.
Geology and Soils	
Minimal impacts on geologic and soil resources due to no new land disturbance. There are no faults located within SRS that intersect the ground surface and therefore ground displacement near the SRPPF complex is highly unlikely. Potential accident impacts associated with earthquakes are discussed under "Facility Accidents" in this table.	Current and planned activities at SRS would continue as required to support various missions. There would be no additional impacts to geology and soil resources beyond current and planned activities.
Water Resources	
There would be minimal impacts on surface water and groundwater resources. Nonhazardous facility wastewater, stormwater runoff, and other industrial waste streams would be managed and disposed of in compliance with the National Pollutant Discharge Elimination System permit limits and requirements. There would be no direct release of contaminated effluents to groundwater or surface waters. During construction and operations, groundwater use would be approximately 2.2 percent and 1.7 percent, respectively, of the total current water use at SRS.	Current and planned activities at SRS would continue as required to support various missions. Impacts to water resources from SRS operations would remain at current levels. DOE will continue to operate facilities in accordance with permit requirements and continue remediation efforts to improve water quality.
Air Quality	
Fugitive dust would be generated during clearing, grading, and other earth-moving operations. Construction and operational emissions would not contribute to an exceedance of an ambient air quality standard at the SRS site boundaries. Total radionuclide emissions at SRS would increase by less than one percent. Greenhouse gas emissions would be approximately 0.00045 percent of the total U.S. greenhouse gas emissions.	Current and planned activities at SRS would continue as required to support various missions. There would be no incremental impacts to air quality and noise beyond current levels and the SRS would remain below the applicable NAAQS.
Noise	
Noise levels in construction areas could be as high as 110 A-weighted decibels but would not be noticeable at the site boundary (approximately six miles away). Operational noises would be similar to other operations in F Area.	Current and planned activities at SRS would continue as required to support various missions. Most industrial facilities at SRS are far enough from the site boundary that noise levels at the boundary from these sources would not be measurable or would be barely distinguishable from background levels.
Ecological Resources	
There are no notable ecological resources (including threatened or endangered and protected	Current and planned activities at SRS would continue as required to support various missions.

Proposed Action	No-Action Alternative
species) or wetlands on or surrounding the proposed SRPPF complex. No notable impacts are expected during either construction or operations.	There would be no incremental impacts to ecological resources beyond current levels.
Cultural and Paleontological Resources	
Construction and operational activities are not expected to impact cultural and paleontological resources; such activities would occur in areas previously surveyed during MFFF construction and no fossil-bearing strata are known within F Area.	Current and planned activities at SRS would continue as required to support various missions. There would be no additional impacts to cultural resources.
Infrastructure	
Minimal impacts are anticipated, as SRS has adequate capacity to meet demand requirements for electricity, water use, steam, fuels, and *sanitary wastewater*.	Current and planned activities at SRS would continue as required to support various missions. The SRS infrastructure capacity is adequate to support current activities.
Socioeconomics	
Approximately 1,800 workers would be directly employed during the peak year of construction. Another 1,134 indirect jobs are expected to be generated in the region of influence (ROI). The peak construction employment (direct and indirect) is estimated to represent approximately 1.2 percent of the projected ROI labor force and is not expected to impact community resources. The value added from the direct economic activity to the local economy would be approximately $178 million, or about 0.6 percent of the projected personal income in the ROI. Once operational, additional direct employment is estimated to be 1,830 jobs (for 50 pits per year) and 2,015 jobs (for 80 pits per year). Another 2,178 (for 50 pits per year) and 2,398 (for 80 pits per year) indirect jobs are expected to be generated. The total additional employment (direct and indirect workers) is estimated to represent approximately 1.5 percent (for 50 pits per year) and 1.7 percent (for 80 pits per year) of the projected ROI labor force in 2030. The value added from the direct economic activity to the local economy would be approximately $273 million (for 50 pits per year) and $300 million (for 80 pits per year), or approximately 0.8 percent of the projected personal income in the ROI in 2030.	Current and planned activities at SRS would continue as required to support various missions. There would be no additional impacts to socioeconomic resources beyond current activities. There would be no major changes in the workforce at SRS.

Proposed Action	No-Action Alternative
Environmental Justice	
No disproportionately high and adverse impacts on minority or low-income populations are expected; to the extent that any impacts may be high and adverse, NNSA expects the impacts to affect all populations in the area equally.	Current and planned activities at SRS would continue as required to support various missions. There would be no disproportionately high and adverse impacts on minority or low-income populations.
Waste Management	
Minimal wastes would be generated during construction. Operations would generate the following additional volumes of waste beyond that currently generated at SRS: TRU waste (yd^3/year): 600–880 LLW solid (yd^3/year): 2,200–2,840 LLW liquid (gallons per year): 600,000–740,000 MLLW (yd^3/year): 10–15 Hazardous (yd^3/year): 20–27 All wastes generated could be managed by existing and planned waste management facilities.	Current and planned activities at SRS would continue. There would be no incremental impacts to waste generation beyond current levels. Current waste generation rates are as listed: TRU waste (yd^3/year): 460 LLW solid (yd^3/year): 13,100 LLW liquid (gallons per year): 20,000,000 MLLW (yd^3/year): 520 Hazardous (yd^3/year): 76 All wastes generated are managed by existing and planned waste management facilities.
Human Health	
Occupational injuries: During construction, 73 days of lost work from illness/injury and less than one fatality would be expected. During operations, NNSA estimates 15 to 17 days per year of lost work from illness/injury and less than one fatality for the duration of the Proposed Action.	Current and planned activities at SRS would continue as required to support various missions. There would be no incremental impacts to human health beyond current levels. Current radiological impacts from SRS are as listed below.

Incremental Radiological Impacts:

Receptor/Dose/Risk	50 to 80 Pits Per Year
Public	
Collective dose to 50-mile population (person-rem)	3.3×10^{-5} – 5.2×10^{-5}
Population LCFs	0 (1.9×10^{-8}–3.1×10^{-8})
Offsite MEI dose (millirem)	5.0×10^{-7}–8.0×10^{-7}
MEI LCF risk	0 (3.0×10^{-13}–4.8×10^{-13})
Workers	
Average dose to radiological worker (millirem/year)	150
Radiological worker LCF risk	0 (9.0×10^{-5})
Collective dose to radiological workers (person-rem/year)	178–200
Total radiological worker LCFs	0 (0.11–0.12)

LCF = latent cancer fatality

Current Radiological Impacts:

Receptor/Dose/Risk	2013–2017 Average
Public	
Collective dose to 50-mile population (person-rem)	4.3
Population LCFs	0 (0.0026)
Offsite MEI dose (millirem)	0.20
MEI LCF risk	0 (1.2×10^{-4})
Workers	
Average dose to radiological worker (millirem/year)	50
Radiological worker LCF risk	0 (3.0×10^{-5})
Collective dose to radiological workers (person-rem/year)	112
Total radiological worker LCFs	0 (0.07)

Proposed Action	No-Action Alternative

Facility Accidents

Proposed Action

Consequences:

Accident	MEI		Offsite Population	
	Dose (rem)	**LCFs**	**Dose (Person-rem)**	**LCFs**
Extremely unlikely earthquake with subsequent fire	0.8	0 (0.00048)	3,610	2.2
Fire in a single fire zone	0.41	0 (0.00024)	1,800	1.1
Explosion in a furnace	1.8	0 (0.0011)	8,120	4.9
Nuclear criticality	3.4×10^{-6}	0 (2.0×10^{-9})	0.0064	0 (3.8×10^{-6})
Radioactive material spill	0.0037	0 (2.2×10^{-6})	16.2	0 (0.0097)

Risks:

Accident	Maximally Exposed Individual (LCF Risk)	Offsite Population (LCF Risk)
Extremely unlikely earthquake with subsequent fire	0 (4.8×10^{-8})	0 (2.2×10^{-4})
Fire in a single fire zone	0 (2.4×10^{-8})	0 (1.1×10^{-4})
Explosion in a furnace	0 (1.1×10^{-5})	0 (4.9×10^{-2})
Nuclear criticality	0 (2.0×10^{-11})	0 (3.8×10^{-8})
Radioactive material spill	0 (2.2×10^{-8})	0 (9.7×10^{-5})

No-Action Alternative

Current and planned activities at SRS would continue as required to support various missions. There would be no incremental impacts from accidents beyond current levels.

Intentional Destructive Acts

Proposed Action

The Complex Transformation SPEIS, which includes a classified appendix that analyzes the potential impacts of intentional destructive acts (e.g., sabotage, terrorism), concluded that, "Depending on the malevolent, terrorist, or intentional destructive acts, impacts would be similar to, or exceed, accident impacts analyzed in the SPEIS" (NNSA 2008a). NNSA reviewed that classified appendix and concluded that the classified appendix analysis is reasonable and adequate to represent the Proposed Action in this EIS and does not need to be revised (NNSA 2019b).

No-Action Alternative

Current and planned activities at SRS would continue as required to support various missions. There would be no change in potential impacts from intentional destructive acts beyond current levels.

Proposed Action	No-Action Alternative
Transportation	
For 50 pits per year, there would be approximately 145 shipments of radiological materials and wastes annually. Total population dose: 6.68 person-rem/year Population LCF risk: 0 (0.00335) Worker dose: 11.61 person-rem/year Worker LCF risk: 0 (0.00741) Accident risks (rad): 0 (3×10^{-7}) LCF/year Accident risks (nonrad): 0.03 fatality/year	Current and planned activities at SRS would continue as required to support various missions. There would be no incremental impacts to transportation beyond current levels.

Table 2-6—Summary Comparison of Cumulative Environmental Impacts

Resource Area	Discussion
Resources Areas Eliminated from Detailed Cumulative Impact Analysis	
Land Use	Proposed Action would not involve any new land disturbance activities and would not affect current land use. Therefore, there would be no notable cumulative impacts.
Visual Resources	Proposed Action would require removal of existing facilities, construction of new facilities, modification of existing facilities, and construction of the PIDAS. These activities would result in temporary visual appearances at F Area and are in the interior of the SRS. Any visual impacts would not be noticeable beyond the SRS boundary. Therefore, there would be no notable cumulative impacts.
Geology and Soils	Proposed Action would not involve any new land disturbance activities and would not impact geological and soils resources. There would be no changes to existing facilities that would affect their ability to withstand a design-basis seismic event. Therefore, there would be no notable cumulative impacts.
Water Resource (Surface Water and Groundwater Quality)	Proposed Action would not produce effluents that could affect surface water or groundwater quality. SRS has permits, plans and procedures in place that would minimize any impacts. Therefore, there would be no notable cumulative impacts.
Air Quality	The emissions from construction activities are expected to be minimal and temporary. During operations, the estimated ambient air pollutant concentrations would be well below the applicable NAAQS and significant levels for all criteria pollutants. The total radionuclide emissions at SRS would increase less than one percent. Therefore, there would be no notable cumulative impacts.
Noise	Any noise levels associated with the Proposed Action would not reach far beyond the boundaries of SRS. DOE has implemented appropriate hearing protection programs to minimize noise impacts to workers. Therefore, there would be no notable cumulative impacts.
Ecological Resources	Proposed Action would not involve any new land disturbance activities and would not affect ecological resources. Therefore, there would be no notable cumulative impacts.

Resource Area	Discussion
Cultural and Paleontological Resources	Proposed Action would not involve any new land disturbance activities and would not affect cultural and paleontological resources. Therefore, there would be no notable cumulative impacts.
Resources Areas Included in Detailed Cumulative Impact Analysis	
Global Climate Change	Emissions of greenhouse gases (carbon dioxide equivalents) in 2018 at SRS were estimated to be 0.559 million metric ton per year, which is less than 0.009 percent of the total U.S. emissions of 6.457 billion metric tons of carbon dioxide equivalent per year (EPA 2019b, p. ES-4). Under the Proposed Action, the estimated total combined greenhouses gas emissions would be approximately 0.00045 percent of the total U.S. greenhouse gas emissions (6.457 billion metric tons of carbon dioxide equivalent in 2017). Therefore, the potential cumulative impacts to global climate change from the Proposed Action would be negligible.
Infrastructure	The cumulative electricity power consumption would be approximately 1,001,520 megawatt-hours, which is well within the total sitewide capacity of 4,400,000 megawatt-hours. The cumulative water usage consumption would be from approximately 459,100,000 to 469,000,000 gallons per year, which is well within the sitewide capacity of 2,950,000,000 gallons per year.
Socioeconomics	Cumulative employment at SRS from past, present, and reasonably foreseeable future actions could reach a peak of about 17,290 persons. By comparison, it is estimated that the projected labor force in the ROI would be 252,188 workers in the peak year of construction and 264,146 workers when operations commence in 2030. In addition to the direct jobs, an estimated 2,178 to 2,398 indirect jobs could be created. Due to the low potential for in-migration and changes to the ROI population, cumulative impacts on the availability of housing and community services are expected to be small.
Environmental Justice	Based on the analysis of impacts for the resource areas in this EIS, few adverse impacts from construction and operational activities at SRS are expected under the Proposed Action. To the extent that any impacts may be adverse, NNSA expects the impacts to affect all populations in the area equally and cumulative environmental justice impacts are not expected.
Waste Management	LLW: The Proposed Action would generate approximately 2,200 to 2,840 cubic yards of LLW generated annually, which would normally be disposed of at SRS. NNSA could also consider the use of a non-DOE commercial, licensed LLW/MLLW disposal facility. In the unlikely event that the LLW were disposed of at NNSS, this volume would represent approximately 5.7 percent of the average volume of LLW disposed of at the NNSS. The LLW generated at LANL from producing 30 pits per year (NNSA 2020a) would be disposed of at the NNSS disposal site as well. At the production rate of 30 pits per year, approximately 885 cubic yards of LLW would be generated annually at LANL. The combined LLW generated from pit production at both SRS and LANL would be approximately 3,085 cubic yards, which would represent approximately 8 percent of the average annual volume of LLW disposed of at the NNSS. If needed, the available capacity at the NNSS would be adequate to accommodate this quantity of waste.

Resource Area	Discussion
	TRU Waste: Under the Proposed Action, significant quantities of TRU waste could be generated at SRS and shipped to WIPP for disposal. It is estimated that approximately 22,950 cubic meters (30,000 cubic yards) of TRU waste could be generated over the life of the project (i.e., 50 years) at SRS, assuming a production rate of 50 pits per year. In addition, approximately 5,350 cubic meters (6,998 cubic yards) of TRU waste could be generated over the life of the project (i.e., 50 years) at LANL, assuming a production rate of 30 pits per year. For NEPA purposes, it is assumed that the available volume capacity of the WIPP facility would accommodate the conservatively estimated TRU waste volume from pit production that could be generated over the next 50 years. The relatively small increase in MLLW production under the Proposed Action would not be expected to adversely impact the current approach to SRS management of MLLW.
Human Health	The maximum cumulative offsite population dose is estimated to be about 30.3 person-rem per year for the regional population. This population dose is not expected to result in any LCFs to the population within a 50-mile radius of SRS. The maximum dose to the public MEI at the SRS boundary is estimated to be about 0.73 millirem per year, which is below the applicable DOE regulatory limits (10 millirem per year from airborne emissions, 4 millirem per year from the liquid pathway, and 100 millirem per year from all pathways). The maximum cumulative annual SRS worker dose could total 1,031.5 to 1,053.5 person-rem (based on 50 and 80 pits per year, respectively), which could result in up to 0.6 annual LCF. These doses fall within the regulatory limits of 10 CFR Part 835.
Transportation	The Proposed Action construction activities would generate commuter traffic. However, this commuter traffic would be less than what was needed for MFFF construction activities that occurred between 2007 and 2018. Area roads adequately supported those ongoing activities with no adverse effects on the level of service. Therefore, the overall contribution of construction activities to cumulative transportation impacts is expected to be negligible. With respect to radiological transportation, the Proposed Action would contribute less than one LCF and less than one traffic fatality to cumulative transportation risk.

CHAPTER 3

Affected Environment

3 AFFECTED ENVIRONMENT

In accordance with CEQ regulations, the affected environment is "interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment" (40 CFR 1508.14). Descriptions of the affected environment provide a *baseline* for understanding the potential direct, indirect, and cumulative impacts of the alternatives (Chapters 4 and 5). To analyze potential environmental impacts that could result from the implementation of each of the alternatives, NNSA compiled information about the environment at and around SRS. This chapter focuses specifically on describing the affected environment to support the analyses in Chapter 4, which evaluates the potential environmental impacts associated with implementation of the Proposed Action, and Chapter 5, which presents the potential cumulative impacts. The scope of the affected environment discussions varies with each resource to ensure inclusion of relevant issues. This EIS evaluates the environmental impacts of the alternatives within a defined *region of influence* (ROI), as described for each resource below. The ROIs encompass geographic areas within which any significant impact would be expected to occur. For example, human health risks to the general public from exposure to airborne radiological emissions are assessed for an area within a 50-mile radius of the proposed SRPPF. The level of detail in the description of each resource varies with the likelihood of a potential impact to the resource. The following resources are described in this chapter.

- **Land use and visual resources:** land use practices and land ownership information; visual resources in terms of land formations, vegetation, and color, and the occurrence of unique natural views. The ROI for land use and visual resources is F Area, SRS, and areas immediately adjacent to SRS.

- **Geology and soils:** the geologic characteristics of the area at and below the ground surface, the frequency and severity of seismic activity, and the kinds and qualities of soils. The ROI for geology and soils is F Area, SRS, and nearby offsite areas.

- **Water resources:** surface-water and groundwater features, water quality, and water use. The ROI for water resources is onsite and adjacent surface water bodies and groundwater.

- **Meteorology, air quality, and noise:** climatic conditions such as temperature and precipitation, the quality of the air, and greenhouse gas emissions; baseline noise environment for F Area. The ROI for meteorology, air quality, and noise is SRS and nearby offsite areas within the Interstate *Air Quality Control Region* (Augusta-Aiken AQCR) Code No. 53, where significant air quality or noise impacts could potentially occur.

- **Ecological resources:** plants and animals that live in the area, including aquatic life in the surrounding surface waters, and the occurrence of threatened or endangered species. The ROI for ecological resources is F Area, SRS, and adjacent areas.

- **Cultural and paleontological resources:** historic and archaeological resources of the area and the importance of those resources. The ROI for cultural resources is F Area, SRS, and adjacent areas.

- **Infrastructure:** utilities, energy, and site services, including site capacities and demands. The ROI for infrastructure is SRS.
- **Socioeconomics and environmental justice:** the labor market, population, housing, some public services, and personal income; location of low-income and minority populations within a 50-mile radius of the project location. The socioeconomics ROI is a four-county area (i.e., Aiken and Barnwell counties, South Carolina, and Columbia and Richmond counties, Georgia) in which more than 86 percent of SRS employees reside. The ROI for environmental justice includes parts of 28 counties throughout South Carolina and Georgia that make up an area within a 50-mile radius of the proposed SRPPF.
- **Waste management:** ongoing solid, hazardous, and radioactive waste generation and management practices, the kinds of waste currently managed at SRS, and the current waste capacities for disposal and management. The ROI for waste management is F Area, SRS, and offsite locations where waste management activities could occur.
- **Human health and safety:** the existing public and occupational safety conditions and estimates of radiation dose to the public and workers from existing radiological sources; baseline conditions to support analysis of potential accident scenarios. The ROI for human health and safety is F Area, offsite areas within a 50-mile radius of the proposed SRPPF, and the transportation corridors between SRS and other sites where workers and the general population could be exposed to radiation, radionuclides, and hazardous chemicals.
- **Transportation:** the existing transportation systems in the area to facilitate analysis of impacts locally and nationally related to transportation of radiological materials. The ROI for transportation is SRS, adjacent areas, and the corridors between SRS and other sites where radiological and hazardous material transportation could occur.

3.1 LAND USE AND VISUAL RESOURCES

3.1.1 Land Use

This section briefly describes land use patterns on and around SRS. “Land use” is the term used to describe the human use of land. It represents the economic and cultural activities (e.g., agricultural, residential, industrial, mining, and recreational uses) that are practiced at a given place (EPA 2018a).

3.1.1.1 General Site Description

Located in southwestern South Carolina, SRS occupies an area of approximately 198,000 acres in a generally rural area about 25 miles southeast of Augusta, Georgia, and 12 miles south of Aiken, South Carolina, the nearest population centers (see Figure 1-1 in Chapter 1). It is bordered by the Savannah River to the southwest and includes portions of three South Carolina counties: Aiken, Allendale, and Barnwell (SRNS 2018a, p. 1-6). SRS is a controlled area, with public access being limited to through traffic on State Highway 125 (SRS Road A), U.S. Highway 278 (SRS Road 1), and the CSX railway line (NNSA 2015, p. 3-3).

Regional land uses in the vicinity of SRS include agricultural, recreational, industrial, and to a lesser extent urban and residential. SRS is bordered mostly by forest and agricultural land. The nearest residences are located to the west, north, and northeast, some within 200 feet of the SRS boundary (NNSA 2015, p. 3-3). Farming is diversified throughout Aiken, Allendale, and Barnwell counties and includes such crops as corn, hay, peanuts, cotton, and winter wheat (USDA 2014). Industrial areas are also present within 25 miles of SRS; industrial facilities include textile mills, polystyrene foam and paper plants, chemical processing plants, the Barnwell Disposal Facility for LLW, and a commercial nuclear power plant. Open water and nonforested *wetlands* occur along the Savannah River Valley. Recreational areas within 50 miles of SRS include Sumter National Forest, Santee National Wildlife Refuge, and Clark's Hill/Strom Thurmond Reservoir. State, county, and local parks include Redcliffe Plantation, Rivers Bridge, Barnwell State Park, Aiken State Natural Area, all in South Carolina, and Mistletoe State Park in Georgia. The Crackerneck Wildlife Management Area occupies a portion of SRS along the Savannah River and is open to the public for hunting and fishing at certain times of the year (NNSA 2015, p. 3-3).

The South Carolina Councils of Governments were formed in 1967, when the state was divided into 10 planning districts. Six counties are included in the Lower Savannah River Planning District and include Aiken, Allendale, and Barnwell counties, the three counties within which SRS is located (LSCOG 2017). Private lands bordering SRS are subject to the planning regulations of these three counties (NNSA 2015, p. 3-3).

Land use at SRS can be classified into three major categories: forest/undeveloped, water/wetlands, and developed facilities. Open fields and pine and hardwood forests make up 73 percent of the site, while 22 percent is wetlands, streams, and two lakes. Production and support areas, roads, and utility corridors account for the remaining 5 percent of the land area (DOE 2005a, p. 3-8). The U.S. Forest Service (USFS), under an interagency agreement with DOE, manages natural resources on about 170,000 acres (USDA 2019). Public hunts for white-tailed deer (*Odocoileus virginianus*), feral hogs (*Sus scrofa*), wild turkeys (*Meleagris gallopavo*), and coyote (*Canis latrans*) are allowed on SRS. In 2018, a total of 275 deer, 66 feral hogs, 14 coyotes, and 27 turkeys were harvested from SRS (SRNS 2019e, p. 5-31). There are soil map units that meet the requirements for *prime farmland* soils on the site. However, the Natural Resources Conservation Service of the U.S. Department of Agriculture does not identify these as prime farmlands because the land is not available for agricultural production (NNSA 2015, p. 3-4).

DOE makes decisions on future land uses at SRS through site development, land use, and future planning processes. SRS has established the Land Use Technical Committee made up of DOE, the management and operating contractor, and other SRS organizations (NNSA 2015, p. 3-4). DOE has prepared a number of documents addressing the future of SRS, including the *Savannah River Site End State Vision* (DOE 2005a), the *Ten-Year Site Plan FY 2016–FY 2025* (NNSA-SRFO 2015), and the *Real Property Five-Year Site Plan FY 2019–2023* (NNSA 2018f). The Environmental Management Cleanup Project is expected to continue through 2065 (NNSA 2018f, p. 1-1), and ongoing NNSA nuclear industrial missions are long-term missions that will continue beyond. SRS is a site with an enduring mission and is not a closure site; thus, SRS land will be federally owned, controlled, and maintained in perpetuity (DOE 2005a, p. 4; NNSA-SRFO 2015, p. 2; NNSA 2018f, p. 1-1).

As depicted in Figure 3-1, the site has been divided into six management areas based on existing biological and physical conditions, operations capability, and suitability for mission objectives. The 38,444-acre Industrial Core Management Area contains the major SRS facilities. The primary objective of this area is to support facilities and site missions. Other important objectives are to promote conservation and restoration, provide research and educational opportunities, and generate revenue from the sale of forest products. Protection of the red-cockaded woodpecker (*Picoides borealis*) dominates natural resource decisions in the 87,200-acre Red-Cockaded Woodpecker Management Area and the 47,100-acre Supplemental Red-Cockaded Woodpecker Management Area (DOE 2005b, p. 3-5). The Crackerneck Wildlife Management Area and Ecological Reserve is 10,600 acres and is managed by the South Carolina Department of Natural Resources (SCDNR 2019a). The primary objective of this management area is to enhance wildlife habitat through forestry and wildlife management practices. The management objective of the 10,000-acre Savannah River Swamp and 4,400-acre Lower Three Runs Corridor Management Area is to improve the physical and biological quality of the wetland environment (DOE 2005b, p. 3-6).

In 1972, all of SRS was designated a National Environmental Research Park. The purpose of the National Environmental Research Park is to conduct research and education activities to assess and document environmental effects associated with energy and weapons material production, explore methods for eliminating or minimizing adverse effects of energy development and nuclear materials on the environment, train people in ecological and environmental sciences, and educate the public (SREL 2019a). DOE has also established a set-aside program to provide reference areas for understanding human impacts on the environment. The SRS set-aside program currently contains 30 research reserves totaling 14,006 acres. These reserves were chosen as representatives of the eight major vegetation communities on the site (SREL 2019b).

3.1.1.2 Proposed Facility Location

The proposed SRPPF complex would be located in F Area adjacent to and including a repurposed MFFF. The F Area is highly developed and covers approximately 364 acres near the center of the site (DOE 2002, p. 3-32). It is located 5.8 miles from the site boundary and is within the Industrial Core Management Area. The area includes nuclear, industrial, warehouse, laboratory, and administrative facilities (NNSA 2015, p. 3-6).

The MFFF is located in the northern portion of the F Area, as shown in Figure 2-1 of Chapter 2. DOE began construction of the MFFF in August 2007 and construction ceased on October 10, 2018, when DOE terminated the contract for the facility. The MFFF contains three floors, 400,000 square feet of space, stands approximately 73 feet above grade, with a building footprint of approximately 120,000 square feet. Other large concrete structures, smaller administrative and support buildings, trailers, and parking lots are adjacent to the MFFF and make up the MFFF complex.

3.1.2 Visual Resources

Visual resources are natural and manmade features that give a particular landscape its character and aesthetic quality. Landscape character is determined by the visual elements of form, line, color, and texture. All four elements are present in every landscape; however, they exert varying degrees of influence. The more visual variety that exists with harmony, the more aesthetically pleasing the landscape (DOI 1986; NNSA 2015, p. 3-6).

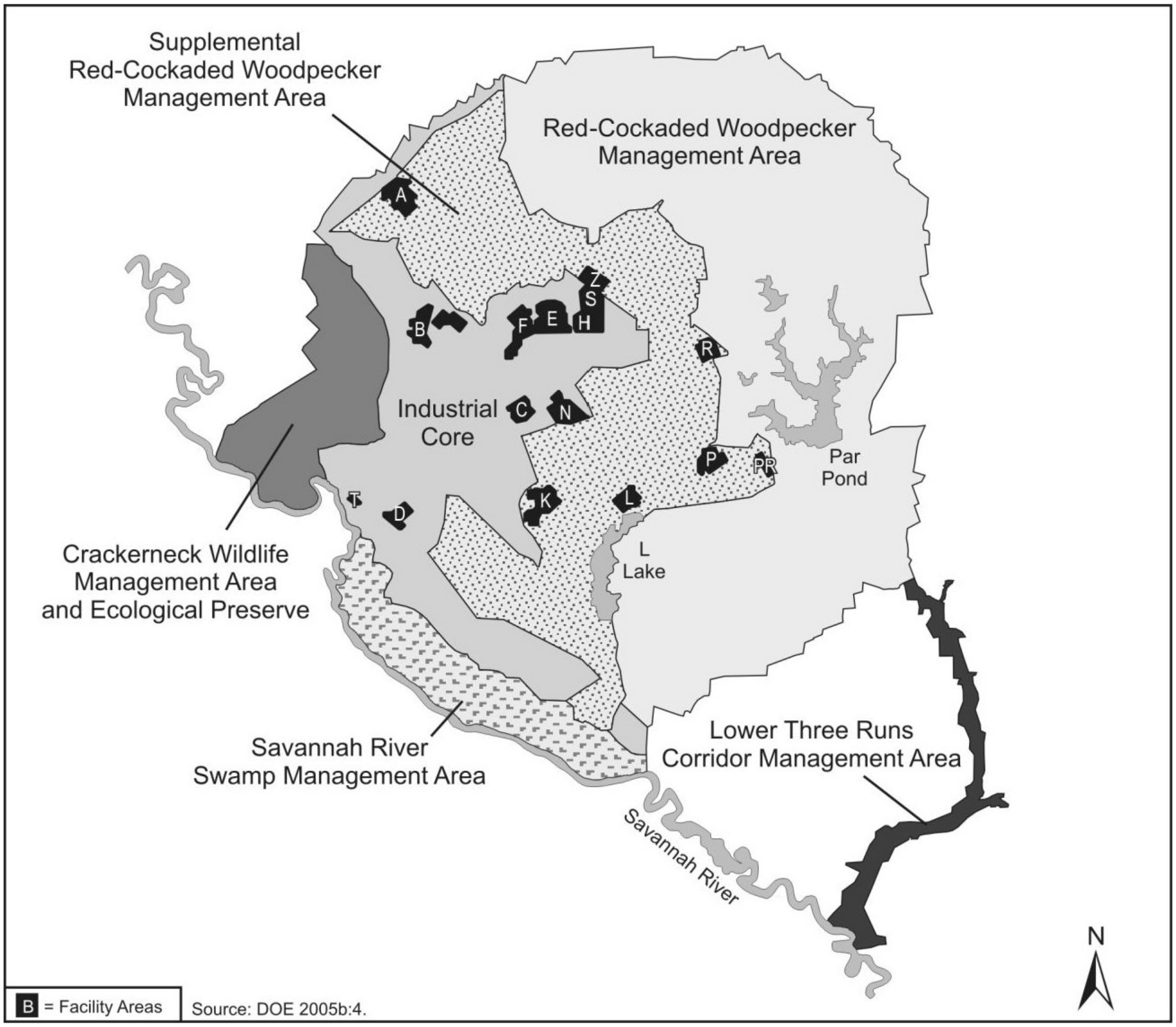


Figure 3-1—Savannah River Site Management Areas (Source: NNSA 2015)

3.1.2.1 General Site Description

The dominant viewshed in the vicinity of SRS consists mainly of agricultural land and forest, with some limited residential and industrial areas. The SRS landscape is characterized by wetlands and upland hills. Vegetation includes bottomland hardwood forests, scrub oak and pine forests, and forested wetlands. Facilities are scattered throughout SRS and are brightly lit at night. These facilities are generally not visible off site, as views are limited by rolling terrain, normally hazy atmospheric conditions, and heavy vegetation. The only areas visually impacted by the DOE facilities are those within the view corridors of State Highway 125 and U.S. Highway 278 (NNSA 2015, p. 3-6; DOE 1999b, p. 3-166).

The developed areas and utility corridors (transmission lines and aboveground pipelines) of SRS are consistent with a *Visual Resource Management* Class IV designation. The remainder of SRS is consistent with a Visual Resource Management Class II or Class III designation (Table 3-1). Management activities within Class II and Class III areas may be seen, but do not dominate the view; management activities in Class IV areas dominate the view and are the focus of viewer attention (DOI 1986, pp. 6 and 7).

Table 3-1—Visual Resource Management Classes

Class	Objective
I	Preserves the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity.
II	Retains the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen but should not attract the attention of the casual observer.
III	Partially retains the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer.
IV	Involves major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention.

Source: DOI 1986

3.1.2.2 Proposed Facility Location

The MFFF, which would be repurposed for the proposed SRPPF, is located within the northern portion of F Area. The MFFF is approximately 73 feet above grade, with a building footprint of approximately 120,000 square feet.

Industrial facilities within F Area consist of large concrete structures, smaller administrative and support buildings, trailers, and parking lots. The structures range in height from 10 to 100 feet, with a few stacks and towers that reach up to 200 feet. The industrial facilities are brightly lit at night and visible when approached via SRS access roads (DOE 1999b, p. 3-164). Visual resource conditions within F Area are consistent with a Visual Resource Management Class IV designation. F Area is about 4.3 miles from State Highway 125 and 5.3 miles from U.S. Highway 278. Public views of the facilities within F Area are restricted by heavily wooded areas and the nature of the terrain bordering segments of State Highway 125 and U.S. Highway 278. Moreover, facilities are not visible from the Savannah River, which is about 6.2 miles from F Area (DOE 1999b, p. 3-166).

3.2 GEOLOGY AND SOILS

This section begins with a general discussion of the regional geological characteristics followed by more site-specific details of the SRS and MFFF location. The affected environment is described below with respect to geologic and topographic setting; SRS stratigraphy; tectonic characteristics including *faults* and seismicity and earthquakes; surface and subsurface stability; and soils and mineral resources. Much of the discussion on the regional, SRS, and MFFF *geology* and soil characteristics is based on detailed discussions presented in the revised *Mixed Oxide Fuel Fabrication Facility License Application* (CB&I AREVA 2015) and the SPD SEIS (NNSA 2015).

3.2.1 Geologic and Topographic Setting

SRS is located on the southeastern Atlantic Coastal Plain (a wedge of unconsolidated river and marine sediments), in an area named the Aiken Plateau. The center of SRS is about 25 miles southeast of the geologic fall line (an area where the sandy soils of the Coastal Plain meet the rocky terrane at the base of the area foothills). Older geologic formations have been leveled by erosion and are overlain by younger, unconsolidated-to-poorly consolidated Coastal Plain sediments (SRNS 2019e, Sec. 1.4.2). This erosional surface dips approximately 37 feet per mile toward the southeast. The Atlantic Coastal Plain sediments in South Carolina are stratified sand, clay, limestone, and gravel that dip gently seaward. Near the coast, the wedge is approximately 4,000 feet thick (CB&I AREVA 2015, p. 1-290). The Aiken Plateau, on which the central and northeastern portions of SRS are located, is highly eroded and characterized by broad flat areas cut by narrow, steep-sided valleys. The southwestern portions of SRS are located on erosional terraces. The terraces are the result of successive marine recessions during the glacial periods about 10,000 to 1 million years ago (NNSA 2015, p. 3-7). The Atlantic Coastal Plain sedimentary sequence near the center of SRS consists of about 1,000 feet of sand, clay, and silt formations.

3.2.2 SRS Stratigraphy

The sedimentary sequence of rocks at SRS is divided into formations and delineated by detailed sedimentary characteristics. Of note is a formation called the Tinker/Santee, which consists of 50 to 70 feet of moderately sorted yellow and tan sand, calcareous sand and clay, and limestone (CB&I AREVA 2015, p. 1-297). This layer is noteworthy because it contains small, discontinuous, thin calcareous sand zones (i.e., sand containing calcium carbonate) that are subject to dissolution by water. These *soft-zone* areas could subside, potentially causing settling of the ground surface (NNSA 2015, p. 3-8). Soft zones occur throughout SRS but are more prevalent moving across the site to the southeast. The soft zones consist of soil rather than open water-filled cavities. These zones were encountered in exploratory borings in F Area, H Area, K Area, and S Area at depths between 100 and 150 feet. Early studies by the U.S. Army Corps of Engineers identified these soft zones as potential concerns for facility foundation design. Overlying the Tinker/Santee Formation are additional deposits that are preserved primarily in terraces along the Savannah River.

3.2.3 Tectonic Characteristics

Tectonic characteristics consist of geological structural elements including faults and seismicity and earthquakes. The following provides a description of tectonic characteristics as they relate to SRS.

3.2.3.1 Faults

The only known faults capable of producing an earthquake within a 200-mile radius of SRS are within the Charleston seismic zone, approximately 70 miles southeast of SRS (NRC 2005a, p. 3-4). Many SRS investigations and an extensive literature review have been used to reach the conclusion that there are no known *capable* or active faults within a 200-mile radius of the site that influence the seismicity of the region, with the exception of the blind, poorly constrained faults associated with the Charleston seismic zone (CB&I AREVA 2015, p. 1-285).

No faults are evident at the surface in the SRS area, although surface exposures of a northeast-trending *reverse fault* having *Cretaceous* and early *Tertiary* displacement were mapped northwest of SRS. Similar northeast-trending reverse faults have been recognized in the Cretaceous and lower Tertiary strata in the subsurface of SRS through subsurface profiling using field instrumentation and confirmatory core drilling (Prowell 1996, p. 4-5). Geophysical studies of SRS have identified seven subsurface faults: Pen Branch, Steel Creek, Advanced Tactical Training Area, Crackerneck, Ellenton, Upper Three Runs, and an unnamed fault that passes approximately 0.5 mile south of F Area, between F Area and Fourmile Branch. The actual faults do not reach the surface, stopping several hundred feet below grade, and therefore do not present any surface expression or displacement at ground level.

Richter Magnitude

The magnitude of most earthquakes is measured on the Richter scale. The Richter magnitudes are based on a logarithmic scale (base 10), which means that for each whole number increase on the Richter scale, the amplitude of the ground motion recorded by a seismograph goes up 10 times. Using this scale, a magnitude 5 earthquake would result in 10 times the level of ground shaking as a magnitude 4 earthquake.

Modified Mercalli Intensity

The effect of an earthquake on the earth's surface is called the intensity. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently used in the United States is the Modified Mercalli Intensity Scale. This scale, composed of 12 increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead, it is a subjective ranking based on observed effects.

The Pen Branch fault has been regarded as the primary structural feature at SRS that has the characteristics necessary to pose a potential seismic risk. The fault is located southeast of K Area, trends in a northeast-southwest direction, and dips steeply to the southeast (DOE 1990c, p. 3-15). In the crystalline basement rocks beneath the sedimentary formations, fault movement was originally down to the southeast. However, movement during Cretaceous into Tertiary time was reverse, that is, up to the southeast. There could also be a component of lateral movement. The bulk of evidence collected for the Pen Branch fault program supports the conclusion that the most recent faulting on the Pen Branch fault is older than 500,000 years. Therefore, the Pen Branch fault is not a capable fault (CB&I AREVA 2015, p. 1-320).

3.2.3.2 Seismicity and Earthquakes

With nearly three centuries of available seismic data, the Charleston and Summerville, South Carolina areas remain the most seismically active region affecting SRS. However, levels of earthquake activity within this region are usually low, with magnitudes generally less than or equal to 3.0 on the *Richter scale*. The Charleston earthquake of 1886 (estimated Richter scale magnitude of 6.8) is the most damaging earthquake known to have occurred in the southeastern United States and one of the largest historic shocks in eastern North America. At SRS, this earthquake had an estimated Richter scale magnitude ranging from 6.5 to 7.5. This earthquake had an estimated *Modified Mercalli Intensity* of X; it damaged or destroyed many buildings in the old city of Charleston, killed 60 people, and produced structural damage up to several hundred miles from its epicenter. The SRS area experienced an estimated *peak ground acceleration* (PGA) of 0.10 *g* (one-tenth the acceleration of gravity) during this event (NRC 2005a, p. 3-4).

Only two moderate-size earthquakes have occurred within 250 miles of SRS since the turn of the 20^{th} century (USGS 2019a). The most recent event occurred on August 9, 2020, near Sparta, North Carolina, approximately 220 miles north of SRS with a Richter scale magnitude of 5.1. The earthquake occurred as a result of faulting in the upper crust of the North American plate and occurred in the interior of the plate. Such mid-plate earthquakes are known as intraplate earthquakes and are generally less common than earthquakes that happen near tectonic plate boundaries. The earthquake could be felt in some areas surrounding SRS with reported Modified Mercalli Intensity values of II to III (USGS 2020).

In 2014, the U.S. Geological Survey (USGS) issued a report (Petersen et al. 2014) that updates the 2008 United States National Seismic Hazard Maps (Petersen et al. 2008). The 2014 report provides updated seismic hazard maps for the entire country and is updated roughly every five to six years to account for new evidence and improvements in the field of seismology. The 2014 report also provides comparative maps that depict the change in seismic hazards since the 2008 report was published. NNSA evaluated the 2014 report to determine if the earthquake hazard, as depicted in the USGS maps, has significantly changed at SRS. Probabilistic PGA (horizontal) data were used to indicate seismic hazard. The PGA values cited are based on a two-percent probability of exceedance in 50 years. This corresponds to an annual occurrence probability of about 1 in 2,500. The USGS estimate for PGA at depth at the MFFF changed from about 0.17 *g* in 2008 to about 0.156 *g* in 2014, an approximately eight-percent decrease in ground motion (USGS 2019a). Most of the PGA is related to the proximity of SRS to the Charleston seismic zone and not from locally generated earthquakes or from more distant moderate-sized earthquakes in the region.

Local seismicity associated with the SRS and surrounding region is characterized by occasional small shallow events associated with strain release near small-scale faults, intrusive bodies, and the edges of metamorphic geologic formations (WSRC 2000, p. 125). Six earthquakes recorded by the USGS with Richter magnitudes between 2.0 and 3.0 and Modified Mercalli Intensities of III or less have occurred on or near SRS during recent years (1985, 2001, 2006, 2009, 2011, and 2015) with focal depths ranging between approximately 0.4 and 6.2 miles (USGS 2019a). The 2001 earthquake was the closest seismic event to F Area, with a local magnitude of 2.6 and a focal depth of 1.7 miles. Its epicenter was approximately 3 miles north of F Area. Earthquakes of this magnitude are generally not felt but do register on seismic instruments and typically would result in little to no structural damage at SRS. Earthquakes capable of producing structural damage are not likely to originate in the vicinity of SRS (NNSA 2015, p. 3-8).

3.2.4 Surface and Subsurface Stability

Surface engineered and natural slopes in the vicinity of the MFFF have been evaluated during original planning for the site. The nearest cut slopes are more than 400 feet both north and west from the existing MFFF structures and are 15 feet high (CB&I AREVA 2015, p. 3-393). Shallow, poorly drained, elliptical depressions with associated sand rims within the surficial sediments are characteristic of the area and are termed *Carolina bays*. A total of 197 Carolina bays have been identified at SRS (CB&I AREVA 2015, p. 1-303). Several hypotheses have been provided for the timing and mode of origin for these bays. The most likely explanation of formation suggests that the bays were formed by action of strong unidirectional wind on water ponded in surface depressions. The resulting waves caused the formation of the sand rims as shoreline features, and the sand rims formed perpendicular to the wind direction. The surficial features have no effect on the subsurface sediments. Slope stability from existing topography and engineered modifications at the MFFF ensure drainage and erosion characteristics have been addressed.

As explained in Section 3.2.2, subsurface locations across SRS contain soft zones interspersed with stronger matrix materials at depths between 100 and 150 feet. The soft zones at SRS and at the MFFF are stable under static conditions. The Tinker/Santee Formation, in which soft zones are found, is generally in the saturated zone, well below the *water table*. Here the sediments are in a stable chemical environment, and carbonate dissolution is minimal. The geologic record at SRS shows that soft zones encountered today have withstood the earthquakes that have occurred since their formation. Exploration programs indicated that soft zones at the MFFF are isolated and found as soft soil pockets at depth (CB&I AREVA 2015, pp. 1-392–1-393).

Subsurface soils at the MFFF have also been evaluated to determine whether they have any potential for *liquefaction* during earthquake events. The potential for liquefaction has been determined using the established *groundwater* levels for the site, including laboratory and geophysical parameters (CB&I AREVA 2015, p. 1-392). These geotechnical investigations demonstrate the acceptability of the MFFF with respect to liquefaction and post-earthquake dynamic settlement. The investigations also demonstrate that the 1886 Charleston earthquake control motion is the controlling earthquake motion for liquefaction and post-earthquake dynamic settlement for the site (NNSA 2015, p. 3-9).

3.2.5 Soils and Mineral Resources

Many different soils exist on SRS, and, in some areas, change within a short distance. SRS soils range from seasonally wet and hydric to well drained. Composition ranges from mostly sand-sized particles with high hydraulic conductivity rates to high clay content with moderately low to low hydraulic conductivity rates. These differences, where the areas are large enough, are shown as a soil series within a mapping unit. A mapping unit is an area dominated by one major kind of soil accompanied by other similar soils. Four orders and 28 soil series are recognized on SRS (Wike et al. 2006, p. 1-4). Of the 28 soil series, 9 are on the list of hydric soils of the SRS. Hydric soils are formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic condition in the upper part. This is an important soil characteristic used for wetland identification. On SRS, there are sizable areas where the upper 6 feet of soil has been altered to the extent that the soil profile cannot be identified.

Most SRS soils within the fence lines of E Area, F Area, H Area, K Area, and S Area have been disturbed to accommodate buildings, parking lots, and roadways. Disturbed soils within these areas are considered to be urban land where covered by structures or well-drained, heterogeneous soil materials that are the spoil or refuse from excavations and major construction activities and are often heavily compacted (NNSA 2015, p. 3-10).

The surface soils allow precipitation to drain rapidly. Because of their sandy texture and drainage characteristics, some soil units at SRS meet the requirements as prime farmland. However, the Natural Resources Conservation Service does not identify these areas as prime farmland because they are not available for agricultural use (NRC 2005a, p. 3-5).

The mixed sands, gravels, and clays commonly found beneath SRS are widespread and therefore are of limited commercial value as a mineral resource. A possible exception might be well-sorted quartz sand, which is valuable as a filtration medium, an abrasive, and engineering backfill (NNSA 2015, p. 3-9).

3.3 WATER RESOURCES

3.3.1 Surface Water

3.3.1.1 General Setting

SRS lies almost entirely within the Savannah River Basin and within the smaller area designated the Middle Savannah River watershed (Hydrographic Unit Code [HUC] 03060106) (SCDHEC 2019a; Seaber et al. 1987). Surface water drainage within the SRS is generally toward the Savannah River, the predominant surface water feature of the region, or toward tributaries that flow to the Savannah River. The river borders the southwest side of the site and also provides the demarcation between the states of South Carolina and Georgia. The only portion of SRS not draining toward the Savannah River is a small area on the northeast side, where drainage is eastward toward the Salkehatchie River and within the Salkehatchie River watershed (HUC 03050207) (SCDHEC 2019a). As can be seen in Figure 3-2, the Savannah River Basin, labeled "Savannah" in the figure, extends the entire length of the southwestern side of the state. SRS extends roughly from side to side in the Middle Savannah River watershed in the same general area as the HUC label "03060106" in the figure. The Salkehatchie River watershed is adjacent to the east side of this area and extends southward to the coast.

The Savannah River along the SRS boundary (about 35 miles) has a wide channel with numerous tributaries and extensive *floodplain* swamps (NNSA 2015, p. 3-11). The USGS maintains records on a Savannah River gauging station (identified as "USGS 021973269 Savannah River Near Waynesboro, GA") adjacent to SRS. According to these records, the daily average flow in this area over the last 13 years has a mean value of 6,090 cubic feet per second; the minimum daily average occurred in 2008 at 4,240 cubic feet per second; and the maximum daily average occurred in 2005 at 12,200 cubic feet per second (USGS 2019b).

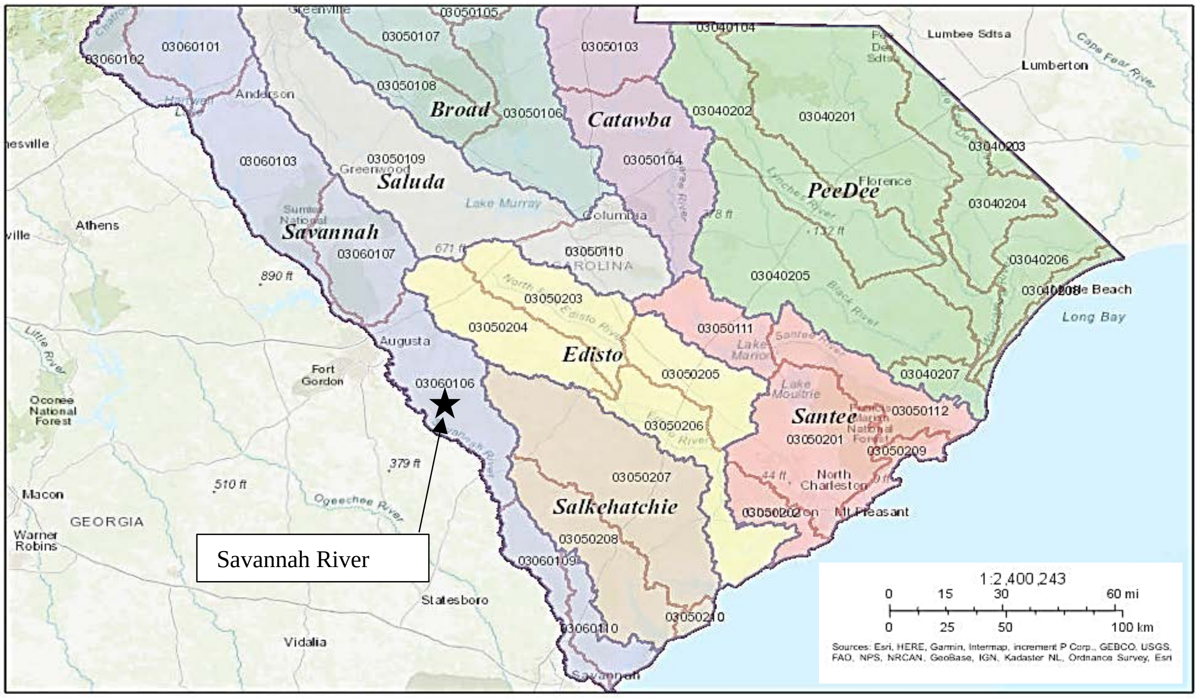


Figure 3-2—South Carolina River Basins and Watersheds (Source: SCDHEC 2019a)

In addition to the Savannah River along SRS's southwestern border, several smaller streams, creeks, and their tributaries cross the site, some even originating within its boundaries. Figure 3-3 provides an overview of the stream systems found within SRS. As can be seen in the figure, F Area lies roughly midway between Upper Three Runs Creek to the north and Fourmile Branch (also known as Fourmile Creek) to the south. Both streams drain to the southwest, eventually reaching the Savannah River. According to the online South Carolina Watershed Atlas, the northern portion of F Area is within the Middle Upper Three Runs local watershed (SCDHEC 2019a), and the natural drainage for the area of the MFFF is northward to the Upper Three Runs Creek. Par Pond and L Lake are manmade ponds that drain to Lower Three Runs and Steel Creek, respectively (Figure 3-3). Other SRS surface water features not shown in the figure include roughly 50 small manmade ponds and 300 natural depressions, referred to as Carolina bays, that are capable of accumulating water from *stormwater* runoff. SRS operations do not include *effluent* discharges into any Carolina bays (NNSA 2015, p. 3-11).

None of the SRS streams or tributaries, including the Savannah River along the site's border, are federally designated Wild and Scenic Rivers or State-designated Scenic Rivers (NNSA 2015, p. 3-11). As noted above, there are significant floodplain swamps associated with the Savannah River in the SRS area. The Federal Emergency Management Agency's (FEMA's) Flood Insurance Rate Maps (e.g., Map Number 45011C0275D), as well as the online South Carolina Watershed Atlas (SCDHEC 2019a), show the river's 100-year flood zone extending as far as one to three miles into the SRS along parts of the site's southwest border. At its nearest, F Area is about seven miles from the river. FEMA Flood Insurance Rate Maps 450002-0695F and

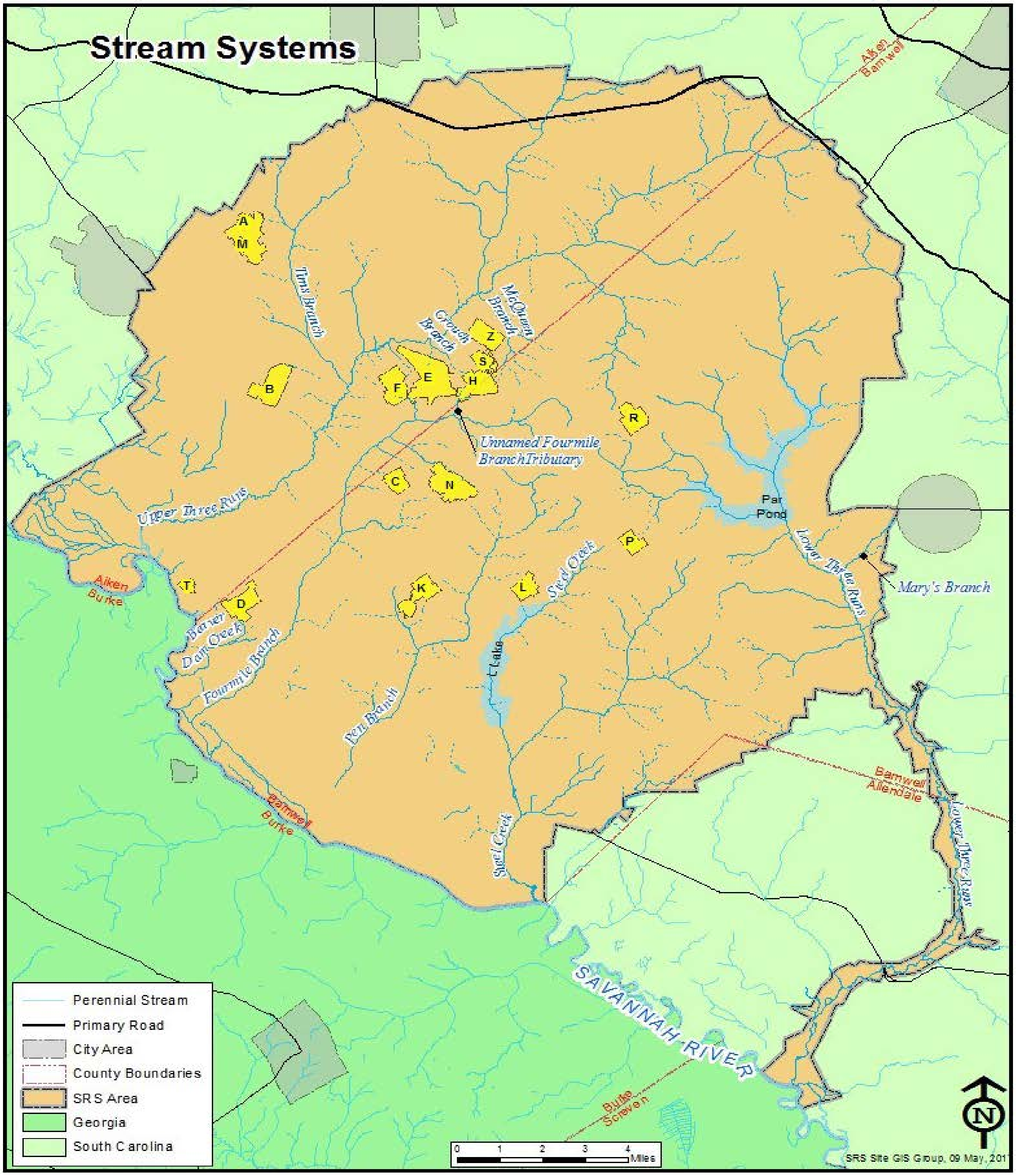


Figure 3-3—Stream Systems within SRS (Source: SRNS 2018a, Fig. 1-2)

450002-0700F also show a 100-year flood zone for Upper Three Runs Creek, the nearest waterbody to the MFFF. The irregular floodplain for this creek appears to extend several hundred feet toward the MFFF in places, but the distance between the creek's normal bed and the nearest edge of the cleared area around the MFFF is upward of 2,000 feet. DOE regulations require that activities determined to be critical actions, where any adverse impacts from flooding would be unacceptable, be evaluated for potential impacts from the larger, but less frequent, 500-year flood event. In 2000, SRS reported the results of a hydrologic study to develop facility-specific probabilistic flood hazard curves to determine flood elevations as a function of return period for SRS facilities. Return periods considered extended to 100,000 years. With regard to F Area, the study concluded that the probabilities of facility flooding from either Upper Three Runs Creek or Fourmile Branch are significantly less than 0.00001 per year (Chen 2000). That is, water elevations in either stream from a 100,000-year flood event would not reach F Area.

3.3.1.2 Water Quality

State Regulation (R.) 61-69, "Classified Waters," Section H, "List of Waterbody Names, County(ies), Class, and Descriptions," classifies the Savannah River as a freshwater source (Class FW) where it is adjacent to SRS. This classification indicates the water is suitable for primary- and secondary-contact recreation, drinking water supply (after appropriate treatment), fishing, industrial use, and agricultural use. Further, in accordance with R.61-69, Section B, "Tributaries and Classified Waters," the SRS surface waters that flow to the Savannah River are also classified as Class FW, as they are not specifically listed in the regulation. R.61-68, "Water Classifications and Standards," establishes water quality standards, including numeric values for specific parameters and pollutants as well as narrative criteria, that are to be achieved and maintained in order to meet this classification. The South Carolina Department of Health and Environmental Control (SCDHEC) is the regulatory authority for this effort and it issues effluent discharge permits and performs surface water monitoring to ensure standards are met or, as appropriate, to develop corrective measures to get surface waters into compliance.

Section 303(d) of the *Clean Water Act of 1972* (33 U.S.C. § 1251, et seq.) requires states to develop and periodically update an inventory of water bodies that do not meet water quality standards (referred to as impaired waters) and, therefore, may not support designated uses. Surface waters not identified are considered to meet the standards for their classification and be suitable for the applicable designated uses. According to South Carolina's latest inventory (SCDHEC 2018a), impaired surface waters within or near SRS and a brief summary of the impairment's basis and status are as follows:

- **Upper Three Runs:** The lower section of Upper Three Runs, including Tim's Branch (see Figure 3-3), has been shown to be impaired due to high *Escherichia Coli* (E. Coli) levels. This contaminant impairs use of the stream for primary contact recreation. A total maximum daily load (TMDL) for E. Coli in these streams has been developed and approved as a means of bringing them into standards.

- **Fourmile Branch:** Sampling of Fourmile Branch near SRS Road A-7 has shown the stream to be impaired due to high E. Coli levels. A TMDL has not yet been established for this stream.

- **Lower Three Runs:** Sampling of Lower Three Runs at a location about 11 miles northwest of Allendale has shown the stream to be impaired due to high E. Coli levels. A TMDL has not yet been established for this stream.

- **Savannah River:** Sampling of the Savannah River adjacent to SRS, at a location near the Aiken-Barnwell county line, has shown the river to be impaired due to high mercury levels. The mercury levels impair aquatic life harvesting and fish consumption. High mercury levels have also been measured in river samples taken several miles upstream and downstream of SRS. A TMDL for this contaminant has not yet been established.

The SRS monitors its discharges of industrial *wastewater* and industrial stormwater at outfalls permitted under the National Pollutant Discharge Elimination System (NPDES) program, which is administered by the SCDHEC. SRS has two NPDES permits for industrial activities; one for D Area (Permit No. SC0047431) and one for the rest of the site (Permit No. SC0000175). The latter permit includes three outfalls on the northwest side of F Area and one on the southeast side (SRNS 2019e, Sec. 4.3.1). In 2018, SRS monitored 28 industrial wastewater outfalls for a permit-specified group of physical, chemical, and biological parameters and reported monthly results to the State. Roughly 2,610 analyses were performed on the samples and all analytical results were within NPDES permit limits.

In 2018, SRS also monitored 39 stormwater outfalls under its Industrial Stormwater General Permit (No. SCR000000) for a permit-specified group of physical, chemical, and biological parameters. The only F Area outfall under this permit is located near the southern extent of the area (SRNS 2019e, Sec. 4.3.1). These outfalls are sampled only during qualifying rain events. In 2018, the copper average at one outfall exceeded the permit benchmark limits. All other sample results and all other stormwater outfalls were in compliance with permit requirements, and corrective measures were taken at the outfall where high copper levels were detected (SRNS 2019e, Sec. 4.3.1).

SRS also performs radiological analyses on samples routinely collected from each liquid effluent discharge point that releases, or has the potential to release, radioactive material (SRNS 2019e, Sec. 5.4.1). Monitoring is also done on site streams and stormwater seepage basins as well as along the Savannah River. Results from these efforts are published in the annual SRS environmental report. Results for the 2018 monitoring effort indicate that tritium is the radionuclide released in the highest *curie* concentrations. Although tritium releases in 2018 were higher than in 2017, its release rate has shown a general decline over the past 10 years (SRNS 2019e, Sec. 5.4.1.1). The annual reports also present results of a dose assessment from all of the site's radiation releases and all reasonable exposure pathways. Results from the assessment of releases in 2018 indicate that the potential dose to a representative person from all SRS liquid releases was only 0.19 percent of the applicable limit (SRNS 2019e, Sec. 6.4.1.3) compared to 0.22 percent in 2017 (SRNS 2018a, Sec. 6.4.1.3).

3.3.2 Groundwater

3.3.2.1 General Setting

SRS, along with large portions of Alabama, northern Florida, Georgia, and South Carolina, is located over an area designated the Southeastern Coastal Plain Aquifer System. The USGS' *Ground Water Atlas of the United States* that covers this area (Miller 1990) describes this complex system as containing multiple regional *aquifers* separated by multiple regional confining units as well as many aquifers and confining units of local extent. At a more site-specific and appropriate discussion level, the *SRS Environmental Report for 2018* (SRNS 2019e) provides the schematic shown in Figure 3-4 to represent the generalized groundwater flow regime beneath the site. As can be seen in the figure, there are four aquifer layers beneath the site that are separated, although site that are separated, although not always continuously, by layers that act as confining units. These confining units are sometimes named by the aquifer that they confine. In Aiken County, where roughly the northern third of SRS is located, the Crouch Branch aquifer occurs from approximately 200 to 300 feet below land surface and the McQueen Branch occurs from approximately 325 to 450 feet below land surface. Most of the wells in Aiken County are screened across both of these aquifers (USGS 2019c). It should be noted that some documents, including references cited in this EIS (e.g., NNSA 2015, Sec. 3.1.3.2), describe the local aquifer system beneath SRS with different names. The designations in Figure 3-4 are used here as those most commonly used within the SRS community and to be consistent with conditions and monitoring results reported in the SRS environmental reports.

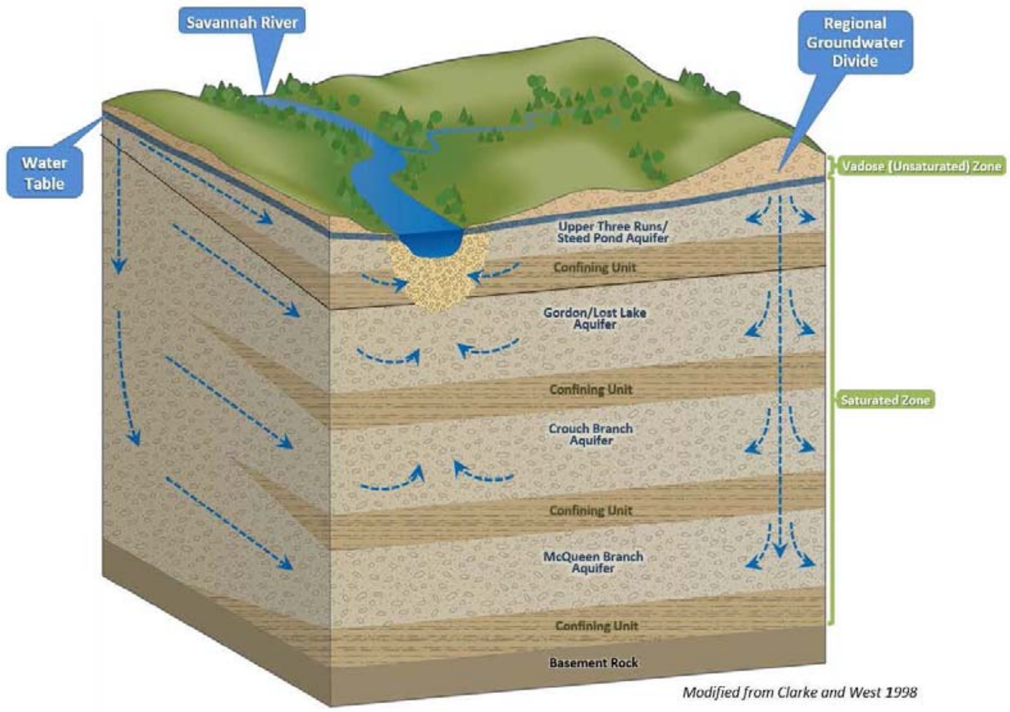


Figure 3-4—Generalized Groundwater Flow System at the SRS
(Source: SRNS 2019e, Fig. 7-1)

As can be seen in Figure 3-4, groundwater movement is largely horizontal toward local discharge zones along streams, but some movement is downward into deeper aquifers, some even reaching the regional flow system. SRS groundwater velocities in confining units are low, generally in the range of several inches to several feet per year; while velocities in aquifers can range from tens to hundreds of feet per year (NNSA 2015, Sec. 3.1.3.2).

Water use at SRS (see Section 3.3.3) includes the use of groundwater to support facility processes as well as for drinking water. Groundwater contamination from past SRS actions, as discussed in Section 3.3.2.2, predominantly occurs in the shallow aquifers, specifically the Upper Three Runs and Gordon Aquifers. The SRS's drinking water wells generally pull water from the deeper Crouch Branch and McQueen Branch Aquifers (SRNS 2018b, Sec. 2.2).

Under F Area, the direction of groundwater flow varies in the different aquifers depending on the locations and depths of streams that intersect the aquifers. The shallow Upper Three Runs aquifer flows primarily to the north, discharging into Upper Three Runs Creek. Its water also moves downward into the Gordon aquifer. Water in the Gordon aquifer flows horizontally toward the Savannah River. Groundwater in deeper aquifers flows horizontally southwest toward the river and the coast level (CB&I AREVA 2015, p. 1-263). The water table of the upper aquifer at F Area is found at a depth of about 100 feet below existing ground level (NNSA 2015, p. 3-17).

3.3.2.2 Groundwater Quality

A USGS overview of a project to evaluate groundwater availability in Aiken County (USGS 2019c) describes the county's groundwater quality as generally high quality, requiring little treatment prior to use. SRS groundwater is generally soft, slightly acidic, and low in dissolved solids with high dissolved iron concentrations in some aquifers (CB&I AREVA 2015, p. 1-264). As described further in Section 3.3.3, most of the SRS obtains its drinking water from groundwater wells. SRS operates a central water treatment facility in A Area that gets its water from several wells. The treatment facility feeds a water distribution system that provides drinking water to most of SRS, including F Area, as well as several facilities farther south. This water system meets State and Federal drinking water quality standards. SCDHEC samples the system quarterly for chemical analyses (SRNS 2019e, Sec. 7.3.4) and requires SRS to collect 10 bacteriological samples each month from varying locations within the system (SRNS 2019e, Sec. 3.3.7.2). All drinking water samples collected in 2018 (the latest report available) complied with applicable water quality standards (SRNS 2019e, Sec 7.3.4). SRS also samples the drinking water system routinely for radiological contaminants and for lead and copper every three years. In 2018, gross alpha and gross beta screening was performed on drinking water samples and results indicated EPA's limits on alpha (15 pCi/L) and beta (50 pCi/L) were not exceeded. Sample results also indicated standards for tritium (at 20 pCi/mL) and strontium-89 and -90 (at 8 pCi/L) were not exceeded (SRNS 2019e, Sec. 5.4.8). With regard to lead and copper, the latest available sampling data in this case is from 2016 and indicates action levels were not exceeded (SRNS 2017a, Sec. 3.3.7.2). Past SRS chemical and radioactive waste management actions that included seepage basins, tanks, ponds, trenches, burial and burning pits, and landfills have resulted in contamination of soil and water resources with waste byproducts. These contamination sites, including groundwater contamination plumes, are being monitored and remediated pursuant to a 1993 tri-party agreement (i.e., the Federal Facility Agreement [FFA] for the Savannah River Site) among DOE, EPA and SCDHEC. The agreement integrates regulatory requirements of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (42 U.S.C. § 9601) (CERCLA) and the *Resource Conservation and Recovery Act of 1976* (42 U.S.C. § 6901) (RCRA). Approximately 5 to 10 percent of SRS groundwater resources have been contaminated with radionuclides (e.g., tritium, gross alpha, and nonvolatile beta emitters) and industrial solvents (e.g., trichloroethylene and tetrachloroethylene) (NNSA 2015, p. 3-17). Metals and other chemicals have also been detected and are included in monitoring efforts. Figure 3-5 shows the groundwater contamination plumes that have been identified at the SRS and identifies the primary contaminants associated with each plume.

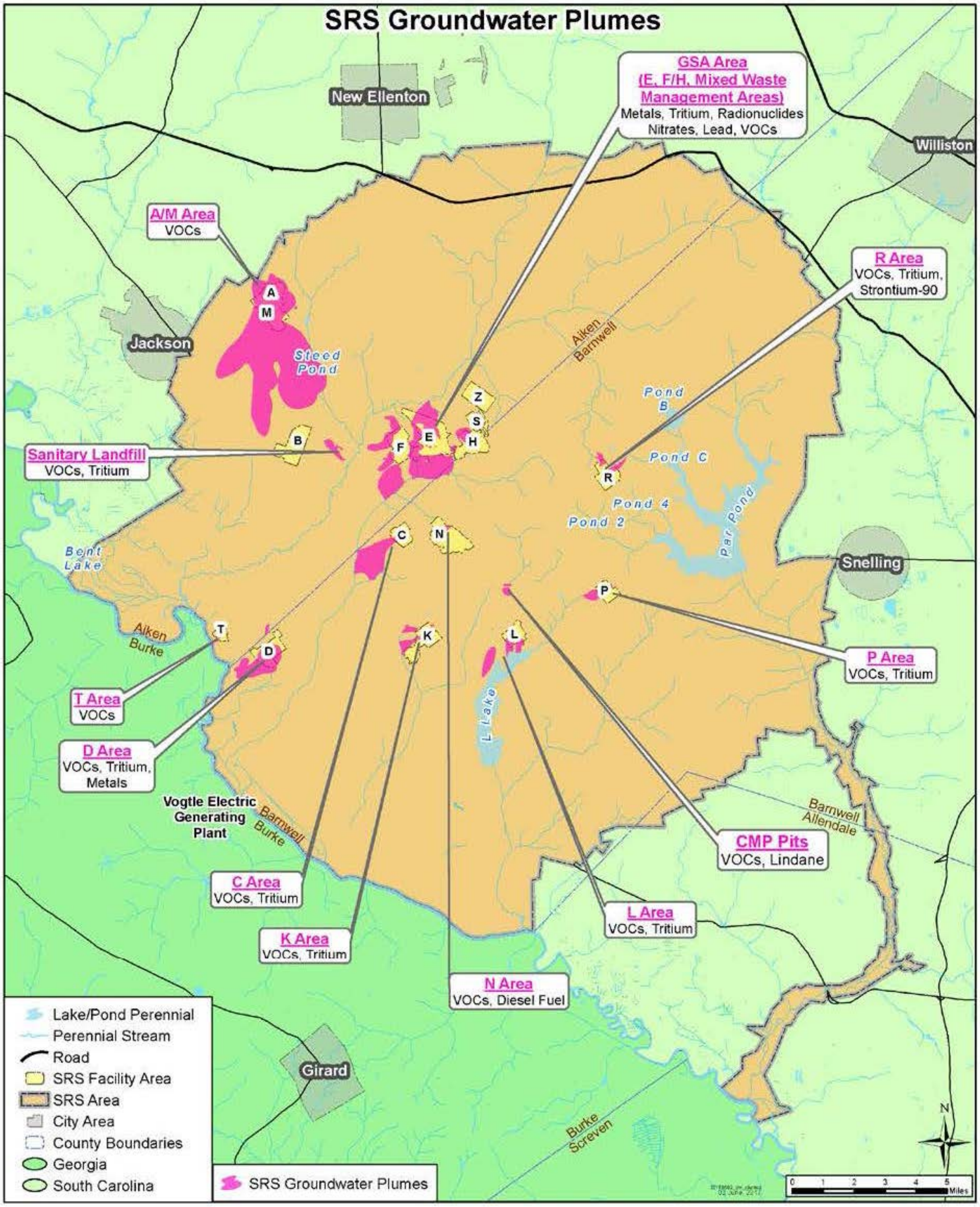


Figure 3-5—Groundwater Plumes at SRS and the Primary Contaminants Associated with Each (Source: SRNS 2019e, Fig. 7-3)

Most of the SRS groundwater plumes are located in the center area of the site, well away from site boundaries. The primary exception to this is the plume beneath the A/M Area near the site's northwest boundary. More than 150 wells concentrated along the site boundary, including wells between the A/M Area and the community of Jackson (the nearest population center) monitor this plume. The data show no exceedances of *drinking water standards* in SRS boundary wells near A/M Area. No detectable contamination exists in a majority of these SRS boundary wells (SRNS 2019e, Sec. 7.3.2.2). SRS has also made a concerted effort to monitor for tritium in wells on the Georgia side of the Savannah River. Since 1999, tritium detected in these offsite wells has been below 1.5 picocuries per milliliter (pCi/ml), well below the drinking water standard of 20 pCi/ml, and sample results for 2018 indicated no detectable concentrations of tritium (SRNS 2019e, Sec. 7.3.2.2).

The SRS Environmental Remediation Program has been under way for more than 20 years, with many of the remedial actions directed at groundwater, either directly or reducing or eliminating the contamination source that lies above the water table. The program has resulted in an overall reduction in the size of most SRS groundwater plumes (SRNS 2019e, Sec. 7.3.3). The status of remedial actions is reported annually in the SRS environmental reports as other publicly available documents, in accordance with the FFA.

3.3.3 Water Use—Surface Water and Groundwater

The USGS compiles water use data for the country every five years and Table 3-2 summarizes water use in 2015 for the combined area of Aiken, Barnwell, and Allendale counties, South Carolina. These are the counties in which the SRS lies. The table presents data for both groundwater and surface water sources as a more complete picture of water use in the area. The thermoelectric designation is for water used in the process of generating thermoelectric power and it can be seen in the table that it represents the single largest water use category in the three-county area. It is also of note that this water comes almost entirely from surface water sources. The second largest water use category is for public supplies and it comes almost equally from groundwater and surface water sources.

Table 3-2—2015 Water Use (in million gallons per day) by Source in Aiken, Barnwell, and Allendale Counties, South Carolina

Water Use Category	Source		Category Totals	Percent of Total Water Use
	Groundwater	Surface Water		
Public (municipal) supply	16.9	17.9	34.7	19.6%
Self-supplied domestic	4.87	0	4.87	2.7%
Irrigation	9.23	6.02	15.3	8.6%
Livestock	0.43	0.24	0.67	0.4%
Industrial	4.06	20.5	24.5	13.9%
Mining	0.95	0	0.95	0.5%
Thermoelectric	0.46	95.7	96.2	54.3%
Water Use Totals	**36.9**	**140**	**177**	**100%**
Percent of Total	**20.8%**	**79.2%**	**100%**	

Source: Dieter et al. 2018

The Savannah River is a source for drinking water (after treatment) at locations downstream of SRS. The nearest downstream intake is for the Purrysburg Water Treatment Plant belonging to the Beaufort-Jasper Water and Sewer Authority. The intake for this plant is approximately 90 river miles downstream of the nearest SRS boundary (NNSA 2015, Sec. 3.1.3.1). The quantity of river water removed at this intake is not included in Table 3-2 because it is well south of the counties considered in the table.

Table 3-3 provides a summary of water use within SRS. In this case, the data are for fiscal year (FY) 2010 and are the most recent data available with the table's water source and category breakouts. As shown in the table, the site uses both groundwater and surface water and, as might be expected from an industrial- and research-type facility, process water uses are much greater than domestic-type uses. Water use in F Area averaged approximately 0.165 million gallons per day in FY 2010 for domestic purposes (NNSA 2015, p. 3-15). The *SRS Environmental Report for 2018* indicates SRS used 2.49 million gallons of groundwater per day during 2018 (SRNS 2019e, Sec. 7.3.4), as compared to groundwater use shown in Table 3-3, which totaled 2.04 million gallons per day. The 2018 report indicates that water use varies from year to year based on the size of the workforce and the specific projects being worked during the year, but that the trend over the past 30 years has been downward (NNSA 2015, p. 3-16). In more recent years, decreasing water use has been largely due to efforts to decrease potable water usage (SRNS 2019e, Sec. 2.2.4).

SRS obtains its groundwater for domestic and process uses from a network of about 40 production wells scattered across the site, eight of which supply the primary drinking water system noted in the Table 3-3 description. The SRS puts its capacity to supply water at almost 3 billion gallons per year or about 8 million gallons per day (NNSA 2015, p. 3-15).

Table 3-3—SRS Water Use During Fiscal Year 2010 (October 2009 through September 2010)

Water Source and Category	Water Use (in million gallons)		Description of Water Use
	Year's Total	Daily Average	
Groundwater – domestic water	316	0.866	Potable water provided to each SRS site from dedicated domestic wells. The Central Domestic Water Plant (located in A Area) serves the A Area, B Area, C Area, F Area, G Area, H Area, K Area, L Area, and N Area.
Groundwater – process water	178	0.487	Water for once-through cooling, boilers and other applications, fire water storage tanks, and flushing and washdown, as well as supply of makeup water for cooling tower water systems. Source is groundwater from dedicated wells in each operating area. Water receives minimal treatment for pH adjustment before introduction into the piping system for use. Service water becomes process water when it reaches a cooling tower.
Groundwater – service water	252	0.691	
Surface water	1,070	2.94	Water pumped directly from the Savannah River. Pump 681-3G provides makeup water to L Lake, for L Area fire protection needs, and steam production (Ameresco Plant).
Totals	**1,820**	**4.99**	

Source: NNSA 2015, p. 3-15

In November 2018, the SCDHEC Board designated Aiken, Allendale, Bamberg, Barnwell, Calhoun, Lexington, and Orangeburg counties as the Western Capacity Use Area (SCDHEC 2019b). This is the latest and fifth capacity use area designation within the state. These five areas now include most of the southeastern half of the state. Groundwater users in capacity use areas must obtain groundwater withdrawal permits if they use three million gallons or more in any month. SRS is located entirely within the Western Capacity Use Area. The State's *Groundwater Use and Reporting Act* (SC Code 49-5 et seq.) requires that a groundwater management plan be developed for a capacity use area before the SCDHEC will issue groundwater withdrawal permits for the area and as a matter of comity, DOE has agreed to submit for a groundwater withdrawal permit, as necessary. The groundwater management plan sets goals and objectives for conserving and protecting resources and establishing conditions conducive to the development and use of water resources. On November 7, 2019, the SCDHEC Board unanimously approved the *Groundwater Management Plan for the Western Capacity Use Area* (SCDHEC 2019i). With a Groundwater Management Plan now in place in the Western Capacity Use Area, the SCDHEC will begin issuing withdrawal permits for groundwater users in the seven-county area (SCDHEC 2019b).

3.4 METEOROLOGY, AIR QUALITY, AND NOISE

3.4.1 Meteorology

Long, humid summers and short, mild winters characterize the climate and meteorology of the proposed SRPPF and surrounding areas. The humid conditions in summer result in scattered afternoon thunderstorms. The average seasonal rainfall is lowest in the fall. Extreme low temperatures and snowfall are rare. The climate has a frost-free season of approximately 250 days per year (SRNS 2018a).

Local Climatology

The historical average temperature for nearby Augusta, Georgia, Bush Field Airport, approximately 12 miles northwest of SRS, is 63.7 degrees Fahrenheit (°F). Temperatures vary from an average daily minimum of 29.2 °F in the coldest month, January, to an average daily maximum of 91.2 °F in the warmest month, July. The average wind speed at the airport is 5.5 miles per hour. The highest wind gust is 74 miles per hour. The average annual rainfall, based on 69 years of record, is 43.29 inches (NOAA 2019a).

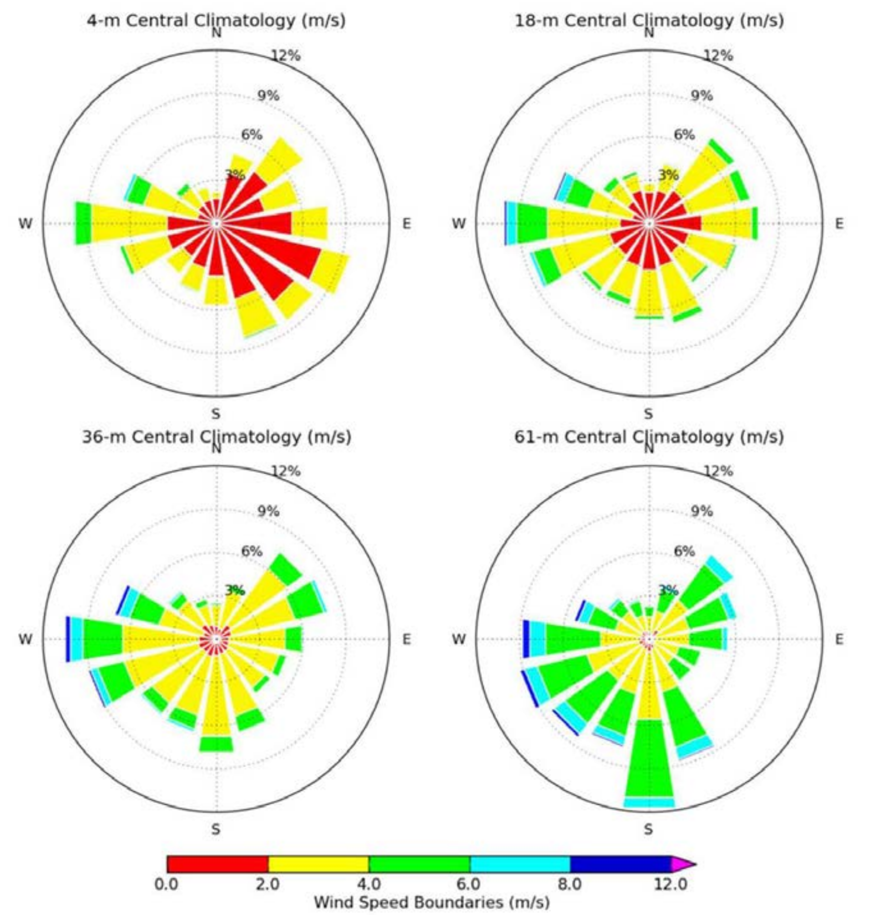
The mountains to the north and west prevent or delay cold air masses from reaching the site. The average monthly wind speed at the site is 4 miles per hour. The average annual site temperature is 64.6 °F. The average annual rainfall is approximately 50 inches (SRNS 2018a).

Figure 3-6 shows the annual *wind roses* for the Central Climatology Tower at SRS for 2011. Typical wind direction patterns at the 200-foot elevation consist of higher frequencies from the south to west sections and northeast sections. Near the ground elevation, winds have higher frequencies from the east to southeast and the west sections.

Damaging hailstorms are rare (NOAA 2019a). Measurable snowfall is rare, with the average annual snowfall typically less than one inch. The greatest single snowfall event at Bush Field in

Augusta was recorded in February 1973. This snowfall event produced a total of 14.0 inches of snow, with 13.7 inches in a 24-hour period (NOAA 2019a).

Thirty-eight tornadoes occurred in Aiken County between 1950 and 2019. Tornadoes rated above Category F2 are rare due to the type of thunderstorms in this region of the United States (NOAA 2019b). Nine tornadoes have occurred on or in close proximity to SRS since operations began in the 1950s. Although there was significant tree damage with the F2 category storms,[15] no discernable damage to SRS buildings was reported (WSRC 2000).



Notes: Windrose plot depicts the frequency of occurrence of wind direction sector (direction from which the wind blows) by wind speed category. The Central Climatology Tower is near N-Area

Source: SRNL 2012.

Figure 3-6—Annual Wind Rose Plots for 2011, Central Climatology, All Levels (Source NNSA 2015, Fig. 3-2)

Hurricanes have caused damage in South Carolina 42 times in the measurable historic period from 1700 to 2019, resulting in a frequency rate of one hurricane per every eight years (DOE 2002;

[15] The Fujita Scale, developed by Tetsuya Fujita in 1971 at the University of Chicago, is a scale for rating tornado intensity, based primarily on the damage tornadoes inflict on human-built structures and vegetation. The scale ranges from F0 (less than 73 miles per hour average winds) to F5 (261 to 318 miles per hour average winds). A storm rated at F2 has average winds from 113 to 157 miles per hour.

NOAA 2019b). The highest wind gust recorded at SRS was during Hurricane Gracie in 1959, at 75 miles per hour, and is less than historic tornadic wind speeds (WSRC 2000).

3.4.2 Air Quality

Air pollution refers to any substance in the air that could harm human or animal populations, vegetation, or structures, or that unreasonably interferes with the comfortable enjoyment of life and property. Air pollution originates from many types of point sources, such as power plants and industrial processing, and mobile sources, such as cars, trucks, and trains. *Air pollutants* are transported, dispersed, or concentrated by meteorological and topographical conditions. Air quality is affected by air pollutant emission characteristics, meteorology, and topography.

The *National Ambient Air Quality Standards* (NAAQS) for criteria air pollutants define ambient limits for *sulfur dioxide*, *particulate matter* equal to or less than 10 microns, particulate matter equal to or less than 2.5 microns, *carbon monoxide*, *nitrogen dioxide*, *ozone*, and lead. The *National Emission Standards for Hazardous Air Pollutants* (NESHAP) establish limits for noncriteria pollutants, such as radionuclides and other toxic compounds.

EPA has delegated regulatory authority for all types of air emissions to SCDHEC. SRS is required to comply with R.61-62, "Air Pollution Control Regulations and Standards." SRS currently has the following six air permits regulating activities on the site (SRNS 2019e, Sec. 3.3.6.1):

- *Clean Air Act* Part 70 Air Quality Permit, TV-0080-0041
- 784-7A Biomass Boiler Construction Permit, TV-0080-0041a-CG-R1
- 784-7A Oil Boiler Construction Permit, TV-0080-0041a-CF-R1
- Ameresco Federal Solutions, Inc. (Ameresco) Biomass Facilities Permit, TV-0080-0144
- MFFF, TV-0080-0139-CA-R1
- Building 235-F Deactivation and Decommissioning Construction Permit, TV-0080-0041-C1

Under Title V of the *Clean Air Act*, SRS is considered a "major source" of nonradiological air emissions and, therefore, must comply with the *Clean Air Act* Part 70 Operating Permit program. SCDHEC operating permits regulate stationary sources with the potential to emit five tons or more per year of any *criteria pollutant*. These major stationary sources are subject to operating and emission limits, as well as emissions monitoring and recordkeeping requirements.

The EPA sets the NAAQS air pollution control standards, and SCDHEC regulates them. The Part 70 operating permit requires SRS to demonstrate compliance through air dispersion modeling and by submitting an emissions inventory of air pollutant emissions every three years.

The Part 70 air quality permit (effective April 1, 2003) expired on March 31, 2008. SRS submitted a complete renewal application of the April 1, 2003, permit prior to the expiration date. SCDHEC granted an application shield, effective on September 21, 2007, allowing the site to continue operating under the April 1, 2003, permit until SCDHEC takes final action on the renewal application.

SRS is near the center of the Augusta, Georgia, Aiken, South Carolina, Augusta-Aiken AQCR Code No. 53. None of the areas within SRS, including surrounding counties, is designated as *nonattainment* with respect to the NAAQS for criteria air pollutants (EPA 2019a). The nearest areas with nonattainment status (8-hour ozone) are in counties near Atlanta, Georgia, located approximately 150 miles west of SRS (EPA 2019a).

The primary sources of air pollutants at SRS are the biomass boilers in K Area and L Area, diesel-powered equipment throughout SRS, DWPF, soil vapor extractors, groundwater air strippers, the Biomass Cogeneration Facility and back-up oil-fired boiler on Burma Road, and various other processing facilities. Other sources of emissions include vehicle traffic and controlled burning of forested areas, as well as temporary emissions from various construction-related activities. Table 3-4 gives the potential annual air emissions from SRS based on 2018 operations (SRNS 2020).

Table 3-4—2018 Criteria and Hazardous Air Pollutants

Pollutant Name	Potential Emissions (tons/yr)
Sulfur dioxide	5.71×10^{2}
Total particulate matter	2.86×10^{2}
Particulate matter <10 microns	2.72×10^{2}
Particulate matter <2.5 microns	2.48×10^{2}
Carbon monoxide	6.60×10^{2}
Ozone (*volatile organic compounds*)	2.28×10^{2}
Nitrogen oxides	8.22×10^{2}
Nitrogen dioxide	6.61×10^{2}
Lead	2.39×10^{-1}
Sulfuric acid mist	5.64

Source: Fanning 2019

SCDHEC issued a *Prevention of Significant Deterioration* (PSD) permit for the Biomass Cogeneration Facility and biomass boilers in the K Area and L Area to Ameresco. The biomass combustion sources are subject to the PSD permit process due to the carbon monoxide levels. The primary fuel source is wood chips; the secondary source (about 30 percent) is tires. Fuel oil is the backup supply (SRNS 2018a).

The Augusta-Aiken AQCR is designated a *Clean Air Act* PSD Class II area in accordance with 40 CFR 51.166. The PSD regulations have been developed to manage air resources in areas that are in *attainment* of the NAAQS. Class II areas have sufficient air quality to support industrial growth. Class I areas are areas in which very little increase in air pollution is allowed due to the pristine nature of the area. There are no PSD Class 1 areas within 62 miles of SRS (SCDHEC 2019e).

3.4.2.1 Nonradiological Air Emissions

Airborne contaminants can present a risk to public health and the environment. Thus, identifying and quantifying these contaminants is essential to a nonradiological monitoring program. SCDHEC regulates nonradioactive air pollutant emissions from SRS sources. The regulations list pollutants, compliance limits, and methods to demonstrate compliance.

Table 3-5 presents the applicable regulatory *ambient standards* and ambient air pollutant concentrations attributable to sources at SRS. These concentrations are based on potential emissions. Only those *hazardous air pollutants* that would be emitted by the proposed SRPPF are presented. Other toxic air pollutants are given in the air emissions inventory. Concentrations shown in Table 3-5 attributable to SRS are in compliance with applicable guidelines and regulations. Data from nearby ambient air monitors in Aiken, Barnwell, and Richland counties in South Carolina are presented in Table 3-6. The data indicate that the NAAQS for particulate matter, lead, ozone, sulfur dioxide, and nitrogen dioxide are not exceeded in the area around SRS.

Table 3-5—Comparison of Ambient Air Concentrations from Existing SRS Sources with Applicable Standards or Guidelines

Pollutant	Averaging Period	More Stringent Standard or Guideline (micrograms per cubic meter)[a]	Concentration (micrograms per cubic meter)
Criteria Pollutants			
Carbon monoxide	8 hours	10,000[b]	292
	1 hour	40,000[b]	1,118.2
Nitrogen dioxide	Annual	100[b]	42.1
Ozone	8 hours	0.07 ppm[b]	(d)
PM_{10}	24 hours	150[b]	50.7
$PM_{2.5}$	24 hours	35[b]	(d)
	Annual	12[b]	(d)
Sulfur dioxide	3 hours	1,300[b]	723
	1 hour	75 ppb	(d)
Lead	Rolling 3-month	0.15[b]	0.11
Other Regulated Pollutants			
Tetrachloroethylene (Perchloroethylene)	24 hours	3,350.00[c]	(d)
Hazardous and Other Toxic Compounds			
Beryllium	24 hours	0.01[c]	(d)

PM_n = particulate matter less than or equal to n microns in aerodynamic diameter; ppb = parts per billion; ppm = parts per million
a. The more stringent of the Federal or State standard is presented if both exist for the averaging period. The computations for determining if the applicable standard is met are found in appendices to 40 CFR Part 50.
b. Federal and State standard
c. Source: SCDHEC Regulation 61-62.5, “Air Pollution Control Standards,” Standard No. 8, “Toxic Air Pollutants” (SCDHEC 2019f)
d. No concentration reported.
Sources: NNSA 2015; EPA 2016a; Fanning 2019

SRS uses nonradioactive volatile chemicals (e.g., gasoline, toluene), fuels, and combustion products that can adversely affect the environment if released into the air in sufficient quantities. However, SRS uses most of these materials in very small quantities, and the environmental impact from their potential release is negligible. Because of the nature and quantity of potential air emissions, SRS is not required to sample or monitor the ambient air for chemical pollutants (SRNS 2018a).

Table 3-6—Ambient Air Quality Standards and Monitored Levels in the Vicinity of SRS

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

PM_n = particulate matter less than or equal to n microns in aerodynamic diameter; ppb = parts per billion; ppm = parts per million
a. 2007 data.
b. 2017 data.
Source: NNSA 2015; SCDHEC 2019g

<u>Proposed Facility Locations</u>

The meteorological conditions for SRS described above are considered to be representative of F Area. The air pollutant sources of importance for permitting will consist of emergency diesel generators and pit production processing points (SRNS 2020). The pit production process is described in Section 2.1 of this EIS.

3.4.2.2 Radiological Air Emissions

Atmospheric radionuclide emissions from SRS are limited under EPA's NESHAP regulation at 40 CFR Part 61, Subpart H. The EPA annual *effective dose equivalent* limit to members of the public is 10 millirem per year. The total effective dose for 2018 at SRS was 0.088 millirem per year, well below the 10 millirem per year limit (SRNS 2019a). Historically, nearly 80 percent of the radionuclides emitted at SRS are tritium compounds.

Radionuclides in and around the SRS environment are from SRS operations as well as events not related to the site, including natural sources, past atmospheric testing of nuclear weapons, and offsite nuclear power plant operations. Tritium in the elemental (hydrogen gas) and oxide (water vapor) forms make up most of the radionuclide emissions from SRS to the air. The amount of tritium released from SRS varies yearly based on mission activities and on the annual production schedules of the tritium processing facilities.

EPA's NESHAP program establishes the limits for radionuclide emissions, detailing the methods for estimating and reporting radioactive emissions from DOE-owned or operated sources. SCDHEC issues *Clean Air Act* Part 70 air quality permits to regulate radioactive airborne pollutant emissions for each major source of airborne emissions on SRS. Each permit has specific limitations and monitoring requirements.

SRS quantifies the total amount of radioactive material released to the environment by the following methods:

- Data obtained from monitored air effluent release points (stacks or vents),
- Calculated releases of unmonitored radioisotopes from the dissolution of spent fuel, and
- Estimates for unmonitored sources based on approved EPA calculation methods.

Onsite Monitoring

SRS monitors the air to determine whether airborne radionuclides from SRS emissions have reached the environment in measurable quantities and to ensure that radiation exposure to the public remains below regulatory limits. SRS performs effluent monitoring of airborne radionuclides at the point of discharge from operating SRS facilities. This monitoring demonstrates compliance with radiation dose limits that the EPA and DOE established to protect the public. SRS conducts additional air sampling at surveillance stations on site, along the SRS perimeter, and within communities surrounding SRS.

SRS monitors the emissions from process area stacks at facilities that release, or have the potential to release, airborne radioactive materials. SRS typically uses laboratory analyses of samples to determine concentrations of radionuclides in airborne emissions. Airborne effluent samples are collected on filter papers for particulates, on charcoal sampling media for gaseous iodine, and in a bubbler solution for airborne tritium. Depending on the processes involved, SRS may also use real-time instrumentation to monitor instantaneous and cumulative releases (of tritium, for example) to the air.

During the past 10 years, the total annual tritium release has ranged from about 15,200 to 40,400 curies per year, with an annual average tritium release of 26,900 curies (Figure 3-7). As shown in Table 3-7, the 2018 tritium emissions were 39,300 curies.

As stated previously, the amount of tritium released from SRS fluctuates due to changes in SRS missions and in the annual production schedules of the tritium-processing facilities. In 2018, the tritium releases increased over 2017 levels due to short-term maintenance activities and increased material stored in waste containers. In addition, a more conservative emission factor was used in 2018 and contributed to a higher value (SNRS 2019e, Sec. 5.3.2.1).

In 2018, tritium accounted for the majority of the total radionuclides SRS operations released to the air. Tritium-processing facilities are responsible for most of the SRS releases. Tritium releases from the separations areas comprise the combination of releases from the tritium processing facilities and the dissolution in H Canyon. Figure 3-7 shows the tritium releases from the separations areas, reactors and SNF facilities, and unmonitored sources (SRNS 2019e, Figure 5-2).

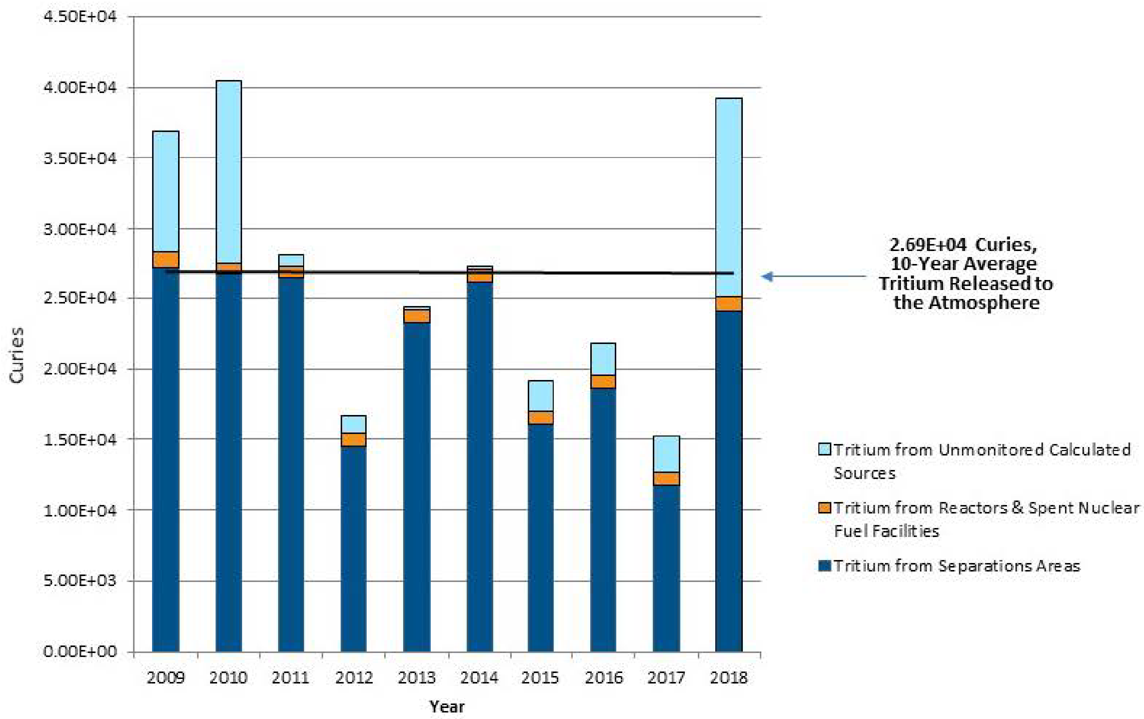


Figure 3-7—10-Year History of SRS Annual Tritium Releases to the Air (Source: SRNS 2019e, Fig. 5-2)

Table 3-7—SRS Radiological Atmospheric Releases for Calendar Year 2018

Release Type	Totals (in curies)
Tritium	3.93×10^{4}
Krypton-85	1.03×10^{4}
Noble gases (T1/2 < 40 days)[a,b]	0
Short-lived fission and activation products (T1/2 < 3 hr)[b,c]	2.00×10^{-8}
Fission and activation products (T1/2 > 3 hr)[b,c]	6.65×10^{-2}
Total radio-iodine[d]	3.76×10^{-3}
Total radio-strontium[e]	5.17×10^{-3}
Total uranium	1.05×10^{-4}
Plutonium[f]	5.90×10^{-4}
Other actinides	2.36×10^{-4}
Other	2.00×10^{-2}

a. SRS did not release any radioactive noble gases in calendar year 2018 other than krypton-85.
b. Source: ICRP 2008
c. International Atomic Energy Agency common fission and activation products.
d. Includes iodine-129 and iodine-131.
e. Includes unidentified beta releases.
f. Includes unidentified alpha releases.
Source: SRNS 2019e, Table 5-2

Offsite Air Monitoring

SRS maintains a network of 14 air sampling stations in and around SRS to monitor concentrations of tritium and radioactive particulate matter in the air and rainwater. Radionuclides exist in the air in various forms (e.g., gaseous, particulate matter, water vapor). Rainwater can redeposit particulate matter from the air onto the ground, and the radionuclides can eventually be adsorbed into vegetation or soil.

The sampling locations are located on and off the site. Onsite locations are at the center of the site and around the perimeter. Offsite locations are 25 miles from the site in population centers and a control location, the U.S. Highway 301 Bridge at the Georgia Welcome Center in Screven County. SRS operations are not likely to affect the control location.

Based on site operations, SRS monitors for tritium, gamma-emitting radionuclides, gross alpha/beta-emitting radionuclides, and iodine-129. Background levels in the air consist of naturally occurring radionuclides (e.g., uranium, thorium, and radon) and radionuclides from global fallout due to historical nuclear weapons testing related to the Cold War (e.g., strontium-89, strontium-90 and cesium-137).

Offsite Air Monitoring Results

Except for the results discussed below, all other onsite surveillance air sampling media were within the trend levels for the previous 10 years. All offsite location results were near the levels observed at the control location at the U.S. Highway 301 Bridge. The composite sample actinide results were within expected levels and the range of historical results of analytes.

In 2017 and 2018, due to elevated analytical results at the F-Canyon stack, SRS analyzed additional samples from a potentially impacted site boundary air surveillance station. SRS does not typically observe DOE-added actinides, such as plutonium-239 and americium-241, at the air stations. However, results of the additional analyses showed a detectable amount of some actinides, but not at levels that would provide any significant dose to the public. Analytical results for 2018 were lower than those observed in 2017 (SRNS 2019e). The Savannah River National Laboratory performed modeling to investigate, and SRS will continue to monitor the nearby air surveillance station for actinides.

All charcoal canisters analyzed annually for radioiodines and gamma-emitting radionuclides showed no detection of iodine-129 or cobalt-60. However, cesium-137 was detected in 12 out of 29 samples tested (41 percent). SRS investigated the cause of the detections and determined that specific lots of vendor-sealed charcoal cannisters contained cesium-137 levels consistent with those observed in cannisters deployed in the field.

The 2018 results for tritium in air showed detectable levels in 96 of the 378 samples (25 percent). The 2018 results for tritium in rainwater showed detectable levels in 27 of the 180 rainwater samples (15 percent). Concentrations from all locations were below the EPA drinking water standard of 20 pCi/ml. While there are no regulatory standards for tritium in rainwater, SRS uses the EPA drinking water standard as a benchmark. As in previous years, the 2018 values were highest near the center of SRS and decreased with distance from the site.

Proposed Facility Locations

The radiological air pollutant sources of importance for permitting will consist of pit production processing points. Emissions will be quantified by direct air effluent monitoring and estimation techniques based on accepted EPA methods.

3.4.2.3 Global Climate Change

Climate change or the natural greenhouse effect is the warming of the earth's atmosphere due to heat from the sun being absorbed or trapped by gases in the atmosphere. These gases primarily consist of carbon dioxide and include trace amounts of nitrous oxide, methane, sulfur hexafluoride, and chlorofluorocarbons. Emissions of greenhouse gases (carbon dioxide equivalents) in 2018 at SRS were estimated to be 0.559 million metric ton per year, which is less than 0.009 percent of the total U.S. emissions of 6.457 billion metric tons of carbon dioxide equivalent per year (EPA 2019b, p. ES-4). The *Environmental Assessment of Biomass Cogeneration and Heating Facilities at the Savannah River Site* (DOE 2008c, p. 30) discusses impacts to greenhouse gas emissions from the conversion of fossil fuel-based energy production to biomass energy production at SRS.

3.4.3 Noise

Noise is generally defined as unwanted sound. Noise that interferes or interacts negatively with the human or natural environment may disrupt normal activities; diminish the quality of the environment, or, at certain levels, cause discomfort and hearing loss. Noise levels perceived by humans are dependent on many variables including distance, ground cover, atmospheric conditions, and barriers between a noise source and a receptor. Sensitive receptors include schools, churches, hospitals, residences, wilderness areas, and threatened or endangered wildlife.

3.4.3.1 General Site Description

Major noise sources at SRS occur primarily in developed or active areas and include various industrial facilities, equipment, and machines (e.g., cooling systems, transformers, engines, pumps, boilers, steam vents, public address systems, and construction and materials-handling equipment). Other major noise sources include onsite vehicular and rail traffic. Existing SRS-related noise sources of importance to the public are those related to transportation of people and materials to and from the site, including trucks, private vehicles, helicopters, and trains. Another important contributor to noise levels is traffic to SRS along access highways through the towns of New Ellenton, Jackson, and Aiken, South Carolina (NNSA 2015, p. 3-23).

Most industrial facilities at SRS are far enough from the site boundary that noise levels at the boundary from these sources would not be measurable or would be barely distinguishable from background levels.

Neither South Carolina nor Georgia has established State noise regulations. To prevent activity interference or annoyance, EPA guidelines recommend an average day-night level of 55 *decibels* or less (EPA 1974).

3.4.3.2 Proposed Facility Locations

No distinguishing noise characteristics have been identified in F Area. The nearest site boundary to F Area is approximately five miles to the west. Facilities in this area are far enough from the site boundary so that noise levels from sources in this area would not be measurable or easily distinguishable from background levels.

3.5 ECOLOGICAL RESOURCES

Ecological resources are defined as terrestrial (predominantly land) and aquatic (predominantly water) *ecosystems* characterized by the presence of native and naturalized plants and animals. For the purpose of this EIS, ecological resources are differentiated by habitat type (aquatic and wetland versus terrestrial) and sensitivity (threatened, endangered, and other special-status species). The *Natural Resources Management Plan for the Savannah River Site* describes how DOE manages the ecological resources on the SRS (DOE 2019g; Wike et al. 2006, p. 3-1).

3.5.1 Terrestrial Resources

3.5.1.1 Vegetation

Terrestrial vegetation on the SRS reflects past disturbances and manipulations that have occurred since the land was acquired by the U.S. Government in 1950. The vegetation on the SRS can be broadly classified into forested and non-forested cover types. Workman and McLeod (1990) provide detailed descriptions of SRS land cover types and associated vegetation species. Forested cover types at SRS include bottomland hardwood, pine forest, mixed forest, and forested wetland. Non-forested cover types include scrub shrub, emergent wetland, industrial, grassland, clearcut, bare soil/borrow pit, and open water. Approximately 90 percent of the land cover at SRS is bottomland hardwood forests, pine forests, mixed forests, and forested wetland (DOE 1999b, p. 3-156; Wike et al. 2006, p. 2-7). Table 3-8 identifies the amount of land of each SRS cover/land use type.

Table 3-8—Cover/Use Types and Approximate Area on the Savannah River Site

Vegetation Type	Acres
Bottomland Hardwood	44,138
Pine Forest	64,676
Mixed Forest	32,839
Forested Wetland	31,596
Scrub Shrub	9,036
Emergent Wetland	1,212
Industrial	2,244
Grassland	1,852
Clearcut	7,556
Bare Soil/Borrow Pit	194
Open Water	3,914
Total	**199,257** [a]

Source: Wike et al. 2006, p. 2-6, Fig. 2-2

a. This area is slightly different (~0.5 percent) from the 198,344 acres of the SRS because of measurements using multispectral sensors with aerial photography.

The proposed SRPPF complex would be located within F Area on the existing MFFF site and on several adjacent developed areas (see Chapter 2, Figures 2-1 and 2-2). The area is industrial, covered with buildings, parking lots, bare soil, and construction equipment and materials. No native vegetation occurs within the area, with only small (i.e., less than 1 acre) patches of installed grass lawn along roads and among industrial and construction facilities. The area is surrounded by a narrow strip (about 50 to 500 feet) of land that has been cleared of pine or mixed forest vegetation and is now grassland or scrub-shrub vegetation. To the west, north, and northeast beyond the strip of grass and scrub-shrubs, pine and mixed forest vegetation extend down to bottomland hardwood forest along Upper Three Runs Creek.

3.5.1.2 Wildlife

The biodiversity within SRS is extensive due to the variety of plant communities and the mild climate. Animal species known to inhabit SRS include 44 species of amphibians, 59 species of reptiles, 255 species of birds, and 55 species of mammals (Wike et al. 2006, p. 3-2). Wike et al. (2006) contains a taxonomic listing and discussion of amphibians, reptiles, birds, and mammals found on the SRS. As discussed in Section 3.5.1.1 of this EIS, the proposed SRPPF would be in an existing industrial area that contains no native vegetation and only small patches of grass lawns. However, urban wildlife studies on SRS have documented the presence of 144 species in developed areas of SRS (Wike et al. 2006, Table 3-13). Only 29 percent of those species were considered common, and an even smaller number, four percent, were classified as abundant. In a highly developed site such as F Area, it is less likely that these common species would be present. The species considered abundant in developed areas include the rock dove (*Columba livia*), common crow (*Corvus brachyrhynchos*), northern mockingbird (*Mimus polyglottos*), American robin (*Turdus migratorius*), European starling (*Sturnus vulgaris*), and house sparrow (*Passer domesticus*). These are all bird species that are known to be highly adaptable to human development. In 2017 and 2018, 11 and 13 (respectively) active bird nests were discovered on large mobile equipment, on structures, or on the ground in areas actively used by personnel throughout SRS (SRNS 2018a, Sec. 3.3.8.6, SRNS 2019e, Sec. 3.3.8.5). Bird species included the northern mockingbird, eastern bluebird (*Sialia sialis*), killdeer (*Charadrius vociferous*), barn swallow (*Hirundo rustica*), northern rough-winged swallow (*Stelgidopteryx serripennis*), Carolina wren (*Thryothorus ludovicianus*), house finch (*Haemorhous mexicanus*), and great crested flycatcher (*Myiarchus crinitus*).

3.5.2 Aquatic Resources

Aquatic resources include both aquatic habitats and the plant and animal species that depend on those habitats for all or part of their life cycle. Aquatic habitats can be broadly divided into open water or wetlands. Open water habitats can be flowing rivers and streams such as the Savannah River and its tributaries or manmade ponds and reservoirs with open water not dominated by hydrophytes (i.e., plants growing in standing water or saturated soils). There are more than 50 manmade water impoundments throughout SRS that support populations of bass and sunfish. Although sport and commercial fishing is not permitted within SRS, the Savannah River is used extensively for both. Important commercial species are the American shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), and striped bass (*Morone saxatilis*), all of which are anadromous (fish that live in the sea and breed in freshwater). The most important warm-water game fish are bass, pickerel, crappie, bream, and catfish (DOE 1999b, p. 3-157). SCDHEC has issued a caution about eating fish from the Savannah River between River Mile 187 (Augusta Lock and Dam), upstream from SRS, and River Mile 91 (Hampton County line), downstream from SRS, because of the potential of mercury (see Section 3.3.1.2 of this EIS), cesium, and strontium accumulating in either the meat or bones of common sportfish (SCDHEC et al. 2001).

3.5.2.1 Wetlands

Wetlands are habitats dominated by hydrophytes, have saturated soils, or are periodically or permanently covered with water. Open water and wetland habitats often occur together. SRS wetlands, most of which are associated with floodplains, streams, and impoundments, include bottomland hardwood, cypress-tupelo, scrub-shrub, emergent vegetation, and Carolina bays (NNSA 2008c, p. 4-355). Forested wetlands (swamp forests) occur along the Savannah River, and bottomland hardwood forest extends upstream along Upper Three Runs Creek (Wike et al. 2006, Table 5-1) (Figure 3-8). Carolina bays, a type of wetland unique to the southeastern United States, are natural, shallow, oval- or elliptical-shaped depressions that occur in isolated

inter-stream areas (Wike et al. 2006, Fig. 5-23). Bays are typically fed by rainfall or shallow groundwater and therefore have an unpredictable hydrology. Carolina bays can range from lakes to shallow *marshes*, with vegetation varying from the drier edges to the more hydric centers. Although many bays are dominated by herbaceous plant species, forest species often occur around the drier outer edge. Among the 300 Carolina bays found throughout the SRS, fewer than 20 have permanent fish populations. Redfin pickerel (*Esox americanus americanus*), mud sunfish (*Acantharchus pomotis*), lake chubsucker (*Erimyzon sucetta*), and mosquito fish (*Gambusia affinis*) are present in these bays. Wike et al. (2006, Sec. 5) provides a description of wetlands found throughout the SRS. The location of the proposed SRPPF is in an existing industrial area that does not contain any wetlands. Forested and shrub wetlands occur approximately 0.5 mile north and northwest of the SRPPF along Upper Three Runs Creek.

3.5.2.2 Floodplains

The USGS has mapped and evaluated the 100-year floodplain along Upper Three Runs Creek and its tributaries (Lanier 1996). A 500-year floodplain has not been defined for SRS. Estimated discharge for a 100-year flood is about 1,600 cubic feet per second (Lanier 1996, Table 1). The surface elevation of a 100-year flood in the segment of Upper Three Runs Creek nearest the proposed SRPPF is estimated to be about 135 feet above sea level (Lanier 1996, Fig. 7A). The site is on a plateau above the 100-year floodplain at an approximate elevation of 275 feet (Figure 3-8) (Lanier 1996, Plate 1).

3.5.2.3 Aquatic Habitat and Species

The land within the proposed SRPPF complex has been previously developed for industrial use. As a result, no open water or wetlands exist within the area. There are, however, aquatic resources, including Upper Three Runs Creek and associated bottom hardwood wetlands located approximately 0.5 mile downslope north of F Area. Upper Three Runs Creek receives effluent from the F/H Area Effluent Treatment Facility (ETF) at a discharge point just downstream of the Road C Bridge (Wike et al. 2006, p. 4-2).

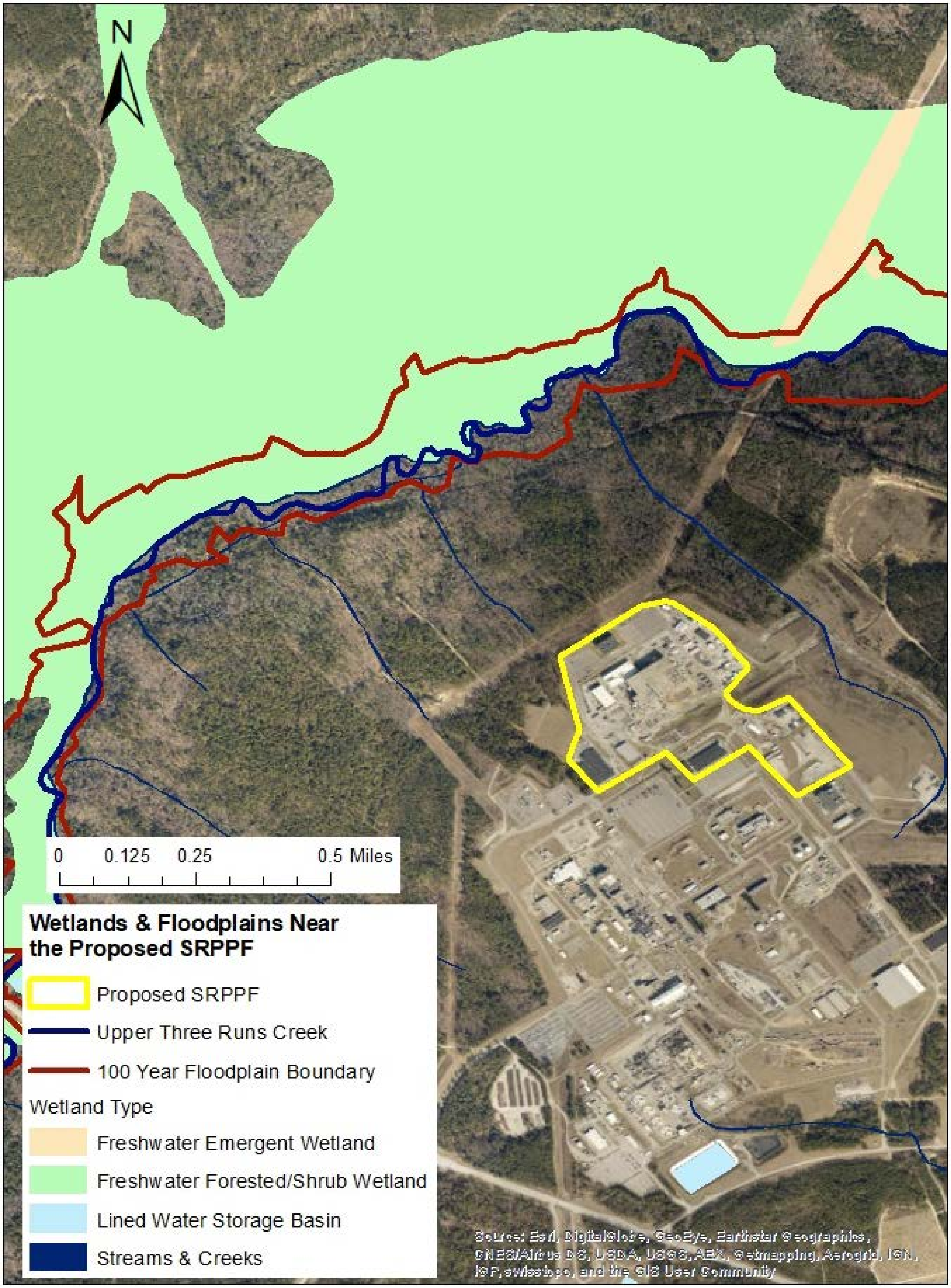


Figure 3-8—Location of Wetlands and the 100-Year Floodplain in the Vicinity of the Proposed SRPPF (Sources: USFWS 2019a; FEMA 2019; Lanier 1996, Plate 1)

Aquatic plant and animal species do not occur within the project area because of the absence of aquatic habitat.

3.5.3 Threatened or Endangered and Protected Species

The *Endangered Species Act of 1973*, as amended (16 U.S.C. § 1536), is intended to prevent the further decline of endangered or *threatened species* and to bring about the restoration of these species and their habitat. When a species is proposed for either endangered or threatened status, areas essential to its survival or conservation may be proposed as *critical habitats*. Table 3-9 lists the threatened, endangered, and other special-status species listed by the Federal Government or the State of South Carolina known to occur on SRS. No critical habitat for threatened or *endangered species* exists on SRS (Wike et al. 2006, p. 3-43; USFWS 2019b). DOE, in collaboration with the USFS, has a long history of managing and protecting threatened, endangered, and other special-status species on SRS (DOE 2019g; Wike et al. 2006, pp. 3-43–3-84).

Table 3-9—Federal or South Carolina Endangered or Threatened Plants and Animals Known to Occur on the Savannah River Site

Species	Status and Occurrence	
	Federal	**State**
Plants		
Smooth purple coneflower (*Echinacea laevigata*)	Endangered; four native colonies on SRS	Endangered
Pondberry (*Lindera melissifolia*)	Endangered; at least one colony known on SRS	Endangered
Animals		
Bald eagle (*Haliaeetus leucocephalus*)	Not listed, protected under the Bald and Golden Eagle Protection Act	Threatened
Red-cockaded woodpecker (*Picoides borealis*)	Endangered; numerous colonies on SRS	Endangered
Wood stork (*Mycteria americana*)	Threatened; feed in SRS swamps and reservoirs	Endangered
Shortnose sturgeon (*Acipenser brevirostrum*)	Endangered; eggs and larvae collected from Savannah River adjacent to SRS	Endangered
American swallow-tailed kite (*Elanoides forficatus*)	Not listed	Endangered; one sighting reported
Gopher tortoise (*Gopherus polyphemus*)	Not listed	Endangered; one reported; habitat on SRS
Rafinesque's big-eared bat (*Corynorhinus rafinesquii*)	Not listed	Endangered[a]

SRS = Savannah River Site.
a. Occurrence data not available.
Source: SCDNR 2019b; Wike et al. 2006, p. 3-45

The smooth purple coneflower (*Echinacea laevigata*) and pondberry (*Lindera melissifolia*) are plant species federally listed as endangered. Four known natural colonies or locations of the smooth purple coneflower occur on SRS (Figure 3-9). The smooth purple coneflower is a

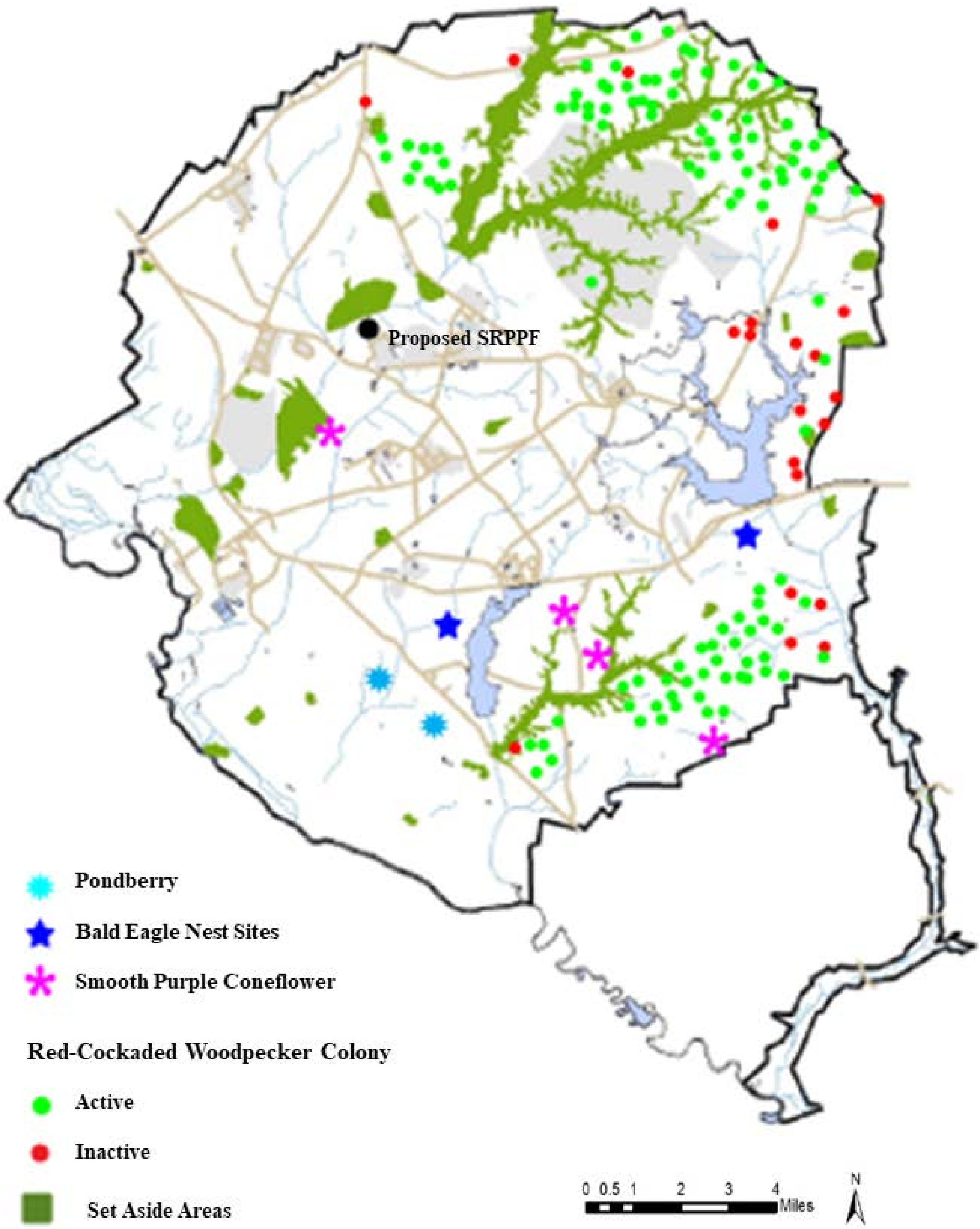


Figure 3-9—Location of Protected Species and Set-Aside Areas in Relation to the Proposed SRPPF (Source: Modified from DOE 2019g, Figs. 9 and 13)

perennial herb that grows up to 5 feet tall (SREL 1998a). Flowering plants produce a smooth stem with a few smaller leaves and a single flower in May or June. The smooth purple coneflower is associated with open woodlands, prairie settings, clear-cuts, and road banks preferring more sunny locations (DOE 2019g, p. 17; Wike et al. 2006, p. 3-44; Knox and Sharitz 1990, p. 38). Management includes selected tree and shrub removal and periodic burning (DOE 2019g, p. 17). Following completion of the MFFF administration building, a conservation garden was established near the building entrance, featuring the smooth purple coneflower to promote preservation and awareness (Aiken Standard 2012). Scientists from the Savannah River Ecology Laboratory (SREL) collected seeds from native SRS smooth purple coneflower plants under permit TE31066A-0 from the U.S. Fish and Wildlife Service. These seeds were propagated in the SREL greenhouse and transplanted to the conservation garden (Augusta Chronicle 2012). Two populations of the pondberry are managed at Carolina bays (DOE 2019g, p. 17; SRNS 2019e). The pondberry and the four naturally occurring populations of the smooth purple coneflower are located about 2 to 12 miles from the project area (Figure 3-9).

The red-cockaded woodpecker (*Picoides borealis*) is a native of the southern pine forests of the United States with a preference for mature pine trees over 70 years old. Once common, it was listed as federally endangered in 1970 owing to loss of mature longleaf pine forests (Wike et al. 2006, Sec. 3.15.4). The red-cockaded woodpecker is the most actively managed protected species on SRS. For management purposes, SRS is divided into six management areas based upon existing biological and physical conditions, operations capability, and suitability for mission objectives (DOE 2019g, Fig. 2) (see Figure 3-1, Section 3.1, of this EIS). The largest of the management areas is the 87,200-acre Red-Cockaded Woodpecker Management Area, which covers the eastern side of the SRS. Within the Red-Cockaded Woodpecker Management Area, the USFS-Savannah River manages more than 65,000 acres with emphasis on improving and creating suitable habitat for red-cockaded woodpeckers (SRNS 2019e, Sec. 3.3.8.4). These restoration efforts have increased active red-cockaded woodpecker clusters on SRS from 3 to 133 from 1985 through 2018. USFS-Savannah River currently manages 133 cluster sites (SRNS 2019e, Sec. 3.3.8.4). The proposed SRPPF complex is located in the Industrial Core Management Area, in the west central part of the SRS (DOE 2019g, Fig. 2) (see Figure 3-1, Section 3.1, of this EIS). The project site contains no habitat for red-cockaded woodpeckers, as the site has been previously developed for industrial uses. The nearest active red-cockaded woodpecker cluster is about three to four miles to the northeast, across the Upper Three Runs Creek (Figure 3-9).

The wood stork (*Mycteria americana*) is a large, long-legged wading bird federally listed as threatened. The wood stork is not known to nest on SRS but forages locally in temporary ponds, shorelines, bottomlands, and swamps, primarily along the Savannah River Swamp, in the delta areas of streams flowing into the river (DOE 2019g, p. 17; Wike et al. 2006, Sec. 3.15.5; SREL 1998b). Wood storks have also been observed foraging in Carolina bay wetlands. The nearest nesting colonies are in Georgia, west of SRS. No wood storks occur within the proposed SRPPF complex, which contains no wood stork habitat.

The shortnose sturgeon (*Acipenser brevirostrum*) is federally listed as endangered and is known to occur in the Savannah River to the south and southwest of the project area. This species does not occur near the project site. The American swallow-tailed kite (*Elanoides forficatus*), Gopher tortoise (*Gopherus polyphemus*), and Rafinesque's big-eared bat (*Corynorhinus rafinesquii*) are not listed under the Federal *Endangered Species Act* but are considered endangered in South

Carolina. None of these species is common on SRS and are only known from a few observations or captures (Wike et al. 2006, Table 3-16, Secs. 3.14.3.3 and 3.16.2). The project area contains no habitat for any of these species.

The bald eagle was delisted under the *Endangered Species Act* in 2007 following a nationwide recovery of populations. The species remains protected under the *Bald and Golden Eagle Protection Act* (16 U.S.C. §§ 668-668[d]) and is considered a threatened species in the state of South Carolina. The bald eagle has never been abundant on the SRS, but sightings have increased as South Carolina populations have recovered (Wike et al. 2006, Sec. 3.15.2). Bald eagles nest on SRS and are considered year-round residents (SRNS 2019e). The golden eagle, also protected under the Act, winters on the SRS. Mid-winter surveys in 2018 documented seven bald eagles and nine golden eagles (SRNS 2019e). Bald and golden eagles do not occur within the proposed SRPPF complex (Figure 3-9).

DOE has designated a series of 30 set-aside areas on SRS. These sites are representative of the major or unique vegetation communities on SRS and serve to provide sites for long-term ecological research, protect sensitive species, and preserve the biological integrity of Upper Three Runs Creek. The set-aside areas contain 14,560 acres, or 7 percent of SRS (SREL 2018, p. 31). The majority of the set-aside areas are located in the Upper Three Runs Creek drainage (Figure 3-9). The nearest set-aside areas are approximately 0.5 mile north and northwest of the project area.

3.6 Cultural and Paleontological Resources

Cultural resources are physical manifestations of culture—specifically, archaeological sites, architectural properties, ethnographic resources, and other historical resources relating to human activities, society, and cultural institutions—that define communities and link them to their surroundings. They include expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, buildings, structures, objects, and districts, considered important to a culture or community. Cultural resources also include locations of important historic events and aspects of the natural environment, such as natural features of the land or biota, that are part of traditional lifeways and practices.

The Federal Government maintains the *National Register of Historic Places* (*National Register*), a listing of prehistoric, historic, and ethnographic buildings, structures, sites, districts, and objects that are considered significant at a national, state, or local level. Listed resources can have significance in the areas of history, archaeology, architecture, engineering, or culture. Cultural resources listed, or determined eligible for listing, on the *National Register* have been documented and evaluated according to uniform standards, in accordance with 36 CFR 60.4, and have been found to meet criteria of significance and integrity. Generally, resources evaluated for eligibility are 50 years old or older, though there are exceptions to this standard, particularly resources associated with the Cold War era. Cultural resources that meet the criteria for listing on the *National Register*, regardless of age, are called historic properties. Resources that have undetermined eligibility are treated as historic properties until a determination otherwise is made.

Paleontology is the study of life in past geological time and the chronology of Earth's history. Paleontological resources are the fossil remains of past life forms. Fossils are the remains of once-living organisms such as plants, animals, fungi, and bacteria that have been replaced by rock material. Fossils also include imprints or traces of organisms preserved in rock, such as impressions, burrows, and trackways. Paleontological resources are considered a fragile and nonrenewable scientific record of the history of life on Earth and so represent an important component of America's natural heritage.

3.6.1 Regulatory and Compliance Setting

Many Federal laws, regulations, and Executive orders address cultural resources that are applicable to SRS. Foremost among these statutory provisions, and most relevant to the current analysis, is the *National Historic Preservation Act* (54 U.S.C. § 300101, et seq.) (NHPA). Section 106 of NHPA requires Federal agencies to take into account the effects of their undertakings on historic properties. The Advisory Council on Historic Preservation regulations that implement Section 106 (36 CFR Part 800) describe the processes for identifying and evaluating historic properties, assessing effects of Federal actions on historic properties, and consulting to avoid, minimize, or mitigate any adverse effects. The NHPA does not mandate preservation of historic properties, but it does ensure that Federal agency decisions concerning the treatment of these properties result from meaningful consideration of cultural and historical values and identification of options available to protect the properties. As part of the Section 106 process, agencies are required to consult with the State Historic Preservation Officer on their determinations and decisions. Such coordination in South Carolina occurs through the *State Historic Preservation Office* of the South Carolina Department of Archives and History (SCSHPO).

Other prominent cultural resource laws pertinent to the SRS include the *Archaeological Resources Protection Act of 1979* (16 U.S.C. §§ 470aa–470mm), which makes it a Federal offense to excavate, remove, damage, alter, or otherwise deface archaeological resources on Federal lands without authorization. In accordance with 32 CFR 229.8, land managing agencies can grant specific permits, allowing for professional archaeological excavations.

The *Native American Graves Protection and Repatriation Act of 1990* (25 U.S.C. § 3001, et seq.) (NAGPRA) establishes a process for Federal agencies to return human remains, associated and unassociated funerary objects, sacred objects, and objects of cultural patrimony to federally recognized Indian Tribes and Native Hawaiian organizations. NAGPRA applies equally to items already in the possession of Federal agencies and those encountered during current actions and undertakings on Federal or Tribal lands. NAGPRA consultation is required in the event of the planned excavation or unexpected discovery of such items on Federal lands.

DOE Policy 141.1, "Department of Energy Management of Cultural Resources," ensures that DOE programs integrate cultural resource management into their missions and activities and raises the awareness of the importance of the Department's cultural resource-related responsibilities. The policy directs that all DOE programs and missions will be implemented in a manner consistent with Federal laws, regulations, orders, and implementation guidance protecting cultural resources.

As a Federal agency, DOE has a responsibility to Native Americans to protect Tribal cultural resources and to consult with Tribes on a government-to-government basis regarding those resources. NHPA Section 101(d)(6) mandates that Federal agencies consult with Tribes and other Native American groups who either historically occupied the project area or may attach religious or cultural significance to historic properties in the region. The NEPA implementing regulations link to the NHPA, as well as to the *American Indian Religious Freedom Act* (42 U.S.C. § 1996), Executive Order 13007, "Indian Sacred Sites," Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," and the Executive Memorandum on Government-to-Government Relations with Native American Tribal Governments (59 FR 22951, May 4, 1994). These requirements call on agencies to consult with Tribal leaders and others knowledgeable about cultural resources important to them. In November 2009, DOE updated its American Indian and Alaska Native Tribal Government Policy (DOE Order 144.1), which provides guidance for consulting and coordinating with Tribal governments in compliance with Federal statutes and regulations. The policy sets forth the principles for DOE to follow to ensure effective implementation of a government-to-government relationship with Tribes, and directs all DOE officials, staff, and contractors regarding fulfilling obligations and responsibilities arising from Departmental actions that may potentially affect Tribal traditional, cultural, and religious values and practices; natural resources; treaties; and other federally recognized and reserved rights.

Paleontological resources that have significant research potential are protected under the *Antiquities Act of 1906* (54 U.S.C. §§ 320301–320302).

3.6.2 Cultural Resource Management on the SRS

Cultural resources on SRS have been managed under the terms of a programmatic memorandum of agreement (PMOA) among DOE, the SCSHPO, and the Advisory Council on Historic Preservation since 1990 (DOE 2004). DOE implements this PMOA by conducting an integrated cultural resource management program at SRS that includes research, public involvement and education, and compliance. The PMOA provides DOE with an alternative method of Section 106 compliance, allowing DOE to submit an annual report that describes all management efforts and results for the year, rather than engaging in project by project consultation (SRARP 2017, p. iii, 2013, pp. 177–188; NNSA 2015, pp. 3-33 and 3-34).

Guidance on the management of cultural resources at SRS is included in two management plans. The *Archaeological Resource Management Plan of the Savannah River Archaeological Research Program* (SRARP 2013) addresses overall management and compliance efforts for the SRS. The PMOA among DOE, the SCSHPO, and the Advisory Council on Historic Preservation, developed in consultation with the SRS Citizen Advisory Board, Citizens for Nuclear Technology Awareness, and the cities of Aiken, Augusta, and New Ellenton, addresses the preservation, management, and treatment of *National Register*-eligible Cold War properties within the SRS Cold War Historic District (DOE 2004). The PMOA is implemented through the *Savannah River Site's Cold War Built Environment Cultural Resources Management Plan* (DOE 2005c).

The Savannah River Archaeological Research Program (SRARP), which is part of the Institute of Archaeology and Anthropology at the University of South Carolina, provides technical expertise to the DOE for implementation of the PMOA and archaeological resource management plan.

Native American groups with traditional ties to the SRS region include the Apalachee, Cherokee, Chickasaw, Creek, Shawnee, Westo, and Yuchi. At different times, each of these groups was encouraged by the English to settle in the area to provide protection from the French, Spanish, or other Native American groups. Native American resources in the region include villages, ceremonial lodges, burials, cemeteries, and natural areas containing traditional plants used in ceremonies. In 1991, DOE conducted consultation to identify Native American concerns about religious rights and cultural and religious properties in the central Savannah River valley. Six groups expressed interest in the SRS region with regard to sites and items necessary for the practice of their traditional religious beliefs: the Yuchi Tribal Organization, the National Council of Muskogee Creek, the Indian People's Muskogee Tribal Town Confederacy, the Pee Dee Indian Nation, the Ma Chis Lower Alabama Creek Indian Tribe, and the United Keetoowah Band of the Cherokee. Concerns were expressed regarding several plant species traditionally used in Tribal ceremonies that could occur on the SRS (NNSA 2008b, pp. 3-35 and 3-36, 2015, p. 4-358). DOE continues to engage with these interested Tribal organizations by notifying them of major planned actions on the SRS and by providing them with environmental reports that address proposed actions at SRS for their review and comment.

3.6.3 Cultural Resources on SRS

SRARP has been conducting archaeological investigations on SRS since 1973. Approximately 36.4 percent of SRS has been surveyed for archaeological resources and historic built environment resources that date prior to 1950, with 70,458 acres surveyed as of 2018 (SRNS 2020). Surveyors have identified a total of 2,043 archaeological sites and 7 historic buildings/structures that date prior to 1950 on SRS (SRNS 2020). Prehistoric resources across SRS include village sites, base camps, limited activity sites, quarries, and workshops. Historic sites include farmsteads, tenant dwellings, mills, plantations, slave quarters, farm dikes, dams, cattle pens, ferry locations, churches, schools, towns, cemeteries, commercial building locations, and roads. Of the archaeological sites, 1,303 are pre-contact Native American sites and 740 are historic archaeological sites (pre-1942) that may be related to early historic Native American, Hispanic, and Euro-American cultures. Of the 1,303 pre-contact archaeological sites, 82 have been determined eligible for listing on the *National Register*. Of the 740 historic archaeological sites, 64 have been determined eligible for listing on the *National Register*. Of the seven historic buildings/structures, all have been determined eligible for listing on the *National Register* (SRNS 2020).

SRS contains no National Historic Landmarks. All of the Cold War-era resources on SRS constructed between 1950 and 1989 were inventoried in 2004. Cold War-era properties include buildings and structures associated with the development of nuclear materials and technologies for use in weapons, power generation, and medical treatments. One Cold War-era historic district, which includes a landscape, sites, buildings, and structures, has been determined eligible for listing on the *National Register* (SRNS 2020).

3.6.4 Cultural Resources in the Project Area

F Area is a highly developed area covering approximately 364 acres near the center of SRS. It is within the Industrial Core Management Area, which contains nuclear, industrial, warehouse, laboratory, and administrative facilities. Although the area has undergone extensive ground disturbance from development of facilities, surveys conducted in the area proposed for construction of the MFFF revealed four prehistoric archaeological sites, two of which were determined eligible for listing on the *National Register*. Adverse effects anticipated to occur to these sites from the construction were mitigated through data recovery undertaken in accordance with a data recovery plan approved by SCSHPO. SRARP staff members monitored five additional eligible archaeological sites located in the vicinity of the construction site during MFFF ground-disturbing activities in accordance with the PMOA (NRC 2005a, pp. 3-38 and 3-39; NNSA 2015, p. 3-34). These eligible sites were determined to be significant due to their research potential to provide information on settlement and subsistence from the Early Archaic through Mississippian time periods (8000 before the Common Era through 1450).

Numerous facilities in F Area have been identified *National Register*-eligible as they relate to two themes: SRS's Cold War production mission and its role within the Atomic Energy Commission's program to develop peaceful uses for atomic energy. None of these facilities was anticipated to be adversely affected by construction of the MFFF (NNSA 2015, p. 3-35).

Traditional cultural properties are places and resources important to traditional American cultures, which include, but are not restricted to, Native American cultures. Village sites, ceremonial locations, cemeteries, burials, and natural areas containing important resources, such as traditionally used plants, are typical of properties of concern to Native American cultures in the U.S. Southeast. No traditional cultural properties were identified during surveys conducted in association with MFFF construction in F Area. Due to the developed nature of F Area, DOE determined that it was unlikely that plants of concern to Native Americans would be found in the project area (NNSA 2015, pp. 3-35 and 3-36).

3.6.5 Paleontological Resources on SRS and on the MFFF

Paleontological resources on SRS largely date from the Eocene Age (54 to 39 million years ago) and include fossilized plants, invertebrate animals, and deposits of giant oysters, other mollusks, and bryozoa. With the exception of giant oysters, all other fossils on SRS are fairly widespread and common, and thus the assemblages have low research potential or scientific value (NRC 2005a, p. 3-39). Paleontological resources are included in the scope of any cultural resource surveys or inventories.

While some fossil-bearing strata are known to exist on SRS, none is known within F Area. Paleontological resources are not likely to occur in F Area due to the highly disturbed nature of the area, and no such resources have been recorded there (NNSA 2015, p. 3-36). Infrastructure

3.7 INFRASTRUCTURE

Site infrastructure includes those basic resources and services required to support planned construction and operations activities and the continued operation of existing facilities. For the purposes of this EIS, infrastructure is defined as electricity, fuel, water, sanitary wastewater, and steam. Table 3-10 describes the SRS infrastructure.

The proposed SRPPF complex would be located in F Area adjacent to and including a repurposed MFFF. Table 3-11 summarizes the current use of F Area resources.

Table 3-10—Savannah River Site Sitewide Infrastructure

Resource	Current Estimated Use	Capacity	Available Capacity[e]
Electricity–power consumption (megawatt-hours per year)[a]	310,000	4,400,000	4,090,000
Electricity–peak load (megawatts)[a]	60	500	440
Fuel–oil (gallons per year)[b]	410,000	N/A[c]	N/A[c]
Biomass (tons per year)	300,000	20,000,000	19,700,000
Domestic water (gallons per year)[a]	320,000,000	2,950,000,000	2,630,000,000
Sanitary wastewater (gallons per year)[a]	250,000,000	383,000,000[d]	133,000,000

N/A = not applicable or not available.
a. Source: NNSA 2015.
b. Oil use is for A Area and K Area.
c. Capacity is generally not limited, as delivery frequency can be increased to meet demand.
d. Capacity includes the Central Sanitary Wastewater Treatment Facility and smaller treatment units in K Area and L Area.
e. Available capacity equals capacity minus current estimated use.

Table 3-11—Current Use of Resources at F Area

Resource	F Area
Electricity–power consumption (megawatt-hours per year)	46,000
Electricity–peak load (megawatts)	10
Diesel/Fuel oil (gallons per year)	718
Domestic water (gallons per year)	61,000,000

Sources: DOE 2015; SRNS 2020

3.7.1 Electricity

Most of the electrical power consumed by SRS is generated by offsite coal-fired and nuclear power plants, supplied by Dominion Energy (formerly supplied by South Carolina Electric and Gas Company). Power is supplied by three transmission lines. SRS uses a 115-kilovolt power line system in a ring arrangement to supply electricity to the operations areas (DOE 2005a, Sec. 3.1.4). Approximately 310,000 megawatt-hours per year of electricity is used at SRS, with an available capacity of 4,400,000 megawatt-hours per year (NNSA 2015, p. 3-42). The peak load use is estimated to be 60 megawatts, with a peak load capacity of 500 megawatts.

F Area receives power from the 200-F power loop supplied by the 251-F electrical substation (NRC 2005a, p. 3-40). Step-down transformers are used to reduce the electrical power from the 115-kilovolt transmission loop to medium voltage levels, typically 4.16 or 13.8 kilovolts, in individual facility areas. There are two 24/32-megavolt-amp transformers for F Area (NNSA 2015, p. 3-43).

The current estimated power consumption for F Area is approximately 46,000 megawatt-hours per year, which accounts for approximately 15 percent of current sitewide electrical usage and represents about 1 percent of the sitewide available capacity. The theoretical maximum peak load that F Area could experience is 10 megawatts, compared to a sitewide peak load of 60 megawatts. SRS has the capacity to deliver a peak load of up to 500 megawatts (NNSA 2015, p. 3-43).

3.7.2 Fuel

Biomass, backed up with fuel oil, is used at SRS to produce steam in boiler plants (SRNS 2018a). Fuel oil is also used to power emergency generators. Natural gas is not used at SRS (DOE 2005a, Sec. 3.1.4). SRS uses an estimated 410,000 gallons of fuel oil per year (NNSA 2015, p. 3-42). Replenishment of onsite fuel oil supplies can be delivered by truck or rail as needed. Furthermore, temporary storage tanks can be installed to supplement fuel consumption needs during construction activities. Thus, the capacity for fuel is generally not considered to be limited.

3.7.3 Domestic Water

Three large domestic water supply systems at SRS deliver the vast majority of the site's requirements. These water treatment facilities are located in A Area and K Area. A smaller system located in B Area is a backup to the facility in A Area. Raw water is drawn from subsurface aquifers through 20-inch-diameter production wells using vertical turbine pumps. Once treated, the potable water is stored in five elevated storage tanks and distributed to the various facilities through a network of piping (DOE 2005a, Sec. 3.1.4).

Approximately 316 million gallons of domestic water are used at SRS annually, with a capacity to supply up to 2,950 million gallons per year (DOE 2015). Process water for individual areas is supplied through separate deep groundwater wells or river intake systems (DOE 2005a, Sec. 3.1.4).

The estimated current annual consumption of domestic water for F Area is approximately 61 million gallons, which accounts for 19 percent of the sitewide use and about 2 percent of sitewide capacity (NNSA 2015, p. 3-43).

3.7.4 Sanitary Wastewater

The Central Sanitary Wastewater Treatment Facility (CSWTF), located on Burma Road and installed in 1995, collects and treats 97 percent of sanitary wastewater generated at SRS. Also constructed in 1995, 18 miles of pressurized sewer line and 12 lift stations are used to transport sanitary wastewater to the CSWTF. The balance of the sanitary wastewater is treated at three smaller, and older, independent facilities located in K Area and L Area. The original treatment facilities, lift stations, and 40 miles of gravity pipe were installed in the 1950s. Collectively, the sanitary wastewater systems include the CSWTF, three smaller treatment facilities, 46 lift stations, and 58 miles of sewer pipe (DOE 2005a, Sec. 3.1.4). The CSWTF and the smaller treatment units in K Area and L Area are estimated to collect and treat approximately 250 million gallons of sanitary wastewater per year with a capacity to treat up to 383 million gallons per year of sanitary wastewater (NNSA 2015, p. 3-43).

3.7.5 Steam

The current mission for the steam generation and distribution system is to provide customers an uninterrupted steam supply for chemical processing or building heat. The steam generation and distribution system at SRS is composed of four steam production facilities and multiple feed line headers. The Site Services' utilities group currently maintains approximately 10 miles of active steam lines and 283 trap stations at SRS. Site Services operates and maintains steam line supply headers and inner area distribution lines up to facility area boundary points (SRNS 2019f).

In 2012, Ameresco constructed the 684-G Biomass Cogeneration Facility (684-G BCF) to produce steam and electricity. In 2016, a new biomass boiler was added (facility 684-2G) for additional steam security (no cogeneration) at the 684-G BCF. Ameresco operates and maintains these facilities, which provides steam service to F, H, and S areas. The 684-G BCF produces steam at a daily average rate of 85,000 pounds per hour and delivery pressure of 385 pounds per square inch gauge, while the 684-2G facility provides supplemental steam. A 24-inch header feeds steam downstream of the 684-G BCF to the distribution header on Burma Road. A 10-inch line feeds F Area from the distribution header. The F Area contains 1.54 miles of line that varies in size and provides steam service to the following facilities: 717-F, F Tank Farm, 285-3F, 285-4F, 772-F, 772-1F, 221-33F, 235-F, and 707-1F (SRNS 2019f).

3.8 SOCIOECONOMIC AND ENVIRONMENTAL JUSTICE

3.8.1 Socioeconomics

Socioeconomics considers the attributes of human social and economic interactions of the Proposed Action and the impacts that such action may have on the ROI. The ROI is defined on the basis of current residential location of full-time SRS workers directly involved in the SRS activities and encompasses the area in which most of these workers spend their wages and salaries. Socioeconomic areas of discussion include the local demographics, regional and local economy, local housing, and community services. Socioeconomic impacts may be defined as the environmental consequences of a proposed action in terms of potential demographic and economic changes. Such impacts and potential consequences are discussed in Chapter 4 of this EIS.

Table 3-12 provides residence information for the four-county ROI (i.e., Aiken and Barnwell counties, South Carolina, and Columbia and Richmond counties, Georgia). As can be seen, approximately 86.6 percent of SRS employees reside in this ROI. In 2018, 11,093 persons were directly employed at SRS (includes permanent and temporary/part-time employees). Direct onsite employment accounts for approximately 4.7 percent of employment in the ROI.

Indirect employment generated by SRS operations has been calculated using a weighted average of the Regional Input-Output Modeling System (RIMS II) direct-effect employment multipliers from the U.S. Bureau of Economic Analysis for select industries that most accurately reflect the major activities at SRS. The Bureau of Economic Analysis develops RIMS II multipliers using input-output tables that show the distribution of inputs purchased and outputs sold for each industry. A national input-output table, representing close to 500 different industries, is adjusted

Table 3-12—Distribution of Employees by Place of Residence in the SRS ROI in 2018

County, State	Number of Employees	% of Total Site Employment
Aiken, South Carolina	5,995	53.7
Barnwell, South Carolina	663	6.0
Columbia, Georgia	1,693	15.3
Richmond, Georgia	1,287	11.6
Other	1,455	13.4
ROI Total	**11,093**	**100.0**

ROI = region of influence.
Source: SRNS 2020

using Bureau of Economic Analysis regional economic accounts to accurately reflect the structure of a given area. The detailed industries included in the RIMS II models that were used to develop the SRS site-specific operations multiplier include Management of Companies and Enterprises; Scientific Research and Development; Investigation and Security Services; Waste Management and Remediation; Other Basic Inorganic Chemical Manufacturing; Forest Nurseries, Forest Products, and Forest Tracts; Environmental and Other Technical Consulting Services; and Construction. This method resulted in an estimated SRS direct-effect employment multiplier of 2.19; meaning that 1.19 indirect jobs would be created for every direct job created (NNSA 2015). Therefore, the *direct employment* of 11,093 at SRS would generate indirect employment of 13,193 within the ROI, resulting in a total employment of 24,286, or 10 percent of the employment in the ROI.

3.8.1.1 Regional Economic Characteristics

From 2010 through 2018, the civilian labor force in the ROI increased 5.4 percent to 243,863 persons. During the same time period, employment in the ROI increased by 12 percent to 233,921 persons, and the number of unemployed decreased by 55.8 percent, reflecting economic recovery after the recession of 2008–2010. Over that same period, the unemployment rate declined 5.6 percent from 9.7 to 4.1 percent. Georgia and South Carolina experienced similar trends in unemployment rates, decreasing 6.6 and 7.8 percentage points, respectively (BLS 2019a). Table 3-13 presents employment statistics in the ROI, Georgia, and South Carolina for 2010 and 2018. In 2018, there were 233,921 people employed in the SRS ROI.

From 2010 to 2017, the per capita income of the ROI increased by approximately 21 percent to $40,770 in 2017. Of the counties within the ROI, Aiken County in South Carolina experienced the highest increase in per capita income (21 percent), while Richmond County in Georgia experienced the lowest increase (19 percent). South Carolina and Georgia experienced a higher increase than the ROI, both increasing approximately 28 percent to $41,633 and $44,145, respectively (BEA 2019a).

Table 3-13—Employment Statistics in the SRS ROI, Georgia, and South Carolina in 2010 and 2018

Area	Labor Force		Employment		Unemployment		Unemployment Rate	
	2010	2018	2010	2018	2010	2018	2010	2018
Aiken	72,368	73,944	65,639	71,470	6,729	2,474	9.3	3.3
Barnwell	9,489	8,343	7,913	7,944	1,576	399	16.6	4.8
Columbia	61,522	74,950	57,027	72,341	4,495	2,609	7.3	3.5
Richmond	87,887	86,626	78,209	82,166	9,678	4,460	11.0	5.1
SRS ROI	**231,266**	**243,863**	**208,788**	**233,921**	**22,478**	**9,942**	**9.7**	**4.1**
South Carolina	2,155,668	2,323,209	1,915,045	2,243,656	240,623	79,553	11.2	3.4
Georgia	4,696,676	5,107,656	4,202,052	4,906,411	494,624	201,245	10.5	3.9

ROI = region of influence; SRS = Savannah River Site.
Source: BLS 2019a

In 2018, Federal, State, and local government services and enterprises accounted for approximately 19 percent of the total employment in the ROI (BEA 2019b). Trade, transportation, and utilities accounted for approximately 17 percent of employment, followed by education and healthcare services, professional services, and leisure and hospitality services, ranging from 12 to 16 percent of employment in the ROI. The distribution of employment in South Carolina and Georgia was generally similar (BEA 2019b).

3.8.1.2 Population

In 2017, the population in the ROI was estimated to be 532,786 people. From 2010 to 2017, the total population in the ROI increased at an average annual rate of approximately 0.7 percent, which was the same as the growth rate in the state of Georgia and lower than the growth rate in the state of South Carolina. Over the same period, the total population of Georgia increased at an average annual rate of approximately 0.7 percent, to 10,201,635 people. South Carolina experienced an increase of approximately 1.0 percent annually, to 4,893,444 people in 2017 (USCB 2019a).

Population projections for Georgia and South Carolina are drawn from the U.S. Census Bureau population estimates program, which provides demographic detail on race, age, and sex at the county level for household residents each year. Using this data, from 2020 to 2025, the total population in the ROI is projected to increase at an average annual rate of approximately 1.8 percent, which is higher than the projected growth rate for both Georgia and South Carolina. Between 2025 and 2030, the ROI population is projected to continue to grow with a projected increase of 4.6 percent in 2030. During the same time period, the state population for both Georgia and South Carolina is projected to increase by 4.4 and 4.6 percent, respectively (GAOPB 2019; SCRFAO 2019). Table 3-14 presents the historical and projected populations of the ROI, Georgia, and South Carolina.

Table 3-14—County and State Historic and Projected Population

Area	2000	2010	2017	2020	2025	2030
Aiken	142,552	160,099	165,707	177,510	187,210	196,500
Barnwell	23,478	22,621	21,788	25,510	26,490	27,190
Columbia	89,288	124,053	143,723	160,304	176,091	193,560
Richmond	199,775	200,549	201,568	201,712	201,913	201,868
SRS ROI	**455,093**	**507,322**	**532,786**	**565,036**	**591,704**	**619,118**
South Carolina	4,012,012	4,625,364	4,893,444	5,020,400	5,256,080	5,488,460
Georgia	8,186,453	9,687,653	10,429,379	10,694,980	11,186,110	11,709,700

ROI = region of influence; SRS = Savannah River Site.
Sources: USCB 2010a, 2019a; GAOPB 2019; SCRFAO 2019

3.8.1.3 Housing

From 2010 to 2017, the number of housing units in the ROI increased by 4.9 percent to 228,447 units (USCB 2010b, 2010c). The number of housing units in South Carolina and Georgia increased by 4.3 and 2.9 percent, respectively, resulting in a total number of 2,229,324 and 4,203,288 units, respectively.

The most recent housing stock statistics from the U.S. Census Bureau estimated 2017 housing occupancy by type (owned or rented). As of 2017, the ROI had 228,447 housing units, of which 84.2 percent were occupied and 15.8 percent were vacant. Of the estimated 36,134 vacant units, 7,894 were estimated to be vacant rental units, or 3.5 percent of the housing stock. This value is slightly higher than the state estimates for South Carolina and Georgia, both with an estimated 3.2 percent of the housing stock. All other vacant housing (such as abandonment and foreclosure) makes up 12.4 percent of the housing stock, or 28,240 units in the ROI. This value is lower than the state estimate for South Carolina (12.9 percent) and higher than Georgia (9.7 percent).

From 2010 to 2017, the median value of owner-occupied housing units in the ROI decreased by 19.2 percent to $88,200. In 2017, the median housing values in the ROI were lower than the median value in South Carolina and Georgia. Table 3-15 presents housing characteristics in the ROI, South Carolina, and Georgia for 2010 and 2017.

3.8.1.4 Community Resources

Existing community resources include police/sheriff, fire protection, medical services, and public educational institutions. Table 3-16 provides an overview of the public services within the ROI

There are eight school districts in the ROI, with a total of 140 schools serving 87,300 students during the 2016–2017 school year (NCES 2019). Aiken and Barnwell counties in South Carolina make up nearly four percent of the state student population, and Columbia and Richmond counties in Georgia make up three percent of the state student population. Richmond County has the greatest number of schools and the largest student population (31,794) within the ROI, while Barnwell County has the least number of schools and smallest student population (3,754) within the ROI. The ROI had an average student-to-teacher ratio of 16 to 1.

Table 3-15—Housing Characteristics

Housing Units	SRS ROI		South Carolina		Georgia	
	Number	%	Number	%	Number	%
2010 Total Housing Units	**217,690**		**2,137,683**		**4,088,801**	
Occupied Housing Units	195,012	89.6	1,801,181	83.4	3,585,584	87.7
Owner Occupied	130,393	66.9	1,248,805	69.3	2,354,402	65.7
Renter Occupied	64,619	33.1	552,376	30.7	1,231,182	34.3
Vacant Housing Units	22,678	10.4	336,502	15.7	503,217	12.3
Vacant Rental Units	6,907	3.2	96,715	4.5	181,208	4.4
All Other Vacant Units	15,771	7.2	239787	11.2	322,009	7.9
Median Value	$109,150		$134,100		$161,400	
2017 Total Housing Units	**228,447**		**2,229,324**		**4,203,288**	
Occupied Housing Units	192,313	84.2	1,871,307	83.9	3,663,104	87.1
Owner Occupied	127,736	66.4	1,284,532	68.6	2,306,772	63.0
Renter Occupied	64,577	33.6	586,775	31.4	1,356,332	37.0
Vacant Housing Units	36,134	15.8	358,017	16.1	540,184	12.9
Vacant Rental Units	7,894	3.5	70,988	3.2	132,497	3.2
All Other Vacant Units	28,240	12.4	287,029	12.9	407,687	9.7
Median Value	$88,200		$148,600		$158,400	

ROI = region of influence; SRS = Savannah River Site.
Sources: USCB 2010b, 2010c, 2019b

Table 3-16—Community Resources within the ROI

Area	Public Schools	Police/Sheriff	Fire and Rescue	Hospitals/Beds
Aiken	43	7	23	1/273
Barnwell	10	4	5	0
Columbia	31	4	5	0
Richmond	56	5	3	6/2,113
SRS ROI	**140**	**20**	**36**	**7/2,386**

ROI = region of influence; SRS = Savannah River Site.
Source: NCES 2019; USACops 2019; USAFireDept.com 2019; AHD 2019

There are seven hospitals in the ROI, all of which provide short-term acute medical care and emergency services. There are six hospitals in Richmond County, Georgia, and one hospital in Aiken County, South Carolina. There are no hospitals in Barnwell or Columbia counties. Aiken Regional Medical Center is a 273-bed acute care facility offering a comprehensive range of specialties and services. University Hospital in Augusta, Georgia, is a 560-bed private hospital and the largest hospital within the ROI (AHD 2019).

There are 20 police and sheriff departments within the ROI, employing approximately 690 law enforcement personnel (445 officers and 245 civilians) (USACops 2019). There are 36 fire departments in the ROI, with 1,493 career and volunteer firefighters and 123 civilian and volunteer nonfirefighting personnel (USAFireDept.com 2019).

3.8.2 Environmental Justice

Under Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," Federal agencies are responsible for identifying and addressing the possibility of disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on *minority populations* and *low-income populations* in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the Commonwealth of the Mariana Islands. Minority populations refer to persons of any race self-designated as Asian, Black, Native American, or Hispanic. Low-income populations refer to households with incomes below the Federal poverty thresholds.

Environmental justice concerns the environmental impacts that proposed actions may have on minority and low-income populations, and whether such impacts are disproportionate to those on the population as a whole in the potentially affected area. The potentially affected area for SRS includes parts of 28 counties throughout South Carolina and Georgia that make up an area within a 50-mile radius of the MFFF. To be consistent with the human health analysis in this EIS, the population distributions of the potentially affected area are calculated using data at the *block*-group level of spatial resolution from U.S. Census Bureau population estimates.

The threshold used for identifying minority and low-income communities surrounding specific sites were developed consistent with CEQ guidance (CEQ 1997, p. 25) for identifying minority populations using either the 50-percent threshold or a "meaningfully greater" percentage of minority or low-income individuals in the general population. Meaningfully greater is defined in this EIS as 20 percentage points above the population percentage in the general population. Figure 3-10 shows the block groups identified as having meaningfully greater minority and low-income populations surrounding the SRS. No populations reside within the five-mile radius of the proposed SRPPF.

The average minority population percentage of South Carolina and Georgia is 43 percent, and the average minority population percentage of the counties surrounding SRS is approximately 42.9 percent. Comparatively, a meaningfully greater minority or low-income population percentage relative to the general population of the state and the surrounding counties would exceed the 50 percent threshold defined by CEQ. Therefore, the lower threshold of 50 percent is used to identify areas with meaningfully greater minority populations surrounding SRS. In order to evaluate the potential impacts on populations closer to the proposed SRPPF, the analysis considered additional radial distances of 5, 10, and 20 miles from the location in F Area. Table 3-17 shows the composition of the area surrounding F Area at each of these distances. No populations reside within the five-mile radius of the proposed SRPPF.

The current estimated population residing within the 50-mile radius of F Area is approximately 816,710 people, of which 45.3 percent is minority. The overall composition of the populations within every radial distance is predominantly nonminority. The concentration of minority populations is greatest within the 50-mile radius. Black or African American population is the largest minority group within every radial distance and makes up 36.6 percent of the population within the 50-mile radius. The Hispanic or Latino population makes up 4.9 percent of the population.

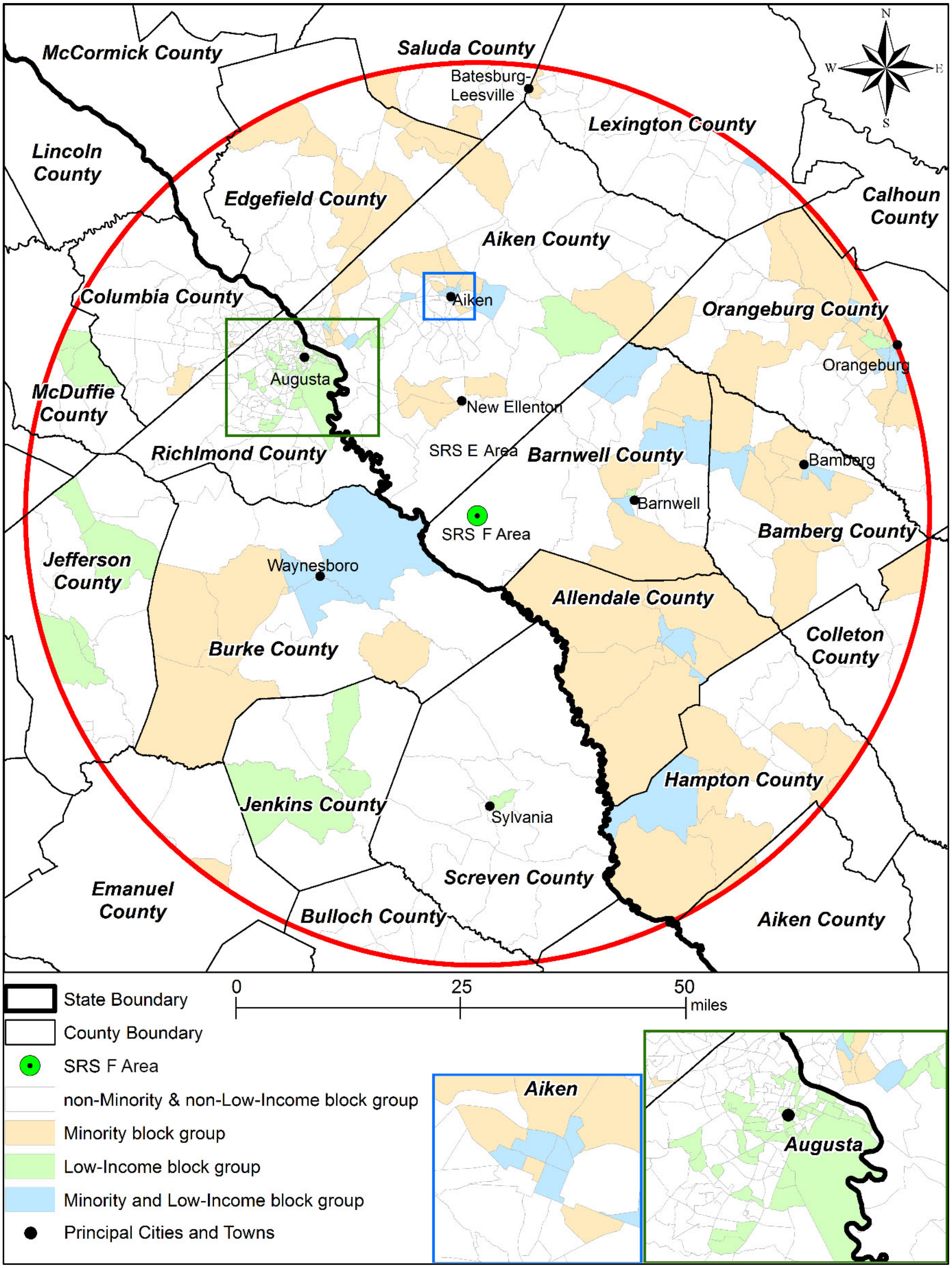


Figure 3-10—Savannah River Site Minority and Low-Income Populations

The current estimated low-income population (those living below the poverty threshold) living within the 50-mile radius of F Area is 174,165 people (19.4 percent). Meaningfully greater low-income populations are identified using the same methodology described above for identification of minority populations. The average low-income population percentage is 18.8 percent in South Carolina and 19.9 percent in Georgia. Comparatively, a meaningfully greater low-income population percentage using these statistics would be 20 percentage points greater than the state low-income population (38.8 in South Carolina and 39.9 in Georgia). Therefore, these state thresholds were used to identify areas that have meaningfully greater low-income populations within the 50-mile radius of the proposed SRPPF. Of the 594 block groups that surround F Area, 87 (14.6 percent) contain meaningfully greater low-income populations.

Table 3-17—Estimated Population in the Potentially Affected Area Surrounding the Proposed SRPPF[a]

Population Group	10 Miles		20 Miles		50 Miles	
	Population	% of Total	Population	% of Total	Population	% of Total
Nonminority	5,250	71.1	77,597	63.7	447,011	54.7
Hispanic	356	4.8	4,658	3.8	39,658	4.9
Black or African American	1,645	22.3	35,926	29.5	298,690	36.6
American Indian or Alaska Native	4	0.1	293	0.2	1,921	0.2
Asian	4	0.1	916	0.8	12,499	1.5
Pacific Islander	0	0.0	72	0.1	722	0.1
Other Race	0	0.0	116	0.1	1,457	0.2
Two or More Races	121	1.6	2,324	1.9	14,752	1.8
Total Minority	**2,130**	**28.9**	**44,305**	**36.3**	**369,699**	**45.3**
Total Population	**7,380**	**100.0**	**121,903**	**100.0**	**816,710**	**100.0**
Low Income	(b)	24.3	(b)	21.2	(b)	19.4

a. Data compiled using the EPA's Environmental Justice Screening and Mapping Tool, https://www.epa.gov/ejscreen.
b. Census Bureau poverty estimates are not based on the same demographic characteristics as minority populations; consequently, only percentages are provided for low-income populations.

3.9 WASTE MANAGEMENT

This section provides a broad overview of SRS waste management actions. Discussions are presented by waste type or category and include a description of the types of materials typically found in the waste, how it is dispositioned (e.g., on or off site), and how much is generated annually. Although the Proposed Action would not generate *high-level radioactive waste* (HLW); HLW management at SRS is a significant element of SRS waste management operations, and elements of HLW management are included in the management of other radioactive wastes. Therefore, HLW is discussed in this affected environment chapter, but is not discussed in Section 4.9, which addresses potential impacts to waste management associated with the Proposed Action.

3.9.1 High-Level Radioactive Waste

The primary materials managed as HLW at SRS are the radioactive liquid waste being held in the site's tank farm facilities and the solidified product generated from its treatment. The radioactive liquid waste was generated as a byproduct from processing nuclear materials; its management and treatment also generate several other non-HLW streams discussed in Section 3.9.3. Nuclear material and SNF processes are still performed at SRS, but much of the radioactive liquid waste inventory was generated from actions no longer being taken (NNSA 2015, p. 3-49). SRS currently has about 35 million gallons of this waste stored in 43 underground tanks in F Area and H Area tank farms (SRR 2019). An additional eight tanks in these two areas have already been operationally closed, and many of the active radioactive liquid waste tanks are scheduled for closure under the terms of the SRS FFA. Closure includes emptying the tanks to the extent practical and filling them with grout. Emptying the tanks and the complex process of treating the radioactive liquid waste to achieve more stable waste forms generates the other HLW addressed in this section.

Once the radioactive liquid waste has been sitting in the tank for some time, it naturally separates into a sludge phase on the bottom of the tank and an overlying liquid phase. The volume of the liquid phase, once retrieved from a tank, is reduced through the use of two evaporators in H Area. The evaporator condensate is sent to the ETF, and the concentrate is sent back to the radioactive liquid waste tank. With the concentrate now having a much higher salt concentration, this mostly liquid phase in the tank is commonly referred to as salt waste and includes solid salt waste from material coming out of solution and crystallizing as the concentrated liquid cools. The main treatment process for the radioactive liquid waste then involves treatment of the salt waste, making up more than 90 percent of the volume (SRR 2019), and the underlying sludge. The treatment processes for salt waste and sludge are summarized and simplified in the following:

- Salt Waste
  - **Actinide Removal Process (ARP) and Modular Caustic Side Solvent Extraction Unit (MCU):** Salt waste from the tanks is sent through a two-step treatment process: the ARP removes radioactive contaminants such as plutonium and strontium and the MCU removes cesium. The material removed from the salt waste goes to the DWPF, and the remaining, treated salt solution goes to the Saltstone Production Facility and Saltstone Disposal Units (see Section 3.9.3).
  - **DWPF:** Waste going to the DWPF is mixed with borosilicate glass frit and melted to form molten glass that is poured into 10-foot-tall, 2-foot-diameter stainless steel canisters. The sealed and welded shut canisters are stored on site.

    Note: The ARP and MCU that have been used at SRS are pilot-scale units and their processes have been scaled up in the newly constructed Salt Waste Processing Facility (SWPF), which is undergoing pre-startup testing. Once fully operational, the SWPF will replace the individual ARP and MCU.
- Sludge Waste
  - Sludge waste is transferred to the DWPF and solidified in a glass waste form in the same manner as described above for the specific waste streams separated from the salt waste.

The canisters of solidified glass, or vitrified waste, are moved from the DWPF to one of two adjacent glass waste storage buildings. At the glass waste storage buildings, the canisters are lowered into an underground reinforced concrete vault where they will be stored until a permanent disposal path is established. The DWPF began operation in 1996 and has produced more than 4,100 canisters of vitrified waste; 52 were filled in 2017 (SRNS 2018a, p. 1-10) and 15 were filled in 2018 when a replacement melter did not start up until June (SRNS 2019e, Sec. 1.5.4.1).

3.9.2 Transuranic Waste

In accordance with the *Waste Isolation Pilot Plant Land Withdrawal Act* (Public Law 102-579, as amended by Public Law 104-201), "the term 'transuranic waste' means waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for – (A) high-level radioactive waste; (B) waste that the Secretary has determined, with the concurrence of the Administrator, does not need the degree of isolation required by the disposal regulations; or (C) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with Part 61 of Title 10, Code of Federal Regulations." TRU waste[16] generated at SRS typically consists of radiologically contaminated items including clothing, tools, rags, residues, and debris (SRNS 2019e, Sec. 3.3.1). SRS packages its TRU waste for transport to the WIPP facility for disposal. The WIPP facility, located near Carlsbad, New Mexico, is DOE's deep geologic repository established for permanent disposal of TRU waste generated from defense activities (SRNS 2019e, Sec. 3.3.1). The WIPP facility has the appropriate permits to accept TRU waste, as well as mixed TRU waste, which contains both radiological and hazardous constituents. Further, the WIPP facility can accept TRU waste or mixed TRU waste containing PCBs, which are regulated under the *Toxic Substances Control Act of 1976* (15 U.S.C. 2601–2629) (TSCA). SRS manages its TRU waste in accordance with DOE orders, as well as Federal and State hazardous and toxic waste regulations (SRNS 2019e, Sec. 3.3.1).

SRS TRU waste (including mixed TRU waste or qualifying waste with PCBs) is verified to meet WIPP's waste acceptance criteria and transportation requirements before being shipped. This verification is achieved by measures such as assaying all TRU waste containers to determine radioactivity amounts, x-raying containers to verify physical contents, and sampling containers for hydrogen gas concentrations (SRNS 2019b). Preparation for shipping also includes packaging the waste in USDOT-approved containers, which are then placed in NRC-licensed casks. Transport is done in specifically designed trucks on routes approved by DOE and the impacted states along the route (SRNS 2019b).

Since the WIPP facility started receiving SRS waste in 2001, SRS has made more than 1,670 shipments to the WIPP facility,[17] and all remaining legacy TRU waste at SRS is packaged and ready for shipment (SRNS 2019b). SRS sent nine shipments of TRU waste to the WIPP facility in 2017, one shipment in 2018, and five shipments in 2019 (DOE 2020a).

[16] The WIPP facility is authorized to accept TRU waste that was generated from atomic energy defense activities. The TRU waste shipped from SRS and projected to be generated at SRPPF is, and would be, defense-related TRU waste. Throughout this SRS Pit Production EIS, the defense-related TRU waste from SRS and SRPPF is referred to as TRU waste.

[17] As of the end of May 2020, SRS had sent 1,677 shipments of TRU waste to the WIPP facility (DOE 2020b).

Over the five-year period from FY 2011 through FY 2015, TRU waste generated by SRS programs and tracked by the SRS solid waste management organization averaged about 1,020 cubic yards (780 cubic meters[18]) per year (Humphries 2016, p. 14). With packaging of legacy TRU waste complete, production of TRU waste at SRS is now estimated at approximately 460 cubic yards (350 cubic meters) per year (SRNS 2020). These projections include TRU wastes from surplus plutonium disposition from SRS and reflect a time frame when the proposed SRPPF would become operational (e.g., estimated 2026).

The *Waste Isolation Pilot Plant Land Withdrawal Act* and the ROD for the WIPP SEIS-II (DOE 1998) establish a total capacity of 6.2 million cubic feet[19] (175,564 cubic meters) of TRU waste for underground disposal at the WIPP facility. DOE has currently (as of July 25, 2020) disposed of approximately 2.4 million cubic feet (69,470 cubic meters) of TRU waste at WIPP (NWP 2020).[20] Therefore, approximately 3.8 million cubic feet (over 100,000 cubic meters) of TRU waste capacity is currently available at WIPP. DOE's National TRU Program evaluates the needs of the various sites sending TRU waste to WIPP, evaluates the ability of WIPP to receive and emplace waste to determine shipments available, and estimates shipping allocations over a five- to ten-year window. The National TRU Program anticipates some variation in shipping numbers over the next three years; in 2022, the number of waste shipments to WIPP is expected to climb steadily to a rate of approximately 750 per year (CBFO 2019a).

WIPP was originally planned for an operational life of 25 years (DOE 1980) and then 35 years (DOE 1997c), followed by closure and postclosure phases. In August 2019, DOE released, for stakeholder review and comment, a draft Carlsbad Field Office Strategic Plan based on maintaining WIPP TRU waste disposal operations active through 2050 as needed to support identified TRU waste inventory (CBFO 2019b, p. 5).

3.9.3 Low-Level Radioactive Waste

DOE defines LLW as radioactive waste that does not meet the definition of HLW, SNF, TRU waste, byproduct materials, or naturally occurring radioactive material. At SRS, LLW produced by most generators typically consists of miscellaneous job control waste, equipment, plastic sheeting, gloves, and soil that are contaminated with radioactive materials (Humphries 2016, p. 20). Radioactivity in LLW is generally caused by isotopes that have relatively short half-lives, but this does not preclude the waste from being highly radioactive and in some cases even requiring remote handling. The LLW category also includes several waste streams from large-scale waste management operations. The discussion that follows addresses three LLW categories: liquid LLW going to the ETF, treated salt waste, and general LLW.

[18] This section uses metric units to allow comparison with existing DOE documentation related to TRU waste.
[19] The use of "cubic feet" here is to allow comparison with the WIPP Land Withdrawal Act.
[20] The volume of waste for the purpose of the WIPP Land Withdrawal Act limit is calculated based on the volume of TRU waste inside a disposal container. Volumes of mixed TRU waste relative to RCRA permit approvals are calculated based on the gross internal volume of the outermost disposal container. The volume of record for the Land Withdrawal Act identified here is per a WIPP Hazardous Waste Permit modification approved by the New Mexico Environment Department in December 2018. That permit modification is under appeal.

3.9.3.1 Liquid LLW Going to the Effluent Treatment Facility

As discussed in Section 3.9.1 of this EIS, evaporators have been used to reduce the volume of the liquid phase of the tank waste and condensate from those evaporators was sent to the ETF. This facility is located in H Area and began operation in 1988 to treat low-level radioactive wastewater that was previously sent to seepage basins. In addition to evaporator overheads, wastewater going to the facility includes segregated cooling water, contaminated surface water runoff, and transfer line catch tank streams. The ETF's treatment processes include pH adjustment, filtration, organic removal, reverse osmosis, and ion exchange (NNSA 2012b). Treated wastewater that meets release criteria is sent to an outfall with an NPDES permit (see Section 3.3 of this EIS) that discharges to Upper Three Runs Creek north of H Area.

The ETF is designed to process 100,000 to 250,000 gallons of liquid effluent per day but has a maximum permitted capacity of 430,000 gallons per day. Actual waste processing at the ETF averages approximately 20 million gallons per year, or 55,000 gallons per day (NNSA 2015, p. 3-50).

3.9.3.2 Treated Salt Waste

The treated salt waste solution from the ARP and MCU derives from reprocessing the radioactive liquid waste in the tank farm facilities, and historically DOE has managed nearly all such waste as HLW. In the case of the SRS treated salt waste, a determination on whether it had to be managed as HLW was made over 10 years ago. In accordance with Section 3116 of the *Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005* (Public Law 108-375), DOE made a determination, in consultation with NRC, that the low-activity salt waste stream, although generated from the reprocessing of HLW, does not require disposal in a deep geologic repository. This 3116 Determination was based on the action meeting the following criteria: the salt waste "had highly radioactive radionuclides removed to the maximum extent practical, … meets concentration limits and/or dose-based performance objectives for near-surface disposal of radioactive waste, and … will be disposed of pursuant to a State-issued permit or State-approved closure plan" (DOE 2006, p. 7). In consultation with the NRC and the State of South Carolina, DOE determined these criteria were met and, accordingly, that the treated salt waste is not HLW and can be disposed of in SRS's Saltstone Disposal Facility pursuant to an industrial landfill permit issued by the SCDHEC (SRNS 2019e, Sec. 3.2.2.3).

From the ARP and MCU (or in the near future from the SWPF [Section 3.9.1]), the treated salt waste is sent to the Saltstone Production Facility (SPF) where it is mixed with cement, fly ash, and blast furnace slag to form grout (NNSA 2012c). In FY 2018, the SPF received and treated 384,000 gallons of the treated salt waste (SRNS 2019e, Sec. 1.5.4.1). Other low-activity liquid wastes, including a waste stream from the ETF, are processed through the SPF (NNSA 2012c). Since it began operation in 1990, the SPF has produced more than 30 million gallons of this mixture of decontaminated wastewater and grout (DOE 2019b), which SRS designates as saltstone.

The saltstone mixture is sent directly from the SPF to one of the Saltstone Disposal Facility units for solidification and disposal. These units, now referred to as saltstone disposal units (SDUs), are cylindrical concrete tanks, similar to those used commercially for storage of water and other liquids. The first three SDUs are 150 feet in diameter and 22 feet tall, each holding approximately three million gallons of grout. For the fourth SDU, completed in 2017, SRS changed to what is referred to as a mega-volume design. This SDU is 375 feet in diameter, 43 feet tall, and will hold approximately 32.8 million gallons of the grouted waste. DOE forecasts that seven of the mega-volume SDUs will eventually be needed to meet SRS's mission needs. Once the SDUs are filled, they will be capped with an engineered, multi-layer cover of limited permeability, isolating the units from the environment for the compliance period.

3.9.3.3 General LLW

The SRS solid waste management group is responsible for receiving LLW from site generators and, in some cases, from offsite generators, primarily the Naval Reactors Program. The group is also responsible for verifying the waste received is as characterized by the generator and that the waste meets the receiving facility's waste acceptance criteria. In most cases, newly generated LLW is taken directly to one of the disposal units shown in Table 3-18. In general, trenches are opened as needed, and there could be more than one trench of a single type open at any given time.

Each of the disposal unit types shown in Table 3-18 has its own general acceptance parameters, which provide a hierarchy of disposal options. If a waste exceeds the progressively expansive hierarchy of criteria or could adversely impact a unit's disposal inventory, disposal at an approved offsite facility is pursued. In some instances, LLW may also be sent off site for treatment and the treated waste sent back to the site for disposal (Humphries 2016, pp. 20–21). SRS has at times (the most recent in FY 2016) sent LLW to NNSS (NNSS 2019). Disposal of LLW at NNSS would remain an option for SRS in the future.

Over the five-year period from FY 2011 through FY 2015, LLW generated by SRS programs and tracked by the SRS solid waste management organization averaged about 19,000 cubic yards per year (Humphries 2016, p. 14). More recently, generation of LLW at SRS has been estimated at approximately 13,100 cubic yards per year (SRNS 2020).

3.9.4 Mixed Low-Level Waste

MLLW is radioactive LLW that also contains material regulated as hazardous waste. MLLW is generated by various SRS activities and operations, including environmental cleanup, D&D, and construction. This waste typically includes materials such as solvent-contaminated wipes, cleanup and construction debris, soils from spill remediation, RCRA metals, and laboratory samples (SRNS 2016a, p. 29). MLLW is sent off site to RCRA-regulated treatment, storage, and disposal facilities, but may first be held in one of several SRS storage facilities that have the necessary permits to accept the waste. One of the permitted storage sites for both MLLW and hazardous waste is a section of the TRU waste storage pads with storage capacity of 390 cubic yards (NNSA 2015, p. 3-51). The disposal facility at NNSS in Nevada is also authorized to accept MLLW and would be considered an option for disposal of MLLW from SRS.

Table 3-18—Types of LLW Disposal Units Used at SRS

Disposal Unit Type	Typical Capacity per Unit[a]	Description
Trenches		
Engineered trench	Total: 61,200 yd^3 Effective: 46,200 yd^3	Used primarily for disposal of LLW in B-12 and B-25 boxes and Sealands. Once full, the engineered trench is backfilled and covered with a minimum of four feet of clean soil.
Slit trench	Total: 37,800 yd^3 per set of five segments Effective: 21,500 yd^3 per set of five segments	Designated for construction/D&D debris, contaminated vegetation, and contaminated soil disposal. Once full, the slit trench is backfilled and covered with a minimum of four feet of clean soil.
Component-In-Grout trench	Total: 21,600 yd^3 Effective: 8,500 yd^3	Similar to slit trenches, but once waste components are in place, they are encapsulated in grout. Used to dispose of bulky and containerized LLW that has higher radioactive inventories than LLW going into standard slit trenches.
E Area Vaults		
Low-activity waste vault	Total: 40,000 yd^3	The at-grade concrete structure's capacity is equivalent to about 12,000 B-25 boxes. The low-activity waste vault is designed to receive, store, and dispose of LLW radiating less than or equal to 200 millirem per hour at about two inches from the box surface.
Intermediate level vault	Total: 5,600 yd^3	Subsurface concrete structure designed for LLW that radiates greater than 200 millirem per hour at about two inches from the unshielded container, or LLW that contains significant amounts of tritium. The intermediate level vault has removable cover to allow top loading, and the cells are encapsulated with grout as the waste is placed for disposal.
Naval reactor component disposal area	Total: 4,400 yd^3	At-grade laydown area designed for permanent disposal of activated metal or surface-contaminated Naval Reactor program components (e.g., core barrels, adapter flanges, closure heads, and pumps). There are two naval reactor component disposal areas, each with capacity shown, but one has been closed to further component placement.

yd^3 = cubic yard.

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

Source: Humphries 2016, pp. 21–25

Over the five-year period from FY 2011 through FY 2015, MLLW generated by SRS programs and tracked by the SRS solid waste management organization averaged about 210 cubic yards per year (Humphries 2016, p. 14). More recently, generation of MLLW waste at SRS has been estimated at approximately 520 cubic yards per year (SRNS 2020).

3.9.5 Hazardous Waste

Hazardous waste is generated by multiple SRS activities and operations, including those noted above for MLLW. Typical hazardous waste at SRS includes RCRA metals, solvents, paints, pesticides, and hydrocarbons. PCB wastes, though regulated under TSCA rather than RCRA, are managed under the SRS Hazardous Waste Program (Humphries 2016, p. 26). As with MLLW, hazardous waste is generally sent off site to commercial RCRA-regulated treatment, storage, and disposal facilities, but may first be held in one of several SRS storage facilities that have the necessary permits to accept the waste. Certain hazardous wastes are recycled, including metals, excess chemicals, solvent, and chlorofluorocarbons. PCB wastes are generally sent off site for commercial treatment and disposal at TSCA-permitted facilities, but some meet restrictive regulatory standards to be disposed of in the local Three Rivers Solid Waste Authority Regional Landfill (Three Rivers Landfill) (NNSA 2015, p. 3-51).

Over the five-year period from FY 2011 through FY 2015, hazardous waste generated by SRS programs and tracked by the SRS solid waste management organization averaged about 52 cubic yards per year (Humphries 2016, p. 14). More recently, generation of hazardous waste at SRS has been estimated at approximately 76 cubic yards per year (SRNS 2020). This later estimate also singled out TSCA waste and estimated a generation rate of about one cubic yard per year.

3.9.6 Solid Waste

Solid waste described in this section is waste that is neither hazardous nor radioactive and consists of two categories. First is municipal-type waste that is commonly disposed of in municipal sanitary landfills and generally referred to as sanitary waste. The second category is referred to as construction and demolition waste and consists of bulky debris and rubble.

3.9.6.1 Sanitary Waste

At SRS, routine *sanitary waste* (e.g., office building and cafeteria waste) is collected in dumpsters at or near the point of origin, and a waste compactor truck picks up the dumpsters on a weekly basis. Trucks collecting office building waste take their loads to the North Augusta Material Recovery Facility for segregation into recycled and disposal streams. The disposal stream is then transported to the Three Rivers Landfill. The cafeteria waste is sent directly to the Three Rivers Landfill (Humphries 2016, p. 35).

The Three Rivers Landfill is a regional municipal and commercial landfill serving the nine counties that are members of the Three Rivers Solid Waste Authority as well as SRS (TRSWA 2019). The landfill opened in 1998 and is located on 1,400 acres of land inside SRS and leased from DOE. The current landfill is on 300 acres, with a projected operational lifespan of 120 years. The landfill is operated under a RCRA Subtitle D permit and receives 1,000 tons of waste per day, or about 250,000 tons per year. The Waste Authority attributes only 1.3 percent of the waste going to the landfill as coming from SRS (TRSWA 2019).

Over the five-year period from FY 2011 through FY 2015, sanitary waste generated by SRS programs and tracked by the SRS solid waste management organization averaged about 18,400 cubic yards per year (Humphries 2016, p. 14). More recently, generation of sanitary waste at SRS has been estimated at approximately 6,500 cubic yards per year (SRNS 2020).

3.9.6.2 Construction and Demolition Waste

Construction and demolition waste typically consist of bulky, inert debris and wood waste generated from land clearing, construction, site preparation, or demolition activities. SRS has operated its own construction and demolition landfill near N Area since 2003. The landfill is permitted and regulated by SCDHEC as a Part III Construction, Demolition, and Land-Clearing Debris Landfill (Humphries 2016, p. 36). If construction and demolition waste is determined to be noncompliant with the landfill's waste acceptance criteria, it is sent to the Three Rivers Landfill for disposal. Over the five-year period from FY 2011 through FY 2015, construction and demolition waste generated by SRS programs and tracked by the SRS solid waste management organization averaged about 63,000 cubic yards per year (Humphries 2016, p. 14).

The Three Rivers Landfill is an SCDHEC-approved asbestos waste landfill (NNSA 2015, p. 3-52).

3.9.7 Other Wastes

The CSWTF receives and treats most of the sanitary wastewater generated on SRS. The facility discharges to NPDES-permitted outfalls and has a treatment capacity of 383 million gallons per year (NNSA 2015, p. 3-52). SRS is actively undertaking an environmental restoration and cleanup program in accordance with the FFA among DOE, EPA, and SCDHEC. The *SRS Environmental Report for 2018* reported that 408 of the 515 waste sites identified as being subject to the FFA had undergone surface and groundwater cleanup. Further, SRS is in the process of remediating 10 additional sites (SRNS 2019e, Sec. 3.2.1). In some cases, these FFA or remediation activities involve waste management or waste management-like activities. However, this EIS does not describe these activities further as there is no reasonable way the Proposed Action could affect or be allowed to affect these actions.

3.10 HUMAN HEALTH

During normal operations, public and worker (occupational) health and safety issues include potentially adverse effects on human health that result from acute and chronic exposure to ionizing radiation and hazardous chemicals.

3.10.1 Radiation Exposure and Risk

3.10.1.1 General Site Description

Major sources and levels of *background radiation* exposure to individuals in the vicinity of SRS are assumed to be the same as those to an average individual in the U.S. population (Table 3-19). Background radiation doses are unrelated to SRS operations. Annual background radiation doses to individuals are expected to remain constant over time.

Releases of radionuclides to the environment from SRS operations are another source of radiation exposure to individuals in the vicinity of SRS. Types and quantities of radionuclides released from

SRS operations are listed in the annual SRS environmental reports. Table 3-20 gives the various exposure limits set for exposure pathways by DOE and the EPA for radiation workers and members of the public. Exposure pathway is how releases of radionuclides into the water and air could impact a person. Table 3-21 presents the annual doses to the public from recent releases of radioactive materials (2013 through 2018) and the average annual doses over this six-year period. These doses fall within radiological limits established in DOE Order 458.1 and are much lower than background radiation.

Table 3-19—Radiation Exposure of Individuals in the Savannah River Site Vicinity Unrelated to Savannah River Site Operations[a]

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

a. An average for the United States.
Source: NCRP 2009, p. 12

Table 3-20—Exposure Limits for Members of the Public and Radiation Workers

Guidance Criteria (organization)	Public Limit at the Site Boundary (millirem per year)	Worker Exposure Limit (millirem per year)
10 CFR 835.202 (DOE)	N/A	5,000[a]
10 CFR 835.1002 (DOE)	N/A	1,000[b]
DOE Order 458.1 (DOE)[c]	10 (all air pathways) 4 (drinking water pathways) 100 (all pathways)	N/A
40 CFR Part 61 (EPA)	10 (all air pathways)	N/A
40 CFR Part 141 (EPA)	4 (drinking water pathways)	N/A

DOE = U.S. Department of Energy; EPA = U.S. Environmental Protection Agency; N/A = not applicable.
a. Same as 10 CFR Part 20, Subpart C, Section 1201. Although this is a limit (or level) that is enforced by DOE, worker doses must be managed in accordance with as low as is reasonably achievable principles. Refer to footnote b.
b. This is a control level that DOE established to assist in achieving its goal to maintain radiological doses as low as reasonably achievable. DOE recommends that facilities adopt a more limiting administrative exposure guideline of 500 millirem per year. The current administrative exposure guideline at SRS is 500 millirem.
c. Derived from 40 CFR Part 61, Subpart H, Section 102; 40 CFR Part 141, Subpart G, Section 66; and 10 CFR Part 20, Subpart D, Section 1301.

Table 3-21—Annual Radiation Doses to the Public from Savannah River Site Operations, 2013–2018 (total effective dose)

Members of the Public	Year	Atmospheric Radioactive Releases[a]	Liquid Radioactive Releases[b,d] (All liquid + irrigation)	Total[c]
Representative person living near the SRS boundary (millirem)[g]	2013	0.052	0.14 (0.05 + 0.09)	0.19
	2014	0.044	0.12 (0.041 + 0.074)	0.16
	2015	0.032	0.15 (0.053 + 0.093)	0.18
	2016	0.038	0.15 (0.05 + 0.10)	0.19
	2017	0.027	0.22 (0.13 + 0.089)	0.25
	2018	0.082	0.19 (0.092 + 0.099)	0.27
	2013–2018 Average	**0.046**	**0.16**	**0.21**
Population within 50 miles (person-rem)[e]	2013	2.2	2.5	4.7
	2014	1.7	2.0	3.7
	2015	1.1	2.6	3.7
	2016	1.4	3.5	4.9
	2017	0.97	3.4	4.4
	2018	2.6	3.4	6.0
	2013–2018 Average	**1.7**	**2.9**	**4.6**
Typical person within 50 miles (millirem)[f]	2013	0.0028	0.0027	0.0055
	2014	0.0022	0.0021	0.0043
	2015	0.0014	0.0027	0.0041
	2016	0.0018	0.0036	0.0054
	2017	0.0012	0.0035	0.0048
	2018	0.0033	0.0035	0.0068
	2013–2018 Average	**0.0022**	**0.0030**	**0.0052**

a. DOE Order 458.1 and *Clean Air Act* regulations in 40 CFR Part 61, Subpart H, establish a compliance limit of 10 millirem per year to a maximally exposed individual.
b. Includes all water pathways, not just the drinking water pathway. Though not directly applicable to radionuclide concentrations in surface water or groundwater, an effective dose equivalent limit of 4 millirem per year for the drinking water pathway only is frequently used as a measure of performance. It is inspired by the National Primary Drinking Water Regulations maximum contaminant level for beta and photon activity that would result in a dose equivalent of 4 millirem per year (40 CFR 141.66).
c. DOE Order 458.1 establishes an all-pathways dose limit of 100 millirem per year to individual members of the public.
d. Beginning with the Savannah River Site Environmental Report for 2011 (SRNS 2012), DOE includes the potential dose from use of Savannah River water for irrigation as part of the liquid pathway dose.
e. About 781,060, based on 2010 Census data. For liquid releases occurring from 2013 through 2018, respectively for each year, additional 161,300, 182,100, 182,100, 183,500, 183,500, and 183,500 water users in Port Wentworth, Georgia, and Beaufort, South Carolina (about 98 river miles downstream), are included in the assessment.
f. Typical person is a hypothetical person receiving a dose that is typical of the population group; established at the 50th percentile (or median) level of national radiation exposure data. Obtained by dividing the population dose by the number of people living within 50 miles of SRS for atmospheric releases; for liquid releases, the number of people includes water users who live more than 50 miles downstream of SRS.
g. Since 2012, SRS has used the representative person (a hypothetical person) concept (instead of the maximally exposed individual concept) to determine if the site is complying with the DOE public dose limit. SRS calculates the representative person dose using site-specific reference person parameters. (Reference person is a hypothetical person with average physical and physiological characteristics—including factors such as age and gender—used internationally to standardize radiation dose calculations.) The SRS representative person falls at the 95th percentile of national and regional data. The applicable national and regional data used are from the EPA's *Exposure Factors Handbook*, 2011 Edition (EPA 2011). The 95th

percentile of a set of data is the value at which 95 percent of the data are below it. (See Appendix B for a discussion of the impacts of radiation doses to other receptors.)

Note: Sums and quotients presented in the table may differ from those calculated from table entries due to rounding. To convert miles to kilometers, multiply by 1.609.

Sources: SRNS 2019e, Chap. 6, 2018a, Chap. 6, 2017a, Chap.6, 2016a, Chap. 6, 2015, Chap. 6, 2014, Chap. 6

Using a risk estimator of 600 *latent cancer fatalities* (LCFs) per 1 million *person-rem* (or 0.0006 LCF per rem) (DOE 2003), the annual average LCF risk to the representative person of the public due to radiological releases from SRS operations from 2013 through 2018 is estimated to be 1×10^{-7}. That is, the estimated probability of this person developing a fatal cancer at some point in the future from radiation exposure associated with one year of SRS operations is 1 in 10 million. (Note: It takes a number of years from the time of radiation exposure until a cancer manifests.)

According to the same risk estimator, no excess fatal cancers are projected in the population living within 50 miles of SRS from one year of normal operations during the period 2013–2018. For perspective, this number may be compared with the number of fatal cancers expected in the same population from all causes. The average annual mortality rate associated with cancer for the entire U.S. population from 2012 through 2016 (the last five years for which final data are available) was 161 per 100,000 people (USCSWG 2019).[21] Based on this national mortality rate, the number of fatal cancers that was expected to occur in 2018 in the population living within 50 miles of SRS is 1,258.

SRS workers receive the same dose as the general public from background radiation, but also receive an additional dose from working in facilities with nuclear materials. Table 3-22 presents the annual average individual and collective worker doses from SRS operations from 2013 through 2018. These doses fall within the regulatory limits of 10 CFR Part 835. Using the risk estimator of 600 LCFs per 1 million person-rem, the annual average LCF risk to a representative member of the SRS workforce due to radiological releases from SRS operations from 2013 through 2018 is estimated to be 3×10^{-5}. That is, the estimated probability of this person developing a fatal cancer at some point in the future from radiation exposure associated with one year of SRS operations is 1 in 33,000.

A more detailed presentation of the radiation environment, including background exposures and radiological releases and doses, is presented in the annual SRS environmental reports. The concentrations of radioactivity in various environmental media (including air, water, and soil) in the site region (on and off site) are also presented in that report.

[21] The number of cancer deaths (cancer mortality) was 163.5 per 100,000 men and women per year (based on 2011–2015 deaths) (NCI 2018). In 2016, the latest year for which incidence data are available, for every 100,000 people, 156 died of cancer (USCSWG 2019).

Table 3-22—Radiation Doses to Savannah River Site Workers from Operations, 2013–2018 (total effective dose)

Occupational Personnel	From Outside Releases and Direct Radiation by Year[a]						
	2013	2014	2015	2016	2017	2018	Average
Number of workers receiving a measurable dose	1,472	1,584	1,884	2,799	4,411	4,415	2,760
Total (collective) worker dose (person-rem)	89	93	95	111	173	135	116
Average radiation worker (millirem)[b]	60	59	51	40	39	31	47

a. The sum of the effective dose (for external exposures) and the committed effective dose.

b. No standard is specified for an "average radiation worker"; however, the maximum dose to a worker is limited as follows: the radiological limit for an individual worker is 5,000 millirem per year (10 CFR Part 835). However, DOE's goal is to maintain radiological exposure as low as reasonably achievable. DOE has therefore established the administrative exposure guideline of 2,000 millirem per year (DOE-STD-1098-2017); the site contractor sets facility administrative exposure guidelines below the DOE level.

Note: The annual average and total dose values are rounded values. The values in the "Average" column are the rounded arithmetic means of the values in their corresponding rows.

Source: DOE 2014, p. 3-10, 2015, p. 3-10, 2016c, p. 3-10, 2017a, p. 3-10, 2018a, p. 3-11, 2019h, p. 3-9

3.10.1.2 Proposed Facility Locations

External radiation doses and concentrations in air of gross alpha, various plutonium isotopes, neptunium-237, and americium-241 have been measured near the center of SRS. From 2005 through 2009, the average annual external dose near the site center was 121 millirem. This is higher than the average annual dose of 84 millirem measured at the offsite control location situated near U.S. Highway 301. During the period 2006–2010, the average concentration of gross alpha near the center of SRS was about 0.001 picocurie per cubic meter compared with the approximately 0.0011 picocurie per cubic meter measured at the offsite control location. These values are virtually the same. During the same time period, the average concentration of plutonium-239 in the air was less than 0.00001 picocurie per cubic meter near the site center and at the offsite control location (SRNS 2019a).

3.10.2 Chemical Environment

The background chemical environment important to human health consists of the atmosphere, which may contain hazardous chemicals that can be inhaled; drinking water, which may contain hazardous chemicals that can be ingested; and other environmental media through which people may come in contact with hazardous chemicals (e.g., surface water during swimming or food through ingestion). Hazardous chemicals can cause cancer and noncancerous health effects. Sections 3.3 and 3.4 of this EIS address the baseline data for assessing potential health impacts from the chemical environment.

Effective administrative and design controls that decrease hazardous chemical releases to the environment and help achieve compliance with permit requirements (e.g., via NESHAP and NPDES permits) contribute to minimizing health impacts on the public. The effectiveness of these controls is verified through the use of environmental monitoring information and inspection of mitigation measures. Health impacts on the public may occur through inhalation of air containing hazardous chemicals released to the atmosphere during normal SRS operations. Risks to public health from other pathways, such as ingestion of contaminated drinking water or direct exposure, are lower than those from inhalation.

Section 3.4 of this EIS addresses the baseline air emission concentrations and applicable standards for hazardous chemicals. The baseline concentrations are estimates of the highest existing offsite concentrations and represent the highest concentrations to which members of the public could be exposed. These concentrations are in compliance with applicable guidelines and regulations.

During normal operations, SRS workers may be exposed to *hazardous materials* by inhaling contaminants in the workplace atmosphere or by direct contact. The potential for health impacts varies among facilities and workers. Workers are protected from workplace hazards through appropriate training, protective equipment, monitoring, materials substitution, and engineering and management controls. Under 10 CFR Part 851, DOE lists the requirements for a worker safety and health program to ensure that DOE contractors and their workers operate a safe workplace. It establishes procedures for investigating whether a violation of a requirement of this part has occurred, for determining the nature and extent of any such violation, and for imposing an appropriate remedy. In addition, 10 CFR Part 851 incorporates many Occupational Safety and Health Administration (OSHA) requirements and other protections. Appropriate monitoring that reflects the frequency and quantity of chemicals used in the operational processes ensures that these standards are not exceeded. DOE also requires that conditions in the workplace minimize recognized chemical hazards that cause, or are likely to cause, illness or physical harm.

3.10.3 Health Effects Studies

In 2002, the U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry (ATSDR) evaluated the public health impacts of releases of tritium from SRS into the environment and concluded that the levels of tritium contamination in the environment around SRS are low, and the radiation doses to members of the public from tritium in drinking water and food are correspondingly low. Individual annual doses are approximately 0.1 millirem, even taking into account possible contributions from organically bound tritium in foodstuffs (ATSDR 2002, pp. 1 and 10).

ATSDR found the nominal lifetime LCF risk of cancer from the annual intake of tritium around SRS to be 2.7×10^{-8} (ATSDR 2002, p. 11). This nominal risk is less than 1 in 10 million, a value that ATSDR defines as representing "no increased risk." ATSDR concluded that any impact on health would be very small and not detectable compared with any potential impact from the natural background radiation.

In 2007, ATSDR also issued an assessment of groundwater *migration* to offsite areas and surface-water contamination at SRS (ATSDR 2007, Summary). That assessment focused on the period from the end of the Centers for Disease Control and Prevention dose reconstruction evaluation timeframe (1992) to the time of the report (2007). ATSDR reached the following conclusions:

- According to the information evaluated by ATSDR, under existing conditions and normal operations, SRS currently poses no apparent public health hazard to the surrounding community from exposure to groundwater or surface water.

- There is no evidence of historical (pre-1993) migration of site-related radiological or chemical contaminants to offsite groundwater, and the monitoring data evaluated since 1993 indicate that the groundwater plumes have not migrated beyond the site boundaries. However, A Area and M Area, which are close to the northwest SRS boundary, could potentially impact offsite groundwater resources in the future. Note: Separate from the ATSDR conclusions, no further offsite groundwater exposure is anticipated. This expectation is based on a consideration of the natural groundwater flow paths, the ongoing capture of the primary groundwater plume in A Area and M Area, and the continued removal of dense, nonaqueous-phase liquid sources by technologies such as dynamic underground stripping.

- Unless onsite processes change and begin releasing additional chemical or radioactive substances, offsite surface-water exposures should remain the same or decrease as onsite remediation projects are completed.

The Centers for Disease Control and Prevention has a long-term program to evaluate the historical releases of radioactive and chemical materials to the environment from SRS, as well as other DOE sites (CDC 2001, 2006). This multi-year program, called the Dose Reconstruction Project, independently evaluated the historical releases from SRS to the environment and estimated the impacts on the surrounding population in terms of radiological dose. Phase I identified and collected the data on historical releases from SRS over a 39-year period, from the start of operations at SRS in 1954 to the end of 1992, when the main production activities ceased. Phase II reported the quantities of radionuclides and chemicals that were released from SRS during that period (CDC 2001). The report from Phase III presents screening estimates of the radiation dose and associated cancer risks for hypothetical persons living near SRS and performing representative activities (CDC 2006).

The results from the Phase III screening calculations indicate that calculated doses and risks to the hypothetical receptors summed over the 39-year study period appear to be small. The largest point estimate dose was 0.94 rem for the "Outdoor Family Child" born in 1955; the corresponding risk of cancer incidence is 0.10 percent and the corresponding risk of cancer fatality is 0.024 percent (CDC 2006, p. viii).[22] The "Outdoor Family Child" was defined as a hypothetical child who lived in Jackson, South Carolina, adjacent to the northwestern SRS boundary; ate food that was grown in Jackson; boated on the Savannah River; swam and spent time along the shoreline at the Jackson Boat Ramp on the Savannah River; and ate fish caught in the river below its confluence with Lower Three Runs Creek. For all exposure scenarios, most of the hypothetical dose from air releases came from iodine-131, argon-41, and tritium. Plutonium releases represented a small fraction of the estimated doses (CDC 2006). The SRS Dose Reconstruction Project was completed in September 2006.

[22] As a point of comparison, a person exposed to the annual background radiation dose of 620 millirem per year (see Table 3-19) would receive a total dose of 24.2 rem over 39 years.

The National Cancer Institute publishes national, state, and county incidence rates of various types of cancer (NCI 2020). However, the published information does not provide an association of these rates with their causes, (e.g., specific facility operations and human lifestyles). Table 3-23 presents incidence rates for the United States, South Carolina, Georgia, the four counties that make up the socioeconomic ROI (Aiken County, South Carolina; Barnwell County, South Carolina; Columbia County, Georgia; and Richmond County, Georgia), and the two other counties (Allendale County, South Carolina, and Burke County, Georgia), which are nearby SRS.

Table 3-23—Cancer Incidence Rates[a] for the United States, South Carolina, Georgia, and Counties Adjacent to the Savannah River Site, 2012–2016

Location	All Cancers	Thyroid	Breast	Lung and Bronchus	Leukemia	Prostate	Colon and Rectum
United States	**448**	**14.5**	**125.2**	**59.2**	**14.1**	**104.1**	**38.7**
South Carolina	**457.3**	**11.6**	**129.2**	**65.5**	**13.5**	**115.4**	**38.6**
Aiken County[b]	411.0	13.5	123.6	55.9	15.0	92.3	36.9
Barnwell County[b]	412.8	14.1	123.4	67.9	(c)	93.2	31.8
Allendale County	388.2	(c)	83.7	61.4	(c)	122.6	28.0
Georgia	**466.4**	**12.1**	**125.8**	**64.1**	**14.5**	**122.3**	**41.8**
Columbia County	**401.1**	**10.6**	**131.7**	**56.5**	**10.2**	**98.3**	**26.3**
Richmond County	468.6	11.3	134.0	70.2	13.0	130.4	33.8
Burke County	473.6	(c)	130.8	77.4	14.7	102.7	45.0

a. Age-adjusted incidence rates; cases per 100,000 persons per year.
b. SRS is located primarily in Aiken and Barnwell counties.
c. Data have been suppressed by the National Cancer Institute to ensure confidentiality and stability of rate estimates when annual average count is three or fewer cases.
Source: NCI 2020

The National Institute for Occupational Safety and Health provided funding to researchers from the University of North Carolina to determine if working with hazardous agents may have led to more deaths at SRS than would be expected in the general population. In a report addressing leukemia mortality among workers at the site hired between 1950 and 1986 and followed through 2002 (Richardson and Wing 2007), evidence is presented that, for 15 years after exposure to radiation, SRS workers have a higher chance of dying from leukemia than if they were not exposed. Although not stated in the report, it should be noted that radiation doses to SRS workers are generally lower today, and have been lower for a number of years, than during the years of operation covered by the study (see Table 3-22 above for recent years).

In early 2012, the Radiation and Public Health Project prepared the report *Assessing Changes in Environmental Radioactivity and Health Near the Savannah River Site—A Prototype to be Used at DOE Facilities* (RPHP 2012) and submitted it to DOE as an independent assessment of the radiation environment surrounding SRS. The report asserts that releases of radioactive contaminants and incident rates of radiosensitive diseases are increasing around SRS and that there is a shortage of published articles regarding the health of SRS workers and those living near SRS. However, following a review of the report, DOE responded by letter to the author of the report noting that (1) the conclusions in the report regarding excess health risk among persons living near SRS do not conform to typical methodology because they use the United States population as a comparison group rather than a more appropriate local or regional population; (2) the report's conclusion is contrary to the results from a Medical University of South Carolina study that shows cancer rates in the population living near the SRS were "lower than expected"; and (3) contrary to the assertion that "there is a relative paucity of articles on the health of SRS workers…or those living in proximity to SRS…," there are in fact at least two dozen publications that include data related to SRS directly or include SRS in multi-site studies. Included in those publications are studies from the Centers for Disease Control and the Agency for Toxic Substances and Disease Registry (DOE 2012).

3.11 Accidents

Accidents on SRS can result in adverse impacts to workers and the public. This section provides an overview of current and historical information relevant to accidents at the site. This section also discusses emergency preparedness.

In preparing this analysis, DOE reviewed SRS annual environmental reports to determine if there were any unplanned releases of radioactivity to the environment around the site during the most recent five years for which data are available (2013–2017); no unplanned releases were reported. The SPD SEIS presented similar results (no reported releases) for the earlier five-year period (i.e., 2007–2011) (NNSA 2015, p. 3-32). Unplanned radioactivity releases to the environment occurred during earlier site operations. The SPD Final EIS presents a discussion of historical unplanned releases (DOE 1999b, pp. 3-147 and 3-148).

With regard to nonradiological releases, the *Clean Air Act of 1990* (42 U.S.C. § 7401), Section 112(r), requires any facility that maintains specific hazardous or extremely hazardous chemicals in quantities above specified threshold values to develop a risk management plan. SRS has maintained hazardous and extremely hazardous chemical inventories below their specific threshold values; therefore, SRS has not been required to develop a risk management plan. There were no reportable Section 112(r)-related hazardous or extremely hazardous chemical releases at SRS during the most recent five years for which data are available (2014–2018) (SRNS 2015, p. 3-8, 2016a, p. 3-9, 2017a, p. 3-11, 2018a, p. 3-12, 2019e, p. 3-12).

The *Clean Air Act* mandates *air quality standards* for the protection of stratospheric ozone. Releases of chemical gases, such as chlorofluorocarbons, hydrofluorocarbons, halons, and other ozone-depleting substances, widely used as refrigerants, insulating foams, solvents, and fire extinguishers, cause ozone depletion. In August 2014, SRS notified EPA Region 4 that a comfort-cooling unit containing R-22 refrigerant had leaked refrigerant and was not repaired within the 30 days allowed by the regulations (SRNS 2015, p. 3-8). In 2013, SRS accidentally discharged approximately 361 pounds of halon due to a one-time fire suppression system failure (SRNS 2014, p. 3-8). For the period 2015 through 2017, SRS reported no exceedances of ozone-depleting substance release limits (SRNS 2016a, p. 3-11, 2017a, p. 3-11, 2018a, p. 3-12).

Emergency Preparedness

In accordance with DOE Order 151.1C, “Comprehensive Emergency Management System,” every site in the Complex has an established emergency management program that is activated in the event of an accident. These programs provide specialized training and equipment for local fire departments and hospitals, State public safety organizations, and other government entities that may participate in response actions, as well as specialized assistance teams. These programs also provide for notification of local governments whose constituencies could be threatened in the event of an accident.

The emergency management system at SRS includes emergency response facilities and equipment, trained staff, and effective interface and integration with offsite emergency response authorities and organizations. SRS personnel maintain the necessary apparatus, equipment, and a state-of-the-art Emergency Operations Center to respond effectively to virtually any type of emergency—not only at SRS, but throughout the local community. SRS conducts an annual comprehensive site-level exercise to test and demonstrate the site’s integrated emergency response capability. Federal, State, local, and private organizations that support the site’s response capability or may be affected by a facility emergency are invited to participate in these exercises at least once every three years.

SRS provides communities with information about what to do in the event of a serious incident or emergency. For example, a publicly available SRS brochure (DOE 2019c) describes emergency plans prepared by officials of Georgia and South Carolina, local governments, and SRS for each *emergency planning zone*. Emergency planning zones are areas that may be affected if an incident should occur at SRS. The brochure describes a system of public notifications and potential actions (e.g., take shelter or evacuate) appropriate for each emergency planning zone to mitigate impacts of a range of potential emergencies. Potential emergencies at SRS are divided into three categories:

1. **Alerts:** A problem or incident has occurred that could potentially impact site safety, such as small amounts of hazardous material released around the incident facility;

2. **Site Area Emergencies:** Something more serious has occurred on the SRS, such as small amounts of hazardous material released into areas of the site beyond the incident facility; and

3. **General Emergencies:** This is the most severe type of problem, such as the potential release of hazardous material off site that could threaten the health and safety of people living near SRS.

3.12 TRANSPORTATION

3.12.1 Transportation Infrastructure

SRS is surrounded by a system of Interstate highways, U.S. highways, State highways, and local roads. The regional transportation network services the four South Carolina counties (Aiken, Allendale, Bamberg, and Barnwell) and two Georgia counties (Columbia and Richmond) that generate nearly all of the SRS commuter traffic (NNSA 2008b, p. 4-375). Figure 3-11 shows the regional transportation infrastructure.

The closest Interstate highway to SRS is Interstate 20 (I-20), west of Aiken and Augusta, and is the major transportation route from the local area to Columbia, South Carolina, and Atlanta, Georgia, and points beyond. I-520 is a loop that circles Augusta and North Augusta, connecting to I-20 at each end of the loop. Truck shipments to and from SRS primarily enter the region on I-20. Trucks to and from SRS primarily use I-520 and South Carolina State Highway 125 (SC 125) (NNSA 2008b, p. 4-375). Figure 3-12 shows the vehicular access to SRS and onsite roads and railways.

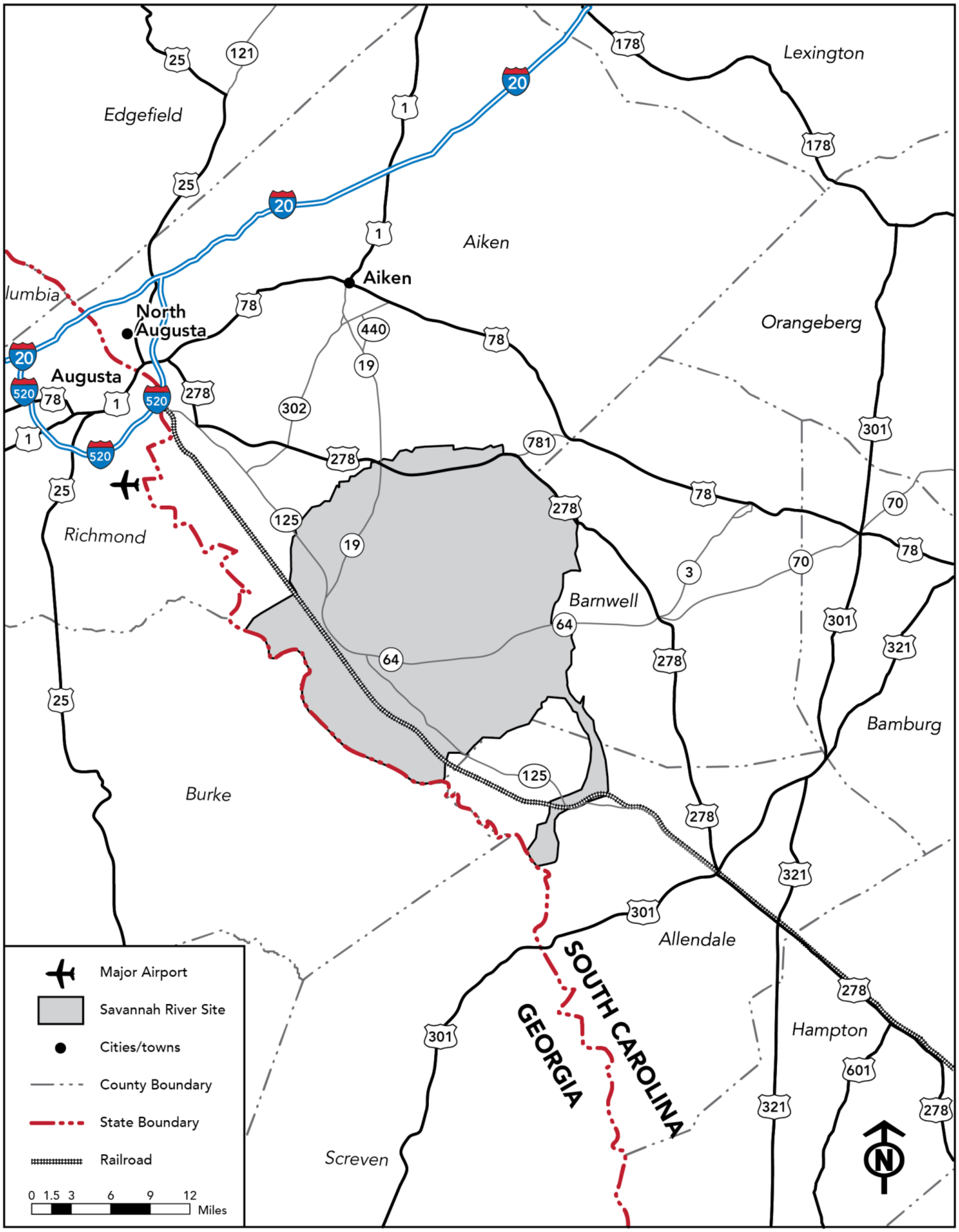


Figure 3-11—Regional Road Network Surrounding SRS
(Source: NNSA 2008b, Fig. 4.8.12.1-1)

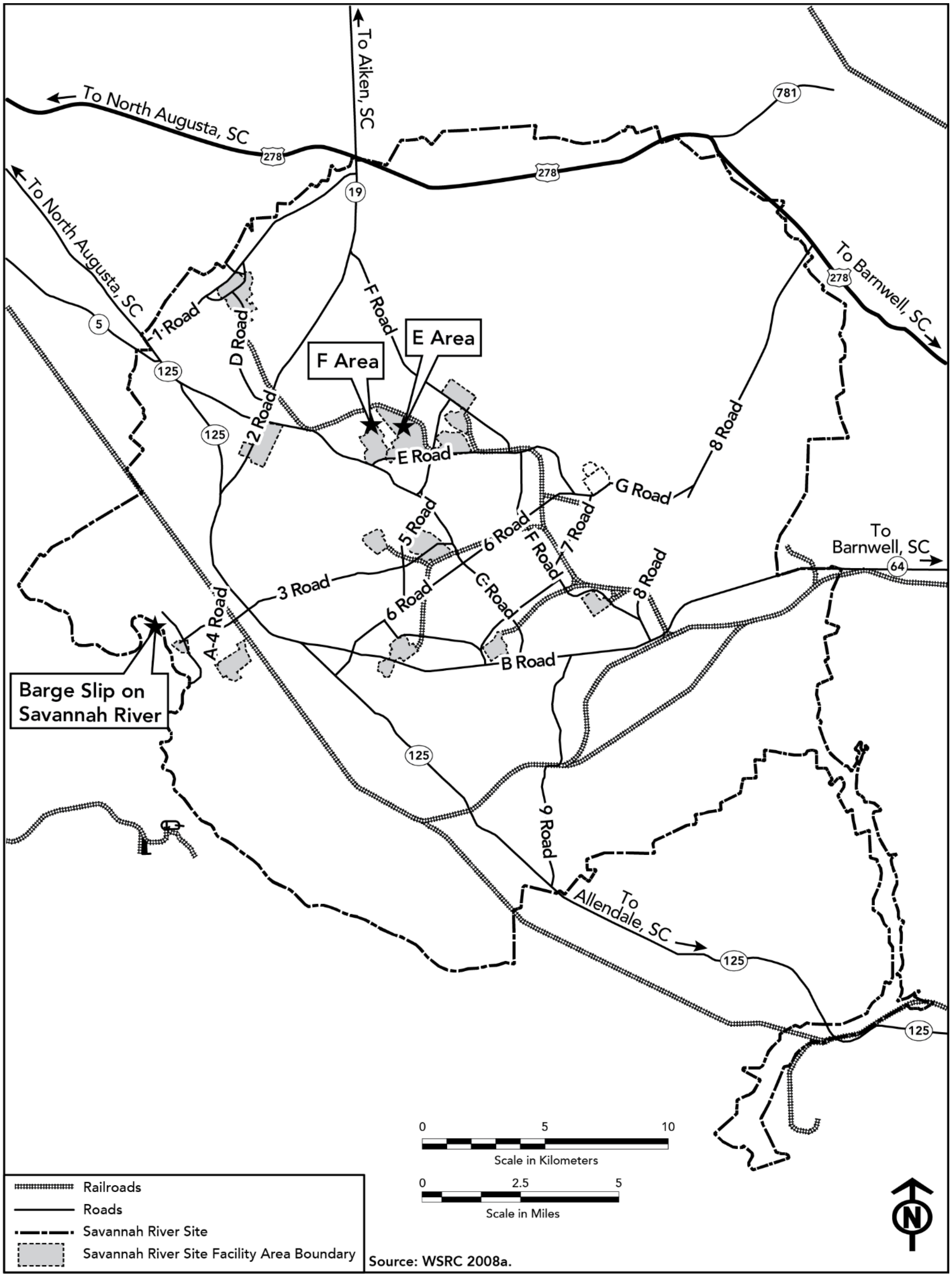


Figure 3-12—Savannah River Site Transportation Infrastructure (Source NNSA 2015, Fig. 3-6)

SRS is managed as a controlled area with limited public access. Vehicular access to SRS is provided from SC 19, 64, 125, and 781, and U.S. Highway 278. SC 19 runs north from the site through New Ellenton toward Aiken; SC 64 runs in an easterly direction from the site toward Barnwell; SC 125 runs through the site itself in a southeasterly direction between North Augusta and Allendale, passing through Beech Island and Jackson. U.S. Highway 278 also runs through the site, in a southeasterly direction between North Augusta and Barnwell. SC 781 connects U.S. Highway 278 with Williston to the northeast of the site. The northern perimeter of the site is about 10 miles from downtown Aiken (NNSA 2015, p. 3-40). Another primary road, U.S. Highway 301, crosses the Savannah River to the south of SRS (NNSA 2008b, pp. 4-375–4-377). Within SRS, there are approximately 130 miles of primary and 1,100 miles of secondary roads that connect the operational areas of the site to each other (NNSA 2015, p. 3-40).

The South Carolina Department of Transportation and the Lower Savannah Council of Governments Transportation Department collect and maintain data on the efficiency of the transportation system in the region surrounding SRS. Road performance is measured using level of service (LOS) ratings. LOS ratings range from "A" to "F," with "A" as the best travel conditions and "F" the worst. Most planners aim for LOS "C," which is defined as roads that are below, but close to, capacity and traffic generally flows at the posted speed.

In the South Carolina counties immediately surrounding SRS (Aiken, Barnwell, and Allendale), the roads with the highest levels of traffic operate at LOS "A" (LSCOG 2017). In Augusta-Richmond County, Georgia, I-520 from I-20 to Peach Orchard Road operates below LOS "C." Principal arterial roads in Augusta-Richmond County that primarily carry commuters that operate below LOS "C" include segments of Deans Bridge Road (U.S. Highway 1), Doug Barnard Parkway (County Road 1518), Mike Padgett Highway, Peach Orchard Road, and Washington Road (ARC 2018, Table T-10).

In regard to planned major road improvements in the region, replacement of the I-20 bridges over the Savannah River and Augusta Canal is scheduled for completion in 2022 (GDOT 2019a). This project will widen 1.8 miles of I-20 from four to six lanes, replace four bridges, and make intersection improvements at the West Martintown Road Interchange in South Carolina.

The Norfolk/Southern Railway owns two tracks that traverse through a five-mile area outside the SRS boundary (greater than 10 miles from the MFFF). One track extends east-southeast from Augusta, Georgia, to Charleston, South Carolina (see Figure 3-11). The other track (not shown in Figure 3-11) extends south from Augusta turning eastward at the Burke County line to a point approximately three miles from SRS and continues south to Savannah, Georgia. A CSX rail line traverses the site outside (west) and approximately parallel to SC 125. SRS operates and maintains its own railroad system for providing direct rail service to various areas within SRS. The onsite rail system, consisting of about 32 miles of track, interfaces with commercial railroads at the site, with a rail spur providing rail access to F Area and E Area (see Figure 3-12). The bulk of rail traffic consists of coal and cask car movements using the Dunbarton and Ellenton interchanges to areas on SRS (CB&I-AREVA 2015, p. 1-174; NNSA 2015, p. 3-42).

Bush Field in Augusta, Georgia, and the Columbia Metropolitan Airport in Lexington County, South Carolina, are the only two airports within 60 miles of SRS that provide scheduled air passenger services. Bush Field is approximately 20 miles from the MFFF. The Columbia

Metropolitan Airport is the nearest air traffic hub, at approximately 60 miles from SRS. Barnwell County Airport, a small general aviation facility, is nearly 16 miles from the MFFF and is the closest airport to the SRS boundary. Private aircraft, including corporate jets, use the Barnwell County Airport. Other small, nearby airports include Aiken Municipal Airport (25 miles away), Allendale County Airport (27 miles away), Bamberg County Airport (30 miles away), Burke County Airport in Waynesboro (26 miles away), and Daniel Field in Augusta (28 miles away) (CB&I AREVA 2015, p. 1-175).

DOE operates a heliport on SRS in B Area, about three miles from the MFFF, where two lightweight, multipurpose helicopters are based to provide support to the security services at SRS. USFS conducts regular helicopter operations across SRS for purposes of wildfire detection/response, prescribed fire operations, and wildlife/forest health surveillance. USFS operations originate from the heliport adjacent to the USFS facility on SRS. In addition, South Carolina Electric and Gas conducts limited helicopter operations across SRS for purposes of right-of-way inspection and clearance. Operations originate off site, with site access accomplished via electrical line pathways only (CB&I AREVA 2015, p. 1-175).

Barge transportation on the Savannah River is available. However, the Savannah River is used primarily for recreation. SRS has no commercial docking facilities but has a boat ramp (see Figure 3-12) that has accepted large transport barge shipments (NNSA 2015, p. 3-42).

3.12.2 Radiological Shipments

3.12.2.1 Packaging and Transportation Regulations

The USDOT and NRC have primary responsibility for Federal regulations governing the transport of commercial radioactive materials. In addition, DOE works with USDOT and NRC in developing requirements and standards for radioactive materials transportation. DOE, including NNSA, has broad authority under the Atomic Energy Act to regulate all aspects of activities involving radioactive materials that are undertaken by DOE or on its behalf, including the transportation of radioactive materials. However, in most cases that do not involve national security, DOE does not exercise its authority to regulate DOE shipments and instead utilizes commercial carriers that undertake shipments of DOE materials under the same terms and conditions as those used for commercial shipments. These shipments are subject to USDOT and NRC regulation. As a matter of policy, however, even in the limited circumstances where DOE exercises its Atomic Energy Act authority for shipments, DOE requirements mandate that all DOE shipments be undertaken in accordance with the requirements and standards that apply to comparable commercial shipments unless there is a determination that national security or another critical interest requires different action (NNSA 2015, pp. E-3–E-4).

The regulatory standards for packaging and transporting radioactive materials are designed to achieve the following four primary objectives:

1. Protect persons and property from radiation emitted from packages during transportation by specific limitations on the allowable radiation levels,

2. Contain radioactive material in the package (achieved by packaging design requirements based on performance-oriented packaging integrity tests and environmental criteria),

3. Prevent nuclear criticality (an unplanned nuclear chain reaction that could occur as a result of concentrating too much fissile material in one place), and

4. Provide physical protection against theft and sabotage during transit.

USDOT regulations pertaining to the transportation of radioactive materials are at 49 CFR Parts 106, 107, and 171–178; NRC regulations are at 10 CFR Parts 20, 61, 71, and 73. U.S. Postal Service Publication 52, *Hazardous, Restricted, or Perishable Mail* (USPS 2018) specifies the quantities of radioactive material prohibited in surface mail. These and USDOT's *Radioactive Material Regulations Review* (USDOT 2008) provide a comprehensive discussion on radioactive material regulations.

Packaging Regulations

The primary regulatory approach to promote safety from radiological exposure is the specification of standards for the packaging of radioactive materials. Packaging represents the primary barrier between the radioactive material being transported and radiation exposure to the public, workers, and the environment. Transportation packaging for radioactive materials must be designed, constructed, and maintained to contain and shield its contents during normal transport conditions. For highly radioactive material, such as HLW or SNF, packaging must contain and shield the contents in the event of severe accident conditions. The type of packaging used is determined by the total radioactive hazard presented by the material within the packaging. Four basic types of packaging are used: Excepted, Industrial, Type A, and Type B. Specific requirements for these packages are detailed in 49 CFR Part 173, Subpart I. All packages are designed to protect and retain their content under normal operations (USDOT 2008, pp. 28–40).

Excepted packaging is limited to transporting materials with extremely low levels of radioactivity and very low external radiation. Industrial packaging is used to transport materials that, because of their low concentration of radioactive materials, present a limited hazard to the public and the environment. *Type A packaging*, typically a 55-gallon drum or standard waste box, is used to transport materials with higher radioactive content than Excepted or Industrial packaging and must maintain sufficient shielding to limit radiation exposure to handling personnel. *Type B packaging* is used to transport material with the highest radioactivity levels and is designed to protect and retain its contents under transportation accident conditions. Packaging requirements are an important consideration for transportation risk assessment (USDOT 2008, pp. 28–40).

Radioactive materials shipped in Type A packages are subject to specific radioactivity limits identified as A_1 and A_2 values in 49 CFR 173.435. In addition, external radiation limits, as prescribed in 49 CFR 173.441, must be met. If the A_1 or A_2 limits are exceeded, the material must be shipped in a Type B package unless it can be demonstrated that the material meets the definition of "low specific activity." If the material qualifies as low specific activity as defined in 10 CFR Part 71 and 49 CFR Part 173, it may be shipped in a shipping container in Industrial or Type A packaging (49 CFR 173.427; USDOT 2008). Type B packages, or casks, are subject to the radiation limits in 49 CFR 173.441. Type A packaging is designed to retain its radioactive contents in normal transport. These regulations define design and test conditions that Types A and B packages must withstand, as defined in 49 CFR 173.465 and 173.466 for Type A packages and 10 CFR 71.73 for Type B packages.

Transportation Regulations

USDOT regulates the transportation of hazardous materials in interstate commerce by land, air, and water. USDOT specifically regulates the carriers of radioactive materials and the conditions of transport, such as routing, handling, storage, and vehicle and driver requirements. USDOT also regulates the labeling, classification, and marking of radioactive material packagings.

NRC regulates the packaging and transportation of radioactive material for its licensees, including commercial shippers of radioactive materials. In addition, under an agreement with USDOT, NRC sets the standards for packages containing fissile materials and Type B packagings.

DOE, through its management directives, orders, and contractual agreements, ensures the protection of public health and safety by imposing on its transportation activities standards that meet those of USDOT and NRC. USDOT recognizes in 49 CFR 173.7(d) that packagings made by or under the direction of DOE may be used for transporting Class 7 materials (radioactive materials) when the packages are evaluated, approved, and certified by DOE against packaging standards equivalent to those specified in 10 CFR Part 71.

USDOT also has requirements that help reduce transportation impacts. Some requirements affect drivers, packaging, labeling, marking, and placarding. Other requirements, specifying the maximum *dose rate* from radioactive material shipments, help reduce *incident-free* transportation doses.

3.12.2.2 Ongoing Shipments

The transport of shipments to and from SRS is conducted to support onsite processes and storage of nuclear materials in support of national defense and U.S. nuclear *nonproliferation* efforts, as well as activities related to environmental cleanup and stewardship (SRNS 2019c, p. 1). Shipments consist of nuclear materials, radioactive and nonradioactive wastes, hazardous materials and waste, and materials needed to conduct the general operations at the site.

NNSA's Office of Secure Transport is responsible for the safe and secure transport of government-owned special nuclear materials in the contiguous United States (NNSA 2019d). Special nuclear material is shipped to and from SRS using containers that meet the requirements of Type B transportation packages. These shipments include the transport of various forms of plutonium and uranium that may use NNSA's safe, secure transport system, in compliance with DOE Order 461.1C, "Packaging and Transportation for Offsite Materials of National Security Interest," which requires that packaging and transportation of all nuclear material are conducted in accordance with USDOT and NRC regulations, except where an alternative course of action is identified in this DOE order. NNSA may use specially designed tractor-trailers to transport special nuclear material. While the specific features are classified, some examples of features include enhanced structural characteristics, heightened thermal resistance, armed escorts, and 24-hour-a-day, real-time communications to monitor the location and status of all NNSA's safe, secure transport system shipments (DOE 1999b, p. 1-14). Since 1975, the Office of Secure Transport has accumulated more than 140 million miles of over-the-road experience with no accidents causing a fatality or release of radioactive material (NNSA 2019d).

TRU waste is defined and described in Section 3.9.2 of this EIS. TRU waste (including mixed TRU waste) is collected, characterized, and packaged for offsite disposal at the WIPP facility in New Mexico. *Contact-handled* TRU waste is loaded into certified packages. Currently, certified packages include the TRUPACT-II, TRUPACT-III, and the HalfPACT transportation packages (DOE 2016d, p. 31). Figure 3-13 is an illustration of TRUPACT-II, which is the package that most likely would be used under the Proposed Action. For *remote-handled*-TRU waste (TRU waste for which the dose rate at the surface of the waste container is greater than 200 millirem per hour) shipments, the packaging consists of the NRC-certified RH-TRU 72-B (DOE 2016d, p. 11). These packagings are NRC-licensed Type B casks designed specifically for the transport of TRU waste and have undergone extensive testing to demonstrate the ability to provide safe containment of TRU waste. Each truck transporting the packagings is tracked by emergency response and law enforcement officials via TRANSCOM, the same as for shipments of special nuclear material (DOE 2019d).

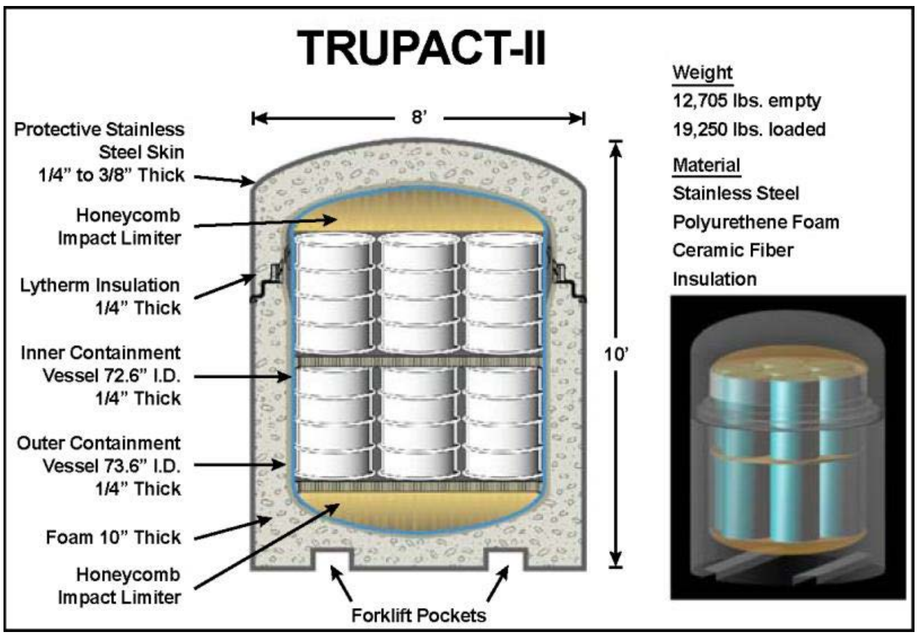


Figure 3-13—Transuranic Package Transporter Model 2 (Source: NNSA 2015, Fig. B-13)

While the majority of LLW generated at SRS is disposed of on site, DOE may also ship LLW off site for disposal at Federal or commercial disposal facilities, typically in drums or steel boxes. All solid LLW that is also hazardous waste (i.e., MLLW) is transported off site for treatment or disposal. DOE uses licensed commercial carriers for most LLW and MLLW shipments, with all shipments conducted in compliance with applicable Federal and State regulations.

3.12.3 Nonradiological Shipments

DOE transports hazardous waste off site for treatment and disposal at licensed treatment and disposal facilities. DOE transports *nonhazardous waste* from the SRS generating facility to onsite disposal facilities. Shipments of materials to and from SRS that are needed to support activities at the site are primarily shipped by commercial carrier. Rail is primarily used to make bulk shipments, such as for casks, coal, bulk chemicals, helium, and various other goods (CB&I AREVA 2015, p. 1-174).

3.12.4 Emergency Response

The U.S. Department of Homeland Security (DHS) is responsible for establishing policies for, and coordinating civil emergency management, planning, and interaction with, Federal agencies that have emergency response functions in the event of a transportation incident. DHS's *National Response Framework* (NRF) establishes the roles, responsibilities, and coordinating structures for managing the response in the event of a transportation incident involving nuclear material. These structures, roles, and responsibilities can be partially or fully implemented in the context of a threat or hazard, in anticipation of a significant event, or in response to an incident (DHS 2019).

FEMA, an organization within DHS, coordinates Federal and State participation in developing emergency response plans and is responsible for the development and the maintenance of the nuclear/radiological incident annex (NRIA) (DHS 2016) to the NRF. NRIA/NRF describes the policies, situations, concepts of operations, and responsibilities of the Federal departments and agencies governing the immediate response and short-term recovery activities for incidents involving release of radioactive materials to address the consequences of the event. FEMA has the authority to activate Nuclear Incident Response Team assets, which include DOE/NNSA and EPA assets that perform nuclear or radiological emergency response and support functions. These teams provide first-responder radiological assistance to protect the health and safety of the general public, responders, and the environment and to assist in the detection, identification, analysis, and response to events involving radiological/nuclear material. Deployed teams provide traditional field monitoring and assessment support, as well as a search capability.

DOE uses DOE Order 151.1C as a basis to establish a comprehensive emergency management program that provides detailed, hazard-specific planning and preparedness measures to minimize the health impacts of accidents involving loss of control over radioactive material or toxic chemicals. The Department provides technical assistance to other Federal agencies and to State and local governments. Contractors are responsible for maintaining emergency plans and response procedures for all facilities, operations, and activities under their jurisdiction and for implementing those plans and procedures during emergencies. Contractor and State and local government plans are fully coordinated and integrated. In addition, DOE established the Transportation Emergency Preparedness Program to ensure its operating contractors and State, Tribal, and local emergency responders are prepared to respond promptly, efficiently, and effectively to accidents involving DOE shipments of radioactive material. This program is a component of the overall emergency management system established by DOE Order 151.1C.

In the event of a release of radiological cargo from a shipment along a route, DOE assumes that local emergency response personnel would be first to arrive at the accident scene. It is expected that response actions would be taken in context of the NRIA. Based on an initial assessment at the scene, their training, and available equipment, first responders would involve State and Federal resources as necessary. First responders and/or State and Federal responders would initiate actions in accordance with the USDOT's *Emergency Response Guidebook* (USDOT 2016) to isolate the incident and perform any actions necessary to protect human health and the environment (such as evacuations or other means to reduce or prevent impacts to the public). Cleanup actions are the responsibility of the carrier. DOE would partner with the carrier, shipper, and applicable State and local jurisdictions to ensure cleanup actions meet regulatory requirements.

To mitigate the possibility of an accident, DOE issued DOE Manual 460.2-1A, which specifies that carriers are expected to exercise due caution and care in dispatching shipments. According to the manual, the carrier determines the acceptability of weather and road conditions, whether a shipment should be held before departure, and when actions should be taken while en route. The manual emphasizes that shipments should not be dispatched if severe weather or bad road conditions make travel hazardous. Current weather conditions, the weather forecast, and road conditions would be considered before dispatching a shipment. Conditions at the point of origin and along the entire route would be considered.

CHAPTER 4

Environmental Impacts

4 ENVIRONMENTAL IMPACTS

In this chapter, NNSA discusses the potential environmental impacts of the Proposed Action and the No-Action Alternative for each resource area. The potential impacts of the Proposed Action during construction and operational activities to produce pits at the proposed SRPPF are based on the methodology described in Appendix A to this EIS. Under the No-Action Alternative, the existing MFFF would remain unused and NNSA would utilize the capabilities at LANL to meet the Nation's long-term needs for pit manufacturing. DOE has re-evaluated the impacts of the pit production capacity at LANL in the Complex Transformation SPEIS and 2019 SPEIS SA (NNSA 2008a, 2019a) and the LANL SWEIS and 2020 Final LANL SA (NNSA 2008c, 2020a).

As described in Section 2.5 of this EIS, the primary construction activities would last approximately six years and would begin following issuance of a ROD, as appropriate. For analytical purposes, the end of the construction period is assumed to be 2026, when NNSA would begin to produce pits for the qualification process. Minor construction activities in the SRPPF complex could continue during startup of the SRPPF after 2026. For analytical purposes, all impacts projected to occur after 2026 are referred to as operations impacts.

This chapter also includes analyses of operational variations and design optimizations as described in Section 2.1.5 for each resource area. The Draft EIS referred to the first three of these as sensitivity analyses. Operational variations are defined as potential changes to internal processes of the SRPPF that are analyzed to provide flexibility in the NEPA coverage to address uncertainties in this early stage of review. Design optimizations are options that are being considered early in the design process that have the potential to affect construction of the SRPPF complex and the internal facility layout. The analyses in each of the resource area discussions in Chapter 4 include the following: Operational Variation #1—producing up to 125 pits per year (see Section 2.1.5.1.1); Operational Variation #2—producing pits using the wrought process (see Section 2.1.5.1.2); Design Optimization #1—retaining the existing administration building (see Section 2.1.5.2.1); Design Optimization #2—using a sand filter system (see Section 2.1.5.2.2); and Design Optimization #3—changing gloveboxes and the aqueous recovery process (see Section 2.1.5.2.3).

As identified in Section 2.1.2, the pit production process involves: (1) material receipt and storage; (2) feed preparation and purification; and (3) manufacturing. Pit reuse involves a subset of these processes, but does not include plutonium purification, furnace, or casting steps. Pit reuse does include material receipt and storage, disassembly (in some cases), machining (in some cases), assembly, and quality assurance. Because the potential environmental impacts associated with the reuse process would be no greater than those identified by the pit production process, this chapter conservatively reflects the potential impacts for production of 50, 80, and 125 new pits per year.

4.1 LAND USE AND VISUAL RESOURCES

4.1.1 Land Use

This section discusses the potential impacts to land use from the Proposed Action and the No-Action Alternative. Table 4-1 shows the estimated land requirements during construction and operations of facilities under the Proposed Action.

Table 4-1—Land Requirements During Construction and Operation of the SRPPF Complex

Project Phase	Footprint (acres)[a]
Construction	
Total construction footprint[b,c]	48
Facility removal[d]	9.0
Facility reuse (building footprint)	8.1
Facility new (construction footprint)	10.0-15.0
Operations	
Operational footprint (SRPPF complex)[e]	40
Proposed Protected Area	25
Operational Variation #1: 125 pits per year (Operational footprint/Protected Area)	40/25–33
Operational Variation #2: wrought production process (Operational footprint/Protected Area)	40/25–33
Design Optimization #1: retain existing administration building (Operational footprint/Protected Area)	40/33
Design Optimization #2: Use a sand filter system (Operational footprint/Protected Area)	40/33
Design Optimization #3: Changing gloveboxes and the aqueous recovery process (Operational footprint/Protected Area)	40/25–33

a. Source: SRNS 2020, 2020a.
b. All land associated with the total construction footprint has been previously disturbed.
c. Construction footprint sums existing MFFF footprint (includes adjacent support facilities), new facility footprint, and additional staging areas.
d. Includes numerous temporary structures/trailers.
e. Operational footprint sums proposed Protected Area and supporting facilities outside of the Protected Area.

4.1.1.1 Proposed Action

Construction

As described in Section 2.1.1, NNSA would repurpose the MFFF and the administrative and support facilities. Repurposing the MFFF would require internal modifications and installation of manufacturing and support equipment associated with the pit production mission. The MFFF contains three floors, 400,000 square feet of space, stands approximately 73 feet above grade, with a building footprint of approximately 120,000 square feet. Additional requirements for establishing pit production at SRS include: (1) removal of existing facilities, (2) construction of new facilities and modification of existing support facilities, and (3) construction of the proposed PIDAS.

Removal of Existing Facilities

Chapter 2, Figures 2-1 and 2-2, show the existing facilities in F Area and the layout of the proposed SRPPF complex, respectively, with the major buildings and their relationships to each other. The following existing facilities would be removed/relocated as part of the Proposed Action (see also Figure 4-1):

- The current administration building, located north of the existing MFFF (labeled "706-5F"), would be demolished to accommodate the proposed PIDAS, which would intersect the building on the northern side.
- The Construction Administration Complex (labeled "706-2F") would be demolished and provide a possible location for a cafeteria.
- The Mixed-Oxide Administration Complex (labeled "706-1F" and "706-8F"), which houses design operations, would be demolished and provide a possible location for the new administration building.
- The current maintenance facility (labeled "706-7F") would be used during initial construction then demolished and a new maintenance facility would be constructed within the proposed Protected Area.

Figure 4-1—Proposed Layout Under the Proposed Action (showing facility removal, reuse, and new construction) (Source: SRNS 2020a)

- Temporary trailers and support buildings east of the MFFF would be removed to provide a possible location for ancillary support facilities.

<u>Construction of New Facilities and Modification of Existing Support Facilities</u>

The following facilities would be constructed or modified to support SRPPF operations:

- A new administration building (labeled "706-5F") would be constructed south of the MFFF and would be built using the design of the existing administration building. Parking would be located adjacent to the new administration building. This facility would be outside of the proposed Protected Area.

- A new cafeteria would be constructed on the site where the Construction Administration Complex (labeled "706-2F") would be demolished.

- The replacement maintenance facility (labeled "Replacement 706-7F") would be constructed within the proposed Protected Area.

- A vehicle inspection facility and vehicle ECF would be constructed to access the Protected Area. A pedestrian ECF would also be constructed to allow personnel access to the Protected Area.

- Environmental storage and waste shipping facilities for managing and shipping wastes generated by SRPPF operations would be constructed. These facilities would vary in size and form, from concrete pads to concrete-walled structures with heating, ventilation, air conditioning, and lighting. Waste management facilities could include the following: TRUPACT-II (conveyance used to transport TRU waste to WIPP) loading facility; RCRA storage of waste awaiting shipment for disposal; a concrete storage pad to store empty or loaded TRUPACT-II shipping trailers; an LLW concrete storage pad; and a loaded TRUPACT-II inspection facility. Existing Building 731-2F is planned to house the TRU waste WIPP characterization process and also would be used for packaged waste storage.

- The Training Building (labeled "706-4F"), which currently houses offices, training rooms, and computer support, would be repurposed as a security force support facility. The facility would include lockers, an arms room, and offices. This facility would be within the proposed Protected Area.

- The existing Training and Operations Center (labeled "226-2F") would be modified to provide office space and include equipment that would support pit production training using surrogate materials that mimic the characteristics of plutonium operations; no radioactive material would be used. The modified Training and Operations Center would also support other DOE operations and would include a classified video conference center and vault room for storage of classified material. It would also support other DOE operations. This facility would be outside the proposed Protected Area.

- The existing Technical Support Building (labeled as "706-3F") would be repurposed to support pit production operations.

- Supporting infrastructure and ancillary facilities, (e.g., nitrogen generator, cooling tower, and chillers, fire water pumps and storage, bottled gas receiving) would be constructed within the proposed SRPPF complex, near or within the Protected Area.

- Construction of the PIDAS is described in Section 2.1.1 of this EIS.

Impacts

Construction activities would occur on previously disturbed land. Additionally, the construction of the SRPPF complex would involve modification and re-use of several existing facilities, which would allow for less land disturbance. After construction, disturbed areas would be restored in accordance with applicable regulations. Once restoration is complete, there would be an increase in open space within F Area, as areas used for staging would be restored and consolidated. The construction of the SRPPF complex would be consistent with current industrial land use within F Area. Therefore, the Proposed Action would not result in impacts to land use.

Operations

Once construction is complete, the Protected Area would be restricted to authorized personnel. During operations, there would be no change in land use for the Proposed Action, as the F Area would continue to be used for industrial applications. No notable impacts to SRS land use plans or policies are expected.

4.1.1.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Potential impacts to land use from construction-related activities associated with the production of 125 pits per year would not be appreciably different from the potential impacts under the Proposed Action because there would be no changes outside of the SRPPF. Potential impacts to land use from operations would also not be different from the potential impacts under the Proposed Action as there would be no change in the operational footprint.

Operational Variation #2: Wrought Production Process

Potential impacts to land use from the wrought process would be no different from the potential impacts under the Proposed Action. The operational footprint would be the same as under the Proposed Action.

Design Optimization #1: Retain Existing Administration Building

Potential impacts to land use from retaining the existing administration building would be similar to the potential impacts under the Proposed Action. During construction, additional work would be required along the northern side of the proposed PIDAS for installation of a retaining wall, which would result in an increase in land required for the proposed PIDAS by approximately 30 percent. Overall, the construction footprint would be expected to be similar to that presented for the Proposed Action. Land proposed for the expanded PIDAS was previously disturbed during construction of the MFFF and installation of the utility corridor.

Design Optimization #2: Use Sand Filter

Potential impacts to land use from the use of a sand filter would be similar to the potential impacts under the Proposed Action. The sand filter would be located within the Protected Area and require an area of approximately 260 feet by 360 feet, with a depth of approximately 35 feet. A total of three retaining walls would be constructed outside the PIDAS. Construction of the sand filter system would disturb approximately 2.9 acres of previously disturbed land (SRNS 2020a). Following construction, the operational footprint of the SRPPF would be generally the same as under the Proposed Action.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery

Potential impacts to land use from changes to gloveboxes and the aqueous recovery process would be no different from the potential impacts under the Proposed Action. The gloveboxes and aqueous recovery process would be housed within the SRPPF. As such, the construction and operational footprint would be the same as under the Proposed Action.

4.1.1.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts to land use would occur at SRS beyond those of existing and future activities that are independent of the Proposed Action.

4.1.2 Visual Resources

4.1.2.1 Proposed Action Alternative

Construction

During construction of the SRPPF complex, activities related to the removal of existing facilities, construction of new facilities, modification of existing facilities, and construction of the PIDAS would result in temporary changes to the visual appearance of F Area due to the presence of construction equipment, new buildings in various stages of construction and demolition, and possibly increased dust. Because the SRPPF is in the interior of the SRS, these activities would not be noticeable at or beyond the SRS boundary (approximately six miles away). Site visitors and employees observing construction would find these activities similar to the past construction activities (i.e., construction of the MFFF) or other developed areas on the SRS. Thus, impacts on visual resources during construction would be minimal.

Cranes used during construction of the SRPPF complex could create short-term visual impacts but would not be out of character for an industrial site such as F Area at SRS. The construction laydown areas, temporary parking, and temporary construction office trailers would also be typical for an industrial site. After construction of the facilities is complete, cranes and temporary construction office trailers would be removed, and construction laydown areas would be restored.

Operations

New buildings associated with the SRPPF complex would be similar in appearance to the existing facilities; the removal and repurposing of existing facilities would not significantly impact the appearance of F Area. Views of the new facilities within F Area by visitors or employees using the SRS road network (Road C and Burma Road) would be limited by the forest vegetation and rolling terrain surrounding the location.

4.1.2.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Potential impacts to visual resources from construction-related or operational-related activities associated with the production of 125 pits per year would not be different from the potential impacts under the Proposed Action because there would be no changes external to the SRPPF or its supporting facilities.

Operational Variation #2: Wrought Production Process

Potential impacts to visual resources from the wrought process would be no different from the potential impacts under the Proposed Action because there would be no changes external to the SRPPF or its supporting facilities.

Design Optimization #1: Retain Existing Administration Building

Potential impacts to visual resources from retaining the existing administration building would not be appreciably different from the potential impacts under the Proposed Action. During construction, additional work would be required along the northern side of the proposed PIDAS for installation of a retaining wall, which would result in an increase in activity in this location. Less than one acre of land would be disturbed by the construction work along the culvert for the PIDAS. Because the culvert runs beneath an existing utility corridor, the land that would be disturbed was previously disturbed during MFFF construction and when the utility corridor was constructed. During operations, the overall appearance of the SRPPF complex would be similar in appearance to the existing facilities.

Design Optimization #2: Use Sand Filter

Potential impacts to visual resources from the use of a sand filter would be no different from the potential impacts under the Proposed Action. The sand filter would be located within the Protected Area. The surface of the sand filter area would be graded and contoured to facilitate surface water drainage; however, most of the sand filter would be installed below grade. Presence of the sand filter would limit future uses of the area directly above the sand filter since construction of other facilities could not occur in this area.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential impacts to visual resources from the changes to the gloveboxes and aqueous recovery process would be no different from the potential impacts under the Proposed Action because there would be no changes external to the SRPPF or its supporting facilities.

4.1.2.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. No additional buildings or facilities would be built beyond current and planned activities, and no additional impacts to visual resources would occur at SRS beyond those of existing and future activities that are independent of the Proposed Action.

4.2 GEOLOGY AND SOILS

4.2.1 Proposed Action

There is no significant discrimination of geological and soils impacts between the construction and operational phases of the Proposed Action because most land disturbances have already occurred to accommodate the MFFF and support facilities, and any land disturbances under the Proposed Action would occur on previously disturbed land. Therefore, the impacts analysis addresses construction and operations together.

Repurposing the MFFF to include internal modifications to the facility for use as the SRPPF would not disturb additional land beyond the existing facility footprint. Construction of new ancillary and support facilities and buildings would also occur on previously disturbed land and would not constitute additional impacts to geological resources. The existing construction pads (disturbed footprint) were designed and sited using engineering cut and fill practices appropriate for foundation stability and are expected to continue to perform. In addition, the existing disturbed footprint that would be used for repurposed or newly constructed facilities has avoided the Carolina bay features (surface depressions) discussed in Chapter 3, Section 3.2.4, of this EIS.

As discussed in Chapter 3, there are no faults located within SRS that intersect the ground surface and therefore ground displacement near the proposed SRPPF is highly unlikely. While there are several faults that have been mapped beneath SRS, their features stop several hundred feet below grade with the Pen Branch fault being the primary structural feature capable of producing an earthquake. However, the evidence collected to date suggests that movement along the fault has not occurred in the past 500,000 years and therefore the fault is not considered a capable fault.

While the risk for an earthquake exists in association with faults within the Charleston seismic zone (approximately 70 miles southeast of SRS), ground shaking could occur that would affect primarily the integrity of inadequately designed or non-reinforced structures, but not damage property or specially designed facilities. Field inspections of the MFFF facility found no unfavorable geotechnical conditions (SRNS 2019d). SRNS geotechnical and structural engineers also evaluated the geotechnical and seismic design criteria for the MFFF (NRC-based) against similar DOE criteria that would be applied under the Proposed Action. The MFFF was evaluated against plausible seismic events (e.g., bedrock motions during an earthquake, which moves the building vertically and horizontally). As shown on Figures 4-2 and 4-3, the SRS seismic spectra (orange and purple lines) are predominately bounded by the previous NRC requirements used to design the MFFF facility (higher black line in the figures). Because the expected seismic spectra are predominately bounded by the previous NRC requirements used to design the MFFF, NNSA has concluded that the MFFF is structurally suitable for repurpose for the SRPPF (SRNS 2019d).

The work was performed consistent with DOE standards and was peer reviewed by independent seismological experts. Nevertheless, earthquakes capable of producing structural damage are not likely to originate near SRS. Unknown potential faults and seismic events cannot be quantified; however, known geologic conditions contribute to the understanding of seismic potential at SRS and add confidence through seismic design parameters. Thus, site geologic conditions would not likely affect the facilities associated with the proposed SRPPF.

Potential accident impacts associated with earthquakes are discussed in Section 4.11. Subsurface geologic strata under static conditions are considered stable subsurface foundations for existing and planned facilities associated with the proposed SRPPF. Identified soft-zones within the Tinker/Santee formations approximately 100 to 250 feet below the ground surface are isolated occurrences and, because of the depth, are also stable under static conditions. Dissolution of the carbonate materials in the soft-zones is so slow (if it is occurring at all) that it is not expected to affect any existing or future facility associated with the SRPPF (NNSA 2015, p. 3-8). Subsurface soft-zones are not expected to destabilize stratigraphy or foundations at the proposed SRPPF complex. Additionally, liquefaction of geologic media beneath proposed facilities is highly unlikely based on expected seismic activity and groundwater characteristics of the region.

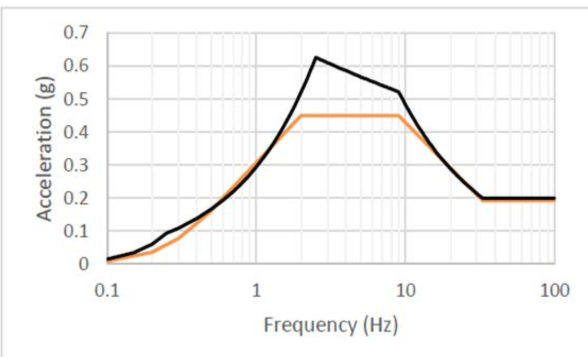


Figure 4-2—Horizontal Frequency Response (Source: SRNS 2019d)

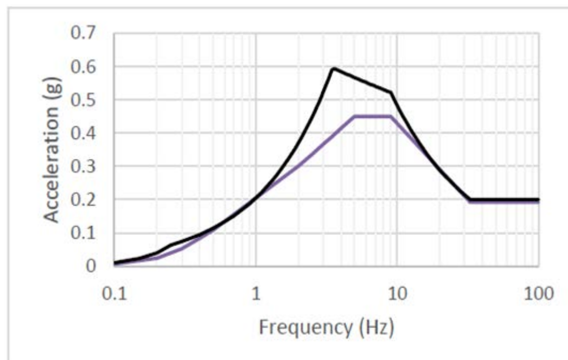


Figure 4-3—Vertical Frequency Response (Source: SRNS 2019d)

Soils within the vicinity of the proposed SRPPF have been disturbed to accommodate buildings, parking lots, and roadways. While the soils near the SRPPF and PIDAS meet the definition of prime farmland, the disturbed area would not be converted for farming, as it is not presently farmed and would not be available for farming in the future due to the restricted status of the lands at SRS. The *Farmland Protection Policy Act* (7 U.S.C. § 4201 et seq.) and associated regulations require agencies to make evaluations of the conversion of farmland to non-agricultural uses by Federal projects and programs. SRS is exempt from the *Farmland Protection Policy Act* under Section 1540(c)(4) because the acquisition of SRS property occurred prior to the Act's effective date of June 22, 1982. Aggregate and other geologic resources (e.g., sand) would be required to support construction activities in the project area, but these resources are abundant in the region.

Contaminated soils and possibly other media could be encountered during excavation and other site activities. Prior to commencing any new ground disturbance, NNSA would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under SRS's environmental restoration program and in accordance with applicable requirements and agreements. Any contaminated soils and media would be managed in accordance with existing waste management practices, which are presented in Sections 3.9 and 4.9 of this EIS.

4.2.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Potential impacts to geological and soil resources from the production of 125 pits per year would be no different from the impacts under the Proposed Action. No additional land disturbance would occur.

Operational Variation #2: Wrought Production Process

Potential impacts to geological and soil resources from activities associated with the wrought process would be no different from the impacts presented for the Proposed Action.

Design Optimization #1: Retain Existing Administration Building

As explained in Section 2.1.5.2.1, the existing administration building would be retained with modifications made to surrounding slope and drainage features that were part of the original design. The existing culvert north of the building would be filled in using a "cut and fill" process along with construction of a reinforced earthen retaining wall along 800 feet of the redesigned feature. The removed soil material along the higher slopes would be used to fill in the lower elevations and approximately 22,350 cubic yards of soil meeting required engineering standards would be used to construct the retaining wall in place of the culvert. If needed, suitable soil materials for construction of the retaining wall are available at several locations on SRS. Because the culvert runs beneath an existing utility corridor, much of the land that would be disturbed was previously disturbed when the utility corridor was constructed. Operational impacts of activities at the administration building would not affect soils or geology.

Design Optimization #2: Use Sand Filter

A sand filter system would be similar to other sand filters used at SRS for processing and material storage facilities and would consist of deep (several feet-thick) beds of rock, gravel, and sand, constructed in layers, with the smallest granule size at the top. The rock, gravel, and sand necessary to construct the sand filter layers are available at several locations in the region. As described in Section 2.1.5.2.2, the sand filter system would be contained within a reinforced concrete structure constructed on previously disturbed land so there would be no additional impacts to geology and soils. Excavation for the sand filter would not encounter ground water, which is approximately 100 feet deep in F-Area. The concrete structure and enclosed sand filter would be able to withstand a design basis earthquake highly resistant to large shock waves and pressure changes without operational failures (DOE 2003a).

Approximately 127,000 million cubic yards of excavated soil from construction would be stockpiled and evaluated for stability and suitability for other purposes. If suitable, some of the soils would be placed as backfill around the perimeter of the sand filter. The topography of the area would be graded and contoured to facilitate surface water drainage and minimize erosion. The relatively deep water table in F-Area and erosional and drainage engineering features to control infiltration and surface water runoff would render potential impacts from soil liquefaction from seismic events highly unlikely. As long as structural integrity is maintained, some seismic scenarios could potentially enhance filtration efficiency (SRNS 2020b) from additional sand and gravel bed settling. Following the useful life of the sand filter system, the subsurface components would likely be decommissioned, sealed, and abandoned in place.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential impacts to geology and soils from changes to the gloveboxes and aqueous recovery process would be no different from the potential impacts under the Proposed Action. The gloveboxes and aqueous recovery process would be housed within the SRPPF. As such, the construction and operational footprint would be the same as under the Proposed Action with no additional surface disturbance required.

4.2.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. There would be no additional impacts to geology and soil resources beyond current and planned activities near the MFFF.

4.3 WATER RESOURCES

4.3.1 Proposed Action

4.3.1.1 Construction

Surface Water

Potential impacts to surface water during construction would be associated with land disturbances that could affect stormwater runoff quality or quantity, the presence of construction equipment that could increase potential for spills or leaks of hazardous substances (i.e., fuels and lubricants) that could then find their way to surface waters, and use of surface water that could affect its availability.

The building that would be the SRPPF is already in place, but demolition of nearby buildings, construction of new support buildings, and construction of the PIDAS are included in the Proposed Action and would be expected to involve removal of structures down to bare ground along with excavation in some areas. Disturbed areas in the already-developed F Area could go from impervious or semi-impervious surfaces to areas where precipitation could soak into the ground, reducing runoff. Periods of more intense or longer-duration precipitation could also increase the potential for runoff to carry soil particles away. Adverse environmental impacts would not be expected from relatively short-term and localized decreases in the amount of runoff reaching surface waters. However, if not properly controlled, runoff carrying soil away could cause turbidity or sedimentation issues in local streams.

SRS has permits, plans, and procedures in place that would minimize the potential for stormwater runoff to carry soil particles or any potential surface water contaminant away from construction areas. SRS operates under a NPDES Industrial Stormwater General Permit that includes monitoring of stormwater discharged from F Area. SRS also operates under a General Permit for Stormwater Discharges from Construction Activities (Permit No. SCR100000). These permits, as well as permits for discharges from SRS industrial activities, have required that SRS prepare and implement plans to "control or eliminate discharge of toxic pollutants, oil, hazardous substances, sediment, and contaminated storm water" (SRNS 2018a, Sec. 3.3.7.1.1). These plans include a best management plan for identifying and controlling discharges of hazardous and toxic substances, a spill prevention, control, and countermeasure (SPCC) plan, and a stormwater pollution prevention plan (SWPPP). Implementation of these plans requires that appropriate soil and sediment control measures be put into effect as necessary during construction. Monitoring the applicable stormwater outfall during qualifying rain events, as required by the discharge permit, would verify the effectiveness of control measures.

The best management plan, SPCC plan, and SWPPP would address the presence of heavy equipment and, possibly, staged fuel storage containers during construction. SRS would be required to take mitigative actions, such as putting temporary storage containers within secondary containment and identifying the types and locations of equipment available to respond to (i.e., contain and cleanup) spills or leaks of potential pollutants. It is unlikely that there would be any significant leaks or releases of the types of hazardous substances that would be present during construction or that surface water would be adversely impacted by their presence.

NNSA expects that only small quantities of surface water would be used for construction purposes. F Area has a system to supply groundwater to the area, discussed later in this section. Surface water might be trucked to the area for dust control, but the quantities would not affect surface supplies for the SRS or downstream users.

Groundwater

Potential impacts to groundwater during construction are related to changes to groundwater recharge rates, the release of hazardous substances that could migrate to groundwater, and water usage that could affect groundwater availability.

The potential for decreased runoff from areas of newly exposed ground and excavations would correspond to areas with a potential for increased infiltration of stormwater and even increased recharge to groundwater. The extent and duration of ground changes during construction, however, would be too limited to expect any notable changes to groundwater levels or flow characteristics. The areas opened by construction, receiving no more than precipitation, would not be considered areas of important groundwater recharge. Similarly, it is expected that ongoing efforts to monitor and remediate the contaminant plume beneath the site (see Chapter 3, Figure 3-5) would not be impacted.

The potential for leaks or releases of contaminants during construction was described in the discussion of surface water. The measures that would be taken to keep contaminants from reaching surface water (i.e., taking actions to prevent leaks and releases and taking quick and appropriate cleanup responses, as necessary) would also be protective of groundwater.

It is expected that all, or essentially all, water needed to support construction activities would come from groundwater sources. As presented in Chapter 2, Table 2-1 of this EIS, peak water demand during construction is estimated to be 16.6 million gallons per year, or an average of about 45,500 gallons per day. This represents about 2.2 percent of the 2.04 million gallons of groundwater used per day by SRS in 2010 (see Chapter 3, Table 3-3) and about 0.12 percent of the 36.9 million gallons per day of groundwater used in the three-county area of Aiken, Barnwell, and Allendale in 2015 (see Table 3-2). Groundwater needed to support construction activities under the Proposed Action would be a small portion of the groundwater already used in the area, and any impacts to groundwater availability would be minor. The required water is also a small increment compared to SRS's water supply capacity of approximately eight million gallons per day (Section 3.3.3).

4.3.1.2 Operations

Surface Water

Potential impacts to surface waters during operations would involve only small changes compared to those of current SRS operations. There would be no direct discharges of water or wastewater to the environment from the proposed SRPPF complex. There would be minor differences in stormwater collection and discharge due to changed locations of some buildings and parking surfaces compared to the current configuration. Stormwater runoff quality could be adversely impacted due to the greater number of workers and associated vehicles parked in the area. Vehicle parking surfaces typically receive leaks and drips of petroleum products, and the increased number of vehicles could result in additional contaminants washing into stormwater collection systems. SRS would employ *best management practices* (BMPs) to ensure compliance with the requirements of the stormwater discharge permit.

Sanitary wastewater from the SRPPF complex and possibly some process wastewater from inside the SRPFF would discharge to existing treatment facilities, specifically, the CSWTF and ETF, respectively. Effluents from the treatment facilities are discharged to local surface water (Section 4.9 of this EIS discusses wastewater). Accordingly, the Proposed Action would involve additional volumes of water discharging from the treatment facilities; those discharges would still be subject to the applicable requirements from the existing discharge permits. As a result, adverse impacts to surface waters would not be expected.

Groundwater

Potential impacts to groundwater resources during operations would be minor. The SRPPF operation would involve no discharges to groundwater and because the site is already a developed area, infiltration and groundwater recharge rates from precipitation are expected to be very similar to those under existing conditions.

Water needed to support the SRPPF operations would come from groundwater sources. As presented in Chapter 2, Table 2-2 of this EIS, water demand during operations is expected to be 12.1 to 13.3 million gallons per year for the production of 50 to 80 pits per year, equating to an average of about 33,200 to 36,400 gallons per day. These numbers represent about 1.6 to 1.8 percent of the 2.04 million gallons of groundwater used per day by SRS in 2010 (Chapter 3, Table 3-3) and about 0.09 to 0.099 percent of the 36.9 million gallons per day of groundwater used in the three-county area of Aiken, Barnwell, and Allendale in 2015 (Table 3-2). Groundwater needed to support operations under the Proposed Action would be a small portion of the groundwater already used in the area, and any impacts to groundwater availability would be minor. The required water is also a small increment compared to SRS's water supply capacity (see Section 3.3.3).

4.3.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Potential impacts to water resources from construction-related activities associated with the production of 125 pits per year would be no different from the impacts under the Proposed Action because there would be no changes external to the SRPPF. Accordingly, the discussion that follows addresses changes that might be expected during operations.

Surface Water

Potential impacts to surface waters from producing 125 pits per year would be similar to those described for the Proposed Action; however, there would be some minor differences. The increased number of workers and associated vehicles parked in the area could increase the quantity of leaks and drips of petroleum products on parking surfaces that would then be subject to washing into stormwater collection systems. But, as described for the Proposed Action, existing stormwater discharge permits and their associated requirements would still be in place, and if there were issues meeting the permit's water quality standards, SRS would remedy the problem.

In addition, there would be increases in the volumes of sanitary wastewater generated and possibly some additional process wastewater from inside the SRPPF. As with the Proposed Action, these wastewaters would discharge to existing treatment facilities, specifically the CSWTF and ETF, which are addressed in more detail in Section 4.9. The effluents from the treatment facilities discharge to local surface water, so increasing pit production to 125 pits per year could involve additional volumes of water discharging from the treatment facilities. Any such discharges would still be subject to the applicable requirements from the existing discharge permits thus, adverse impacts to surface waters would not be expected.

Groundwater

Potential impacts to groundwater from producing 125 pits per year would be the same as described for the Proposed Action, except that more water would be needed to support SRPPF operations. As presented in Chapter 2, Table 2-2, water demand for the increased pit production is estimated to be 19 million gallons per year. This water use rate equates to an average of about 52,100 gallons per day, which is about 2.6 percent of the 2.04 million gallons of groundwater used per day by SRS in 2010 (Chapter 3, Table 3-3) and about 0.14 percent of the 36.9 million gallons per day of groundwater used in the three-county area of Aiken, Barnwell, and Allendale in 2015 (Table 3-2). Thus, water demands for the increased pit production would still represent a small portion of the area's groundwater usage and, therefore, impacts to groundwater availability would be minor. The required water is also a small increment of the SRS water supply capacity (see Section 3.3.3).

Operational Variation #2: Wrought Production Process

Potential impacts to water resources from activities associated with the wrought process would be no different from the impacts presented for the Proposed Action.

Design Optimization #1: Retain Existing Administration Building

Retaining the existing administration building would involve a notable change to the scope of activities during construction (i.e., eliminating a major building demolition effort). This change would be expected to decrease the amount of water needed to support demolition, but would be offset, to a degree, by water needs associated with construction of the retaining wall on the north side of the existing administration building and the larger PIDAS.

Changes to the facility layout of the Proposed Action, particularly filling in the culvert on the north side of the existing administration building and constructing a retaining wall in its place, would result in changes to the F Area runoff collection and discharge system. However, the same approach and requirements described for the Proposed Action to control the quality and discharge rates of stormwater runoff would still be in place. As a result, potential impacts to surface waters would be expected to remain the same as for the Proposed Action.

Design Optimization #2: Sand Filter

Potential impacts to surface water from construction of a sand filter exhaust system would result in similar potential impacts as under the Proposed Action. Such potential impacts would be associated with stormwater runoff quality and quantity and construction equipment that could lead to spills or leaks of fuels and lubricants. The potential for adverse impacts would be minimized in the same manner as described under the Proposed Action.

NNSA estimates that construction of the sand filter would require 120,000 gallons of water per year. This would represent an increase of less than one percent to the peak water demand under the Proposed Action (see Table 2-1). Accordingly, potential impacts associated with groundwater use would be unchanged from those under the Proposed Action.

During SRPPF operations, the sand filter would be expected to have no impacts on water resources. Integration of the sand filter system into the project would, however, involve an added element of potential long-term impact to water resources, primarily groundwater, at the end of the SRPPF's operational life. As described in Section 2.1.5.2.2, the sand filter would likely be left in place at the project's end of life and possibly be grouted in place for decommissioning to ensure the long-term protection of groundwater. Similar to the approach described in Section 4.14 of this Final EIS, NNSA would evaluate the situation, the level of radionuclide inventory contained in the sand filter, and available technologies to ensure that the final disposition of the sand filter would prevent radionuclide migration into groundwater.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential impacts to water resources from the change in gloveboxes and aqueous recovery process would be no different from the potential impacts under the Proposed Action because liquid wastes from aqueous recovery processes would be neutralized and solidified for disposal; wastewater collection and treatment systems would not be affected.

4.3.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. Impacts to surface water resources from SRS operations would remain at current levels.

4.4 AIR QUALITY AND NOISE

Impacts to air quality can result from the release of radioactive and nonradioactive air pollutant emissions during construction and operations activities at the proposed SRPPF complex. This section evaluates these impacts. The potential health effects associated with the potential release impacts of radioactive air pollutants are evaluated in Section 4.10. Impacts related to noise can also result from construction and operation activities at the SRPPF complex.

The SRS is located in the Augusta-Aiken Interstate AQCR. All areas within this region are in attainment with NAAQS (40 CFR Part 50). See Section 3.4 of this EIS for the discussion on existing air quality and noise resources.

Construction, operations, and transportation activities under the Proposed Action could result in air emissions of criteria pollutants, hazardous air pollutants, and greenhouse gases. Air quality impacts were assessed by comparing expected emissions of criteria pollutants and hazardous air pollutants from construction and operation activities at the proposed SRPPF complex with approved SRS air permit emission levels. In addition, air pollutant concentrations were evaluated for operational activities and compared to applicable national and State ambient air quality standards and significance levels. Greenhouse emissions are discussed later in this section and include impacts related to the transportation of materials and waste.

The EPA's final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (40 CFR Part 93, Subpart B) requires a *conformity* determination for projects that exceed emission *de minimis* levels in nonattainment areas. However, a conformity determination is not required for the Proposed Action because the SRPPF is within an area that is in attainment (see Chapter 3, Section 3.4.2).

4.4.1 Air Quality

4.4.1.1 Proposed Action

<u>Construction</u>

Implementation of the Proposed Action would require building demolition and construction in F Area and would involve indoor and outdoor construction activities. Expected emissions from construction activities are summarized in Table 4-2 and are primarily attributed to nonroad construction equipment emissions and site preparation activities. Annual construction emissions for SRS under the Proposed Action are expected to be minimal compared to current SRS sitewide emissions, which have been modeled and have demonstrated compliance with regulatory limits.

Construction of new structures would result in temporary increases in air quality emissions from construction equipment, trucks, and employee vehicles. Exhaust emissions from these sources would result in releases of sulfur dioxide, nitrogen oxide, PM_{10}, $PM_{2.5}$, volatile organic compounds, and carbon monoxide. The calculation of emissions from construction equipment was based on source information (i.e., 700,000 gallons of diesel fuel per year) and factors for nonroad equipment provided in EPA's MOVES2014b model.[23]

Table 4-2—Estimated Peak Nonradiological Air Emissions for the SRPPF During Construction

Pollutant	Estimated Annual Emission Rate Under the Proposed Action (tons/yr)	SRS Sitewide Emissions Rate (tons/yr)[a]
Carbon monoxide	38.2	660
Carbon dioxide equivalent	18,240	616,018
Nitrogen oxides	41.2	822
Sulfur dioxide	0.1	571
Volatile organic compounds	2.9	228
PM_{10}	12.3	272
$PM_{2.5}$	3.1	248

PM_{10} = particulate matter less than or equal to 10 microns in aerodynamic diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in aerodynamic diameter.

a. Source: Fanning 2019

These emission rates are conservative because vehicle emission rates have improved in recent years.

Fugitive dust generated during the clearing, grading, and other earth-moving operations is dependent on a number of factors including silt and moisture content of the soil, wind speed, and area disturbed. A common procedure to estimate *fugitive emissions* from an entire construction site is to use the EPA emission factor of 1.20 tons/acre per month of activity (EPA 1995, Sec. 13.2.3). This emission factor represents total suspended particulates (i.e., particles less than 30 microns in diameter). PM_{10} emissions are assumed to be 35 percent of total suspended particulates (MRI 1999, p. 4-12). $PM_{2.5}$ emissions are estimated by applying a particle size multiplier of 0.10 to PM_{10} emissions. Applying water to disturbed areas for dust suppression would reduce estimated emissions by approximately 50 percent.

The intermittent nature of construction emission sources would result in dispersed concentrations of air pollutants adjacent to construction activities. The substantial transport distance of construction emissions from F Area to the SRS boundary (at least six miles) would produce further dispersion and inconsequential concentrations of air pollutants at the SRS boundary. Estimated construction emissions are minimal when compared to the sitewide SRS emissions as shown in Table 4-2. Ambient air concentrations at SRS are in compliance with the applicable standards or guidelines as shown in Chapter 3, Table 3-5. As a result, air pollutant concentrations generated from construction activities under the Proposed Action would be below the applicable NAAQS.

[23] The EPA's MOVES2014b model is available online, https://www.epa.gov/moves/latest-version-motor-vehicle-emission-simulator-moves.

In addition, NNSA also modelled emissions from an onsite electric concrete batch plant that could be utilized during construction activities and produce as much as 70,000 cubic yards of concrete in support of the project. Although the area is in attainment and the general conformity rules do not apply, the *de minimis* threshold values were carried forward to determine the level of effects under NEPA for the batch plant. As shown in Table 4-3, the estimated emissions from the batch plant would be below the *de minimis* thresholds; therefore, the level of effects would be minor.

Table 4-3—Batch Plant Annual Air Emissions Compared to *De Minimis* Thresholds

Activity/Source	Carbon Monoxide	Nitrogen Oxides	Volatile Organic Compounds	Sulfur Dioxide	PM_{10}	$PM_{2.5}$	*De Minimis* Threshold (tpy)	Exceeds *De Minimis* Thresholds? (yes/no)
Batch plant emissions	0	0	0	0	2.0	4.5	100	No

PM_{10} = particulate matter less than or equal to 10 microns in aerodynamic diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in aerodynamic diameter; tpy = tons per year.
Source: EPA 2006

Operations

Nonradiological Impacts

Pit manufacturing activities could result in the release of criteria and toxic pollutants into the surrounding air. The majority of these releases would be from backup diesel generators. Process emissions are expected to be negligible due to the design of the building ventilation system that would maintain confinement of process air. The primary volume contributors are nitrogen and argon, used to maintain inert atmospheres for glovebox operations. Organic solvents used for cleaning and chemicals used in the analytical laboratory for various analyses would not be expected to contribute any appreciable quantities to the annual nonradioactive air emissions. Metal processing is expected to create large shavings versus inhalable particles. Metal processing would be conducted in gloveboxes and would be controlled by HEPA filters. Estimated ambient air pollutant concentrations that would occur at the SRS boundary due to glovebox emissions would be well below the applicable NAAQS and significance levels for all criteria pollutants.

Air emissions from periodic functional testing support systems (primarily backup diesel generators operating a maximum of 100 hours per year) include carbon monoxide, nitrogen dioxide, PM_{10}, sulfur dioxide, and volatile organic compounds. The estimated emission rates (tons per year) for nonradiological pollutants emitted under the Proposed Action are presented in Table 4-4. These emissions would be incremental to the SRS baseline presented in Chapter 3, Section 3.4.2.

The estimated maximum concentrations (in micrograms per cubic meter [$\mu g/m^3$]) at the SRS boundary that would be associated with the release of criteria pollutants are presented in Table 4-5. The air pollutant concentration data were developed by factoring the results of the dispersion modeling analyses conducted for the Complex Transformation SPEIS by the ratio of operation emissions estimated for the Proposed Action to the operation emissions estimated for activities at SRS in the Complex Transformation SPEIS (NNSA 2008a). The 2,015 workers (including security workforce) required during operations activities would be approximately 18 percent of the current SRS workforce on the order of 11,000 employees, and commuter vehicle emissions from this workforce would increase by a corresponding amount from current levels. Estimated emissions from the Proposed Action would be below permitted levels.

Table 4-4—Estimated Annual Nonradiological Air Emissions for the Proposed Action—Operations

Pollutant	Quantity Released (tons/year)
Carbon dioxide[a]	7,149
Carbon monoxide[b]	1.33
Nitrogen dioxide[b]	6.20
PM_{10}[b]	0.439
$PM_{2.5}$[b]	0.439
Sulfur dioxide[b]	0.002
Volatile organic compounds[b]	0.493

PM_{10} = particulate matter less than or equal to 10 microns in aerodynamic diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in aerodynamic diameter

a. Estimate based on backup diesel generators and employee commuting for 80 pits per year.

b. Estimate based on 15,000 gallons per year fuel limit, i.e., 100 hours per year, for backup diesel generators, conservative EPA AP-42 emission factors.

Table 4-5—Estimated Criteria Pollutant Concentrations at the SRS Boundary for the Proposed Action—Operations

Pollutant	Averaging Times	Most Stringent Standard or Guideline ($\mu g/m^3$)[a]	Background Ambient Air Concentration ($\mu g/m^3$)[b]	Proposed Action Maximum Incremental Concentration ($\mu g/m^3$)[c]	Significant Impact Levels ($\mu g/m^3$)[d]
Carbon monoxide	8-hour	10,000	2,863	0.36[e]	500
	1-hour	40,000	3,350	0.52[e]	2,000
Lead	Rolling 3-month Average	0.15	0.002	(f)	NA
Nitrogen dioxide	Annual	100	6.6	0.17[e]	1
	1-hour	188	71[g]	0.029[e]	7.5
PM_{10}	Annual[h]	50	17	0.014[e]	1
	24-hour	150	61	0.17[e]	5
$PM_{2.5}$	Annual[i]	15	13.5	0.0022[e]	0.3
	24-hour[j]	65	32.1	0.18[e]	1.2
Ozone	8-hour[k]	70 ppb	59 ppb	(l)	1.0 ppb
Sulfur oxides	1-hour	75	4	0.0086[e]	1
	3-hour	1,300	39.3	0.00079[e]	25
	24-hour	365	NA	0.00036[e]	5

μg/m^3 = micrograms per cubic meter; NA = not applicable; PM_{10} = particulate matter less than or equal to 10 microns in aerodynamic diameter; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in aerodynamic diameter; ppb = parts per billion.

a. The more stringent of the Federal and State standards is presented if both exist for the averaging period.
b. SCDHEC, see Chapter 3, Table 3-6, of this EIS.
c. Based on estimated emissions and scaling of existing modeling results from NNSA 2008b, Appendix F and NNSA 2015.
d. 40 CFR 51.165(b)(2) for comparison to PSD significance levels.
e. Emissions estimates based on backup diesel generators combustion.
f. Negligible based on use of HEPA filters.
g. Source: SCDHEC 2019h
h. To attain this standard, the three-year average of the weighted annual mean PM_{10} concentration at each monitor within an area must not exceed 50 μg/m^3.
i. To attain this standard, the three-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 μg/m^3. Significant impact level based on EPA (2018b).
j. To attain this standard, the three-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 65 μg/m^3.
k. To attain this standard, the three-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
l. Ozone concentration is not included in air modeling results.

Greenhouse Gas Emissions

Table 4-6 presents estimates of greenhouse gas emissions in terms of carbon dioxide equivalent that would occur from construction and operations activities and the transport of waste and materials by diesel-powered trucks under the Proposed Action. Carbon dioxide equivalent is the standard unit used to compare greenhouse gas emissions based on the global warming potential. Under the Proposed Action, the estimated total combined greenhouse gas emissions would be approximately 0.00045 percent of the total U.S. greenhouse gas emissions (6.457 billion metric tons of carbon dioxide equivalent in 2017) (EPA 2019b). The emissions estimate given in Table 4-6 is conservative; emissions are expected to be less due to SRS environmental goals to increase the use of alternative fuels (e.g., E-85) and decrease the use of gasoline and diesel, resulting in lower emissions of carbon dioxide equivalent.

Table 4-6—Total Carbon Dioxide Equivalent Emissions for Construction, Operations, and Transportation Activities

Activity	Proposed Action ($MT\ CO_2e/yr$)
Construction[a,b]	16,562
Operations[a,c]	10,621
Material transport[a,d]	1,576
Total	**28,759**

CO_2E = carbon dioxide equivalent; MT = metric ton.

a. Emissions based on EPA emission factors (EPA 2018c) and are given in metric units for comparison to U.S. emissions.
b. Based on 700,000 gallons of diesel per year.
c. Based on production of 80 pits per year. Commuter estimate of 252 workdays per year, 50 round-trip miles per day.
d. Distances for waste transport based on NNSA 2008b, Table E-1.

Radiological Impacts

Radioactive air emissions from pit manufacturing activities could include plutonium, americium, and enriched uranium. To minimize potential emissions, pit manufacturing activities would be performed within gloveboxes or vaults for radiological containment. Analytical operations would be conducted in laboratories consisting of rooms with gloveboxes and hoods for radiological containment. Each laboratory module would be separated from occupied areas of the laboratory facility by airlocks. The ventilation exhaust from process and laboratory facilities would be filtered through at least two stages of HEPA filters before releasing to the air. HEPA filters are the best available control technology for particulate emissions and are capable of removing more than 99.99 percent of particles from the exhaust air.

The estimated routine radionuclide air emissions under the Proposed Action would be small compared to the SRS existing emissions (Table 4-7). Total radionuclide emissions at SRS would increase by less than 2.0×10^{-7} percent. To ensure that total emissions were not underestimated, the analysis used a conservative approach for estimating emissions. Therefore, actual emissions from pit manufacturing operations likely would be smaller.

Table 4-7—Estimated Annual Radiological Air Emissions for the Proposed Action—Operations

Isotope	SRS Existing Emissions (Ci/yr)	Annual Emissions in Addition to Existing Emissions—50 pits per year (Ci/yr)	Annual Emissions in Addition to Existing Emissions—80 pits per year (Ci/yr)
Americium-241	2.00×10^{-5}	7.80×10^{-8}	1.25×10^{-7}
Plutonium-239	1.85×10^{-4}	2.55×10^{-6}	4.08×10^{-6}
Plutonium-240	7.68×10^{-6}	6.65×10^{-7}	1.06×10^{-6}
Plutonium-241	2.07×10^{-4}	4.90×10^{-5}	7.84×10^{-5}
Uranium-234	4.06×10^{-5}	1.26×10^{-9}	2.01×10^{-9}
Uranium-235	2.54×10^{-6}	3.95×10^{-11}	6.32×10^{-11}
Uranium-236	3.01×10^{-8}	6.40×10^{-12}	1.02×10^{-11}
Uranium-238	6.20×10^{-5}	3.55×10^{-13}	5.68×10^{-13}
Tritium	3.93×10^{4}	0	0
Krypton-85	1.03×10^{4}	0	0
All other	2.00×10^{-2}	0	0
Total	**$<5.0 \times 10^{4}$**	**5.23×10^{-5}**	**8.37×10^{-5}**

Ci/yr = curies per year.
Sources: Fanning 2019 (for SRS baseline emissions); NNSA 2008b (for scaled estimated annual emissions)

4.4.1.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Potential impacts to air quality from construction-related activities associated with the production of 125 pits per year would the same as the potential impacts under the Proposed Action because no additional facilities would be constructed. Potential operations-related impacts would increase because of the increase in process emissions and workforce. For nonradiological impacts, the 2,950 workers (including security workforce) required during peak operations activities equate to approximately 27 percent of the current SRS workforce, and commuter vehicle emissions from this workforce would increase by a corresponding amount from current levels. Radiological emissions due to processing 125 pits per year would increase by approximately 50 percent above the Proposed Action. Total radionuclide emissions at SRS would increase by less than 2.6×10^{-7} percent. Estimated emissions to produce 125 pits per year are shown in Table 4-8.

Operational Variation #2: Wrought Production Process

Potential impacts to air quality from the wrought process would be no different from the potential impacts under the Proposed Action because the amount of material in the gloveboxes would be similar and the wrought process does not have notably different emissions than casting.

Table 4-8—Estimated Annual Radiological Air Emissions to Produce 125 Pits Per Year

Isotope	SRS Existing Emissions (Ci/yr)	Annual Emissions in Addition to Existing Emissions—125 pits per year (Ci/yr)
Americium-241	2.00×10^{-5}	1.95×10^{-7}
Plutonium-239	1.85×10^{-4}	6.38×10^{-6}
Plutonium-240	7.68×10^{-6}	1.66×10^{-6}
Plutonium-241	2.07×10^{-4}	1.23×10^{-4}
Uranium-234	4.06×10^{-5}	3.14×10^{-9}
Uranium-235	2.54×10^{-6}	9.88×10^{-11}
Uranium-236	3.01×10^{-8}	1.60×10^{-11}
Uranium-238	6.20×10^{-5}	8.88×10^{-13}
Tritium	3.93×10^{4}	0
Krypton-85	1.03×10^{4}	0
All other	2.00×10^{-2}	0
Total	**$<5.0\times10^{4}$**	**1.31×10^{-4}**

Ci/yr = curies per year.
Sources: Fanning 2019 (for SRS existing emissions); NNSA2008b (for scaled estimated annual emissions)

Design Optimization #1: Retain Existing Administration Building

Potential construction-related impacts to air quality from retaining the existing administration building would be no more than the potential impacts estimated for the Proposed Action. While this scenario would involve additional earthmoving associated with the partial filling of the culvert and construction of a retaining wall, it would not include the air quality impacts associated with demolishing the existing administration building. During operations, potential impacts to the public and workers would be essential the same as under the Proposed Action because impacts would be a function of the backup diesel generators and pit manufacturing and not of the administration building (SRNS 2020).

Design Optimization #2: Use Sand Filter

Potential impacts from construction of the sand filter system would be small. The PM_{10} emissions due to the land disturbance during construction would be less than one ton per year. During operations, potential impacts to the public and workers would be essentially the same as under the Proposed Action because the sand filter would not replace the HEPA filters on Zone 1 areas (inlets and outlets of gloveboxes containing the process sources of radiological emissions). Other laboratory or process emissions that would be vented to the sand filter would have insignificant air quality impacts.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential construction-related impacts to air quality from glovebox changes and aqueous recovery modification would be essentially the same as under the Proposed Action. During operations, potential impacts to the public and workers would be essentially the same as under the Proposed Action because reduction in the number of gloveboxes or modification of the aqueous recovery system would not affect the radiological or non-radiological emissions from the SRPPF.

4.4.1.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. There would be no incremental impacts to air quality beyond current levels and the SRS would remain below the applicable NAAQS.

4.4.2 Noise

4.4.2.1 Proposed Action

Impacts from noise (i.e., unwanted audible sound) and vibration related to construction and operations activities can affect workers and the public. Activities under the Proposed Action would result in noise from vehicles, construction equipment, and facility operations.

Construction

As described in Section 4.1.1, the Proposed Action would involve construction of the SRPPF complex in F Area. Construction activities at SRS would increase noise levels temporarily in the immediate construction area and in the vicinity of the site because of increased traffic (see Section 4.12). Construction equipment expected to be used includes the following:

- backhoes
- excavators
- cranes
- soil compactors
- work trucks, four-wheel drive
- concrete delivery trucks
- concrete pump trucks
- water truck
- generators
- front end loader
- flatbed
- telescoping forklifts
- welder
- dump trucks
- skid steer
- fuel truck
- mini excavator

The majority of the site is already developed; therefore, construction noise such as loud impulsive blasting would be minimal. Although noise levels in construction areas could be as high as 110 A-weighted decibels (i.e., the relative loudness of sounds in air as perceived by the human ear), these high, local noise levels would not extend far beyond the boundaries of the construction site due to sound attenuation. Table 4-9 shows the attenuation of construction noise over relatively short distances. At 400 feet from the construction site, construction noises would range from approximately 55 to 85 decibels. Golden et al. (1980) suggests that noise levels higher than 80 to 85 decibels are sufficient to startle or frighten birds and small mammals. Thus, there would be little potential for disturbing wildlife outside a 400-foot radius of the construction site. See Section 4.5.1.1 of this EIS for a discussion of potential impacts to ecological resources from construction. Given the distance to the site boundary (approximately six miles), there would be no change in noise impacts to the public as a result of construction activities, except for a small, temporary increase in traffic noise levels from construction employees and material shipments.

Construction workers could be exposed to noise levels higher than the acceptable limits specified by the OSHA (29 CFR 1926.52). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts to workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

Table 4-9—Peak Noise Levels Expected from Construction Equipment

Source	Noise level (dBA)				
	Peak	Distance from source (feet)			
		50	100	200	400
Heavy trucks	95	84–89	78–83	72–77	66–71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80–89	74–82	68–77	60–71
Dozer	107	87–102	81–96	75–90	69–84
Generator	96	76	70	64	58
Crane	104	75–88	69–82	63–76	55–70
Loader	104	73–86	67–80	61–74	55–68
Grader	108	88–91	82–85	76–79	70–73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Fork lift	100	95	89	83	77

Source: Golden et al. 1980

Operations

The location of the proposed SRPPF complex relative to the site boundary and sensitive receptors was examined to evaluate the potential for onsite and offsite noise impacts. Noise impacts from pit manufacturing operations under the Proposed Action would be expected to be similar to those from existing operations. There could be an increase in equipment noise (e.g., heating and cooling systems, generators, vents, motors, material-handling equipment) from pit manufacturing activities. However, given the distance to the site boundary (approximately six miles), noise emissions from equipment would not be noticeable to the public. Some noise sources (e.g., public address systems and testing of radiation and fire alarms) could have onsite impacts, such as the disturbance of wildlife. These noise sources would be intermittent and would not be expected to disturb wildlife outside of facility boundaries. Traffic noise associated with the operation of these facilities would occur on site and along offsite local and regional transportation routes used to bring materials and workers to the site.

As with construction workers, operations workers could be exposed to noise levels higher than the OSHA-permissible exposure limit of 90 A-weighted decibels (29 CFR Part 1926, Subpart D). However, DOE has implemented appropriate hearing protection programs to minimize noise impacts to workers. These include the use of administrative controls, engineering controls, and personal hearing protection equipment.

4.4.2.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Potential impacts from noise from construction- and operations-related activities associated with the production of 125 pits per year would be no different from the potential impacts under the Proposed Action because noise levels would be the same for both conditions.

Operational Variation #2: Wrought Production Process

Potential impacts from noise from the wrought process would be the same as the potential impacts under the Proposed Action because the processes would be internal to the building.

Design Optimization #1: Retain Existing Administration Building

Potential construction-related impacts from noise from the retention of the existing administration building would be less than under the Proposed Action because NNSA would not be demolishing the existing administration building. However, these reductions would be partially offset by the added activities associated with construction of the retaining wall north of the PIDAS.

During operations, potential impacts from noise would be the same as under the Proposed Action.

Design Optimization #2: Use Sand Filter

Potential impacts from noise from construction of the sand filter system would be similar to the potential impacts under the Proposed Action. Even though there would be additional construction activity and excavation inside the Protected Area, those activities would be similar to other construction and earthmoving activities that would occur at the same time under the Proposed Action. During operations, use of the sand filter would result in a slight increase in noise from the fan house, although this increase would not be detectable at offsite locations.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential impacts from noise from construction and operations activities associated with the changes to gloveboxes and the aqueous recovery process would be no different from the potential impacts under the Proposed Action because these changes would be internal to the SRPPF.

4.4.2.3 No-Action Alternative

Under the No-Action Alternative, the existing MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. There would be no incremental impacts from noise beyond current levels.

4.5 ECOLOGICAL RESOURCES

4.5.1 Proposed Action

The ROI for the impacts analysis for ecological resources is the land occupied by and immediately surrounding (approximately 200 to 400 feet) the SRPPF complex. For aquatic habitats, such as streams and wetlands and aquatic species occupying those habitats, the ROI also includes those areas that may be affected by wastewater discharges and stormwater runoff and sedimentation.

4.5.1.1 Construction

Under the Proposed Action, potential impacts during construction could include loss of habitat from land clearing, erosion and sedimentation, and human disturbance and noise. Construction impacts are expected to occur over approximately six years and are considered short-term impacts (see Chapter 2, Section 2.2).

Terrestrial Resources

Construction related to the proposed SRPPF complex would occur on previously disturbed land in F Area (see Chapter 2, Figures 2-1 and 2-2). No disturbance of previously undisturbed lands is expected (see Table 2-1). Therefore, there would be no notable impacts to vegetation communities.

Because no vegetation communities on or surrounding the proposed SRPPF complex would be disturbed, impacts to wildlife species from habitat loss would not occur. During construction, presence of human activity and associated construction noise can cause wildlife species to avoid habitats surrounding a construction site. The area was an industrial construction site from 2007 to the fall of 2018 for the construction of the MFFF, and other locations within F Area have a longer history of human activity and industrial uses. Because SRPPF construction would be comparable to existing activities in F Area and noise attenuates with distance to receptors (NNSA 2008b, Table 5.1.4-7), no new impacts to wildlife species are expected from human presence and noise from SRPPF complex construction.

Aquatic Resources

No wetlands occur within the footprint of the proposed SRPPF complex and no notable impacts would occur to wetland habitats. The nearest 100-year floodplain is approximately one-half mile north of the SRPPF construction site along Upper Three Runs Creek. No construction activity would occur within the floodplain, and the function of the floodplain would not be affected. The SRPPF is located on a high point between the Upper Three Runs and Fourmile Branch watersheds. The elevation of the SRPPF is approximately 140 feet above the estimated elevation of a 100-year flood in the Upper Three Runs watershed to the north of the construction site (Section 3.5.2.2). No notable impacts from flooding are expected.

Aquatic species do not occur near the proposed SRPPF complex because of the absence of suitable habitat. Erosion and sedimentation from potential stormwater runoff would be managed through a NPDES permit and a SWPPP, and discharges to aquatic habitats are not expected to impact water quality (see Section 4.3). Appropriate soil erosion and sediment control measures (e.g., sediment fences, stacked hay bales, mulching disturbed areas) would be employed during construction to minimize suspended sediment and material transport, as well as potential water quality impacts. The proposed SRPPF would be located on an existing construction site and increases in erosion and runoff of sediments into Upper Three Runs Creek are not expected. No notable construction impacts are expected to aquatic species in the Upper Three Runs watershed.

<u>Threatened or Endangered and Other Protected Species</u>

Several threatened or endangered and protected species occur on SRS but none occur in the vicinity of the proposed SRPPF complex. No critical habitat designated for threatened or endangered species would be affected by project construction as no critical habitat is located on SRS.

The smooth purple coneflower and pondberry are plant species federally listed as endangered. Locations of natural populations of these two plant species on SRS are known and do not occur in the vicinity of the proposed SRPPF. Any new construction for the SRPPF complex would occur on previously disturbed areas and would not disturb any new land where undiscovered natural populations could occur. Construction would not affect natural populations of either species. Smooth purple coneflower plants that were propagated from seed and planted in the conservation garden at the MFFF administration building would be salvaged and transplanted to a location determined by the SREL if that building were demolished and removed for construction of the PIDAS. Several of the plants have been successfully relocated (i.e., transplanted) within the garden for landscaping purposes. The mature plants are hardy and no notable impacts from transplanting are expected (SRNS 2020).

The endangered red-cockaded woodpecker occurs primarily in the northern and eastern parts of the SRS, in areas with older, mature stands of longleaf pine. The nearest red-cockaded woodpecker cluster is approximately three to four miles northeast of the SRPPF, on the opposite side of Upper Three Runs Creek (see Chapter 3, Figure 3-9). The location of the SRPPF complex contains no suitable habitat for the red-cockaded woodpecker. Construction would not affect the red-cockaded woodpecker.

The threatened wood stork does not occur near the proposed SRPPF complex. The nearest foraging habitat on the SRS where the wood stork may occur is eight or more miles away, along the Savannah River. Construction would not affect the wood stork. The endangered shortnose sturgeon exists in the Savannah River at least eight or more miles from the construction site and would not be affected by the Proposed Action.

NNSA has determined that construction of the SRPPF complex would not affect any Federal- or State-listed threatened or endangered species.

Existence of the American swallow-tailed kite, gopher tortoise, and Rafinesque's big-eared bat on the SRS is known from only a few observations (Wike et al. 2006, Table 3-16, Secs. 3.14.3.3 and 3.16.2). SCDHEC considers all three species endangered. As an existing industrial site, the location of the SRPPF complex contains no suitable habitat for these three species and none of these species would be affected by project construction.

The bald eagle remains a protected species under the *Bald and Golden Eagle Protection Act*, even though it was delisted under the *Endangered Species Act* in 2007. South Carolina still considers the bald eagle endangered within the state. The proposed SRPPF and surrounding area do not contain suitable bald eagle habitat. Observations of bald eagles on the SRS are primarily associated with Par Pond and L Lake, approximately seven to eight miles from the SRPPF. Golden eagles use the SRS as winter habitat but do not occur in the proposed SRPPF complex. Construction would not affect either bald or golden eagles on the SRS.

Migratory birds and their nests are protected under the *Migratory Bird Treaty Act*. DOE, including NNSA, operates under a signed Memorandum of Understanding with the U.S. Fish and Wildlife Service regarding implementation of Executive Order 13186 (66 FR 3853, January 17, 2001) concerning the responsibilities of Federal agencies to promote the conservation of migratory bird populations (DOE 2013). Some migratory birds are known to use industrial areas on the SRS, and nests have been found on buildings, structures, and equipment (e.g., in 2017 and 2018, 11 and 13 nests (respectively) were found across the entire SRS, respectively) (SRNS 2018a, 2019e). Because the number of nests found across the entire SRS has been relatively few, the probability that a nest would be found in the SRPPF complex during construction is expected to be low. SRS has established sitewide procedures for the protection of nests, and construction activities would be modified until young are fledged or the nest is abandoned; no notable impacts to migratory birds are expected (SRNS 2019e, Sec. 3.3.8.5).

DOE has designated 30 set-aside areas on the SRS as protected natural resource areas for long-term ecological research, protecting sensitive species, and preserving the biological integrity of Upper Three Runs Creek. The nearest set-aside areas are approximately 0.5 mile north and northwest of the SRPPF complex, along Upper Three Runs Creek. Construction on an existing industrial site would not affect the integrity of any protected set-aside area on the SRS.

4.5.1.2 Operations

Potential impacts to ecological resources during operation of the SRPPF could occur from changes in land use, radiological and nonradiological air emissions, stormwater and wastewater discharge, and human disturbance, including operational noise. Operational impacts would be considered long term, as impacts would occur over the life of the project. Operation of the SRPPF on the existing MFFF site would not change any land use and would not impact any ecological resource during operations. Wastewater would be discharged through NPDES-permitted outfalls and stormwater runoff would be managed through a SWPPP. Quality of discharge water would be below NPDES-permitted limits (see Section 4.3). Therefore, no impacts to aquatic habitat or aquatic species are expected during operation of the SRPPF. During operations, most of the human activity would occur inside SRPPF buildings except for material shipments to and from the SRPPF. Human activity is not expected to impact any ecological resources such as wildlife living in areas surrounding the SRPPF. Noise levels during operations are not expected to be greater than existing levels (see Section 4.4.1.2). No noise impacts are expected to impact any ecological resource.

The control of air emissions from the SRPPF to protect workers and the public are discussed in Sections 4.4 and 4.10 of this EIS. The measures to protect human health from nonradiological air emissions and radiological exposure are sufficient and adequate to protect ecological resources surrounding the SRPPF. Air emission and radiological impacts to nonhuman receptors are not expected. Routine radiological monitoring of biotic resources is conducted on the SRS and reported in annual site environmental reports. Most radionuclide and most chemical concentrations in soil, plants, and wildlife from onsite and perimeter locations were not detected, were similar to background, or were below screening levels protective of biota (SRNS 2019e).

NNSA has determined that SRPPF operations would not affect any Federal- or State-listed threatened or endangered species.

4.5.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Potential impacts to ecological resources associated with the production of 125 pits per year would be no different from the impacts under the Proposed Action. Facility changes to accommodate increased pit production would be internal to the pit production building and would not affect any ecological resource surrounding the SRPPF. Any increase in discharges or emissions from production of 125 pits would remain within permitted limits and would not affect ecological resources.

Operational Variation #2: Wrought Production Process

Potential impacts to ecological resources from the wrought process would be no different from the impacts under the Proposed Action. Facility changes to use the wrought process for pit production would be internal to the pit production building and would not affect any ecological resource surrounding the SRPPF.

Design Optimization #1: Retain Existing Administration Building

Potential construction-related impacts to ecological resources from retaining the existing administration building would be the same as the Proposed Action. The reinforced-earth retaining wall would be constructed in an existing utility corridor and would disturb less than one acre of land (see Section 2.1.5.2.1). Forest vegetation in this area was previously cleared during construction of the utility corridor. Existing vegetation consists of herbaceous grasses and forbs and a few small trees or shrubs. Disturbance of less than one acre would have no measurable impact on any ecological resource. Under this option, the smooth purple coneflower plants that were established in the conservation garden near the existing administration building would not be affected.

Design Optimization #2: Use Sand Filter

Construction of a sand filter system for SRPPF ventilation/filtration/exhaust within the Protected Area would occur on previously disturbed land and would not disturb any vegetation or wildlife habitat. Potential impacts to ecological resources from construction and operation of the sand filter system would be similar to the potential impacts under the Proposed Action.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential impacts to ecological resources from construction and operations activities associated with the changes to the gloveboxes and aqueous recovery process would be no different from the potential impacts under the Proposed Action because these processes would occur internal to the SRPPF.

4.5.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. Any NPDES permits and SWPPP for the MFFF would remain and discharges of wastewater or stormwater runoff would be managed to prevent any potential impacts to aquatic resources in the Upper Three Runs watershed.

4.6 Cultural and Paleontological Resources

4.6.1 Cultural Resources

4.6.1.1 Proposed Action

Construction

Under the Proposed Action, all construction-related activities would occur on previously disturbed lands and no notable impacts to archaeological resources are expected. In accordance with the PMOA (NRC 2005a, pp. 3-38–3-39; NNSA 2015, p. 3-34), SRARP staff members were monitoring five eligible archaeological sites during MFFF ground-disturbing activities. If construction of the SRPPF complex would involve further ground-disturbing activities, similar monitoring would occur in accordance with the PMOA during SRPPF construction. BMPs would be utilized during construction to control drainage and erosion patterns, thereby limiting the potential for erosion impacts to archaeological resources in the vicinity. Any inadvertent discoveries during construction would be evaluated and, if needed, mitigated in accordance with the PMOA, the associated Archaeological Resources Management Plan (SRARP 2013), and applicable law.

The new facilities that would be constructed in F Area would not have an adverse visual impact on the setting of Cold War-era historic properties in F Area, as the facilities would be similar in look and design to existing buildings and structures. The four existing MFFF buildings that would be repurposed (226-F, 706-3F, 706-4F, and 731-2F) are recent in age and are not historic properties. For the same reasons as the new facilities, any changes to the exteriors of these repurposed buildings would not have an adverse visual impact to the setting of Cold War-era historic properties in F Area. The buildings to be removed have either been evaluated as not eligible for listing on the *National Register* (221-12F, 221-21F, and 221-22F; DOE 2005c, p. 34) or are recent in age and not historic properties (226-2F, 706-1F, 706-2F, 706-5F, 706-7F, and 706-8F), thus their removal would not impact historic properties. Best management practices would be implemented to reduce the short-term visual impact of construction dust to Area-F Cold War-era historic properties.

Operations

Operational activities are not expected to impact cultural resources because such activities would occur either inside new buildings, inside recently constructed, repurposed buildings, or in previously disturbed and developed outdoor areas. Activities observed from Cold War-era historic properties in F Area would be similar to activities that currently occur and thus would not introduce visual elements that conflict with the historic setting.

4.6.1.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Potential impacts to cultural resources associated with the production of 125 pits per year would be no different from the impacts under the Proposed Action because there would be no additional facilities constructed.

Operational Variation #2: Wrought Production Process

Potential impacts to cultural resources from the wrought process would be no different from the impacts under the Proposed Action because there would be no additional facilities constructed.

Design Optimization #1: Retain Existing Administration Building

Potential impacts to cultural resources from retaining the existing administration building and slightly expanding the area within the PIDAS would likely be the same as for the Proposed Action. Much of the one acre of land that would be disturbed under this option would occur along the existing culvert. If any portion of the one-acre construction area has not been previously disturbed and undergone archaeological survey, NNSA would ensure that the portion is surveyed and consultation under Section 106 of the NHPA is conducted per the PMOA and the Archaeological Resources Management Plan (SRARP 2013).

Design Optimization #2: Use a Sand Filter

Potential impacts to cultural resources from construction of a sand filter system would likely be the same as under the Proposed Action. Much of the land that would be disturbed for the retaining walls would occur just outside of and along the PIDAS boundary. If any portion of the construction area had not undergone archaeological survey, NNSA would ensure that the portion is surveyed and consultation under Section 106 of the NHPA conducted per the PMOA and the Archaeological Resources Management Plan (SRARP 2013). If determined necessary during Section 106 consultation, monitoring similar to that conducted during MFFF construction would occur during ground-disturbing activities in accordance with the PMOA during SRPPF construction. BMPs would be utilized during construction to control drainage and erosion patterns, thereby limiting the potential for erosion impacts to archaeological resources that could be outside the construction area in the vicinity. Any inadvertent discoveries during construction would be evaluated and, if needed, mitigated in accordance with the PMOA, the associated Archaeological Resources Management Plan (SRARP 2013), and applicable law. Use of the sand filter during operations would not impact cultural resources.

Design Optimization #3: Option to Change Gloveboxes and Aqueous Recovery Process

Potential impacts to cultural resources from construction and operations activities associated with the changes to the gloveboxes and aqueous recovery process would be no different from the potential impacts under the Proposed Action because all actions would be internal to the SRPPF.

4.6.1.3 No-Action Alternative

Under the No-Action Alternative, the existing MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. There would be no notable impacts to cultural resources under this alternative since SRS would continue to operate in compliance with the PMOA.

4.6.2 Paleontological Resources

4.6.2.1 Proposed Action

Construction

No fossil-bearing strata are known within F Area and no paleontological resources have been recorded there. All construction-related activities under the Proposed Action are expected to have no notable impacts to paleontological resources.

Operations

Operational activities are not expected to impact paleontological resources because such activities would occur either inside new buildings, inside recently constructed, repurposed buildings, or in previously disturbed and developed outdoor areas, and because no fossil-bearing strata are known to exist within F Area.

4.6.2.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Potential impacts to paleontological resources associated with the production of 125 pits per year would be no different from the impacts under the Proposed Action because there are no known fossil-bearing strata in F Area.

Operational Variation #2: Wrought Production Process

Potential impacts to paleontological resources from the wrought process would be no different from the impacts under the Proposed Action because there are no known fossil-bearing strata in F Area.

Design Optimization #1: Retain Existing Administration Building

Potential impacts to paleontological resources from retaining the existing administration building and slightly expanding the area within the PIDAS would be no different from the impacts under the Proposed Action because there are no known fossil-bearing strata in F Area.

Design Optimization #2: Use a Sand Filter

Potential impacts to paleontological resources from construction of a sand filter system would be no different from the impacts under the Proposed Action because there are no known fossil-bearing strata in F Area.

Design Optimization #3: Option to Change Gloveboxes and Aqueous Recovery Process

Potential impacts to paleontological resources from reducing the number of gloveboxes in the SRPPF and modifying the aqueous recovery process would be no different from the impacts under the Proposed Action because the changes would be internal to the SRPPF.

4.6.2.3 No-Action Alternative

Under the No-Action Alternative, the existing MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. There would be no notable impacts to paleontological resources under this alternative.

4.7 INFRASTRUCTURE

4.7.1 Proposed Action

Table 4-10 presents the expected utility and fuel usage for the Proposed Action during construction and operations.

4.7.1.1 Construction

Electricity

The proposed SRPPF would have two separate, three-phase sources: Feeder 1 and Feeder 5. These 13.8-kilovolt feeders come from the Dominion Energy-owned Substation 23. Feeder 1 and Feeder 5 would have a peak demand of 2–3 megawatts. Currently, the MFFF and immediate support facilities receive temporary electrical power from SRS 115 kV station 21 and station 23. Construction power during SRPPF complex activities will continue to receive power from SRS 115 kV station 21 and station 23. Temporary power requirements during construction are estimated to be two megawatts and would provide a power source to the SRPPF sanitary wastewater lift station, SRPPF tower crane, and other construction equipment.

Based on the large available site capacity and the low usage for construction relative to the available site capacity (less than one percent) (Table 4-10), annual electricity demand on site capacity for construction activities would be small. Substation 23 would have the capacity to accommodate the estimated peak load (of two megawatts) during construction.

Table 4-10—Peak Anticipated Annual Resource Needs to Support Construction and Operations

Resource	Proposed Action (50 to 80 Pits)		No-Action (sitewide and F Area Current Use)[b]	Capacity (sitewide and F Area)[b]
	Construction Requirement	Operations Requirement		
Electrical power consumption (megawatt-hours per year)	17,520[a]	≤30,000[a]	310,000 (46,000)[d]	4,400,000 (314,000)[d]
Electrical peak load (megawatts)	2–3	≤11	60 (10)[d]	500[c]
Diesel fuel (gallons per year)	700,000	15,000	410,000[c]	N/A[f]
Domestic water (gallons per year)	16,600,000	12,100,000–13,300,000	320,000,000 (61,000,000)[d]	2,950,000,000 (473,040,000)[a,d,e]
Sanitary wastewater (gallons per year)	5,500,000	2,600,000	250,000,000[c]	383,000,000[c]

N/A = not applicable.
a. Based on 24 hours per day, 365 days per year (SRNS 2020, 2020a).
b. Source: NNSA 2015.
c. Sitewide value only.
d. Values in "( )" are for F Area only.
e. Process water from two production wells in F Area.
f. Capacity not generally limited as delivery frequency can be increased to meet demand.

Fuel

An estimated 700,000 gallons per year of diesel fuel would be required to support construction activities. Capacity would generally not be limited, as delivery frequency would be increased to meet demand. The delivery of fuel would have minimal impact on the existing SRS infrastructure.

Water

The SRS domestic water distribution system has an annual capacity that exceeds 1,600 million gallons, and the current annual SRS demand is approximately 320 million gallons. The peak annual water demand of 16.6 million gallons from construction activities would represent a small fraction (1.3 percent) of the unused SRS domestic water capacity and would therefore have a minimal impact on the SRS water distribution system.

Sanitary Wastewater

The CSWTF would have sufficient capacity for sanitary wastewater treatment demand during construction because current usage is approximately 30 percent of its capacity. The available capacity of the CSWTF is 268 million gallons per year. If all the domestic water usage for the peak construction staff required wastewater treatment (estimated at one-third the construction water usage), then construction sanitary wastewater treatment demand would be 5.5 million gallons per year, or two percent of the available capacity. This estimate verifies that the CSWTF would have sufficient capacity to meet construction wastewater demand. Sanitary wastewater treatment needs are likely to be less because portable toilets would be used during some construction activities.

Steam

Facility heating (comfort and process) could be electrical or steam. If steam is used, the existing steam infrastructure in F Area would be extended to the SRPPF. No new land disturbance would be required to extend the infrastructure. Steam would be supplied by the existing 684-G BCF, which currently produces approximately 85,000 pounds of steam per hour and has adequate capacity to supply steam to the SRPPF.

4.7.1.2 Operations

Electricity

The SRS power grid can support a peak demand of 500 megawatts, and peak SRS demand is generally below 50 megawatts. SRPPF operations would require an estimated peak load of 11 megawatts. Feeders 1 and 5 exceed peak load operation requirements of the SRPPF. Therefore, the impact on the current SRS power grid would be minimal.

Fuel

Fuel oil would be required to power backup diesel generators. There would be multiple redundant backup diesel generator systems that would tie into four 160-kilovolt power buses (within the SRPPF). The backup diesel generators would be designed to start and operate all associated loads while maintaining acceptable voltage levels. The backup diesel generators would have a continuous rating of 1,800 kilowatts. Approximately 15,000 gallons of fuel would be used annually for maintenance operations of the backup diesel generators. Fuel capacity is not limited because fuel would be delivered to the site by truck as needed.

Water

The SRS domestic water distribution system has an annual capacity that exceeds 1,600 million gallons, and the current annual SRS demand is approximately 320 million gallons. The annual water demand of 13.3 million gallons from SRPPF operations would represent a small fraction (less than one percent) of the unused SRS domestic water capacity and would therefore have a minimal impact on the SRS water distribution system.

Sanitary Wastewater

The CSWTF would have sufficient capacity for sanitary wastewater treatment demand during operations because current usage is approximately 30 percent of its capacity. The available capacity of the CSWTF is 268 million gallons per year. If one third of the domestic water used during operations required sanitary wastewater treatment, then sanitary wastewater treatment demand during operations would be 2.6 million gallons per year (or less than one percent of the available capacity). Therefore, operations would not have a notable impact on the SRS wastewater treatment system.

4.7.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Potential impacts to site infrastructure associated with the production of 125 pits per year would be no different from the impacts under the Proposed Action, except for domestic water and electricity usage during operations. The production of 125 pits per year would require an increase in annual domestic water usage (to 10.8 million gallons); however, this would still be less than one percent of available capacity. There is the possibility that electricity usage during production of 125 pits could also increase slightly from the baseline estimates of 11 megawatts; however, these increases would still be well within the existing capacity of the SRS power grid.

Operational Variation #2: Wrought Production Process

Potential impacts to site infrastructure from the wrought process would be no different from the impacts under the Proposed Action, as demands on infrastructure would be the same.

Design Optimization #1: Retain Existing Administration Building

Potential impacts to infrastructure from retaining the existing administration building would be similar to the impacts under the Proposed Action. During construction, not demolishing the existing administration building would reduce the key construction parameters; however, those reductions would be partially offset by the additional construction associated with the culvert fill, retaining wall, and proposed Protected Area expansion. NNSA does not expect any notable changes in the construction and operational requirements for this option related to infrastructure.

Design Optimization #2: Use Sand Filter

Construction of a sand filter system would require an additional 120,000 gallons of water per year, which is approximately 0.03 percent of the available water capacity for F Area. Potential impacts to infrastructure from the use of a sand filter would not be appreciably different from the potential impacts under the Proposed Action.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential impacts to infrastructure from the change in gloveboxes and aqueous recovery process would be no different from the potential impacts under the Proposed Action since these changes would not significantly affect the amount of water or electricity that would be required.

4.7.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. No additional buildings or facilities would be built beyond current and planned activities, and no additional demands on infrastructure would occur at the SRS beyond those of existing and future activities that are independent of the Proposed Action.

4.8 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

4.8.1 Socioeconomics

4.8.1.1 Proposed Action

Socioeconomic impacts result from the direct employment of construction and operations workers and the impacts on regional economic characteristics, population, housing, and community resources within the ROI. As described in Chapter 3, Section 3.8, the ROI for socioeconomics includes Aiken and Barnwell counties in South Carolina and Columbia and Richmond counties in Georgia because over 86 percent of the workforce reside in those four counties. Table 4-11 provides a summary of construction and operations impacts from the Proposed Action.

Table 4-11—Summary of Socioeconomic Impacts Related to SRPFF Construction and Operation

Resource	Proposed Action		
	Construction	Operations	
		50 Pits Per Year	80 Pits Per Year
Direct employment (number of personnel in peak year)	1,800[a]	1,830	2,015
Indirect employment (number of personnel in peak year)	1,134[b]	2,178[c]	2,398[c]
Direct earnings in peak year ($ in millions)	110	153	168
Direct output in peak year ($ in millions)	178	327	360
Value added in peak year ($ in millions)	168	273	300
Projected personal income in peak year ($ in millions)	27,615	35,747	35,747
Projected labor force of ROI in peak year	252,118	264,146	264,146

ROI = region of influence.
a. Peak construction activities would occur in 2023 and 2024.
b. Indirect employment was estimated using a direct-effect employment multiplier of 1.63 (NNSA 2008b, 2015).
c. Indirect employment was estimated using a direct-effect employment multiplier of 2.19.
Sources: BEA 2019a; BLS 2019a; NNSA 2008b, 2015; SRNS 2020, 2020a

<u>Construction</u>

Under the Proposed Action, employment from construction activities is expected to peak in 2023–2024. At the peak of construction, approximately 1,800 workers would be directly employed. Another 1,134 indirect jobs are expected to be generated in the SRS ROI. The labor force in the ROI in 2023 is projected to be 252,118 workers. The peak construction employment (direct and indirect) is estimated to represent approximately 1.2 percent of the projected ROI labor force.

During the peak year of construction activities, it is estimated that the value added from the direct economic activity to the local economy would be approximately $178 million, or about 0.6 percent of the projected personal income in the SRS ROI. Approximately $110 million of the value added would be in the form of earnings of construction workers.

Any in-migration of workers into the ROI during construction of the SRPPF is expected to be small when compared to the projected population of the ROI. Furthermore, any in-migration would be within the historical trends of population growth within the ROI. No adverse impacts on the availability of housing and community services under the Proposed Action are expected. Payroll and materials expenditures would have a positive impact on the local economics.

<u>Operations</u>

Operation of the SRPPF is expected to begin in 2030. As reported in Section 2.1.3 of this SRS Pit Production EIS, the current estimate of the number of workers required for operations of SRPPF has increased since the Draft SRS Pit Production EIS. Direct employment is estimated to be 1,830 jobs for the production of 50 pits per year and 2,015 jobs for the production of 80 pits per year. Another 2,178 (50 pits per year) and 2,398 (80 pits per year) indirect jobs are expected to be generated. The labor force in the ROI in 2030 is projected to be 264,146 workers. The total additional employment (direct and indirect workers) associated with the Proposed Action is estimated to represent approximately 1.5 percent (50 pits per year) and 1.7 percent (80 pits per year) of the projected SRS ROI labor force in 2030.

Under the Proposed Action, the value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services would be approximately $273 million from the production of 50 pits per year, or approximately 0.8 percent of the projected personal income in the SRS ROI in 2030, and $300 million from the production of 80 pits per year, and not statistically different with respect to impacts on the projected personal income in the SRS ROI in 2030 from the 50 pits per year capacity. Approximately $153 million (50 pits per year) and $168 million (80 pits per year) of the value added to the local economy would be in the form of earnings of SRS employees.

Any in-migration of workers into the ROI due to implementing the Proposed Action is expected to be small when compared to the projected population of the ROI. Furthermore, any in-migration would be within the historical trends of population growth within the ROI. No adverse impacts on the availability of housing and community services under the Proposed Action are expected. Payroll and materials expenditures would have a positive impact on the local economics.

4.8.1.2 Analyses of Operational Variations and Design Optimizations

<u>Operational Variation #1: 125 Pits Per Year</u>

Potential impacts to socioeconomics associated with the construction phase for the production of 125 pits per year would be the same as under the Proposed Action. Accordingly, the discussion that follows addresses changes that might be expected during operations. Table 4-12 provides a summary of these changes.

Table 4-12—Summary of Socioeconomic Impacts under Operational Variation #1

Resource	Operational Variation #1, 125 Pits Per Year
Direct employment (number of personnel in peak year)	2,950
Indirect employment (number of personnel in peak year)	3,511[a]
Direct earnings in peak year ($ in millions)	246
Direct output in peak year ($ in millions)	528
Value added in peak year ($ in millions)	440
Projected personal income in peak year ($ in millions)	35,747
Projected labor force of ROI in peak year	264,146

Source: SRNS 2020, 2020a

a. Indirect employment was estimated using a direct-effect employment multiplier of 2.19.

Once operational, direct employment from the production of up to 125 pits per year is estimated to be 2,950 jobs, an increase of 1,120 jobs compared to the production of 50 pits per year, and 935 jobs compared to the production of 80 pits per year. Another 3,511 indirect jobs are expected to be generated, an increase of 1,333 jobs compared to the production of 50 pits per year, and 1,113 jobs compared to the production of 80 pits per year. The labor force in the ROI in 2030 is projected to be 264,146 workers. The total additional employment (direct and indirect workers) associated with this increased pit production is estimated to represent approximately 2.4 percent of the projected SRS ROI labor force in 2030.

Value added from the direct economic activity to the local economy of the SRS ROI in the form of final goods and services would be approximately $440 million, or approximately 1.1 percent of the projected personal income in the SRS ROI in 2030. This is an increase of $167 million compared to the production of 50 pits per year, and $140 million compared to the production of 80 pits per year. Approximately $246 million of the value added to the local economy would be in the form of earnings of SRS employees.

Any in-migration of workers into the ROI is expected to be small when compared to the projected population of the ROI. Furthermore, any in-migration would be within the historical trends of population growth within the ROI. Due to the low potential for in-migration and changes to the ROI population, operational impacts on the availability of housing and community services under Operational Variation #1 are expected to be small. Payroll and materials expenditures would have a positive impact on the local economics.

Operational Variation #2: Wrought Production Process

Potential impacts to socioeconomics from the wrought process would be no different from the impacts under the Proposed Action because the wrought process would not require a noticeable increase in workforce.

Design Optimization #1: Retain Existing Administration Building

Potential impacts to socioeconomics from retaining the existing administration building would be similar to the impacts under the Proposed Action because it would not require a noticeable increase in workforce. During construction, the existing administration building would not be demolished, which would reduce some key construction parameters; however, those reductions would be offset by the additional construction associated with the culvert fill, retaining wall, and proposed Protected Area expansion. NNSA does not expect any notable changes in the construction and operational requirements from retaining the existing administration building (see Section 2.1.5.2.1).

Design Optimization #2: Use Sand Filter

Potential impacts to socioeconomics from constructing and operating a sand filter system would be no different from the potential impacts under the Proposed Action because the sand filter system would not require a noticeable increase in workforce.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential impacts to socioeconomics from design changes that would reduce the number of gloveboxes and modify the aqueous recovery process would be no different from the potential impacts under the Proposed Action because these changes would not require a noticeable increase in workforce.

4.8.1.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. There would be no additional impacts to socioeconomic resources beyond current activities. There would be no major changes in the workforce at SRS.

4.8.2 Environmental Justice

4.8.2.1 Proposed Action

Under Executive Order 12898, DOE is responsible for identifying and addressing disproportionately high and adverse impacts on minority or low-income populations. Minority persons are those who identify as being Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and other Pacific Islander, another non-White race, or persons of Hispanic or Latino ethnicity. Persons whose incomes are below the Federal poverty threshold are designated low-income. Environmental justice concerns include the environmental impacts that proposed actions may have on minority and low-income populations, and whether such impacts are disproportionate to those on the population as a whole in the potentially affected area.

Chapter 3, Section 3.8.2, presents the existing environmental justice characteristics of the ROI of block groups within a 50-mile radius and additional radial distances of 5, 10, and 20 miles. The current estimated population residing within the 50-mile radius of the proposed SRPPF is approximately 816,710, of which 45.3 is minority. The current estimated low-income population living within the 50-mile radius of the proposed SRPPF is 19.4 percent. The population within the 50-mile radius in 2030 is projected to be 862,957.

Adverse health effects are measured in risks and rates that could result in LCFs and other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as defined by NEPA) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group (CEQ 1997).

A disproportionately high environmental impact that is significant (as defined by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as defined by NEPA). In assessing cultural and aesthetic environmental impacts, NNSA considered impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian Tribes (CEQ 1997).

Based on the analysis of impacts for the resource areas in this EIS, no high and adverse impacts from construction and operation activities at SRS are expected under the Proposed Action. To the extent that any impacts may be high and adverse, NNSA expects the impacts to affect all populations in the area equally. There were no discernable adverse impacts to land use, visual resources, geology and soils, water resources, air quality, noise, ecological resources, cultural and paleontological resources, infrastructure, socioeconomic resources, waste management, facility accidents, and transportation. As shown in Section 4.10 of this EIS, the potential radiological impacts to the public from SRPPF normal operations would be less than regulatory limits. The annual radiation dose to the offsite *maximally exposed individual* (MEI) would be a maximum of 8.0×10^{-7} millirem per year (for production of 80 pits per year), which is well below the limit of 10 millirem per year set by both the EPA (40 CFR Part 61) and DOE (DOE Order 458.1) for airborne releases of radioactivity. The risk of an LCF to this individual from operations would be essentially zero (4.8×10^{-13} per year). The projected number of LCFs to the population within 50 miles would be essentially zero (i.e., less than or equal to 3.1×10^{-8}).

4.8.2.2 Analyses of Operational Variations and Design Optimizations

<u>Operational Variation #1: 125 Pits Per Year</u>

Potential impacts to minority or low-income populations associated with the production of 125 pits per year essentially would be the same as under the Proposed Action.

Operational Variation #2: Wrought Production Process

Potential impacts to minority or low-income populations from the wrought process would be the same as under the Proposed Action.

Design Optimization #1: Retain Existing Administration Building

Potential impacts to minority or low-income populations from retaining the existing administration building would be the same as potential impacts under the Proposed Action.

Design Optimization #2: Use Sand Filter

Potential impacts to minority or low-income populations from construction and operation of a sand filter system would be the same as the potential impacts under the Proposed Action.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential impacts to minority or low-income populations from design changes that would reduce the number of gloveboxes and modify the aqueous recovery process would be the same as potential impacts under the Proposed Action.

4.8.2.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. There would be no disproportionately high and adverse impacts on minority or low-income populations.

4.9 WASTE MANAGEMENT

Table 4-13 presents a summary of the waste generation volumes discussed in this section. Existing waste management quantities come from Section 3.9 of this EIS. Waste quantities shown for the SRPPF are solely from the construction and operation of that facility. As discussed in Chapter 3, Section 3.9, the Proposed Action would not generate HLW.

4.9.1 Proposed Action

4.9.1.1 Construction

As indicated in Table 4-13, construction activities would not be expected to generate waste with radioactive contaminants; that is, no TRU waste, LLW (solid or liquid), or MLLW would be expected.

Table 4-13—Summary of Waste Generation under the Proposed Action

Waste Type	Units	SRS Existing	SRPPF Construction[a]	SRPPF Operational Level[a]	
				50 Pits Per Year	80 Pits Per Year
TRU waste	yd^3/yr	460	0	600	880
LLW – solid	yd^3/yr	13,100	0	2,200	2,840
LLW – liquid[b]	gal/yr	20,000,000	0	600,000	740,000
MLLW	yd^3/yr	520	0	10	15
Hazardous	yd^3/yr	76	3	20	27
Solid waste – sanitary waste	yd^3/yr	6,500	600	3,200	5,200
Solid waste – C&D waste	yd^3/yr	63,000	1,700[a]	0	0
Solid waste – liquid	gal/yr	0	6,000	0	0
Sanitary wastewater[c]	gal/day	320,000	27,000	54,900	60,450

C&D = construction and demolition; gal/day = gallon per day; gal/yr = gallon per year; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste (hazardous and radioactive); TRU = transuranic; yd^3/yr = cubic yards per year.

a. Source: SRNS 2020, 2020a.

b. The estimated volume of liquid LLW increased from the values presented in the Draft EIS to account for larger estimates that could result from laboratory wastes from analytical chemistry and material characterization.

c. Generation rates for sanitary wastewater were developed as described in Sections 4.9.1.1 and 4.9.1.2 for construction and operations, respectively, and are judged to be conservatively high.

<u>Hazardous Waste</u>

Approximately 4.5 tons of hazardous waste could be generated during the six-year construction period, or about 0.75 ton per year. Using a rough approximation of one cubic yard of hazardous waste weighing 500 pounds (or about twice the density of typical uncompacted mixed municipal solid waste [EPA 2016b]), this equates to three cubic yards per year. Compared to an SRS-wide generation rate of 76 cubic yards per year, the added hazardous waste during construction would represent an increase of approximately four percent. Hazardous waste is managed under contract with large commercial enterprises that must show adequate capacity and compliance with applicable permitting and regulatory requirements to be considered for the contract. The contract holder would be expected to have the capacity to accept the additional amount of waste. NNSA does not expect that management of the hazardous waste generated during construction would add risks or adverse impacts to ongoing hazardous waste activities on the SRS.

<u>Solid Waste—Sanitary</u>

The estimated quantity of nonhazardous, non-liquid solid waste that would be generated during construction is about 2,300 cubic yards per year. A quarter of this waste, or approximately 600 cubic yards per year, would be sanitary, or municipal-type waste and the remaining 1,700 cubic yards per year would be construction and demolition waste. As shown in Table 4-13, the 600 cubic yards per year would be less than 10 percent of the current sanitary waste being produced within SRS. At a typical density of 250 pounds per cubic yard for uncompacted mixed municipal waste (EPA 2016b), 600 cubic yards per year equates to 75 tons per year. This equates to approximately 0.03 percent of the 250,000 tons per year currently going to the Three Rivers

Landfill (see Chapter 3, Section 3.9.6 of this EIS). This quantity of waste would not overload existing capacity within SRS or at the landfill.

Solid Waste—Construction and Demolition

Approximately 1,700 cubic yards of construction and demolition waste would be generated during each year of construction. This quantity represents less than three percent of the 63,000 cubic yards disposed of in the SRS onsite construction and demolition landfill each year during the period from FY 2011 through FY 2015 (see Section 3.9.6). It is expected that SRS's construction and demolition waste generation varies greatly by year depending on the type of work planned, and 1,700 cubic yards per year would not be expected to overload existing capacity. Also, if all of this waste were to go to the Three Rivers Landfill, it would still represent a very small portion of the waste disposed of at that facility each year and would not be expected to present capacity issues.

Solid Waste—Liquid[24]

Up to about 6,000 gallons of liquid waste may be generated each year during construction. This waste would be primarily from concrete equipment cleanout and concrete production if a concrete batch plant was set up on site to support construction. Whether or not a batch plant was present, a basin would be needed where concrete trucks could be washed out after delivering concrete and possibly where off-specification concrete could be dumped and allowed to set. At the completion of construction, the batch plant, if present, would be disassembled, the basin emptied, and the area restored. This type of setup is typical for large construction actions and has been used previously within SRS. Adverse impacts would not be expected.

Sanitary Wastewater

The construction workforce would peak at 1,800 (see Chapter 2, Table 2-1), which is of similar magnitude to the operational workforce (see Tables 2-2 and 2-4). However, the rates of sanitary wastewater generated during construction would be different from the rate of 30 gallons per day per worker during operations (see Section 4.9.1.2). Although a portion of the construction workforce would be working in existing facilities already connected to the SRS sewer system, a large portion would be outside of existing facilities (demolishing buildings or constructing new support facilities) and likely would be served to some extent by portable toilets. Between having portable toilets serviced off site and construction workers generally producing less sanitary wastewater than the operational workers, for purposes of this evaluation, it is assumed that construction workers would produce sanitary wastewater at half the rate of operations workers; that is, 15 gallons per day per worker. During peak construction, that equates to 27,000 gallons per day.

As described in more detail below, the CSWTF has more than sufficient capacity to receive sanitary wastewater that would reach the existing sewer system during construction. Further, treated discharge from the CSWTF is subject to the conditions and requirements of an existing NPDES permit. In addition to the expected use of portable toilets, it is expected that contracts covering such operations would require the portable toilets to be emptied and cleaned at a fully

[24] EPA's definition of solid waste includes discarded liquids and, for this EIS, liquid wastes not addressed in other categories.

authorized and permitted sanitary wastewater treatment facility. No adverse impacts are expected from management of sanitary wastewater during construction.

4.9.1.2 Operations

TRU Waste

TRU waste would be generated routinely during operation of the proposed SRPPF. Waste streams would include process residues for which plutonium could not be practicably recovered and waste (e.g., tools, rags, protective clothing, and filters) from plutonium processing areas with enough contamination to qualify as TRU waste. As shown in Table 4-13, the Proposed Action would involve an increase in the amount of TRU waste generated within the SRS. At a production rate of 50 pits per year, the site's TRU waste generation rate would increase by about 130 percent (i.e., total SRS generation would be 2.3 times the current rate), but as noted in Section 3.9.2, the site's currently projected TRU waste generation rate is less than half of what it was just a few years ago (i.e., 2011–2015 averaged 1,020 cubic yards per year). At a production rate of 80 pits per year, the TRU waste generation rate would increase by about 190 percent (i.e., the SRS total would be 2.9 times the current projection). As the design of the SRPPF matured, the estimates for TRU waste generation decreased from those presented in the Draft EIS.

Despite the increase in the TRU waste generation rate (from that currently generated on SRS), adverse impacts to the site's existing waste management capabilities (e.g., equipment, facilities, labor force) would not be expected. TRU waste generated from the Proposed Action would be managed, to the extent practical, within the SRPPF; the equipment, facilities, and labor force needed to support such actions would be incorporated into planned operations. Waste generating operations would package TRU waste such that all containers ready for shipment to the WIPP facility would qualify as contact-handled waste. Further, storage needs for the additional TRU waste would be limited because the waste is expected to be regularly shipped off site to the WIPP facility for disposal. Staging areas within the PIDAS would provide surge storage to accommodate waste accumulation between shipments and any "more-than-normal" buildup of waste due to minor changes in waste generation rates or shipment schedules. This TRU waste storage capacity would be equivalent to more than one year of storage within the Protected Area for a production rate of 50 pits per year and just under one year of storage for a production rate of 80 pits per year. With additional storage capacity outside the Protected Area (for that portion of the TRU waste that can be stored outside the Protected Area), storage capacity increases to two to three years. A recent curtailment of WIPP activities lasted for longer than one year and could happen again, if necessary, to ensure safe operations at that site. However, planning internal storage capacity to accommodate more than one year of waste generation is deemed a sufficient contingency.

TRU waste that also includes components that qualify as hazardous waste would be stored at locations with appropriate hazardous waste permits. Similarly, if there are SRPPF process residues for which plutonium recovery is considered impractical or not applicable, such residues would be considered waste and any subsequent treatment within the SRPPF also would be subject to regulatory requirements.

TRU waste generated by the Proposed Action would also impact the WIPP facility, which is the only authorized disposal site for this waste type. As of July 25, 2020, the WIPP facility had disposed of approximately 90,863 cubic yards (69,470 cubic meters) of TRU waste since it first received waste in March 1999. Discounting the almost three-year span (2014 through 2016) during which WIPP waste emplacement operations were suspended, the facility has received approximately 5,100 cubic yards of waste per year. The TRU waste generated under the Proposed Action (i.e., producing 50 to 80 pits per year) would represent increases of 12 to 17 percent of this average value. A better gauge of impacts to WIPP operations may be a comparison with expected future operations rather than with an average of past operations. As indicated in Chapter 3, Section 3.9.2 of this EIS, the annual waste shipments from all DOE sites to the WIPP facility are expected to climb to a rate of approximately 750 in the years following 2022. At pit production rates of 50 and 80 pits per year, SRPPF shipments of TRU waste to the WIPP facility are expected to be about 77 and 113, respectively (see Section 4.12). Thus, the additional waste shipments represent increases of 10 to 15 percent over current planning. These increases are slightly smaller, but similar to average past waste receipts.

Although there would be increases in waste shipments to the WIPP facility, adverse impacts to the WIPP facility operational capabilities are not expected. Waste generation at SRPPF and disposal at the WIPP facility are actions that DOE controls. DOE would have sufficient lead time to adjust the WIPP facility operational capabilities (i.e., manpower and equipment) as needed to accommodate changes in waste receipt due to the Proposed Action. The potential cumulative impacts of TRU waste disposal at the WIPP facility are addressed in Chapter 5 of this EIS.

Low-Level Radioactive Waste—Solid

A recent SRS waste management planning document (SRNS 2016b) describes the operational status of existing or soon to be opened LLW disposal trenches and vaults. Specific units are identified as closed or opened during a 10-year planning period and some are identified as operational at the end of the period (SRNS 2016b, Sec. 2.4.3). Other elements of the document describe the SRS solid waste management group's planning assumption that it would complete operations and decommissioning as of FY 2065, with the possible exception of portions of the Solid Waste Disposal Facility that may be needed after FY 2065 to support other SRS programs, in which case, the needed portions of the disposal facility would transfer to another DOE program (SRNS 2016b, Sec. 1.1–1.2). Therefore, operation of the SRS LLW disposal facility is expected to continue well into the future as individual units are closed and others opened. SRS LLW disposal activities consist of a hierarchy of disposal options, as described in Section 3.9.3.3, and are represented by a hierarchy of waste acceptance criteria. For simplicity, the discussion here refers to waste acceptance criteria for the SRS LLW disposal facility as if it were a single set of criteria.

The SRS waste management group recognizes that the volume of LLW that would be generated from the Proposed Action, coupled with the long lifespan planned for the SRPPF, would represent an increase to current LLW management planning levels. The existing LLW disposal area (within E Area) would have to be expanded at some point if it were to accommodate the SRPPF LLW. The potential for LLW disposal area expansion is addressed further in the Chapter 5 discussion of cumulative impacts.

Onsite disposal of SRPPF LLW would be contingent upon the waste meeting the disposal facility's waste acceptance criteria and adherence to the associated performance assessment. The capacity of the SRS disposal operations is not only a matter of physical space but of limits set by DOE's performance assessment on the type and amount of radionuclides that can be disposed of that still allow the disposal site to meet necessary worker and public health and safety performance objectives, measures, and standards as well as any other applicable regulatory criteria. At this stage of the Proposed Action planning, it is assumed that SRPPF LLW, or least a portion of the SRPPF LLW, would meet acceptance criteria for onsite disposal. If the LLW generated under the Proposed Action met all acceptance criteria for onsite disposal, this would indicate that related impacts would be at acceptable levels. As the design of the SRPPF matured, the estimates for solid LLW generation decreased from those presented in the Draft EIS.

In the unlikely event that some LLW generated from the Proposed Action did not meet waste acceptance criteria or if a decision was made to save SRS disposal capacity for other waste generators, the NNSS disposal facility would be considered a waste management approach alternative (see Section 3.9.3.3). If the SRPPF generated classified LLW, the NNSS would likely be the preferred option for its disposition. If DOE capabilities are not practical or cost effective, exemptions may be approved to allow use of a non-DOE commercial, licensed LLW disposal facility, consistent with DOE Order 435.1. In the five-year timeframe from FY 2014 through FY 2018, the NNSS disposed of an average of approximately 38,600 cubic yards of LLW per year, mostly from DOE operations outside of Nevada (NNSS 2019). At a production rate of 50 pits per year, the estimated 2,200 cubic yards of LLW from the SRPPF would represent about 5.7 percent of the average amount of LLW going to the NNSS. At the production rate of 80 pits per year, the estimated 2,840 cubic yards of LLW would represent 7.4 percent. To be accepted for disposal at the NNSS disposal site, the SRPPF LLW would have to meet all NNSS waste acceptance criteria, so environmental impacts from NNSS waste disposal would not be expected to change. However, increasing the quantities of waste received by these levels could require NNSS to increase equipment and manpower levels.

<u>Low-Level Radioactive Waste—Liquid</u>

SRPPF operations would include liquid laboratory wastes from analytical chemistry and material characterization that would be sent to the SRS ETF through a connection to an existing conveyance (pipeline). As described in Section 3.9.3.1 of this EIS, the ETF contains multiple treatment process units in order to treat the variety of wastewaters it receives, and treated wastewater discharged from the ETF is subject to an existing NPDES permit. The ETF currently processes approximately 55,000 gallons per day (or 20 million gallons per year) of liquid waste but is designed to process 100,000 to 250,000 gallons per day. The annual liquid LLW waste generation rates shown in Table 4-13 for 50 or 80 pit production scenarios equate to about 1,600 or 2,000 gallons per day, respectively. These numbers (representing 2.9 or 3.6 percent increases to the existing ETF loading) would not affect the ETF's treatment capacity or operational level. The liquid LLW from the Proposed Action is expected to be amenable to the ETF's treatment processes and meet the appropriate waste acceptance criteria but would be sent to the ETF only if it met those criteria. Meeting the NPDES permit's discharge limits should validate the treatment processes' appropriateness for the additional liquid LLW and ensure that water quality standards set for the receiving water (i.e., Upper Three Runs Creek) are not exceeded. Adverse impacts from management of the Proposed Action's liquid LLW are not expected.

The added wastewater stream going to the ETF would also add to the treatment residues generated within the ETF. It is expected, however, that contributions from treatment of SRPPF liquid LLW would be small and there would be no notable changes in existing waste management actions, which include a waste stream going to the Saltstone Production Facility (NNSA 2015, Sec. 3.1.10.4).

Mixed Low-Level Radioactive Waste

Under the Proposed Action, MLLW would be produced at a rate of 10 cubic yards per year (50 pits per year) and 15 cubic yards per year (80 pits per year). Compared to an SRS-wide production rate of 520 cubic yards per year, the added MLLW at the 50 or 80 pit production rate would represent increases of 1.9 or 2.9 percent, respectively. Currently, MLLW is managed under contract with large commercial enterprises that must show adequate capacity and compliance with applicable permitting and regulatory requirements in order to be considered for the contract. The relatively small increase in MLLW production from the Proposed Action would not be expected to adversely impact the current approach to SRS management of MLLW.

As indicated in Section 3.9.4, the NNSS disposal facility is also authorized to accept MLLW and would be considered an alternative waste management approach for SRS. If the SRPPF generated classified MLLW, the NNSS would likely be the preferred option for its disposition. If DOE capabilities are not practical or cost effective, exemptions may be approved to allow use of a non-DOE commercial, licensed MLLW disposal facility, consistent with DOE Order 435.1. In the five-year timeframe from FY 2014 through FY 2018, the NNSS disposed of an average of approximately 3,500 cubic yards of MLLW per year (NNSS 2019). At a production rate of 50 pits per year, the 10 cubic yards of MLLW from the SRPPF would represent 0.29 percent of the MLLW going to the NNSS. At the production rate of 80 pits per year, the 15 cubic yards of MLLW would represent 0.43 percent. Even if all SRPPF MLLW were to go to the NNSS disposal site, no adverse impact on NNSS operations would be expected.

Hazardous Waste

Under the Proposed Action, hazardous waste would be generated at a rate of 20 to 27 cubic yards per year. Compared to an SRS-wide generation rate of 76 cubic yards per year, the added hazardous waste would represent increases of 26 to 36 percent. Similar to MLLW, hazardous waste is managed under contract with large commercial enterprises that must show adequate capacity and compliance with applicable permitting and regulatory requirements in order to be considered for the contract. Depending on its specific terms, an existing contract may have to be modified to cover the SRPPF waste, but these waste generation numbers are not large on a national, or even state level. Per EPA's records on hazardous waste biennial reports, there were almost 165,000 tons of hazardous waste generated in South Carolina in 2017 (EPA 2018d). Using a rough, and conservatively high, approximation of one cubic yard of hazardous waste weighing 500 pounds (or about twice the density of typical, uncompacted mixed municipal solid waste [EPA 2016b]), 20 to 27 cubic yards of hazardous waste from the SRPPF would represent a small portion (on the order of 0.001 percent) of the hazardous waste generated in the state.

Management of the hazardous waste that would be produced from the SRPPF under the Proposed Action would not be expected to add any additional risks or adverse impacts to ongoing hazardous waste activities within SRS or to offsite commercial facilities.

Solid Waste

Under the Proposed Action, the annual SRPPF sanitary waste generation rate is estimated at approximately 3,200 cubic yards (50 pits per year) and 5,200 cubic yards (80 pits per year). These waste generation rates would represent increases of 49 and 80 percent, respectively, to the current SRS (sitewide) generation rate of 6,500 cubic yards per year. However, as noted in Section 3.9.6 of this EIS, SRS generated an average of 18,400 cubic yards per year of sanitary waste over the five-year period from FY 2011 through FY 2015. With the SRPPF producing 50 or 80 pits per year, the total SRS sanitary waste generation numbers would still be lower than the 18,400 cubic yards per year. Accordingly, existing facilities and equipment are expected to have capacity to handle the increased volume of sanitary waste.

At a typical density of 250 pounds per cubic yard for uncompacted mixed municipal waste (EPA 2016b), the 3,200 cubic yards per year from the SRPPF (50 pits per year) equates to only 400 tons per year. At a production rate of 80 pits per year, the corresponding sanitary waste generation rate is 650 tons per year. These numbers are only 0.16 and 0.26 percent, respectively, of the 250,000 tons per year currently going to the Three Rivers Landfill. This quantity of waste would not impact operations at the municipal landfill.

Sanitary Wastewater

Sanitary wastewater generated within the SRPPF and its support facilities would flow into the existing wastewater collection system that leads to the CSWTF. The CSWTF receives 97 percent of the sanitary wastewater generated at SRS (NNSA 2015, p. 3-43), has a treatment capacity of 1.05 million gallons per day, and is currently operating at about 30 percent capacity, or about 320,000 gallons per day. The remaining three percent of SRS's sanitary wastewater goes to three small treatment facilities serving several outlying areas. At any given time in recent years, the total SRS workforce has been about 11,000 people. If it is assumed that sanitary wastewater generation correlates directly with the number of contributing workers, then 97 percent of 11,000 workers (that is, 10,700 workers) correlates to a wastewater generation of 320,000 gallons per day, or roughly 30 gallons per day per worker.

Under the Proposed Action, the additional workforce (including security workforce) would range from 1,830 to 2,015 workers (see Chapter 2, Table 2-2). Assuming these workforce levels would generate sanitary wastewater at a rate of 30 gallons per person per day (per the rationale presented in the preceding paragraph), sanitary wastewater generation would range from 54,900 to 60,450 gallons per day. Adding either of these wastewater generation rates to the existing wastewater going to the CSWTF, the treatment facility would still be operating at less than 40 percent of its capacity. Correspondingly, sanitary wastewater generated from the Proposed Action would not adversely impact existing treatment capacity, and CSWTF effluent monitoring required by its NPDES permit would help ensure that treated wastewater remained within standards.

4.9.2 Analyses of Operational Variations and Design Optimizations

<u>Operational Variation #1: 125 Pits Per Year</u>

If the proposed SRPPF and support facilities were used to produce 125 pits per year, potential impacts to waste management during construction would be no different from the Proposed Action because there would be no changes to the exterior of the SRPPF or its supporting facilities. Accordingly, the discussion that follows addresses changes that might be expected during operations. Table 4-14 presents a summary of the waste generation volumes for the production of 125 pit per year.

Table 4-14—Summary of Waste Generation under Operational Variation #1

Waste Type	Units	Operational Variation #1, 125 Pits Per Year	Proposed Action 50 to 80 Pits Per Year
TRU waste	yd^3/yr	1,000	600-880
LLW – solid	yd^3/yr	3,460	2,200-2,840
LLW – liquid	gal/yr	1,154,000	600,000-740,000
MLLW	yd^3/yr	20	10-15
Hazardous	yd^3/yr	43	20-27
Solid Waste – sanitary waste	yd^3/yr	8,100	3,200–5,200
Solid Waste – C&D waste	yd^3/yr	0	0
Solid Waste – liquid	gal/yr	0	0
Sanitary wastewater	gal/day	88,500	54,900-60,450

C&D waste = construction and demolition; gal/day = gallon per day; gal/yr = gallon per year; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; TRU = transuranic; yd^3/yr = cubic yards per year.
Source: SRNS 2020, 2020a

<u>TRU Waste</u>

Producing 125 pits per year would increase the generation of TRU waste to an estimated 1,000 cubic yards per year. This represents a 14 percent increase over the upper end of the Proposed Action's range and would be more than double the 460 cubic yards currently generated annually at SRS. As described for the production rate of 50 to 80 pits per year, impacts to the onsite management of this waste would be expected to be minor because it would be internal to the SRPPF operations and, combined with the current TRU waste generation rate, is 43 percent higher than annual averages of TRU waste managed onsite between 2011 and 2015. Workforce, equipment, and any other waste management elements would be ramped up to support the need. The operational goal would continue to be the staging of TRU waste containers until there was enough for a shipment to the WIPP facility; however, the shipments would need to be more frequent than expected under the Proposed Action. If shipments to the WIPP facility were curtailed or suspended for some reason, impacts to site operations would be greater than for the lower pit production rates. If TRU wastes could not be shipped out, storage capacity within the SRPPF would fill faster and the need for SRS storage locations outside the SRPPF would arise sooner.

Potential impacts to the WIPP facility under the increased pit production rate would be similar to those described for the 50-to-80-pit production rate. Shipments from SRPPF would increase to an estimated 129 per year, which would represent approximately 17 percent of the planned 750 shipments per year to the WIPP facility.

Low-Level Radioactive Waste—Solid

Producing 125 pits per year would generate an estimated 3,460 cubic yards of LLW per year, which represents an increase of 22 percent over the upper end of the Proposed Action's range and an increase of 26 percent over SRS generation rates without the SRPPF. Potential impacts from the management of this increased waste basically would be the same as under the Proposed Action (i.e., 50 to 80 pits per year). For discussion purposes, it can be assumed that waste acceptance criteria would be met and onsite disposal capacity would be available, but radionuclide limits set by the Solid Waste Disposal Facility's performance assessment or other permit limits would be reached sooner with the additional waste. If SRPPF LLW did not meet SRS disposal site waste acceptance criteria, if SRS disposal capacity was unavailable, or if the LLW was determined to be classified, offsite disposal alternatives would be pursued. As described for the Proposed Action, the NNSS disposal site would be considered a reasonable alternative. If DOE capabilities are not practical or cost effective, exemptions may be approved to allow use of a non-DOE commercial, licensed LLW disposal facility, consistent with DOE Order 435.1. If all SRPPF LLW were sent to the NNSS, it would represent an increase of about nine percent over current volumes of waste going to the NNSS. As with the Proposed Action, increasing the quantities of waste received by these levels could require the NNSS to increase equipment and manpower levels.

Low-Level Radioactive Waste—Liquid

Producing 125 pits per year would increase liquid LLW to 1,154,000 gallons per year. Impacts from the management of this waste stream would be the same as described for the lower pit production rate of the Proposed Action. The liquid LLW would be processed at the ETF where it would still be a small contribution to existing flows, which are well below the facility's treatment capacity. The liquid LLW would also contribute to ETF residues going to the SPF, but again the contribution would not have any adverse impact.

Mixed Low-Level Radioactive Waste

Producing 125 pits per year would generate MLLW at a rate of 20 cubic yards per year. This would represent a 33-percent increase over the upper end of the Proposed Action's range and a 4-percent increase to the SRS's existing MLLW generation rate of 520 cubic yards per year. As described for the Proposed Action, this relatively small increase in MLLW production would not be expected to adversely impact the current SRS approach to management of MLLW, which is via contracts with commercial enterprises. Disposal of MLLW at either the NNSS or a commercial, licensed MLLW disposal facility is also considered a viable alternative for disposition of this waste, and the 20 cubic yards per year would represent less than a one-percent increase in the average quantity of MLLW disposed of at the NNSS in a year.

Hazardous Waste

Producing 125 pits per year would generate hazardous waste at a rate of 43 cubic yards per year. This would represent a 59-percent increase over the upper end of the Proposed Action's range and an approximately 57-percent increase to the SRS's existing hazardous waste generation rate of 76 cubic yards per year. Although this would be an increase over existing levels, the quantity is still small in relation to the quantities of hazardous waste managed within the state each year and by the commercial enterprises that are under contract to take the waste. As described for the Proposed Action, management of the hazardous waste that would be produced from the SRPPF would not be expected to add any additional risks or adverse impacts to ongoing hazardous waste activities within the SRS or to offsite commercial facilities.

Solid Waste

Producing 125 pits per year would generate solid sanitary waste at a rate of 8,100 cubic yards per year. This would represent a 56-percent increase over the upper end of the Proposed Action's range and an approximately 125-percent increase to the SRS's existing sanitary waste generation rate of 6,500 cubic yards per year. Although this is an increase, the total SRS production under this scenario, at 14,600 cubic yards per year, would be less than the average of 18,400 cubic yards per year generated from FY 2011 through FY 2015. As a result, existing SRS facilities and equipment should not be adversely impacted by the increase.

At a typical density of 250 pounds per cubic yard for uncompacted mixed municipal waste (EPA 2016b), the 8,100 cubic yards per year from the SRPPF (when producing 125 pits per year) equates to approximately 1,000 tons per year. This number is 0.4 percent of the 250,000 tons per year currently going to the Three Rivers Landfill. This quantity of waste would not be expected to adversely impact operations at the municipal landfill.

Sanitary Wastewater

The total SRPPF workforce (including security workforce) is estimated at 2,950 persons for a production rate of 125 pits per year. Using the rough, conservative estimate of 30 gallons per day per person under the Proposed Action, sanitary wastewater generated under this scenario would be about 88,500 gallons per day. This flow would be added to the 320,000 gallons per day already going to the CSWTF and, as described in the discussion of the lower pit production rates, the CSWTF would still be operating at just 40 percent of its capacity. Accordingly, potential impacts to the management of sanitary wastewater would be the same as under the Proposed Action, and no adverse impacts would be expected.

Operational Variation #2: Wrought Production Process

Changes to waste management impacts would be expected to be minor if the wrought process was incorporated into the Proposed Action. The types of wastes (i.e., TRU waste, LLW, or MLLW) generated using the wrought process would be the same as the casting process, and waste quantities generated during pit production would be similar for both processes. The only notable difference in waste quantities would result from maintenance associated with the wrought process. Because the wrought process would use rollers and hydraulic presses, equipment replacements and die changeouts could generate TRU waste or LLW that would not be generated in the casting process. However, these wastes would occur infrequently, and quantities would be much smaller than the annual wastes from pit production operations (SRNS 2020). Conversely, the casting process involves the disposition of molds, which would not occur in the wrought process. Therefore, the overall differences in wastes generated would be minor. Wastes from the wrought process would be managed in the same manner as the casting process, and waste management facilities have adequate capacity to dispose of all wastes generated. As indicated in Section 2.1.5.1.2 of this EIS, the wrought process would only be used to supplement the casting process, not replace it.

Design Optimization #1: Retain Existing Administration Building

Retaining the existing administration building would involve changes to construction activities (i.e., eliminating a major building demolition effort and construction of a retaining wall). These changes would be expected to decrease the amount of waste generated during this project phase. The construction and demolition waste associated with the demolition of the existing administration building would not occur, decreasing the generation of this nonhazardous waste from 1,700 to 700 cubic yards per year during construction. The liquid waste described in Section 4.9.1.1 (associated with concrete equipment cleanout and concrete production if a concrete batch plant is established) would be slightly higher to account for the construction of the retaining wall on the north side of the PIDAS.

Design Optimization #2: Use Sand Filter

If the sand filter exhaust system described in Section 2.1.5.2.2 were constructed, there would be minor changes in construction waste generation rates, particularly for C&D wastes. Construction of the sand filter would not be expected to require demolition of any additional facilities, and excavated soils would be stockpiled and reused to the extent practicable.

During operations, the sand filter system would replace many of the SRPPF's exhaust fans and HEPA filters. Waste generated from the routine maintenance and replacement of these HEPA filters would be eliminated. The eliminated filters would not be located in Zone 1 areas so it is likely that the eliminated waste would not be TRU waste, but it could represent a small reduction in LLW.

Integration of the sand filter system into the project would involve an added element in the management of waste and facilities at the end of the SRPPF's operational life. As described in Section 2.1.5.2.2, the sand filter would likely be left in place at the project's end of life and possibly be grouted in place for decommissioning. Similar to the approach described in Section 4.14 of this Final EIS, NNSA would evaluate the situation, the level of radionuclide inventory contained in the sand filter, and available technologies to ensure that the final disposition of the sand filter would be appropriate for management of in-situ waste.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential impacts related to waste generation rates from design changes that would reduce the number of gloveboxes and modify the aqueous recovery process would be the same as potential impacts under the Proposed Action. Affected glovebox operations would involve waste generation, but the changes would be expected to be primarily in the locations and manner in which waste is generated rather than in notable changes to the quantities generated.

4.9.3 No-Action Alternative

Under the No-Action Alternative, the existing MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. Impacts associated with waste management activities at SRS would remain at current levels.

4.10 HUMAN HEALTH

4.10.1 Proposed Action

4.10.1.1 Construction

Construction activities under the Proposed Action would occur in a nonradiological area, and dosimetry would not be required. Consequently, construction activities would not pose radiological risks to workers or members of the public.

Nonradiological impacts to workers were evaluated using Bureau of Labor Statistics occupational injury/illness and fatality rates. NNSA values are historically lower than Bureau of Labor Statistics values due to the increased focus on safety fostered by integrated safety management, and the voluntary protection program. The potential risk of occupational injuries/illnesses and fatalities to workers constructing the proposed SRPPF complex would be bounded by injury/illness and fatality rates for general industrial construction. A discussion of the methodology for analysis of impacts to public and worker health and safety is provided in Appendix A, Section A.11.

Table 4-15 lists the potential estimates of injuries/illnesses and fatalities estimated for both the peak year of construction and the total six-year construction period. Over the full construction period, 73 days of lost work from illness/injury and less than one fatality would be expected.

Table 4-15—Occupational Injury/Illness and Fatality Estimates for SRPPF Complex Construction

Injury, Illness, and Fatality Categories	Results
Peak Construction	
Peak construction workforce (persons)	1,800
Lost days due to injury/illness	18
Number of fatalities	0.2
Total Construction (six years)	
Total construction worker-years[a]	7,300
Lost days due to injury/illness	73
Number of fatalities	0.8

a. Construction workforce would be as follows: Year 1: 700 workers; Year 2: 1,200 workers; Year 3: 1,800 workers; Year 4: 1,800 workers; Year 5: 1,500 workers; Year 6: 300 workers.
Sources: SRNS 2020; BLS 2019b

No hazardous chemicals have been identified that would pose a risk to members of the public from construction activities. Construction workers would be protected from overexposure to hazardous chemicals by adherence to regulatory occupational standards that limit concentrations of potentially hazardous chemicals and implementation of integrated safety management programs that provide hazards identification and control measures for construction activities.

4.10.1.2 Operations

NNSA regulates the releases of radiological materials for its facilities and the potential level of radiation doses to workers and the public. Environmental radiation protection is currently regulated by DOE Order 458.1, which sets annual dose standards from routine DOE operations of 100 millirem through all exposure pathways to members of the public. The order requires that no member of the public receive an effective dose in a single year greater than 10 millirem from airborne emissions of radionuclides and four millirem from ingestion of drinking water. In addition, the dose requirements in 40 CFR Part 61, Subpart H, limit exposure to the MEI from all air emissions to 10 millirem per year.

Under normal operation of the SRPPF, there would be minimal public health impacts from radiological releases. Public radiation doses would occur from airborne releases only (see Table 4-7 in Section 4.4). Table 4-16 lists incremental radiation doses estimated for the public (offsite MEI and collective population dose) and corresponding incremental LCFs.

As shown in Table 4-16, the potential radiological impacts to the public during SRPPF normal operations would be small. The annual radiation dose to the offsite MEI would be much smaller than the limit of 10 millirem per year set by both the EPA (40 CFR Part 61) and DOE (DOE Order 458.1) for airborne releases of radioactivity. The risk of an LCF to this individual from operation of the SRPPF would be essentially zero (3.0×10^{-13} to 4.8×10^{-13}) per year. The projected number of LCFs to the population within a 50-mile radius of the proposed SRPPF would be essentially zero (i.e., 1.9×10^{-8} to 3.1×10^{-8}).

Table 4-16—Annual Radiological Impacts to the Public from SRPPF Operations

Receptor/Dose/Risk	50 Pits Per Year	80 Pits Per Year
Offsite MEI[a]		
Dose (millirem)	5.0×10^{-7}	8.0×10^{-7}
LCF risk[b]	0 (3.0×10^{-13})	0 (4.8×10^{-13})
Population Within 50 Miles[c]		
Collective dose (person-rem)	3.3×10^{-5}	5.2×10^{-5}
LCF[b]	0 (1.9×10^{-8})	0 (3.1×10^{-8})

LCF = latent cancer fatality; MEI = maximally exposed individual.
a. The offsite MEI is assumed to reside at the site boundary, approximately 6.7 miles away. An actual residence may not currently be present at this location.
b. Based on an LCF risk estimate of 0.0006 LCF per rem or person-rem.
c. Based on 862,957 people living within 50 miles of SRS in the year 2030.
Source: SRNS 2020

Occupational radiation protection at DOE facilities is regulated under 10 CFR Part 835, which limits the occupational dose for an individual worker to 5,000 millirem per year. DOE has set administrative exposure guidelines at a fraction of this exposure limit to help keep exposures *as low as reasonably achievable* (*ALARA*; DOE administrative exposure guidelines are set at 1,000 millirem per year). The worker radiation dose projected in this EIS is the total effective dose incurred by workers as a result of routine operations. This dose is the sum of the external whole-body dose and internal dose, as required by 10 CFR Part 835.

The estimates of annual radiological doses to workers (both radiological workers in the SRPPF and security workforce in the vicinity of the SRPPF) are provided in Table 4-17. As shown in the table, the annual doses to individual workers for all levels of production would be well below the DOE limit of 5,000 millirem (10 CFR Part 835) and the DOE-recommended control level of 1,000 millirem (10 CFR Part 835). Operation of the proposed SRPPF would result in an average individual worker dose of approximately 150 millirem annually (security workforce would receive one-half this dose because they are typically farther removed from the production areas). The total annual collective dose to all SRPPF radiological workers would be 178 to 200 person-rem under the Proposed Action. Statistically, a total annual dose of 178 to 200 person-rem would result in essentially zero (0.11 to 0.12) LCF annually to the proposed SRPPF radiological workforce. Security personnel would receive a collective dose of approximately one-tenth the dose to radiological workers.

Table 4-17—Annual Radiological Impacts to SRPPF Workers

Receptor/Dose/Risk	50 Pits Per Year	80 Pits Per Year
Radiological Workers		
Number of radiological workers	1,190	1,330
Average annual dose to radiological worker (millirem)	150	150
Average radiological worker annual LCF risk	0 (9.0×10^{-5})	0 (9.0×10^{-5})
Collective annual dose to radiological workers (person-rem)	178	200
Total Radiological Worker LCFs[a]	**0 (0.11)**	**0 (0.12)**
Security Workforce		
Number of security workers	240	240
Average annual dose to security worker (millirem)	75	75
Average security worker annual LCF risk	0 (4.5×10^{-5})	0 (4.5×10^{-5})
Collective annual dose to security workers (person-rem)	18	18
Total Security Worker LCFs[a]	**0 (0.01)**	**0 (0.01)**

LCF = latent cancer fatality.
a. Based on a LCF risk estimator of 0.0006 LCF per rem or person-rem.
Note: The regulatory dose limit for an individual worker is 5,000 millirem/year (10 CFR Part 835). However, the administrative limit for an SRS worker is 500 millirem per year, which is below the DOE administrative exposure guideline of 1,000 millirem per year, as established in 10 CFR Part 835.
Source: SRNS 2020a

Occupational impacts during operations would involve 1,590 to 1,775 staff for the production of 50 to 80 pits per year, plus an additional 240 security personnel. The potential risk of occupational injuries/illnesses and fatalities to workers during operations would be expected to be bounded by injury and fatality rates for general chemical manufacturing. Table 4-18 presents the potential estimates of injuries/illnesses and fatalities for the average year of operations for production of 50 to 80 pits per year. In an average year, 15 to 17 days of lost work from illness/injury and less than one fatality would be expected.

Table 4-18—Annual Occupational Injury/Illness and Fatality Estimates for Operations

Injury, Illness, and Fatality Categories	50 Pits Per Year	80 Pits Per Year
Operational workforce (persons)	1,830	2,015
Lost days due to injury/illness	15	17
Number of fatalities	0.03	0.03

Sources: SRNS 2020a; BLS 2019b

No chemical-related health impacts are associated with normal (accident-free) operations of the SRPPF complex. Initial screens for the hazard analysis did not result in the identification of any controls necessary to protect the public or workers from direct chemical exposures. Facility design features that minimize worker exposures during facility operations act as defense-in-depth controls. In addition to these controls, worker protection is augmented by facility safety programs such as integrated safety management, work planning, chemical hygiene, industrial hygiene personnel monitoring, and emergency preparedness (NNSA 2008b).

Beryllium. Beryllium components would be used at times at the proposed SRPPF. Because inhalation of beryllium dust and particles has been proven to cause adverse health effects, beryllium is of special interest from a health effects perspective. The disassembly operations are expected to generate only larger, nonrespirable turnings and pieces of metal, and all work would be performed in gloveboxes. No grinding would be done that could cause small pieces of beryllium to become airborne.

In 1997, DOE initiated the Interim Chronic Beryllium Disease Prevention Program. The purpose of the program was to enhance, supplement, and integrate a worker protection program to reduce the number of current workers exposed, minimize the levels of beryllium exposure and the potential for exposure to beryllium, and to establish medical surveillance protocols to ensure early detection of disease. In December 1999, DOE published a final rule to establish the chronic beryllium disease prevention program that became effective on January 7, 2000 (10 CFR Part 850). The final rule establishes:

- An airborne beryllium concentration action level as 0.2 microgram per cubic meter;
- A requirement for employers to ensure that workers use respirators in areas where the concentration of beryllium is at or above the action level and to provide a respirator to any employee who requests one regardless of the concentration of airborne beryllium;
- Criteria and requirements governing the release of beryllium-contaminated equipment and other items at DOE sites for use by other DOE facilities or the public;
- Requirements for offering medical surveillance to any "beryllium-associated worker"; and
- Medical removal protection and multiple physician review provisions.

The beryllium in solid form would be disposed of as LLW or TRU waste and has been included in the waste estimates presented in Sections 2.3.2 and 2.3.4 of this EIS (SRNS 2020).

4.10.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

The potential human health impacts from construction would not change compared to the impacts presented in Section 4.10.1.1 because construction impacts are independent of the pit production rate. Regarding operations, Tables 4-19 through 4-21 present the potential impacts to human health associated with production of 125 pits per year.

Table 4-19—Annual Radiological Impacts to the Public under Operational Variation #1

Receptor/Dose/Risk	125 Pits Per Year
Offsite MEI[a]	
Dose (millirem)	1.2×10^{-6}
LCF risk[b]	0 (7.2×10^{-13})
Population Within 50 Miles[c]	
Collective dose (person-rem)	8.2×10^{-5}
LCF[b]	0 (4.9×10^{-8})

LCF = latent cancer fatality; MEI = maximally exposed individual.
a. The offsite MEI is assumed to reside at the site boundary, approximately 6.7 miles away. An actual residence may not currently be present at this location.
b. Based on an LCF risk estimate of 0.0006 LCF per rem or person-rem.
c. Based on 862,957 people living within 50 miles of SRS in the year 2030.
Source: SRNS 2020

Table 4-20—Annual Occupational Injury/Illness and Fatality Estimates under Operational Variation #1

Injury, Illness, and Fatality Categories	125 Pits Per Year
Operational workforce (persons)	2,950
Lost days due to injury/illness	24
Number of fatalities	0.05

Sources: SRNS 2020a; BLS 2019b

Table 4-21—Annual Radiological Impacts to SRPPF Workers under Operational Variation #1

Attribute	125 Pits Per Year
Radiological Workers	
Number of radiological workers	1,995
Average annual dose to radiological worker (millirem)	150
Average radiological worker annual LCF risk	0 (9.0×10^{-5})
Collective annual dose to radiological workers (person-rem)	299
Total Radiological Worker LCFs[a]	**0 (0.18)**
Security Workforce	
Number of security workers	290
Average annual dose to security worker (millirem)	75
Average security worker annual LCF risk	0 (4.5×10^{-5})
Collective annual dose to security workers (person-rem)	22
Total Security Worker LCFs[a]	**0 (0.013)**

LCF = latent cancer fatality.
a. Based on an LCF risk estimator of 0.0006 LCF per rem or person-rem.
Note: The regulatory dose limit for an individual worker is 5,000 millirem per year (10 CFR Part 835). However, the maximum annual dose to a worker is estimated at 500 millirem/year, which is below the DOE administrative exposure guideline of 1,000 millirem per year, as established in 10 CFR Part 835.
Source: SRNS 2020a

<u>Operational Variation #2: Wrought Production Process</u>

Potential construction-related impacts to human health from the wrought process would be no different than the impacts from the casting process. During pit production, the wrought process would use rollers and hydraulic presses that could introduce occupational safety hazards (i.e., rolling/pinching/crushing hazards, ejection hazards, electrical hazards, and chemical hazards from hydraulic fluid and lubricants) which are different from the casting process (SRNS 2020). However, because the analysis in this EIS of potential occupational hazards during operations is based on injury and fatality rates for general chemical manufacturing, it is not possible to quantify the magnitude of any changes in occupational hazards between the wrought and casting processes. Radiological doses to occupational workers are largely a function of the time required to produce a pit as well as the number of workers involved in the process. For production of large quantities of pits, the wrought process is considered to be a quicker process than the casting process, which would suggest a potential for reduced worker exposure (SRNS 2020). However, for the relatively small quantities of pits associated with the Proposed Action, NNSA does not expect any notable differences in worker exposures between the two processes (SRNS 2020).

<u>Design Optimization #1: Retain Existing Administration Building</u>

Potential construction-related impacts to human health from retaining the existing administration building would be the same as the Proposed Action because NNSA does not expect any notable change in the construction parameters. While impacts would be reduced as a result of not demolishing the existing administration building, these reductions would be partially offset by the increased construction activities for the larger Protected Area and retaining wall to the north. During operations, potential impacts to the public and workers would be the same as under the Proposed Action because impacts are essentially a function of the number of pits produced.

Design Optimization #2: Use Sand Filter

Potential impacts to human health from construction of the sand filter would be the same as under the Proposed Action because NNSA does not expect any notable change in the construction parameters (see Table 2-1). There could be additional excavation and construction activities; however, additional construction personnel would not be required. During operations, potential impacts to the public and workers would be the same as under the Proposed Action because impacts are essentially a function of the number of pits produced, and the radiological emissions would be essentially the same as under the Proposed Action.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Changes to gloveboxes and the aqueous recovery process would not change human health impacts during normal operations because worker and public exposures would not be different that those estimated under the Proposed Action.

4.10.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. Impacts associated with human health operations at SRS would remain at current levels.

4.11 FACILITY ACCIDENTS

This section presents the potential impacts on workers (both involved and noninvolved) and the public from potential accidents from SRPPF operations. Additional details supporting the analysis are provided in Appendix B to this EIS.

An accident is a sequence of one or more unplanned events with potential outcomes that endanger the health and safety of workers and the public. An accident can involve a combined release of energy and hazardous materials (radiological or chemical) that might cause prompt or latent health effects. The sequence usually begins with an initiating event, such as human error, equipment failure, or earthquake, followed by a succession of other events that could be dependent or independent of the initial event, which dictates the accident’s progression and the extent of materials released. Initiating events fall into three categories:

1. **Internal Initiators:** Normally originate in and around the facility, always a result of the facility’s operations. Examples include equipment or structural failures and human errors.

2. **External Initiators:** Independent of facility operations and normally originate from outside the facility. Some external initiators affect the ability of the facility to maintain its confinement of hazardous materials because of potential structural damage. Examples

include aircraft crashes, vehicle crashes, nearby explosions, and toxic chemical releases at nearby facilities that affect worker performance.

3. **Natural Phenomena Initiators:** Natural occurrences that are independent of facility operations and occurrences at nearby facilities or operations. Examples include earthquakes, high winds, floods, lightning, and snow. Although natural phenomena initiators are independent of external facilities, their occurrence can involve those facilities and compound the progression of the accident.

If an accident involving the release of radioactive or chemical materials occurred, workers, members of the public, and the environment would be at risk. Workers in the facility where the accident occurred would be particularly vulnerable to the effects of the accident because of their location. The offsite public would also be at risk of exposure to the extent that meteorological conditions exist for the atmospheric dispersion of released hazardous materials. Using approved computer models, this analysis used estimates of the dispersion of released hazardous materials and their potential effects. However, estimation of potential health effects becomes increasingly difficult to quantify for facility workers as the distance between the accident location and the worker decreases. This is because the individual worker exposure cannot be adequately defined with respect to the presence of shielding and other protective features. The worker also may be injured or killed by physical effects of the accident unrelated to hazardous material.

Emergency Preparedness. Each NNSA site has established an emergency management program. This program was developed and is maintained to ensure adequate response for most accident conditions and to provide response efforts for accidents not specifically considered. The emergency management program incorporates activities associated with emergency planning, preparedness, and response.

Radiological Impacts. For this analysis, NNSA estimated radiological impacts to three receptors: (1) the MEI at the SRS boundary; (2) the offsite population within 50 miles of the proposed SRPPF; and (3) a noninvolved worker 0.62 mile from the accident location.

4.11.1 Proposed Action

4.11.1.1 Radiological Accidents

Table 4-22 shows the frequencies and consequences of a postulated set of accidents for the public (offsite MEI and the general population living within 50 miles of the proposed SRPPF) and a hypothetical noninvolved worker for the production of 80 pits per year. The potential accident consequences associated with production rates of 50 pits per year would not be notably different than those estimated for 80 pits per year. As described in Appendix B, the doses shown in the tables were calculated by the MACCS computer code[25] based on accident data. The LCF values were calculated using a dose-to-LCF conversion factor of 0.0006 LCF per rem (MEI and worker) or person-rem (population). If the dose to an MEI or worker exceeds 20 rem, the dose-to-risk conversion factor is doubled to 0.0012. If the dose to an MEI or worker exceeds 1,000 rem, the

[25] MACCS (MELCOR Accident Consequence Code System) is a fully integrated, engineering-level computer code developed at Sandia National Laboratories for the NRC. MACCS simulates the impact of severe accidents at nuclear power plants on the surrounding environment.

MEI or worker was assumed to acquire acute radiation illness, resulting in a prompt fatality (death within days). For each of the accidents presented in Table 4-22, fatal or serious non-fatal injuries may be expected because of an involved worker's proximity to the accident.

Accident frequencies are generally grouped into bins such as the following:

- "anticipated" (with estimated annual frequencies of greater than or equal to 1 in 100 [$\geq 1\times10^{-2}$]);
- "unlikely" (with estimated annual frequencies between 1 in 100 and 1 in 10,000 [$\leq1\times10^{-2}$ to 1×10^{-4}]);
- "extremely unlikely" (with estimated annual frequencies between 1 in 10,000 to 1 in 1 million [$\leq1\times10^{-4}$ to 1×10^{-6}]); and
- "beyond extremely unlikely" (estimated annual frequencies less than 1 in 1 million [$\leq1\times10^{-6}$]). These accidents are not considered reasonably foreseeable and were not considered further in this analysis.

The evaluated accidents in Table 4-22 represent a spectrum of accident frequencies and consequences ranging from "anticipated" to "extremely unlikely."

Table 4-22—Radiological Accident Frequency and Consequences—80 Pits Per Year[a]

Accident	Frequency	Maximally Exposed Individual[b,e]		Offsite Population[c]		Noninvolved Worker[d,e]	
		Dose (rem)	Latent Cancer Fatality	Dose (person-rem)	Latent Cancer Fatality	Dose (rem)	Fatality[f]
Extremely unlikely earthquake with subsequent fire	1×10^{-4} to 1×10^{-6}	0.8	0 (0.00048)	3,610	2.2	372	0.45
Fire in a single fire zone	1×10^{-4} to 1×10^{-6}	0.41	0 (0.00024)	1,800	1.1	279	0.33
Explosion in a furnace	1×10^{-2} to 1×10^{-4}	1.8	0 (0.0011)	8,120	4.9	1,260	1.0
Nuclear criticality	1×10^{-2}	3.4×10^{-6}	0 (2.0×10^{-9})	0.0064	0 (3.8×10^{-6})	0.0015	0 (8.8×10^{-7})
Radioactive material spill	1×10^{-2}	0.0037	0 (2.2×10^{-6})	16.2	0 (0.0097)	2.5	0 (0.0015)

a. Impacts presented for 80 pits per year. Impacts for 50 pits per year would be bounded by analysis for 80 pits per year.
b. At site boundary, approximately 6.7 miles from release.
c. Based on a projected future population (year 2030) of 862,957 persons residing within 50 miles of SRS location.
d. At a distance of 1,000 meters.
e. The MEI and the noninvolved worker scenarios each assumes that one person was exposed. If more than one person was exposed in either of these scenarios, then that scenario's dose would be per person and the fatalities would be multiplied by the number of persons exposed.
f. If the dose is ≥ 1,000 rem, these are prompt fatalities; otherwise, they are LCFs.
Source: SRNS 2020 (for accident scenarios and frequencies)

Table 4-23 shows the accident risks (per year) of the production of 80 pits per year, obtained by multiplying the consequences by the upper bound frequency of an accident occurring. The accidents listed in these tables were selected from a wide spectrum of accidents described in SRNS (2020). The selection process, screening criteria used, and conservative estimates of *material-at-risk* and *source term* (see Appendix B) ensure that the accidents chosen for evaluation in this EIS provide a conservative estimate of the impacts of all reasonably foreseeable accidents that could occur at the proposed SRPPF. Thus, if any other reasonably foreseeable accident that was not evaluated in this EIS were to occur, its impacts on workers and the public would be expected to be within the range of the impacts evaluated.

Table 4-23—Annual LCF/Fatality Risks—80 Pits Per Year[a]

Accident	Maximally Exposed Individual[b]	Offsite Population[c]	Noninvolved Worker[d]
Extremely unlikely earthquake with subsequent fire	0 (4.8×10^{-8})	0 (2.2×10^{-4})	0 (4.5×10^{-5})
Fire in a single fire zone	0 (2.4×10^{-8})	0 (1.1×10^{-4})	0 (3.3×10^{-5})
Explosion in a furnace	0 (1.1×10^{-5})	0 (4.9×10^{-2})	0.01[e]
Nuclear criticality	0 (2.0×10^{-11})	0 (3.8×10^{-8})	0 (8.8×10^{-9})
Radioactive material spill	0 (2.2×10^{-8})	0 (9.7×10^{-5})	0 (1.5×10^{-5})

a. Impacts presented for 80 pits per year. Impacts for 50 pits per year would be bounded by analysis for 80 pits per year.
b. At site boundary, approximately 6.7 miles from release.
c. Based on a projected future population (year 2030) of 862,957 persons residing within 50 miles of SRS location.
d. At a distance of 1,000 meters.
e. Since an explosion in a furnace would likely result in a prompt fatality, this value reflects the annual risk of a fatality rather than an annual risk of cancer.
Source: SRNS 2020 (for accident scenarios and frequencies)

The reasonably foreseeable accident with the highest potential consequences to the offsite population (Table 4-22) is an explosion in a furnace and is thus considered the maximum reasonably foreseeable accident. Approximately 4.9 LCFs in the offsite population could result from such an accident in the absence of mitigation. This accident has a probability of occurring once every 100 to 10,000 years. An offsite MEI would receive a dose of approximately 1.8 rem. Statistically, the MEI would have a 0.0011 chance of developing an LCF, or about 1 in 900. A noninvolved worker, located 0.62 mile from the accident, would receive a dose of approximately 1,260 rem, which would probably be fatal.

When probabilities are taken into account (see Table 4-23), the accident with the highest risk to the MEI is also an explosion in a furnace. For this accident, the LCF risk to the MEI would be 1.1×10^{-5} per year, or approximately one statistical fatality in 90,000 years. For the population, the LCF risk would be approximately 4.9×10^{-2} per year, meaning that an LCF in the population would statistically occur once every 20 years. A noninvolved worker, located 0.62 mile from the accident, would have a 0.01 chance of developing an LCF, or about 1 in 100.

With regard to earthquakes, as explained in Chapter 3, Section 3.2.3.2 of this EIS, the analysis used USGS probabilistic PGA data to indicate seismic hazard. The PGA values cited are based on a two-percent probability of exceedance in 50 years. This corresponds to an annual occurrence probability of about 1 in 2,500.

At SRS, the coordinates of the MFFF (33.2931 N, 81.6772 W) were entered into the USGS online tool[26] to calculate an estimate of the PGA at firm rock with two-percent probability of exceedance in 50 years for both the USGS 2008 and USGS 2014 reports (Petersen et al. 2008, 2014). Based on the calculation, the PGA at SRS changed from approximately 0.17 *g* in 2008 to approximately 0.156 *g* in 2014, which represents a decrease in predicted ground motion of approximately eight percent. NNSA also evaluated the PGA at rock values on contour maps provided by USGS in order to check the values obtained using the online calculator. The mapped values for SRS are well within the online calculator values. Based on the information collected from the USGS online tool and subsequent calculations, NNSA concludes that the USGS 2014 report and subsequent data are fully accounted for in NNSA's seismic hazard evaluations. Appendix B of this EIS provides additional details regarding the extremely unlikely earthquake and other accidents evaluated in this EIS.

4.11.1.2 Hazardous Chemicals Impacts

The adverse effects of exposure vary greatly among chemicals. They range from physical discomfort and skin irritation to respiratory tract tissue damage and, at the extreme, death. For this reason, allowable exposure levels differ from substance to substance. This analysis used the American Industrial Hygiene Association's Emergency Response Planning Guide (ERPG) values to develop hazard indices for chemical exposures. ERPG definitions are provided below.

ERPG DEFINITIONS

ERPG-1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to one hour without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

ERPG-3 is the maximum airborne concentration below which nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

The analysis used estimated impacts of the potential release of the most hazardous chemicals used at the proposed SRPPF. A chemical's vapor pressure, acceptable concentration (ERPG-2), and quantity available for release are factors used to rank a chemical's hazard. The accident scenario postulates a major leak, such as a pipe or tank rupture, and the released chemical forming a pool about one inch deep in the area around the point of release. Table 4-24 provides information on each chemical and the frequency and consequences of an accidental release. The source term shown represents the amount of the chemical that is accidentally released.

[26] Access to the USGS design ground motion values for a particular latitude, longitude, risk category, and site class may be obtained at https://earthquake.usgs.gov/ws/designmaps/.

Table 4-24—Chemical Accident Frequency and Consequences—80 Pits Per Year

Chemical Released	Quantity Released (kg)	ERPG-2		Concentration		Frequency
		Limit (ppm)	Distance to Limit (km)	At 1,000 m (ppm)	At Site Boundary[a] (ppm)	
Nitric acid	10,500	6	0.17	0.19	<0.01	1×10^{-4}
Hydrochloric acid[b]	600	20	0.13	0.23	<0.01	1×10^{-4}

kg = kilogram; km = kilometer; ppm = parts per million.
a. Site boundary is at a distance of 6.7 miles.
b. See Section 4.11.2 of this Final EIS for impact of Design Optimization #3
Source: SRNS 2020

The impacts of chemical releases are measured in terms of ERPG-2 protective concentration limits given in parts per million. The distances at which the limit is reached are also provided for the ERPG-2 limit. The concentration of the chemical at the noninvolved worker (i.e., 0.62 mile from the accident) is shown for comparison with the concentration limit for ERPG-2. The distance to the site boundary and the concentration at the site boundary are also shown for comparison with the ERPG-2 concentration limits and for determining if the limits are exceeded off site. Conservative modeling of chemical release over the period of one hour was based on a spill and subsequent pool with evaporation resulting in calculated downwind concentrations. Appendix B describes the methodologies that were used to evaluate the potential consequences associated with a chemical release accident situation. Table 4-24 shows the consequences of the dominant loss of containment accident scenarios.

The distance from the release point to the point where the ERPG-2 concentration is reached in relation to the site boundary reflects the consequence of the chemical's release. As the distance to the ERPG-2 point increases, the potential number of persons on site and off site that may be exposed to concentrations in excess of ERPG-2 would be expected to increase. None of the chemicals released in the accident would exceed ERPG-2 limits offsite.

4.11.1.3 Involved Worker Impacts

For all accidents, there is a potential for injury or death to involved workers in the vicinity of the accident. Estimation of potential health effects becomes increasingly difficult to quantify as the distance between the accident location and the worker decreases because the exposure cannot be adequately established with respect to the presence of shielding and other protective features. The worker also may be acutely injured or killed by physical effects of the accident.

No major consequences for the involved worker are expected from leaks, spills, and smaller fires. These accidents are such that involved workers would be able to evacuate immediately or would be unaffected by the events. Explosions could result in immediate injuries from flying debris, as well as the uptake of radioactive particulates through inhalation. If a criticality occurred, workers in the immediate vicinity could receive very high to fatal radiation exposures from the initial burst. The dose would strongly depend on the magnitude of the criticality (number of fissions), the distances of the exposed workers from the criticality, and the amount of shielding provided by structures and equipment between workers and the accident. The extremely unlikely earthquake with subsequent fire could also have substantial consequences, ranging from workers being killed by debris from collapsing structures to high radiation exposure and uptake of radionuclides. For most accidents, immediate emergency response actions would likely reduce the consequences for workers near the accident. Established emergency management programs would be activated in the event of an accident. Following initiation of accident/site emergency alarms, workers would evacuate the area in accordance with site emergency operating procedures and would not be vulnerable to additional radiological or chemical risk of injury.

First response organizations develop plans and protocols that address radiation protection during a radiological incident and that ensure appropriate training is provided to responders and decisionmakers. The radiological impacts to first responders are controlled during the accident by incident commanders using the EPA's emergency worker protective action guides (EPA 2017, Section 3). Generally, the protective action guide is 5 rem, but may be exceeded to prevent further destruction and/or loss of life. Each first responder makes an informed decision as to how much radiation risk he or she is willing to accept to complete a particular critical infrastructure/key resources or lifesaving mission. Therefore, the first responder's potential radiological exposures are administratively controlled, even during an accident.

4.11.1.4 Intentional Destructive Acts

The Complex Transformation SPEIS includes a classified appendix that analyzes the potential impacts of intentional destructive acts (e.g., sabotage, terrorism). The conclusion in the classified appendix can be summarized as follows: "Depending on the malevolent, terrorist, or intentional destructive acts, impacts would be similar to, or exceed, accident impacts analyzed in the SPEIS" (NNSA 2008a). In preparing this SRS Pit Production EIS, NNSA reviewed the classified appendix that was prepared for the Complex Transformation SPEIS to address intentional destructive acts. Based on that review, NNSA concluded that the classified appendix analysis is reasonable and adequate to represent the Proposed Action in this EIS and does not need to be revised (NNSA 2019b).

4.11.2 Analyses of Operational Variations and Design Optimizations

<u>Operational Variation #1: 125 Pits Per Year</u>

If the proposed SRPPF and support facilities were used to produce 125 pits per year, the material-at-risk and source term would not notably change from that associated with production of 50 or 80 pit per year. Consequently, potential impacts from accidents associated with the production of 125 pits per year would be similar to the potential impacts under the Proposed Action.

<u>Operational Variation #2: Wrought Production Process</u>

If the wrought process were used to produce the pits, the frequencies and consequences of a radiological accident would be no different from the Proposed Action. There are no additional accident scenarios that would be unique to the wrought process.

<u>Design Optimization #1: Option to Retain Existing Administration Building</u>

Potential accident-related impacts from retaining the existing administration building and building a retaining wall would be similar to the potential impacts under the Proposed Action.

Design Optimization #2: Use Sand Filter

Potential effects on the accident scenarios or results (consequences and risks) from use of a sand filter would not be noticeably different from the potential impacts under the Proposed Action. As reported in Section 2.1.5.2.2, the sand filter would result in an insignificant reduction in filtration efficiency (sand filter is 99.89 percent effective for 0.3-micron particulates versus HEPA efficiency of 99.99 percent for 0.3-micron particulates). The gloveboxes (Zone 1), which would contain the plutonium during the pit production processes, would still be utilized. Because HEPA filters require a safety class fire protection system and cease to filter once they become wet, the sand filter system would be more reliable and provide an improvement in safety for some accidents.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Section 2.1.5.2.3 describes six changes that could be made under Design Optimization #3. Those potential design optimizations and their effect on the accident impacts presented for the Proposed Action are listed below:

- Installing two furnaces per glovebox in the pyrochemical processing, heat treatment, and casting process steps – the only accident scenario that would be affected by this change is "explosion in a furnace"; however, that accident assumes a steam explosion within a single furnace that causes it to fail catastrophically. It is assumed that the failure of one furnace within a glovebox would not cause the second furnace to fail; therefore, this change would not affect the potential impacts presented for the Proposed Action.

- Reducing the number of waste staging gloveboxes – this change would not affect the material-at-risk, source term, or consequences of postulated accident scenarios; therefore, this change would not affect the potential impacts presented for the Proposed Action.

- Combining the cleaning and density operations into single gloveboxes – this change would not affect the material-at-risk, source term, or consequences of postulated accident scenarios; therefore, this change would not affect the potential impacts presented for the Proposed Action.

- Combining furnace gloveboxes in foundry and machining operations – this change would not affect the material-at-risk, source term, or consequences of postulated accident scenarios; therefore, this change would not affect the potential impacts presented for the Proposed Action.

- Reducing the nitrate recovery to a single line – since, as described in Section 4.11.1.2, the postulated accident scenario is "from bulk storage" (i.e., a storage tank), this change would not affect the potential impacts presented for the Proposed Action.

- Eliminating the chloride recovery line (SRNS 2020a) – this potential change would eliminate the hydrochloric acid accident from Table 4-23 since the hazard (hydrochloric acid) would no longer be used in the SRPPF.

4.11.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. There would be no additional accident risks beyond those associated with current and planned activities that are independent of this action.

4.12 TRANSPORTATION

4.12.1 Proposed Action

4.12.1.1 Construction

Construction activities would require the transport of equipment, materials, personnel, and construction wastes to and from F Area to support the proposed SRPPF (see Chapter 2, Section 2.3.1). Because construction activities would not require the transport of any radiological materials or wastes, this analysis focuses on nonradiological impacts (i.e., traffic fatalities and road congestion).

DOE previously evaluated the potential nonradiological impacts of transporting construction materials, personnel, and wastes to support construction of facilities that would support surplus plutonium disposition (NNSA 2015, Appendix E). In that analysis, no transportation fatalities would occur under any of the scenarios considered, which included construction of a new pit disassembly and conversion facility and immobilization capabilities. Tiering from that analysis, NNSA determined that the nonradiological impacts of transporting construction materials, personnel, and wastes for the SRPPF would result in less than one fatality.[27]

Construction activities would also generate commuter traffic. However, this commuter traffic would be less than what was needed for MFFF construction activities that occurred between 2007 and 2018. As reflected in Chapter 3, Section 3.12.1 of this EIS, the LOS of area roads was established using data during MFFF construction, and area roads adequately supported those ongoing activities with no adverse effects on LOS. The roads in Aiken, Barnwell, and Allendale counties in South Carolina that have the highest levels of traffic would continue to operate at LOS "A," and roads in Augusta-Richmond County, Georgia, would continue to operate at currently designated LOS levels.

Table 4-11 in Section 4.8 shows that the total direct and indirect employment associated with construction is 2,934 workers. Assuming a round trip of 50 miles, 252 workdays, no carpooling, and an accident fatality rate of 1.8 fatalities per 100,000 million miles per year (averaged over 2015 to 2017) (SCDPS 2019, p. 6), less than one, or about 0.7 fatality per year, would occur.

[27] The scope and level of effort associated with SRPPF construction activities would be less than construction activities analyzed for the surplus disposition alternatives (NNSA 2015, Appendix E).

4.12.1.2 Operations

The Proposed Action would involve offsite shipment of radiological and nonradiological materials and wastes. Radiological materials and wastes to be transported include:

- Transport of pits between Pantex and SRS;
- Transport of HEU between SRS and Y-12;
- Transport of plutonium materials between other locations (e.g., LANL and Pantex) and SRS (for startup activities);
- Transport of TRU waste between SRS and the WIPP facility; and
- Transport of classified LLW and classified MLLW between SRS and NNSS.

The transport of the above materials could be via different routes. For purposes of analysis, the routes in Figure 4-4 are representative of the routes that would be taken between the DOE/NNSA sites (see Appendix A of this EIS for a description of how these routes were determined).

Shipments containing Category I special nuclear material would use NNSA's safe, secure transport system (see Chapter 3, Section 3.12.2.2). Transport of other radiological materials and wastes would be conducted by licensed commercial carriers.

Nonradiological shipments would include transport of commodities to the SRPPF and transport of hazardous waste off site to treatment, storage, and disposal facilities. Impacts associated with these shipments are expressed as potential traffic accident fatalities. Most nonradiological shipments would occur within an approximate 50-mile radius of the SRS, although the SRPPF would require the transport of some nonnuclear materials from the Kansas City National Security Campus. In addition, beryllium and graphite components would be transported from LANL or a commercial supplier to the SRPPF.

<u>Radiological Shipments and Impacts</u>

Radiological impacts are caused by low levels of radiation emitted during incident-free transportation and from the release of radioactive materials in the event of an accident. These risks are expressed as additional LCFs. For the incident-free transport of radiological materials and wastes, radiological impacts were determined for crew members and the general population using the RADTRAN 6 computer model (see Appendix A of this EIS for a description of RADTRAN 6 and the assumptions that were used for the transportation analyses). The crew members are the driver and backup driver of the shipment vehicle. For this analysis, the general population is defined as the persons residing within 0.50 mile of the truck route (off-link), persons sharing the road (on-link), and persons at stops. This analysis also addresses exposures to workers who would load and unload the radiological shipments.

As a starting point in this transportation analysis, NNSA used data from the SPD SEIS (NNSA 2015). Data from this document are specifically applicable to the analysis in this SRS Pit Production EIS because the types of radiological materials and wastes associated with the

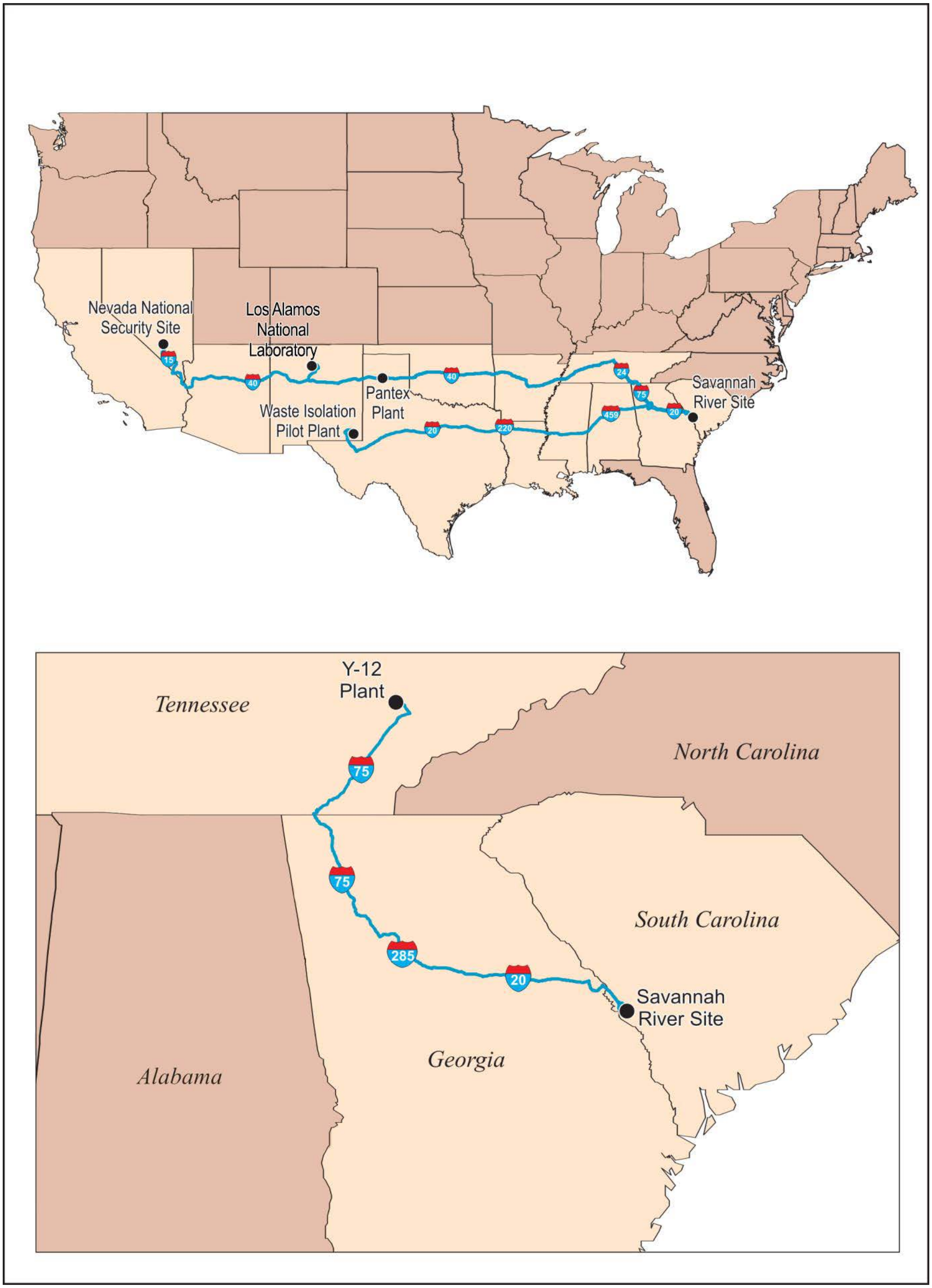


Figure 4-4—Representative Routes for Transporting Radiological Materials and Wastes

proposed SRPPF would be the same, although quantities would be different. In addition, the transportation routes considered in the SPD SEIS are likely the same routes under the Proposed Action of this EIS, as is the packaging. Because the SPD SEIS was based on a projected 2020 population, the impacts analysis for this EIS adjusted the population-related risks to reflect population increases to the year 2030 (see Appendix A, Section A.12).

Tables 4-25 and 4-26 show the potential impacts associated with transporting radiological materials and wastes for production of 50 or 80 pits per year, respectively, at the proposed SRPPF. Accident risks in the tables represent a broad spectrum of accident severities and radioactive release conditions, as described in Appendix A, Section A.12. The accident analysis calculated the probabilities and consequences from this spectrum of accidents, with the "dose risk" being representative of the risk to the population within 50 miles of the accident. Nonradiological risks are expressed in terms of traffic fatalities. Table 4-27 shows the potential transportation impacts associated with transporting plutonium materials between other locations (such as LANL and Pantex) and the SRS. Lastly, Table 4-28 shows the potential human health impacts associated with handling activities.

Table 4-25—Annualized Transportation Impacts—50 Pits Per Year[a]

Material or Waste	Route	Shipments per Year	Incident-Free				Accident	
			Crew Dose (person-rem)[b]	Crew Risk (LCF)	Population Dose (person-rem)	Population Risk (LCF)	Rad Risk (LCF)	Nonrad Risk (traffic fatalities)
Pits	Pantex and SRS	6[d]	0.3	0 (0.0002)	0.4	0 (0.0002)	0 (9×10^{-9})	0 (0.0004)
HEU	Y-12 and SRS	4[d]	0.01	0 (1×10^{-5})	0.08	0 (5×10^{-5})	0 (6×10^{-10})	0 (0.00007)
TRU waste	WIPP and SRS	77	7	0 (0.004)	4	0 (0.002)	0 (2×10^{-7})	0 (0.01)
LLW[c]	SRS and NNSS	55	4	0 (0.003)	2	0 (0.001)	0 (2×10^{-8})	0 (0.01)
MLLW[c]	SRS and NNSS	3	0.3	0 (0.0002)	0.2	0 (0.0001)	0 (2×10^{-9})	0 (0.0005)
Totals	**N/A**	**145**	**11.61**	**0 (0.00741)**	**6.68**	**0 (0.00335)**	**0 (2×10^{-7})**	**0 (0.02097)**

HEU = highly enriched uranium; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; N/A = not applicable; NNSS = Nevada National Security Site; Nonrad = nonradiological; rad = radiological; SRPPF = Savannah River Plutonium Processing Facility; TRU = transuranic waste.

a. Per-shipment risk factors shown in Table E-5 of the SPD SEIS (NNSA 2015) were used as a basis to obtain incident-free and accident impacts. These data are adjusted to reflect the population in the year 2030 and multiplied by the number of shipments.

b. A DOE employee would also need to comply with DOE regulations at 10 CFR Part 835 ("Occupational Radiation Protection"), which limits worker radiation doses to five rem per year; however, DOE has also established an administrative exposure guideline of two rem per year (DOE-STD-1098-2017). This limit would apply to any non-TRU waste shipment conducted by DOE personnel. Drivers of TRU waste shipments to the WIPP facility have an administrative exposure guideline of one rem per year (WTS 2006). Commercial drivers are subject to OSHA regulations, which limit the whole-body dose to five rem per year (29 CFR 1910.1996[b]), and the USDOT requirement of two millirem per hour in the truck cab (49 CFR 173.411).

c. The number of shipments assumes that all LLW and MLLW generated by SRPPF operations would be transported to NNSS for treatment, storage, and disposal. If LLW and MLLW were transported to the Waste Control Specialists or Energy*Solutions* commercial disposal facilities, impacts would be bounded by transport to NNSS.

d. Unclassified estimate derived from NNSA (2003b). Shipment numbers for pits and HEU are classified.

Table 4-26—Annualized Transportation Impacts—80 Pits Per Year[a]

Material or Waste	Route	Shipments per Year	Incident-Free				Accident	
			Crew Dose (person-rem) [b]	Crew Risk (LCF)	Population Dose (person-rem)	Population Risk (LCF)	Rad Risk (LCF)	Nonrad Risk (traffic fatalities)[c]
Pits	Pantex and SRS	10[d]	0.5	0 (0.0003)	0.7	0 (0.0004)	0 (2×10^{-8})	0 (0.0006)
HEU	Y-12 and SRS	6[d]	0.02	0 (1×10^{-5})	0.1	0 (7×10^{-5})	0 (9×10^{-10})	0 (0.0001)
TRU waste	WIPP and SRS	113	11	0 (0.006)	6	0 (0.003)	0 (3×10^{-7})	0 (0.02)
LLW[c]	SRS and NNSS	71	6	0 (0.03)	2	0 (0.001)	0 (2×10^{-8})	0 (0.01)
MLLW[c]	SRS and NNSS	5	0.5	0 (0.0003)	0.3	0 (0.0002)	0 (1×10^{-9})	0 (0.0009)
Totals	**N/A**	**205**	**18.02**	**0 (0.00961)**	**9.1**	**0 (0.00467)**	**0 (3×10^{-7})**	**0 (0.0316)**

HEU = highly enriched uranium; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; N/A = not applicable; NNSS = Nevada National Security Site; Nonrad = nonradiological; rad = radiological; SRPPF = Savannah River Plutonium Processing Facility; TRU = transuranic.

a. Per-shipment risk factors shown in Table E-5 of the SPD SEIS (NNSA 2015) were used as a basis to obtain incident-free and accident impacts. These data are adjusted to reflect the population in the year 2030 and multiplied by the number of shipments.

b. A DOE employee would also need to comply with DOE regulations at 10 CFR Part 835 ("Occupational Radiation Protection"), which limits worker radiation doses to five rem per year; however, DOE has also established an administrative exposure guideline of two rem per year (DOE-STD-1098-2017). This limit would apply to any non-TRU waste shipment conducted by DOE personnel. Drivers of TRU waste shipments to the WIPP facility have an administrative exposure guideline of one rem per year (WTS 2006). Commercial drivers are subject to OSHA regulations, which limit the whole-body dose to five rem per year (29 CFR 1910.1996[b]), and the USDOT requirement of two millirem per hour in the truck cab (49 CFR 173.411).

c. The number of shipments assumes that all LLW and MLLW generated by SRPPF operations would be transported to NNSS for treatment, storage, and disposal. If LLW and MLLW were transported to the Waste Control Specialists or Energy*Solutions* commercial disposal facilities, impacts would be bounded by transport to NNSS.

d. Unclassified estimate derived from NNSA (2003b). Shipment numbers for pits and HEU are classified.

As shown in Tables 4-25 through 4-27, less than 0.01 LCF to the crew and population along the route would be expected annually from incident-free transport; and essentially zero (3×10^{-7}) LCF to the population would be expected from an accident annually. In addition, with respect to nonradiological impacts, about 0.03 traffic fatality would be expected annually from the transport of radiological materials and wastes. Regarding handling impacts, as shown in Table 4-28, LCFs would also be less than 0.01 annually.

Table 4-27—Transportation Impacts Associated with Transporting Plutonium Materials from Other Locations to SRS[a]

Material or Waste	Route[b]	Number of Shipments[c]	Incident-Free				Accident	
			Crew Dose (person-rem)[d]	Crew Risk (LCF)	Population Dose (person-rem)	Population Risk (LCF)	Rad Risk (LCF)	Nonrad Risk (traffic fatalities)
Pu materials	SRS to LANL	4	0.11	0 (0.00006)	0.2	0 (0.0001)	0 (6×10^{-9})	0 (0.0003)

LANL = Los Alamos National Laboratory; Nonrad = nonradiological; Pu = plutonium; Rad = radiological; SRS = Savannah River Site.

a. Table 5.10-6 of the Complex Transformation SPEIS (NNSA 2008a) was used as a basis to obtain the number of shipments. The number of shipments was multiplied by the per-shipment risk factors in the SPD SEIS (NNSA 2015, Table E-5) after adjustment for population changes to the year 2030.

b. Other DOE sites could include LANL and Pantex. The analysis used LANL. The impacts associated with transporting plutonium materials from LANL would be conservative as compared to the impacts of transporting plutonium materials from Pantex because most of the route from these facilities to SRS is shared; the distance from LANL to SRS is greater than from Pantex to SRS; the population along the route from LANL to SRS is greater than that from Pantex to SRS; the population densities in the rural, suburban, and urban segments along the routes are greater along the LANL to SRS route as compared to the Pantex to SRS route (see NNSA 2015, Table E-1); and the same transport packages and mode of transport (i.e., safe, secure transport system) would be used.

c. The number of shipments is based on Table 5.10-6 of the Complex Transformation SPEIS (NNSA 2008b).

d. A DOE employee would also need to comply with DOE regulations at 10 CFR Part 835 ("Occupational Radiation Protection"), which limits worker radiation doses to five rem per year; however, DOE has also established an administrative exposure guideline of two rem per year (DOE-STD-1098-2017). This limit would apply to any non-TRU waste shipment conducted by DOE personnel. Drivers of TRU waste shipments to the WIPP facility have an administrative exposure guideline of one rem per year (WTS 2006). Commercial drivers are subject to OSHA regulations, which limits the whole-body dose to five rem per year (29 CFR 1910.1996[b]), and the USDOT requirement of two millirem per hour in the truck cab (49 CFR 173.411).

Table 4-28—Annual Estimated Impacts Due to Handling

Total Dose[a] (person-rem)	Total LCF
14.9	0 (0.009)

LCF = latent cancer fatality.

a. Handling dose based on transportation activities associated with production of 80 pits per year.

Source: Derived from NNSA 2008b, Table 5.10-4; based on production of 80 pits per year.

In addition to evaluating the incident-free impacts to the crew and population along the representative route(s), NNSA evaluated the incident-free risks to different MEIs that would be associated with the radiological shipments: an inspector, a person in traffic congestion next to the transport vehicle, a person at a rest stop or gas station, a gas station attendant, and a resident living along the transportation route. An inspector of the conveyance and its cargo would be exposed to a maximum dose rate of 0.019 rem (or 19 millirem) per hour if the inspector stood within approximately three feet of the cargo for the duration of the inspection (NNSA 2015, Table E-11). The maximum dose rate to a person sitting in traffic next to a shipment would be 0.0081 rem (8.1 millirem) per hour (NNSA 2015, Table E-11). This is generally considered a one-time event for that individual, although this individual may encounter another exposure of a similar or longer duration in his or her lifetime. A person at a rest stop or gas station would receive a maximum dose rate of 0.00024 rem (0.24 millirem) per hour per stop, while a gas station attendant would receive a maximum dose of 0.00053 rem (0.53 millirem) per event.

A member of the public residing along the route could receive multiple exposures from passing shipments. The cumulative dose to this person is calculated by assuming all shipments pass the MEI's home. The analysis further assumes that the MEI is present for every shipment and is 98 feet from the route (assumes no dose reduction from shielding from structures). Therefore, the cumulative dose would depend on the number of shipments passing any point and is independent of the actual route being considered. This MEI would receive a maximum dose of 2.6×10^{-7} rem per shipment (NNSA 2015, Table E-11). If SRPPF operations produced 80 pits per year, the MEI could be exposed to a maximum of 205 shipments annually (Table 4-26); therefore, the maximum annual dose to the MEI would be approximately 5×10^{-5} rem (0.05 millirem), which corresponds to an LCF risk of 3×10^{-8}, or essentially zero.

In addition to calculating the risks for a spectrum of accidents as shown in Tables 4-25 through 4-28, NNSA also calculated the maximum reasonably foreseeable impacts to individuals and populations from an accident in an urban or suburban population zone and to a MEI for an accidental release with a likelihood of occurrence greater than 1 in 10 million per year in the SPD SEIS using the computer code RISKIND (NNSA 2015, Table E-12). The methodology is described in Appendix A, Section A.12. Table 4-29 presents those results.

Table 4-29—Potential Impacts for the Maximum Reasonably Foreseeable Accident

Transport Mode	Material With Highest Consequences	Probability of Accident (per year)[a]	Population Zone[b]	Population		MEI[d]	
				Dose (person-rem)[c]	LCF	Dose (rem)	LCF
Safe, secure transport between SRS and Pantex	Pits[e]	1.2×10^{-7}	suburban	90	0 (0.05)	0.07	0 (4×10^{-5})
Truck transport between SRS and WIPP	TRU waste in a TRUPACT II	5.7×10^{-7}	urban	10	0 (0.006)	0.0011	0 (6×10^{-7})
Truck transport between SRS and NNSS	LLW in B-25s	1.7×10^{-6}	suburban	0.017	0 (0.00001)	0.00001	0 (7×10^{-9})

LCF = latent cancer fatality; MEI = maximally exposed individual; SRS = Savannah River Site; STA = secure transportation asset

a. Representative of the frequency of shipments for 80 pits per year.
b. If the likelihood of an accident is equal to or greater than 1 in 10 million per year for both suburban and urban population zones, then the consequences are provided for the urban population zone.
c. Population extends at a uniform density to a radius of 50 miles. The weather condition was assumed to be Pasquill Stability Class D with a wind speed of 8.8 miles per hour. The population dose is based on the 2030 population.
d. The MEI is assumed to be 330 feet downwind from the accident and exposed to the entire plume of the radioactive release. The weather condition is assumed to be Pasquill Stability Class F with a wind speed of 2.2 miles per hour.
e. Maximum reasonably foreseeable accident impacts for pits bound impacts for HEU. (See NNSA 2008a, Table 5.10.3.2, which shows radiological accident impacts for pit transportation to be significantly greater than HEU transportation).

Source: NNSA 2015, Table E-12

The impacts presented in Tables 4-25 through 4-28 could occur off the SRS. Onsite shipment of radioactive materials and wastes at SRS would not affect members of the public because roads between SRS processing areas are closed to the public; therefore, shipments would only affect onsite workers. Shipment of TRU waste, LLW, and MLLW to E Area is currently conducted as part of site operations with no discernible impacts on noninvolved workers. The transport of radioactive materials and wastes under the Proposed Action is not expected to significantly increase the risk to these workers. The risks from incident-free transport of radioactive waste and materials off site over long distances (hundreds to thousands of miles) are very small; therefore, the risks from transporting radioactive waste and materials on site, where distances would be less than five miles, would be even smaller.

For safe, secure transport system shipments, onsite roads would be closed during transport, further limiting the risk of noninvolved worker exposure. All involved workers (i.e., drivers and escorts) would be monitored, and the maximum annual dose to a transportation worker would be administratively limited to two rem (10 CFR Part 835). The potential for a trained radiation worker to develop a fatal latent cancer from the maximum annual exposure is 0.0012 LCF; therefore, an individual transportation worker is not expected to develop a lifetime fatal latent cancer from exposure during these activities. Impacts associated with accidents during onsite transport of radioactive materials and wastes would be less than the impacts assessed for the bounding accident analyses for the plutonium facilities (see Section 4.11) and less than the impacts for offsite transports because of the much shorter distance traveled on site and because of onsite security measures and lower vehicle speeds.

Nonradiological Shipments and Impacts

NNSA would ship hazardous waste off site for treatment, storage, and disposal. About 10 hazardous waste shipments would be made each year under the 50 pits per year scenario, and about 15 hazardous waste shipments would be made each year under the 80 pits per year scenario. The potential risk of a traffic fatality associated with these shipments would be less than 0.006 over the duration of the scenario (NNSA 2015, Table E-14).

SRPPF operations would generate commuter traffic. However, this commuter traffic would represent less than one percent of the total employment in the ROI and would not adversely affect the LOS of local roads. More specifically, the roads in Aiken, Barnwell, and Allendale counties in South Carolina that have the highest levels of traffic would continue to operate at LOS "A," and roads in Augusta-Richmond County, Georgia, would continue to operate at currently designated LOS levels.

Table 4-11 in Section 4.8 shows that the total direct and indirect employment associated with a production rate of 50 and 80 pits per year is 3,151 and 3,4,6,7 workers, respectively. Assuming a round trip of 50 miles, 252 workdays, no carpooling, and an accident fatality rate of 1.8 fatalities per 100,000 million miles per year (averaged over 2015 to 2017) (SCDPS 2019, p. 6), less than one, or about 0.7 fatality per year for 50 pits and 0.8 fatality per year for 125 pits, would occur.

4.12.2 Analyses of Operational Variations and Design Optimizations

Operational Variation #1: 125 Pits Per Year

Table 4-26 shows the potential transportation impacts associated with transporting radiological materials and wastes for production of 80 pits per year. The potential transportation impacts associated with pit production would generally increase linearly based on increased production.

Consequently, the impacts shown in Table 4-26 would be expected to increase by approximately 50 percent for production of 125 pits per year. In that scenario, less than 0.015 LCF to the crew and population along the route would be expected due to incident-free transport, and essentially zero (4.5×10^{-7}) LCF to the population would be expected due to an accident. In addition, with respect to nonradiological impacts, less than 0.045 traffic fatality would be expected due to the transport of radiological materials and wastes. Regarding handling impacts, LCFs would also be less than 0.015. The potential risk of a traffic fatality associated with hazardous waste transportation would be less than 0.006 over the duration of the scenario (NNSA 2015, Table E-14). Regarding increased employment, commuter traffic would continue to represent less than one percent of the total employment in the ROI and would not adversely affect the LOS of local roads as reflected in Chapter 3, Section 3.12.1 of this EIS. About 1.2 fatalities per year would occur to commuters (includes direct and indirect employment).

Operational Variation #2: Wrought Production Process

Most transportation-related impacts from the wrought process would be no different from the impacts under the Proposed Action. As discussed in Section 4.9.2, the wrought process would not change waste types, and changes in waste quantities are expected to be minimal. Given that the amount of waste generated would need to increase by several orders of magnitude to cause an LCF during incident-free transport or a traffic fatality, which is not expected; therefore, no notable changes in transportation impacts would occur. The wrought process would not require a noticeable increase in the workforce; therefore, traffic and accident fatality impacts would not change.

Design Optimization #1: Option to Retain Existing Administration Building

Potential impacts during construction would not appreciably change. While the existing administration building would not be demolished, additional construction would be required for the Protected Area expansion and construction of a retaining wall. As stated in Section 2.1.5.2.1, NNSA does not expect any notable change in the construction parameters for this option. This option would not require a noticeable increase in the construction workforce; therefore, traffic and accident fatality impacts would not change. There would be no change in transportation impacts during operations for this option. Radiological operations would not change, and this option would not require a noticeable increase in the workforce.

Design Optimization #2: Use Sand Filter

Construction and operation of a sand filter would not appreciably change the estimated quantities of wastes. Neither would these activities affect the numbers of radioactive material shipments to or from SRS. Therefore, construction and operation of a sand filter would not affect the potential impacts as presented under the Proposed Action.

Design Optimization #3: Change Gloveboxes and Aqueous Recovery Process

Potential transportation-related impacts from the changes in gloveboxes and aqueous recovery process would be no different from the potential impacts under the Proposed Action since these activities would not appreciably change the estimated quantities of wastes or affect the numbers of radioactive material shipments to or from SRS.

4.12.3 No-Action Alternative

Under the No-Action Alternative, the MFFF would remain unused. Current and planned activities at SRS would continue as required to support various missions. There would be no change in the transportation activities at SRS.

4.13 Design Features, Best Management Practices, and Mitigation Measures

As specified in the CEQ's NEPA regulations (40 CFR 1508.20), mitigation includes:

- Avoiding the impact altogether by not taking a certain action or parts of an action;
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and
- Compensating for the impact by replacing or providing substitute resources or environments.

The Proposed Action has the potential to affect one or more resource areas. If mitigation measures above and beyond those required by regulations are needed to reduce impacts, NNSA is required to describe mitigation commitments in the ROD and prepare a mitigation action plan (10 CFR 1021.331). The mitigation action plan would explain how, before implementing the Proposed Action, certain measures would be planned and implemented to mitigate adverse environmental impacts. Because no potential adverse impacts were identified that would require additional mitigation measures beyond those required by regulation or achieved through design features or BMPs, NNSA does not expect to prepare a mitigation action plan.

A combination of design features and BMPs would be implemented to avoid or reduce potential environmental impacts that could result from implementing the Proposed Action. The SRPPF design includes many features (e.g., HEPA filtration, seismically qualified confinement structures) that would be critical to minimizing potential impacts to worker and public safety. BMPs are policies, practices, and measures that reduce the environmental impacts of proposed activities, functions, or processes.

Table 4-30 provides examples of design features and potential BMPs (discussed in more detail in Sections 4.13.1 through 4.13.12). The first column lists a series of potential design features and BMPs, and the remaining columns identifies those environmental resource areas that could benefit from the potential design features and BMPs. In general, activities associated with the Proposed Action would follow standard practices, such as BMPs for minimizing impacts on environmental resources as required by regulation, permit, or guidelines. For the Proposed Action, NNSA would implement stewardship practices that are protective of the air, water, land, and other natural and cultural resources affected by NNSA operations in accordance with an environmental management system established pursuant to DOE Order 436.1, "Departmental Sustainability," which was prepared to incorporate the requirements of Executive Order 13514, "Federal Leadership in Environmental, Energy, and Economic Performance."

Table 4-30—Design Features and Potential BMPs

Design Feature or BMP	Land Use & Visual	Geology and Soils	Water Resources	Air Quality & Noise	Ecological Resources	Cultural Resources	Infrastructure	Socioeconomics	Environmental Justice	Waste Management	Human Health	Transportation
Potential Design Features or BMPs During Construction												
Use of existing facilities in industrial areas	✓	✓	✓	✓	✓	✓	✓			✓	✓	
Erosion and sediment control plans		✓	✓		✓							
Sequencing or scheduling of work		✓		✓	✓		✓	✓				✓
Spill prevention control and countermeasures		✓	✓		✓						✓	
Use of low-sulfur, more-refined fuels				✓	✓						✓	✓
Dust suppression measures	✓	✓		✓	✓						✓	
HEPA filters, ventilation systems				✓	✓						✓	
Silencers/mufflers, hearing protection programs				✓							✓	
Preconstruction characterization/surveys of site		✓	✓		✓	✓					✓	
Personal protective equipment				✓							✓	
Potential Design Features or BMPs During Operations												
Water conservation practices			✓				✓					
Spill prevention control and countermeasures		✓	✓		✓						✓	
Personal protective equipment				✓							✓	
Confinement and shielding systems				✓							✓	
Ventilation and filter systems			✓	✓	✓						✓	
Emergency preparedness and response plans									✓		✓	✓
Radiological Protection and ALARA Program											✓	
High-efficiency electric equipment/off-peak use							✓					
Pollution prevention and waste minimization							✓			✓	✓	✓
Public outreach and training									✓		✓	
Scheduling, carpooling							✓	✓				✓

ALARA = as low as reasonably achievable; BMP = best management practice; HEPA = high-efficiency particulate air.

4.13.1 Land Use and Visual Resources

Several measures could be considered for minimizing impacts on land use and visual resources, including the following:

- Follow the objectives of the SRS land use plans and permitting requirements.

- Use existing facilities and buildings whenever possible. For example, NNSA would modify the MFFF and support buildings 706-3F and 731-2F, Training Building (706-4F), and Training and Operations Center (226-2F) for reuse.

- Limit land disturbed at SRS to areas already designated for industrial use. For example, NNSA would implement the Proposed Action within the industrial F Area on previously disturbed land.

- Collocate facilities involved with plutonium processing within the proposed Protected Area to reduce land disturbance at SRS.

- Use existing infrastructure and rights of way at SRS.

- Designate an environmental inspector for construction activities to ensure protection of vegetation and adherence to ground disturbance limits.

- Minimize damage to drainage features and other improvements such as ditches, culverts, levees, tiles, and terraces; however, if these features or improvements are inadvertently damaged, they would be repaired and or restored.

- Site access roads and temporary work areas to avoid and/or minimize impacts to existing operations and structures.

- Restore and landscape open areas upon completion of construction-related activities.

- Implement measures (such as rock construction entrances) to minimize the transfer of mud onto primary roads.

The generation of dust during construction and operations activities could be reduced by limiting speed and/or travel routes utilized by equipment. Water, dust palliative, or gravel may be applied to access roads or exposed surfaces to reduce dust.

4.13.2 Geology and Soils

Facility construction or modification may disturb soil, although new disturbances are expected to be minimal since the Proposed Action would be implemented on previously developed land. At all areas on the SRS where construction or facility modifications would occur, adherence to BMPs for soil erosion and sediment control during land-disturbing activities would minimize soil erosion and loss. In general, limiting the amount of time soils are exposed, limiting the area disturbed during any phase of a construction project, and applying protective coverings to denuded areas during construction (e.g., mulching and/or geotextiles) until such time as disturbed areas could be revegetated or otherwise covered by facilities would reduce the potential for soil loss. Soil loss would be further reduced by the use of appropriate sedimentation and erosion control measures as weather conditions dictate. Stockpiles of soil removed during construction would be covered with a geotextile or temporary vegetative covering and enclosed by a silt fence to prevent loss by erosion.

Contaminated soils and possibly other media could be encountered during excavation and other site activities. Prior to commencing any new ground disturbance, NNSA would survey potentially affected areas to determine the extent and nature of any contaminated media and required remediation in accordance with the procedures established under SRS's environmental restoration program. Any contaminated soils and media would be managed in accordance with existing waste management practices.

4.13.3 Water Resources

There would be no direct discharge of effluents to surface waters or groundwater during construction or operations; therefore, the Proposed Action would not result in appreciable direct impacts on water quality. Potential impacts from stormwater discharges during construction and operations would be minimized by compliance with two existing SRS NPDES permits: (1) the General Permit for Stormwater Discharges from Construction Activities and (2) the Industrial Stormwater General Permit. These permits and related regulations have required SRS to prepare and implement plans to control or eliminate discharge of pollutants, including hazardous and toxic substances, sediment, and contaminated storm water. These plans include a best management plan, an SPCC plan, and an SWPPP. These plans, particularly the SPCC plan, also protect surface waters from spills of hazardous materials in instances where hazardous materials are being handled.

During construction, these plans would address the presence of heavy equipment and staged fuel storage containers, as applicable, and would require actions, such as putting temporary storage containers within secondary containment and identifying the types and locations of equipment available to respond to (i.e., contain and cleanup) spills or leaks of potential pollutants. These efforts to protect surface water from spills and leaks also act to protect groundwater from pollutants infiltrating from the surface.

Groundwater use for facility construction and operations would be well within available SRS capacity; surface water use, if any, would be minor. No mitigation would be required to reduce potential impacts from water use, but existing sitewide efforts to identify and implement water conservation opportunities would be pursued in the new operations.

4.13.4 Air Quality and Noise

Construction or modification of facilities under the Proposed Action would result in some emissions of criteria and hazardous air pollutants, of which particulate matter would be a primary concern. Construction equipment criteria pollutant emissions would be minimized by using specific fuels (e.g., low-sulfur diesel fuel, alternative ethanol-containing fuel) and by maintaining equipment to ensure that emissions control systems and other components are functioning at peak efficiency. Soils exposed in excavations and slope cuts during new facility construction would be subject to wind or rain erosion if left exposed. In addition, fugitive dust emissions would result from land disturbed by heavy equipment and motor vehicles. Construction emissions would be minimized using water to control dust emissions from exposed areas, revegetation of exposed areas, watering of roadways, and minimizing construction activities under dry or windy conditions. No open burning would be conducted.

Facility operations would result in air emissions of various criteria and non-criteria air pollutants, including radionuclides, and organic and inorganic constituents. These emissions would be controlled using best available control technologies to ensure that emissions are compliant with applicable standards. Impacts would be minimized by use of glovebox confinement and air filtration systems (e.g., double HEPA filters or possibly a sand filter) to remove radioactive particulates before discharging process exhaust air to the atmosphere.

Construction and operations workers could be exposed to noise levels higher than acceptable limits, particularly for confined areas, as specified in OSHA noise regulations. DOE has implemented hearing protection programs that meet or exceed OSHA standards to minimize noise impacts on workers. These include the use of standard silencing packages on construction equipment, sequencing and scheduling work shifts, administrative controls, engineering controls, and personal hearing protection. Noise impacts on the public would be minimized by sound attenuation due to the distance of facilities from SRS boundaries (approximately six miles). Noise impacts on ecological resources would be minimized by sound attenuation (i.e., the facilities are located away from ecologically sensitive areas). There would be some temporary, additional noise during construction due to additional worker traffic. Operations would not increase noise levels over existing activities, although there could be some additional noise due to additional worker traffic to support additional activities.

4.13.5 Ecological Resources

Ecological impacts during SRPPF complex construction would be minimized by using previously disturbed land within F Area. The proposed sites for construction of new facilities are in previously disturbed or developed areas. The new facility construction would not be located near ecologically sensitive areas with threatened or endangered species. The smooth purple coneflower plants established in the conservation garden near the existing MFFF administration building would be salvaged prior to demolition of that building and transplanted to another location to be determined by SREL staff. If active nests of migratory birds are found in construction sites, nests would be protected in accordance with SRS environmental procedures until young are fledged or the nests are abandoned.

Implementation of soil erosion and sediment control and SWPPPs would prevent runoff and dust from entering sensitive habitats and nearby streams or wetlands. Construction activities would avoid disturbing nearby streams and wetlands. Construction crews would also receive environmental briefings, as appropriate, on environmental compliance issues, including ecological resource concerns. Following construction, the cleared and graded areas not covered with facilities, parking lots, or roads would be landscaped except for areas required to remain clear for security or fire prevention purposes.

During operations, SWPPPs and wastewater treatment would minimize potential impacts to aquatic resources from stormwater runoff and effluent discharges. The Radiological Protection and ALARA Program designed to protect human health would also minimize or eliminate potential radiological impacts to ecological resources.

4.13.6 Cultural and Paleontological Resources

As described in Section 4.6, SRARP staff members monitored five eligible archaeological sites located in the vicinity of the MFFF construction site during MFFF ground-disturbing activities in accordance with the PMOA (NRC 2005a, pp. 3-38–3-39; NNSA 2015, p. 3-34). If further ground-disturbing activities took place in the vicinity of these sites, similar monitoring would occur in accordance with the PMOA. If a site could not be avoided, a data recovery plan for impact mitigation would be developed for South Carolina SHPO approval. BMPs would be used during construction to control drainage and erosion patterns, thereby limiting the potential for erosion impacts to archaeological resources in the vicinity. In the unlikely event of an unanticipated discovery of archaeological materials, such discovery would be evaluated, as necessary, in accordance with the PMOA and the associated archaeological resources management plan (SRARP 2013).

4.13.7 Infrastructure

Construction activities associated with the Proposed Action would occur in areas with existing utility infrastructure. The consumption of energy, fuel, and water resources would be within the capabilities of the existing infrastructure. Impacts on the regional electrical grid would be minimized by incorporating high-efficiency motors, pumps, lights, and other energy-saving equipment into the design of new facilities, and by scheduling some operations during off-peak times. Impacts on water use would be minimized by using water-conserving processes and equipment. Impacts on fuel use would be reduced by using fuel-efficient processes, equipment, and vehicles (e.g., hybrids). Pursuant to DOE Order 436.1 and Executive Order 13514, DOE has established goals for energy efficiency and water conservation improvements at DOE sites, including reductions in energy and potable water consumption, use of advanced electric metering systems, use of sustainable building materials and practices, and use of innovative renewable and clean energy sources (DOE 2016e). Working to implement these goals by incorporation of Leadership in Energy and Environmental Design principles would further reduce impacts on site infrastructure.

4.13.8 Socioeconomics and Environmental Justice

Impacts related to population changes, availability of housing, and community services during the life of the project are expected to be small. Payroll and materials expenditures would have a positive impact on the local economies. During construction, NNSA could consider sequencing or scheduling work to more evenly distribute the number of personnel. This measure could reduce potential impacts on population, housing, and community services.

No mitigation measures specific to environmental justice would be necessary because the Proposed Action would not result in disproportionately high and adverse impacts on minority or low-income populations. However, measures that would minimize impacts to human health, as well as emergency preparedness and response plans and public outreach and training, would help ensure adverse impacts related to environmental justice would not occur.

4.13.9 Waste Management

NNSA would manage wastes generated during the Proposed Action in a manner consistent with existing practices. That is, each waste type would be managed through facilities and processes that have the appropriate operational permits and are in compliance with applicable waste management regulations.

Section 4.9 of this EIS identifies the amounts of TRU waste and LLW that would be generated during operations. These projected volumes are higher than the amounts currently generated at SRS. Although no mitigation would be required to achieve acceptable environmental impacts in the management of these wastes, waste minimization efforts could potentially make waste management simpler and even conserve resources. Waste minimization would be pursued during operations as part of the goals and objectives of the ongoing SRS Site Sustainability Plan and the overriding SRS Environmental Management System (SRNS 2018a, Secs. 2.1 and 2.2).

4.13.10 Human Health

During normal operations, construction would occur in nonradiological areas and doses to workers would be essentially zero. Although contaminated soils are not expected, NNSA would prevent potential exposure from excavation activities by sampling the soil for radioactive contamination before excavation begins. If contaminated soil is discovered, appropriate techniques would be applied to remediate the conditions and ensure worker safety.

Several features are expected to be incorporated into the design of the SRPPF to minimize radiation exposures to workers and the public. These include, but are not limited to, confinement (e.g., gloveboxes), shielding, ventilation, and air filtration systems. BMPs to ensure radiation protection would include formal analysis by workers, supervisors, and radiation protection personnel of methods to reduce exposure of workers to the lowest practicable level. For all activities involving radiation work, NNSA would employ ALARA measures, such as minimizing time spent in high-radiation areas, maximizing distances from sources of radiation, using shielding, and/or reducing the radiation source. The radiological limit for an individual worker is 5,000 millirem per year; as part of the SRS Radiological Protection and ALARA Program, however, the maximum dose to a worker involved in operations would be kept below the DOE administrative control level of 2,000 millirem per year (10 CFR Part 835).

SRS adheres to programs used to ensure minimization of human health and safety impacts to the maximum extent practicable. The Radiological Protection and ALARA Program ensures that radiological exposures and doses to all personnel are maintained to ALARA levels and by providing job-specific instructions in job hazard analyses to the facility workers regarding the use of personal protective equipment. The Emergency Preparedness Program minimizes accident consequences by ensuring that appropriate organizations (e.g., fire department, operations, medical, and security) are available to respond to emergency situations and take appropriate actions to recover from anticipated events while reducing the spread of contamination and protecting facility personnel and the public.

Occupational safety risks to workers would be minimized by adherence to Federal and State laws; OSHA regulations; DOE requirements, including regulations and orders; and plans and procedures for performing work. DOE regulations addressing worker health and safety include 10 CFR Part 851, "Worker Safety and Health Program," and 10 CFR Part 850, "Chronic Beryllium Disease Prevention Program." Workers are protected from specific hazards by training, monitoring, use of personal protective equipment, and administrative controls (i.e., job hazard analyses).

4.13.11 Facility Accidents

Appendix B, Section B.3.3.2, discusses mitigation measures related to accidents.

4.13.12 Transportation

Measures that could be used to minimize transportation impacts include transporting materials and wastes during periods of light traffic volume, providing vehicle escorts, avoiding high-population areas, avoiding high-accident areas, and training drivers and emergency response personnel. As described in Chapter 3, Section 3.12.4, the Department of Homeland Security is responsible for coordinating the response to accidents involving radioactive materials and waste, with DOE maintaining many of the resources that would be used if such an event were to occur. In addition, to reduce the possibility of an accident, DOE issued DOE Manual 460.2-1A, which establishes a set of standard transportation practices for the DOE, including the NNSA, to use in planning and executing offsite shipments of radioactive materials and wastes. BMPs related to minimizing commuter traffic fatalities include encouraging carpooling and promoting safe driving practices among the workforce.

4.14 DECONTAMINATION AND DECOMMISSIONING

Eventually, the facilities associated with the Proposed Action would be subject to D&D. If NNSA decides to conduct pit production operations at the proposed SRPPF, the SRPPF complex would undergo D&D at the project's end of life. If NNSA decides to not repurpose the MFFF, the MFFF would someday undergo D&D.[28] For the Proposed Action, the primary D&D goal would be to decontaminate any facility to the extent that its residual radioactivity would be at an acceptable level. The facility decontamination would be conducted in accordance with all applicable regulations and requirements and in a manner that would minimize potential impacts to the health and safety of workers, the general public, and the environment.

Prior to the initiation of D&D activities, the facility operator would prepare a detailed D&D plan for NNSA approval. The D&D plan would contain a detailed description of the site-specific D&D activities to be performed and would be sufficient to allow an independent reviewer to assess the appropriateness of the decommissioning activities; the potential impacts on the health and safety of workers, the public, and the environment; and the adequacy of the actions to protect health and safety and the environment. All buildings and systems would require regulatory planning, document preparation, and characterization and deactivation before any D&D activities would be allowed to commence. Facilities would be characterized to identify waste types (e.g., radiological and chemical waste), construction material types (e.g., steel, roofing, concrete), presence of equipment, levels of contamination, expected waste volumes, and other information that would be

[28] Under the No-Action Alternative, only decommissioning would be required for the MFFF; decontamination would not be necessary because no radiological operations have been conducted in that facility and there is no contamination. If another purpose was identified in the future for the MFFF, a separate NEPA review would be conducted.

used to support safe demolition and clarify requirements for developing facility-specific plans. Active systems (e.g., electric, water, telecommunications) would be identified and deactivated, as appropriate. Adaptive reuse of such infrastructure would be considered, and recyclable materials would be sorted and managed separately, to the extent practicable.

Because the Proposed Action in this EIS involves radiological materials, there is a potential for residual contamination, in the following areas:

- Surface contamination in and on building structures, such as equipment (e.g., gloveboxes), walls, ceilings, roof, floors, sinks, laboratory hoods, and air ventilation ducts;
- Solid and liquid contaminated waste from normal operations and off-normal and accident events; and
- Land contamination from normal and off-normal operations and accident events.

The extent and amount of D&D associated with the Proposed Action cannot be estimated without a detailed assessment of the facilities, which would not be conducted until the SRPPF end-of-life is reached. However, this EIS acknowledges that the Proposed Action could involve D&D of approximately 400,000 square feet, which would account for the HC-2 space within the proposed SRPPF. Any LLW would be disposed of at SRS, NNSS, or other appropriate permitted disposal facility, while nonradioactive waste would likely be disposed of at landfills in the SRS area.

Although D&D activities would generate nonradiological air emissions, there is a potential for radiological air emissions to occur. The intermittent nature of D&D emission sources would result in dispersed concentrations of air pollutants adjacent to D&D activities. The substantial transport distance of D&D emissions from F Area to the SRS boundary (at least six miles) would result in farther dispersion and minimal concentrations of air pollutants at the SRS boundary. Ambient air concentrations at SRS are in compliance with the applicable standards or guidelines, as shown in Chapter 3, Table 3-5. As a result, air pollutant concentrations generated from D&D activities are expected to remain below the applicable NAAQS.

Potential impacts to ecological resources during D&D operations could occur from changes in land use and human disturbance and noise. However, given the minimal ecological resources at F Area, impacts would not be notable. Infrastructure demands associated with D&D are expected to be less than construction demands, and the SRS infrastructure has adequate supply to meet demand.

D&D activities would also cause health and safety impacts to workers (occupational and radiological), as well as potential health impacts to the public through the release of radiological materials. D&D planning would implement ALARA objectives and follow radiological protection guidelines to ensure that radiation doses to employees are kept below administrative guidelines and that airborne releases, which could impact the public, are kept to *de minimis* levels. Lessons learned from D&D at other DOE sites would be applied to minimize impacts to workers and the public. Experience with other D&D operations has shown that while occupational impacts to workers are expected, best management practices can reduce impacts. For example, at the Rocky Flats Plant, occupational impacts during D&D were considerably less than impacts in the construction industry as a whole. At the Rocky Flats Plant, the 12-month total recordable cases rolling average was 0.9 per 100 full-time workers. By comparison, the total recordable cases rolling average in the construction industry for calendar year 2004 was 6.4 per 100 full-time workers (GAO 2006).

While D&D activities would also produce socioeconomic impacts, it would be speculative to quantify the number of jobs that would be created; however, D&D activities at other DOE sites, such as the East Tennessee Technology Park in Oak Ridge, Tennessee, and the Rocky Flats Plant, have created a significant number of temporary jobs relative to the number of operational jobs that were lost when a facility ceased operations.

It is expected that most surface contamination would be easily removed and reduced to acceptable levels. Any wastes from such decontamination would likely be categorized as LLW, in accordance with the *Low-Level Radioactive Waste Policy Act Amendments Act of 1985* (42 U.S.C. § 2021b), since the wastes would not be HLW, SNF, or byproduct material as defined by the *Atomic Energy Act of 1954* (NNSA 2008a). These wastes (e.g., clothing, gloves, equipment, rags, paper, filters, and plastic) would likely be disposed of on the SRS. There would also likely be TRU wastes, which would be sent to the WIPP facility for disposal. Under the No-Action Alternative, there would be no contamination and no radiological wastes at SRS.

Of the five operational variations/design optimizations considered for the SRPPF, only the sand filter system (Design Optimization #2) would notably change the D&D impacts discussed above. As discussed in Section 2.1.5.2.2, the sand filter system would likely be left in place at the project's end of life, possibly be grouted in place for decommissioning. However, given that decommissioning would not occur for approximately 50 years after SRPPF began operations, NNSA acknowledges that new technologies or standards could change that assumption/approach. If the sand filter system were grouted in place, NNSA would develop a performance assessment to (1) demonstrate achievement of long-term performance objectives and comply with applicable regulatory criteria, (2) protect worker and public health and safety, and (3) minimize potential impacts to the environment. Such a performance assessment could require implementation of measures to monitor, detect, and prevent contaminants from being released from the grouted sand filter system. Ultimate management of the sand filter would be part of the detailed D&D plan, described above, that would be prepared at the project's end of life.

4.15 Unavoidable Adverse Impacts

This EIS has identified potential adverse impacts that could occur under the Proposed Action and measures that could be taken to minimize or avoid these impacts. The residual adverse impacts of actions remaining after design features and BMPs are credited, if any, are considered to be unavoidable. In accordance with NEPA requirements (40 CFR 1502.16), this section discusses any potential unavoidable adverse impacts that could occur if the Proposed Action were implemented.

Construction activities associated with the Proposed Action would re-disturb approximately 48 acres of previously disturbed land. This land requirement represents less than one percent of the total 198,344-acre SRS. Although construction activities would change the existing land use, the proposed SRPPF would be compatible and consistent with the land use plans at SRS and would be compatible with the current land use designations.

The site for the proposed SRPPF complex is located in a highly developed and previously disturbed industrial area; therefore, there would be no loss of habitat or impacts to biological, cultural, or archaeological resources. Construction impacts would be minor, and appropriate soil and erosion mitigation measures would minimize any adverse impacts. No Federal- or State-threatened or endangered species and other species of special interest are expected to be impacted by the Proposed Action.

For both construction and operations, the use of water, fuel, and electricity is considered unavoidable. During construction and operations, groundwater use would be approximately 2.2 percent and 1.7 percent, respectively, of the total current water use at SRS. As reported in Section 4.7.1.1, fuel capacity would generally not be limited, as delivery frequency would be increased to meet demand. The maximum amount of electrical consumption would represent less than four percent of the SRS sitewide electrical capacity.

Although there would be overall positive socioeconomic impacts associated with construction and operational workforces, an increase in vehicle traffic could affect the roads and transportation network surrounding SRS. Even though the employment increases would represent less than one percent of the total employment in the socioeconomic ROI, the resulting impacts on traffic and congestion resulting from socioeconomic growth, although minor, would be unavoidable.

During normal operations, a minimal amount of radioactive material and activation products could be released to the environment. However, any radiation dose received by a member of the public from emissions would be small and well below regulatory limits. The collective dose to the 50-mile population is estimated to be from 3.3×10^{-5} to 5.2×10^{-5} person-rem per year, which translates into an LCF risk of essentially zero (i.e., 1.9×10^{-8} to 3.1×10^{-8}). During normal operation, workers would be exposed to an increased risk of cancer as a result of occupational exposure to radiation. The collective dose to radiological workers is estimated to be from 178 to 200 person-rem per year, which translates into an LCF risk of essentially zero (i.e., 0.11 to 0.12).

Operation of the proposed SRPPF would generate a variety of wastes (including radioactive, hazardous, mixed, and sanitary) as an unavoidable result of normal operations. Although SRS uses pollution prevention and waste avoidance measures, generation of chemical and radioactive wastes would be unavoidable. SRS would continue to further reduce hazards and potential exposures through the continued success of pollution prevention and waste avoidance measures.

For production of 50 pits per year, there would be approximately 145 annual shipments of radiological materials and wastes, which could impact the public along transportation routes. The total population dose is estimated at 6.68 person-rem per year, which translates into an LCF risk of essentially zero (i.e., 0.003). Potential worker dose associated with transportation would be approximately 11.6 person-rem per year, which also translates into an LCF risk of essentially zero (i.e., 0.007).

4.16 RELATIONSHIP BETWEEN SHORT-TERM USES AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Sections 4.1 through 4.12 of this EIS discuss potential impacts that could occur under the Proposed Action, and Chapter 5 identifies cumulative impacts that could occur from the Proposed Action and ongoing and reasonably foreseeable actions. NNSA reviewed these potential impacts and determined that land use, ecological resources, water resources, air quality, and waste management warranted discussion regarding short-term uses of the environment and the maintenance and enhancement of long-term productivity. In accordance with NEPA requirements (40 CFR 1502.16), this section discusses the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

Land Use and Ecological Resources. Construction of the SRPPF would re-disturb approximately 48 acres of previously disturbed land within the existing industrial landscapes of F Area. Once construction is complete, pit production activities would not adversely affect the long-term productivity of the land because the proposed SRPPF operations would be compatible with historic nuclear weapons support at SRS. Losses of terrestrial habitat to accommodate the proposed SRPPF are not expected due to the industrialized nature of the proposed SRPPF site, and short-term disturbances of previously disturbed land is not expected to cause long-term reductions in the biological productivity of the SRS area as a whole. After the operational life of the proposed SRPPF, NNSA would perform D&D of the facilities (see Section 4.14) in accordance with applicable regulatory requirements and then close in place or restore the areas occupied by the facilities to brownfield sites that would be available for other industrial use. Appropriate reviews under CERLCA and/or NEPA would be conducted before initiation of D&D actions. In all likelihood, the site for the proposed SRPPF would be restored to a natural terrestrial habitat.

Water Resources. Groundwater would be used to meet process and sanitary wastewater needs over the short term (during construction and operations). After use and treatment, this water would be released through permitted outfalls into surface water streams; eventually recharging the groundwater or entering the Savannah River. The withdrawal, use, and treatment of water are not likely to affect the long-term productivity of water resources.

Air Resources. Air emissions associated with construction and operation of the proposed SRPPF would add small amounts of radiological and nonradiological constituents to the SRS regional air environment. During the short term, these emissions are not expected to affect SRS compliance with radiation exposure or air quality standards. Under the Proposed Action, the estimated total combined greenhouse gas emissions would be approximately 0.00045 percent of the total U.S. greenhouse gas emissions (6.457 billion metric tons of carbon dioxide equivalent in 2017) (EPA 2019b). No significant residual environmental effects on long-term environmental productivity are expected.

Wastes. The management and disposal of LLW and solid wastes would require energy and space at treatment, storage, or disposal facilities at SRS and regional landfills. Land used for LLW and solid waste disposal would require a long-term commitment of terrestrial resources. The short-term use of these facilities to support pit production activities is not expected to change their planned closure dates, and therefore, should not result in an incremental change in the potential long-term productivity of these sites. Similarly, disposal of TRU waste at the WIPP facility would require the continued long-term commitment of that site to support national defense missions.

4.17 IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

A commitment of resources is irreversible when its primary or secondary impacts limit the future options for a resource. For example, as a landfill receives waste, the primary impact is a limit on waste capacity. The secondary impact is a limit on future land use options. An irretrievable commitment refers to the use or consumption of a resource that is neither renewable nor recoverable for use by future generations. NNSA reviewed the impacts in Chapters 4 and 5 of this EIS and determined that land, energy, material, and water have the potential to be committed irreversibly or irretrievably under the Proposed Action. In accordance with NEPA requirements (40 CFR 1502.16), this section discusses any potential irreversible or irretrievable commitments of resources under the Proposed Action.

Land. The land requirements in support of the Proposed Action would be minimal in relation to the existing land at SRS and would represent an irreversible commitment of the land. Construction of the SRPPF would re-disturb approximately 48 acres of previously disturbed land within the existing industrial landscapes of F Area. The areas identified for the Proposed Action were previously committed to the MFFF project, whose mission was not dissimilar to the current proposed land commitment. Once the SRPPF is operational, the land would not be available for other uses. Once the project reaches its end of life, it is possible that the land would not be restored to its original condition or even to minimum cleanup standards. This land could be permanently unusable because the substrata would not be available for other potential intrusive uses such as mining, utility infrastructure, or foundations for other buildings. However, the surface area appearance and biological habitat lost during construction and operation of the SRPPF could, to a large extent, be restored to pre-disturbed conditions.

Energy. The irretrievable commitment of resources during construction and operation of the proposed SRPPF would include the consumption of fossil fuels used to generate heat and electricity. Energy would also be expended in the form of diesel fuel, gasoline, and oil for construction equipment and transportation vehicles. The amounts of irretrievable energy required to construct and operate the proposed SRPPF are estimated in Section 4.7 of this EIS. In general, the irretrievable energy amounts would represent a fraction of the SRS sitewide capacity and current uses.

Materials. The irreversible and irretrievable commitment of material resources during the life of the proposed SRPPF includes construction materials that cannot be recovered or recycled, materials that are rendered radioactive and cannot be decontaminated, and materials consumed or reduced to unrecoverable forms of waste. Materials used during construction would include wood, concrete, sand, gravel, plastics, steel, aluminum, and other metals. At this time, no unique construction material requirements have been identified—whether type or quantity. The construction resources, except for those that can be recovered and recycled with present technology, would be irretrievably lost. However, none of these identified construction resources is in short supply and all are readily available in the vicinity of SRS. The materials to be manufactured into new equipment that could not be recycled at the end of the project's useful life are considered irretrievable. While irretrievable, consumption of operating supplies, miscellaneous chemicals, and gases would not constitute a permanent drain on local sources or involve any material in critically short supply in the United States as a whole. Plans to recover and recycle as much of useful materials as practical would depend upon need. Each item would be considered individually at the time a recovery decision is required.

Water. Water is a scarce resource in many parts of the United States and must not be taken for granted. During construction and operations, groundwater use for the proposed SRPPF would be approximately 2.2 percent and 1.7 percent, respectively, of the total current water use at SRS. There would be minimal impacts on surface water and groundwater resources. Nonhazardous facility wastewater, stormwater runoff, and other industrial waste streams would be managed and disposed of in compliance with the NPDES permit limits and requirements. There would be no direct release of contaminated effluents to groundwater or surface waters. To the extent water is recoverable, it has been designed into the facility planning process.

4.18 Regulations and Permits

Activities at the proposed SRPPF must be performed in a manner that ensures the protection of public health, safety, and the environment through compliance with all applicable Federal, State, and local laws, regulations, and other requirements. This chapter identifies the statutory requirements and environmental standards that are applicable to the plutonium production activities addressed in this EIS. These requirements and standards originate from several sources. Federal and State statutes define broad environmental and safety programs and provide authorization to agencies to carry out the mandated programs. More specific requirements are established through regulations at both the Federal and State level. Federal agencies, such as DOE/NNSA, receive additional direction in complying with executive policy through Executive Orders. In addition, DOE/NNSA has established regulations and management directives (DOE orders) that are applicable to DOE/NNSA activities, facilities, and contractors. Regulations often include requirements for permits and consultations, which provide an in-depth, facility-specific review of the activities proposed. Laws, regulations, Executive Orders, and DOE orders are described in Section 4.18.1. Other regulatory activities and environmental permits are described in Sections 4.18.2 and 4.18.3, respectively.

4.18.1 Laws, Regulations, Executive Orders, and DOE Orders

Multiple Federal agencies regulate specific aspects of activities that would be conducted at the proposed SRPPF. The EPA regulates air emissions, hazardous waste management, water quality, and emergency management. In many cases, the EPA delegated all or part of its environmental protection authorities to states, including South Carolina, but retains oversight authority. In this delegated role, SCDHEC regulates air emissions, discharges to surface water and groundwater, drinking water quality, and hazardous and nonhazardous waste treatment, storage, and disposal.

DOE/NNSA imposes its own standards on many aspects of activities that would be conducted at the proposed SRPPF through regulations, orders, and contract requirements related to facility design and operations, radioactive waste management, and health and safety, including radiation protection. USDOT regulates commercial transportation of hazardous and radioactive materials.

As described in Section 2.1.1 of this EIS, the Proposed Action would not involve disturbance of previously undisturbed land at SRS. In addition, resources addressed by statutory requirements and environmental standards may not exist at SRS or would not be affected by the Proposed Action.

Table 4-31 lists environmental laws, regulations, and other requirements, including but not limited to those mentioned below, that are potentially applicable to the Proposed Action.

Table 4-31—Environmental Laws, Regulations, Executive Orders, and DOE Orders

Law, Regulation, Executive Order, DOE Order	Description
Environmental Quality	
National Environmental Policy Act of 1969 42 U.S.C. § 4321 et seq.	Establishes a national policy for environmental protection and directs all Federal agencies to use a systematic, interdisciplinary approach to incorporating environmental values into decision making.
Council on Environmental Quality, “Regulations for Implementing NEPA” 40 CFR Parts 1500–1508	Defines actions that Federal agencies must take to comply with NEPA, including the development of environmental impact statements.
DOE “National Environmental Policy Act Implementing Procedures” (2011) 10 CFR Part 1021	Procedure for implementing the procedural provisions of NEPA.
Executive Order 11514, “Protection and Enhancement of Environmental Quality” (03/05/1970)	Requires Federal agencies to direct their policies, plans, and programs to meet national environmental goals established by NEPA.
Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations” (02/11/1994)	Requires each Federal agency to identify and address any disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.
Executive Order 13045, “Protection of Children from Environmental Health Risks and Safety Risks” (04/21/1997)	Requires each Federal agency to identify and assess any environmental health risks and safety risks that may disproportionately affect children and ensure that its policies, programs, activities, and standards address these disproportionate risks.
Executive Order 13834, “Efficient Federal Operations” (05/17/2018)	Focuses on meeting statutory requirements to improve efficiency, optimize performance, eliminate unnecessary use of resources, and protect the environment.
DOE Order 231.1B, “Environment, Safety, and Health Reporting” (06/27/2011 Change 1, 11/28/2012)	Defines requirements to ensure timely collection, reporting, analysis, and dissemination of information about environment, safety, and health issues as required by law or regulations or as needed by DOE.
DOE Order 436.1, “Departmental Sustainability” (05/02/2011)	Defines requirements and responsibilities for managing sustainability within DOE.

Law, Regulation, Executive Order, DOE Order	Description
DOE Policy 450.4A, "Integrated Safety Management Policy" (04/25/2011); Change 1, 01/18/2018	Sets forth the framework for identifying, implementing, and complying with environmental safety and health requirements so that work is performed in the DOE Complex in a manner that ensures adequate protection of workers, the public, and the environment.
DOE Policy 451.1, "National Environmental Policy Act Compliance Program" (12/21/2017)	Establishes DOE's expectations for implementing the NEPA, the CEQ Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500–1508), and the DOE NEPA Implementing Procedures (10 CFR Part 1021).
Environmental Audit Privilege and Voluntary Disclosure SC Code §48- 57-10, et seq. 90	Promotes voluntary internal environmental audits of compliance programs in South Carolina.
Air Quality and Noise	
Clean Air Act of 1970, as amended 42 U.S.C. § 7401 et seq. 40 CFR Part 61, Subpart H	Protects and enhances the nation's air quality. Requires Federal agencies to comply with air quality regulations. EPA has delegated authority for most Clean Air Act provisions to SCDHEC for activities in South Carolina, which would issue permits or modify permits as needed for the proposed SRPPF activities. Subpart H indicates the dose standard for DOE radionuclide air emissions.
Title V Operating Permit Programs 40 CFR Part 70 SC Regulation 61-62.70	Governs the permitting programs for most large sources of air pollution. They define the minimum permit requirements, including air pollution control, reporting, monitoring, and compliance certification requirements.
Ambient Air Quality Standards/State Implementation Plans 40 CFR Parts 51 and 58 SC Regulation 61-62.5, Standard 2	Includes standards that are divided into primary and secondary categories for the following pollutants: carbon monoxide, lead, nitrogen dioxide, ozone, sulfur dioxide, and particulate matter.
New Source Performance Standards 40 CFR Part 60 SC Regulation 61-62.60	Stipulates Federal and South Carolina industry- and process-specific standards that may apply to any new, modified, or reconstructed sources of air pollution.
Control of Emissions from New and In-use Highway Vehicles and Engines 40 CFR Part 86	Includes emissions standards and testing and maintenance requirements for highway vehicles, including heavy-duty vehicles (trucks).
National Emission Standards for Hazardous Air Pollutants and for Source Categories 40 CFR Parts 61 and 63 SC Regulation 61-62.61 and 62.63	Provides standards for air emissions, including hazardous air pollutants, such as radionuclides, benzene, dioxins, mercury, and asbestos. Maximum achievable control technologies are identified by industry or process.

Law, Regulation, Executive Order, DOE Order	Description
Prevention of Significant Deterioration 40 CFR 51.166 SC Regulation 61-62.5, Standard 7	Establishes the program designed to maintain air quality in areas already in compliance with ambient air quality standards (attainment areas). They require comprehensive preconstruction review and the application of best available control technology to major stationary sources.
South Carolina Pollution Control Act (1972) SC Code §48-1-10 et seq. SC Regulation 61-62	Defines regulatory authority for air quality permitting and regulation. Pertains to activities at SRS that are permitted by the State.
Noise Control Act of 1972 42 U.S.C. § 4901 et seq. as amended by the Quiet Communities Act of 1978	Protects the health and safety of the public from excessive noise levels. Requires Federal agencies to comply with Federal, State, and local noise abatement requirements.
Water Resources	
Federal Water Pollution Control Act (Clean Water Act) 33 U.S.C. § 1251 et seq.	Protects water quality and regulates the chemical, physical, and biological integrity of navigable waters by prohibiting the discharge of toxic pollutants in significant amounts. Requires that Federal agencies comply with Federal, State, and local water quality requirements. EPA has delegated primary enforcement authority for the Clean Water Act to SCDHEC.
National Pollutant Discharge Elimination System 40 CFR Part 122 SC Regulation 61-9.122	Provides regulations that define the permitting requirements for point-source discharges of pollutants to waters of the United States. Permits establish effluent limits to ensure that water quality standards are met.
Energy Independence and Security Act of 2007, Section 438 42 U.S.C. § 17094	Requires the sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet to use strategies to maintain or restore the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow.
State Water Quality Certification SC Regulation 61-101	Provides an opportunity for a State to review and certify a Federal permit or license for activities that result in discharges to navigable waters.
South Carolina Pollution Control Act SC Code § 48-1-10 et seq.	Establishes a wide-ranging water protection program, including some provisions not addressed by the Clean Water Act (for example, permit requirements for construction of wastewater treatment plants).
Safe Drinking Water Act 42 U.S.C. § 300f et seq.	Ensures the quality of drinking water in public water systems. EPA has delegated primary enforcement authority to SCDHEC.

Law, Regulation, Executive Order, DOE Order	Description
South Carolina Safe Drinking Water Act SC Code § 44-55-10 et seq.	Governs the South Carolina program regulating public water systems.
Primary Drinking Water Standards 40 CFR Part 141 SC Regulation 61-58	Define the standards for maximum contaminant levels for pollutants in drinking water. Also are used as groundwater protection standards.
Oil Pollution Prevention 40 CFR Part 112	Defines the Federal program that prevents the discharge of oil into navigable waters. Facility owner/operator is required to prepare a Spill Prevention, Control, and Countermeasure Plan.
South Carolina Groundwater Use and Reporting Act of 2000 SC Code § 49-5-10 to § 49-5-150	Establishes State standards to restrict groundwater use.
South Carolina Surface Water Withdrawal, Permitting Use, and Reporting Act SC Code § 49-4-10 to § 49-4-180	Establishes State requirements for surface water withdrawals.
Procedures for Decision-making (Permitting) 40 CFR Part 124	Provides procedures for issuing, modifying, revoking and reissuing, or terminating specific permits, including NPDES permits.
Ecological Resources	
Endangered Species Act of 1973 16 U.S.C. § 1531 et seq.	Governs the protection and recovery of imperiled species and their ecosystems. Requires Federal agencies to assess whether their actions could adversely affect threatened or endangered species or critical habitat.
South Carolina Nongame and Endangered Species Conservation Act (Title 50 “Fish, Game and Watercraft,” Chapter 15 “Nongame and Endangered Species,” Article 1 “Nongame and Endangered Wildlife Species”) SC Code § 50-15-30 SC Reg. 123-150, 150.1, 150.2	Provides lists of and protection for State-designated endangered species and threatened species in need of management. The statute says it is unlawful to take indigenous species (including sea turtles, birds, fish, reptiles, amphibians, and mammals) in the state, which SCDHEC lists as endangered.
Migratory Bird Treaty Act of 1918 16 U.S.C. § 703 et seq.	Implements several international treaties related to the protection of migratory birds and makes it illegal to take, capture, or kill any migratory bird, or to take any part, nest, or egg of any such birds. Applies to purposeful actions, not to actions that result from otherwise lawful activities (incidental take).
Executive Order 13186, “Responsibilities of Federal Agencies to Protect Migratory Birds” (01/10/2001)	Requires Federal agencies to avoid or minimize the adverse impact of their actions on migratory birds and to assure that environmental analyses under NEPA evaluate the effects of proposed Federal actions on such species. A Memorandum of Understanding between DOE and USFWS implements the Order targeting the conservation and management of migratory birds and their habitats.

Law, Regulation, Executive Order, DOE Order	Description
Executive Order 13112, “Invasive Species” (02/03/1999)	Directs each Federal agency whose actions may affect the status of invasive species to take action to prevent the introduction of invasive species and promote restoration of native species and natural habitat.
Cultural Resources	
National Historic Preservation Act of 1966 54 U.S.C. § 300101 et seq.	Protects historic properties. Section 106 of this Act requires consultation with the State Historic Preservation Officer and other consulting parties prior to any Federal funding, permit, or action located on federally managed lands that could affect cultural resources. Additional provisions of the NHPA provide direction to Federal agencies on the protection and management of cultural resources located on federally managed lands.
Protection of Historic Properties 36 CFR Part 800	Implements the requirements of NHPA, Section 106.
South Carolina Institute of Archaeology and Anthropology SC Code § 60-13-210	Establishes and recommends methods and standards for archaeological and anthropological research on behalf of the State; in use at SRS.
Archaeological Resources Protection Act of 1979 16 U.S.C. § 470aa et seq.	Protects archaeological resources and sites on Federal and American Indian lands.
Archaeological and Historic Preservation Act of 1974, as amended 54 U.S.C. § 312501 et seq.	Requires the preservation of historical and archaeological data (including relics and specimens) that might otherwise be irreparably lost or destroyed as the result of Federal construction projects, such as the proposed SRPPF.
American Antiquities Act of 1906 54 U.S.C. § 320301 et seq.	Protects prehistoric American Indian ruins and artifacts on Federal lands and authorizes the President to designate historic areas as national monuments.
Historic Sites Act of 1935 54 U.S.C. § 320101 et seq.	Provides for the preservation of historic American sites, buildings, objects, and antiquities of national significance, and serves other purposes.
Manhattan Project National Historical Park Study Act Public Law 108-340	Directs the Secretary of the Interior to conduct a study of the preservation and interpretation of the historic sites of the Manhattan Project for potential inclusion in the National Park System.
Executive Order 11593, “Protection and Enhancement of the Cultural Environment” (05/13/1971)	Requires preservation of historic and archaeological information prior to construction activities such as those associated with the proposed SRPPF.
Executive Order 13287, “Preserve America” (03/03/2003)	Promotes the protection of Federal historic properties and cooperation among governmental and private entities in preserving cultural heritage.

Law, Regulation, Executive Order, DOE Order	Description
Curation of Federally Owned and Administered Archeological Collections 36 CFR Part 79	Establishes definitions, standards, procedures and guidelines to be followed by Federal agencies to preserve collections of prehistoric and historic material remains, and associated records, recovered under the authority of the American Antiquities Act (54 U.S.C. § 320301 et seq.), the Reservoir Salvage Act (54 U.S.C. § 312505 et seq.), NHPA Section 110 (54 U.S.C. § 300101 et seq.), or the Archaeological Resources Protection Act (16 U.S.C. §§ 470aa–mm).
National Register of Historic Places 54 U.S.C. § 302101 et seq. 36 CFR Part 60	Sets forth the procedural requirements for listing properties in the National Register of Historic Places.
Determinations of Eligibility for Inclusion in the National Register of Historic Places 36 CFR Part 63	Identifies the process for evaluating the eligibility of properties for inclusion in the National Register of Historic Places.
Protection of Archeological Resources 43 CFR Part 7	Implements provisions of the Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. § 470aa-mm) by establishing the uniform definitions, standards, and procedures to be followed by all Federal land managers in providing protection for archaeological resources located on public lands and American Indian lands of the United States.
American Indian Religious Freedom Act of 1978 42 U.S.C. § 1996	Protects and preserves for American Indians their inherent right of freedom to believe, express, and exercise their traditional religions, including access to sites.
Native American Graves Protection and Repatriation Act of 1990 25 U.S.C. § 3001 et seq. 43 CFR Part 10	Protects American Indian burial remains and funerary objects found on Federal or Tribal land. Could apply if such resources were to be disturbed by activities associated with the proposed SRPPF.
Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments" (11/06/2000)	Requires consultation and coordination with American Indian Tribes prior to taking actions that affect federally recognized Tribal governments.
Executive Order 13007, "Indian Sacred Sites" (05/24/96)	Requires Federal agencies to accommodate, to the extent practicable, access to American Indian sacred sites and avoid adverse impacts on such sites.
DOE Policy 141.1, "Department of Energy Management of Cultural Resources" (5/2/01, Certified 01/28/2011)	Ensures that DOE programs and field elements integrate cultural resources management into their mission and activities.
DOE Order 144.1, "Department of Energy American Indian Tribal Government Interactions and Policy" (01/16/2009; Change 1, 11/06/2009)	Commits to consultation with American Indian Tribal governments to solicit input about DOE issues.

Law, Regulation, Executive Order, DOE Order	Description
Waste Management and Pollution Prevention	
Solid Waste Disposal Act of 1965 as amended by the Resource Conservation and Recovery Act of 1976 (RCRA) and the Hazardous and Solid Waste Amendments of 1984 42 U.S.C. § 6901 et seq.	Establishes a comprehensive management system for hazardous wastes, addressing generation, transportation, storage, treatment, and disposal. Section 3006 of RCRA (42 U.S.C. § 6926) allows States to establish and administer permit programs with EPA approval. SCDHEC administers the RCRA program in South Carolina and issues SRS's RCRA operating permit.
Hazardous Waste Management Regulations 40 CFR Parts 260–273 SC Regulation 61-79 (revised May 28, 2010)	Governs the generation, transportation, treatment, storage, and disposal of hazardous waste.
South Carolina Hazardous Waste Management Act SC Code § 44-56-10-840	Regulates the generation, transportation, treatment, storage, and disposal of hazardous waste in South Carolina.
Federal Facility Compliance Act of 1992 42 U.S.C. § 6961 et seq.	Waives sovereign immunity for Federal RCRA facilities and requires DOE to inventory wastes and develop a treatment plan for mixed wastes.
Byproduct Material 10 CFR Part 962	Defines byproduct material as identified in the Atomic Energy Act and clarifies that the hazardous portion of mixed radioactive waste is subject to RCRA.
Comprehensive Environmental Response, Compensation, and Liability Act of 1980 42 U.S.C. § 9601 et seq.	Provides broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment.
Toxic Substances Control Act of 1976 15 U.S.C. § 2601 et seq.	Gives EPA the authority to screen and regulate new and existing chemicals to protect the public from the risks of exposure to chemicals. Specific provisions address polychlorinated biphenyls, asbestos, radon, and lead-based paint.
Pollution Prevention Act of 1990 42 U.S.C. § 13101 et seq.	Establishes the requirement to prevent pollution by emphasizing source reduction and recycling. EPA is charged with developing measures for source reduction and evaluating regulations to promote source reduction.
Low-Level Radioactive Waste Policy Act of 1980 42 U.S.C. § 2021 et seq.	Specifies that the Federal Government is responsible for the disposal of certain low-level radioactive waste, including low-level radioactive waste owned or generated by DOE, and that States are responsible for the disposal of commercially generated low-level radioactive waste. Pertains to waste that could be generated by the proposed SRPPF.

Law, Regulation, Executive Order, DOE Order	Description
Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes 40 CFR Part 191	Indicates the standard for radiation doses received by members of the public as a result of the management (except for transportation) and storage of used nuclear fuel, high-level radioactive wastes, and TRU waste.
DOE Order 435.1, "Radioactive Waste Management" (07/09/1999; Change 1, 08/28/2001)	Defines requirements to ensure that all DOE radioactive waste is managed in a manner that is protective of worker and public health and safety and the environment.
Nuclear Weapons and Management of Nuclear Materials	
Atomic Energy Act of 1954, as amended 42 U.S.C. § 2011 et seq.	Provides fundamental jurisdictional authority to DOE and NRC over governmental and commercial use, respectively, of nuclear materials. It authorizes DOE to establish standards to protect health or minimize dangers to life or property for activities under DOE jurisdiction, such as the proposed plutonium disposition activities at SRS. DOE has issued a series of Orders to establish a system of standards and requirements to ensure safe operation of DOE facilities. Assigns responsibility to the DOE.
Atomic Energy Act of 1954, as amended 42 U.S.C. § 2011 et seq.	Assigns responsibility to DOE for providing nuclear weapons to support U.S. national security strategy.
National Nuclear Security Administration Act (Public Law 106-65, Title XXXII	Assigns responsibility for providing nuclear weapons to support U.S. national security strategy to NNSA within DOE.
Price -Anderson Amendments Act 42 U.S.C. § 2210	Allows DOE to indemnify its contractors if the contract involves the risk of public liability from a nuclear incident.
Energy Policy Act of 2005 Public Law 109-58	Extends the Price-Anderson Nuclear Industries Indemnity Act through 2025.
Atomic Energy Defense Act 50 U.S.C. § 2538a	Enacted in 2014, the Secretary of Energy is charged with producing not less than 80 war reserve plutonium pits beginning during 2030 and submitting an annual certification to Congress and the Secretary of Defense that the programs and budget of the Secretary of Energy will enable the nuclear security enterprise to meet these requirements.
Procedural Rules for DOE Nuclear Facilities 10 CFR Part 820	Regulates procedures to govern the conduct of persons involved in DOE nuclear activities and, in particular, to achieve compliance with DOE nuclear safety requirements.

Law, Regulation, Executive Order, DOE Order	Description
Nuclear Safety Management 10 CFR Part 830	Establishes requirements governing the conduct of DOE contractors, DOE personnel, and other persons conducting activities (including providing items and services) that affect, or may affect, the safety of DOE nuclear facilities, such as the proposed SRPPF.
DOE Order 410.2, "Management of Nuclear Materials" (08/17/09, Change 1, 04/10/2014)	Defines the requirements and procedures for the lifecycle management of nuclear materials within DOE.
DOE Order 425.1D, "Verification of Readiness to Start Up or Restart Nuclear Facilities" (04/16/10, 04/02/13, Change 2 (MinChg) 10/4/2019)	Establishes requirements for DOE/NNSA for verifying readiness for startup of new nuclear facilities and for the restart of existing nuclear facilities that have been shut down.
DOE Order 426.2, "Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities" (04/21/10, Change 1, 07/29/2013)	Defines selection, qualification, and training requirements for management and operating contractor personnel involved in the operation, maintenance, and technical support of DOE/NNSA reactors and nonreactor nuclear facilities.
DOE Order 433.1B, "Maintenance Management Program for DOE Nuclear Facilities" (04/21/10, Change 1, 03/12/2013)	Establishes the safety management program required by 10 CFR Part 830 for maintenance and the reliable performance of structures, systems, and components that are part of the safety basis at Hazard Category 1, 2, and 3 DOE nuclear facilities.
DOE Order 458.1, "Radiation Protection of the Public and the Environment" (02/11/2011, Change 3, 01/15/2013)	Establishes requirements to protect the public and the environment against undue risk from radiation associated with radiological activities conducted under the control of DOE pursuant to the Atomic Energy Act of 1954, as amended.
DOE Policy 470.1B, "Safeguards and Security Program" (02/10/2016)	Ensures that DOE efficiently and effectively meets all its obligations to protect special nuclear material, other nuclear materials, classified matter, sensitive information, government property, and the safety and security of employees, contractors, and the general public.
DOE Order 470.4B, "Safeguards and Security Program" (07/21/11; Change 2, 01/17/2017)	Identifies roles and responsibilities for the DOE Safeguards and Security Program.
DOE Guidance 440.1-7A, Implementation Guide for use with 10 CFR Part 850, Chronic Beryllium Disease Prevention Program (1/4/2001)	Provides guidance for implementing the regulatory requirements for the Chronic Beryllium Disease Prevention Program.
Worker Safety and Health	
Occupational Safety and Health Act of 1970 29 U.S.C. § 651 et seq.	Ensures worker and workplace safety, including a workplace free from recognized hazards, such as exposure to toxic chemicals, excessive noise levels, and mechanical dangers.
Occupational Safety and Health Standards 29 CFR Part 1910 29 CFR Part 1926	Protect workers from hazards encountered in the workplace (Part 1910) and at the construction site (Part 1926).

Law, Regulation, Executive Order, DOE Order	Description
Worker Safety and Health Program 10 CFR Part 851	Defines controls and monitoring of hazardous materials to ensure that workers are not being exposed to health hazards, such as toxic chemicals, excessive noise, and ergonomic stressors.
Chemical Accident Prevention Provisions 40 CFR Part 68	Provide the list of regulated substances and thresholds, and the requirements for owners or operators of stationary sources concerning the prevention of accidental releases, and the State accidental release prevention programs approved under Clean Air Act Section 112(r).
Occupational Radiation Protection 10 CFR Part 835	Defines radiation protection standards, limits, and program requirements for protecting workers from ionizing radiation resulting from DOE activities.
DOE Order 6430.1A, "General Design Criteria" (04/06/1989)	Provides general design criteria for use in the acquisition of DOE facilities.
DOE Policy 420.1, "Department of Energy Nuclear Safety Policy" (02/08/2011)	Documents DOE's nuclear safety policy.
DOE Order 420.1C, "Facility Safety" (12/13/12, 07/26/18, Change 3 [LtdChg] 11/14/19)	Establishes facility and programmatic safety requirements for DOE facilities, including nuclear and explosives safety design criteria, fire protection, criticality safety, natural phenomena hazards mitigation, and the System Engineer Program.
DOE Order 430.1C, "Real Property Asset Management" (08/19/2016)	Establishes a corporate, holistic, and performance-based approach to real property lifecycle asset management that links real property asset planning, programming, budgeting, and evaluation to program mission projections and performance outcomes. This Order identifies requirements and establishes reporting mechanisms and responsibilities for real property asset management.
DOE Order 440.1B, "Worker Protection Program for DOE (including the National Nuclear Security Administration) Federal Employees" (05/17/2007; Change 2, 03/14/2013)	Establishes and describes the program to protect workers and reduce accidents and losses; adopts occupational safety and health standards.
Transportation	
Hazardous Materials Transportation Act of 1975 49 U.S.C. § 5101 et seq.	Provides the USDOT with authority to protect against the risks associated with transportation of hazardous materials, including radioactive materials, in commerce.
Hazardous Materials Regulations 49 CFR Parts 171–185, 385, 397	Establish USDOT requirements for classification, packaging, hazard communication, incident reporting, handling, and transportation of hazardous materials; hazardous materials safety permits; and driving and parking rules.

Law, Regulation, Executive Order, DOE Order	Description
Packaging and Transportation of Radioactive Material 10 CFR Part 71	Defines NRC requirements for packaging, preparation for shipment, and transportation of licensed materials, including reactor fuel.
DOE Order 460.1D, “Hazardous Materials Packaging and Transportation Safety” (12/20/2016)	Establishes safety requirements for the proper packaging and transportation of DOE offsite shipments and onsite transfers of radioactive and other hazardous materials.
DOE Order 460.2A, “Departmental Materials Transportation and Packaging Management” (12/22/2004)	Establishes requirements and responsibilities for management of DOE materials transportation and packaging to ensure the safe, secure, and efficient packaging and transportation of materials, both hazardous and nonhazardous.
DOE Order 461.1C, “Packaging and Transportation for Offsite Shipment of Materials of National Security Interest” (07/20/2016)	Specifies that the packaging and transportation of all offsite shipments of materials of national security interest for DOE, including plutonium and pits, must be conducted in accordance with USDOT and NRC regulations that would be applicable to comparable commercial shipments, except where an alternative course of action is identified in the order.
DOE Order 461.2, “Onsite Packaging and Transfer of Materials of National Security Interest” (11/01/2010)	Establishes safety requirements and responsibilities for onsite packaging and transfers of materials of national security interest to ensure safe use of Transportation Safeguards System, non-TSS Government-, and contractor-owned and/or leased resources.
Emergency Management	
Emergency Planning and Community Right-to-Know Act of 1986 42 U.S.C. § 11001 et seq. 40 CFR Parts 350–372	Establishes an emergency response system to help local communities protect public health and safety and the environment from unplanned releases of hazardous materials. SRS is required to provide the needed information to local and State emergency response planning authorities regarding operations at SRS. Would need to include the proposed SRPPF once operational or additional activities that may take place in existing facilities, as appropriate.
Radiological Emergency Planning and Preparedness 44 CFR Part 351	Requires emergency plans for DOE nuclear facilities; additional DOE responsibilities defined for assisting the Federal Emergency Management Agency. Emergency plans for SRS would need to include the proposed SRPPF, once operational.
Emergency Planning and Notification 40 CFR Part 355	Establishes emergency planning provisions for facilities in possession of an extremely hazardous substance in a quantity exceeding a specified threshold quantity. Could apply to substances to be used in the proposed SRPPF.

Law, Regulation, Executive Order, DOE Order	Description
Hazardous Chemical Reporting: Community Right-To-Know 40 CFR Part 370	Establishes reporting requirements for providing the public with important information about the hazardous chemical inventories in their communities.
Toxic Chemical Release Reporting: Community Right-To-Know 40 CFR Part 372	Establishes reporting requirements for providing the public with important information about the release of toxic chemicals in their communities.
Executive Order 12656, "Assignment of Emergency Preparedness Responsibilities" (11/18/1988)	Establishes requirement to have sufficient capabilities to meet defense and civilian needs during a national emergency. DOE is the lead agency responsible for energy-related emergency preparedness and for assuring the security of DOE nuclear materials and facilities.
DOE Order 151.1D, "Comprehensive Emergency Management System" (08/11/2016)	Establishes policy and assigns and describes roles and responsibilities for the DOE Emergency Management System. Cancels DOE M 151.1-1, "Power Marketing Administration Emergency Management Program" (09/18/2008), which was incorporated into this Order.
DOE Order 153.1, "Departmental Radiological Emergency Response Assets" (06/27/2007)	Defines requirements and responsibilities for the DOE/NNSA national radiological emergency response assets and capabilities and Nuclear Emergency Support Team assets.

CEQ = Council on Environmental Quality; CFR = *Code of Federal Regulations*; USDOT = U.S. Department of Transportation; EPA = U.S. Environmental Protection Agency; NEPA = National Environmental Policy Act; NHPA = National Historic Preservation Act; NNSA = National Nuclear Security Administration; NPDES = National Pollutant Discharge Elimination System; NRC = U.S. Nuclear Regulatory Commission; RCRA = Resource Conservation and Recovery Act; SCDHEC = South Carolina Department of Health and Environmental Control; SRS = Savannah River Site; TRU = transuranic; TSS = Transportation Safeguards System; USFWS = U.S. Fish and Wildlife Service; U.S.C. = *United States Code*; WIPP = Waste Isolation Pilot Plant.

a. The DOE directives included in this table include the latest changes to these directives. Certain contracts may require compliance with prior versions of the directives. Issuance of a new or revised directive does not alleviate the DOE contractors from having to comply with their contractual requirements.

4.18.2 Regulatory Activities

The proposed SRPPF would be designed, constructed, and operated in accordance with a variety of applicable laws and regulations. Below is a brief discussion of the major laws and regulations that would apply to the construction and operation of the SRPPF.

The major DOE design criteria may be found in DOE Order 6430.1A (1989), "General Design Criteria," and its successive Orders 420.1C, Change 3 (2019), "Facility Safety," and 430.1C, "Real Property Asset Management," which delineate applicable regulatory and industrial codes and standards for both conventional facilities designed to industrial standards and "special facilities," defined as nonreactor nuclear facilities and explosive facilities. The facilities would also comply with all the requirements of 10 CFR Part 830, "Nuclear Safety Management." 10 CFR Part 830 provides both quality assurance and safety requirements for the design and operations of the facilities, as documented in the required facility safety analysis. Prior to operation, the facilities would undergo cold and hot startup testing and an operational readiness review in accordance with the requirements of DOE Order 425.1D, Change 2 (2019), "Verification of Readiness to Start Up or Restart Nuclear Facilities." Prior to startup, NNSA would prepare a safety evaluation report to evaluate the proposed safety basis and controls for the new facilities and would obtain approval of the NNSA Administrator or designee prior to startup.

The proposed SRPPF would need to comply with 10 CFR Part 820, "Procedural Rules for DOE Nuclear Facilities," and other applicable regulations and standards related to worker and public health and safety and environmental protection, including radiation protection standards (10 CFR Part 835, "Occupational Radiation Protection," and 10 CFR Part 851, "Worker Safety and Health Program"). Occupational Safety and Health Administration regulations governing industrial safety aspects of chemical risks to workers would apply. Also radiological exposure levels to members of the public would apply, as regulated under DOE O 458.1, "Radiation Protection of the Public and the Environment" (DOE Order 458.1 2013), 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities," for radionuclide emissions to air. The protection of the environment from chemical risks is regulated by EPA and SCDHEC.

Because the facility is located at a DOE site and would be operated by a contractor, certain DOE requirements affecting site interfaces and infrastructure would also be applicable. In addition, certain Federal or State regulations implementing the Clean Water Act and the Clean Air Act would also be applicable. These regulations are implemented through permits, mainly through SCDHEC. Prior to SRPPF operations, an evaluation would be required to determine whether SRPPF emissions and activities require modification of existing permits and the acquisition of additional air and water permits. TRU waste would be generated routinely during operations of the proposed SRPPF but would be regularly shipped offsite to the WIPP facility for disposal. Before any TRU waste could be sent to the WIPP facility for disposal, NNSA would prepare or modify Waste Certification Plans, Quality Assurance Plans, and Transuranic Waste Authorized Methods for Payload Control, as applicable. Methods of compliance with each requirement and associated criterion to be implemented at the site shall be described or specifically referenced and shall include procedural and administrative controls consistent with the Carlsbad Field Office (CBFO) Quality Assurance Program Document (DOE 2017b). NNSA would be required to submit these program documents to the CBFO for review and approval prior to their implementation (DOE 2017b). NNSA would then certify that each container of TRU waste they intend to transport to the WIPP facility meets the most current waste acceptance criteria (DOE 2016f).

Operation of the SRPPF would generate solid LLW. Onsite disposal of SRPPF LLW would be contingent on waste meeting the SRS disposal facility's waste acceptance criteria and adherence to the associated performance assessment. The performance assessment sets limits based on the type and amount of radionuclides and still meet the worker and public health and safety performance standards and other applicable regulatory criteria for the disposal facility. If DOE capabilities are not practical or cost effective, exemptions may be approved to allow use of a non-DOE commercial, licensed LLW disposal facility, consistent with DOE Order 435.1. NNSS disposal of LLW would be an alternative to onsite disposal if SRS waste acceptance criteria were not met or SRS disposal capacity was limited. The SRPPF LLW would have to meet the NNSS waste acceptance criteria.

4.18.3 Permits

Many of the SRPPF activities would be conducted within existing structures in developed areas of SRS, would use existing infrastructure, and would operate under existing permits. The need for new permits or modifications to existing permits would depend on new construction, demolition of existing structures, and operation scenarios. Prior to project implementation, required environmental permits would be obtained in accordance with Federal, State, and local requirements. Below is a brief discussion of some permits expected to be evaluated.

Hazardous waste management activities at SRS are regulated under RCRA Part A/Part B permits. In the case of TRU waste being shipped to the WIPP facility for disposal, the waste would need to meet the waste acceptance criteria, waste analysis plan, and WIPP permit requirements.

SRS also complies with over 400 environmental permits covering air quality, water quality and wetlands, hazardous waste, sanitary waste, and underground storage tanks. The *Savannah River Site Environmental Report for 2017* contains a compilation of permits for the site (SRNS 2018a). Drinking water at SRS is regulated by SCDHEC under the State and Federal Safe Drinking Water Acts (SC Code § 44-55-10 et seq., and 42 U.S.C. § 300f et seq.). Permits for domestic water supplies cover 17 separate systems across SRS; new permits would be required for tie-ins to the existing domestic water supplies for modifications or new construction that may be required for the SRPPF.

Wastewater discharges at SRS are regulated by four permits under the NPDES Program, a Clean Water Act (33 U.S.C. § 1251 et seq.) program administered by SCDHEC under authority delegated by EPA. Wastewaters (i.e., stormwater, sanitary wastewaters, cooling water, and production effluents) from existing facilities are covered under permits already in place. During construction of the proposed SRPPF, stormwater would be managed under the SRS general stormwater permit. A Notice of Intent and SWPPP would address facility-specific stormwater measures. Sanitary and industrial wastewater treatment and disposal are regulated under several permits for facilities across SRS. For sanitary wastewaters, the facilities and associated buildings would tie into existing SRS systems; permits could be required for both the construction and operations phases for these tie-ins.

Air emissions from SRS facilities, including both radioactive and nonradioactive criteria and toxic air pollutant emissions, are regulated under the SRS air quality operating permit (SCDHEC 2018b), issued under Title V of the Clean Air Act (42 U.S.C. § 7401 et seq.) and administered by SCDHEC. Changes resulting from SRPPF activities could necessitate modifications to the Title V permit. Permit revisions would be made as required as the project proceeds to construction and then to operations.

CHAPTER 5

Cumulative Impacts

5 CUMULATIVE IMPACTS

INTRODUCTION

This chapter discusses the potential cumulative impacts resulting from the Proposed Action. CEQ NEPA regulations at 40 CFR Part 1508.7 define cumulative impacts as "…the incremental impact of [an] action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time." Thus, the cumulative impacts of an action can be viewed as the total effects on a resource (e.g., land, air, water, soil), ecosystem, or human community of that action and all other activities affecting that resource no matter what entity (Federal, non-Federal, or private) is taking the actions (EPA 1999). It is possible that a potential impact that may be small by itself could result in a moderate or large cumulative impact when considered in combination with the impacts of other actions on a particular affected resource. For example, if a resource is regionally declining or imperiled, even a small, individual impact could be substantial if it contributes to or accelerates the overall resource decline.

Cumulative effects can also result from spatial (geographic) and/or temporal (time) crowding of environmental perturbations (i.e., concurrent human activities and the resulting impacts on the environment are additive if there is insufficient time for the environment to recover). The geographic area over which past, present, and reasonably foreseeable future actions could contribute to cumulative impacts is dependent on the type of resource considered.

5.1 METHODOLOGY AND ASSUMPTIONS

The following approach was used to estimate cumulative impacts for this SRS Pit Production EIS:

- In general, potential cumulative impacts are determined by considering the baseline affected environment, the Proposed Action, and other current and reasonably foreseeable future actions. The affected environment, which is described in Chapter 3 of this EIS, includes the impacts of past and present projects and serves as the baseline for the cumulative impacts analysis.

- Current and reasonably foreseeable future actions include projects and activities that could result in impacts to resources, ecosystems, or human communities within the defined ROI. These actions are described in Section 5.2.

- Cumulative impacts are assessed by combining the effects of the Proposed Action with the effects of other past, present, and reasonably foreseeable future actions in the ROI. Many of these actions occur at different times and locations and the potential impacts may not be truly additive. For example, actions affecting air quality occur at different times and locations across the ROI; therefore, it is unlikely that the impacts would be completely additive. The effects were combined irrespective of the time and location of the impact to envelope any uncertainties in the projected activities and their effects. This approach produces a conservative estimation of cumulative impacts for the activities considered.

- A cumulative impact analysis is only conducted for those resource areas with the potential for substantial cumulative impacts. Based on an analysis of the impacts presented in Chapter 4 of this EIS, the resource areas identified for cumulative impact analysis are global climate change, infrastructure (electricity availability and water use), socioeconomics, waste management (i.e., radioactive waste), human health (normal operations), and transportation.

5.2 CURRENT AND REASONABLY FORESEEABLE FUTURE ACTIONS

In addition to the Proposed Action evaluated in this EIS, actions that may contribute to cumulative impacts include onsite and offsite projects conducted by Federal, State, and local governments or the private sector that are within the ROIs of the actions considered in this EIS. Information on current and reasonably foreseeable future actions was obtained by reviewing publicly available information for the region, site-specific actions, and NEPA documents. The current and reasonably foreseeable future actions discussed below represent the major projects that may contribute to cumulative impacts.

5.2.1 U.S. Department of Energy Actions

Surplus Plutonium Disposition

Since the end of the Cold War, to advance nonproliferation goals and missions, the United States has declared a large quantity of plutonium surplus to the Nation's defense needs. Surplus plutonium is safely stored primarily at Pantex, with lesser quantities at SRS and other locations within the Complex. Surplus plutonium is separate from plutonium that remains available for use in nuclear weapons programs, such as the plutonium that would be used in the SRPPF to manufacture pits.

In the mid-1990s DOE began studying technologies for preparing surplus plutonium for disposal and studying locations and facilities for disposal of surplus plutonium. In 2000, DOE issued a ROD (65 FR 1608, January 11, 2000; DOE 2000a) documenting the decision to construct and operate three facilities at SRS: an immobilization facility, a pit disassembly and conversion facility, and the MFFF. In 2003, DOE amended the ROD (68 FR 20134, April 24, 2003) and decided to cancel the immobilization program and manufacture mixed-oxide fuel from 34 metric tons of surplus plutonium. NNSA never began construction of a pit disassembly and conversion facility but the capabilities currently exist at LANL. Construction of the MFFF began in 2006 and was terminated in 2018, primarily due to cost and schedule overruns. Termination of MFFF construction resulted in the termination of the mixed-oxide fuel program. NNSA intends to evaluate the use of the dilute and dispose process for the 34 metric tons of surplus plutonium intended for disposition at the MFFF.

In 2016, DOE issued a ROD, supported by the analysis in the SPD SEIS (NNSA 2015), that documented the decision to dispose of six metric tons of surplus plutonium using the dilute and dispose process (the WIPP Disposal Alternative). That six metric tons of surplus plutonium had no designated disposition path and was incremental to the 34 metric tons. NNSA is currently in the planning process for installation and operation of additional equipment in K Area at SRS to dilute and dispose of that six metric tons of surplus plutonium. The additional equipment and current capabilities could be used to dilute and dispose of the 34 metric tons, but to date that analysis is underway and no official decisions have been made. In the 2015 SPD SEIS, DOE also evaluated alternatives including dilute and dispose for disposition of an additional 7.1 metric tons of surplus plutonium that had no designated disposition path.

As identified in Section 1.5.2 of this SRS Pit Production EIS, NNSA prepared the *Supplement Analysis for Disposition of Additional Non-Pit Surplus Plutonium* (NNSA 2020c) to consider whether the proposal to prepare and dispose of 7.1 metric tons of additional non-pit plutonium (rather than the pit plutonium described in the 2015 SPD SEIS) using the WIPP Disposal Alternative represented significant new circumstances or information relevant to environmental concerns. NNSA concluded that the 2015 SPD SEIS addressed the impacts of the proposed preparation of an additional 7.1 metric tons of non-pit plutonium for disposal at the WIPP facility, and that no additional NEPA review was required. On August 28, 2020, NNSA announced its decision to dispose of an additional 7.1 metric tons of non-pit plutonium using the WIPP Disposal Alternative (85 FR 53350).

The current design of the SRPPF includes excess space that NNSA could use to support other missions, including surplus plutonium disposition. The SRPPF would be designed to include a pit disassembly capability (see Section 2.1.2 of this SRS Pit Production EIS), and excess space could be used for equipment for other processing steps. Therefore, SRPPF space and capabilities could be used to support the dilute and dispose process for plutonium disposition, or other NNSA missions.

In this SRS Pit Production EIS, NNSA includes data from the SPD SEIS (NNSA 2015) to address cumulative impacts. The SPD SEIS incorporates and updates data from the 2000 SPD EIS on impacts at SRS and impacts of transportation of materials.

Versatile Test Reactor

On August 8, 2019, DOE issued a Environmental Impact Statement Notice of Intent (DOE 2019e) to prepare an EIS to evaluate alternatives for a versatile reactor-based fast-neutron source facility and associated facilities for the preparation, irradiation, and post-irradiation examination of test/experimental fuels and materials. DOE's proposed action is to construct and operate the versatile test reactor at a suitable DOE site, utilizing existing or expanded, collocated, post-irradiation examination capabilities as necessary to accomplish the mission. Two locations currently under consideration for construction of the versatile test reactor are the Idaho National Laboratory in eastern Idaho, and Oak Ridge National Laboratory in eastern Tennessee. In addition, the Idaho National Laboratory and SRS are being considered for the fabrication of the driver fuel for the versatile test reactor. If SRS is selected to fabricate the driver fuel for the versatile test reactor, cumulative impacts at SRS could occur. The Draft EIS for the Versatile Test Reactor has not yet been issued, therefore, the potential impacts have not yet been determined and are not included in the cumulative impacts analysis for this SRS Pit Production EIS.

<u>Potential Acceptance of Spent Nuclear Fuel from Foreign and Domestic Research Reactors and Processing of Material through H-Canyon</u>

SRS manages SNF (including target materials) originating from the Atomic Energy Commission and DOE production activities, as well as SNF from foreign and domestic research reactors. The SNF currently is safely stored at SRS pending disposition. The receipt, storage, and disposition of SNF supports programmatic missions of the DOE's Office of Nuclear Energy, Office of Science, Office of Environmental Management, and NNSA.

The environmental impacts of the SNF management at SRS were analyzed in the *Savannah River Site, Spent Nuclear Fuel Management Final Environmental Impact Statement* (DOE/EIS-0279; DOE 2000b) and associated supplement analyses, and the *Proposed Nuclear Weapons Nonproliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel Final Environmental Impact Statement* (DOE/EIS-0218; DOE 1996c) and associated supplement analyses. These EISs evaluate future receipts of SNF for foreign and domestic research reactors and evaluates conventional processing of SNF through H-Canyon. The cumulative impacts from these activities are described in Section 5 of DOE (2000b) and in the *Environmental Assessment for the Acceptance and Disposition of Spent Nuclear Fuel Containing U.S.-Origin Highly Enriched Uranium from the Federal Republic of Germany* (DOE/EA-1977; DOE 2017c). DOE prepared a supplement analysis in 2019 to DOE/EIS-0218 (DOE 2019f), which extended the Foreign Research Reactor SNF Acceptance Program through May 2029. These ongoing and proposed actions are included in the cumulative analysis for this SRS Pit Production EIS.

<u>Existing Operations/F-Area Cleanup Actions at the Savannah River Site</u>

The 1993 FFA for SRS, a tri-party agreement among DOE, EPA, and South Carolina, integrates CERCLA and RCRA requirements to achieve a comprehensive remediation strategy and to coordinate administrative and public participation requirements. The FFA governs remedial actions, sets annual work priorities, establishes milestones for cleanup and waste tank closure, and includes provisions for D&D actions.

SRS has 515 waste units subject to the FFA. At the end of FY 2018, SRS had completed the surface and groundwater cleanup of 408 of these units and was in the process of remediating an additional 10 units. These cleanup actions began prior to final signature of the FFA in 1993 and are expected to continue for many more years. Waste tanks, manufacturing/processing facilities, radioactive waste burial grounds, and an ash basin are among the units listed in the FFA that are also located in F Area. Cleanup decisions made under this agreement are approved by EPA and SCDHEC and meet the mandatory CERCLA requirements of being protective of human health and the environment. Cleanup decisions that do not meet a current residential use standard apply permanent-use restrictions on adjacent land and water resources that will result in an irreversible and irretrievable commitment and loss of natural resources.

<u>Tritium Finishing Facility at the Savannah River Site</u>

The Tritium Finishing Facility project would replace key capabilities in H-Area Old Manufacturing, which is a 1950s vintage building that presents a potential risk to the tritium mission. The H-Area Old Manufacturing supports an extensive array of mission critical capabilities, such as the pre-loading process, inert loading, reservoir acceptance, assembly of reservoir components, packaging, storage, shipping, and metallurgical analysis. These capabilities directly support shipments of Gas Transfer Systems and Limited Life Component Exchanges to the DoD. The proposed Tritium Finishing Facility complex, to be located in the northeast Tritium Area, includes two new buildings: Building 1 would be a HC-2 nuclear facility and Building 2 would be a below HC-3 radiological facility. The Project would also include renovations of existing Building 249-H and a portion of existing Building 234-7H, removal of three warehouses, replacement of one warehouse, and upgrades to utilities and infrastructure to support these facilities.

5.2.2 Other Actions

Nuclear Facilities

The following nuclear facilities are located in the vicinity of SRS:

- **Georgia Power's Vogtle Electric Generating Plant (Plant Vogtle).** Plant Vogtle is a commercial nuclear power plant near Waynesboro, Georgia, located approximately 13 miles south-southwest of the MFFF. Units 1 and 2 at Vogtle are operational and Units 3 and 4 are currently under construction. Units 3 and 4 are scheduled to begin power production in 2021 and 2022, respectively. Considering that both units started construction in 2013, their peak construction coincided with ongoing construction of the MFFF. Because repurposing of the MFFF would begin after the completion of the Plant Vogtle's Units 3 and 4 construction, there will be no overlap of construction activities at the two sites. Operations would overlap and potential impacts are included in the cumulative analysis for this SRS Pit Production EIS.

- **Energy*Solutions* LLW Disposal Facility.** The Energy*Solutions* LLW Disposal Facility is located about eight miles east of F Area and H Area. Annual monitoring reports filed with the State of South Carolina indicate that operation of the Energy*Solutions* facility does not noticeably affect radiation levels in air or water in the vicinity of SRS (SCDHEC 2018c). Therefore, this facility is not included in this cumulative assessment.

- **Starmet CMI Facility.** The Starmet CMI Facility is located about 15 miles southeast of the F Area and H Area. Annual monitoring reports filed with the State of South Carolina indicate that operation of the Starmet CMI Facility does not noticeably affect radiation levels in air or water in the vicinity of SRS (NRC 2018). Therefore, this facility is not included in this cumulative impact assessment.

Interstate 20 Augusta Canal and Savannah River Bridge Replacement

Georgia and South Carolina Departments of Transportation are replacing the existing I-20 Augusta Canal and Savannah River bridges, which are currently two, two-lane structures with a six-lane bridge (three lanes in each direction). The construction of this project was initiated in January 2019 and is expected to be completed in January 2022. The bridge replacement is about 25 miles northwest of SRS, with the entire project being constructed within the existing right of way along I-20. Construction of the new lanes and widened shoulders along I-20 would occur within the existing median. There would be no offsite detour necessary for the project, and traffic would be maintained during construction. The Georgia Department of Transportation has determined this action to be categorically excluded from NEPA (GDOT 2019b). It is not expected that the construction related to this project will impact transportation to and from SRS. Therefore, this project is not included in this cumulative impact assessment.

Savannah Harbor Expansion Project, Georgia and South Carolina: Fish Passage at New Savannah Bluff Lock and Dam

The U.S. Army Corps of Engineers, Savannah District, conducted an environmental analysis of the Savannah Harbor Expansion Project for a proposed fish passage by removing the lock and dam and building an in-channel fish passage. This passage is about 11 miles northwest of the SRS. The Corps has prepared a draft Finding of No Significant Impact (USACE 2019). The Proposed Action of this SRS Pit Production EIS would not have any potential impacts to river operations or aquatic species or habitats; therefore, this project is not included in this cumulative impact assessment.

5.3 CUMULATIVE IMPACTS BY RESOURCE AREA

Chapter 4 of this EIS presents the potential environmental impacts associated with the Proposed Action. Based on information presented in Chapter 4, the Proposed Action would not result in notable impacts to land use, visual resources, geology and soils, water resources, air quality, noise, ecological resources, or cultural and paleontological resources. Therefore, the Proposed Action would not contribute incremental impacts to these resources that would be cumulative with past, present, and reasonably foreseeable future actions identified in Section 5.2. The cumulative impacts analysis in this EIS focuses on those resources impacted by the Proposed Action; namely, global climate change, infrastructure, socioeconomics and environmental justice, waste management, human health, and transportation.

5.3.1 Global Climate Change

As stated in Chapter 3, Section 3.4.2.3 of this EIS, climate change or the natural greenhouse effect is the warming of the earth's atmosphere due to terrestrial radiation being absorbed or trapped by gases in the atmosphere. These gases primarily consist of carbon dioxide and include trace amounts of nitrous oxide, methane, sulfur hexafluoride, and chlorofluorocarbons. The *Environmental Assessment of Biomass Cogeneration and Heating Facilities* (DOE 2008c, p. 30) discusses impacts to greenhouse gas emissions from the conversion of fossil fuel-based energy production to biomass energy production.

Emissions of greenhouse gases (carbon dioxide equivalents) in 2018 at SRS were estimated to be 0.559 million metric ton per year, which is less than 0.009 percent of the total U.S. emissions of 6.457 billion metric tons of carbon dioxide equivalent per year (EPA 2019b, p. ES-4). As discussed in Section 4.4.1.1 of this EIS, under the Proposed Action, the estimated total combined greenhouse gas emissions would be approximately 0.00044 percent of the total U.S. greenhouse gas emissions (6.457 billion metric tons of carbon dioxide equivalent in 2017). This is a conservative estimate; emissions are expected to be less due to SRS environmental goals to increase the use of alternative fuels and decrease the use of gasoline and diesel, resulting in lower emissions of carbon dioxide equivalent. Therefore, the potential cumulative impacts to global climate change from the Proposed Action would be negligible.

As part of this EIS, NNSA also considered the potential impacts to the SRPPF complex from the potential future climate change. Because of its location outside of existing floodplains and its construction to protect against external events (including weather-related events) to maintain confinement, it is highly unlikely that future climate change would have a significant impact on the proposed SRPPF.

5.3.2 Infrastructure

Table 5-1 presents the estimated annual cumulative infrastructure requirements for electricity and water from construction and operations at SRS under the Proposed Action, existing SRS site activities, and other reasonably foreseeable future actions. The cumulative electricity power

Table 5-1—Annual Cumulative Infrastructure Impacts at the Savannah River Site

Activity		Electricity Consumption (megawatt-hours per year)	Domestic Water (gallons per year)
Past, Present, and Reasonably Foreseeable Future Actions			
Existing SRS site activities[a]		310,000	320,000,000
Other DOE actions evaluated in the SPD SEIS[b]		334,000	69,631,000
SPD SEIS proposed action[c]		310,000	57,000,000
Subtotal – Baseline Plus Other Actions		**954,000**	**447,000,000**
SRS Pit Production EIS[a]	No-Action Alternative	0	0
	Proposed Action – 50 to 80 pits per year (construction)	17,520	16,600,000
	Proposed Action – 50 to 80 pits per year (operations)	30,000	12,100,000–13,300,00
Total[d]		**1,001,520**	**459,100,000–469,000,000**
Total Sitewide Capacity[a]		**4,400,000**	**2,950,000,000**

a. Estimates are from Chapter 4, Table 4-10, of this EIS.
b. Contribution from SPD SEIS alternatives (i.e., the action alternative with largest impact), environmental restoration/D&D, SWPF, and tank closure (NNSA 2015, Table 4-43).
c. Values from alternative resulting in the greatest impact (NNSA 2015, Table 4-43).
d. Total is a range that represents the construction and operations requirements of the Proposed Action.

consumption would be approximately 1,001,520 megawatt-hours, which is well within the total sitewide capacity of 4,400,000 megawatt-hours. In addition, once operational, Vogtle Units 3 and 4 would provide additional electrical capacity for the ROI. Therefore, this future action would have a positive impact on electrical capacity for the ROI.

The cumulative water usage would range from approximately 459,100,000 to 469,000,000 gallons per year, which is well within the sitewide capacity of 2,950,000,000 gallons per year.

The overall contribution to infrastructure impacts from the Proposed Action is expected to be negligible.

5.3.3 Socioeconomics and Environmental Justice

Socioeconomics

As shown in Table 5-2, cumulative employment at SRS from past, present, and reasonably foreseeable future actions could reach a peak of about 17,290 persons. By comparison, it is estimated that the projected labor force in the ROI would be 252,188 in the peak year of construction and 264,146 when operations commence in 2030. In addition to the direct jobs, an estimated 2,178 to 2,398 indirect jobs could be created.

Table 5-2—Cumulative Employment Changes at the Savannah River Site

Activity		Direct Employment (number of personnel in peak year)
Past, Present, and Reasonably Foreseeable Future Actions		
Existing SRS site activities[a]		11,093
Other DOE actions evaluated in the SPD SEIS[b]		2,071
SPD SEIS proposed action[c]		2,111
Subtotal – Baseline Plus Other Actions		**15,275**
SRS Pit Production EIS[d]	No-Action Alternative	0
	Proposed Action (construction) – 50 to 80 pits per year	1,800
	Proposed Action (operations) – 50 to 80 pits per year	1,830-2,015
Total[e]		**17,105–17,290**
Projected Labor Force of ROI[d]		**252,188–264,146**

ROI = region of influence.
a. Estimates are from Chapter 3, Section 3.8.1, of this EIS.
b. Contribution from SPD SEIS alternatives (i.e., the action alternative with largest impact), environmental restoration/D&D, SWPF, and tank closure (NNSA 2015, Table 4-42).
c. Values from alternative resulting in the greatest impact (NNSA 2015, Table 4-42).
d. Estimates are from Chapter 4, Table 4-11, of this EIS.
e. Total is a range that represents the construction and operations requirements of the Proposed Action.

Any migration of workers into the ROI during construction of the SRPPF is expected to be small when compared to the projected population of the ROI. Furthermore, any in-migration would be within the historical trends of population growth within the ROI. Due to the low potential for in-migration and changes to the ROI population, impacts on the availability of housing and community services under the Proposed Action are expected to be small.

The overall contribution to cumulative socioeconomic resource impacts from the Proposed Action is expected to be small.

Environmental Justice

DOE's environmental strategy reflects a commitment to advance the quality of life for the communities near DOE facilities. This commitment emphasizes community participation, stakeholder involvement, and community empowerment. It refocuses research in recognition of various health issues in minority and low-income populations, American Indian tribes, and Alaska Natives. DOE's environmental strategy encourages new approaches to occupational and environmental science research for high-risk communities and workers, embraces interagency coordination to facilitate environmental justice, and heightens the sensitivity of managers and staff within DOE to environmental justice issues.

Based on the analysis of impacts for the resource areas in this EIS, no disproportionately high and adverse impacts from construction and operational activities at SRS are expected under the Proposed Action. To the extent that any impacts could be adverse, NNSA expects the impacts to affect all populations in the area equally. There were no discernable adverse impacts to land use, visual resources, geology and soils, water resources, air quality, noise, ecological resources, cultural and archaeological resources, and socioeconomic resources. As shown in Chapter 4, Section 4.10, the potential radiological impacts to the public from SRPPF normal operations would be small. The annual radiation dose to the offsite MEI would be a maximum of 8.0×10^{-7} millirem per year (for production of 80 pits per year), which is well below the limit of 10 millirem per year set by both the EPA (40 CFR Part 61) and DOE (DOE Order 458.1) for airborne releases of radioactivity. The risk of an LCF to this individual from operations would be approximately 4.8×10^{-13} per year. The projected number of LCFs to the population within 50 miles would be essentially zero (i.e., less than or equal to 3.1×10^{-8}).

5.3.4 Waste Management

The assessment of waste management cumulative impacts considers the activities from the generation and disposal of radioactive waste, specifically LLW, MLLW, and TRU waste, from the Proposed Action and from all other reasonably foreseeable projects occurring at the site. The following sections discuss potential impacts by waste type.

<u>Low-Level Radioactive Waste and Mixed Low-Level Radioactive Waste</u>

Table 5-3 presents a summary of the estimated LLW and MLLW generation rates at SRS over a 50-year period. These estimates also include the potential waste generated as identified in the SPD SEIS (NNSA 2015).

Table 5-3—Total Cumulative LLW and MLLW Generation at the Savannah River Site

Activity		LLW-Solid (yd^3)	MLLW (yd^3)
Past, Present, and Reasonably Foreseeable Future Actions			
Existing SRS site activities (baseline–50 years)[a]		655,000	26,000
Other DOE actions evaluated in the SPD SEIS[b]		83,300	4,408
SPD SEIS proposed action[c]		41,900	1,177
Subtotal – Baseline Plus Other Actions		**780,200**	**31,585**
SRS Pit Production EIS[a]	Proposed Action – 50 pits per year	110,000	500
Total[d]		**890,200**	**32,085**

yd^3 = cubic yard.
a. Waste generation estimates are from Chapter 4, Table 4-13, of this EIS scaled to 50 years.
b. Contribution from environmental restoration/D&D (35-year estimate), SWPF, and tank closure (NNSA 2015, Table 4-45).
c. Waste values from alternative resulting in the greatest impact (excluding the MOX Fuel Alternative) (NNSA 2015, Table 4-45).
d. Total values are rounded.

The SRS waste management group recognizes that the volume of LLW that would be generated from operations of the Proposed Action, coupled with the long lifespan planned for the SRPPF, would represent an increase above current LLW management planning levels. The existing LLW disposal area (within E Area) would have to be expanded at some point if it were to accommodate the SRPPF LLW. SRS has already identified acreage on the north side of the disposal area for potential expansion, and there may be other locations within SRS that could be developed for LLW disposal given the need and sufficient lead time. However, onsite disposal of SRPPF LLW would be contingent upon the waste meeting the disposal facility's waste acceptance criteria and adherence to the associated performance assessment.

In the unlikely event that some LLW generated from the Proposed Action did not meet waste acceptance criteria or if a decision was made to limit disposal at SRS, the NNSS disposal facility would be considered a waste management approach alternative. If DOE capabilities are not practical or cost effective, exemptions may be approved to allow use of a non-DOE commercial, licensed LLW/MLLW disposal facility, which would be considered a reasonable alternative. In the five-year timeframe from FY 2014 through FY 2018, the NNSS disposed of approximately 38,600 cubic yards of LLW per year, mostly from DOE operations outside of Nevada (NNSS 2019). At the production rate of 50 pits per year, the Proposed Action would generate approximately 2,200 cubic yards of LLW annually, representing approximately 5.7 percent of the average annual volume of LLW disposed of at NNSS. To be accepted for disposal at the NNSS disposal site, the LLW from SRS would have to meet all waste acceptance criteria, so environmental impacts from NNSS operation would not be expected to change. However, increasing the quantities of waste received by these levels could require NNSS to increase equipment and manpower.

It is also probable that the LLW generated at LANL from producing 30 pits per year (NNSA 2019a) would be disposed of at the NNSS disposal site as well. At the production rate of 30 pits per year, approximately 885 cubic yards of LLW would be generated annually at LANL. The combined LLW generated annually from pit production at both SRS and LANL would be approximately 3,085 cubic yards, which would represent approximately 8 percent of the average annual volume of LLW disposed of at NNSS. Impacts of disposing of LLW at NNSS have been evaluated in the NNSS SWEIS (NNSA 2013).

The relatively small increase in MLLW production under the Proposed Action would not be expected to adversely impact the current approach to SRS management of MLLW.

Transuranic Waste

The WIPP Alternative in the SPD SEIS (NNSA 2015) evaluated disposition of 13.1 metric tons of surplus plutonium at the WIPP facility. Six metric tons of plutonium would be prepared at the K Area Complex at SRS, and 7.1 metric tons of surplus plutonium could be prepared at a combination of facilities using the K Area Complex at SRS and/or TA-55 facilities at LANL. As previously stated, the surplus plutonium TRU waste would be prepared to meet the WIPP waste acceptance criteria and would be disposed of at the WIPP facility as contact-handled TRU waste. If this activity was conducted in the excess HC-2 space at the SRPPF, the wastes generated from preparation for disposal would be similar to and potentially collocated with the waste generated under the Proposed Action.

The environmental impacts from construction and operation of the WIPP facility have been addressed in several NEPA analyses, particularly in the WIPP SEIS-II (DOE 1997c). The WIPP SEIS-II evaluated the impacts from disposal at the WIPP facility of a TRU waste quantity equivalent to that established by the WIPP Land Withdrawal Act, as well as a larger quantity of waste, taking into account other sources of waste such as TRU waste that was not generated from defense activities. The WIPP SEIS-II analyses concluded that the WIPP facility could be operated safely and that the WIPP facility would not be expected to result in any long-term (over 10,000 years) impacts on human health (DOE 1997c). This supported DOE's decision to develop the WIPP facility for TRU waste disposal (63 FR 3624, January 23, 1998; DOE 1998).

In January 2018, DOE submitted a request to modify the New Mexico Environment Department WIPP Hazardous Waste Facility Permit to differentiate between the way RCRA waste volume was defined versus the way the WIPP Land Withdrawal Act TRU waste volume (175,564 cubic meters) was calculated and tracked (DOE 2018b; NMED 2018). In December 2018, the New Mexico Environment Department approved the DOE's request to modify the existing WIPP Hazardous Waste Facility Permit (NMED 2018), and in January 2019 DOE fully implemented the change in the method of tracking, reporting, and recording the TRU waste disposal volumes. The New Mexico Environment Department's approval decision is under appeal.

Using the WIPP Land Withdrawal Act TRU waste volume of record tracking and reporting methodology, the volume of TRU waste disposed of as of July 25, 2020, is 69,470 cubic meters.[29] Based on the statutory limitations and agreements between DOE and the State of New Mexico and considering past disposals of TRU waste from across the DOE Complex, for NEPA purposes, NNSA estimated a TRU waste remaining disposal capacity of just over 100,000 cubic meters (see Table 5-4, noting that quantities are expressed in cubic meters, although the waste volumes for other waste types and in other sections of this EIS are expressed in cubic yards).

To address the potential cumulative impacts to the WIPP facility from disposal of TRU waste generated under the Proposed Action, NNSA compared the quantities of wastes generated from the proposed activities analyzed in this EIS and other applicable DOE activities against the WIPP Land Withdrawal Act volume capacity limit for TRU waste disposal. Projected inventories of TRU waste from DOE activities (including waste resulting from downblending 13.1 metric tons of surplus plutonium) are presented in the *Annual Transuranic Waste Inventory Report – 2019* (DOE 2019j). Under the Proposed Action, significant quantities of TRU waste could be generated at SRS and shipped to the WIPP facility for disposal. It is estimated that approximately 22,950[30] cubic meters of TRU waste could be generated over the life of the project (i.e., 50 years) at SRS, assuming a production rate of 50 pits per year. In addition, approximately 5,350 cubic meters of TRU waste could be generated over the life of the project (i.e., 50 years) at LANL, assuming a production rate of 30 pits per year. Table 5-4 presents a summary of the estimated TRU waste

[29] The Annual Transuranic Waste Inventory Report-2019 (DOE 2019j) focuses on all TRU waste stored or projected to be generated through calendar year 2033 at the TRU waste generator sites but includes data on projected TRU waste inventories through calendar year 2050. This report can be viewed online at https://wipp.energy.gov/library/TRUwaste/DOE-TRU-19-3425_R0_FINAL.pdf. This report shows that past, present, and reasonably foreseeable future actions, including TRU waste to be generated as a result of this Proposed Action, considering uncertainties, are not expected to exceed the WIPP Land Withdrawal Act capacity limits. TRU waste numbers will change over time and this table represents a snapshot of the waste inventory. The Annual TRU Waste Inventory Report is updated annually and current TRU waste volumes at WIPP can be viewed online at https://wipp.energy.gov/shipment-information.asp.

[30] This projected volume represents the volume of the outermost disposal container for TRU waste from SRPPF.

generation rates of the Proposed Action over a 50-year period along with past, present, and reasonably foreseeable TRU waste generation and the WIPP facility capacity estimates.

As shown in Table 5-4, the estimated available capacity of the WIPP facility would accommodate the conservatively estimated TRU waste that could be generated over the next 50 years. Table 5-4 also demonstrates that TRU waste generation estimates from pit production vary (on a per-pit basis) between LANL and the proposed SRPPF. The main factor contributing to this difference is that the waste stream at SRPPF would include americium-241 (the LANL TRU waste stream does not), which limits the amount of waste that can be packaged for disposal because of americium's radioactivity. The americium-241 in the LANL process is recovered as a byproduct.

Table 5-4—Cumulative Transuranic Waste (both contact- and remote-handled)

Activity	TRU Waste (m^3)
Past TRU Waste Disposed of at the WIPP facility as of July 25, 2020[a]	**69,470**
Present and Projected TRU Waste Needing Disposal (Annual Transuranic Waste Inventory Report – 2019)[b]	
Contact-handled TRU waste total inventory volume[c]	42,600
Remote-handled TRU waste total inventory volume[d]	2,580
Projected TRU volume beyond 2033[e]	14,290
Present and Projected TRU Waste Needing Disposal (Other Potential NNSA Actions)	
TRU waste projected from SRS Pit Production (50 pits per year): 50-year projection[f]	22,950
TRU waste projected from LANL Plutonium Pit Production (30 pits per year): 50-year projection[g]	5,350
Projected TRU waste from surplus plutonium (7.1 MT of surplus Pu)[h]	365
Total of Present and Reasonably Foreseeable (Projected) Future Actions	**88,135**
Total Past, Present, and Reasonably Foreseeable Future Actions	**156,560**
Land Withdrawal Act TRU total waste volume[i]	**175,564**

m^3 = cubic meter; MT = metric ton; TRU = transuranic.

a. Volume represents the Land Withdrawal Act total volume of record. Information obtained from https://wipp.energy.gov/shipment-information.asp and is a snapshot of levels on July 25, 2020. Some waste that was emplaced at the WIPP facility between the inventory report on this date will show up in past, present, and projected waste volumes so there is a small variation on waste volume numbers depending on the dates of publication of these reports and the date the waste volumes emplaced is pulled from this website. Any future evaluation should start with a review of current TRU waste volumes at the WIPP facility online at this website.
b. Source: DOE 2019j.
c. DOE (2019j, Table 3-1) provides contact-handled TRU waste inventory projections through 2033. This volume includes TRU waste resulting from disposition of 6 metric tons of surplus plutonium (SR-KAC-PuOX).
d. DOE (2019j, Table 3-2) provides remote-handled TRU waste inventory projections through 2033.
e. DOE (2019j, Table 4-4) provides the projected TRU volume beyond 2033 as 18,400 cubic meters. The LANL waste stream LA-MHD01.001 (4,110 cubic meters) was subtracted from this total to prevent double counting of LANL TRU waste.
f. Annual waste volumes from Chapter 4, Section 4.9 of this EIS, multiplied by years of operation (50 years).
g. Annual waste volumes from NNSA 2020a, Table 3-7, multiplied by years of operation (50 years).
h. DOE (2019j, Table 4-2) provides the estimated DOE directed potential WIPP waste streams (SR-KAC-HET-1 and SR-KAC-PuOx-1), which represent TRU waste resulting from disposition of the 7.1 metric tons of surplus plutonium.
i. In accordance with the WIPP Land Withdrawal Act the total capacity of the WIPP facility volume is 6.2 million cubic feet (175,564 cubic meters).

5.3.5 Human Health

Cumulative impacts on human health could arise from construction and operations of the proposed SRPPF in combination with other past, present, and reasonably foreseeable future activities. The cumulative impacts analysis focuses on onsite workers and the offsite public in the ROI. Cumulative radiological health effects on the public in the vicinity of SRS are presented in terms of radiological doses and the resultant potential LCFs in the offsite population and to the hypothetical MEI. Cumulative radiological health effects on involved workers are presented in terms of radiological doses and the resultant potential excess LCFs in the workforce.

A summary of the annual cumulative radiological health effects on the public from routine SRS operations, other DOE actions previously evaluated (NNSA 2015), proposed DOE actions, and non-Federal nuclear facility operations (e.g., Vogtle Electric Generation Plant) is provided in Table 5-5.

Table 5-5—Annual Cumulative Population Health Effects of Exposure to Radiation at SRS

Activity		Population within 50 miles		Offsite MEI	
		Dose (person-rem per year)	Annual LCF Risk[a]	Dose (millirem per year)	Annual LCF Risk[a]
Past, Present, and Reasonably Foreseeable Future Actions					
Existing site activities (baseline)[b]		1.7	1.0×10^{-3}	0.21	1.3×10^{-7}
Other DOE actions evaluated in the SPD SEIS[c]		18	0.01	0.31	2.0×10^{-7}
SNF from foreign and domestic research reactors[d]		7.8	5.0×10^{-3}	0.21	7.0×10^{-8}
SPD SEIS proposed action[e]		0.97	0.0006	0.010	6.0×10^{-9}
Subtotal – Baseline Plus Other DOE Actions		**28.5**	**0.02**	**0.73**	**4.3×10^{-7}**
SRS Pit Production EIS[f]	No-Action Alternative	0	0	0	0
	Proposed Action – 50 pits per year	3.3×10^{-5}	1.9×10^{-8}	5.0×10^{-7}	3.0×10^{-13}
	Proposed Action – 80 pits per year	5.2×10^{-5}	3.1×10^{-8}	8.0×10^{-7}	4.8×10^{-13}
Total for Savannah River Site		**28.5**	**0.02**	**0.73**	**4.3×10^{-7}**
Plant Vogtle[g]		1.8	1.0×10^{-3}	2.4	1.4×10^{-6}
Total for Region		**30.3**	**0.02**	**(h)**	**(h)**

LCF = latent cancer fatality; MEI = maximally exposed individual.

a. LCFs are calculated using a conversion of 0.0006 LCF per rem or person-rem (DOE 2003). The annual LCFs for the analyzed population represent the number of LCFs calculated by multiplying the listed doses by the risk conversion factor; no population LCFs are expected from any individual activity or from all combined activities. The annual MEI LCF risk represents the calculated risk of an LCF to an individual.
b. Impact indicators are from Chapter 3, Section 3.10, of this EIS.
c. Contribution from the SWPF and tank closure (NNSA 2015, Table 4-38).
d. Dose values from alternative resulting in the greatest impact (DOE 2017c, Table 4-14)
e. Dose values from alternative resulting in the greatest impact (NNSA 2015, Table 4-38).
f. Impact indicators are from Chapter 4, Section 4.10.1, of this EIS.
g. Contribution from Plant Vogtle (NNSA 2015, Table 4-38).
h. The same individual would not be the MEI for all activities at SRS and Plant Vogtle; therefore, MEI impacts for SRS and Plant Vogtle have not been summed.

These estimates also include the potential human health impacts as identified in the SPD SEIS (NNSA 2015), which includes the WIPP Alternative. The WIPP Alternative evaluated disposition of the TRU waste associated with 13.1 metric tons of surplus pit and non-pit plutonium at the WIPP facility. The six metric tons of surplus plutonium is currently being diluted and prepared at the K Area Complex at SRS, and the 7.1 metric tons of surplus plutonium could be prepared at a combination of facilities using the K Area Complex at SRS and/or TA-55 facilities at LANL. As previously stated, the TRU wastes associated with the disposition of surplus plutonium would be prepared to meet the WIPP waste acceptance criteria and would be disposed of at the WIPP facility as contact-handled TRU waste. If this activity was conducted in the excess HC-2 space at the SRPPF, the potential human health impacts from preparation for disposal would be similar to impacts presented in the SPD SEIS.

As shown in Table 5-5, the maximum cumulative offsite population dose is estimated to be about 30.3 person-rem per year for the regional population. This population dose is not expected to result in any LCFs to the population within a 50-mile radius of SRS. The Proposed Action would not result in any additional cumulative human health impacts to the local population.

As indicated in Table 5-5, the maximum dose to the MEI at SRS is estimated to be about 0.73 millirem per year, which is below the applicable DOE regulatory limits (i.e., 10 millirem per year from airborne pathways, 4 millirem per year from the liquid pathway, and 100 millirem per year from all pathways). This is a very conservative estimate of potential dose to an MEI because the SRS activities contributing to this dose are not likely to occur at the same time and location.

Table 5-6 shows a summary of the annual cumulative worker doses and annual LCFs from routine SRS operations, the Proposed Alternative, other DOE actions previously evaluated (NNSA 2015), and proposed DOE actions. The maximum cumulative annual SRS worker dose could total 1,031.5 to 1,053.5 person-rem (base on 50 and 80 pits per year, respectively), which could result in up to 0.63 annual LCF. These doses fall within the regulatory limits of 10 CFR Part 835.

Table 5-6—Annual Cumulative Health Effects on SRS Workers from Exposure to Radiation

Activity		Involved Workers: Dose (person-rem per year)	Involved Workers: Annual LCF Risk[a]
Past, Present, and Reasonably Foreseeable Future Actions			
Existing site activities (baseline)[b]		116	0.07
Other DOE actions evaluated in the SPD SEIS[c]		59.5	0.036
SNF from foreign and domestic research reactors[d]		58	0.035
SPD SEIS proposed action[e]		620	0.37
Subtotal – Baseline Plus Other DOE Actions		**853.5**	**0.51**
SRS Pit Production EIS[f]	No-Action Alternative	0	0
	Proposed Action – 50 pits per year	178	0.11
	Proposed Action – 80 pits per year	200	0.12
Total for Savannah River Site[g]		**853.5–1,053.5**	**0.51–0.63**

LCF = latent cancer fatality.

a. LCFs are calculated using a conversion of 0.0006 LCF per rem or person-rem (DOE 2003). The annual LCFs for analyzed population represent the number of LCFs calculated by multiplying the listed doses by the risk conversion factor; no population LCFs are expected from any individual activity or from all combined activities. The annual MEI LCF risk represents the calculated risk of an LCF to an individual.

b. Impact indicators are from Chapter 3, Section 3.10, of this EIS.

c. Contribution from the SWPF and tank closure (NNSA 2015, Table 4-38.

d. Dose values from alternative resulting in the greatest impact (DOE 2017c, Table 4-15)

e. Dose values from alternative resulting in the greatest impact (NNSA 2015, Table 4-38).

f. Impact indicators are for pit production workers from Section 4.10.1 of this EIS and do not include security workers.

g. The range reflects the differences of doses and LCFs for the No-Action Alternative and 50 pits per year and 80 pits per year.

5.3.6 Transportation

<u>Local Transportation</u>

As stated in Chapter 4, Section 4.12.1.1, of this EIS, DOE previously evaluated the potential nonradiological impacts of transporting construction materials, personnel, and wastes to support construction of the MFFF (NNSA 2015, Appendix E). Tiering from that analysis, NNSA determined that the nonradiological impacts of transporting construction materials, personnel, and wastes for the SRPPF would result in less than one nonradiological traffic fatality.

Construction activities under the Proposed Action would also generate commuter traffic. However, this commuter traffic would be less than what was needed for MFFF construction activities that occurred between 2007 and 2018. As reflected in Chapter 3, Section 3.12.1 of this EIS, the LOS of area roads was established using data during MFFF construction, and area roads adequately supported those ongoing activities with no adverse effects on the LOS. The roads in Aiken, Barnwell, and Allendale counties in South Carolina that have the highest levels of traffic would continue to operate at LOS “A,” and roads in Augusta-Richmond County, Georgia, would continue to operate at currently designated LOS levels. Therefore, the overall contribution of construction activities to transportation impacts from the Proposed Action is expected to be negligible.

National Transportation

As stated in Section 4.12.1.2 of this EIS, the Proposed Action would involve offsite shipment of radiological and nonradiological materials and wastes during operations. Radiological materials and wastes to be transported include:

- Transport of pits between Pantex and SRS;
- Transport of HEU between SRS and Y-12;
- Transport of plutonium materials between other locations (e.g., LANL and Pantex) and SRS (for startup activities);
- Transport of TRU waste between SRS and WIPP; and
- Transport of LLW/MLLW between SRS and NNSS or a non-DOE commercial, licensed LLW/MLLW disposal facility.

The transport of the above materials could be via different routes.

The assessment of cumulative impacts for past, present, and reasonably foreseeable future actions involving radioactive material transport focuses on radiological impacts from offsite transportation throughout the nation that would result in potential radiation exposure to the general population, in addition to those impacts evaluated for the Proposed Action in this EIS. Cumulative radiological impacts from transportation are measured using the collective dose to the general population and workers because dose can be directly related to LCFs using a dose conversion factor.

Table 5-7 compares the potential impacts on transport workers and the general population from future transportation activities considered in this EIS with the cumulative impacts estimates from historical actions (SNF to SRS); past, present, and reasonably foreseeable future DOE actions; past, present, and reasonably foreseeable future non-DOE actions; and general radioactive material transport (1943 to 2073).

Table 5-7—Cumulative Transportation Impacts

Action		Crew Dose (person-rem)	Risk of Latent Cancer Fatality	Population Dose (person-rem)	Risk of Latent Cancer Fatality
Past, Present, and Reasonably Foreseeable Future DOE Actions as identified in the SPD SEIS (NNSA 2015)					
Historical (SNF to SRS) – (1953 to 1993)		49	0.03	25	0.02
Past, present, and reasonably foreseeable DOE actions[a]		30,900	18.5	36,700	22.5
Additional Reasonably Foreseeable Future DOE Actions since publication of the SPD SEIS (NNSA 2015)					
Permanent disposal or interim storage of SNF[b]		5,600–5,900	3.4–3.5	1,100–1,200	0.66–0.72
Greater-than-Class C waste EIS[c]		180	0.1	68	0.04
WIPP Supplement Analysis[d]		492	0.3	383	0.23
Production of tritium in a commercial light-water reactor[e]		25–60	0.02–0.04	2.7–12	0.0–0.01
SPD SEIS proposed action[f]		230–650	0.4	150–580	0.3
Total DOE Actions		**37,600**	**23**	**39,000**	**23**
Past, Present, and Reasonably Foreseeable Future Non-DOE Actions					
Enrichment facility in Lea County[g]		1,500	0.90	450	0.27
Eagle Rock enrichment facility[h]		3,350	2.01	60,000	36
GE Global laser enrichment[i]		242	0.15	419	0.25
American Centrifuge plant[j]		285	0.17	390	0.23
General radioactive material transport (1943 to 2073)[a]		384,000	230	338,000	203
Total Non-DOE Actions		**389,000**	**233**	**399,000**	**239**
Subtotal		**427,000**	**256**	**438,000**	**263**
SRS Pit Production EIS (50 years of operation)[k]	No-Action Alternative	0	0	0	0
	Proposed Action – 50 pits per year	581	0.40	334	0.17
	Proposed Action – 80 pits per year	901	0.48	455	0.23
Total Impacts (up to 2073)		**427,580–427,901**	**257**	**438,334–438,455**	**263**

a. Does not include the doses from shipping Greater-than-Class C waste.
b. Source: DOE 2008d, Table 8-14; assumed the Yucca Mountain, Nevada, surrogate for repository or interim storage.
c. Source: DOE 2016g, Table 4.3.9-1, pp. 4-68 and 4-69; DOE 2018a, p. 3-20
d. Source: DOE 2009, Table 2.
e. Source: DOE 2016h, Table F-12; calculated from LCFs.
f. Source: NNSA 2015.
g. Source: NRC 2005b. The values presented are for 30 years of operation.
h. Source: NRC 2011, Table 4-12.
i Source: NRC 2012, Table 4-14.
j. Source: NRC 2006.
k. Impact indicators are from Chapter 4, Tables 4-25 and 4-26, of this Final EIS.

CHAPTER 6

Index

6 INDEX

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A

B

C

E

R

S

T

V

W

Y

CHAPTER 7

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CHAPTER 8

List of Preparers

8 List of Preparers

U.S. Department of Energy/NNSA

Name	Education	Responsibility
Jane Summerson	Ph.D., Geology M.S., Geobiology M.A., Anthropology B.A., Anthropology	NEPA Compliance Officer
Jennifer Nelson	B.S., Education	NEPA Document Manager
James Sanderson	M.S., Chemical Engineering B.E., Chemical Engineering	NA-GC Reviewer
Mary-Ellen Noone	J.D., University of Baltimore B.A., Accounting	SRS Site Counsel
Kristen Dor	M.S., Natural Resources B.S., Environmental Science	NNSA Los Alamos Reviewer
Geary Pyles	J.D., University of Kentucky Bachelor of Science	NA-10 Representative Reviewer

Savannah River Nuclear Services

Name	Education	Responsibility
Keith Dyer	M.S., Ecology B.S., Natural Sciences	Data Development/Reviewer
Mary Flora	B.S., Geology	Data Development/Reviewer
Michele Wilson	B.S., Biology B.S., Construction Engineering Technology	Data Development/Reviewer
Mtesa Cottemond Wright	J.D., Yale University B.A., Government Environmental Studies	Reviewer

TRIAD

Name	Education	Responsibility
Maxine McReynolds	J.D., University of Colorado MBA BA	Reviewer
James Jackson	M.S., Environmental and Resource Management B.S., Ecology and Evolutionary Biology	Reviewer

This SRS Pit Production EIS is being prepared by Tetra Tech and its three subcontractors, Rivers Consulting, Inc., SC&A, Inc., and TechSource, Inc. The following tables list the EIS preparers from these organizations.

Tetra Tech

Name	Education/Expertise	Responsibility
Jay Rose	J.D., Catholic School of Law B.S., Ocean Engineering Over 30 years of experience	Deputy program manager
Maher Itani	M.E.A, Engineering Administration B.S., Civil Engineering Over 30 years of experience	Quality assurance
Jacqueline Boltz	M.B.A., Business B.A., French Language and Literature Over 25 years of experience	Public outreach
Delight Buenaflor	B.A., Biology Over 18 years of experience	Socioeconomics, environmental justice
Henry Garson	J.D., State University of New York at Buffalo School of Law B.S., Finance Over 45 years of experience	Sr. NEPA consultant
Kathy Roxlau	M.A., Anthropology B.A., Anthropology Over 30 years of experience	Cultural and historic resources
Stephen Sohinki	J.D., Georgetown University Law Center B.A., Political Science (summa cum laude) Over 44 years of experience	Regulatory subject matter expert
David Wertz	M.S., Geophysics B.S., Environmental Science Over 17 years of experience	Land use, visual resources, infrastructure

Rivers Consulting, Inc.

Name	Education/Expertise	Responsibility
Joseph Rivers	B.S., Mechanical Engineering Over 35 years of experience	Program manager
Joanne Stover	B.S., Business Administration Over 25 years of experience	Technical editor, administrative record
Keith Davis	M.S., Civil/Environmental Engineering B.S., Civil Engineering Over 40 years of experience	Water resources, waste management
Cindy Fasano	B.S., Chemical Engineering Over 30 years of experience	Air quality, noise
Greg Fasano	M.B.A., Business Administration B.S., Geology Over 37 years of experience	Geology and soils, data call coordination

Name	Education/Expertise	Responsibility
Ron Green	Ph.D., Zoology M.S., Wildlife Biology B.S., Wildlife Biology Over 30 years of experience	Ecological resources
Joe Ziegler	B.S., Engineering Over 40 years of experience	SRS liaison

SC&A Inc.

Name	Education/Expertise	Responsibility
Eric Cohen	M.S., Environmental Science in Civil Engineering B.A., Chemistry and Biology Over 39 years of experience	NEPA reviewer
Milton Gorden	B.S., Nuclear Engineering Over 29 years of experience	Transportation
Stephen Marschke	B.S., Nuclear Engineering Over 46 years of experience	Accidents
Amir Mobasheran	Ph.D., Nuclear Engineering M.S., Nuclear Engineering B.S., Physics Over 30 years of experience	Human health and safety

TechSource, Inc.

Name	Education/Expertise	Responsibility
Michael Blau	Ph.D., Mining Engineering/Metallurgy M.S., Metallurgy B.S., Physical Metallurgy B.S., Chemical Engineering Over 34 years of experience	Project engineer
Diana Hirrlinger	M.B.A. Organizational Behavior and Marketing B.S., Conservation of Natural Resources Over 35 years of experience	Sr. NEPA consultant
Mary Alice Spivey	B.S., Environmental Science Over 35 years of experience	Cumulative impacts

CHAPTER 9

Glossary

9 Glossary

NNSA has provided this glossary to assist readers in the interpretation of terms used in this SRS Pit Production EIS. The glossary includes definitions of technical and regulatory terms specific to this EIS. The main sources of the definitions in this glossary are the *Surplus Plutonium Disposition Final Supplemental Environmental Impact Statement* (NNSA 2015) and the *Final Complex Transformation Supplemental Programmatic Environmental Impact Statement* (NNSA 2008a) (see Chapter 7 of this EIS).

air pollutant—Generally, an airborne substance that could, in high enough concentrations, harm living things or cause damage to materials. From a regulatory perspective, an air pollutant is a substance for which emissions or atmospheric concentrations are regulated or for which maximum guideline levels have been established due to potential harmful effects on human health and welfare.

air quality control region—An interstate or intrastate area designated by the U.S. Environmental Protection Agency for the attainment and maintenance of National Ambient Air Quality Standards (NAAQS).

air quality standards—The level of pollutants in the air prescribed by regulations that may not be exceeded during a specified time in a defined area.

ALARA—*See* as low as reasonably achievable.

ambient air quality standards—The level of pollutants in the air prescribed by government regulations that may not be exceeded during a specified time in a defined area. Air quality standards are used to provide a measure of the health-related and visual characteristics of the air.

aquifer—An underground geologic formation, group of formations, or part of a formation capable of yielding a significant amount of water to wells or springs.

as low as reasonably achievable (ALARA)—An approach to radiation protection to manage and control worker and public exposures (both individual and collective) and releases of radioactive material to the environment to as far below applicable limits as social, technical, economic, practical, and public policy considerations permit. ALARA is not a dose limit, but a process for minimizing doses to as far below limits as is practicable.

attainment area—An area that the U.S. Environmental Protection Agency has designated as being in compliance with one or more of the National Ambient Air Quality Standards (NAAQS) for sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and particulate matter. An area may be in attainment for some pollutants but not for others. (*See* National Ambient Air Quality Standards, nonattainment area, and particulate matter.)

background radiation—Radiation from (1) cosmic sources; (2) naturally occurring radioactive materials, including radon (except as a decay product of source or special nuclear material); and (3) global fallout as it exists in the environment (e.g., from the testing of nuclear explosive devices).

baseline—For *National Environmental Policy Act* evaluations, baseline is defined as the existing environmental conditions against which impacts of the Proposed Action and its alternatives can be compared.

best management practices—Best management practices are policies, practices, and measures that reduce the environmental impacts of proposed activities, functions, or processes.

beryllium—An extremely lightweight element with the atomic number 4, it is metallic and used in reactors as a neutron reflector.

block—U.S. Bureau of the Census term describing small areas bounded on all sides by visible features or political boundaries; used in tabulation of census data.

canyon—As used at the Savannah River Site, a large heavily shielded concrete building containing a remotely operated plutonium and uranium processing facility.

capable fault—A fault is described as capable if it has had movement at or near the ground surface at least once within the past 35,000 years or recurrent movement within the past 500,000 years.

carbon monoxide—A colorless, odorless gas that is toxic, due to the formation of carboxyhemoglobin in the bloodstream, if breathed in high concentrations over an extended period.

Carolina bay—Closed, elliptical depressions capable of holding water that are common to South Carolina. A Carolina bay is a type of wetland. (*See* wetlands.)

conformity—Conformity is defined in the Clean Air Act as the action's compliance with an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards, expeditious attainment of such standards, and that such activities will not (1) cause or contribute to any new violation of any standard in any area; (2) increase the frequency or severity of any existing violation of any standard in any area; or (3) delay timely attainment of any standard, required interim emission reduction, or other milestones in any area.

contact-handled waste—A waste classification defined by WIPP to be TRU waste with a surface dose rate of less than 200 millirem per hour. (*See* remote-handled waste.)

container—In regard to radioactive waste, the metal envelope in the waste package that provides the primary containment function of the waste package, which is designed to meet the containment requirements of 10 CFR Part 60.

Council on Environmental Quality regulations—Regulations at 10 CFR Parts 1500–1508 that direct Federal agencies in complying with the procedures of and achieving the goals of the *National Environmental Policy Act*.

Cretaceous—A geologic time period thought to have covered the span of time between approximately 135 and 65 million years ago; also the corresponding system of rocks.

criteria pollutant—An air pollutant that is regulated under the National Ambient Air Quality Standards. The U.S. Environmental Protection Agency must describe the characteristics and potential health and welfare effects that form the basis for setting, or revising, the standard for each regulated pollutant. Criteria pollutants include sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and two size classes of particulate matter (that is less than 10 micrometers [0.0004 inch] in diameter, and that is less than 2.5 micrometers [0.0001 inch] in diameter). New pollutants may be added to, or removed from, the list of criteria pollutants as more information becomes available. (*See* National Ambient Air Quality Standards.)

critical habitat—Habitat essential to the conservation of an endangered species or threatened species that has been designated as critical by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures outlined in the *Endangered Species Act* and its implementing regulations (50 CFR Part 424). The lists of critical habitats can be found in 50 CFR 17.95 (fish and wildlife), 50 CFR 17.96 (plants), and 50 CFR Part 226 (marine species). (*See* endangered species and threatened species.)

criticality—The condition in which a system undergoes a sustained nuclear chain reaction.

cultural resources—Protected resources, including archaeological sites, architectural features, traditional-use areas, and American Indian sacred sites.

cumulative impacts—Impacts on the environment that result when the incremental impact of a proposed action is added to the impacts from other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes the other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

curie—A unit of radioactivity equal to 37 billion disintegrations per second (i.e., 37 billion Becquerel); also a quantity of any radionuclide or mixture of radionuclides having 1 curie of radioactivity.

decibel—A unit for expressing the relative intensity of sounds on a logarithmic scale from zero for the average least perceptible sound to about 130 for the average level at which sound causes pain to humans. For traffic and industrial noise measurements, the A-weighted decibel, a frequency-weighted noise unit, is widely used. The A-weighted decibel scale corresponds approximately to the frequency response of the human ear and thus correlates well with loudness.

decommissioning—The process of safely closing a nuclear power plant (or other facility where nuclear materials are handled) to retire it from service after its useful life has ended. This process primarily involves decontaminating the facility to reduce residual radioactivity and then releasing the property for unrestricted or (under certain conditions) restricted use. This often includes dismantling the facility or dedicating it to other purposes. Decommissioning begins after the nuclear fuel, coolant, and radioactive waste are removed.

decontamination—A process used to reduce, remove, or neutralize radiological, chemical, or biological contamination to reduce the risk of exposure. Decontamination may be accomplished by cleaning or treating surfaces to reduce or remove the contamination; filtering contaminated air or water; subjecting contamination to evaporation and precipitation; or covering the contamination to shield or absorb the radiation. The process can also simply allow adequate time for natural radioactive decay to decrease the radioactivity.

design optimizations—Options that are being considered early in the design process that have the potential to affect construction of the SRPPF complex and the internal facility layout.

direct employment—The number of jobs required to implement an alternative.

dose—A generic term meaning absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or committed equivalent dose. For ionizing radiation, the energy imparted to matter by ionizing radiation per unit mass of the irradiated material (e.g., biological tissue). The units of absorbed dose are the rad and the gray. In many publications, the rem is used as an approximation of the rad.

dose equivalent—A measure of radiological dose that correlates with biological effect on a common scale for all types of ionizing radiation. Defined as a quantity equal to the absorbed dose in tissue multiplied by a quality factor (the biological effectiveness of a given type of radiation) and all other necessary modifying factors at the location of interest. The units of dose equivalent are the rem and sievert.

dose rate—The radiation dose delivered per unit of time (e.g., rem per year).

drinking water standard—The level of constituents or characteristics in a drinking water supply specified in regulations under the *Safe Drinking Water Act* as the maximum permissible.

ecosystem—A community of organisms and their physical environment interacting as an ecological unit.

effective dose equivalent—The dose value obtained by multiplying the dose equivalents received by specified tissues or organs of the body by the appropriate weighting factors applicable to the tissues or organs irradiated, and then summing all of the resulting products. It includes the dose from radiation sources internal and external to the body. The effective dose equivalent is expressed in units of rem or Sieverts.

effluent—A waste stream flowing into the atmosphere, surface water, groundwater, or soil. Most frequently the term applies to wastes discharged to surface waters.

emission standards—Legally enforceable limits on the quantities or kinds of air contaminants that can be emitted into the atmosphere.

endangered species—Plants or animals that are in danger of extinction through all or a significant portion of their ranges and that have been listed as endangered by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures outlined in the *Endangered Species Act* and its implementing regulations (50 CFR Part 424). The lists of endangered species can be found in 50 CFR 17.11 (wildlife), 50 CFR 17.12 (plants), and 50 CFR 222.23(a) (marine organisms). (*See* critical habitat and threatened species.)

environmental justice—The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, State, local, and Tribal programs and policies. Executive Order 12898 directs Federal agencies to make achieving environmental justice part of their missions by identifying and addressing disproportionately high and adverse effects of agency programs, policies, and activities on minority and low-income populations. (*See* minority population and low-income population.)

fault—A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred.

Finding of No Significant Impact—A public document issued by a Federal agency briefly presenting the reasons why an action for which the agency has prepared an environmental assessment has no potential to have a significant effect on the human environment and, thus, will not require preparation of an environmental impact statement. (*See* environmental assessment and environmental impact statement.)

floodplains—The lowlands and relatively flat areas adjoining inland and coastal waters and the flood-prone areas of offshore islands. Floodplains include, at a minimum, that area with at least a 1-percent chance of being inundated by a flood in any given year. Such a flood is known as a 100-year flood.

fugitive emissions—(1) Emissions that do not pass through a stack, vent, chimney, or similar opening where they could be captured by a control device, or (2) any air pollutant emitted to the atmosphere other than from a stack. Sources of fugitive emissions include pumps; valves; flanges; seals; area sources such as ponds, lagoons, landfills, and piles of stored material (such as coal); and road construction areas or other areas where earthwork is occurring.

geology—The earth science that deals with the study of the materials, processes, environments, and history of the earth, including rocks and their formation and structure.

glovebox—Enclosure that separates workers from equipment used to process hazardous material, while allowing the workers to be in physical contact with the equipment; normally constructed of stainless steel, with large acrylic/lead glass windows. Workers have access to equipment through the use of heavy-duty, lead-impregnated rubber gloves, the cuffs of which are sealed in portholes in the glovebox windows.

groundwater—Water below the ground surface in a zone of saturation.

hazardous air pollutants (HAPs)—Air pollutants not covered by ambient air quality standards, but that may present a threat of adverse human health or environmental effects. Those specifically listed in 40 CFR 61.01 are asbestos, benzene, beryllium, coke oven emissions, inorganic arsenic, mercury, radionuclides, and vinyl chloride. More broadly, HAPs are any of the 189 pollutants listed in or pursuant to Section 112(b) of the Clean Air Act. Very generally, HAPs are any air pollutants that may realistically be expected to pose a threat to human health or welfare.

hazardous chemical—Under 29 CFR Part 1910, Subpart Z, hazardous chemicals are defined as "any chemical which is a physical hazard or a health hazard." Physical hazards include combustible liquids, compressed gases, explosives, flammables, organic peroxides, oxidizers, pyrophorics, and reactives. A health hazard is any chemical for which there is good evidence that acute or chronic health effects occur in exposed employees. Hazardous chemicals include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, agents that act on the hematopoietic system, and agents that damage the lungs, skin, eyes, or mucous membranes.

hazardous material—A material, including a hazardous substance as defined by 49 CFR 171.8, that poses a risk to health, safety, and property when transported or handled.

hazardous waste—A category of waste regulated under the *Resource Conservation and Recovery Act* (RCRA). To be considered hazardous, a waste must be a solid waste under RCRA and must exhibit at least one of four characteristics described in 40 CFR 261.20–24 (i.e., ignitability, corrosivity, reactivity, or toxicity), or be specifically listed by the U.S. Environmental Protection Agency in 40 CFR 261.31–33.

high-efficiency particulate air filter—An air filter capable of removing at least 99.97 percent of particles 0.3 micrometers (about 0.00001 inches) in diameter. These filters include a pleated fibrous medium (typically fiberglass) capable of capturing very small particles.

high-level radioactive waste—Defined by statute (the *Nuclear Waste Policy Act*) to mean the highly radioactive waste material resulting from the reprocessing of used nuclear fuel, including liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and other highly radioactive material that the U.S. Nuclear Regulatory Commission (NRC), consistent with existing law, determines by rule requires permanent isolation.

On October 10, 2018, DOE issued 83 FR 50909, requesting public comment on a revision to its interpretation of the statutory term, "high-level radioactive waste" (HLW). On June 10, 2019, DOE issued a Supplemental Notice (84 FR 26830) that provides additional explanation of DOE's interpretation of HLW, as informed by public review and comment and further consideration by DOE following the October 10 notice. DOE now interprets the statutes to provide that reprocessing waste may be determined to be non-HLW if the waste meets either of the following two criteria:

> I) does not exceed concentration limits for Class C low-level radioactive waste as set out in section 61.55 of title 10, Code of Federal Regulations, and meets the performance objectives of a disposal facility; or
>
> II) does not require disposal in a deep geologic repository and meets the performance objectives of a disposal facility as demonstrated through a performance assessment conducted in accordance with applicable requirements.

DOE has not made, and does not presently propose, any changes or revisions to current policies, legal requirements or agreements with respect to HLW. Decisions about whether and how this interpretation of HLW will apply to existing wastes and whether such wastes may be managed as non-HLW will be the subject of subsequent actions.

highly enriched uranium—Uranium whose content of the fissile isotope uranium-235 has been increased through enrichment to 20 percent or more (by weight). Highly enriched uranium can be used in making nuclear weapons and also as fuel for some isotope-production, research, naval propulsion, and power reactors.

incident-free—Normal transport or operation.

incident-free risk—The radiological or chemical impacts resulting from emissions during normal operations and packages aboard vehicles in normal transport. This includes the radiation or hazardous chemical exposure of specific population groups such as crew, passengers, and bystanders.

indirect employment—Jobs generated or lost in related industries within a regional economic area as a result of a change in direct employment.

industrial wastewater—Used water that contains chemicals or pollutants from industrial or manufacturing processes.

latent cancer fatalities—Deaths from cancer resulting from and occurring sometime after exposure to ionizing radiation or other carcinogens.

liquefaction—A process by which water-saturated sediment temporarily loses strength and acts as a fluid. This effect can be caused by earthquake shaking.

low-income population—Defined in terms of U.S. Census Bureau annual statistical poverty levels, a population may consist of groups or individuals who live in geographic proximity to one another or who are geographically dispersed or transient (e.g., migrant workers or Native Americans), where the population experiences common conditions of environmental exposure or effect. (*See* environmental justice and minority population.)

low-level radioactive waste—Radioactive waste that is not classified as high-level radioactive waste, transuranic waste, used nuclear fuel, or byproduct tailings from processing of uranium or thorium ore.

marsh—An area of low-lying wetland dominated by grass-like plants. (*See* wetlands.)

material-at-risk—The amount of radionuclides in curies of activity or grams for each radionuclide available for release when acted upon by a given physical insult, stress, or accident. The material-at-risk is specific to a given process in the facility of interest. It is not necessarily the total quantity of material present, but it is that amount of material in the scenario of interest postulated to be available for release.

material control and accountability—The part of safeguards that detects or deters theft or diversion of nuclear materials and provides assurance that all nuclear materials are accounted for appropriately.

maximally exposed individual—A hypothetical individual whose location and habits result in the highest total radiological or chemical exposure (and thus dose) from a particular source for all exposure routes (i.e., inhalation, ingestion, direct exposure, resuspension).

migration—The natural movement of a material through the air, soil, or groundwater; also, seasonal movement of animals from one area to another.

minority population—Minority populations exist where either: (1) the minority population of the affected area exceeds 50 percent, or (2) the minority population percentage of the affected area is meaningfully greater than in the general population or other appropriate unit of geographic analysis (such as a governing body's jurisdiction, a neighborhood, census tract, or other similar unit). "Minority" refers to individuals who are members of the following population groups: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic. "Minority populations" include either a single minority group or the total of all minority persons in the affected area. They may consist of groups of individuals living in geographic proximity to one another or a geographically dispersed/transient set of individuals (such as migrant workers or American Indians), where the population experiences common conditions of environmental exposure or effect. (*See* environmental justice and low-income population.)

mitigation—Mitigation includes (1) avoiding an impact altogether by not taking a certain action or parts of an action; (2) minimizing impacts by limiting the degree or magnitude of an action and its implementation; (3) rectifying an impact by repairing, rehabilitating, or restoring the affected environment; (4) reducing or eliminating the impact over time by preservation and maintenance operations during the life of an action; or (5) compensating for an impact by replacing or providing substitute resources or environments.

mixed low-level radioactive waste—Waste that contains both hazardous waste, as defined under the *Resource Conservation and Recovery Act*, and source, special nuclear, or byproduct material subject to the *Atomic Energy Act*.

Modified Mercalli Intensity—A level on the modified Mercalli scale. A measure of the perceived intensity of earthquake ground shaking with 12 divisions, from I (not felt by people) to XII (nearly total damage). It is a unitless expression of observed effects.

National Ambient Air Quality Standard—Standards defining the highest allowable levels of certain pollutants in the ambient air (the outdoor air to which the public has access). Because the U.S. Environmental Protection Agency must establish the criteria for setting these standards, the regulated pollutants are called criteria pollutants. Criteria pollutants include sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, and two size classes of particulate matter (that less than or equal to 10 micrometers [0.0004 inch] in diameter and that less than or equal to 2.5 micrometers [0.0001 inch] in diameter). Primary standards are established to protect public health; secondary standards are established to protect public welfare (such as visibility, crops, animals, buildings). (*See* criteria pollutant.)

National Emission Standards for Hazardous Air Pollutants (NESHAPs)—Emissions standards set by the U.S. Environmental Protection Agency for air pollutants that are not covered by National Ambient Air Quality Standards and that may, at sufficiently high levels, cause increased fatalities, irreversible health effects, or incapacitating illness. These standards are given in 40 CFR Parts 61 and 63. NESHAPs are given for many specific categories of sources (e.g., equipment leaks, industrial process cooling towers, dry cleaning facilities, petroleum refineries). (*See* hazardous air pollutants.)

National Pollutant Discharge Elimination System (NPDES)—A provision of the *Clean Water Act* that prohibits discharge of pollutants into waters of the United States unless a special permit is issued by the U.S. Environmental Protection Agency, a state, or, where delegated, a tribal government on an American Indian reservation. The NPDES permit lists either permissible discharges, the level of cleanup technology required for wastewater, or both.

National Register of Historic Places (NRHP)—The official list of the Nation's cultural resources that are worthy of preservation. The National Park Service maintains the list under direction of the Secretary of the Interior. Districts, sites, buildings, structures, and objects are included in the NRHP for their importance in American history, architecture, archaeology, culture, or engineering. Properties included on the NRHP range from large-scale, monumentally proportioned buildings to smaller-scale, regionally distinctive buildings. The listed properties are not just of nationwide importance; most are significant primarily at the state or local level. Procedures for listing properties on the NRHP are found in 36 CFR Part 60.

Nitrogen dioxide—One of several nitrogen oxides. These are produced in the combustion of fossil fuels and can constitute an air pollution problem. Nitrogen dioxide emissions contribute to acid deposition and the formation of atmospheric ozone.

nonattainment area—An area that the U.S. Environmental Protection Agency has designated as not meeting (i.e., not being in attainment of) one or more of the National Ambient Air Quality Standards for sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, or both sizes of particulate matter (i.e., that with an aerodynamic diameter less than or equal to 10 or 2.5 micrometers [0.0004 or 0.0001 inches]). An area may be in attainment for some pollutants, but not for others. (*See* attainment area, National Ambient Air Quality Standards, and particulate matter.)

nonhazardous waste—Any garbage or refuse; sludge from a wastewater treatment plant, water supply treatment plant, or air pollution control facility; and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities that is not otherwise characterized as radioactive or hazardous.

non-pit plutonium—Plutonium-239 was made in nuclear reactors for use in nuclear weapons. Historically, the United States operated weapons material production reactors at the Savannah River Site and the Hanford Reservation. The term "non-pit plutonium" refers to plutonium that is not in the metal pit form that is the core of a nuclear weapon. Non-pit plutonium may be in metal or oxide form, or may be associated with other materials that were used in the process of manufacturing and fabrication of plutonium for use in nuclear weapons. The non-pit plutonium discussed in this environmental impact statement was in some phase of the production cycle when the Cold War ended and the United States ceased production of plutonium. Some non-pit plutonium was generated during research and development activities that support weapons production. Most surplus non-pit plutonium is currently stored at the Savannah River Site.

nonproliferation—Preventing the spread of nuclear weapons, nuclear weapons materials, or nuclear weapons technology to rogue nations, terrorists, and countries that have not signed nonproliferation agreements.

Notice of Availability—A formal notice, published in the *Federal Register*, that announces the issuance and public availability of a draft or final environmental impact statement. The U.S. Environmental Protection Agency Notice of Availability is the official public notification of an environmental impact statement; a U.S. Department of Energy Notice of Availability is an optional notice used to provide information to the public.

Notice of Intent—Public announcement that an environmental impact statement will be prepared and considered. It describes the Proposed Action, possible alternatives, and scoping process, including whether, when, and where any scoping meetings will be held. The Notice of Intent is usually published in the *Federal Register* and in the local media. The scoping process includes holding at least one public meeting and requesting written comments on issues and environmental concerns that an environmental impact statement should address.

nuclear material—Composite term applied to (1) special nuclear material; (2) source material such as uranium, thorium, or ores containing uranium or thorium; and (3) byproduct material, which is any radioactive material that is made radioactive by exposure to the radiation incident or to the process of producing or using special nuclear material.

operational variation— Potential changes to internal processes of the SRPPF that are analyzed to provide flexibility in the NEPA coverage to address uncertainties in this early stage of review.

oxide—A compound formed when an element (e.g., plutonium) is bonded to oxygen.

ozone—The tri-atomic form of oxygen, which in the stratosphere protects the earth from the sun's ultraviolet rays but, at lower atmospheric levels, is an air pollutant. Ozone is a major constituent of smog.

packaging—For radioactive materials, a container consisting of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or absorbing mechanical shock; all to ensure compliance with U.S. Department of Transportation 49 CFR Parts 171–180 and U.S. Nuclear Regulatory Commission 10 CFR Part 71 regulations.

particulate matter (PM)—Any finely divided solid or liquid material, other than uncombined (i.e., pure) water. A subscript denotes the upper limit of the diameter of particles included. Thus, PM_{10} includes only those particles equal to or less than 10 micrometers (0.0004 inch) in diameter; $PM_{2.5}$ includes only those particles equal to or less than 2.5 micrometers (0.0001 inch) in diameter. Particulate matter can result in increased respiratory symptoms, decreased lung function, aggravated asthma, chronic bronchitis, irregular heartbeat, nonfatal heart attacks, and premature death in people with heart or lung disease. $PM_{2.5}$ is a major cause of reduced visibility. Particulate matter can contribute to acidification of streams and lakes, changes in nutrient balance of coastal waters and larger river basins, depletion of nutrients in soil, damage to forests and crops, and damage to stone and other building materials.

peak ground acceleration—A measure of the maximum horizontal acceleration (as a percentage of the acceleration due to the earth's gravity) experienced by a particle on the surface of the earth during the course of earthquake motion.

Perimeter Intrusion Detection and Assessment System—A mutually supporting combination of barriers, clear zones, lighting, and electronic intrusion detection, assessment, and access control systems constituting the perimeter of a Complex protected area and designed to detect, impede, control, or deny access to the protected area.

person-rem—A unit of collective radiation dose applied to populations or groups of individuals; that is, a unit for expressing the dose when summed across all persons in a specified population or group. One person-rem equals 0.01 person-Sieverts.

pit—The core element of a nuclear weapon's "primary" or fission component. The pit contains a potentially critical mass of fissile material, such as plutonium-239 or highly enriched uranium, arranged in a subcritical geometry and surrounded by some type of casing.

plutonium—A heavy radioactive, metallic element with the atomic number 94. It is produced artificially by neutron bombardment of uranium and is used in the production of nuclear weapons. Plutonium has 15 isotopes with atomic mass numbers ranging from 232 to 246 and half-lives from 20 minutes to 76 million years. Its most important isotope is fissile plutonium-239. Weapons-usable plutonium consists mainly of plutonium-239, which has a radiological half-life of 24,110 years.

prevention of significant deterioration—Regulations established to prevent significant deterioration of air quality in areas that already meet National Ambient Air Quality Standards. Specific details of prevention of significant deterioration are found in 40 CFR 51.166. Among other provisions, cumulative increases in levels of sulfur dioxide, nitrogen dioxide, and particulate matter equal to or less than 10 micrometers (0.0004 inch) in diameter after specified baseline dates must not exceed specified maximum allowable amounts. These allowable increases, also known as increments, are especially stringent in areas designated as Class I areas (such as national parks, wilderness areas) where the preservation of clean air is particularly important. All areas not designated as Class I are currently designated as Class II. Maximum increments in pollutant levels are also given in 40 CFR 51.166 for Class III areas, if any such areas should be so designated by the U.S. Environmental Protection Agency. Class III increments are less stringent than those for Class I or Class II areas. (*See* National Ambient Air Quality Standards.)

prime farmland—Under the *Farmland Protection Policy Act of 1981*, defined as land with the best combination of physical and chemical characteristics (i.e., soil quality, growing season, and moisture supply) for economically producing high yields of food, feed, forage, fiber, and oilseed crops, with minimum inputs of fuel, fertilizer, pesticides, and labor without intolerable soil erosion. Land classified as prime farmland includes crop land, pasture land, range land, and forest land, but not urban or built-up land or land covered with water. Prime farmlands are designated by the Natural Resources Conservation Service.

Protected Area—A type of security area defined by physical barriers (i.e., walls or fences), to which access is controlled, used for protection of security Category II special nuclear materials and classified matter and/or to provide a concentric security zone surrounding a material access area (security Category I nuclear materials) or a vital area.

radioactive waste—In general, waste that is managed for its radioactive content. Waste material that contains source, special nuclear, or byproduct material is subject to regulation as radioactive waste under the *Atomic Energy Act*. Also, waste material that contains accelerator-produced radioactive material or a high concentration of naturally occurring radioactive material may be considered radioactive waste.

Record of Decision (ROD)—A concise public document that records a Federal agency's decision(s) concerning a proposed action for which the agency has prepared an environmental impact statement. The ROD is prepared in accordance with the requirements of the Council on Environmental Quality National Environmental Policy Act regulations (40 CFR 1505.2). A ROD identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), factors balanced by the agency in making the decision, whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why they were not. (*See* environmental impact statement.)

region of influence—The physical area that bounds the environmental, sociological, economic, or cultural features of interest for the purpose of analysis.

remote-handled waste—A waste classification defined by WIPP to be TRU waste with a surface dose rate 200 millirem per hour or greater. (*See* contact-handled waste.)

repository—A facility for disposal of radioactive waste.

reverse fault—A fault along which the hanging wall has been raised relatively to the foot wall.

Richter magnitude—The Richter scale magnitudes are based on a logarithmic scale (base 10), which means that for each whole number increase on the Richter scale, the amplitude of the ground motion recorded by a seismograph goes up 10 times. Using this scale, a magnitude 5 earthquake would result in 10 times the level of ground shaking as a magnitude 4 earthquake.

risk—The probability of a detrimental effect from exposure to a hazard. Risk is often expressed quantitatively as the probability of an adverse event occurring multiplied by the consequence of that event (i.e., the product of these two factors). However, separate presentation of probability and consequence is often more informative.

safe, secure transport system—A specially designed part of an 18-wheel rig that incorporates various deterrents to prevent unauthorized removal of cargo. The trailer has been designed to protect the cargo against damage in the event of an accident. Escort vehicles accompany the tractor-trailers during transportation activities. These tractors and escort vehicles are equipped with communications, electronic, and other equipment that further enhance en-route safety and security.

sanitary wastes—Nonhazardous, nonradioactive liquid and solid wastes generated by normal housekeeping activities.

sanitary wastewater—Used water collected from residences, offices and institutions. Examples of sanitary wastewater is the liquid waste from bathrooms, showers, toilets, sinks and kitchens. SRS sanitary wastewater goes to the Central Sanitary Wastewater Treatment Facility.

scoping—An early and open process, including public notice and involvement, for determining the scope of issues to be addressed in an environmental impact statement and for identifying the significant issues related to a Proposed Action. The scoping period begins after publication in the *Federal Register* of a Notice of Intent to prepare an environmental impact statement. The public scoping process is that portion of the process where the public is invited to participate. The U.S. Department of Energy's scoping procedures are found in 10 CFR 1021.311.

security—An integrated system of activities, systems, programs, facilities, and policies for the protection of Restricted Data and other classified information or matter, nuclear materials, nuclear weapons and nuclear weapons components, and/or U.S. Department of Energy or contractor facilities, property, and equipment.

soft-zones—Small, discontinuous, thin subsurface sand zones containing calcium carbonate. Soft zones at SRS are limited in size and areal extent, and are poorly interconnected.

solid waste—For purposes under the *Resource Conservation and Recovery Act*, solid waste is any garbage; refuse; sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and/or other discarded material. Solid waste includes solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. Solid waste does not include solid or dissolved materials in domestic sanitary wastewater or irrigation return flows or industrial discharges, which are point sources subject to permits under Section 402 of the *Clean Water Act*. Finally, solid waste does not include source, special nuclear, or byproduct material as defined by the *Atomic Energy Act*. A more detailed regulatory definition of solid waste can be found in 40 CFR 261.2.

source term—The amount of a specific pollutant (e.g., chemical, radionuclide) emitted or discharged to a particular environmental medium (e.g., air, water) from a source or group of sources. It is usually expressed as a rate (i.e., amount per time).

special nuclear material—As defined in Section 11 of the Atomic Energy Act: "(1) plutonium, uranium enriched in the isotope 233 or in the isotope 235, and any other material which the U.S. Nuclear Regulatory Commission determines to be special nuclear material, or (2) any material artificially enriched by any of the foregoing."

There are four designated categories of special nuclear material (Categories I, II, III, and IV), consistent with DOE Manual 470.4–6, "Nuclear Material Control and Accountability," determined by the quantity and type of special nuclear material or a designation of a special nuclear material location based on the type and form of the material and the amount of nuclear material present. A designation of the significance of special nuclear material based upon the material type, the form of the material, and the amount of material present in an item, grouping of items, or in a location.

spent nuclear fuel—Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated. Also known as used nuclear fuel.

State Historic Preservation Office—State office charged with the identification and protection of prehistoric and historic resources in accordance with the *National Historic Preservation Act*.

stormwater—Stormwater runoff, snow melt runoff, and surface runoff and drainage (40 CFR 122.26(b)(13)).

sulfur dioxide—A heavy, pungent colorless gas formed in the combustion of fossil fuels and considered a major air pollutant. During its long-range transport, it can combine with water vapor to form sulfuric acid, which contributes to the formation of acid rain, which damages trees, crops, and buildings and makes soils, lakes, and streams acidic. It also contributes to reduced visibility and can irritate the upper respiratory tract and cause lung cancer.

supplement analysis—A document prepared under the U.S. Department of Energy's *National Environmental Policy Act* implementing guidelines (10 CFR 1021.314(c)) to provide the information and analysis of proposed activities necessary to determine whether a supplemental or new environmental impact statement is required.

supplemental environmental impact statement—A document prepared as a supplement to an environmental impact statement, required when a change in a Proposed Action is substantial and relevant to environmental concerns or when new circumstances or information relevant to environmental concerns are significant.

surface water—All bodies of water on the surface of the Earth and open to the atmosphere, such as rivers, lakes, reservoirs, ponds, seas, and estuaries.

Tertiary—A geologic time period thought to have covered the span of time between approximately 65 and 2 million years ago; also the corresponding system of rocks.

threatened species—Any plants or animals that are likely to become endangered species within the foreseeable future throughout all or a significant portion of their ranges and have been listed as threatened by the U.S. Fish and Wildlife Service or the National Marine Fisheries Service following the procedures set out in the *Endangered Species Act* and its implementing regulations (50 CFR Part 424). The list of threatened species can be found at 50 CFR 17.11 (wildlife), 17.12 (plants), and 227.4 (marine organisms). (*See* critical habitat and endangered species.)

transuranic—Of, relating to, or being any element whose atomic number is higher than that of uranium (i.e., atomic number 92), including neptunium, plutonium, americium, and curium. All transuranic elements are produced artificially and are radioactive.

transuranic waste— In accordance with the *Waste Isolation Pilot Plant Land Withdrawal Act*, "the term 'transuranic waste' means waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for – (A) high-level radioactive waste; (B) waste that the Secretary has determined, with the concurrence of the Administrator, does not need the degree of isolation required by the disposal regulations; or (C) waste that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with Part 61 of Title 10, Code of Federal Regulations." WIPP is authorized to accept TRU waste that was generated from atomic energy defense activities. The TRU waste shipped from SRS and projected to be generated at SRPPF is, and would be, defense-related TRU waste. Throughout this SRS Pit Production EIS, the defense-related TRU waste from SRS and SRPPF is referred to as TRU waste.

Type A packaging—As defined at 49 CFR Part 173, Subpart I, A regulatory category of packaging for transportation of radioactive material designed to protect and retain its contents under normal transport conditions. It must maintain sufficient shielding to limit radiation exposure to handling personnel. (See Packaging)

Type B packaging—As defined at 49 CFR Part 173, Subpart I, A regulatory category of packaging for transportation of radioactive material used to transport material with the highest radioactivity levels and is designed to protect and retain its contents under transportation accident conditions. (See Packaging)

visual resource management—A process devised by the Bureau of Land Management to assess the aesthetic quality of a landscape, and consistent with the results of that analysis, to design proposed activities so as to minimize their visual impact on that landscape. The process consists of a rating of visual quality followed by a measurement of the degree of contrast between proposed development activities and the existing landscape. Four classifications are employed to describe different degrees of modification to landscape elements: Class I, areas where the natural landscape is preserved, including national wilderness areas and the wild sections of national wild and scenic rivers; Class II, areas with very limited land development activity, resulting in visual contrasts that are seen but do not attract attention; Class III, areas in which development may attract attention, but the natural landscape still dominates; and Class IV, areas in which development activities may dominate the view and may be the major focus in the landscape.

volatile organic compounds—A broad range of organic compounds, often halogenated, that vaporize at ambient or relatively low temperatures (e.g., benzene, chloroform, and methyl alcohol). With respect to air pollution, any non-methane organic compound that participates in atmospheric photochemical reaction, except for those designated by the U.S. Environmental Protection Agency as having negligible photochemical reactivity.

Waste Isolation Pilot Plant—A U.S. Department of Energy facility designed and authorized to permanently dispose of defense-related contact-handled and remote-handled transuranic radioactive waste in a mined underground facility in deep geologic salt beds. It is located in southeastern New Mexico, 26 miles east of the city of Carlsbad.

wastewater—Water originating from human sanitary wastewater use (i.e., domestic wastewater) and from a variety of industrial processes (i.e., industrial wastewater).

water quality standards—Limits on the concentrations of specific constituents or on the characteristics of water, often based on water use classifications (e.g., drinking water, recreation, propagation of fish and aquatic life, agricultural and industrial use). Water quality standards are legally enforceable under the *Clean Water Act*, whereas water quality criteria are nonenforceable recommendations based on biotic impacts.

water table—The boundary between the unsaturated zone and the deeper, saturated zone; the upper surface of an unconfined aquifer.

wetlands—Those areas that are inundated by surface or groundwater with a frequency sufficient to support, and under normal circumstances do or would support, a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas (e.g., sloughs, potholes, wet meadows, river overflow areas, mudflats, natural ponds).

wind rose—A circular diagram showing, for a specific location, the percentage of the time the wind is from each compass direction. A wind rose for use in assessing consequences of airborne releases also shows the frequency of different wind speeds for each compass direction.