DOE/EIS-0549

Final Environmental Impact Statement for the Surplus Plutonium Disposition Program

December 2023

K - Area at Savannah River Site

PF - 4 at Los Alamos National Laboratory

National Nuclear Security Administration

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Volume I

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FINAL

ENVIRONMENTAL IMPACT STATEMENT FOR THE SURPLUS PLUTONIUM DISPOSITION PROGRAM

Volume 1
(Sections 1 through 9)

COVER SHEET

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Locations: New Mexico, South Carolina, Texas, and Tennessee

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- ***Abstract***: The National Nuclear Security Administration (NNSA), a semi-autonomous agency organized in 2000 within the United States (U.S.) Department of Energy (DOE),[1] works to prevent nuclear weapon proliferation and reduce the threat of nuclear and radiological terrorism around the world. NNSA's Office of Defense Nuclear Nonproliferation works globally to prevent state and non-state actors from developing nuclear weapons or acquiring weapons-usable nuclear or radiological materials, equipment, technology, and expertise. Among other missions, NNSA is engaged in a program to disposition U.S. surplus weapons-grade plutonium (referred to in this Surplus Plutonium Disposition Program Environmental Impact Statement (SPDP EIS) as "surplus plutonium"). NNSA has prepared this document (DOE/EIS-0549) pursuant to the National Environmental Policy Act of 1969 (NEPA) (42 United States Code 4321 et seq.), to evaluate the potential environmental impacts of the disposition of plutonium that is surplus to the defense needs of the United States.

  DOE's purpose and need for action is to safely and securely disposition plutonium that is surplus to the Nation's defense needs so that it is not readily usable in nuclear weapons.

[1] In this SPDP EIS, DOE's NNSA is referred to as NNSA for the sake of brevity.

- ***Preferred Alternative***: NNSA's Preferred Alternative to meet the purpose and need is implementation of the dilute and dispose strategy for the full 34 metric tons of surplus plutonium (DOE 2018h). The effort would require new, modified, or existing capabilities at the Pantex Plant, Los Alamos National Laboratory, Savannah River Site, Y-12 National Security Complex, and the Waste Isolation Pilot Plant facility. Four sub-alternatives to the Preferred Alternative are considered in this environmental impact statement (EIS). The sub-alternatives differ based on the location (Los Alamos National Laboratory or Savannah River Site) for the processing activities. The sub-alternatives were selected so that the analyses presented in this EIS would bound the impacts (including impacts from transportation) that would occur if either site or a combination of the sites was used (i.e., if some of the 34 metric tons of surplus plutonium is processed at one site and the remainder is processed at the other site).

- ***Public Involvement***: In preparing this Final SPDP EIS, NNSA considered comments received during the scoping period (December 16, 2020 through February 18, 2021), during the public comment period on the Draft SPDP EIS (December 16, 2022 through March 16, 2023), and late comments received after the close of the public comment period but prior to May 2023. NNSA held in-person public hearings in Aiken, South Carolina (January 19, 2023), Carlsbad, New Mexico (January 24, 2023), and Los Alamos, New Mexico (January 26, 2023). In addition, NNSA held an internet-based virtual public hearing (with telephone access) on January 30, 2023. This Final SPDP EIS contains revisions and new information based in part on comments received on the Draft SPDP EIS. Volume 3 contains reproductions of comments, summaries of the comments, and NNSA's responses to the comments. NNSA will use the analysis presented in this SPDP EIS, as well as other information, in preparing a Record of Decision regarding the disposition of 34 metric tons of surplus plutonium.

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ABBREVIATIONS AND ACRONYMS

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
ac	acre(s)
ACS	American Community Survey
AEI	Area of Environmental Interest
ALARA	as low as reasonably achievable
APCS	Abandonment of Panel Closures in the South
ARIES	Advanced Recovery and Integrated Extraction System
AROD	Amended Record of Decision
ATSDR	Agency for Toxic Substances and Disease Registry
ATWIR	Annual TRU Waste Inventory Report
BLM	Bureau of Land Management
BMP	best management practice
C&P	characterization and packaging
CAA	Clean Air Act
CBFO	(DOE) Carlsbad Field Office
CCO	criticality control overpack
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CH-TRU	contact-handled transuranic
Ci	curie(s)
cm	centimeter(s)
CO	carbon monoxide
CO_2e	carbon dioxide equivalent
CRMP	Cultural Resources Management Plan
CSWTF	Central Sanitary Wastewater Treatment Facility
dBA	A-weighted decibel
DD&D	deactivation, decontamination, and decommissioning
DHF	Drum Handling Facility
DOE	U.S. Department of Energy
DSA	documented safety analysis(es)
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FGR	Federal Guidance Report
FR	*Federal Register*
ft	foot (feet)
ft^3	cubic foot (feet)
FY	fiscal year
g	acceleration due to gravity

g	gram(s)
gal	gallon(s)
gal/yr	gallon(s) per year
GHG	greenhouse gas
gpd	gallon(s) per day
gpm	gallon(s) per minute
GWP	global warming potential
HAP	hazardous air pollutant
HEPA	high-efficiency particulate air (filter)
HEU	highly enriched uranium
HLW	high-level (radioactive) waste
hr	hour(s)
HVAC	Heating, ventilation, and air-conditioning
ICRP	International Commission on Radiological Protection
ID	identification
in.	inch(es)
IPCC	Intergovernmental Panel on Climate Change
KAC	K-Area Complex
kg	kilogram(s)
KIS	K-Area Interim Storage
km	kilometer(s)
L	liter(s)
LANL	Los Alamos National Laboratory
lb	pound(s)
LCF	latent cancer fatality
LLW	low-level (radioactive) waste
LOS	level of service
LSC	Logistical Support Center
LWA	Land Withdrawal Act
m	meter(s)
m/s	meter(s) per second
m^3	cubic meter(s)
MACCS	MELCOR Accident Consequence Code System
MAR	material at risk
MEI	maximally exposed individual
MFFF	Mixed Oxide Fuel Fabrication Facility
mi	mile(s)
MLLW	mixed low-level (radioactive) waste
MOX	mixed oxide
mpg	mile(s) per gallon
mph	mile(s) per hour

mrem	millirem
MT	metric ton(s)
MVA	mega volt amp(s)
MW	megawatt(s)
MWh	megawatt-hour(s)
MWh/yr	megawatt-hour(s) per year
NAAQS	National Ambient Air Quality Standard
NASEM	National Academy of Sciences, Engineering and Medicine
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NSHM	National Seismic Hazard Model
NMED	New Mexico Environment Department
NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPMP	non-pit metal processing
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
ODS	ozone-depleting substances
OPT	Office of Packaging and Transportation
OST	NNSA's Office of Secure Transportation
PA	Programmatic Agreement
Pantex	Pantex Plant
PCB	polychlorinated biphenyl
pCi	picocurie(s)
PDCF	Pit Disassembly and Conversion Facility
PDP	pit disassembly and processing
PEIS	programmatic environmental impact statement
PF-4	Plutonium Facility-4
PGA	peak ground acceleration
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PMDA	Plutonium Management and Disposition Agreement
psig	pounds per square inch gauge
Pu	plutonium
PuE	plutonium-239 dose equivalent
RCRA	Resource Conservation and Recovery Act
REAC/TS	Radiation Emergency Assistance Center/Training Site
rem	roentgen equivalent man
RH-TRU	remote-handled transuranic
RLUOB	Radiological Laboratory/Utility/Office Building

RLWTF	Radioactive Liquid Waste Treatment Facility
ROD	Record of Decision
ROI	region of influence
s	second(s)
S&D	storage and disposition
SA	supplement analysis
SCDHEC	South Carolina Department of Health and Environmental Control
SC-GHG	social cost of greenhouse gas
SEIS	supplemental environmental impact statement
SHPO	State Historic Preservation Office(r)
SNL	Sandia National Laboratories
SPD EIS	*Surplus Plutonium Disposition Final Environmental Impact Statement* (1999)
SPD SEIS	*Surplus Plutonium Disposition Supplemental Environmental Impact Statement* (2015)
SPDP	Surplus Plutonium Disposition Program
SRPPF	Savannah River Plutonium Processing Facility
SRS	Savannah River Site
SWEIS	Site-Wide Environmental Impact Statement
SWPPP	stormwater pollution prevention plan
SWSP	Sanitary Wastewater System Plant
SWTP	Sanitary Wastewater Treatment Plant
T	ton(s)
TA	Technical Area
TCEQ	Texas Commission on Environmental Quality
TCP	Traditional Cultural Property
TDEC	Tennessee Department of Environment and Conservation
TRU	transuranic
TRUPACT-II	Transuranic Package Transporter Model-II
TSCA	Toxic Substances Control Act
TWF	Transuranic Waste Facility
U.S.	United States
U.S.C.	United States Code
USGS	United States Geological Survey
VTR	Versatile Test Reactor
WAC	Waste Acceptance Criteria
WebTRAGIS	Web Transportation Routing Analysis Geographic Information System
WG	weapons-grade
WIPP SEIS	*Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement*
WIPP	Waste Isolation Pilot Plant
WSB	Waste Solidification Building
Y-12	Y-12 National Security Complex

yd^3	cubic yard(s)
yr	year(s)
ZPPR	Zero Power Physics Reactor

CONVERSION TABLE

Metric to English			English to Metric		
Multiply	**by**	**to get**	**Multiply**	**by**	**to get**
Area					
Square meters	10.764	square feet	square feet	0.092903	square meters
Square kilometers	247.1	acres	acres	0.0040469	square kilometers
Square kilometers	0.3861	square miles	square miles	2.59	square kilometers
Hectares	2.471	acres	acres	0.40469	hectares
Concentration					
Kilograms/square meter	0.16667	tons/acre	tons/acre	0.5999	kilograms/square meter
Milligrams/liter	1[(a)]	parts/million	parts/million	1[(a)]	milligrams/liter
Micrograms/liter	1[(a)]	parts/billion	parts/billion	1[(a)]	micrograms/liter
Micrograms/cubic meter	1[(a)]	parts/trillion	parts/trillion	1[(a)]	micrograms/cubic meter
Density					
Grams/cubic centimeter	62.428	pounds/cubic feet	pounds/cubic feet	0.016018	grams/cubic centimeter
Grams/cubic meter	0.0000624	pounds/cubic feet	pounds/cubic feet	16,018.5	grams/cubic meter
Length					
Centimeters	0.3937	inches	inches	2.54	centimeters
Meters	3.2808	feet	feet	0.3048	meters
Kilometers	0.62137	miles	miles	1.6093	kilometers
Radiation					
Sieverts	100	rem	rem	0.01	sieverts
Temperature					
Degrees Celsius (C)	Multiply by 1.8 and then add 32	degrees Fahrenheit (F)	degrees Fahrenheit (F)	Subtract 32 and then multiply by 0.55556	degrees Celsius (C)
Velocity/Rate					
Cubic meters/second	2,118.9	cubic feet/minute	cubic feet/minute	0.00047195	cubic meters/second
Grams/second	7.9366	pounds/hour	pounds/hour	0.126	grams/second
Meters/second	2.237	miles/hour	miles/hour	0.44704	meters/second
Volume					
Liters	0.26417	gallons	gallons	3.7854	liters
Liters	0.035316	cubic feet	cubic feet	28.316	liters
Liters	0.001308	cubic yards	cubic yards	764.54	liters
Cubic meters	264.17	gallons	gallons	0.0037854	cubic meters
Cubic meters	35.315	cubic feet	cubic feet	0.028317	cubic meters
Cubic meters	1.3079	cubic yards	cubic yards	0.76456	cubic meters
Cubic meters	0.0008107	acre-feet	acre-feet	1,233.49	cubic meters

Conversion Table

Metric to English			English to Metric		
Multiply	**by**	**to get**	**Multiply**	**by**	**to get**
Weight/Mass					
Grams	0.035274	ounces	ounces	28.35	grams
Kilograms	2.2046	pounds	pounds	0.45359	kilograms
Kilograms	0.0011023	tons (short)	tons (short)	907.18	kilograms
Metric tons	1.1023	tons (short)	tons (short)	0.90718	metric tons
English to English					
Acre-feet	325,850.7	gallons	gallons	0.000003046	acre-feet
Acres	43,560	square feet	square feet	0.000022957	acres
Square miles	640	acres	acres	0.0015625	square miles

(a) This conversion is only valid for concentrations of contaminants (or other materials) in water.

Note: Conversion factors have been rounded to an appropriate number of significant digits for each conversion given the order of magnitude of the conversion.

1.0 INTRODUCTION AND PURPOSE AND NEED

Section 1.0 of this *Surplus Plutonium Disposition Program Environmental Impact Statement* (SPDP EIS) describes the purpose and need for agency action. The proposed action evaluated in this SPDP EIS is to disposition 34 metric tons (MT) of surplus plutonium. The Preferred Alternative is based on the dilute and dispose strategy, which includes processing surplus plutonium to plutonium oxide, diluting it with an adulterant to inhibit plutonium recovery, and disposing the resulting defense-related contact-handled transuranic (CH-TRU) waste at the Waste Isolation Pilot Plant (WIPP) facility. This section further describes the surplus plutonium and the decisions that could be made upon completion of this environmental impact statement (EIS).

1.1 Introduction

The National Nuclear Security Administration (NNSA), a semi-autonomous agency organized in 2000 within the United States (U.S.) Department of Energy (DOE),[2] works to prevent nuclear weapon proliferation and reduce the threat of nuclear and radiological terrorism around the world. NNSA's Office of Defense Nuclear Nonproliferation works globally to prevent state and non-state actors from developing nuclear weapons or acquiring weapons-usable nuclear or radiological materials, equipment, technology, and expertise. Among other missions, NNSA is engaged in a program to disposition U.S. surplus weapons-grade plutonium (referred to in this *Surplus Plutonium Disposition Program Environmental Impact Statement* [SPDP EIS] as "surplus plutonium"). NNSA has prepared this document (DOE/EIS-0549) pursuant to the *National Environmental Policy Act* of 1969 (NEPA), as amended (42 United States Code [U.S.C.] 4321 et seq.),[3] Council on Environmental Quality (CEQ) (40 CFR Part 1508), and DOE implementing regulations (10 CFR Part 1021), to evaluate the potential environmental impacts of the disposition of plutonium that is surplus to the defense needs of the United States.

"Disposition" for radiological materials is defined as the process of disposal, which results in conversion to a form that is substantially and inherently more proliferation-resistant than the original form.

In 1994, after the end of the Cold War, the President of the United States declared 52.5 MT of plutonium to be surplus to the defense needs of the Nation (GAO 2019|p. 2, footnote 6). In 2007, the United States declared an additional 9 MT of plutonium to be surplus. In 2000, discussions that had begun in the 1990s culminated in the United States and the Russian Federation signing the *Agreement between the Government of the United States of America and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Cooperation* (Plutonium Management and Disposition Agreement) (United States of America and Russian Federation 2000). The two nations agreed to each dispose of no less than 34 MT of weapons-grade plutonium in forms unusable for nuclear weapons. Despite Russia's purported unilateral suspension of the Plutonium Management and Disposition Agreement, the United States remains committed to the safe and secure disposition of 34 MT of surplus weapons-grade

[2] In this SPDP EIS, DOE's NNSA is referred to as NNSA for the sake of brevity.
[3] Because this SPDP EIS is tiered from previous EIS's that were started before the CEQ regulations were changed in 2020 and 2022, subsequent references in this document are to the 2018 version of 40 CFR Part 1508.

plutonium, so it can never again be used for nuclear weapons (IPFM 2016; DOS 2020; DOS 2021).[4] The 34 MT of surplus plutonium evaluated for disposition in this SPDP EIS is a subset of the 61.5 MT of surplus plutonium described above (52.5 MT plus 9 MT).

Plutonium is a heavy radioactive metallic element with the atomic number 94. Trace amounts of plutonium exist in nature, but most of it is produced artificially by neutron bombardment of uranium. Plutonium has 23 isotopes with atomic mass numbers ranging from 228 to 246 and half-lives up to 80.8 million years (NCBI 2023). The radionuclides that are the main sources of occupational and environmental exposures from surplus plutonium disposition are plutonium-239, plutonium-240, plutonium-238, and americium-241, a decay product of plutonium-241 (LANL 2023a|p. 2-6|). Americium-241 builds up in activity as plutonium-241 decays. Plutonium-240 is largely indistinguishable from plutonium-239, and they are included together for radiation dose calculations using the notation plutonium-239/240.

Most forms of plutonium including plutonium-239/240, emit high-energy alpha particles and low-energy gamma and x-rays as they decay. Alpha particles have a short range (inches in air) and can easily be stopped by other materials. The energy from the gamma rays and x-rays is of low intensity, and as a result, the external dose is low (ATSDR 2023|Section 3.1|). However, when plutonium is inhaled, it can become lodged in the lung tissue and cause scarring of the lungs as it kills surrounding lung cells, leading to lung disease and cancer. Particles of plutonium can be carried to other parts of the body through the blood and can concentrate in the kidneys, bones, spleen, and liver, thus also exposing these organs to alpha radiation. Ingested plutonium is not as serious a threat since the stomach does not absorb it easily (EPA 2023b; CDC 2015). Americium-241 has similar characteristics to the plutonium isotopes but is a larger source of external radiation thank plutonium.

Plutonium isotopes are fissionable; the atom's nucleus can easily split apart when struck by a neutron. Plutonium isotopes also undergo spontaneous fission to various extents, and neutrons emitted during these processes are included in the external dose estimates included in this EIS. The configuration and geometry of surplus plutonium must be strictly controlled during operations and transport to prevent inadvertent criticality, where the neutron emissions produce a chain reaction with spontaneous emission of radiation and energy that can be hazardous to nearby workers.

The surplus plutonium that NNSA plans to disposition includes material sourced from both pit and non-pit plutonium. A pit is the central core of a nuclear weapon that principally contains plutonium or enriched uranium. The plutonium contained in the pit is termed "pit plutonium." Non-pit surplus plutonium may be in metal or oxide form or may be associated with other materials that were used in manufacturing and fabricating plutonium for use in nuclear weapons.

Weapons-grade plutonium is largely plutonium-239, and contains no more than 7 percent plutonium-240 (DOE Order 410.2, Change 1 2014). A different range is used in the Plutonium Management and Disposition Agreement *(United States of America and Russian Federation 2000)*: a ratio of plutonium-240 to plutonium-239 no greater than 0.10; approximately equal to 9 percent plutonium-240.

Surplus plutonium has no identified programmatic use and does not fall into any of the national security reserves categories.

[4] Only reports prior to 2022 are referenced in the text, because the reports in 2022 and 2023 (DOS 2022; DOS 2023) do not contain information on the Plutonium Management and Disposition Agreement. However, the Department of State's 2023 publication indicated that the Plutonium Management and Disposition Agreement will no longer be covered in the *Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Covenants Report* "unless a significant issue is newly identified."

Since the 52.5 MT of plutonium was declared surplus in 1994, DOE and NNSA have studied many methods and prepared several NEPA reviews to evaluate alternative means of assuring that surplus plutonium would never again be used for nuclear weapons. Table 1-1 provides an overview of the previous NEPA reviews and decisions. A list with detailed descriptions of these NEPA reviews is provided in Appendix A.

Table 1-1. Overview of *National Environmental Policy Act* Reviews and Decisions Related to Surplus Plutonium Disposition

Year	NEPA Reviews and Decisions	Summary
1996	DOE/EIS-0229 – Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement (DOE 1996)	Evaluation of dispositioning up to 50 MT of surplus plutonium
1997	62 FR 3014	ROD to pursue immobilization and MOX fuel approaches for disposition
1998	DOE-1207 – Pit Disassembly and Conversion Demonstration Environmental Assessment and Research and Development Activities (DOE 1998)	Evaluation of the environmental consequences of the ARIES, a pit disassembly and conversion demonstration project at LANL. Plutonium oxide produced from the ARIES system was designated for disposition via MOX fuel.
1999	DOE/EIS-0283 – Surplus Plutonium Disposition Final Environmental Impact Statement (DOE 1999b)	Evaluation of dispositioning up to 50 MT of surplus plutonium
2000	65 FR 1608	ROD to disposition up to 50 MT of surplus plutonium at Savannah River Site and construct a MOX Fuel Fabrication Facility, a Pit Disassembly and Conversion Facility, and an Immobilization Facility
2002	67 FR 19432	AROD to cancel the Immobilization Facility
2003	68 FR 20134	AROD to change the amount of surplus plutonium to be fabricated into MOX fuel from 33 MT to 34 MT
2015	DOE/EIS-0283-S2 – Surplus Plutonium Disposition Supplemental Environmental Impact Statement (DOE 2015c)	Evaluation of dispositioning surplus plutonium (13.1 MT) not previously assigned a disposition path; updated analyses for surplus plutonium (34 MT) previously decided to be fabricated into MOX fuel
2016	81 FR 19588	ROD to implement the dilute and dispose strategy to prepare 6 MT of non-pit surplus plutonium (part of the 13.1 MT) for disposal at the WIPP facility
2020	DOE/EIS-0283-SA-4 – Supplement Analysis for Disposition of Additional Non-Pit Surplus Plutonium (DOE 2020e)	Evaluation of the dilute and dispose strategy to prepare up to an additional 7.1 MT of non-pit surplus plutonium for disposal at the WIPP facility
2020	85 FR 53350	AROD to implement the dilute and dispose strategy to prepare up to 7.1 MT of non-pit surplus plutonium for disposal at the WIPP facility
Present	DOE/EIS-0549 – Surplus Plutonium Disposition Program Environmental Impact Statement	Evaluation of the dilute and dispose strategy to prepare 34 MT surplus plutonium for disposal at the WIPP facility

AROD = Amended Record of Decision; FR = *Federal Register*; MOX = mixed oxide; NEPA = *National Environmental Policy Act*; ROD = Record of Decision; WIPP = Waste Isolation Pilot Plant.

This SPDP EIS is tiered from the *Storage and Disposition of Weapons-Usable Fissile Materials Final Programmatic Environmental Impact Statement* (S&D PEIS [DOE 1996]), the *Surplus Plutonium Disposition Final Environmental Impact Statement* (SPD EIS [DOE 1999b]), and the *Final Surplus Plutonium Disposition Supplemental Environmental Impact Statement* (2015 SPD Supplemental EIS or 2015 SPD SEIS [DOE 2015c]). These documents are described in detail below.

In 1996, DOE prepared the S&D PEIS (DOE 1996), in which it evaluated deep borehole, immobilization, and reactor alternatives, each with several sub-alternatives, for disposition of surplus plutonium. In a 1997 Record of Decision (ROD) (62 FR 3014), DOE documented its decision to (1) immobilize some or all surplus plutonium for disposal in a geologic repository; (2) fabricate some surplus plutonium into mixed oxide (MOX) fuel for irradiation in domestic commercial nuclear power reactors; (3) consolidate storage of pit plutonium at the Pantex Plant (Pantex) near Amarillo, Texas; and (4) consolidate storage of non-pit surplus plutonium at the Savannah River Site (SRS) near Aiken, South Carolina.

In 1999, DOE completed the SPD EIS (DOE 1999b), in which it evaluated immobilization (ceramic and glass) alternatives and MOX fuel fabrication alternatives, as well as siting alternatives for a Mixed Oxide Fuel Fabrication Facility (MFFF, also known as the MOX Facility), a Pit Disassembly and Conversion Facility (PDCF), and an immobilization facility. In a 2000 ROD (65 FR 1608), DOE documented its decision to pursue a hybrid approach to disposition surplus plutonium by (1) immobilizing approximately 17 MT of surplus plutonium, (2) using up to 33 MT of surplus plutonium to fabricate MOX fuel for irradiation in domestic commercial nuclear power reactors, and (3) constructing and operating an immobilization facility, a PDCF, and an MFFF at SRS.

In 2002 (67 FR 19432) and 2003 (68 FR 20134), NNSA issued Amended Record of Decisions (ARODs) to (1) cancel the immobilization program, (2) immediately consolidate storage of non-pit surplus plutonium at SRS (formerly stored at the Rocky Flats Environmental Technology Site), and (3) designate 34 MT rather than 33 MT of surplus plutonium for fabrication into MOX fuel for irradiation in domestic commercial nuclear power reactors. In 2008, NNSA issued an AROD to construct and operate a Waste Solidification Building (WSB) at SRS to prepare waste from MFFF and PDCF for disposal (73 FR 75088). Construction of MFFF at SRS began in 2007. NNSA cancelled the construction of PDCF in 2012 because other more cost-effective options were identified (DOE 2012b). NNSA completed construction of the WSB and placed it in a safe ready condition in 2015 (SRNS 2015).

In 2015, NNSA completed the SPD Supplemental EIS (hereafter referred to as the 2015 SPD SEIS), in which it evaluated the potential environmental impacts of alternatives for dispositioning 13.1 MT of surplus plutonium (7.1 MT of pit and 6 MT of non-pit) for which a disposition path had not been assigned (DOE 2015c|p. S-9|). The 13.1 MT of surplus plutonium analyzed in the 2015 SPD SEIS was separate from the 34 MT of surplus plutonium that NNSA decided to fabricate into MOX fuel in the 2003 AROD (68 FR 20134). The alternatives evaluated in the 2015 SPD SEIS included the MOX Fuel Alternative, the WIPP Alternative, and two variations of waste immobilization. In addition, NNSA evaluated four options for pit disassembly and processing[5] using facilities at SRS and Los Alamos National Laboratory (LANL) (DOE 2015c).

In 2015 (80 FR 80348), NNSA announced that its Preferred Alternative for the 6 MT of non-pit surplus plutonium evaluated in the 2015 SPD SEIS was to prepare this plutonium for eventual disposal at the WIPP facility near Carlsbad, New Mexico. In a 2016 ROD, NNSA announced a decision to disposition the 6 MT of non-pit surplus plutonium (81 FR 19588) by downblending it with an adulterant, packaging it as

[5] Pit disassembly and processing was termed “pit disassembly and conversion” in the 2015 SPD SEIS (DOE 2015c).

defense-related CH-TRU waste,[6] and shipping it to the WIPP facility for disposal. In the 2016 ROD, NNSA did not make a decision about the disposition of the 7.1 MT of pit plutonium or about the various options for pit disassembly and processing (PDP) that were analyzed in the 2015 SPD SEIS.

> The dilute and dispose strategy involves the conversion of surplus pit and non-pit plutonium to an oxide, blending the surplus plutonium in oxide form with an adulterant to inhibit plutonium recovery, packaging the diluted plutonium oxide as CH-TRU waste, and characterizing, certifying, and transporting the waste for disposal underground at the WIPP facility. Downblending is equivalent to the dilute and dispose strategy. The term downblending is used by the DOE Office of Environmental Management. NNSA uses the term dilution for international understanding.

In 2016, NNSA, partnering with the U.S. Army Corps of Engineers, developed an independent cost estimate for the MFFF project, and concluded that the cost of the project, upon completion of construction, would be approximately $17 billion, and construction would not be complete until 2048. Congress directed NNSA to prepare a lifecycle cost estimate for disposal of surplus plutonium using the same approach announced for the 6 MT, now referred to as the dilute and dispose strategy (GAO 2017). The completed cost estimate indicated that the estimate-to-complete lifecycle cost of the dilute and dispose strategy would be substantially lower than the cost to complete the MOX project (DOE 2018k). In response, the Secretary of Energy halted construction of the MOX fuel project in May 2018 by waiving the requirement to use funds for construction and support activities for the MFFF per the *National Defense Authorization Act*. In a letter dated May 10, 2018, the Secretary of Energy certified "that the remaining lifecycle cost for the dilute and dispose approach will be less than approximately half of the estimated remaining lifecycle cost of the MOX fuel program" (DOE 2018h). On October 10, 2018, NNSA issued a Notice of Termination to CB&I AREVA MOX Services, LLC (NNSA 2018). The notice terminated the contract for construction of MFFF and began the process of ceasing construction operations and preserving MFFF and associated structures. On February 8, 2019, the U.S. Nuclear Regulatory Commission (NRC) terminated the construction license for MFFF (NRC 2019).

In 2020, NNSA issued the *Supplement Analysis for Disposition of Additional Non-Pit Surplus Plutonium* (DOE 2020e). In this document NNSA determined that proposing to disposition up to 7.1 MT of non-pit surplus plutonium was not a substantial change in the action analyzed in the 2015 SPD SEIS to disposition 7.1 MT of pit plutonium, and that the potential environmental impacts had been sufficiently analyzed. On August 28, 2020, NNSA amended its previous decision in the April 2003 AROD for the SPD EIS (68 FR 20134) to include preparation of up to an additional 7.1 MT of non-pit surplus plutonium for disposal as CH-TRU waste at the WIPP facility (85 FR 53350). NNSA based the 2020 AROD on the analysis in the 2015 SPD SEIS as described in the 2020 Supplement Analysis (SA). The 7.1 MT of non-pit surplus plutonium to be sent to the WIPP facility as CH-TRU waste is part of the 34 MT of surplus plutonium that NNSA had decided to disposition by fabricating it into MOX fuel for use in commercial reactors. The disposition of that 34 MT is the subject of this SPDP EIS. In the same 2020 AROD, NNSA also decided that non-pit metal processing (NPMP) may be performed at either LANL or SRS, as discussed in Section 2.1.2.

Figure 1-1 summarizes the various plutonium disposition paths decided to date for plutonium that was declared surplus by the United States in 1994 and 2007. The figure displays 61.5 MT of plutonium,

[6] The WIPP facility is authorized to accept TRU waste that was generated from atomic energy defense activities. All CH-TRU wastes described in this SPDP EIS are defense-related wastes. **Throughout this SPDP EIS, the defense-related TRU wastes described as shipped from LANL or SRS to WIPP are referred to as CH-TRU waste.**

which was part of the excess plutonium declarations. In addition, the figure includes 0.9 MT non-pit metal and oxide with the Declarations' 5.1 MT non-pit metal and oxide, for a total of 6 MT. This 0.9 MT originated outside of the United States and thus was not considered in the Declarations. With 0.9 MT, the total accounted for in the figure is 62.4 MT.[7]

Figures similar to Figure 1-1 were published in the 2015 SPD SEIS and in the National Academies of Sciences, Engineering, and Medicine (NASEM) 2020 *Review of the Department of Energy's Plans for Disposal of Surplus Plutonium in the Waste Isolation Pilot Plant* (DOE 2015c; NASEM 2020|Figure 2-1|), but Figure 1-1 differs slightly from those prior versions. In some cases (i.e., MOX fuel fabrication), the disposition paths indicated in the 2015 SPD SEIS figure have since changed, and the new paths are reflected here.[8] The Surplus Plutonium Disposition Program that is the subject of this SPDP EIS involves 34 MT of surplus plutonium. If additional quantities are proposed for emplacement in WIPP, the NNSA will prepare the appropriate NEPA review.

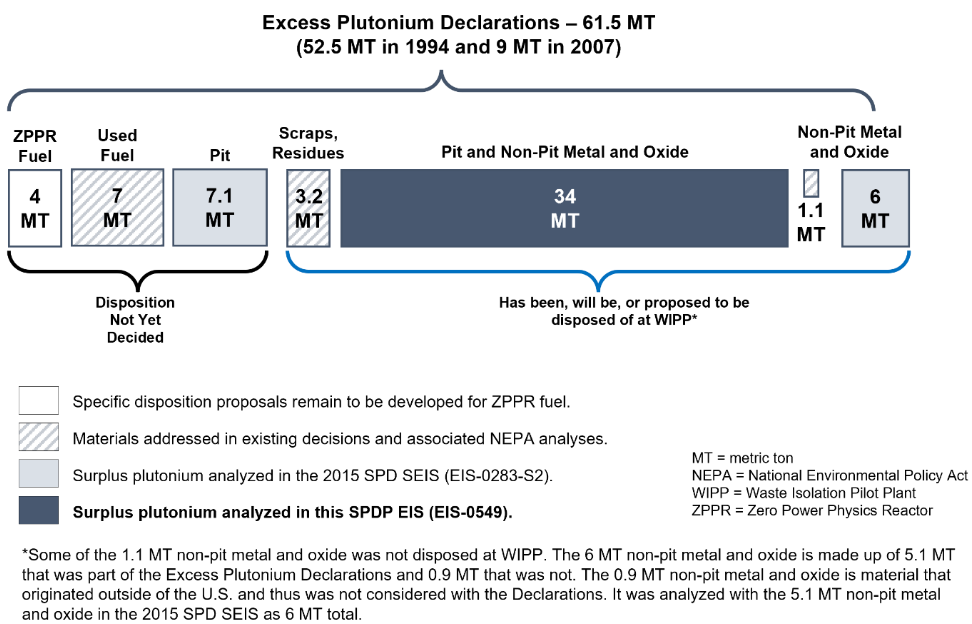

Figure 1-1. Current Disposition Paths for Surplus Plutonium

1.2 Purpose and Need for Action

NNSA's purpose and need for action is to safely and securely disposition plutonium that is surplus to the Nation's defense needs so that it is not readily usable in nuclear weapons.

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[7] The 2015 SPD SEIS (DOE 2015c) analyzed the 0.9 MT of non-pit metal and oxide that originated outside of the U.S. along with the 5.1 MT of non-pit metal and oxide that was part of the 1994 Declaration.

[8] The NASEM Report (NASEM 2020) determined that 48.2 MT of surplus plutonium is designated for WIPP. The NASEM Report determination included 7.1 MT of pits for which no disposition decision has been made and excluded 3.2 MT of surplus plutonium that was emplaced in WIPP prior to 2010. The total amount of surplus plutonium described in this SPDP EIS (Figure 1-1) for WIPP emplacement differs from the NASEM Report because the category shown in Figure 1-1 as "has been, will be, or is proposed to be emplaced in WIPP" excludes the 7.1 MT of pits and includes the 3.2 MT surplus plutonium previously emplaced in WIPP, which results in a total of 44.3 MT of surplus plutonium for WIPP emplacement.

Since the end of the Cold War in the early 1990s and the Presidential declarations of surplus fissile materials, DOE has been charged with the disposition of surplus plutonium. Over the last 25 years, NNSA has studied many alternative technologies and locations for plutonium disposition.

NNSA needs to disposition 34 MT of surplus plutonium in a safe and secure manner and in a reasonable time frame at a cost consistent with programmatic priorities and fiscal realities. To achieve this, NNSA must use mature methods and proven technologies that are based on processes requiring minimal research and engineering development.

1.3 Proposed Action

NNSA proposes to implement the dilute and dispose strategy for 34 MT of surplus plutonium to safely and securely disposition the surplus plutonium such that it could never again be readily used in a nuclear weapon. Studies conducted over the last several years have identified the dilute and dispose strategy as being a technically mature and cost-effective alternative for surplus plutonium disposition (DOE 2014b; Hart et al. 2015). DOE's Plutonium Disposition Working Group in its report, *Analysis of Surplus Weapon Grade Plutonium Disposition Options* (DOE 2014b), indicated that although the dilute and dispose strategy does not change the isotopic composition of the plutonium, it does meet two of the attributes for minimizing accessibility and reuse through physical and chemical barriers. The physical barrier is its placement 2,150 ft below the Earth's surface in an underground salt rock formation at the WIPP facility and the chemical barrier is the adulterant.

NNSA evaluated this alternative in the 2015 SPD SEIS (DOE 2015c) and decided to use the process to prepare 6 MT of non-pit surplus plutonium for disposal as CH-TRU waste at the WIPP facility (81 FR 19588). NNSA also decided to use the process to prepare up to an additional 7.1 MT of non-pit surplus plutonium (85 FR 53350) for disposal as CH-TRU waste at the WIPP facility based on the analysis in the 2015 SPD SEIS as described in the 2020 SA (DOE 2020e).

To provide a comprehensive analysis in this SPDP EIS, NNSA includes the impacts of dispositioning up to 7.1 MT of non-pit surplus plutonium using the dilute and dispose strategy, for which NNSA has already made a decision, as announced in the 2020 AROD (85 FR 53350). The 7.1 MT non-pit surplus plutonium is considered here as part of the 34 MT of surplus plutonium and is analyzed for the Preferred Alternative. However, because the impacts of dispositioning up to 7.1 MT of non-pit surplus plutonium have already been analyzed and a disposition pathway was assigned in the 2020 AROD, the 7.1 MT of non-pit surplus plutonium is also analyzed as part of the No Action Alternative described in Section 1.4. Further discussion of the quantities of surplus plutonium that are evaluated in this SPDP EIS is provided in Section 2.1.

1.4 Alternatives Evaluated

NNSA prepared a PEIS in 1996 (DOE 1996) that was followed by several NEPA reviews that tiered from the PEIS to evaluate alternative means of assuring that surplus plutonium can never again be readily used in a nuclear weapon. The most recent document tiered from the PEIS was published in 2020 (DOE 2020e). The analysis related to the consideration of alternatives that is presented in the PEIS and subsequent tiered documents is incorporated by reference in this SPDP EIS, which concentrates on issues specific to the dilute and dispose strategy.

The analyses in the S&D PEIS (DOE 1996), SPD EIS (DOE 1999b), and the 2015 SPD SEIS (DOE 2015c) evaluated multiple alternatives for the dispositioning of surplus plutonium. Some alternatives, including MOX fuel and immobilization are not reevaluated in this EIS because of the absence of significant new circumstances or information that would change the results of the previous evaluations. As a result, a limited set of alternatives are analyzed in this SPDP EIS. The evaluated alternatives are briefly described below (see Section 2.0 for more detail):

- **Preferred Alternative**. NNSA's Preferred Alternative to meet the purpose and need is implementation of the dilute and dispose strategy for the full 34 MT of surplus pit and non-pit plutonium (DOE 2018h). Using this alternative, NNSA would disassemble up to 34 MT of pits; convert up to 34 MT of surplus pit and non-pit plutonium to oxide; blend the surplus plutonium in oxide form with an adulterant to inhibit plutonium recovery; package the diluted plutonium oxide as CH-TRU waste; characterize, certify, and transport the waste to the WIPP facility; and dispose of it underground at the WIPP facility. The effort would require new, modified, or existing capabilities at Pantex, LANL, SRS, Y-12 National Security Complex (Y-12), and the WIPP facility (see Figure 1-2). Four sub-alternatives to the Preferred Alternative are considered in this EIS and discussed in Section 2.1.1. The sub-alternatives differ based on the location (LANL or SRS) for pit disassembly and processing, NPMP, dilution, and characterization and packaging. The sub-alternatives were selected so that the analyses presented in this EIS would bound the impacts (including impacts from transportation) that would occur if either site or a combination of the sites was used (i.e., if some of the 34 MT of surplus plutonium is processed at one site and the remainder is processed at the other site).
- **No Action Alternative**. NNSA's No Action Alternative for dispositioning 34 MT of surplus plutonium is the continued management of 34 MT of surplus plutonium. This includes (1) continued storage of pits at Pantex, (2) the continued plutonium mission at LANL to process up to 400 kg of actinides (including surplus plutonium) a year (DOE 2008a|p. 2-62|), and (3) disposition of up to 7.1 MT of non-pit surplus plutonium using the dilute and dispose strategy, as announced in NNSA's 2020 AROD (85 FR 53350).

The dilute and dispose strategy used for the No Action Alternative for disposition of up to 7.1 MT of non-pit surplus plutonium is the same strategy that would be used for the Preferred Alternative for the full 34 MT of surplus plutonium. Under the No Action Alternative, NPMP of up to 7.1 MT of non-pit surplus plutonium would occur at either LANL or SRS. If NPMP occurs at LANL, then the resulting plutonium oxide would be transported to SRS to undergo dilution and characterization and packaging (C&P) and would then be transported as CH-TRU waste to the WIPP facility for disposal. If NPMP occurs at SRS, then the resulting plutonium oxide would remain at SRS for dilution and C&P and then be transported as CH-TRU waste to the WIPP facility for disposal.

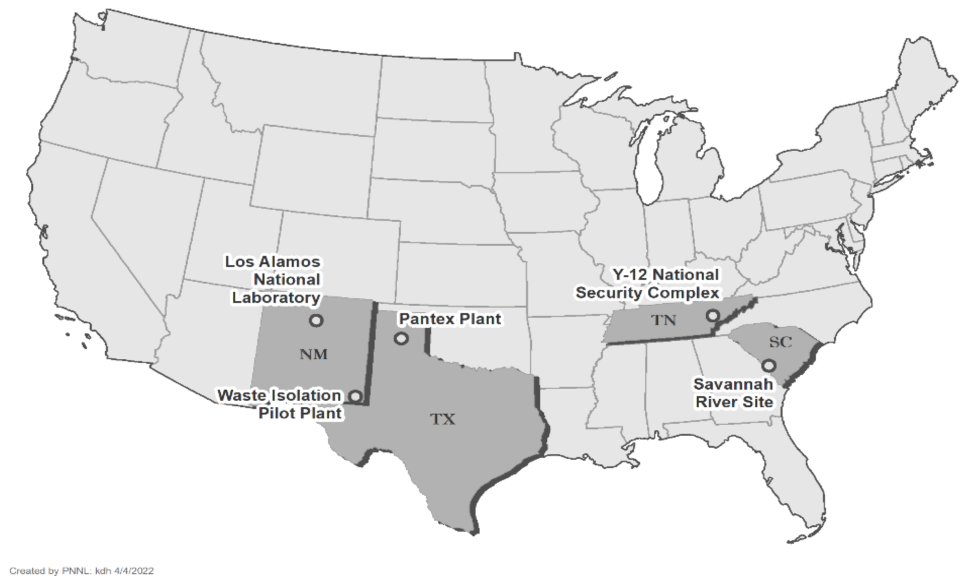

Figure 1-2. Locations of Major Facilities Included in this SPDP EIS

1.5 Decisions to Be Supported by this EIS

Upon completion of this SPDP EIS, NNSA will issue a ROD, proceeding with either the continued management of the 34 MT of surplus plutonium as described under the No Action Alternative, or the disposition of the 34 MT of surplus plutonium using the dilute and dispose strategy as described under the Preferred Alternative. NNSA has analyzed impacts so that it could decide to implement some or all aspects of the Preferred Alternative and its sub-alternatives (see Section 2.1) at one or more sites. This could be accomplished by using strategies such as building similar capabilities at different sites or supplementing activities at one site using a similar capability at another site or at another location within the same site.

1.6 Public Involvement

1.6.1 Public Scoping

Scoping is a process required for preparation of an EIS, which helps to determine the scope of issues for analysis in an EIS, including identifying significant issues and eliminating nonsignificant issues from detailed study (40 CFR Part 1501). Scoping provides an opportunity for the public, governmental entities including Native American Tribes, and other stakeholders to provide comments directly to the Federal agency about the alternatives and issues to be addressed in the EIS. The scoping phase and the public review of the Draft EIS are two opportunities for public input on the content of the EIS (Figure 1-3).

Figure 1-3. The EIS Process Showing Opportunities for Public Involvement During Scoping and Review of the Draft EIS

On December 16, 2020, NNSA published a Notice of Intent (NOI) in the *Federal Register* (85 FR 81460) announcing a 45-day public scoping period ending February 1, 2021 and subsequently extended to February 18, 2021 for this SPDP EIS. The NOI also provided information regarding NNSA's overall NEPA strategy related to fulfilling the purpose and need to disposition 34 MT of surplus plutonium. Considering the public health concerns at the time, NNSA held virtual public scoping meetings on January 25 and 26, 2021, to discuss the SPDP EIS and to receive comments on the potential scope of the SPDP EIS. In addition to the scoping meetings, NNSA encouraged members of the public to provide comments via U.S. postal mail, email, or telephone. NNSA received 279 comment documents related to the project scope during the public scoping process.

NNSA considered all comments received during the public scoping process including some received after the close of the comment period, when preparing the SPDP EIS. The summary of the comments, including an indication of how NNSA addressed the comments, was published in the Draft SPDP EIS.

1.6.2 Public Comments on the Draft

In accordance with NEPA regulations, the Draft SPDP EIS was provided to the public for comment on December 16, 2022, with the publication of a Notice of Availability in the *Federal Register* (87 FR 77096). The publication of the EPA's Notice of Availability (87 FR 77106) started a 60-day public comment period that initially ran until February 14, 2023, and was extended an additional 30 days until March 16, 2023, based on requests from the public. The U.S. Environmental Protection Agency (EPA) announced the comment period extension in a February 10, 2023, notice in the *Federal Register* (88 FR 8843). NNSA held in-person public hearings at locations near SRS, the WIPP facility, and LANL on January 19, 24, and 26, 2023, and held a virtual public hearing on January 30, 2023, to present preliminary findings and to provide the public, governmental entities, including Native American Tribes, and other stakeholders with the opportunity to comment on the Draft SPDP EIS.

The Notice of Availability encouraged members of the public to provide comments on the Draft EIS. The options for submitting comments on the Draft EIS included email, U.S. postal mail, leaving a voicemail using a designated phone number, providing oral comments via speaking at a public hearing, or submitting written comments via a comment form at the in-person public hearings. Comments were accepted beyond the end of the comment period. NNSA considered all comments equally, regardless of the method by which they were provided.

A total of 121 pieces of correspondence were received from individuals, interested groups, and Federal, State, and local agencies during the public comment period on the Draft EIS. Accounting for campaign submittals, duplicate submittals, and non-comment submittals (e.g., questions regarding the schedule), the 121 comment documents included 86 unique submittals and four public meeting transcripts. Comment analysis identified 816 unique comments within the 90 pieces of correspondence. The primary topics identified in the public comments include:

- Need for a programmatic EIS and updated site-specific EISs for each of the sites involved.
- Concerns about the purpose and need, including concerns related to the disposal of surplus pits while making new ones.
- Concerns about the dilute and dispose strategy and questions or suggestions about pursuing other alternatives.
- Concerns or proposed changes related to the scope and content of the EIS.

- Concerns regarding over-commitment of the disposal capacity at WIPP, including concerns about perceived deviations from WIPP's original mission.
- Concerns related to the adequacy of tribal engagement.
- Requests for additional public involvement opportunities.
- Resource-area specific concerns and questions.
- Concerns about accidents at individual sites and along the transportation routes.
- Support for the proposed action, preferred alternative, and/or specific sites.
- Opposition to the proposed action, preferred alternative, and/or specific sites.

After considering the public comments received, the NNSA revised the Draft SPDP EIS. The primary changes to the Final SPDP EIS that resulted from public comments include:

- Clarification regarding whether proposed construction areas and footprints were selected to minimize environmental impacts.
- Clarification regarding compliance with the requirements of the least environmentally damaging practicable alternative.
- Clarification that no discharge of dredged or filled materials into the waters of the United States is planned.
- Clarification regarding assumptions used in technical calculations and analyses.
- Clarification related to pit and non-pit plutonium terminology and descriptions. Clarification that the throughput in each facility is found in Table B-2 of Appendix B.
- Background information related to plutonium and americium-241.
- Clarification of the various plutonium disposition paths decided to date for plutonium that was declared surplus by the United States.
- Updated radiological health information to address potential impacts to surrounding communities.
- Information related to soil quality and plutonium monitoring.
- Information related to climate change impacts, adaptation, and resilience planning.
- Updated and expanded information related to traffic in the vicinity of LANL.

NNSA has also provided responses to comments in Volume 3 of this Final SPDP EIS. Volume 3 provides a more detailed description of the public comment process, and copies of correspondence received on the Draft SPDP EIS.

- In addition to changes made in the Final EIS as a result of the public comments, NNSA has also made changes to the Final EIS to update the environmental baseline information, update analyses based on more recent information, correct inaccuracies, make editorial corrections, and clarify text. A brief list of major changes includes: Incorporated recently available updated census data (multiple sections including Sections 4.1.2.9 and 4.1.3.9)
- Incorporated updated information received from the sites (primarily LANL and SRS)
- Updated information based on the most recent Annual Site Environmental Report.

- Added information related to affordable housing at LANL
- Updated accident analysis calculations based on new assumptions and an updated version of the MELCOR Accident Consequence Code System software.

1.7 Tribal Interactions

NNSA invited 24 Native American groups with ties to the land on or in the vicinity of the SRS and LANL sites to participate in government-to-government consultations and offered briefings on this SPDP EIS. The initial briefing meeting was held on December 6, 2022. The Pueblo de San Ildefonso requested an additional briefing consultation meeting to discuss the program and potential impacts of the SPDP. The meeting with the San Ildefonso Pueblo leadership and attorneys was held on January 31, 2023. Tribal interactions are described further in Sections 5.4.1 and 5.4.2.

1.8 Organization of this EIS

The subsequent sections in Volume 1 of this EIS are organized as follows:

- Section 2.0 describes the two alternatives and four sub-alternatives for the disposition of surplus plutonium that are considered by NNSA in this EIS.
- Section 3.0 discusses the environment at each of the DOE sites that could be affected by the Preferred Alternative and the No Action Alternative.
- Section 4.0 examines the potential environmental consequences of the activities required under the Preferred Alternative and the No Action Alternative.
- Section 5.0 discusses associated regulations, permits, and consultations.
- Section 6.0 provides a list of preparers of this EIS.
- Section 7.0 presents a glossary of terms used in this EIS.
- Section 8.0 lists references for sources cited in this EIS.
- Section 9.0 provides an index for this EIS.

Additional information is provided in the following appendices in Volume 2:

- Appendix A – Related *National Environmental Policy Act* Reviews and Decision Documents
- Appendix B – Facilities Description
- Appendix C – Detailed Environmental Consequence Tables
- Appendix D – Evaluation of Human Health Effects from Facility Accidents
- Appendix E – Evaluation of Human Health Effects from Transportation
- Appendix F – Conflict of Interest Disclosure Statements.

Volume 3 of this SPDP EIS contains three parts:

- Comment and response process and summary
- Attachment A – Comment Response Report
- Attachment B – Correspondence related to public review of the Draft EIS.

2.0 ALTERNATIVES FOR DISPOSITION OF SURPLUS PLUTONIUM

Section 2.0 of this *Surplus Plutonium Disposition Program Environmental Impact Statement* (SPDP EIS) describes the alternatives proposed by the NNSA to disposition 34 MT of surplus plutonium. It also describes alternatives considered and dismissed from detailed study; the methodologies used to develop this EIS; a summary of the potential environmental consequences of the alternatives analyzed; and a summary of potential cumulative impacts of the alternatives analyzed.

This section describes the alternatives NNSA has identified to disposition 34 MT of surplus plutonium. Section 2.1 describes the alternatives considered for detailed analysis in this SPDP EIS. Other alternatives that were considered and dismissed from detailed analysis in previous EISs and Supplemental EISs are described in Section 2.2. Section 2.3 describes the methodologies used to develop this EIS. Section 2.4 provides a summary and comparison of the potential environmental consequences of the alternatives considered in this SPDP EIS, and Section 2.5 provides a summary of potential cumulative impacts. Appendix B provides a more detailed description of the facilities associated with the two alternatives considered for detailed analysis in this document.

2.1 Alternatives Considered for Detailed Analysis in this SPDP EIS

NNSA's purpose and need is to disposition 34 MT of surplus plutonium in a safe and secure manner and within a reasonable time frame at a cost consistent with NNSA priorities and fiscal realities. Two alternatives are analyzed in detail in this SPDP EIS—the Preferred Alternative, consisting of four sub-alternatives, and the No Action Alternative. Both alternatives use the dilute and dispose strategy and both address up to 7.1 MT of non-pit surplus plutonium that NNSA previously decided to dispose of (85 FR 53350) using the dilute and dispose strategy. NNSA's Preferred Alternative is to use the dilute and dispose strategy for 34 MT of surplus plutonium comprised of both pit and non-pit plutonium, as shown in Figure 2-1. The No Action Alternative is continued management of the 34 MT of both surplus pit and non-pit plutonium, including the disposition of up to 7.1 MT of non-pit surplus plutonium using the dilute and dispose strategy based on a previous NNSA decision (85 FR 53350). The Preferred Alternative is the only alternative evaluated that meets the purpose and need.

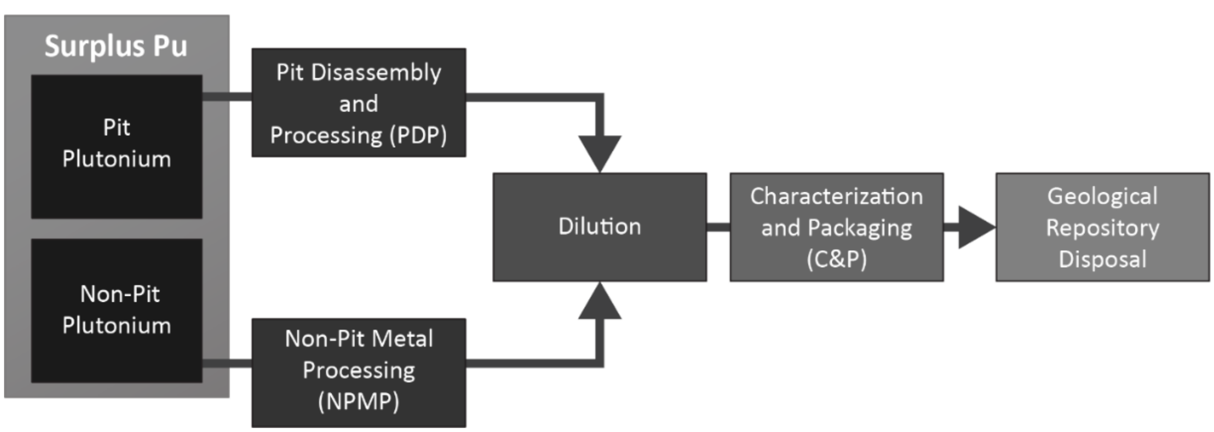

Figure 2-1. High-Level Overview of Dilute and Dispose Strategy Process

The steps in the dilute and dispose strategy include:

- **Pit packaging and shipping**. Surplus plutonium pits are packaged at Pantex in Texas and shipped for processing to either LANL in New Mexico, or SRS in South Carolina. This only occurs for the Preferred Alternative.
- **PDP**. Surplus plutonium pits are disassembled to segregate the plutonium metal from other materials. The plutonium metal is oxidized in furnaces located in gloveboxes to form plutonium oxide powder. Some pit plutonium has already been processed into oxide (DOE 2008a|p. 2-62|; LANL 2023a|Section 2.12.1.2|). PDP only occurs under the Preferred Alternative.
- **Decontamination, oxidation, and shipment of HEU**. Highly enriched uranium (HEU) from pit disassembly is decontaminated, oxidized, packaged, and shipped to Y-12 in Tennessee (LANL 2023a|Sections 1.1.2.1, 2.15.1.2.2|). This only occurs under the Preferred Alternative.
- **NPMP**. Non-pit surplus plutonium in a metal form is processed by oxidation in furnaces located in gloveboxes to form plutonium oxide. Processing the non-pit surplus plutonium can take place in the same gloveboxes or in different gloveboxes from the processing of the pit plutonium. Some of the non-pit surplus plutonium is already in an oxide form and does not need to be processed prior to dilution.
- **Preparation and packaging of plutonium oxide**. The plutonium oxide from PDP and/or NPMP is either moved to a second set of gloveboxes at the same site for dilution or it may be packaged and shipped to another site for dilution.
- **Dilution of plutonium oxide**. The plutonium oxide from PDP and/or NPMP is diluted in a set of gloveboxes by blending the plutonium oxide with an adulterant to reduce the plutonium concentration and inhibit plutonium recovery. The dilution process combines the plutonium oxide with an adulterant that contains nonhazardous inorganic materials to form a chemically stable matrix suitable for plutonium disposition. The multi-component adulterant is designed to impede recovery of the surplus plutonium such that the waste form complies with DOE requirements for termination of safeguards (NNSA 2022).

  The dilution process combines the plutonium oxide with an adulterant that contains nonhazardous inorganic materials to form a chemically stable matrix suitable for plutonium disposition.

- **Characterization, packaging, and shipment of diluted plutonium oxide CH-TRU waste.** After dilution, the composition of the adulterated plutonium oxide mixture (CH-TRU waste) is analyzed or “characterized” using radiography and nondestructive assay analysis. The purpose of the characterization process is to verify that the resulting diluted plutonium oxide, which is packaged as CH-TRU waste, complies with the WIPP Waste Acceptance Criteria (WAC) for disposal. DOE will verify that the transuranic (TRU) TRU waste stream is of defense origin and that the TRU waste meets the WIPP WAC by performing nondestructive assay and evaluating acceptable knowledge (information related to how the TRU waste stream was created and managed). An initial waste certification audit of the SPDP diluted plutonium oxide CH-TRU waste packaging program will be scheduled and conducted by the DOE’s Carlsbad Field Office and technical assistant contractor at the appropriate time, with approval of the final audit report by the New Mexico Environment Department (NMED). The EPA will also perform an inspection and provide approval of characterization equipment and controls. If the SPDP diluted plutonium oxide CH-TRU waste packaging program passes the audit, then the waste can be certified to indicate that it meets the WIPP WAC before it is shipped to the WIPP facility.

- **Preparation and packaging of job control waste**. Job control wastes of various kinds are packaged for shipment and disposal. This includes gloves or other materials used in the above processes that become contaminated with TRU material. The CH-TRU job control waste must also meet the WIPP WAC.
- **Disposal of job control and diluted plutonium oxide CH-TRU waste at the WIPP facility**. The CH-TRU waste that is disposed at the WIPP facility is tracked by an audited Nuclear Quality Assurance compliant waste data system and procedures.

The Preferred Alternative requires all of the above steps. The No Action Alternative does not require pit packaging and shipping, PDP, or decontamination, oxidation, and shipment of HEU because only non-pit surplus plutonium is processed in the No Action Alternative.

2.1.1 Preferred Alternative

The Preferred Alternative is to disposition 34 MT of surplus plutonium using the dilute and dispose strategy described in Section 2.1. This 34 MT consists of both surplus pit and non-pit forms of plutonium. As discussed in Section 2.1, some of the non-pit and pit plutonium is already in oxide form and a portion of the 34 MT has an existing ROD for disposal. NNSA has already decided to disposition up to 7.1 MT of non-pit surplus plutonium using the dilute and dispose strategy (85 FR 53350). The exact amounts of pit and non-pit forms of plutonium that compose the 34 MT are safeguarded, so they cannot be delineated further. Therefore, to bound the impacts, the analysis in this SPDP EIS evaluates the impacts of dispositioning 34 MT of surplus plutonium in pit form and the impacts of dispositioning 7.1 MT of non-pit surplus plutonium. These amounts were selected so that the analysis of impacts would cover the full environmental effects of dispositioning the 34 MT regardless of the final proportion of surplus pit plutonium or non-pit plutonium. By evaluating the impacts of dispositioning 34 MT of pit plutonium and 7.1 MT of non-pit plutonium, NNSA will provide a conservative assessment of the impacts of completing the 34 MT mission.

> To bound the impacts, the analysis in this SPDP EIS evaluates the impacts of dispositioning 34 MT of pit plutonium and 7.1 MT of non-pit plutonium. However, <u>there is only 34 MT</u> of surplus plutonium to be dispositioned.

The strategy of diluting plutonium oxide with an adulterant and disposing the resultant CH-TRU waste at the WIPP facility was previously demonstrated using non-pit plutonium during the closure of the Rocky Flats Environmental Technology Site (Mason 2015|p. 26|; 68 FR 20134; DOE 2002b). The dilute and dispose strategy was also evaluated as a viable approach for dispositioning 13.1 MT of surplus plutonium in the 2015 SPD SEIS (DOE 2015c). The strategy was selected and is currently being used to disposition 6 MT of non-pit surplus plutonium (81 FR 19588) and up to 7.1 MT of non-pit surplus plutonium (85 FR 53350).

The description of the Preferred Alternative is organized below by describing each of the four sub-alternatives and then discussing the activities that will occur at each site for each of the sub-alternatives.

2.1.1.1 Overview of Preferred Alternative by Sub-Alternative

The activities that are part of the Preferred Alternative would occur at five DOE sites—Pantex in Texas, LANL in New Mexico, SRS in South Carolina, Y-12 in Tennessee, and the WIPP facility in New Mexico.

NNSA has developed four sub-alternatives for the Preferred Alternative based on the location of activities, as described below and shown in Figure 2-2 through Figure 2-5. In the figures, the arrows between storage and processing or between the processing steps indicate movement of material or waste between sites (e.g., Pantex to LANL) or between different capabilities or facilities for each of the sub-alternatives. Table 2-1 illustrates the activities that occur at each site under each of the four sub-alternatives that are considered in this SPDP EIS. For all sub-alternatives, pits are stored at Pantex prior to their disassembly and processing. The sub-alternatives were defined so that the analyses presented in this EIS bound the impacts that would occur from processing a portion of the 34 MT at either LANL or SRS and the remainder of the 34 MT at the other site.

Table 2-1. Location Summary of Activities in Each Sub-Alternative of the Preferred Alternative

Activities	Base Approach	SRS NPMP	All LANL	All SRS
Pit Packaging and Shipping	Pantex	Pantex	Pantex	Pantex
PDP	LANL	LANL	LANL	SRS
Decontamination, oxidation, and shipment of HEU to Y-12	LANL	LANL	LANL	SRS
NPMP	LANL	SRS	LANL	SRS
Preparation, packaging, and inter-site shipment of plutonium oxide	LANL	LANL	NA	NA
Dilution of plutonium oxide	SRS	SRS	LANL	SRS
C&P of diluted plutonium oxide CH-TRU waste for shipment to the WIPP facility	SRS	SRS	LANL	SRS
Packaging and shipment of CH-TRU job control waste to the WIPP facility	LANL and SRS	LANL and SRS	LANL	SRS
Disposal of diluted plutonium oxide CH-TRU waste and CH-TRU job control waste	WIPP	WIPP	WIPP	WIPP

C&P = characterization and packaging; CH-TRU = contact-handled transuranic; HEU = highly enriched uranium; LANL = Los Alamos National Laboratory; NA = not applicable; NPMP = non-pit metal processing; Pantex = Pantex Plant; PDP = pit disassembly and processing; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant; Y-12 = Y-12 National Security Complex.

2.1.1.1.1 Base Approach Sub-Alternative

Under the Base Approach Sub-Alternative (Figure 2-2), NNSA evaluates the impacts of shipping 34 MT of pit plutonium from Pantex to LANL and disassembling and processing the 34 MT of pit plutonium at LANL with subsequent shipment of the decontaminated and oxidized HEU to Y-12. In the Base Approach Sub-Alternative, NNSA also evaluates the impacts of processing up to 7.1 MT of non-pit surplus plutonium in the same capability used for PDP at LANL. This sub-alternative relies on expanding existing capabilities at LANL in the Plutonium Facility (PF-4) for PDP and NPMP. The resulting plutonium oxide from the surplus pit and non-pit plutonium would be shipped to K-Area at SRS, where it would be diluted and characterized and packaged as CH-TRU waste for shipment to and disposal at the WIPP facility.

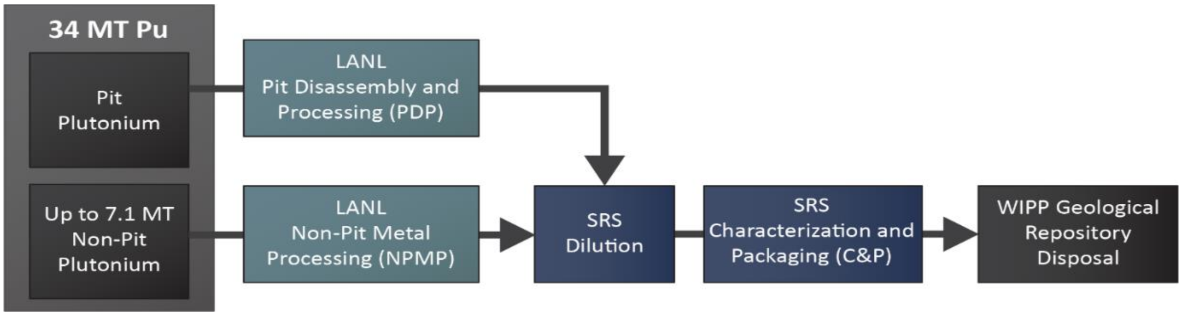

Figure 2-2. Preferred Alternative – Base Approach Sub-Alternative

2.1.1.1.2 SRS NPMP Sub-Alternative

The SRS NPMP Sub-Alternative is shown in Figure 2-3. This sub-alternative is similar to the Base Approach Sub-Alternative: NNSA analyzes the impacts of shipping 34 MT of pit plutonium from Pantex to LANL and disassembly and processing of the 34 MT of pit plutonium in an expanded existing facility (PF-4) at LANL. In the SRS NPMP Sub-Alternative, NNSA also analyzes the subsequent shipment of the decontaminated and oxidized HEU to Y-12. PDP is followed by shipment of the resulting plutonium oxide to SRS (K-Area). Unlike the Base Approach Sub-Alternative, the SRS NPMP Sub-Alternative does not analyze NPMP at LANL. Instead, it evaluates the impacts of processing up to 7.1 MT of non-pit surplus plutonium at SRS's K-Area either in Building 105-K or in a modular system adjacent to the building. Similar to the Base Approach Sub-Alternative, the SRS NPMP Sub-Alternative considers the impacts of dilution and C&P of the diluted plutonium oxide CH-TRU waste in SRS's K-Area for shipment to and disposal at the WIPP facility.

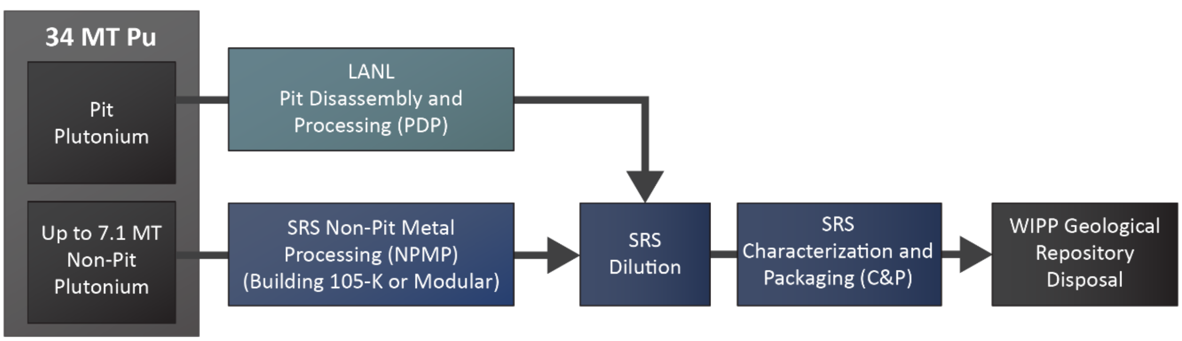

Figure 2-3. Preferred Alternative – SRS NPMP Sub-Alternative

2.1.1.1.3 All LANL Sub-Alternative

The All LANL Sub-Alternative is shown in Figure 2-4. This sub-alternative considers only capabilities at LANL for the entire disposition pathway. Similar to the Base Approach Sub-Alternative, under the All LANL Sub-Alternative, NNSA analyzes the impacts of shipping 34 MT of pit plutonium from Pantex to LANL and disassembly and processing of the 34 MT of pit plutonium in an expanded existing facility (PF-4) at LANL with subsequent shipment of the decontaminated and oxidized HEU to Y-12. In the All LANL Sub-Alternative, NNSA also evaluates the impacts of processing up to 7.1 MT of non-pit surplus plutonium at LANL in PF-4. Unlike the Base Approach Sub-Alternative, the resulting plutonium oxide would remain at LANL for dilution and C&P before shipment to and disposal at the WIPP facility as CH-TRU waste.

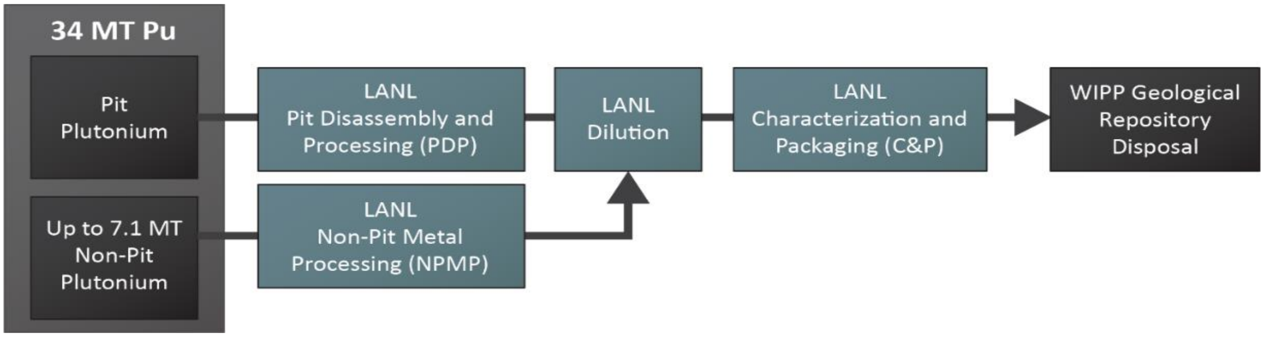

Figure 2-4. Preferred Alternative – All LANL Sub-Alternative

2.1.1.1.4 All SRS Sub-Alternative

The All SRS Sub-Alternative is shown in Figure 2-5. NNSA would use only capabilities at SRS. Under this sub-alternative, NNSA analyzes the impacts of shipping 34 MT of pit plutonium from Pantex to SRS and the disassembly and processing of the 34 MT of pit plutonium in a new capability installed at SRS in either K-Area or F-Area. In the All SRS Sub-Alternative, NNSA also analyzes the subsequent shipment of the decontaminated and oxidized HEU to Y-12 as well as the impacts of processing up to 7.1 MT of non-pit surplus plutonium at SRS using the same new capability used for PDP. The resulting plutonium oxide would remain at SRS for dilution and C&P before shipment to and disposal at the WIPP facility as CH-TRU waste.

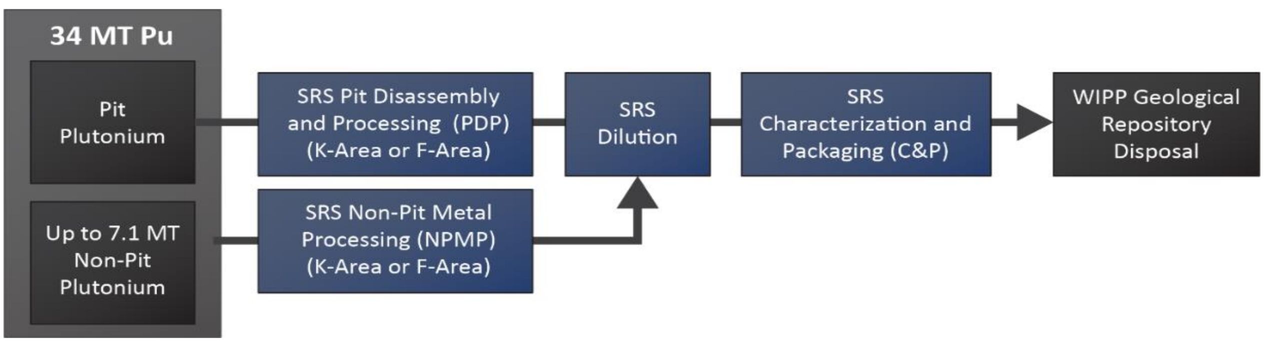

Figure 2-5. Preferred Alternative – All SRS Sub-Alternative

2.1.1.2 Overview of the Preferred Alternative by Site

The operational activities in each step of the Preferred Alternative are described in the following sections, organized by site. These sections also describe the construction and/or modification activities that would be necessary to build the operational capabilities. Some of the capabilities at LANL and SRS are in an early planning stage. As such, the analyses in this EIS are based on the best available information. Additional details about the facilities and the throughputs that are assumed for the analyses are provided in Appendix B. A discussion of the transportation that occurs between each site follows in Section 2.1.1.2.6.

2.1.1.2.1 Pantex

NNSA decided to consolidate the storage of surplus pit plutonium at Pantex (e.g., 62 FR 3014; 62 FR 3880; 67 FR 19432). Transportation of surplus plutonium to consolidated storage at Pantex is discussed in *The Final Supplement Analysis for the Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components* (DOE 2018f), incorporated herein by reference. Under the Preferred Alternative, pits stored at Pantex would be packaged in Type B packages[9] for shipment (CNS 2019), via the NNSA's Office of Secure Transportation (OST) transporter, to either LANL or SRS for disassembly and processing. Integration of additional packaging line(s), if needed, would occur in existing facilities at Pantex to support planned pit packaging and shipping rates. Packaging of pits for shipment to LANL or SRS is a continuation of ongoing activities that were previously reviewed (DOE 2018f) and is not re-analyzed in this SPDP EIS.

2.1.1.2.2 Los Alamos National Laboratory

The activities that could occur at LANL for the Preferred Alternative are summarized in Table 2-2 for each of the sub-alternatives. No activities occur at LANL under the All SRS Sub-Alternative aside from the transportation activities described in Section 2.1.1.2.6.

Table 2-2. Activities that Could Occur at LANL in Each Sub-Alternative of the Preferred Alternative

Activities	Base Approach	SRS NPMP	All LANL	All SRS
PDP	**Yes**	**Yes**	**Yes**	No
Decontamination, oxidation, and shipment of HEU to Y-12	**Yes**	**Yes**	**Yes**	No
NPMP	**Yes**	No	**Yes**	No
Preparation, packaging, and shipment of plutonium oxide to SRS	**Yes**	**Yes**	No	No
Dilution of plutonium oxide	No	No	**Yes**	No
C&P of diluted plutonium oxide CH-TRU waste for shipment to the WIPP facility	No	No	**Yes**	No
Packaging and shipment of CH-TRU job control waste to the WIPP facility	**Yes**	**Yes**	**Yes**	No

C&P = characterization and packaging; CH-TRU = contact-handled transuranic; HEU = highly enriched uranium; LANL = Los Alamos National Laboratory; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant; Y-12 = Y-12 National Security Complex.

Construction at Los Alamos National Laboratory

The Preferred Alternative would include construction and modification activities to expand the existing PDP capability (DOE's Advanced Recovery and Integrated Extraction System Oxide Production Program) in the PF-4 building located in LANL's Technical Area (TA)-55. The construction and modification activities would include the addition of new or modified gloveboxes, material entry hoods, and other upgrades to increase throughput. These activities would occur largely inside the PF-4 building and would expand the current space used for PDP from 5,200 ft^2 to 6,800 ft^2 (LANL 2023a|Sections 1.1.2.1, 1.1.2.2|).

NNSA would construct new facilities to support the increased activities in PF-4 for the Base Approach Sub-Alternative, the SRS NPMP Sub-Alternative, and the All LANL Sub-Alternative. These facilities include a Logistical Support Center (LSC), a separate office building, a warehouse, a security portal, and a weather enclosure at the loading dock of PF-4 (LANL 2023a|Section 1.1.2|). The office building and

[9] Type B packages are designed in accordance with Federal Regulations (49 CFR Parts 100-177) for transporting materials and wastes that could be a radiation hazard to the environment or the public if the contents were released.

warehouse would be built on undisturbed land in TA-52. The other structures would be built in industrial areas in TA-55. The All LANL Sub-Alternative would require modifications to PF-4 to increase throughput for PDP and install the dilution capability. The expansion would increase the floor space from the existing 5,200 ft^2 to 8,400 ft^2 (LANL 2023a|Section 1.1.2.1). NNSA would construct a new Drum Handling Facility (DHF) to support the C&P of diluted plutonium oxide CH-TRU waste for shipment to and disposal at the WIPP facility (LANL 2023a|Section 1.1.2.2|). The building functions, size, locations, and acreage of land disturbed are presented in Table 2-3. Utilities for the new facilities would also be installed.

The proposed location of the facilities, laydown areas used during construction or modification, and the facility footprints are shown in Figure 2-6 for activities that would occur in TA-55. The proposed locations for the office building and warehouse in TA-52 are shown in Figure 2-7.

Table 2-3. New Facilities to Be Constructed and Land Disturbed under the Preferred Alternative[(a)] at LANL

Structure/Laydown Area	Function	Location	Facility Footprint or Area Size[(b)] ft^2 (ac)
Drum Handling Facility	Characterization, packaging, shipment to the WIPP facility	TA-55	20,000 (0.46)
Warehouse	Storage	TA-52	18,000 (0.41)
Parking area	Parking by warehouse	TA-52	12,600 (0.29)
Security portal	Vehicle/pedestrian security checkpoint	TA-55	4,620 (0.11)
Parking area	Parking by security portal	TA-55	3,000 (0.069)
Road extensions	Access to security portal, parking and Drum Handling Facility	TA-55	13,000 (0.30)
Road extensions	Access to office building and Warehouse	TA-52	4,800 (0.11)
Weather enclosure	Weather covering for the loading dock of PF-4 in TA-55	TA-55 adjacent to PF-4	4,100 (0.094)
Laydown areas in TA-55	Laydown areas would contain portable office trailers, construction equipment, supplies, and infrastructure	Various locations in TA-55	123,000 (2.8)
Laydown areas in TA-52	Laydown areas	Various locations in TA-52	10,200 (0.23)
Logistical Support Center	Offices, meeting rooms, and locker rooms	TA-55 separate from, but adjacent to, PF-4	10,800 (0.25)/floor (2 floors)[(c)]
Office Building	Offices	TA-52	12,000 (0.28)/floor (2 floors)[(c)]
Parking area	Parking by office building	TA-52	12,600 (0.29)

LANL = Los Alamos National Laboratory; PF-4 = Plutonium Facility; SRS = Savannah River Site; TA = Technical Area; WIPP = Waste Isolation Pilot Plant.

(a) No construction or land disturbance would occur at LANL under the All SRS Sub-Alternative.
(b) Conversions from square feet to acres may not equate because of rounding.
(c) Structures with multiple floors only have the area listed for one floor, because land disturbance is based on the footprint rather than total cumulative area.

Source: LANL 2023a|Figures 1-11, 1-12, Sections 1.1.2, 2.8.1, 2.8.2|.

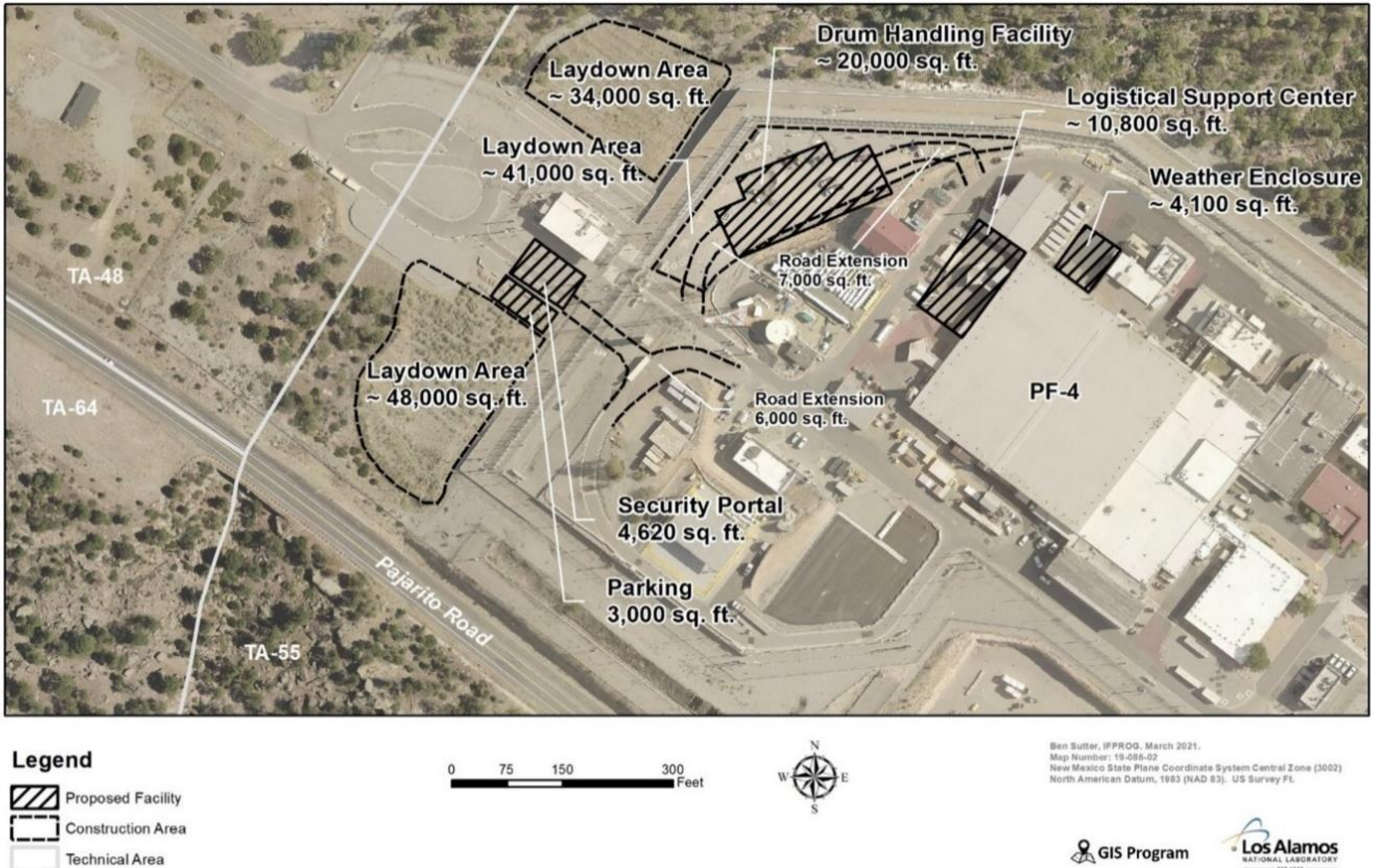

Figure 2-6. Potential Facility and Laydown Area Locations at TA-55(LANL 2023a|Figure 1-11|)[10]

[10] The Drum Handling Facility would be constructed only for the All LANL Sub-Alternative.

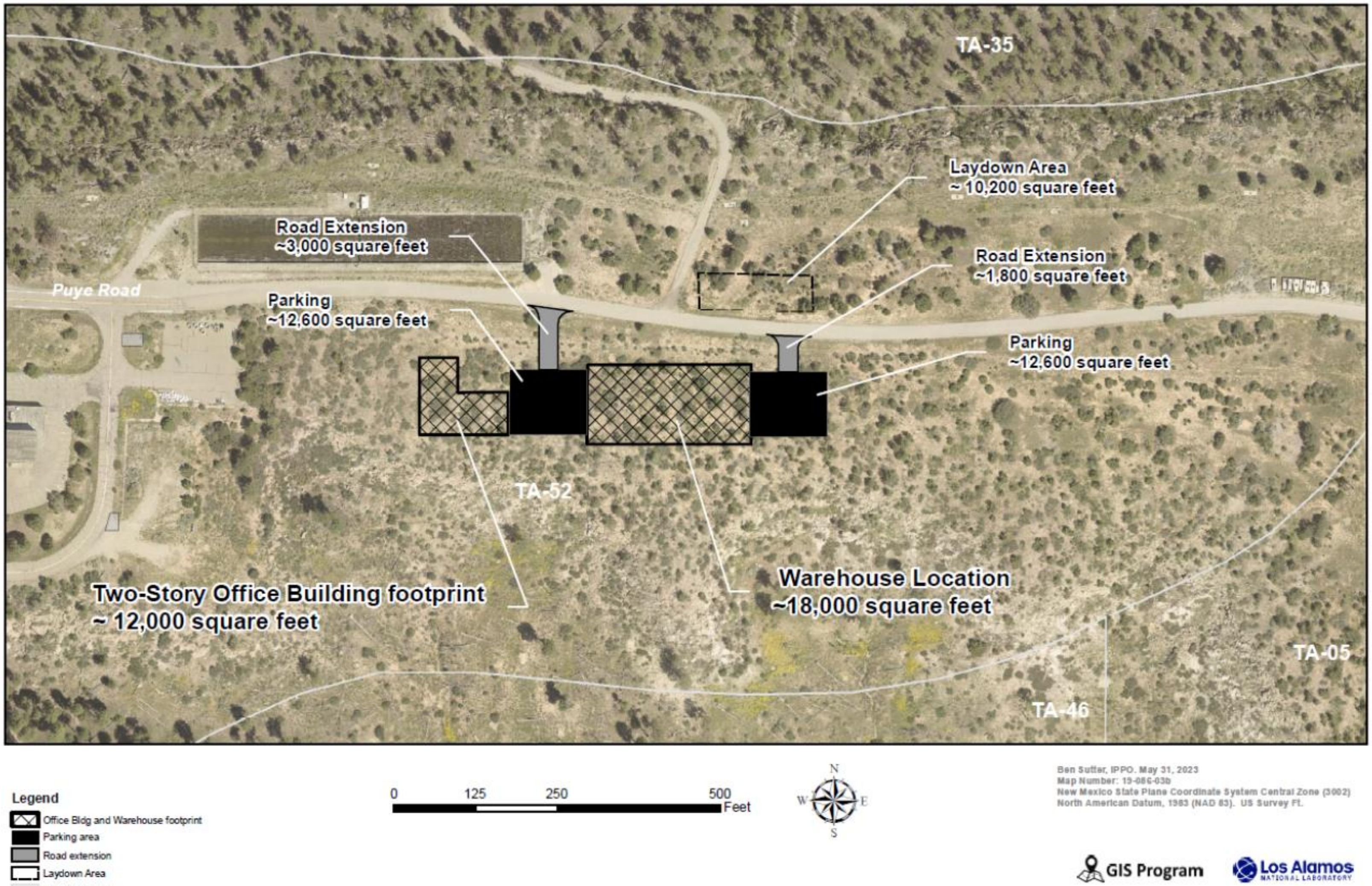

Figure 2-7. Potential Facility and Laydown Area Location at TA-52 for the Office Building and Warehouse (LANL 2023a|Figure 1-12|)

Operations at Los Alamos National Laboratory

The operations activities for all three sub-alternatives occurring at LANL under the Preferred Alternative would include PDP in PF-4. Pit disassembly would be conducted in a series of gloveboxes (Figure 2-8) using a pit cutter or a lathe.

Figure 2-8. Gloveboxes

Processing activities would also occur in gloveboxes and use furnaces to heat up the plutonium until it turns into an oxide. Similar PDP activities already occur in PF-4 for smaller amounts of plutonium (DOE 2008a|p. 2-62|; LANL 2023a|Section 2.12.1.2|). HEU recovered during pit disassembly would be decontaminated, oxidized, and prepared for shipment to DOE's Y-12 at Oak Ridge, Tennessee (LANL 2023a|Sections 1.1.2.1, 2.15.1.2.2|). For the Base Approach Sub-Alternative and the All LANL Sub-Alternative, NPMP would occur in gloveboxes installed as part of the PDP capability in PF-4.

For the Base Approach and SRS NPMP Sub-Alternatives, after processing, the resulting plutonium oxide would be packaged in PF-4 into Type B packages and loaded into an appropriate OST Transporter (LANL 2023a|Section 2.15.1.2.3|) for shipment to SRS. Some of the job control waste, specifically waste such as gloves from gloveboxes and other waste from inside gloveboxes, would be classified as CH-TRU waste and packaged for shipment in the Transuranic Waste Facility at LANL and shipped to the WIPP facility for disposal.

In the All LANL Sub-Alternative, plutonium oxide would be diluted in PF-4 (LANL 2023a|Section 1.1.2.2|). The oxide could be a product of processing activities at LANL or could be from material that already exists in oxide form. The oxide would be blended with an adulterant in blend cans (Figure 2-9) within dedicated gloveboxes to reduce the plutonium concentration and inhibit plutonium recovery.

Figure 2-9. Blending of Plutonium Oxide and Adulterant in a Blend Can

Mixers would be used to assure uniform mixing and dilution within the blend cans. After blending with the multicomponent adulterant, the resulting mixture would be placed in a shielded container and the lid would be press fit. Compressing the blended adulterant and diluted plutonium oxide mixture into the shielding container helps to minimize the container size and the mass of shielding required (NNSA 2022). After dilution, the plutonium oxide is considered to be CH-TRU waste. The container of diluted plutonium oxide CH-TRU waste would be removed from the glovebox and packaged in a can/bag/can configuration inside a convenience can (Figure 2-10).

Figure 2-10. Diluted Plutonium Oxide CH-TRU Waste Packaged in a Can/Bag/Can

Neutron counters and gamma spectrometers would be used to assay the diluted plutonium oxide CH-TRU waste in the convenience can. After the assay is completed, up to two convenience cans could be placed in a criticality control container. The criticality control container would be loaded into a criticality control overpack (CCO) container (LANL 2023a|Section 2.15.2.2|) (Figure 2-11). In addition, integrated assay systems would be used (LANL 2023a|Section 1.1.2.2|) as approved by the DOE Carlsbad Field Office (CBFO)/WIPP for assay of CH-TRU job control waste.

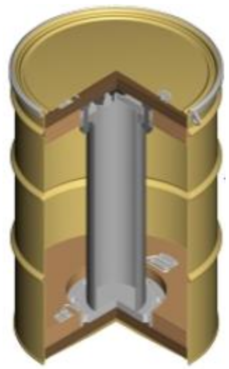

Figure 2-11. CCO

In the All LANL Sub-Alternative, plutonium in diluted oxide form would be characterized and packaged in a newly constructed DHF at LANL for shipment to and disposal at the WIPP facility (LANL 2023a|Section 1.1.2.2|). C&P of small amounts of diluted plutonium oxide CH-TRU waste could occur in PF-4 until the DHF becomes operational (LANL 2023a|Section 1.1.2.2|). Once the DHF is operational, these processes could be transferred, and the C&P rate would be increased. However, for analysis, it is assumed that the CCOs containing the diluted plutonium oxide CH-TRU waste would be moved to the new DHF for C&P. The characterization process is conducted as approved by CBFO/WIPP to verify that the diluted plutonium oxide CH-TRU waste complies with the WIPP WAC (DOE 2022i) for disposal as CH-TRU waste at the WIPP facility. Waste characterization would include radiography and nondestructive assay analysis of each loaded CCO. Characterization is conducted by personnel certified by the WIPP facility and the process can be modified as approved by CBFO/WIPP. After characterization, CCOs would be packaged in approved TRU waste transportation containers (e.g., Transuranic Package Transporter Model-II [TRUPACT-II]) (Figure 2-12 and Figure 2-13) and shipped to the WIPP facility for disposal. Each TRUPACT-II can be loaded with up to 14 CCOs (LANL 2023a|Section 2.12.2|). Three TRUPACT-II containers can be loaded on a TRUPACT-II transporter (SRNS 2023d|Section 20.1). CH-TRU job control waste could also be packaged and transported to the WIPP facility from the Transuranic Waste Facility (see Section B.1.2.4 in Appendix B) for disposal (LANL 2023a|Section 1.8, Table 1-5|).

Figure 2-12. Drums Loaded into a TRUPACT-II for Transport

Figure 2-13. TRUPACT-II Transporter Used for Shipping CH-TRU Waste to the WIPP Facility

2.1.1.2.3 Savannah River Site

The activities that could occur at SRS for the Preferred Alternative are summarized in Table 2-4. No activities occur at SRS under the All LANL Sub-Alternative aside from transportation activities described in the Section 2.1.1.2.6.

Table 2-4. Activities that Could Occur at SRS in Each Sub-Alternative of the Preferred Alternative

Activities	Base Approach	SRS NPMP	All LANL	All SRS
PDP	No	No	No	**Yes**
Decontamination, oxidation, and shipment of HEU to Y-12	No	No	No	**Yes**
NPMP	No	**Yes**	No	**Yes**
Preparation, packaging, and intra-site shipment of plutonium oxide between F-Area and K-Area	No	No	No	**Yes**
Dilution of plutonium oxide	**Yes**	**Yes**	No	**Yes**
C&P of diluted plutonium oxide CH-TRU waste for shipment to the WIPP facility	**Yes**	**Yes**	No	**Yes**
Packaging and shipment of CH-TRU job control waste to the WIPP facility	**Yes**	**Yes**	No	**Yes**

C&P = characterization and packaging; CH-TRU = contact-handled transuranic; HEU = highly enriched uranium; LANL = Los Alamos National Laboratory; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant; Y-12 = Y-12 National Security Complex.

Construction at Savannah River Site

The dilution and C&P capabilities in the Base Approach Sub-Alternative of the Preferred Alternative do not require any construction activities at SRS. The construction activities for the dilution capability were evaluated in the 2015 SPD SEIS (DOE 2015c) and are not considered to be a part of the action evaluated in this SPDP EIS. Construction of the K-Area Characterization and Storage Pad was analyzed as a separate action (DOE 2017a) to support C&P of the 6 MT of surplus plutonium DOE already decided to dilute and dispose of at the WIPP facility (81 FR 19588). Construction was categorically excluded from further NEPA review (SRNS 2023d|Section 1|), and therefore, is not evaluated in this SPDP EIS.

For the SRS NPMP Sub-Alternative, two options are being considered. The first option involves modifications in Building 105-K in K-Area to install capabilities for NPMP (SRNS 2023d|Section 1|). Because the modifications would occur inside Building 105-K, no land-disturbing activities are anticipated. The second option is a modular system that would be constructed and tested offsite and then assembled adjacent to Building 105-K. The modular system would be placed on concrete pads that are approximately 4,500 ft^2 and are located close to Building 105-K. The land required for the modular system, including a perimeter security barrier, is 14,450 ft^2 (0.33 ac) in a 170 ft by 85 ft perimeter configuration within a previously disturbed industrial area (SRNS 2023d|Section 3.2|).

For the All SRS Sub-Alternative, two options are being considered. Construction activities at SRS could take place to install PDP and NPMP capabilities at SRS in either Building 226-F (the Savannah River Plutonium Processing Facility [SRPPF]) located in F-Area or in Building 105-K located in K-Area. Plans for construction activities at both sites are in the early stages, and the exact locations within the buildings are not known. For this EIS analysis, NNSA assumes that adequate space is available in Building 226-F for PDP and NPMP as well as interim storage for incoming and outgoing surplus plutonium. However, because the facility design is incomplete, available total square footage in Building 226-F (SRPPF) is not known at this time. Additional support systems within the building would include active confinement ventilation; heating, ventilation, and air-conditioning (HVAC); radiation monitoring; criticality alarm system; safeguards and security system; electrical; fire detection; suppression and water collection system; compressed gas and air systems; and gas supply.

Based on a preliminary study for the K-Area option, NNSA assumes that the processing equipment would be installed in the disassembly basin area in Building 105-K. To prepare the disassembly basin area for installation of equipment and support systems, a process similar to the one used for decommissioning the disassembly basin in C-Reactor would be used (SRNS 2013). The radioactive water that is currently in the disassembly basin would be removed using forced evaporation, which requires pumping the water to multiple diesel-fired evaporators where it would be heated and vaporized. Existing components and scrap would remain in the basin along with the evaporation equipment once dewatering has been completed. The disassembly basin would be filled with structured grout, which would form the floor for the installation of the processing equipment and gloveboxes. Additional support systems similar to those listed above for PDP and NPMP in F-Area would also be installed.

Construction of additional support facilities such as warehouses or office buildings outside of Building 226-F or Building 105-K would be needed to support PDP and NPMP capabilities in F-Area or K-Area. The number of buildings is not known at this time for either F-Area or K-Area but would likely include warehouses, mechanical shops, equipment storage and waste storage locations, parking lots, and emergency generator buildings to supply power to critical safety systems in the event of a power outage. In total, approximately 20 ac of previously disturbed land in F-Area or K-Area would be used for buildings as well as any needed temporary construction and laydown areas. Total building footprints for support facilities in F-Area or K-Area are assumed to be 10 ac (not including the existing Buildings 226-F or 105-K).

Operations at Savannah River Site

PDP at SRS is only considered for the All SRS Sub-Alternative. The other sub-alternatives rely on LANL's capability for completion of the PDP activities. In the All SRS Sub-Alternative, PDP and NPMP would occur at SRS in either Building 226-F (SRPPF) located in F-Area or in Building 105-K located in K-Area in a manner similar to that described previously for LANL.

In the Base Approach Sub-Alternative, plutonium oxide from PDP and NPMP would arrive from LANL and be placed in Building 105-K in preparation for the dilution step (SRNS 2023d|Section 1|). After unpacking, the plutonium oxide would be transferred to gloveboxes (Figure 2-9) to be diluted.

In the SRS NPMP Sub-Alternative, PDP would occur at LANL, so plutonium oxide from the processing of pits would arrive from LANL in the same manner as discussed for the Base Approach. However, NPMP would occur at SRS instead of LANL. The processing of non-pit surplus plutonium in gloveboxes could be located in two possible locations at SRS: Building 105-K in K-Area (SRNS 2023d|Section 1|) or in a modular system placed adjacent to Building 105-K. After NPMP, the resulting plutonium oxide would be removed from the furnace and placed in a convenience can and removed safely from the NPMP glovebox and then introduced into the dilution glovebox (SRNS 2023d|Section 3.1|).

The gloveboxes for dilution would also be located in Building 105-K. The plutonium oxide would be blended with an adulterant, as previously described for LANL (see Section 2.1.1.2.2). The diluted plutonium oxide CH-TRU waste would be characterized and packaged in K-Area at the existing Characterization and Storage Pad. The C&P and shipment process currently used at SRS is identical to that described previously for LANL (see Section 2.1.1.2.2). CH-TRU job control waste would be processed through existing facilities in E-Area (SRNS 2023d|Section 20.3|).

2.1.1.2.4 Y-12 National Security Complex

During PDP, surplus plutonium pits would be disassembled to segregate the plutonium from other materials such as HEU. HEU would be decontaminated, oxidized, and shipped to the Y-12 in Oak Ridge, Tennessee. The storage and disposition of weapons-grade fissile materials, such as HEU, occur at Y-12 and are discussed in the *Final Site-Wide Environmental Impact Statement for the Y-12 National Security Complex* (DOE 2011a), as supplemented (DOE 2018i) and are incorporated herein by reference.

2.1.1.2.5 Waste Isolation Pilot Plant

The WIPP facility is the only waste repository authorized for permanent disposal of TRU waste generated by *Atomic Energy Act* defense activities in the United States. The TRU and mixed TRU wastes must meet WIPP WAC before they can be shipped to and disposed of at the WIPP facility (DOE 2022i).

Activities following the transportation of the CH-TRU waste to the WIPP facility include receiving, unloading, waste transfer, and disposal. These activities are described and analyzed in the *Waste Isolation Pilot Plant Disposal Phase Final Supplemental Environmental Impact Statement* (WIPP SEIS; DOE 1997|Section 3.1.3|) and are not re-evaluated in this document. Similar activities would occur at the WIPP facility until it reaches the WIPP Land Withdrawal Act (WIPP LWA) total TRU waste volume capacity limit, regardless of whether waste from the activities discussed in this SPDP EIS is sent to the WIPP facility. DOE has authorized WIPP to use fiscal year (FY) 2050 as a planning assumption for a closure date for project management plans related to capital asset projects and other strategic planning initiatives (DOE 2015e). Therefore, NNSA has chosen FY 2050 as the date for completion of the 34 MT mission described in this EIS. NNSA estimated operational durations based on throughputs (as discussed in Appendix B) that would result in mission completion in FY 2050. Throughput rates are based on currently available planning data, including operating experience and estimates of the operational capability.

2.1.1.2.6 Transportation

Offsite transportation is described separately because the impacts from these activities would not occur at one specific site, but instead would occur along the transportation route. Transportation methodologies are further described in Appendix E. The following offsite transportation routes are analyzed for the sub-alternatives considered in the Preferred Alternative:

- **Shipping construction materials to LANL and SRS**. Materials to support construction and modification activities (see Sections 2.1.1.2.2 and 2.1.1.2.3) would generally be shipped from locations within 30 mi of the site for all sub-alternatives.
- **Shipping adulterant to LANL or SRS**. Adulterant would be shipped from a commercial vendor to either LANL or SRS. The shipping distance is assumed to be 3,000 mi under all sub-alternatives.
- **Shipping pits from Pantex to LANL or SRS**. As described in Section 2.1.1.2.1, pits would be shipped from Pantex to LANL under the Base Approach, SRS NPMP, or All LANL Sub-Alternatives. Pits would be shipped from Pantex to SRS under the All SRS Sub-Alternative.
- **Shipping non-pit surplus plutonium from SRS to LANL or LANL to SRS**. Non-pit surplus plutonium including non-pit metal and some previously processed non-pit oxide would be shipped between sites as appropriate for processing and/or dilution.
- **Shipping plutonium oxide from LANL to SRS**. Plutonium oxide from pit processing would be shipped from LANL to SRS for dilution under the Base Approach and SRS NPMP Sub-Alternatives. Plutonium oxide from the processing of non-pit surplus plutonium at LANL would also be shipped to SRS under the Base Approach Sub-Alternative.
- **Shipping HEU from LANL or SRS to Y-12**. After PDP at LANL or SRS, HEU would be shipped to Y-12 under all sub-alternatives.
- **Shipping byproduct material from SRS to LANL**. After PDP at SRS, byproduct material would be shipped to LANL under the All SRS Sub-Alternative if required.
- **Shipping diluted plutonium oxide CH-TRU waste from LANL or SRS to the WIPP facility**. As described in Sections 2.1.1.2.2 and 2.1.1.2.3, after C&P, the diluted plutonium oxide CH-TRU waste would be shipped from LANL or SRS to the WIPP facility as CH-TRU waste under all sub-alternatives.
- **Shipping CH-TRU job control waste from LANL and SRS to the WIPP facility**. As described in Sections 2.1.1.2.2 and 2.1.1.2.3, CH-TRU job control waste would also be shipped from SRS and LANL to the WIPP facility. CH-TRU job control waste would be shipped from LANL to the WIPP facility under the Base Approach, SRS NPMP, and All LANL Sub-Alternatives. CH-TRU job control waste would be shipped from SRS to the WIPP facility under the Base Approach, SRS NPMP, and All SRS Sub-Alternatives.
- **Shipping low-level radioactive waste (LLW), mixed low-level radioactive waste (MLLW), and other job control wastes from LANL and SRS to offsite locations**. LLW generated at SRS would be disposed of onsite at SRS (SRNS 2023d|Section 20.3|). LLW generated at LANL and MLLW generated at LANL could be shipped to commercial disposal facilities such as EnergySolutions in Utah or Waste Control Specialists in Texas or to the DOE Nevada National Security Site (NNSS) near Las Vegas, Nevada (LANL 2023a|Section 2.12.3|). For purposes of analysis in this SPDP EIS, the offsite facility was assumed to be NNSS near Las Vegas.[11]

[11] A very small quantity of MLLW is expected to be generated at SRS for the All SRS Sub-Alternative. For the purposes of analysis, NNSA assumes it would be transported to NNSS.

2.1.2 No Action Alternative

NNSA's No Action Alternative for dispositioning 34 MT of surplus plutonium, shown in Figure 2-14, is the continued management of 34 MT of surplus plutonium. This includes (1) continued storage of pits at Pantex, (2) the continued plutonium mission at LANL to process up to 400 kg of actinides (including surplus plutonium) a year (DOE 2008a|p. 2-62|), and (3) disposition of up to 7.1 MT of non-pit surplus plutonium for which the disposition decision, using the dilute and dispose strategy, was announced in NNSA's 2020 AROD (85 FR 53350).

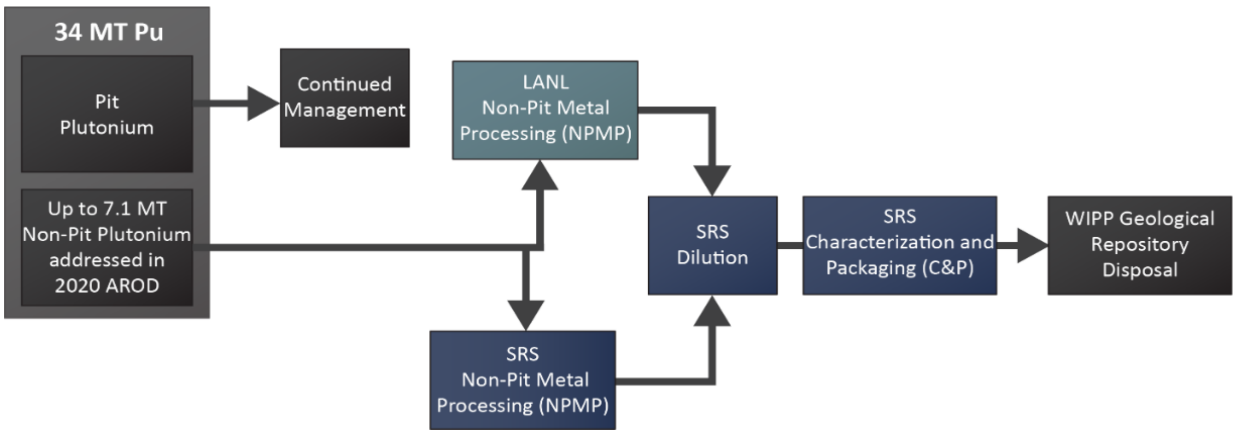

Figure 2-14. No Action Alternative

NPMP of up to 7.1 MT could be performed in the existing furnaces installed in gloveboxes at LANL's PF-4 or in a NPMP capability that would be built at Building 105-K in K-Area at SRS. If NPMP occurs at LANL, the resulting plutonium oxide would be shipped to SRS for dilution and C&P. Shipments of plutonium oxide would be packaged in Type B packages and loaded into an OST Transporter for shipment to SRS (LANL 2023a|Section 2.15.1.2.3|). If processing occurs at SRS, the resulting plutonium oxide would be transferred to a glovebox in Building 105-K for dilution.

After dilution, CCOs of diluted plutonium oxide CH-TRU waste would be characterized and packaged at SRS in approved TRU waste transportation containers (e.g., TRUPACT-II) and shipped from K-Area to the WIPP facility for disposal (SRNS 2023d|Section 20.1|). CH-TRU job control waste, including waste such as gloves from gloveboxes and other waste from inside gloveboxes, would be classified as CH-TRU waste and packaged and transported through E-Area at SRS for disposal at the WIPP facility (SRNS 2023d|Section 20.3|).

The activities that could occur at LANL or SRS under the No Action Alternative are summarized in Table 2-5. The operational activities in each step of the No Action Alternative are described in the following sections, organized by site. These sections also describe the construction or modification activities that would be necessary to build the operational capabilities. Additional details about the facilities are in Appendix B. A discussion of the transportation that occurs during the No Action Alternative follows in Section 2.1.2.5.

Table 2-5. Location Summary of Activities under the No Action Alternative

Activities	LANL NPMP Option	SRS NPMP Option
NPMP	LANL	SRS
Preparation, packaging, and shipment of plutonium oxide to SRS	LANL	NA
Dilution of plutonium oxide	SRS	SRS
C&P of diluted plutonium oxide CH-TRU waste for shipment to the WIPP facility	SRS	SRS
Packaging and shipment of CH-TRU job control waste to the WIPP facility	LANL/SRS	SRS
Disposal of diluted plutonium oxide CH-TRU waste and CH-TRU job control waste	WIPP	WIPP

C&P = characterization and packaging; CH-TRU = contact-handled transuranic; LANL = Los Alamos National Laboratory; NA = not applicable; NPMP = non-pit metal processing; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

2.1.2.1 Pantex

Under the No Action Alternative, surplus plutonium pits at Pantex would remain in storage under its existing management plan. The No Action Alternative does not affect the ongoing shipping from Pantex to LANL to support the ongoing processing of up to 400 kg/yr of actinides (includes plutonium) at PF-4 at LANL (DOE 2008a|p. 2-62|).

2.1.2.2 Los Alamos National Laboratory

Construction of new facilities at LANL would not be required for the No Action Alternative.

Operations at LANL for the No Action Alternative would be similar to those described for the Preferred Alternative for NPMP (see Section 2.1.1.2.2). NPMP would be performed in existing gloveboxes in PF-4, which are located in TA-55, using existing furnaces. Plutonium oxide would be packaged in Type B packages and loaded into an OST Transporter adjacent to PF-4 for shipment to SRS (LANL 2023a|Sections 1.1.2.1, 2.15.1.2.3|). CH-TRU job control waste resulting from NPMP would be packaged and loaded for shipment to the WIPP facility for disposal.

2.1.2.3 Savannah River Site

NPMP at SRS could be conducted in a new NPMP capability installed in K-Area at SRS at Building 105-K. No new land-disturbing construction activities would occur at SRS to support NPMP (SRNS 2023d|Section 11|). However, activities to replace, modify, or install equipment currently in K-Area would occur, as necessary.

NPMP at Building 105-K in K-Area would be conducted using furnaces, as discussed in Section 2.1.1.2.3. The resulting plutonium oxide would be placed in appropriate containers (DOE 2018b) and transported to the dilution capability gloveboxes located in Building 105-K. The dilution and C&P processes and locations used for plutonium oxide from LANL or SRS would be the same as those described for the Preferred Alternative. After characterization, CCOs would be packaged in approved TRU waste transportation containers (e.g., TRUPACT-II) and shipped from SRS to the WIPP facility for disposal. CH-TRU job control waste would also be packaged and transported to the WIPP facility for disposal through E-Area.

2.1.2.4 Waste Isolation Pilot Plant

As discussed in Section 2.1.1.2.4, the WIPP facility is the only waste repository authorized for permanent disposal of TRU waste generated by *Atomic Energy Act* defense activities. TRU and mixed TRU wastes must meet the WIPP WAC before they can be shipped to and disposed of at the WIPP facility (DOE 2022i).

Activities following the transportation of the CH-TRU waste to the WIPP facility, including receiving, unloading, and waste transfer and disposal, are described and analyzed in the WIPP SEIS (DOE 1997|Section 3.1.3|) and are not re-evaluated in this document.

2.1.2.5 Transportation

Offsite transportation is described separately because the impacts from these activities would not occur at one specific site, but instead would occur along the transportation route. Transportation methodologies are further described in Appendix E. The following offsite transportation routes are analyzed for the No Action Alternative:

- **Shipping adulterant to SRS**. Adulterant would be shipped from a commercial vendor assumed to be located 3,000 mi from SRS.
- **Shipping non-pit surplus plutonium from SRS to LANL or LANL to SRS**. Non-pit surplus plutonium, including non-pit metal and some previously processed non-pit oxide, would be shipped between sites as appropriate for processing and/or dilution.
- **Shipping plutonium oxide from LANL to SRS**. If processing of up to 7.1 MT of non-pit surplus plutonium occurred at LANL, then the resulting plutonium oxide would be shipped from LANL to SRS for dilution.
- **Shipping diluted plutonium oxide CH-TRU waste from SRS to the WIPP facility**. After C&P, diluted plutonium oxide CH-TRU waste would be shipped from SRS to the WIPP facility.
- **Shipping CH-TRU job control waste from LANL and SRS to the WIPP facility**. CH-TRU job control waste would be shipped from LANL and SRS to the WIPP facility.
- **Shipping LLW, MLLW, and other job control wastes from LANL and SRS to offsite locations**. LLW generated at SRS would be disposed of onsite at SRS (SRNS 2023d|Section 20.3|). LLW and MLLW generated at LANL could be shipped to commercial disposal facilities such as EnergySolutions in Utah or Waste Control Specialists in Texas or to NNSS, a Federal site in Nevada. For purposes of analysis in this SPDP EIS the offsite facility was assumed to be NNSS near Las Vegas.

2.2 Alternatives Considered and Dismissed from Detailed Study

NNSA has considered many alternatives for the dispositioning of surplus plutonium in studies, technology reviews, and previous NEPA analyses. Most were ultimately dismissed from detailed study in those analyses. Table 2-6 describes such alternatives and the reasons DOE dismissed them in the S&D PEIS; DOE 1996). Similarly, Table 2-7 describes such alternatives considered in the SPD EIS (DOE 1999b), and Table 2-8 describes the additional alternatives considered in the 2015 SPD SEIS (DOE 2015c). The reasons for dismissal given in these tables are those that were given at the time of publication. However, NNSA has reviewed the reasons for dismissal and finds them to be valid today, unless otherwise noted.

Table 2-6. Alternatives Considered and Dismissed in the S&D Programmatic EIS

Disposition Alternative[(a)]	Reason for Dismissal from Detailed Study
Radiation barrier alloy for indefinite storage – forming a plutonium-beryllium compound	Unsuitable material form for a civilian waste repository. Requires reconversion of material to remove plutonium and process it into a repository-compatible waste form.
Injection into continental magma	Immature technology. Licensing and regulatory aspects are undefined and uncertain. Environmental safety and health concerns exist.
Emplacement in sub-seabed	Immature technology. Licensing and regulatory aspects are undefined and uncertain. Schedule is uncertain. Increased opportunities for vessel accidents in which material could be lost at sea.
Launching to deep outer space	High risk (accidents). Accident risk and potential dispersal of radioactive materials are higher than other options. Chances of recovering material lost during an accident are lower. Expensive and time-consuming to complete.
Direct immobilization with radionuclides in borosilicate glass and use of a retrofitted Defense Waste Processing Facility	Expensive and disruptive. Installing a specifically designed melter for plutonium immobilization would require major retrofitting of the existing equipment in the Defense Waste Processing Facility at SRS because of criticality concerns. This would interfere with the Defense Waste Processing Facility mission to stabilize and treat high-level radioactive waste.
Reactor and accelerator options: • Accelerator conversion using a molten salt target • Accelerator conversion using a particle bed target • Accelerator driven using a modular helium reactor • Particle bed reactor • Molten salt reactor.	Immature technology. Technical immaturity of options and lengthy development and demonstration effort to bring them to a "viable and practical status and enable disposition options to be initiated with certainty".
Consuming in modular helium reactors	Immature technology. Less technically mature than other available options for using mixed oxide fuel in operating water-cooled reactor plants.
Advanced liquid metal reactors with pyroprocessing	Expensive and time-consuming. Requires an advanced liquid metal-cooled reactor that has not been developed.
Direct emplacement in HLW repository without immobilization	Because of proliferation concerns, a determination of the acceptability of this waste in a HLW repository is highly unlikely to be reached in a timely manner. Additional security would be required until the repository is sealed.
Dispose surplus plutonium at the WIPP facility	Regulatory concerns. Assumed that this option would exceed capacity at the WIPP facility and would require amendment of the Waste Isolation Pilot Plant Land Withdrawal Act and implementing documents. Note: A WIPP facility permit modification and an EPA planned change request allow for accounting of the volume of TRU waste in an overpacked container, as the waste volume allowed by the WIPP Land Withdrawal Act (NMED 2018), rather than the volume of the entire overpacked container (volume of waste plus empty space in the container). As a result, the apparent lack of unsubscribed disposal capacity is no longer a constraint. Therefore, in this SPDP EIS, NNSA is evaluating the impacts of disposing of diluted plutonium oxide as CH-TRU waste at the WIPP facility.

Disposition Alternative[(a)]	Reason for Dismissal from Detailed Study
Hydraulic fracturing	Not technically viable; of high risk. No assurance of technical feasibility and no engineered barrier exists to prevent leakage into subsurface aquifers.
Injection of slurry into deep wells	High risk (environmental and health). No engineered barrier to prevent leakage into subsurface aquifers. Would pose unacceptable environmental safety and health risks.
Melting into crystalline rock	Not technically viable. Uncertainties related to criticality and difficulty in assuring enough heat would be available from the spent fuel commingled with surplus plutonium to melt the rock.
Disposal under ice caps	Not technically viable; of high risk. Poses unacceptable environmental health and safety risks because of the instability of ice caps in Greenland and Antarctica. Low likelihood of obtaining an Agreement with Denmark or revising the current international treaty for Antarctica.
Seabed disposal and controlled dilution in oceans	Regulatory, environmental, health, and safety concerns. Contrary to domestic and international laws, treaties, and policies.
Underground nuclear detonation	Regulatory, environmental, health, and safety concerns. Considered unreasonable because compliance with regulatory and licensing requirements is very uncertain. Compliance with environmental safety and health regulations is unlikely and this option may undermine national and international policy related to the Comprehensive Test Ban Treaty.
Naval nuclear fuel – using plutonium fuel in naval reactor plants	Regulatory concerns and time-consuming. Processes and facilities necessary for this option cannot be declassified, thus eliminating the possibility of transparent confirmation of the process or final condition by international inspections as required by DOE international obligations and commitments. Could not be accomplished in a reasonable time frame because the number of new fuel loadings in naval reactor plants is so small.
Reprocessing using plutonium fuel in existing or new evolutionary advance light water reactors with chemical reprocessing of spent fuel	Expensive, time-consuming, and security concerns. Specific stages of the processing and handling are more vulnerable to theft and diversion of the material. Time and cost required to design and construct reprocessing plants is greater than for plants that are available and do not have the vulnerability concerns.
Advanced liquid metal reactor with recycle and reuse of metallic alloy fuel elements	Immature reactor concept. Development of liquid metal reactors/integral fast reactors is no longer being pursued because of the U.S. nonproliferation policy to not develop technologies that rely on plutonium recycling.
Glass material oxidation and dissolution system	Immature technology and time-consuming. Time required to complete the necessary research and development is longer than for other alternatives and options.
Euratom mixed oxide fuel reactor use	Institutional complexities and security concerns. Institutional complexities related to transportation, security, and geopolitical factors.

CH-TRU = contact-handled transuranic; DOE = U.S. Department of Energy; EIS = environmental impact statement; HLW = high-level radioactive waste; NNSA = National Nuclear Security Administration; SPDP = Surplus Plutonium Disposition Program; S&D = storage and disposition; SRS = Savannah River Site; TRU = transuranic; WAC = Waste Acceptance Criteria; WIPP = Waste Isolation Pilot Plant.

(a) Technologies may have changed with time, but these changes are not addressed in this document.

Source: DOE 1996|p. 2-10 to 2-15|.

Table 2-7. Alternatives Considered and Dismissed in the SPD EIS

Disposition Alternative	Reason for Dismissal from Detailed Study
Deep-borehole direct disposition or immobilized disposition	Regulatory and siting concerns. Institutional uncertainties associated with the siting of borehole facilities make timely implementation of this alternative unlikely. New legislation and regulations, or clarification of existing regulations, may be necessary.
Electrometallurgical treatment	Immature technology. The technology is less mature than vitrification or ceramic immobilization.
MOX fuel irradiation in a partially completed light water reactor	Expensive, time-consuming, and regulatory concerns. Offers no advantages over existing reactors for plutonium dispositioning and would involve higher costs, greater regulatory uncertainties, higher potential environmental impacts from construction, and less timely commencement of dispositioning actions.
MOX fuel irradiation in an evolutionary advanced light water reactor	Expensive, time-consuming, and regulatory concerns. Offers no advantages over existing reactors for plutonium dispositioning and would involve higher costs, greater regulatory uncertainties, higher potential environmental impacts from construction, and less timely commencement of dispositioning actions.

EIS = environmental impact statement; MOX = mixed oxide; SPD = Surplus Plutonium Disposition.
Sources: DOE 1999b|p. 2-11 to 2-13|; 62 FR 3014|p. 3029|.

Table 2-8. Alternatives Considered and Dismissed in the 2015 SPD SEIS for 13.1 MT of Surplus Plutonium that Were Not Included in the Previous SPD EIS or the S&D Programmatic EIS

Disposition Alternative	Reason for Dismissal from Detailed Study
Ceramic can-in-canister approach for immobilizing plutonium	The program was cancelled in 2002 because of budgetary constraints. Subsequently, further refinement of the technology was stopped, and DOE infrastructure and expertise associated with this technology have not evolved or matured.
Dispositioning of plutonium using the H-Canyon/HB-Line and Defense Waste Processing Facility	This approach was considered viable for up to 6 MT; however, there was insufficient high-level radioactive waste with the characteristics needed to vitrify the entire amount of surplus plutonium to be dispositioned.
Disposal of plutonium at a secondary repository similar to the WIPP facility	The WIPP facility was considered to have sufficient capacity to accommodate dispositioning of the entire amount of surplus plutonium based on the *Annual Transuranic Waste Inventory Report – 2012* (DOE 2012a), published after the Draft SPD SEIS was issued; therefore, a secondary repository was not necessary and the 2015 SPD SEIS WIPP Alternative was revised. Note: DOE evaluates the need for disposal facilities periodically, and as that need changes additional repositories may become available, but at this time none are envisioned.
Outsourcing plutonium dispositioning activities to foreign entities	Sending U.S. pits or plutonium from pits to a foreign country would involve significant nonproliferation and national security concerns.
Modification of the MFFF to incorporate pit disassembly and conversion	The 2015 SPD SEIS included an analysis of an alternative that considered plutonium processing (conversion) in a modified MFFF, but did not consider pit disassembly because of security, design, and licensing considerations. Note: Because the MOX project was cancelled, these concerns are no longer considerations. Therefore, in this SPDP EIS, NNSA is reevaluating housing PDP activities in Building 226-F or Building 105-K. This alternative is considered as part of the All SRS Sub-Alternative in this SPDP EIS, as discussed in Section 2.1.1.2.3.

CH = contact-handled; DOE = U.S. Department of Energy; EIS = environmental impact statement; MFFF = MOX Fuel Fabrication Facility; MOX = mixed oxide; NNSA = National Nuclear Security Administration; PDP = pit disassembly and processing; SEIS = Supplemental Environmental Impact Statement; SPD = Surplus Plutonium Disposition; SPDP = Surplus Plutonium Disposition Program; SRS = Savannah River Site; S&D = storage and disposition; TRU = transuranic; WIPP = Waste Isolation Pilot Plant.
Source: DOE 2015c|p. 2-14 to 2-19|.

Two additional alternatives were considered but dismissed in this SPDP EIS:

- **Use of plutonium as feedstock for fuel in the Versatile Test Reactor (VTR)**. DOE recently considered the use of surplus plutonium as feedstock for preparation of fuel for the proposed VTR (DOE 2022e). On July 22, 2022, DOE issued a ROD for the VTR EIS. DOE decided to construct and operate a VTR at the Idaho National Laboratory (87 FR 47400). DOE has not decided whether to establish VTR driver fuel production capabilities at the Idaho National Laboratory, SRS, or a combination of the two sites. DOE is considering the use of surplus plutonium as feedstock for preparation of fuel for the VTR (DOE 2022e). However, the VTR is in the early stages of design, and although a Final EIS and ROD have been issued, the details related to making surplus plutonium available as a VTR feedstock are not currently known. In addition, while Congress has previously authorized funding for the VTR, no funding has been provided in FY 2022 or 2023. Therefore, an alternative that considers VTR as a potential disposition path for surplus plutonium would be premature at this time. If DOE proposes in the future to make a portion of its surplus plutonium inventory available as feedstock for VTR driver fuel, the VTR Program would be responsible for any technical activities and process changes that may be necessary to accept this source of feedstock. Any changes to allow use of surplus plutonium as feedstock for VTR fuel production would be the subject of future NEPA analysis.
- **Demilitarization and direct disposal of pits**. This alternative was not considered further because it does not meet the nonproliferation goals set forth in the purpose and need, as described in Section 1.2, to safely and securely disposition plutonium that is surplus to the Nation's defense needs so that it is not readily usable in nuclear weapons.

Two additional sub-alternatives to the Preferred Alternative were also not considered for further detailed analysis:

- **Pantex Greenfield Sub-Alternative in this SPDP EIS**. NNSA considered a Pantex Greenfield Sub-Alternative for the disposition of surplus plutonium. This sub-alternative would require the construction and operation of greenfield facilities for PDP, NPMP, dilution, and C&P. This sub-alternative was considered, but found to be unreasonable and dismissed from detailed analysis for the following reasons:
  - Lack of Adequate Waste Support Facilities – Pantex does not have waste management facilities that can support the amount of LLW and TRU waste that would be generated for PDP, NPMP, dilution, and C&P of 34 MT. The Pantex SA (DOE 2018f) does not include numbers for TRU waste disposal and the quantity of LLW waste currently generated at Pantex is significantly lower than that estimated for SPDP. Support facilities for waste may be needed in addition to the facilities where PDP, NPMP, dilution, and C&P occur.
  - Significant Increase in Staffing Levels – This SPDP EIS estimates between 549 and 844 operations workers would be needed at Pantex (based on the estimated LANL staffing levels in the All LANL Sub-Alternative and estimated SRS staffing levels under the All SRS Sub-Alternative, respectively, for the years when project employment and expenditures are highest). This would be an increase of between 14 and 20 percent over the current

Pantex staffing level of 3,800 workers, as shown in the Pantex SA (DOE 2018f). This does not include the additional staff needed for construction.

- Lack of Plutonium Processing Experience – Pantex does not have experience processing plutonium and would need to build an entirely new capability from the ground up.
- Insufficient Infrastructure – Significant changes in infrastructure would likely be needed to accommodate the additional staff and the new facilities. This additional site infrastructure would increase the time and cost to complete the project.
- Design and Construction Timing Challenges – The timeline for design and construction of new facilities is unknown and based on previous NNSA experience it would extend well beyond the desired schedule for dispositioning the 34 MT. In addition, the costs for incorporating the required support facilities and infrastructure would be high.
- The ceramic can-in-canister approach that was previously considered and dismissed, as shown in Table 2-8, was also not considered an option for Pantex. In addition to the reasons for dismissal in Table 2-8, HLW does not exist at Pantex. HLW in liquid form would have to be transported to Pantex from another site, and a new vitrification facility would have to be designed, constructed, and operated at Pantex.

- **WSB Option for the All SRS Sub-Alternative in this SPDP EIS**. NNSA also considered a third option for the All SRS Sub-Alternative to the Preferred Alternative: use of the WSB at SRS to house the PDP capability. This option was considered but dismissed from further evaluation because costly and time-consuming upgrades to WSB infrastructure would be necessary to support PDP mission capabilities. In addition, none of the infrastructure needed to make the WSB a stand-alone Category 1 security facility exists. The cost to establish that infrastructure would be very high, thus making the use of the WSB fiscally challenging. However, if the decision makers were to select the WSB for the PDP mission, the potential environmental impacts would be similar to those identified in this EIS for inclusion of the PDP capabilities in Building 226-F (SRPPF), as both are radiologically clean facilities and are located near each other within F-Area at SRS.

2.3 Methodologies Used to Develop the SPDP EIS

This section describes the methods NNSA used to assess the potential direct and indirect impacts of the proposed action of this SPDP EIS. This EIS evaluates the potential environmental impacts of both alternatives within a defined region of influence (ROI) for each of the resource areas discussed in Section 4.0. It relies on information that is available from DOE sites for similar activities that are ongoing, specifically PDP that has been occurring at LANL and the dilution process occurring at SRS for the 6 MT of non-pit plutonium, which is not part of the 34 MT analyzed in this EIS, but which uses the same processes.

NNSA sent Data Call Requests to Pantex, LANL, and SRS and asked for information related to the parameters that were needed to complete the analysis for this SPDP EIS. The sites responded with Data Call Responses (CNS 2019, LANL 2023a, SRNS 2023d) that provided information including the amount of land that would be used for buildings; assumed releases to the air; the number of staff (including radiation workers) required for each different part of the process; and the amount of waste that would be generated. References were also provided to document assumptions in the Data Call Responses.

NNSA used a combination of the references and the Data Call Responses to develop the EIS. In cases where there was uncertainty or disagreement between documents, the analysis was completed using assumptions that were documented. Specific areas of uncertainty are discussed in Section 4 of the EIS or in Appendices D (Accidents) or E (Transportation).

2.4 Comparison of the Alternatives

This section provides the reader with an understanding of the differences between the Preferred and No Action Alternatives as well as the differences between the sub-alternatives of the Preferred Alternative. Table 2-9 summarizes the potential environmental consequences that would be expected as a result of the alternatives considered in this SPDP EIS. This table is intended to help the reader quickly compare environmental consequences across sub-alternatives and options. Table 2-9 has columns for each sub-alternative and option of the Preferred Alternative and the No Action Alternative. It contains rows for each resource area analyzed in this SPDP EIS, separated when relevant into construction and operations. The content in each row may be numbers associated with a key category of environmental consequence (i.e., acres of land disturbed; risk of a latent cancer fatality (LCF); number of LCFs; cubic meters of waste generated) or may be a narrative summary. In cases where environmental consequences would be the same across multiple sub-alternatives or options, cells of the table may be merged to display a single environmental consequence. A full discussion of the impacts for all resources is found in Section 4.0. Appendix C contains the detailed potential environmental impacts broken out by activity and site (LANL and SRS), as well as impacts across the sites under each of the alternatives and sub-alternatives.

As summarized in the table below, at LANL, impacts from the surplus plutonium disposition activities evaluated in this SPDP EIS would be negligible to minor on land use and visual resources, air quality, noise, geology and soils, water resources, human health (chemical use), and waste management. At SRS, impacts from surplus plutonium disposition activities evaluated in this SPDP EIS would be negligible to minor on land use and visual resources, air quality, noise, geology and soils, water resources, human health (chemical use), and waste management. Cumulative impacts are summarized in Section 2.4.

Table 2-9. Comparison of Alternatives - Summary

Area of Impact	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP[a] Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP[a] Sub-Alternative (Modular NPMP Option)	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP[b] Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP[b] Option)	No Action Alternative (SRS NPMP Option)	No Action Alternative (LANL NPMP Option)
Land Disturbance (ac)	**Construction**							
	5.1	5.1	5.4	5.1	20	20	0	(c)
	Operations							
	No land disturbance is anticipated during operations.							
Visual	**Construction and Operations**							
	Proposed new facilities would be built away from the site boundaries and would be structurally similar to, and blend in with, the existing viewscapes.						(c)	(c)
Geologic Materials Used (sand, gravel, crushed stone) (yd^3)	**Construction**							
	30,000	30,000	30,000	41,000	260,000	260,000	0	(c)
	Operations							
	No geologic materials are used during operations.							
Water Resources	**Construction and Operations**							
	Construction and operations water use at either site is anticipated to be less than 1 percent of the current site water use and less than 3 percent of available capacity. Thus, only minor impacts to groundwater resources are expected for either alternative. Stormwater runoff would be managed at both sites to minimize the effects of construction and operation on surface waters receiving discharge. Treated sanitary wastewater discharge would be less than 4 percent of the expected flow in the receiving stream at LANL and less than 0.5 percent of the flow in the receiving stream at SRS. Thus, only minor impacts to surface water quality are expected for either alternative. At LANL, impacts on the wastewater treatment capacity are minimal with respect to present and ongoing operations. At SRS, site operations associated with all activities under both the Preferred and No Action Alternatives would have minimal impacts on wastewater treatment capacity once a project to tie the K-Area into the CSWTF is completed.							

Area of Impact	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP[(a)] Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP[(a)] Sub-Alternative (Modular NPMP Option)	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP[(b)] Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP[(b)] Option)	No Action Alternative (SRS NPMP Option)	No Action Alternative (LANL NPMP Option)
				Construction				
Air Quality	Fugitive dust would be generated during construction and construction equipment would generate emissions, including non-radiological HAPs at LANL. No construction would occur at SRS.	Fugitive dust would be generated during construction and construction equipment would generate emissions including non-radiological HAPs at LANL. Minor construction activities and impacts would occur at SRS.		Fugitive dust would be generated during construction and construction equipment would generate emissions including non-radiological HAPs at LANL.	Fugitive dust would be generated during construction and construction equipment would generate emissions including non-radiological HAPs at SRS.		Minor construction activities and impacts would occur at SRS.	No construction activities would occur at either LANL or SRS.
				Operations				
	Operations are not expected to produce additional air emissions at LANL. At SRS emissions would result from the use of diesel generators. Emissions associated with dilution activities are expected to produce negligible non-radiological HAPs.			Operations are expected to produce minimal additional air emissions at LANL. No additional diesel generators required for operational activities.	SRS emissions would result from the use of diesel generators. Emissions associated with dilution activities are expected to produce negligible non-radiological HAPs. There is expected to be a minor increase in emissions for PDP due to the use of additional backup diesel generators.		Operations are not expected to produce additional air emissions at LANL. At SRS emissions would result from the use of diesel generators and dilution activities. Emissions associated with dilution activities are expected to produce negligible non-rad HAPs.	

Area of Impact	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP[a] Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP[a] Sub-Alternative (Modular NPMP Option)	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP[b] Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP[b] Option)	No Action Alternative (SRS NPMP Option)	No Action Alternative (LANL NPMP Option)
	Construction and Operations							
Noise	Construction and Operations noise levels at sites are anticipated to be similar to current operations beyond the site boundaries.							
	Construction							
Ecological Resources	Activities have the potential to affect Mexican spotted owl and the Jemez Mountains salamander. LANL would conduct a Section 7 consultation under the Endangered Species Act. No construction activities at SRS.	Activities have the potential to affect Mexican spotted owl and the Jemez Mountains salamander. LANL would conduct a Section 7 consultation under the Endangered Species Act. Construction activities at SRS are minor and would have negligible impact on ecology or on protected species		Activities have the potential to affect Mexican spotted owl and the Jemez Mountains salamander. LANL would conduct a Section 7 consultation under the Endangered Species Act.	Impacts at SRS would occur in previously disturbed areas and are unlikely to affect protected species including the red-cockaded woodpecker or the smooth purple cone flower.		No impact	No impact
	Operations							
	Background noise and light levels could affect Mexican spotted owl but are unlikely to affect habitat for the Jemez Mountains salamander. LANL would conduct a Section 7 consultation under the Endangered Species Act for the Mexican spotted owl and the Jemez Mountains salamander; impacts at SRS would be negligible to ecological resources			LANL would conduct a Section 7 consultation under the Endangered Species Act for	Impacts at SRS would be unlikely to affect the red-cockaded woodpecker or the smooth purple cone flower.		No impact	No impact

Area of Impact	**Preferred Alternative** **Base Approach Sub-Alternative**	**Preferred Alternative** **SRS NPMP[a] Sub-Alternative** **(105-K NPMP Option)**	**Preferred Alternative** **SRS NPMP[a] Sub-Alternative** **(Modular NPMP Option)**	**Preferred Alternative** **All LANL Sub-Alternative**	**Preferred Alternative** **All SRS Sub-Alternative** **(F-Area PDP[b] Option)**	**Preferred Alternative** **All SRS Sub-Alternative** **(K-Area PDP[b] Option)**	**No Action Alternative** **(SRS NPMP Option)**	**No Action Alternative** **(LANL NPMP Option)**
Ecological Resources	and would not affect the red-cockaded woodpecker or the smooth purple cone flower.			the Mexican spotted owl and the Jemez Mountains salamander.				
	Construction - Worker – highest risk of LCF for project duration							
	0.001	0.001	0.001	0.001	0	0.0001	0.0005	None[c]
	Operations - Worker – highest risk of LCF for project duration							
	0.005	0.007	0.005	0.007	0.005	0.005	0.007	0.007
	Construction - Workforce – total number of LCFs							
	0 (0.008)	0 (0.009)	0 (0.008)	0 (0.01)	0 (0)	0 (0.003)	0 (0.0007)	None[c]
	Operations - Workforce – total number of LCFs							
Human Health	2 (2.4)	3 (2.9)	3 (2.5)	2 (1.8)	2 (2.4)	2 (2.4)	1 (0.8)	1 (0.8)
	Construction - Public – MEI total risk of LCF							
	(d)	(d)	(d)	(d)	0	3×10^{-8}	(d)	None[c]
	Operations - Public – MEI total risk of LCF							
	3×10^{-8}	3×10^{-8}	3×10^{-8}	6×10^{-8}	2×10^{-9}	2×10^{-9}	4×10^{-10}	8×10^{-9}
	Construction - Public – Population number of LCFs							
	(d)	(d)	(d)	(d)	0 (0)	0 (0.002)	(d)	None[c]
	Operations - Public – Population number of LCFs							
	0 (0.0001)[e]	0 (0.0002)[e]	0 (0.0002)[e]	0 (0.0002)	0 (0.00008)	0 (0.00008)	0 (0.00002)	0 (0.00004)[e]

Area of Impact	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP[a] Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP[a] Sub-Alternative (Modular NPMP Option)	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP[b] Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP[b] Option)	No Action Alternative (SRS NPMP Option)	No Action Alternative (LANL NPMP Option)
	Operations Bounding Accidents – Noninvolved Worker maximum LCF Risk[f]							
	0.1	0.06	0.06	0.1	0.004	0.004	0.004	0.1
	Operations Bounding Accidents - Public – MEI maximum LCF Risk[f]							
	0.004	0.003	0.003	0.004	0.0001	0.0001	0.0001	0.004
	Operations Bounding Accidents - Public – Population maximum LCFs[f]							
	0 (0.2)	0 (0.1)	0 (0.3)[g]	0 (0.2)	0 (0.1)	0 (0.09)	0 (0.08)	0 (0.2)
Cultural Resources	**Construction**							
	Activities have the potential to affect archaeological resources and historic buildings. Determination of effects would utilize the NHPA Section 106 process in the Programmatic Agreement and the Cultural Resources management Plan and would be followed by the NNSA Los Alamos Field Office as would the Archaeological Resource Management Plan and associated Programmatic Agreement at SRS.							No impact because existing equipment is being used.
	Operations							
	There would be no impact on cultural resources during operations. The LANL CRMP and the SRS Archeological Resource Management Plan of the Savannah River Archeological Research Program has controls in place to minimize or mitigate impacts on resources during operations.							
Socioeconomics	**Construction – Direct Employment (FTE in Peak Year)**							
	116	194	146	139	525	525	78	(c)
	Operations – Direct Employment (FTE in Peak Year)							
	917	1,030	955	549	1,016	1,016	212	246
	Construction – Total ROI Employment (FTE in Peak Year)							
	221	418	290	263	1,092	1,092	197	(c)
	Operations – Total ROI Employment (FTE in Peak Year)							
	2,761	3,054	2,860	1,794	4,084	4,084	567	650

Area of Impact	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP[a] Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP[a] Sub-Alternative (Modular NPMP Option)	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP[b] Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP[b] Option)	No Action Alternative (SRS NPMP Option)	No Action Alternative (LANL NPMP Option)
Socioeconomics	**Construction – Direct Earnings ($Million in Peak Year)**							
	19.4	38.9	26.9	23.2	131.3	131.3	19.5	(c)
	Operations – Direct Earnings ($Million in Peak Year)							
	599.4	630.2	607.2	513.7	714.3	714.3	57.7	110.5
	Construction – Total ROI Earnings ($Million in peak year)							
	23.6	47.9	31.5	28.2	176.7	176.7	24.3	(c)
	Operations – Total ROI Earnings ($Million in peak year)							
	778.6	810.2	789.3	703.1	1,025.3	1,025.3	60.1	142.7
	Construction – Direct Output ($Million in peak year)							
	20.3	39.6	26.6	24.2	168.5	168.5	19.3	(c)
	Operations- Direct Output ($Million in peak year)							
	1,481.3	1,514.2	1,492.4	1,428.8	1,481.3	1,481.3	70.3	266.3
	Construction – Total ROI Output ($Million in peak year)							
	36.3	73.4	48.4	43.3	306.8	306.8	37.1	(c)
	Operations – Total ROI Output ($Million in peak year)							
	2,195.3	2,254.5	2,215.3	2,027.7	2,837.7	2,837.7	122.5	396.2
Infrastructure[h]	**Construction – Electricity Use (MWh/yr)**							
	160	160	160	160	16,000	16,000	minimal	(c)
	Operations – Electricity Use (MWh/yr)							
	19,000	21,000	21,000	9,400	53,000	53,000	4,200	5,200
	Construction – Electricity Peak Load (MW)							
	0.02	0.02	0.02	0.02	1.8	1.8	minimal	(c)

Area of Impact	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP[a] Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP[a] Sub-Alternative (Modular NPMP Option)	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP[b] Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP[b] Option)	No Action Alternative (SRS NPMP Option)	No Action Alternative (LANL NPMP Option)
Infrastructure[h]	**Operations – Electricity Peak Load (MW)**							
	2.5	2.7	2.8	1.1	6.4	6.4	0.55	0.67
	Construction – Fuel Use (gal/yr)							
	54,000	58,000	55,000	69,000	300,000	540,000	4,000	(c)
	Operations – Fuel Use (gal/yr)							
	7,200	14,000	14,000	0	180,000	180,000	3,000	1,500
	Construction – Water Use (millions of gal/yr)							
	2.6	3.6	3.1	2.6	1.1	2	1	(c)
	Operations – Water Use (millions of gal/yr)							
	5.3	6.3	6.3	2.5	8.6	8.6	1.8	1.4
	Construction – Sewage Generation (millions of gal/yr)							
	0.055	1.1	0.56	0.055	1.1	1.1	1	(c)
	Operations – Sewage Generation (millions of gal/yr)							
	5.3	6.3	6.3	2.5	8.6	8.6	1.8	1.4
Waste Generation	**Construction – CH-TRU Waste (job control waste) (m^3)**							
	69	170	69	110	0	0	110	(c)
	Operations – CH-TRU Waste (job control waste) (m^3)							
	2,000	2,200	2,300	1,600	2,000	2,000	170	200
	Construction – LLW (m^3)							
	360	360	360	560	0	12,000	0	(c)

Area of Impact	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP[a] Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP[a] Sub-Alternative (Modular NPMP Option)	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP[b] Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP[b] Option)	No Action Alternative (SRS NPMP Option)	No Action Alternative (LANL NPMP Option)
				Operations – LLW (m^3)				
	23,000	25,000	26,000	17,000	23,000	23,000	2,400	2,200
				Construction – MLLW (m^3)				
	4.8	4.8	4.8	7.4	0	210	0	(c)
				Operations – MLLW (m^3)				
	42	42	42	89	42	42	0	3.7
				Construction – Liquid LLW (m^3)				
Waste Generation	0	0	0	0	0	0	0	(c)
				Operations – Liquid LLW (m^3)				
	65,000	65,000	65,000	65,000	65,000	65,000	0	0
				Construction – Solid Hazardous Waste (m^3)				
	2.4	2.4	2.4	3.1	45	6,600	0	(c)
				Operations – Solid Hazardous Waste (m^3)				
	6.6	6.6	6.6	6.8	6.6	6.6	0.0	0.7
				Construction – Solid Non-Hazardous Waste (m^3)				
	210	280	280	280	1,000	6,900	66	(c)
				Operations – Solid Non-Hazardous Waste (m^3)				
	14,000	16,000	16,000	1,500	14,000	14,000	1,600	1,400

Area of Impact	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP[a] Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP[a] Sub-Alternative (Modular NPMP Option)	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP[b] Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP[b] Option)	No Action Alternative (SRS NPMP Option)	No Action Alternative (LANL NPMP Option)
	Construction and Operations							
Environmental Justice	No disproportionately high and/or adverse impacts on minority or low-income populations affected by activities at either the LANL or SRS sites are expected.							
Offsite Transportation Impacts[j]	**Construction - Traffic Fatalities Risk from Non-Radioactive Hazardous Waste Construction Materials Shipments**							
	(i)	(i)	(i)	(i)	0.24	0.24	0	0
	Operations - Incident-Free Crew Impact (LCFs) from Operational Radioactive Materials Shipments							
	0 (0.2)	0 (0.2)	0 (0.2)	0 (0.08)	0 (0.2)	0 (0.2)	0 (0.03–0.04)	0 (0.03–0.04)
	Operations - Incident-Free Population Impact (LCFs) from Operational Radioactive Material and Waste Shipments							
	0 (0.2)	0 (0.2)	0 (0.2)	0 (0.08)	0 (0.2)	0 (0.2)	0 (0.03–0.04)	0 (0.04–0.05)
	Operations - Radiological Accident Impact (LCFs) from Operational Radioactive Material and Waste Shipments							
	0 (0.0001)	0 (0.0001)	0 (0.0001)	0 (0.000001)	0 (0.00006)	0 (0.00006)	0 (0.00003–0.00005)	0 (0.00005–0.00007)
	Operations - Traffic Fatalities Risk from Operational Radioactive Material and Waste Shipments							
	1 (0.6)	1 (0.6)	1 (0.6)	0 (0.3)	1 (0.6)	1 (0.6)	0 (0.1)	0 (0.1)
	Operations - One-Way Distance Traveled (million km) for Operational Radioactive Material and Waste Shipments							
	12	12	12	6.9	12	12	2-2.2	2.5-2.7
Global Commons	**Total Greenhouse Gas Emissions (MT)**							
	28,000	30,000	30,000	18,000	84,000	87,000	9,000[k]	
	Social Cost of Greenhouse Gases ($)							
	360,000–4,100,000	370,000–4,300,000	370,000–4,300,000	230,000–2,600,000	1,100,000–12,000,000	1,100,000–13,000,000	110,000–1,300,000[k]	

CH-TRU = contact-handled transuranic; CRMP = Cultural Resources Management Plan; CSWTF = Central Sanitary Wastewater Treatment Facility; FTE = full time equivalent (employee); HAP = hazardous air pollutant; LANL = Los Alamos National Laboratory; LCF= latent cancer fatality (the risk of LCF in an individual and the number of LCF in an exposed population); LLW = low-level radioactive waste; MEI = maximally exposed individual; MLLW = mixed low-level radioactive waste; NHPA = National Historic Preservation

Act; NNSA = National Nuclear Security Administration; NPMP = non-pit metal processing; PA = Programmatic Agreement; PDP = pit disassembly and processing; ROI = region of influence; SPDP EIS = Surplus Plutonium Disposition Program Environmental Impact Statement; SRS = Savannah River Site.

(a) Impacts are presented for PDP and NPMP separately because PDP and NPMP would occur at different sites in the SRS NPMP Sub-Alternative, unlike the other sub-alternatives. The impacts of 34 MT PDP and 7.1 MT NPMP together bound the impacts of the total 34 MT of surplus plutonium that would be processed in the Preferred Alternative.

(b) Both PDP and NPMP would occur in F-Area and K-Area, respectively, in the F-Area PDP Option and K-Area PDP Option.

(c) No construction/modification activities are anticipated.

(d) LCFs to the public and the MEI from construction activities for all sub-alternatives other than the All SRS Sub-Alternative were not calculated because doses and corresponding LCFs to workers at the site were extremely low and the expectation is that a negligible dose and corresponding LCF would be received by the MEI and other members of the public. See Table C-17 for details of the differences in construction LCFs for sub-alternatives.

(e) Population doses and the resulting LCFs are split between LANL and SRS. The population LCF at any one site will be lower than the total LCF shown.

(f) Beyond-design-basis accidents are not included in this table. See Appendix D for more detail.

(g) The maximum LCF for the population in the vicinity of LANL is 0 and the maximum LCF for the population in the vicinity of SRS is 0.

(h) Differences in electricity are based on the estimated facility needs at the two facilities. Diesel and other fuel types are not expected to be used at LANL as there will be no additional generators required.

(i) The All SRS Sub-Alternative involves the largest quantity of construction material and number of hazardous waste shipments when compared to the other Preferred Alternative sub-alternatives (as discussed in Appendix E of this SPDP EIS). The elements of proposed construction activities are discussed further in Sections 4.1.2 and 4.1.3 of this SPDP EIS. Therefore, the impacts under the other sub-alternatives are less than those provided for the All SRS Sub-Alternative.

(j) The cited operational radioactive material shipments and impacts for the Preferred Alternative are only those related to the processing of the pit plutonium. The shipments and the related impacts for processing non-pit plutonium under the Preferred Alternative are within the bounds cited under the No Action Alternative.

(k) Value based on the maximum number of kilometers traveled for the two No Action Alternative options; see Table 4-33.

Sources: Information is summarized from the applicable subject areas in Section 4 and cross-site tables in Appendix C.

2.5 Summary of Cumulative Impacts

Potential cumulative impacts were assessed for each resource within the ROI specific to that resource at both LANL and SRS. Potential cumulative impacts for the associated resource areas range from none to minor for all resource areas except for cultural resources, transportation, and air quality, which are discussed below and in Section 4.2.

Potential cultural resources cumulative impacts may occur because cultural resources are considered nonrenewable. Although guidance documents (the Programmatic Agreement [PA] and Cultural Resources Management Plan [CRMP]) address identification, evaluation, and mitigation of National Register of Historic Places (NRHP)-eligible resources, if activities under the Preferred Alternative, No Action Alternative, or any other action cause the inadvertent destruction or loss of any NRHP-eligible or potentially eligible historic resources, the result may cause an adverse effect through National Historic Preservation Act Section 106 and could substantially contribute to cumulative impacts within the LANL or SRS ROI.

Potential transportation cumulative impacts may arise from offsite transportation throughout the United States Under the Preferred and No Action Alternatives evaluated in this SPDP EIS, doses to the worker and the general population would be less than 330 and 350 person-rem, respectively, and no LCFs (0.2) would be expected. When combined with past, present, and reasonably foreseeable future actions, the collective worker dose was estimated to be 430,000 person-rem (260 LCFs) as discussed in the cumulative analysis in Section 4.2.3.4. The collective general population dose was estimated to be 440,000 person-rem (260 LCFs). The total number of LCFs (among the workers and general population) estimated to result from radioactive material and waste transportation over the period between 1943 and 2073 is 520, or an average of about 4 LCFs per year (DOE 2015c|Table 4-48|). The transportation-related LCFs represent about 0.0007 percent of the overall annual number of cancer deaths in the United States in 2019. Most of the cumulative risk to workers and the general population would be due to the general transportation of radioactive material and waste unrelated to activities evaluated in this SPDP EIS. Potential transportation cumulative impacts may also arise from traffic fatalities. In the United States, the average number of highway traffic fatalities was 34,860 per year for the 10-year period from 2010 through 2019 (DOT 2021|Table 2|). It is estimated that there could be an additional increase in the number of traffic fatalities of up to 1 (0.3 to 0.6) under the Preferred Alternative and none (0.1) under the No Action Alternative over about 30 years.

Potential air quality cumulative impacts may arise from emissions of greenhouse gases (GHGs) associated with activities under the Preferred or No Action Alternatives, including transportation. GHG emissions under the Preferred and No Action Alternatives would be 89,000 and 10,000 MT carbon dioxide equivalent (CO_2e) total, respectively. Global GHG emissions were estimated to be 34.8 billion MT of CO_2e in 2020 (ICOS 2021). Although estimates for GHG emissions were developed for each alternative, there is uncertainty in evaluating longer-term emissions levels and the relationship between GHG sources and sinks over a long timeframe. Climate change effects resulting from GHG emissions are global in scale, and there is no guidance for how to quantify whether or to what extent local GHG emissions contribute to observed regional trends, or how they contribute to future climate change. Additionally, emissions of ozone-depleting substances from the activities under the Preferred or No Action Alternatives would be very small and would represent a negligible contribution to the destruction of the Earth's protective ozone layer.

3.0 AFFECTED ENVIRONMENT

Section 3.0 of this *Surplus Plutonium Disposition Program Environmental Impact Statement (SPDP EIS)* describes the affected environment for the Pantex, LANL, SRS, Y-12, and the WIPP facility. At Pantex, Y-12, and the WIPP facility, only limited new activities associated with the alternatives go beyond the current work scope, so only brief affected environment discussions are provided for those sites. The affected environments for LANL and SRS are described for the following resource areas: land use and visual resources; geology and soils; water resources; meteorology and air quality; noise; ecological resources; human health; cultural and paleontological resources; socioeconomics; infrastructure; waste management; and environmental justice.

In accordance with the CEQ's NEPA regulations (40 CFR Parts 1500-1508), this section of the SPDP EIS describes the environment that could be affected by the activities associated with the alternatives under consideration. The descriptions of the affected environment provide the context for understanding the environmental consequences described in Section 4.0 of this SPDP EIS and serve as baselines from which any potential incremental and cumulative environmental impacts are evaluated. The level of detail provided varies depending on the potential for impacts within each resource area.

The ROI is the geographic area in which incremental and cumulative impacts are expected to occur. The ROIs are specific to the resource area and the type of effect evaluated. Table 3-1 briefly describes the ROIs for each resource area evaluated in this SPDP EIS.

Table 3-1. ROI for Each Resource Area

Resource Area	ROI
Land use and visual resources	Onsite and nearby offsite areas where changes to the land use and visual resources may occur
Geology and soils	Onsite and nearby offsite areas where geologic and soil resources exist
Water resources	Surface waterbodies and groundwater within the site and nearby offsite areas
Meteorology and air quality	Onsite and nearby offsite areas within local air quality control regions and the transportation corridors for the sites
Noise	Onsite areas where noise is produced within audible range of public receptors
Ecological resources	Onsite and nearby offsite areas where ecological communities exist, including nonsensitive and sensitive habitats and species
Human health risk	Onsite and offsite areas (within 50 mi of the sites) where radiation, radionuclide, and hazardous chemical exposures could occur to workers and the general population for both normal operations and accidents
Cultural and paleontological resources	Onsite and nearby offsite areas where cultural and paleontological resources exist
Socioeconomics	The seven counties surrounding LANL: Los Alamos, Mora, San Miguel, Santa Fe, Sandoval, Taos, and Rio Arriba The four largest population counties near SRS: Aiken and Barnwell in South Carolina, and Columbia and Richmond in Georgia
Infrastructure	Power, fuel supply, water supply, sewage, and transportation infrastructure within the site

Resource Area	ROI
Waste management	Waste treatment, storage, and disposal facilities within the site and noncommercial offsite disposal locations where waste management activities could occur (e.g., NNSS)
Environmental justice	The minority and low-income populations within 50 mi of the site
Transportation	The population living within 0.5 mi of either side of an offsite route for incident-free impacts, and the population within 50 mi of a postulated accident

LANL = Los Alamos National Laboratory; NNSS = Nevada National Security Site; ROI = region of influence; SRS = Savannah River Site.

This section includes descriptions of the affected environment at Pantex in Section 3.1, followed by LANL in Section 3.2, SRS in Section 3.3, Y-12 in Section 3.4, and the WIPP facility in Section 3.5.

3.1 Pantex

Pantex is the primary facility for final assembly, maintenance, and dismantlement of nuclear weapons in the United States (DOE 2018f).

Pantex is located in Carson County, approximately 17 mi northeast of Amarillo, Texas. The site is approximately 11,700 ac in area; it is buffered on the south side by 5,748 ac of land leased by the DOE from Texas Tech University. US-60 borders Pantex on the south and provides the main access to Pantex. The nearest interstate highway is I-40, which runs east-west, and the closest viewpoint is about 6 mi south of Pantex. The nearest residences are approximately 100 ft from the site boundary on Farm-to-Market Road 293 on the north and Farm-to-Market Road 683 on the west; there are also several residences within 0.5 mi east of the site boundary along Farm-to-Market Road 2373. The surrounding land is mainly used for farming, ranching, and oil and gas extraction (DOE 2018f|p. 21-23|).

Pantex mission support activities occur in several major operating areas or zones on the site. Most of the remaining area is undeveloped or used for agriculture. The *Final Supplement Analysis for the Final Environmental Impact Statement for the Continued Operation of the Pantex Plant and Associated Storage of Nuclear Weapon Components* (DOE 2018f) provides a description of the affected environment for activities at Pantex; the Annual Site Environmental Report for calendar year 2021 (CNS 2022) provides additional environmental, land use, and population information about the site.

3.2 Los Alamos National Laboratory

This section describes the LANL environment in general and any unique attributes of TA-55 and TA-52, the two technical areas where the activities described in Section 2.1 would occur.

3.2.1 LANL Land Use and Visual Resources

Land use is the way land is developed and used in terms of the kinds of human activities that occur (e.g., agriculture, residence, and industry). The DOE-owned LANL site is located on approximately 40 mi^2 (25,563 ac) of land in north-central New Mexico, about 60 mi north-northeast of Albuquerque, and 25 mi northwest of Santa Fe (DOE 2018j|p. 1|; LANL 2023a). The LANL site is divided into 47 contiguous technical areas (LANL 2023a) plus two offsite technical areas: one at Fenton Hill, 20 mi west of the main campus, and an office complex in Santa Fe. Figure 3-1 shows LANL's location in New Mexico, technical areas, and land use designations (derived from LANL 2023a|Figure 1-2|). In total, approximately 20 percent of the site is developed (DOE 2011b|p. 3-2|). LANL buildings and facilities total approximately 8.4 million ft^2 (gross), including approximately 744 permanent and 115 temporary and miscellaneous structures (DOE 2018j|p. 62|; LANL 2023b). There are no agricultural activities on the LANL site, nor are there any residential uses of LANL property (DOE 2015c|Section 3.2.1.1|). However, a privately owned mobile home community is located within the LANL site boundary along East Jemez Road (DOE 2015c|Section 3.2.1.1|).

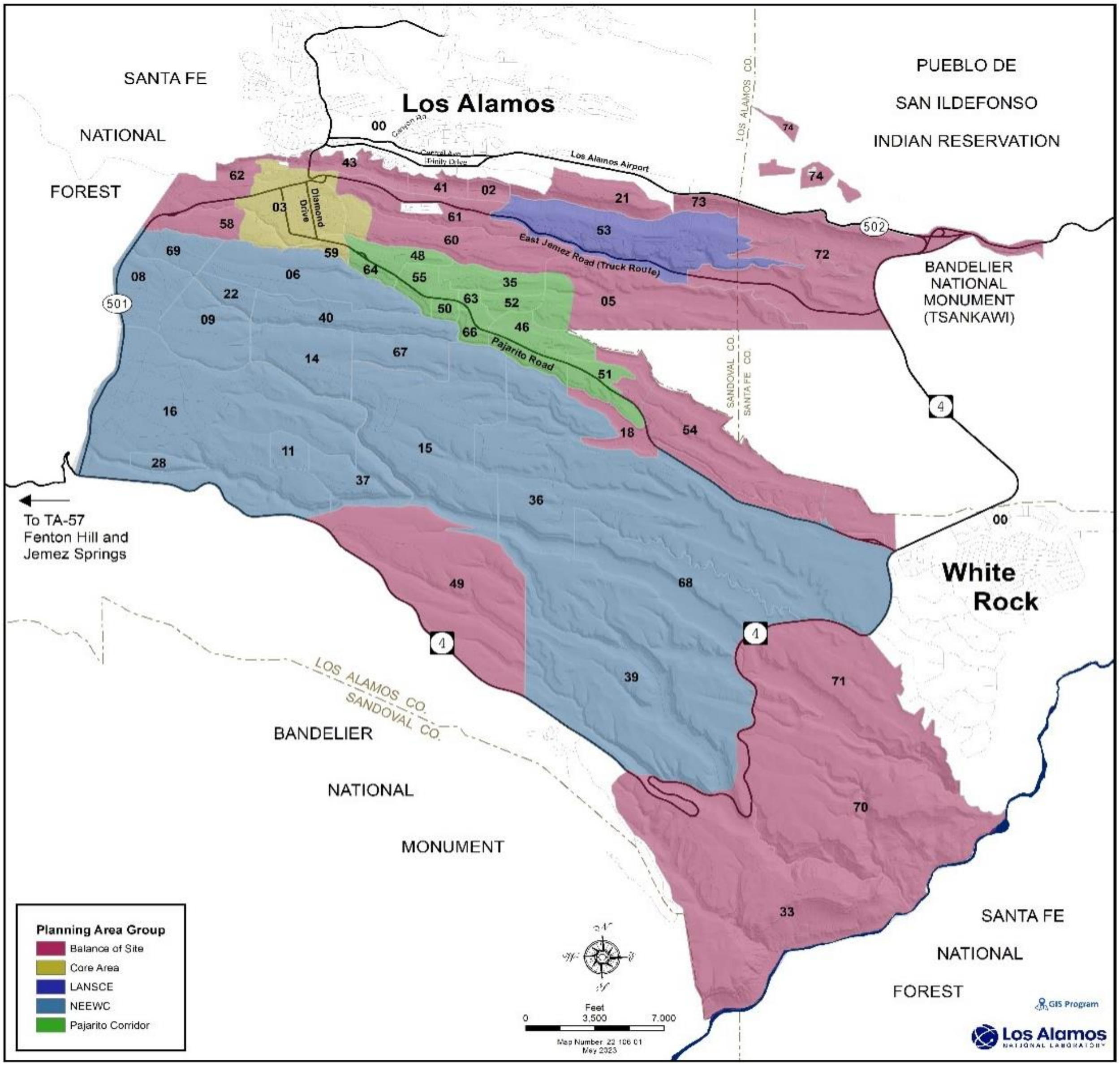

Figure 3-1. LANL Location, Technical Areas, and Planning Area Designations (DOE 2018j|p. 2|; LANL 2022|Figure 2-6|)

Visual resources are natural and manmade features that give a particular landscape its character and aesthetic quality. The topography of northern New Mexico, including the LANL site, is rugged (DOE 2015c|Section 3.2.1.2|). Mesas are cut by deep canyons, creating sharp angles in the landform. Often, little vegetation grows on these steep slopes, exposing the geology, with contrasting horizontal planes varying from fairly bright reddish orange to almost white in color (DOE 2015c|Section 3.2.1.2|). A variety of vegetation grows in the region (see Section 3.2.6), and changes in density and height can affect the visibility of areas within the LANL viewshed. Views of the site have changed over the last decade as a result of wildfires and thinning operations that were undertaken to remove wildfire fuels. While in the past motorists may have viewed more-mature woodlands, views are currently more open (DOE 2015c|Section 3.2.1.2|). Much of the development on the LANL site occurs on mesas, and for security reasons, out of public view (DOE 2015c|Section 3.2.1.2|). The most visible developments at LANL are a limited number of tall structures; facilities at relatively high, exposed locations; or those beside well-traveled, publicly accessible roads. At night, the lights of LANL, Los Alamos, and White Rock are directly visible from various locations across the viewshed and as far away as the towns of Española and Santa Fe (DOE 2011b|Section 3.2.1.2|).

TA-55 is approximately 93 ac and slightly more than half of the area is considered developed land (LANL 2023a|Section 2.8.3|). TA-55 is accessible from Pajarito Road, which is closed to the public (DOE 2011b|Section 4.3.2.2|). The undeveloped areas of TA-55 are mostly associated with canyon areas that are primarily vegetated with mixed-conifer trees and some sparsely vegetated rock areas (LANL 2023a|Section 2.8.3|). TA-55 land use is designated by LANL as Nuclear Materials Research and Development (an isolated, secured area; this land use includes security and radiation hazard buffer zones, but does not include waste disposal sites) and Undeveloped (this area may include environmental core and buffer areas, and vacant land) (DOE 2015c|p. 3-56, 3-59 |; LANL 2023a|Figure 2-6|). TA-55 includes the two-story PF-4 building and the three-story Radiological Laboratory/Utility/Office Building (RLUOB) (DOE 2015c|p. 3-59|). The visual character at PF-4 and the RLUOB in TA-55 is shown in Figure 3-2. RLUOB is visible from several locations throughout the LANL site and from Pajarito Road. The nearest offsite public receptor for PF-4 is 1,018 m north-northeast at the Elk Ridge community (LANL 2023a|Section 2.2.1.2.1|).

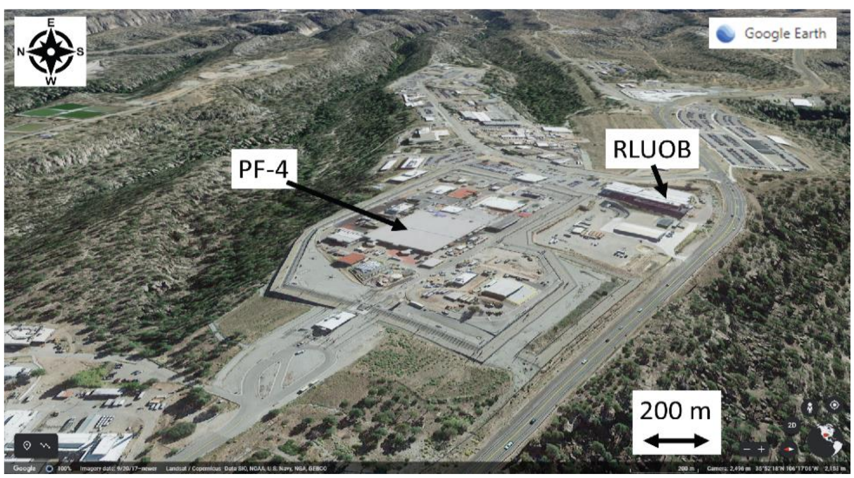

Figure 3-2. The PF-4 in Technical Area-55 at LANL

TA-52 is approximately 69 ac and is serviced by Puye Road, which is a side road off of Pajarito Road (LANL 2023a|Section 2.5.1|). TA-52 is partially developed, with land designated as Undeveloped, Administrative/Service (administrative functions, nonprogrammatic technical expertise, support, and services for LANL management and employees), and Experimental Science (applied research and development activities tied to major programs) (LANL 2023a|Figure 2-6|; DOE 2015c|Section 3.2.1.1|). The undeveloped areas of TA-52 are vegetated with juniper, ponderosa pine, and pinyon trees (LANL 2023a|Section 2.8.1|). Like Pajarito Road, Puye Road is closed to the public (LANL 2023a|Section 2.9.1|).

Using the Bureau of Land Management's (BLM) contrast rating process as the basis for conducting visual impact assessments, developed areas within the LANL site are consistent with a BLM Class IV Visual Resource Contrast rating (BLM 1986|Appendix 2|), in which management activities dominate the view and are the focus of viewer attention (DOE 2015c|Section 3.2.1.2|). Along Pajarito Road near TA-55, the view north of the road is similar to a BLM Class IV rating, whereas the visual landscape looking south of Pajarito Road is similar to a BLM Class III rating, in which the development may attract attention, but the natural landscape dominates (DOE 2015c|Section 3.2.1.2|). Undeveloped lands within LANL have BLM Visual Resource Contrast ratings of Class II or III. Management activities within these classes may be seen but should not dominate the view (DOE 2015c|Section 3.2.1.2|).

3.2.2 LANL Geology and Soils

Geologic resources are consolidated or unconsolidated earth materials, including ore and aggregate materials, fossil fuels, and significant landforms. Soil resources are the loose surface materials of the Earth in which plants grow, usually consisting of disintegrated rock, organic matter, and soluble salts.

3.2.2.1 Geology

LANL is located on the Pajarito Plateau, between the Jemez Mountains to the west and the Rio Grande River to the east. The geology of the region and the LANL site is described in Section 3.2.2.1 of the 2015 SPD SEIS (DOE 2015c) and Section 3.5 of the *Final Supplemental Environmental Impact Statement for the Nuclear Facility Portion of the Chemistry and Metallurgy Research Building Replacement Project at Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2011b).

The Bandelier Tuff, consisting of multiple tuff and pumice deposits, forms the bedrock on which nearly all LANL facilities are constructed. This unit is approximately 700 ft thick at TA-55, and it thins and dips gently southeastward. The uppermost portion of this geologic unit is composed of soft volcanic tuff that has slight to moderate welding and substantial random fracturing. The underlying rock is similar, but less fractured and weathered. Beneath the Bandelier Tuff is the older alluvial Puye Formation, consisting predominantly of coarse sands to boulders (DOE 2003b|p. 3-21|), interfingered with several hundred feet of the Cerros del Rio basalt and the Tschicoma Formation volcanic rocks. Underlying the volcanic rocks is the Santa Fe Group of slightly consolidated sedimentary deposits (DOE 2003b|p. 3-21|).

The major tectonic feature in the region is the Rio Grande rift, which trends north to south through central New Mexico. The Jemez Mountains and associated Pajarito fault system form the western margin of the rift. Although large historical earthquakes have not occurred in the Pajarito fault system, geologic evidence indicates that it is seismically active (LANL 2007b|p. ES-2, 3-9|). There appear to be no active surface-displacing faults at TA-55 or TA-52; the closest mapped surface trace of faults associated with the Pajarito fault system lies about 2,400 ft to the west of TA-55 (DOE 2011b|p. 3-26|). Investigations at and near TA-55 using intensive geologic field techniques have concluded that the identified geologic structures (exposed fractures and faults) pose no independent seismic surface rupture hazard (DOE 2011b|p. 3-27|; DOE 2020b|Section 3.3.1.1|).

NNSA considered data available from the U.S. Geological Survey (USGS) when evaluating seismic conditions at LANL. The USGS reported 32 minor earthquakes (ranging in magnitude from 1.6 to 4.5) within a 62 mi radius of TA-55 from 1973 to May 2021 (USGS 2021a); however, none occurred within the LANL site boundary. The latest probabilistic peak (horizontal) ground acceleration (PGA) map from the USGS, used to indicate seismic hazard, shows a maximum PGA between 0.2 and 0.3 *g*[12] for the central LANL area (USGS 2019). The PGA values cited are based on a 2 percent probability of exceedance in 50 years, corresponding to an annual occurrence probability of about 1 in 2,500. The probabilistic seismic hazard analysis process required by NNSA uses information available to the USGS, but also incorporates more detailed, site-specific geologic, geophysical, and geotechnical information to determine seismic hazard curves (DOE 2020b|p. 40-41|). Site-specific seismic hazard analysis at LANL estimated horizontal and vertical PGAs at TA-55 of 0.47 *g* and 0.51 *g*, respectively, for a 2,500-year return period event (LANL 2009b; DOE 2011b|p. 3-28|). Because the site-specific seismic hazard estimates are larger than the USGS estimates, the site-specific probabilistic seismic hazard analysis results in a more conservative approach to seismic hazard mitigation. The potential for seismically induced land subsidence at LANL is considered to be low and, for soil liquefaction, negligible (DOE 2003b|p. 3-25|); these conclusions are expected to be valid at TA-55 and TA-52.

Volcanism in the vicinity of the LANL site is very unlikely over the next 50 to 100 years. The recurrence rate for an eruption that could produce major impacts at LANL was estimated to be 1×10^{-5} per year, an order of magnitude lower than the performance goal of 1×10^{-4} per year for facilities such as PF-4 at LANL (LANL 2010|p. vii, 21|). Because of the low recurrence rate, the risk from volcanic events is low.

Potential mineral resources at the LANL site consist of rock and soil for use as backfill or borrow material, or for construction of waste unit covers. Sand and gravel are primarily used at the LANL site for road building, and pumice is used for landscaping. The only borrow pit currently in use at the LANL site is the East Jemez Road Borrow Pit in TA-61, which is used for soil and rubble storage and retrieval. This borrow pit is cut into the upper Bandelier Tuff. No sizable, economically valuable geologic deposits are known to occur in the vicinity of TA-55 or TA-52. Numerous commercial offsite borrow pits and quarries in the vicinity of LANL produce sand, gravel, and volcanic pumice. Eleven pits or quarries are located within 30 mi of LANL, which is the distance considered the upper economically viable limit for hauling borrow material to the LANL site (DOE 2008a|p. 4-33|).

3.2.2.2 Soils

Soils in Los Alamos County have developed from the decomposition of volcanic and sedimentary rocks within a semiarid climate, and they range in texture from clay and clay loam to gravel. The general soil map unit that characterizes the LANL site includes approximately 52 percent rock outcrop, which occurs on the edges and sides of mesas (NRCS 2008|p. 27|). Soils that formed on the mesa tops of the Pajarito Plateau are well-drained and range from very shallow (0 to 10 in.) to moderately deep (20 to 40 in.); the greatest depth to the underlying Bandelier Tuff is about 60 in. (NRCS 2008; Nyhan et al. 1978|p. 22-30|). Soils that develop in canyon settings can be locally much thicker than those on the mesa tops.

Most surface soils within TA-55 and much of the TA-52 soils have been disturbed to accommodate buildings, parking lots, and roadways, or have been otherwise affected by previous construction activities. The underlying soils and the undisturbed soils in TA-55 and TA-52 consist primarily of three soil series, along with rock outcrops: Carjo loam with 1 to 9 percent slopes, Tocal very fine sandy loam with 3 to 8 percent slopes, Hackroy-Nyjack soil with 1 to 5 percent slopes (NRCS 2018a). Carjo and Nyjack soils are moderately deep and well-drained, while the Tocal and Hackroy soils are shallow to very shallow and well-drained. The rock outcrop map unit consists of barren or nearly barren areas of bedrock as benches, ledges, and escarpments (NRCS 2008|p. 136|).

[12] Earthquake-produced ground motion is expressed relative to Earth's acceleration due to gravity.

Past activities have resulted in soil contamination at LANL. Soil sampling is carried out to monitor specific facilities, and soil samples are collected once every three years at locations across the LANL site, at the site perimeter, and at offsite locations as part of the institutional monitoring (LANL 2022c|pp. 7-6 to 7-17 and 7-35 to 7-44|). The most common radionuclides detected above background levels in the 2021 institutional monitoring were americium-241, plutonium-239/240, and uranium-238, but all radionuclide concentrations in soil were well below the no-effect ecological screening levels (LANL 2022c|p. 7-40|). Non-radionuclide elements/compounds detected above soil background levels but below screening levels in the 2021 institutional monitoring included antimony, mercury, lead, polychlorinated biphenyls (PCBs), explosives, and per-and polyfluorinated substances (LANL 2022c|pp. 7-41 to 7-44|). Some dioxin, furan, and semi-volatile organic compounds exceeded ecological screening levels in some soil samples (LANL 2022c|pp. 7-42 to 7-43|).

LANL evaluated plutonium in soil samples collected within about 500 m of PF-4 during 2021 (LANL 2022c|p. 7-40|) and 2022 (Intellus 2023). Some of these samples had plutonium-239/240 concentrations above the background levels, with a maximum concentration of 0.285 pCi/g, but all samples were well below the residential screening action level of 79 pCi/g (LANL 2015a|p. 4|).

No soils at the LANL site are classified as prime farmland. Soils at LANL are acceptable for standard construction techniques.

3.2.3 LANL Water Resources

Water resources encompass the sources of water that are useful or potentially useful to plants, animals, and humans in a particular area. Unless otherwise indicated, water resources information in this section is summarized from DOE 2015c and from DOE 2011b.

3.2.3.1 Surface Water

The LANL surface-water drainage system consists of the principal canyons, their smaller tributary canyons, and the contributing mesa areas. TA-55 is located on a narrow mesa between Twomile Canyon to the south (a tributary to Pajarito Canyon) and the Mortandad Canyon Complex to the north. The southern portion of the TA-55 area lies within the Pajarito watershed, although the majority of the TA-55 buildings lie within the Mortandad watershed (LANL 2008|p. 102|; LANL 2013a). The northern portion of TA-55 drains to Effluent Canyon, a tributary to Mortandad Canyon. The northern portion of the TA-52 area drains to Ten Site Canyon, a tributary to Mortandad Canyon (LANL 2006a). The area of TA-52 occupied by buildings drains south to Cañada del Buey, which eventually merges with Mortandad Canyon approximately 0.5 mi from its terminus at the Rio Grande River (LANL 2009a|p. 53|; LANL 2013a). Water drainage from within the developed areas of TA-55 and TA-52 primarily occurs as sheet flow runoff from impervious surfaces to the stormwater conveyance systems.

The 12.8 mi^2 Pajarito watershed originates on the eastern boundary of the Valles Caldera National Preserve, extends 15.4 mi across the central portion of the LANL site and the community of White Rock, and joins the Rio Grande at an elevation of 5,422 ft above sea level (LANL 2006b|p. 50|). Water flow in Pajarito Canyon is predominantly intermittent (seasonal) and/or ephemeral (in response to rainfall) and discontinuously perennial in its upper and lower reaches. Approximately one-half mi of the upper Pajarito Canyon exhibits natural spring-fed perennial flow (LANL 2022c|p. 6-5|). No permitted non-stormwater outfalls discharge to the Pajarito watershed.

The 10.4 mi^2 Mortandad watershed originates on LANL property, extends 10 mi across the LANL site and San Ildefonso Pueblo, and joins the Rio Grande at an elevation of 5,450 ft above sea level (LANL 2006b|p. 39|). No perennial springs or stream reaches exist in the Mortandad watershed, and no significant snowmelt runoff occurs in the watershed (LANL 2006b|p. 39|). Three of the four LANL point-source outfalls permitted to discharge to the Mortandad watershed were active in 2021 (LANL 2022c|p. 2-18|). The largest discharge (about 3.0 million gal in 2021) was from the TA-55 PF-4 cooling tower. Discharge from an emergency cooling system in TA-3 was 0.74 million gal in 2021. The TA-50 Radioactive Liquid Waste Treatment Facility (RLWTF) outfall discharge was about 0.24 million gal in 2021 (LANL 2022c|p. 2-18|).

LANL industrial and sanitary discharges to surface water are regulated under National Pollutant Discharge Elimination System (NPDES) permit NM0028355 (EPA 2022). Effluent from the Sanitary Wastewater System Plant (SWSP) is combined with power plant discharge to Sandia Canyon. Discharge to the power plant outfall was 65.2 million gal in 2021 (LANL 2022c|p. 2-18|). Eight exceedances of effluent concentration limits were observed at NPDES outfalls in 2021, including two chlorine exceedances for outfalls to Mortandad Canyon arising from temporary operational issues (LANL 2022c|p. 2-19|). Two chemical oxygen demand exceedances arising from an undetermined cause were reported for an outfall to Mortandad Canyon (LANL 2022c|p. 2-20|). NPDES permits are discussed further in Sections 5.1 and 5.3.1.

No lakes or reservoirs have been identified within the LANL site boundary. No federally designated Wild and Scenic Rivers occur within, are in the vicinity of, or are in the drainage ROI of the LANL site (NPS 2017).

Stream segments within the LANL site are designated by the New Mexico Water Quality Control Commission for uses of livestock watering, wildlife habitat, human contact, and aquatic life (LANL 2022c|p. 6-9 to 6-11|). These designated uses are not supported in all canyons because of impairment by a variety of contaminants. Twomile Canyon in TA-55 is impaired by aluminum, copper, PCBs, and gross alpha; Pajarito Canyon below Twomile Canyon is impaired by these contaminants as well as cyanide (LANL 2022c|p. 6-10, 6-11|). Mortandad Canyon in TA-55 is impaired by copper, mercury, PCBs, and gross alpha; Ten Site Canyon and Cañada del Buey in TA-52 are impaired by PCBs and gross alpha (LANL 2022c|p. 6-9 to 6-11|). The Rio Grande River from Cochiti Reservoir to the San Ildefonso boundary, which includes the stretch of the river along the LANL site boundary, is impaired by gross alpha, aluminum, mercury, selenium, PCBs, temperature, and turbidity (NMSWQB 2022|p. 192|); a fish consumption advisory is in effect for the reservoir and this reach of the river (NMED 2022).

Canyon flash flooding during summer thunderstorms can mobilize contaminated sediments and transport them beyond the LANL site boundary. To mitigate the effects of flooding, LANL uses sediment control structures in canyons to detain and divert stormwater, reduce peak flows, and trap sediments (LANL 2015b|p. 6-5|). In addition, sediment detention basins, ground cover, and other stormwater control measures are used on mesa tops and hill slopes to reduce erosion and peak stormwater flows. Stormwater samples in canyons receiving runoff from TA-55 and TA-52 were collected during 2021 in Pajarito Canyon above State Route 4 and in Mortandad Canyon below Effluent Canyon. Sample water quality exceeded screening levels at these locations in 2021 for one or more of the following contaminants: aluminum, copper, selenium, zinc, dioxins, PCBs, and gross alpha (LANL 2022c|p. 6-18, 6-20|). No exceedances were reported for stormwater samples collected during 2021 in Pajarito Canyon at the Rio Grande River (LANL 2022c|p. 6-18, 6-20|). Two sediment samples collected in 2021 in Pajarito Canyon near the downstream LANL boundary exceeded the screening level for arsenic and manganese, respectively; no exceedances were reported for sediment samples collected during 2021 in Mortandad Canyon (LANL 2022c|p. 6-22|).

3.2.3.2 Groundwater

Groundwater in the LANL region occurs in three characteristic locations: at shallow depths in alluvial sediments of limited spatial extent along canyon bottoms; at intermediate depths perched above the regional aquifer, most commonly in the larger, relatively wet canyons and those receiving effluent discharge; and in the deep, regional aquifer. Neither the alluvial nor the intermediate-depth perched groundwater is a source of municipal drinking water for the Los Alamos area. The regional aquifer is a major source of drinking water and agricultural use in northern New Mexico, extending throughout the Española Basin (approximately 2,317 mi^2) (LANL 2005|p. 2-103|). It has been designated by the EPA as a sole-source aquifer (73 FR 3723), indicating that the aquifer supplies at least 50 percent of the drinking water for its service area and there are no reasonably available alternative drinking water sources if the aquifer becomes contaminated. The regional aquifer provides the public water supply for various customers, including LANL, Los Alamos County, Bandelier National Monument, and other consumers located in portions of Santa Fe and Rio Arriba Counties.

The regional aquifer occurs at a depth of about 1,000 ft in the central portion of the Pajarito Plateau and is separated from alluvial and intermediate-depth perched groundwater by approximately 350 to 600 ft of unsaturated tuff, basalt, and sediments. Groundwater in the regional aquifer generally flows east to southeast across the LANL site toward the Rio Grande with an average velocity of about 30 ft/yr (LANL 2022c|p. 5-5|). The primary recharge source for the regional aquifer is infiltration of precipitation that falls on the Jemez Mountains and the primary discharge is to the Rio Grande River (LANL 2005|p. 2-108|).

Alluvial groundwater occurs in portions of Pajarito and Mortandad Canyons, and intermediate-depth perched groundwater has been observed in both canyons (LANL 2008|p. 41-43|; LANL 2006a|p. 64-66|). The upper portion of the regional aquifer in both watersheds is unconfined and the deep portion of the aquifer is predominately under confined conditions, with spatially variable hydraulic communication between the zones, which does not preclude the possibility of vertical contaminant transport (LANL 2006a|p. 66|). Cañada del Buey is a dry canyon, characterized by little alluvial groundwater and slow to absent unsaturated flow and transport from the surface to the regional aquifer (LANL 2009a|p. 26|). A zone of shallow perched groundwater has been observed in Cañada del Buey wells, but estimated recharge is low, inhibiting transport of contaminants to deeper groundwater (LANL 2009a|p. 28|).

LANL holds four active permits from the New Mexico Water Quality Control Commission for liquid discharges onto or below the ground surface, including a permit for TA-46 SWSP discharges, and a pending permit for the TA-50 RLWTF discharges to Effluent Canyon (LANL 2022c|p. 2-33 to 2-34|). Monitoring required as part of these permitted activities met the applicable water quality standards in 2021, with the exception of a disinfection byproduct exceedance for the SWSP, exceedances associated with the RLWTF, and exceedances for total nitrogen, iron, and phenol from domestic septic tank disposal systems (LANL 2022c|p. 2-33 to 2-34|).

Liquid effluent discharges at LANL since the 1940s, including accidental and unintended releases, have affected the quality of groundwater. Past Pajarito Canyon groundwater sampling identified the presence of radionuclides, metals, high explosives, volatile organic compounds, and anions (LANL 2008|p. 44|). The most mobile of the contaminants (nitrate, perchlorate, and tritium) have been detected in alluvial, intermediate-depth perched, and regional aquifer groundwater samples. Organic compounds were detected in an intermediate-depth well in Pajarito Canyon in 2021 at levels above (1,4-Dioxane) and below (1,1,1-Trichloroethane) groundwater standards (LANL 2022c|p. 5-33, 5-34|).

The most important source of contaminants of potential concern in Mortandad Canyon has been discharge from the TA-50 RLWTF into Effluent Canyon (LANL 2006a|p. 68|). Alluvial groundwater samples obtained in 2021 as part of this permitted discharge exceeded the applicable water quality standards for nitrate and perchlorate at one well (LANL 2022c|p. 2-34, 5-32, 5-33|). The total per-and polyfluoroalkyl substances level was above the screening level at one alluvial well location in 2020, but was below the screening level in 2021 (LANL 2022c|p. 5-35, 5-37|). Perchlorate and an organic compound (1,4-dioxane) were detected in 2021 at concentrations above the tap-water screening levels in an intermediate-depth well in Mortandad Canyon (LANL 2022c|p. 5-22 to 5-24|). For Mortandad Canyon samples obtained from the regional aquifer general surveillance wells in 2021, no constituents exceeded the screening levels (LANL 2022c|p. 5-32|). Monitoring in 2021 showed that hexavalent chromium (originating from releases in Sandia Canyon) exceeded the groundwater standard in intermediate-depth perched and regional aquifer wells in Mortandad Canyon (LANL 2022c|p. 5-16 to 5-21|). Data show the chromium plume continuing to evolve, with increasing concentrations in some wells. The data indicate that the ongoing interim measures to control the chromium plume (extraction of contaminated groundwater and reinjection after treatment) may be reducing concentrations along the downgradient edge of the plume (LANL 2022c|p. 5-18, 5-19|). Additional investigations are underway to determine the vertical extent of chromium contamination where it occurs at depths greater than 100 ft in the regional aquifer (LANL 2022c|p. 5-17|).

Plutonium has negligible solubility in water under typical environmental conditions (Reilly et al. 2016|pp. 3-4, 3-5, and 3-11|), but could be transported as an oxide precipitated on or adsorbed to soil particles. LANL includes plutonium isotope analyses in selected groundwater monitoring. This has yielded mostly non-detects and no exceedances of screening levels or water quality standards (Intellus 2023). Plutonium-239/240 was detected at one alluvial well (MCO-5 in Mortandad Canyon, TA-05) in 2022 at an activity of 0.123 pCi/L (Intellus 2023), well below the derived concentration standard (400 pCi/L) (LANL 2022c|p. A-2|).

The LANL potable water supply is provided by the Los Alamos County Department of Public Utilities using water from the regional aquifer. Water quality was monitored in 11 water supply wells located on the Pajarito Plateau (LANL 2022c|p. 5-10, 5-13, 5-14|). No violations of water quality standards were reported for 2021 (LADPU 2022), and no contaminants derived from LANL activities were detected above drinking water standards in samples from the Los Alamos County and Santa Fe water supply wells (LANL 2022c|p. 5-14|). Annual water consumption at LANL has decreased by more than 100 million gal since 2012 (DOE 2018j|p. 106|). LANL water consumption was approximately 269 million gal in 2019 (LANL 2021b|p. 3-20|). Although groundwater levels have declined over time in response to pumping, the current pumping rates are likely to be sustainable for many decades (LADPU 2018|p. 20|).

3.2.4 LANL Meteorology and Air Quality

Air quality is defined by the degree to which the ambient air is pollution-free: free of smoke, dust, smog, and other gaseous impurities. Site meteorology, the climate and weather of the region, plays an important role in determining air quality.

3.2.4.1 Meteorology

Los Alamos County has a semiarid climate (LANL 2022c|p. 1-7|). On average, winter temperatures range from 30°F (-1°C) to 50°F (10°C) during the day and 15°F (-9°C) to 25°F (-4°C) at night, while summer temperatures range from 70°F (21°C) to 88°F (31°C) during the day and from 50°F (10°C) to 59°F (15°C) at night (LANL 2022c|p. 1-8|). Average annual precipitation is about 17 in., and average annual snowfall is about 43 in. (LANL 2022c|p. 1-8|). The complex topography of Los Alamos influences local wind patterns that vary depending on time of day (LANL 2022c|p. 4-17|). Winds are typically from the south and southwest during the day, while at night the winds are typically from the west and northwest (LANL 2022c|p. 4-21|). In 2021, the average annual windspeed was 6.5 mph (LANL 2022c|Table 4-12|).

In summer, the rainiest season, afternoon thunderstorms yield short, heavy downpours and frequent lightning (LANL 2022c|p. 4-17|). The local lightning density is estimated at 15 strikes per square mile per year (LANL 2022c|p. 1-8|). Between 1955 and 2020, there were 33 reports of storms in Los Alamos County (average of 1 storm every 2 years) that produced hail equal to or larger than 0.75 in. diameter (NWS 2022). No tornadoes were reported in Los Alamos County from January 1950 to January 2021; one funnel cloud event was reported in 2013 (NOAA 2021d).

Additional information about LANL climate and meteorology is presented in the *2021 LANL Annual Site Environmental Report* (LANL 2022c|p. 4-14 to 4-24|).

3.2.4.2 Air Quality

Air quality in a given location is defined by the size and topography of an air basin, the air emissions that occur within and outside of the air basin, local and regional meteorological influences, and the resulting types and concentrations of pollutants in the atmosphere. The significance of a pollutant concentration often is determined by comparing its concentration to an appropriate national or State ambient air quality standard. These standards represent the allowable atmospheric concentrations that assure public health and welfare are protected and include a margin of safety to protect the more sensitive individuals in the population. Areas are classified as being in an “attainment area” if they meet the *Clean Air Act* (CAA) National Ambient Air Quality Standards (NAAQSs) for criteria pollutants and in “nonattainment” if they exceed the NAAQSs. LANL is located within the Upper Rio Grande Valley Intrastate Air Quality Control Region (#157) (DOE 2015c|p. 3-79|). The area encompassing LANL and Los Alamos County is classified as an attainment area for all CAA criteria pollutants (40 CFR 81.332). The State of New Mexico also has established ambient air quality standards for some criteria pollutants and for total suspended particulates, hydrogen sulfide, and total reduced sulfur. LANL is considered a “major source” of air pollutants under the CAA based on its “potential to emit” nitrogen oxides, carbon monoxide (CO), and volatile organic compounds (LANL 2022c|p. 2-14|). In accordance with Title V of the CAA and NMED Air Quality Bureau regulations, emission sources at LANL operate under a site-wide Title V Operating Permit (P100-R2M4) (LANL 2023a|Section 2.2.3|). LANL submitted a Title V renewal application on February 26, 2019, and the NMED is processing the application (LANL 2022c|p. 2-14 to 2-15|). LANL continues to operate under its existing Title V permit until a final renewal permit is issued. Prior to construction, the NMED Air Quality Bureau requires air permits for new stationary emission sources, depending on their design and operations. Operations at LANL emit criteria pollutants primarily from combustion sources, such as boilers, generators, and motor vehicles (DOE 2015c|p. 3-79|; LANL 2023a|Section 2.2.3|). Table 3-2 presents estimated actual emissions of annual air pollutants at LANL in 2022 and the LANL Title V Operating Permit Facility-Wide Limits (LANL 2023a|Table 2-2|).

Table 3-2. LANL 2022 Annual Air Pollutant Emissions and Title V Operating Permit Annual Facility-Wide Levels

Pollutant	2022 LANL Facility-Wide Emissions (T/yr)	Title V LANL Facility-Wide Permit Limit (T/yr)
Nitrogen oxides[(a)]	46.3	245
Sulfur oxides	1.4	150
Carbon monoxide	26.0	225
Particulate matter	5.4	120
Volatile organic compounds[(a)]	14.3	200

LANL = Los Alamos National Laboratory.
(a) Ozone (O_3), a criteria pollutant, is commonly produced from the degradation of nitrogen oxides and volatile organic compounds emissions.
Source: LANL 2023a|Section 2.2.3|.

Hazardous air pollutants (HAPs) are air pollutants known or suspected to cause serious health effects or adverse environmental effects. HAPs are compounds that generally have no established ambient standards. The CAA identifies 187 substances as HAPs (e.g., benzene, formaldehyde, mercury, and toluene). HAPs are emitted from a range of industrial facilities and vehicles. HAP emissions from LANL activities are primarily related to laboratory, maintenance, and waste management operations. Table 3-3 provides the annual HAP emissions that occurred at LANL in 2022 and the Title V Operating Permit Facility-Wide Limits.

Table 3-3. LANL 2022 Annual Hazardous Air Pollutant Emissions and *Clean Air Act* Title V Operating Permit Annual Facility-Wide Levels

Hazardous Air Pollutants	2022 LANL Facility-Wide Emissions (T/yr)	Title V LANL Facility-Wide Permit Limit (T/yr)
Hydrochloric acid	1.20	8.0[(a)]
Ethylene glycol	0.47	8.0[(a)]
Methanol	0.62	8.0[(a)]
Methylene chloride	0.74	8.0[(a)]
Hexane	0.24	8.0[(a)]
Methylene diphenyl diisocyanate	0.37	8.0[(a)]
All other HAPs from chemical use	1.93	8.0[(a)]
Total HAPs	5.57	24.0

HAP = hazardous air pollutant; LANL = Los Alamos National Laboratory.
(a) 8.0 for any individual HAP (NMED 2015|Table 102.B|).
Source: LANL 2023a|Section 2.2.3|.

LANL borders the Bandelier Wilderness Area CAA Class I area, in which the CAA provides special protection for air quality and air quality-related values (including visibility and air pollutant deposition). Class I areas are those in which any appreciable deterioration of air quality is considered significant (CAA Section 162; 42 U.S.C. § 7472). National Park Service monitoring indicates an improving trend in visibility within the Bandelier Wilderness Area during the period for which data are available (1988 through 2019) (NPS 2021).

3.2.5 LANL Noise

Noise is unwanted sound that interferes or interacts negatively with the human or natural environment. Noise may disrupt normal activities, diminish the quality of the environment, or if loud enough, cause discomfort and even hearing loss.

This SPDP EIS addresses public and occupational noise impacts on human health. Sound pressure levels are typically measured using the logarithmic decibel scale. To assess potential noise impacts on humans, the weighting scale, denoted as A-weighted decibel (dBA), is widely used in environmental noise assessments because it correlates well with a human's subjective reaction to sound (Cowan 1994). For context, Tipler and Mosca (2008) list the sound intensity of a quiet office as 50 dBA, normal conversation as 60 dBA, busy traffic as 70 dBA, and a noisy office with machines or an average factory as 80 dBA.

There are no Federal Regulations for public exposure to noise. Congress passed the *Noise Control Act* of 1972 (42 U.S.C. § 4901 et seq.); however, in 1982 Federal noise control policy transferred the responsibility to State and local governments. Safety and health requirements for DOE occupational workers are governed by Title 10 of the *Code of Federal Regulations* Part 851 (10 CFR Part 851), which establishes requirements for a worker safety and health program. Noise to workers is subject to threshold values from the National Institute for Occupational Safety and Health under the *Occupational Safety and Health Act* of 1970 (Public Law 91-596; 29 U.S.C. § 651 et seq.). National Institute for Occupational Safety and Health's Recommended Exposure Limit for occupational noise exposure is 85 dBA (CDC 2018). The Occupational Safety and Health Administration's permissible exposure limit states that a worker cannot be exposed to more than a 90 dBA for an 8-hour shift without administrative or engineering controls being implemented (29 CFR 1910.95|Table G-16 and 1910.95(b)(1)|).

The EPA guidance to protect human health sets the noise limit at 55 dBA for residential and other outdoor areas, and the U.S. Department of Housing and Urban Development sets the limit at 65 dBA (EPA 1974|p. 4|; 24 CFR Part 51 Subpart B). Los Alamos County has regulations for environmental noise, which include prohibited noise and decibel provisions to protect the public from noise impacts from construction and operations. The county regulations limit noise levels to no more than 65 dBA across any residential property line during the daytime (7:00 a.m. to 9:00 p.m.) and no more than 53 dBA during the nighttime (9:00 p.m. to 7:00 a.m.). The permissible noise level can be increased to 75 dBA in residential areas during the daytime, provided that noise is limited to 10 minutes in any 1 hour (Los Alamos County Ord. No 18-73|Chapter 18/Article III/Sec. 18-73|). Common sources of environmental noise at LANL are vehicle traffic to and from the LANL technical areas (i.e., worker personal vehicles, trucks, security), industrial equipment and machinery, high-explosives testing, and firearms practice by security guards (DOE 1999b). The background noise level at TA-55 is assumed to be 62 dBA. The location of the nearest offsite human receptor (Elk Ridge Mobile Home Park) to PF-4 in TA-55 is 1,018 m north-northeast (LANL 2023a|Section 2.10.3|). For TA-52 the background noise level is 51 dBA (LANL 2023a|Section 2.10.1|). The nearest offsite receptor for the proposed office building and warehouse at TA-52 is 1,790 m northwest of the Elk Ridge Mobile Home Park (LANL 2023a|Section 2.10.3|).

3.2.6 LANL Ecological Resources

Ecological resources include terrestrial (see Section 3.2.6.1), aquatic (see Section 3.2.6.2), and wetland (see Section 3.3.6.3) habitat types, and include common wildlife and plant species and federally listed threatened and endangered species (see Section 3.3.6.4).

3.2.6.1 Terrestrial Resources

The LANL site is situated on the Pajarito Plateau, a series of fingerlike mesas separated by steep east-to-west–oriented canyons. The LANL facilities are located on mesas that range in elevation from approximately 7,800 ft on the flanks of the Jemez Mountains to about 6,200 ft at the edge of White Rock Canyon located on the eastern edge of Pajarito Plateau (LANL 2022c|p. 1-4|). The major upland vegetation cover types that occupy the LANL site are described in the *2021 Annual Site Environmental Report* (LANL 2022c|p. 1-4 through 1-10|). Riparian vegetation occurs in scattered locations at springs and in canyon bottoms, and along the Rio Grande River in White Rock Canyon (Figure 3-1) (DOE 2015c|p. 3-83|). Approximately 20 percent of the LANL site is developed (DOE 2015c|p. 3-82|). Large portions of the LANL site have been affected by forest fire, drought, bark beetle infestation, and forest thinning to reduce the risk of wildfire (LANL 2019a|p. 22-24|; LANL 2007a|p. 10-11|; DOE 2019b|p. 1, 2, 5, 8|; LANL 2022c|p. 1-4 through 1-10|).

The Pajarito Plateau is biologically diverse, owing to large variations in temperature and precipitation resulting from differences in elevation and aspect (LANL 2007a|p. 6, 7|; LANL 2022c|p. 1-4 through 1-10|). Local wetlands (see Section 3.2.6.3) and riparian areas enrich the diversity of plants and animals (LANL 2022c|p. 1-4 through 1-10|; LANL 2007a|p. 18|). LANL supports 57 species of mammals, 200 species of birds, 28 species of reptiles, and 9 species of amphibians (DOE 2015c|p. 3-82|). Common species are described in the 2015 SPD SEIS (DOE 2015c|p. 3-82|), *Biological Resources Management Plan for Los Alamos National Laboratory* (LANL 2007a|p. 14|), and *Field Validation of Predicted Large Game Movement Corridors and Pinch Points at Los Alamos National Laboratory* (Bennett et al. 2014|p. 1|).

TA-55 is partially developed with land designated as "Undeveloped" and "Nuclear Materials Research and Development" (LANL 2023a|Figure 2-6|). It is located primarily within the ponderosa pine forest and mixed-conifer forest vegetation types (DOE 2015c|p. 3-83|). TA-55 experienced a low-intensity burn during the Cerro Grande fire of 2000 (LANL 2002a|p. 25|), which may have had minor effects on vegetation at project locations. For TA-55, the background noise related to potential effects on wildlife is assumed to be 62 dBA (LANL 2023a|Section 2.10.3|).

TA-52 is partially developed with land designated as Undeveloped, Administrative, and Experimental Science (LANL 2023a|Figure 2-6|). The undeveloped areas of TA-52 are vegetated with ponderosa pine trees (LANL 2023a|Section 2.5.1.1|). For TA- 52 the background noise level related to potential effects on wildlife is 51 dBA (LANL 2023a|Section 2.10.3|).

3.2.6.2 Aquatic Resources

Water resources on the LANL site are described in Section 3.2.3, and major waterways are described in Section 3.2.3, and major waterways are depicted in Figure 3-12 of the 2015 SPD SEIS (DOE 2015c). Some canyons on the LANL site contain springs (LANL 2007a|p. 19|) and receive base flow from perennial springs in the Jemez Mountains, but their volume is generally insufficient to maintain perennial flow (LANL 2022c|p. 1-4 through 1-10|). Surface water on the LANL site thus occurs primarily as ephemeral or intermittent flow in canyons as a result of spring snowmelt and summer rain (DOE 2015c|p. 3-83|), as discussed in Section 3.2.3. Consequently, the springs and streams at the LANL site do not support fish populations (DOE 2015c|p. 3-83|), and aquatic invertebrate communities are likely absent or limited (Stubbington et al. 2017). Surface water does not occur at project locations in TA-55 or TA-52. Surface water may occur ephemerally or intermittently in Mortandad Canyon, which is located at the northern border of TA-55, and in Twomile Canyon at the southern border of TA-55 (Figure 3-1) (DOE 2015c|p. 3-73, 83|).

3.2.6.3 Wetlands

Thirty separate wetlands totaling approximately 34 ac occupy portions of 14 technical areas on the LANL site (DOE 2015c|p. 3-83|). Most of the wetlands are associated with canyon stream channels as shown in Figure 3-3 (LANL 2023a|Figure 2-1|) or are present on mountains or mesas as isolated meadows, often in association with springs, seeps, or effluent outfalls (DOE 2015c|p. 3-83|). Dominant wetland plants across the LANL site are documented in the 2015 SPD SEIS (DOE 2015c|p. 3-83|).

Two wetlands lie within TA-55 along its northern boundary (Figure 3-1) (LANL 2023a|Section 2.5.1|). An active erosion feature transports sediment from the TA-55 detention pond to the watercourse when stormwater discharges occur. The discharge flows into the watercourse downstream of the wetlands (see Section 3.2.3) (LANL 2023a|Section 2.16.3|; LANL 2018b|p. 1|). The Middle-Mortandad controls (i.e., controls implemented for stormwater and erosion) were completed in February 2020 and were certified by the State of New Mexico in March 2020 (LANL 2023a|Section 2.16.3|). Stormwater piping transports water from the canyon rim directly to the canyon watercourse, avoiding the eroded area (LANL 2018b|p. 1|). Benefits to the wetland in Mortandad Canyon from the stormwater controls include reduced erosion and sedimentation from high flow velocities in the channel and off the canyon rim, stabilization of the wetland, and improvement of wetland hydrology (LANL 2018b|p. 8|). Current data do not indicate the existence of any wetlands in the canyons adjacent to TA-52 (LANL 2023a|Section 2.16.3|).

3.2.6.4 Threatened and Endangered Species

The LANL site contains habitat for three federally listed species—the southwestern willow flycatcher (*Empidonax traillii extimus*), the Jemez Mountains salamander (*Plethodon neomexicanus*), and the Mexican spotted owl (*Strix occidentalis lucida*) (LANL 2022c|p. 2-37 to 2-38). Two other federally listed species, the western distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus)* and New Mexico meadow jumping mouse (*Zapus hudsonius luteus)* (79 FR 33119|33121|; LANL 2022c|p. 2-37 to 2-38|), occur near the LANL site (LANL 2022c|p. 2-37 to 2-38|), but do not have breeding habitat on the site (Hathcock et al. 2017|p. 1|). The black-footed ferret (*Mustela nigripes*) is also federally listed as endangered; however, no sightings of black-footed ferrets have been reported in Los Alamos County (LANL 2023a). Of these species, only the Mexican spotted owl and Jemez Mountains salamander have been observed on the LANL site (LANL 2022c|p. 2-37 to 2-38|); two active owl nests were observed in 2015, 2016, and 2017 (LANL 2017d|p. 5|), and one salamander was observed in 2015 (LANL 2017d|p. 7|) (see Table 3-4). Surveys were not conducted in 2018 or 2020 because it was too dry (LANL 2019b; LANL 2022c). During surveys conducted in 2019 and 2020, no salamanders were detected (LANL 2020a; LANL 2021a; LANL 2021d|Table 5-2|). However, during surveys conducted in 2021, one salamander was found by biologists on non-LANL lands. No salamanders were found on LANL lands (LANL 2022c|p. 2-39). No designated or proposed critical habitat for any of the federally listed species occurs on the LANL site (81 FR 14263; 79 FR 71373; 78 FR 343; 78 FR 69569; 69 FR 53182). Several Federal species of concern and New Mexico State-listed species that potentially occur on the LANL site are listed in th*e 2021 Annual Site Environmental Repo*rt (LANL 2022c|Table 2-13|).

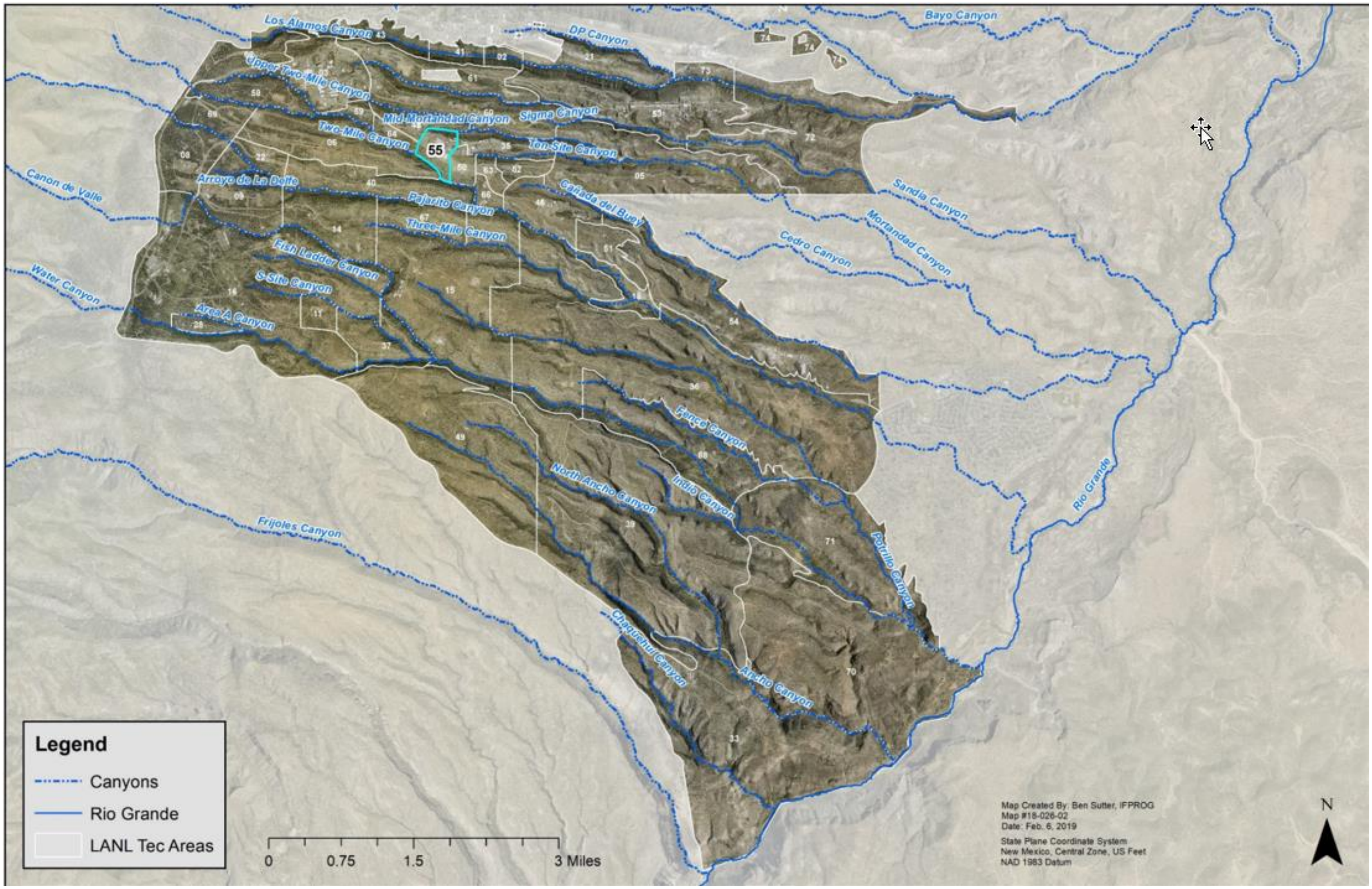

Figure 3-3. Los Alamos County Canyons

Suitable habitats for federally listed species on the LANL site have been designated by LANL as Areas of Environmental Interest (AEIs), which are managed for species protection and consist of core and buffer habitat areas. Core habitat protects areas essential for the existence of the species. Buffer habitat protects core areas from undue disturbance and habitat degradation (Hathcock et al. 2017|p. 1|). Both buffer and core habitat for the Mexican spotted owl occur within the boundary of TA-55 in the Pajarito AEI and the Mortandad AEI (LANL 2023a|Section 2.5.1|); LANL 2016). Mortandad Canyon has an active spotted owl nest site located about 0.75 mi east of PF-4 in TA-55. TA-52 is also within both core and buffer habitat for the Mexican spotted owl in the Mortandad Canyon AEI (LANL 2007a|p. 33|). This AEI is currently occupied by a pair of Mexican spotted owls (LANL 2023a|Section 2.5.1|).

Table 3-4. Federally Listed Species Known to Occur on the LANL Site and in the Vicinity of the Project Areas

Scientific Name	Common Name	Federal Status	State Status	Habitat	Probability of Occurrence on the LANL Site[(a)]
Plethodon neomexicanus	Jemez Mountains salamander	Endangered	Endangered	Jemez Mountains, mostly at 7,000–11,000 ft elevation in mixed-conifer forests. Mostly subterranean, surfacing July–September when warm and wet (LANL 2022c|p. 4-17, 7-54 to 7-55|).	High
Strix occidentalis lucida	Mexican spotted owl	Threatened	SGCN	Generally uneven-aged, multistoried mixed-conifer and ponderosa pine-Gambel oak forests with closed canopy in mountains and canyons (LANL 2022c|p. 7-54 to 7-55|; LANL 2007a|p. 16, Table 1|).	High

LANL = Los Alamos National Laboratory; SGCN = Species of Greatest Conservation Need (NHNM 2018).
(a) High = habitat exists and the species occurs at the LANL site (LANL 2022c|p. 2-37 through 2-38|). LANL has developed a site plan for the protection of species that have a high probability of occurrence (Hathcock et al. 2017|p. 1|).
Source: LANL 2022c|Table 2-13|.

In TA-55, designated buffer and core habitat for the Jemez Mountains salamander is located about 0.5 mi south of PF-4 in Pajarito Canyon, there are no requirements or mitigations associated with this habitat from a biological resources standpoint (LANL 2023a|Figure 2-2, Section 2.5|). In TA-52, designated buffer and core habitat for the Jemez Mountains salamander in Pajarito Canyon is located about 0.6 mi southwest of the proposed project area (LANL 2023a|Figure 2-2, Section 2.5|).

3.2.7 LANL Human Health

Safety and health requirements for DOE workers are governed by 10 CFR Part 851 and 10 CFR Part 835, which establish requirements for a worker safety and health program. Additionally, DOE has put forth orders, such as the *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees* (DOE Order 440.1B Chg 4 2022a]), *Integrated Safety Management* (DOE Order 450.2 Chg 1 [2017]), and *Radiation Protection of the Public and the Environment* (DOE Order 458.1 Chg 4 [2020]), that dictate facility and programmatic safety requirements. Every site in the DOE Complex has established programs to maintain effective occupational and public health. These programs include elements such as facility safety and conduct of operations and are intended to guard against impacts such as radiological, chemical, biological, and other hazards.

3.2.7.1 Radiation Exposure and Risk

The primary sources and levels of background radiation to which individuals in the vicinity of LANL could be exposed are listed in Table 3-5. The background radiation doses presented here are unrelated to LANL operations. The annual background radiation doses to individuals are not expected to change significantly over time.

Table 3-5. Radiation Exposure of Individuals in the LANL Vicinity Unrelated to LANL Site Operations

Source	Effective Dose (mrem/yr)
Natural background radiation - Cosmic and external terrestrial radiation	~170
Natural background radiation - Internal terrestrial radiation	30
Natural background radiation - Radon-220 and -222 in homes (inhaled)	~300
Other background radiation - Diagnostic x-rays and nuclear medicine	300
Other background radiation - Consumer and industrial products	10

LANL = Los Alamos National Laboratory. Source: LANL 2022b|p. 8-5|.

Releases of radionuclides to the environment from LANL operations are another source of radiation to which individuals in the LANL vicinity could be exposed. The types and quantities of radionuclides released from LANL operations are listed in the annual LANL environmental reports. The annual doses to the public from recent releases of radioactive materials (2017–2021) and the average annual doses over this 5-year period are presented in Table 3-6. The doses are less than the radiation dose limits established in DOE Order 458.1 (Chg 4 2020) and are much lower than background radiation. Doses to the offsite population were calculated by LANL for the annual dose reports from 2017–2021 based on approximately 343,000 persons within 50 mi, taken from the LANL Annual Site Environmental Reports (LANL 2018a; LANL 2019b; LANL 2020a; LANL 2022b; LANL 2022c).[13]

Table 3-6. Estimated Annual Radiation Doses to the Public from LANL Site Operations from 2017–2020[(a)]

Year	Maximally Exposed Individual (rem)[(b)]	Population within 50 Miles (person-rem)[(c)]
2017	0.00047	0.20
2018	0.00035	0.09
2019	0.00043	0.07
2020	0.00029	0.08
2021	0.00050	0.08
2017–2021 Total (average)	**0.0020 (0.00041)**	**0.52 (0.10)**

LANL = Los Alamos National Laboratory.

(a) Doses are from atmospheric releases only. No liquid effluent pathways from normal LANL operations result in doses to the public.

(b) DOE Order 458.1 (Chg 4 2020) establishes an all-pathways dose limit of 100 mrem/yr to individual members of the public.

(c) Doses are to a population of about 343,000 for 2017–2021, as provided in Section 8 of the LANL Annual Site Environmental Reports.

Sources: LANL 2018a; LANL 2019b; LANL 2020a; LANL 2022b; LANL 2022c.

[13] Chapter 8 of the LANL Annual Site Environmental Reports used 2010 Census Bureau data, which does not reflect more recent Census Bureau values presented in Section 3.2.12.

Using a risk estimator of 0.0006 LCFs per rem or person-rem (DOE 2003a), the risk of an LCF to the maximally exposed member of the public from releases of radioactive material from LANL operations from 2017–2021 was very low (1×10^{-6}). The number of excess LCFs projected in the population living within 50 mi of LANL during that period was 0 (0.00031).

LANL workers receive the same dose as the general public from background radiation but may also receive an additional dose from working in facilities with nuclear materials. Table 3-7 presents the annual individual and collective worker doses from LANL operations from 2017–2021, the latest 5-year period for which data are available. Individual worker doses are below the regulatory limits of 10 CFR Part 835, "Occupational Radiation Protection". The average annual projected number of excess LCFs in the exposed workforce would be 1 (0.67) from the 1,110 person-rem collective radiation dose received from 2017–2021.

A description of the LANL radiation environment, including background exposures and radiological releases and doses, is presented in the annual LANL surveillance and environmental reports, which are the source documents for Table 3-6 (LANL 2018a; LANL 2019b; LANL 2020a; LANL 2022b; LANL 2022c). The concentrations of radioactivity in various environmental media (including air, water, and soil) in the region (onsite and offsite) are also presented in those reports.

Table 3-7. Radiation Dose to LANL Workers from Onsite Releases and Direct Radiation from Operations, 2017–2021

Occupational Personnel	2017	2018	2019	2020	2021	5 years
Average dose for radiation worker with a measurable dose (rem)[(a)]	0.087	0.100	0.110	0.092	0.072	0.088[(b)]
Total worker dose (person-rem)	160	200	220	230	300	1,100
Number of workers receiving a measurable dose	1,850	2,000	2,000	2,500	4,200	12,550

DOE = U.S. Department of Energy; LANL = Los Alamos National Laboratory.

(a) No standard is specified for an "average radiation worker," but the radiation dose limit for an individual worker is 5 rem/yr (10 CFR Part 835). DOE's goal is to maintain radiological exposure as low as reasonably achievable. DOE has therefore established the Administrative Control Level of 2 rem/yr; the site contractor sets facility administrative control levels below the DOE level (DOE 2017b|p. 2-3|).

(b) The 5-year average is the total collective dose during the 5-year period (1,110 person-rem) divided by the number of workers during the period (12,550).

Sources: DOE 2018a|Exhibit 3-13|; DOE 2021f|Exhibit 3-12|; DOE 2021g|Exhibit 3-12|; DOE 2022g|Exhibit 3-12|; DOE 2023d |Exhibit 3-12|.

3.2.7.2 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 or food, which may contain hazardous chemicals that can be ingested; and other environmental media that may expose people to hazardous chemicals by their contact with the media. Hazardous chemicals can cause cancer and noncancerous health effects. Hazardous chemicals used for the SPDP capabilities at LANL are typically present only in very small quantities.

For the offsite public, inhalation is the primary hazard. The release of hazardous chemicals to the atmosphere is controlled through compliance with permit requirements and is verified by environmental monitoring information and inspection of mitigation measures.

Workers may be exposed to hazardous materials by inhaling contaminants in the workplace environment or by direct contact. Workers are protected from workplace chemical hazards through institutional training related to hazardous materials specific to their work activities and as appropriate the use of protective equipment, monitoring, materials substitution, and engineering and management controls.

3.2.7.3 Health Effects Studies

Numerous epidemiological studies have been conducted in the area of the LANL site. A study conducted by the Agency for Toxic Substances and Disease Registry (ATSDR) is summarized below. For a summary of earlier health effects studies of the LANL site, refer to Section 3.2.6.3 of the 2015 SPD SEIS (DOE 2015c).

In 2006, ATSDR released a public health assessment of possible public exposures to radioactive materials and other toxic substances in the environment near the LANL site (ATSDR 2006). ATSDR examined the results of the prior studies and determined that there were no data to link environmental factors, other than naturally occurring ultraviolet light from the sun, with the observed incidence of any cancer in Los Alamos County. ATSDR concluded that, "[o]verall, cancer rates in the Los Alamos area are similar to cancer rates found in other communities. In some time periods, some cancers will occur more frequently and others less frequently than seen in reference populations. Often, the elevated rates are not statistically significant."

The National Cancer Institute makes available national, state, and county mortality rates (latent fatal cancer rates) for various types of cancer (NCI 2022a). These data do not associate these rates with any specific causes, e.g., facility operations or human lifestyles. Table 3-8 presents cancer mortality and incidence rates for the United States, New Mexico, and the four counties adjacent to the LANL site for all cancers and the organ with highest mortality, lung and bronchus. The percent mortality for lung and bronchus ranges from 52 percent to 82 percent. This is higher than the percent mortality for all cancers. Additional information about cancer incidence and mortality in the vicinity of the LANL site is available in the State cancer profile (https://statecancerprofiles.cancer.gov/index.html) for New Mexico (NCI 2022a).

Table 3-8. Cancer Mortality and Incidence Rates[(a)] for the United States, New Mexico, and Los Alamos Region, 2015–2019

Location	All Cancers Mortality	All Cancers Incidence	All Cancers Percent Mortality	Lung and Bronchus Mortality	Lung and Bronchus Incidence	Lung and Bronchus Percent Mortality
United States	152.4	449.4	33.9%	36.7	56.3	65.2%
New Mexico	138	374	36.9%	25.3	36	70.3%
Los Alamos County[(b)]	114.3	415.7	27.5%	15.7	30	52.3%
Rio Arriba County	126.4	300.2	42.1%	19.8	24.3	81.5%
Sandoval County	132.4	412.9	32.1%	21.4	33.8	63.3%
Santa Fe County[(b)]	117.2	343	34.2%	17.4	27	64.4%

(a) Age-adjusted mortality rates per 100,000 persons per year, all races, and both sexes (as appropriate).
(b) Portions of the Los Alamos National Laboratory site are located in Los Alamos and Santa Fe Counties.
Source: NCI 2022a.

3.2.7.4 Accidents

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

Federally permitted releases comply with legally enforceable licenses, permits, regulations, or orders. If an unpermitted release to the environment of an amount greater than, or equal to, a reportable quantity of a hazardous substance (including radionuclides) occurs, the *Emergency Planning and Community Right-to-Know Act* of 1986, *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), *Clean Water Act*, and CAA require notification be sent to the National Response Center and applicable State agencies. In preparing this analysis, the NNSA reviewed LANL annual environmental reports to determine if there were any unplanned releases of radioactivity to the environment around the site during the most recent 5 years for which data are available; no unplanned radiological releases were reported (LANL 2018a|p. 2-45|; LANL 2019b|p. 2-59|; LANL 2020a|p. 2-44|; LANL 2022b|p. 2-44|; LANL 2022c|p. 2-45|).

The 2015 SPD SEIS presented similar results (no reported releases) for a 5-year period (i.e., 2007–2011) (DOE 2015c|Section 3.2.6.4|). LANL did experience unplanned releases of radioactivity to the environment during earlier operations. A discussion of these earlier releases and their impacts is presented in the LANL Site-Wide EIS (DOE 2008a|Section 4.6.3|).

As discussed in Section 3.2.7.2, hazardous chemicals used for the SPDP capabilities at LANL are typically present only in very small quantities, and therefore no significant accident releases are expected.

3.2.7.5 Emergency Preparedness

Every site in the DOE Complex has an established emergency management program in accordance with DOE Order 151.1C (2005) or DOE Order 151.1D. These programs have been developed and maintained to facilitate an effective response to emergencies involving hazardous material releases that could generate offsite consequences and/or affect the environment. The emergency management program elements include emergency planning, training and drills, readiness assurance, emergency medical responses, offsite interfaces, protective actions, emergency notifications, and consequence assessments.

3.2.8 LANL Cultural and Paleontological Resources

Cultural resources are human imprints on the landscape. DOE views cultural resources as being archaeological materials (artifacts) and sites from pre-European contact, historic, or ethnohistoric periods that are located on or beneath the ground surface; standing structures that are more than 50 years old or represent a major historical theme or era; cultural and natural places, certain natural resources, and sacred objects that are important to Native Americans and other ethnic groups; and American folklife traditions and arts (DOE Policy 141.1 2011; DOE 2015c). Paleontological resources, as defined in the *Paleontological Resources Preservation Act* (16 U.S.C. § 470aaa), are any fossilized remains, traces, or imprints of organisms, preserved in or on the Earth's crust, that are of paleontological interest and that provide information about the history of life on Earth.

3.2.8.1 Cultural Resources

LANL is required to comply with Federal historic and cultural resources compliance requirements in addition to those required by *National Historic Preservation Act* (NHPA) Section 106 (54 U.S.C. § 306101) and NEPA (42 U.S.C. § 4321 et seq). The complete list of laws and regulations related to cultural resources can be found in Section 5.0.

To meet the requirements of these laws, regulations, and guidelines, DOE has implemented *A Plan for the Management of the Cultural Heritage at Los Alamos National Laboratory, New Mexico* (LANL 2017a). The CRMP defines the responsibilities, requirements, and methods for managing cultural resources at the LANL site and provides a series of steps and procedures for complying with Federal historic preservation laws and regulations (LANL 2017a). The CRMP, which was reviewed by the public and was completed in consultation with Tribes, was also written to fulfill the requirements of a DOE PA with the Advisory Council on Historic Preservation and the New Mexico State Historic Preservation Office (SHPO) (LANL 2022a).

The three general categories of cultural resources addressed in this section are as follows:

- **Archaeological resources** – physical properties that remain from past human activities, including features and artifacts reflecting specific activities, including the remaining ruins of buildings and structures. Pre-European contact resources are physical properties that remain from human activities that pre-date European contact. Historic-era archaeological resources (historic debris or remains/ruins of historic structures) are generally considered to be those that post-date the existence of written records (DOE 1999b).
- **Historic-era buildings and structures** – physical standing structures, properties, and associated material that post-date the existence of written records (DOE 1999b). Historic buildings include standing buildings or other standing structures constructed more than 50 years ago and buildings that have been evaluated for eligibility for listing in the NRHP. This category is discussed below under the same heading as the archaeological resources.
- **Traditional Cultural Properties (TCPs)** – places of special heritage value to living communities (often, but not necessarily, Native American groups). TCPs' association with the cultural practices and/or beliefs is tied to the histories of those communities and is important in maintaining the communities' cultural identity (LANL 2017a|p. 97|). The National Park Service, SHPOs, and the Advisory Council on Historic Preservation all have definitions for TCPs, but TCPs are defined by the groups who hold the place(s) to be important. They are not defined by these agencies and officials. Physical and tangible elements that can contribute to the significance of a TCP can vary, but may include things like structures, archaeological material, landscape, or viewshed.

As of 2021, 93 percent (23,259 ac of 25,786 ac) of the LANL site has been surveyed for cultural resources (LANL 2023a|Section 2.3.3|).

3.2.8.1.1 Archaeological Resources and Historic-Era Buildings and Structures

As of 2021, 410 Manhattan Project, Early Cold War, and Late Cold War period buildings and 1,903 archaeological resource sites have been identified on the LANL site. The archaeological resource sites include 1,757 Native American (or pre-European contact-era) archaeological sites associated with Ancestral Pueblo peoples of the Southwest and 146 historic Hispanic and Euro-American archaeological sites. Of the 146 historic-era archaeological sites, 92 have been determined to be eligible for listing in the NRHP. Of the 1,757 Native American (or pre-European contact era) archaeological sites, 1,641 have been determined to be eligible for listing in the NRHP (LANL 2023a|Section 2.3.3|).

In general terms, pre-European contact-era archaeological sites on the LANL site consist of boulder and bedrock features, cavates/cliff dwellings, garden plots, hunting game pits, kivas, lithic and ceramic scatters, small adobe structures, pit structures, plaza or complex pueblos, pueblo roomblocks, rock art, rock/wood enclosures, rock features, rock rings, rock shelters, talus houses, thermal features, stairways, trails, and water control features (LANL 2017a|p. 14-31|).

Types of historic-era archaeological sites include historic artifact scatter/trash scatter, historic infrastructure, dendroglyphs (pictures carved into tree bark), and other features, artifacts and structural remains from farmsteads, homesteads, and roads (LANL 2017a|p. 14-31|).

In 2004, the National Park Service, directed by Congress, made recommendations concerning a new national park that includes historic properties related to the Manhattan Project at the LANL site (Public Law 108-340 [Manhattan Project National Historical Park Study Act]). Within 8 of the LANL technical areas, 17 Manhattan Project-period historic resources were identified as being eligible for inclusion in the Manhattan Project National Historical Park. Nine individual buildings are listed in the Manhattan Project National Historical Park and are located in TA-8, TA-16, and TA-18. Eight additional properties, eligible for future inclusion, are listed in the final park legislation (LANL 2017a; LANL 2023a|Section 2.3.3.1|).

There are also potential NRHP districts on the LANL site. They include archaeological site complexes, Cold War era historic building complexes, and Homesteading period properties (LANL 2023a). Archaeological site complexes associated with the Ancestral Pueblo periods include the Mesa del Potrillo Complex (727 ac), Los Alamos and Sandia Canyons Complex (277 ac), Puye Mesa Complex (108 ac), Mesita del Buey Cavate Complex (60 ac), TA-39 Archaic Complex (216 ac), and TA-39 Developmental Complex (80 ac). The Cold War era historic building complexes on the LANL site include TA-16 S-Site (48 buildings), TA-9 Anchor Ranch Site East (36 buildings), and Cold War era guard stations (12 buildings). Homestead Period complexes include the Grant Homestead (4 ac), Anchor Ranch (14 ac), and Gomez Homestead (9 ac; LANL 2023a|Section 2.3.3.2|).

Per NHPA Section 106, a historic building evaluation of the TA-55 complex, including PF-4, was completed in 2023. The NHPA Section 106 process to document, assess, and make recommendations to the DOE/NNSA Los Alamos Field Office was completed. The LANL Historic Buildings staff developed a plan to complete documentation and consultation requirements for modifications to the exterior of PF-4. The evaluation report and recommendation for eligibility for the NRHP is submitted by DOE/NNSA to the New Mexico State Historic Preservation Office in 2023 for final determination of historic eligibility. A determination is anticipated in 2023 (LANL 2023a|Section 2.3.1|).

The proposed siting areas for the office building, warehouse, and associated parking areas in TA-52 area have been surveyed for cultural resources. A survey has been completed under U.S. Department of the Interior standards (36 CFR Part 61). Although none were identified within the proposed siting areas, several archaeological sites are located adjacent to and downslope from the proposed construction areas. One of them is an archaeological site that has already been determined to be eligible for listing in the NRHP, with concurrence of the New Mexico SHPO (LANL 2023a|Section 2.3.1|). The remaining archaeological sites are undetermined for eligibility for listing in the NRHP (LANL 2023a|Section 2.3.1|), but if impacts are possible, they would be evaluated for eligibility/addressed per the CRMP and PA, and eligible sites may be avoided or mitigated.

3.2.8.1.2 Traditional Cultural Properties

The TCPs on the LANL site include ancestral villages, shrines, petroglyphs (carvings or line drawings on rocks), sacred springs, trails, and traditional use areas that could be identified by Pueblo and Hispanic communities as TCPs within the boundaries of the LANL site. In addition to the physical cultural resources, consulting Tribes have expressed concern to DOE that "spiritual," "unseen," "undocumentable," or "beingness" aspects that are an important part of Native American culture may be present on the LANL site. Native American Tribes may request permission to visit sacred sites within LANL site boundaries to conduct ceremonies (DOE 2018j|p. 98|).

Laws, Executive Orders, and DOE policy require consultation with Native American Tribes that have ancestral/historic ties to the LANL site (see Table 5-1 for a list of laws, regulations, executive orders, presidential memorandums, and DOE Orders). For LANL, this includes the following groups: Pueblos of Santa Clara, Cochiti, San Ildefonso, and Jemez. In addition, the Mescalero Apache, the Hopi Tribe, the Pueblo of Acoma, and the Pueblo of Santa Ana have also expressed interest in consultation regarding land use issues on the LANL site (LANL 2023a|Section 2.3.3.3|).

The existence of TCPs in TA-55 and TA-52 is unknown but would be addressed by DOE through NHPA Section 106 (54 U.S.C. § 306101) consultation with the Tribes.

3.2.8.2 Paleontological Resources

A single paleontological artifact was discovered at a site formerly within LANL site boundaries and the land has since been conveyed to Los Alamos County; however, in general, the near-surface stratigraphy is not conducive to preserving plant and animal remains. The near-surface materials on the LANL site are volcanic ash and pumice that were extremely hot when deposited; most carbon-based materials (such as bones or plant remains) would likely have been vaporized or burned if present (DOE 2015c|p. 3-92|). No paleontological resources have been identified in TA-55 (DOE 2015c|p. 3-93|).

3.2.9 LANL Socioeconomics

In this SPDP EIS, "socioeconomics" refers to the economic activity associated with alternatives and the potential impacts on the ROI. Socioeconomic impacts may be defined as environmental consequences in terms of potential demographic and economic changes.

Table 3-9 provides the residence information for the LANL employees that live within the ROI. In 2023, 19,497 persons were directly employed by LANL or by LANL site-related affiliates, contractors, or partners (LANL 2023a|Section 2.14|) and 14,283 (approximately 73.3 percent) lived within the seven-county ROI. Direct onsite employment accounts for approximately 7.3 percent of employment in the ROI (calculated from BLS 2023a). As of 2022, 194,537 persons were employed in the LANL ROI.

Indirect and induced levels of employment generated by LANL operations have been calculated using a weighted average of employment multipliers estimated using the IMPLAN economic impact model (calculated from IMPLAN 2021). IMPLAN was calibrated to produce the LANL direct employment number by modeling the impact of the annual budget allocation and scaling the locally expended portion accordingly. This method resulted in an estimated LANL total employment multiplier of 1.957.

Therefore, the 14,283 LANL employees that reside in the ROI would generate indirect and induced employment of 8,859 within the ROI, resulting in a total employment of 23,142, or approximately 11.9 percent of the employment in the ROI.

Table 3-9. Distribution of Employees by Place of Residence in the LANL ROI in 2023

County	Number of Employees	Percent of Total Site Employment
Los Alamos	6,021	30.9
Santa Fe	4,300	22.1
Rio Arriba	2,696	13.8
Sandoval	790	4.1
Taos	340	1.7
San Miguel	109	0.6
Mora	27	0.1
ROI Total	**14,283**	**73.3**

LANL = Los Alamos National Laboratory; ROI = region of influence.
Source: LANL 2023a|Section 2.14|.

3.2.9.1 Regional Economic Characteristics

Between 2012 and 2021, the civilian labor force in the ROI increased 2.80 percent to 193,959. At the same time, the number of unemployed people decreased by 6.07 percent—reflecting the economic recovery after the recession of 2008–2010. The unemployment rate declined by 0.62 percentage points from 7.12 percent to 6.50 percent. New Mexico experienced similar trends in unemployment rates, with a slightly lower reduction, decreasing by 0.2 percentage points (calculated from BLS 2023b). Table 3-10 illustrates the change in unemployment rates in the ROI and New Mexico between 2012 and 2021.

Table 3-10. Unemployment Rates in the LANL ROI and New Mexico in 2012 and 2021 (percent)

Year	LANL ROI	New Mexico
2012	7.12	7.0
2021	6.50	6.8

LANL = Los Alamos National Laboratory; ROI = region of influence.
Source: Calculated from data in BLS 2023b|Local Area Unemployment Statistics|.

From 2010 to 2023, the median family income (calculated from HUD 2023b) in the ROI increased by an average of 0.4 percent per year, from $84,897 to $88,341 in 2023 dollars. Real median family income was adjusted from the nominal values using the Bureau of Labor Statistics Consumer Price Index for All Urban Consumers (calculated from BLS 2023). This indicates that although job growth has been strong, real income has had minimal growth over this period, and there may be relatively similar stress on household finances for the average family, compared to previous years.

3.2.9.2 Population and Housing

In 2021, the population in the ROI was estimated to be 426,386 (calculated from USCB 2021p). From 2011 to 2021, the total population in the ROI increased at an average annual rate of approximately 0.7 percent, which was higher than the growth rate in New Mexico. Over the same time period, the total population of New Mexico increased at an average annual rate of approximately 0.4 percent to

2,115,877 people. The populations of the ROI and New Mexico in 2011 and 2021 are shown in Table 3-11.

Table 3-11. Total Population of the LANL ROI and New Mexico in 2011 and 2021

Year	LANL ROI	New Mexico
2011	396,487	2,037,136
2021	426,386	2,115,877

LANL = Los Alamos National Laboratory; ROI = region of influence.
Sources: USCB 2011b; USCB 2021o. Calculated from data in USCB 2021p.

The most recent housing stock statistics from the U.S. Census Bureau (calculated from USCB 2021b, USCB 2021h) report estimated 2021 housing occupancy by type (owned or rented). Of interest for impact analysis is the capacity of the ROI to absorb any new housing demand created by the proposed actions. As of 2021, the ROI had 200,731 housing units of which 83.3 percent were occupied and 16.7 percent were vacant. Of the estimated 33,566 vacant units, 4,172 were estimated to be vacant rental units or 2.1 percent of the housing stock. All other vacant housing makes up 14.6 percent of the stock, or 29,394 units in the ROI. In New Mexico, an estimated 14.9 percent of the stock is vacant. Vacant rental stock makes up 2.6 percent of the stock in the State. The distribution of housing units in the ROI and New Mexico is listed in Table 3-15. The LANL Comprehensive Plan (Los Alamos County 2016|p. 58|) states that based on known vacancies, including housing and vacant land, Los Alamos County could accommodate a population growth of 2,000 people within its existing development boundaries. However, the study conducted to support the Comprehensive Plan does not differentiate the amount of housing types and the analysis of demographic distribution, and housing availability and the trends in hiring indicate that there is a projected shortage of some specific types of housing. Although available housing can change from year to year, in 2021 U.S. Census Bureau's American Community Survey (ACS) data indicate there was a general housing surplus. The Santa Fe Association of Realtors estimates that the recent housing market for Santa Fe has been trending into an undersupply situation as characterized by the average inventory of 1 month (SFAR 2022|p. 27). A "normal" housing market is characterized by having a 3–9-month supply of inventory for sale.

From 2011 to 2021, the median home value (calculated from USCB 2021a) in the ROI increased by an average of 1.31 percent, from $300,700 to $343,100 in 2020 dollars, which is similar to the growth rate in New Mexico (see Table 3-12). Over the same period, the median home value in New Mexico increased by 1.32 percent, from $161,800 to $184,800. From 2011 to 2021 the percent of households determined to be cost-burdened (defined as housing costs requiring more than 30 percent of income) decreased by 6.7 percent, from 33.5 percent to 26.8 percent within the LANL ROI (calculated from USCB 2021c). During the same time, the percent of cost-burdened households in New Mexico decreased by 3.3 percent from 32.2 percent to 28.9 percent (see Table 3-13).

The Los Alamos Housing Program conducted a housing market needs analysis that estimated there was an unmet need of 1,312 rental units and 388 owner-occupied units (see Table 3-14). The study indicated that the majority of households with unmet needs are commuters who rent elsewhere (Los Alamos County 2019). There is limited land available for the construction of new single-family homes in the Los Alamos area. Los Alamos and White Rock are considering the development of high-density, mixed-use housing units in the town center areas that would include a transit center to the LANL site. The plans include up to 363 housing units in White Rock and 2,591 units in Los Alamos (Los Alamos County 2021b, Los Alamos County 2021a).

Table 3-12. Median Home Value in the LANL ROI and New Mexico in 2011 and 2021

Year	LANL ROI	New Mexico
2011	$300,700	$161,800
2021	$343,100	$184,800

LANL = Los Alamos National Laboratory; ROI = region of influence.
Source: Calculated from data in USCB 2021a.

Table 3-13. Percent of Cost Burdened Households in the LANL ROI and New Mexico in 2011 and 2021

	LANL ROI		New Mexico	
Income Range	**2011**	**2021**	**2011**	**2021**
Under $20,000	74.1%	75.3%	73.6%	77.3%
$20,000-34,999	53.2%	52.5%	47.5%	51.6%
$35,000-49,999	34.9%	42.1%	28.3%	33.3%
$50,000-74,999	22.3%	20.4%	15.1%	15.0%
$75,000-99,999	9.1%	3.9%	5.9%	2.9%
Overall	**33.5%**	**26.8%**	**32.2%**	**28.9%**

LANL = Los Alamos National Laboratory; ROI = region of influence.
Source: Calculated from data in USCB 2021c.

Table 3-14. Unmet Housing Need in Los Alamos

Income Range	Max Monthly Cost	Unmet Need for Homeownership	Unmet Need for Rentals
Under $20,000	$500	NA	251
$20,000-34,999	$875	106	324
$35,000-49,999	$1,250	110	341
$50,000-74,999	$1,875	96	112
$75,000-99,999	$2,500	36	48
$100,000-124,999	$2,500+	0	126
$125,000 and over	$2,500+	40	110
Total		**388**	**1312**

Source: Los Alamos County 2019.

Table 3-15. Distribution of Housing Units in the LANL ROI and New Mexico in 2021

2021 Housing Units	New Mexico Number	New Mexico %	LANL ROI Number	LANL ROI %
Total Housing Units	937,397	100	198,022	100
Occupied Housing Units	797,596	85.1	167,165	83.3
Owner Occupied	543,834	58.0	126,121	62.8
Renter Occupied	253,762	37.1	41,044	20.4
Vacant Housing Units	139,801	14.9	33,566	16.7
Vacant Rental Units	24,521	2.6	4,172	2.1
All Other Vacant Units	115,280	12.3	29,394	14.6

LANL = Los Alamos National Laboratory; ROI = region of influence.
Note: Percent of totals may not add because of rounding of individual values and totals.
Source: Calculated from data in USCB 2021e.

3.2.9.3 Local Traffic

Road performance is measured using level of service (LOS) ratings. LOS ratings range from "A" to "F," with "A" being the best travel conditions and "F" being the worst. Most planners aim for LOS C. At LOS C, roads are below but close to capacity and traffic generally flows at the posted speed. Traffic on arterial roadway segments is generally described by assigning LOS categories that reflect peak-hour traffic conditions, as defined below:

- LOS A describes the highest quality of traffic service, when motorists are able to travel at their desired speed. Most drivers find operating a vehicle on a LOS A roadway to be stress free.
- LOS B describes a condition where the drivers have some restrictions on their speed of travel. Most drivers find operating a vehicle on a LOS B roadway slightly stressful.
- LOS C describes a condition of stable traffic flow that has significant restrictions on the ability of motorists to travel at their desired speed. Most drivers find operating a vehicle on a LOS C roadway somewhat stressful.
- LOS D describes unstable traffic flow. Drivers are restricted in slow-moving platoons and disruptions in the traffic flow can cause significant congestion. There is little or no opportunity to pass slower-moving traffic. Most drivers find operating a vehicle on a LOS D roadway stressful.
- LOS E represents the highest volume of traffic that can move on the roadway without a complete shutdown. Most drivers find operating a vehicle on a LOS E roadway very stressful.
- LOS F represents heavily congested flow, with traffic demand exceeding capacity. Traffic flows are slow and discontinuous. Most drivers find operating a vehicle on a LOS F roadway extremely stressful.

Motor vehicles are the primary means of transportation to and from the LANL site. Northern New Mexico is bisected by Interstate-25 (I-25) in a generally northeast–southwest direction. This interstate highway connects Santa Fe with Albuquerque. Regional transportation routes connect LANL with Albuquerque and Santa Fe via I-25 to US-84/285 to State Route (SR)-502; with Española via SR-30 to SR-502; and with Jemez Springs and western communities via SR-4.

Only two major roads, SR-502 and SR-4, provide access to Los Alamos County. Los Alamos County traffic volume on these two segments of highway is primarily associated with LANL activities. Most commuter traffic originates from Los Alamos County or east of Los Alamos County (Rio Grande Valley and Santa Fe) as a result of the large number of LANL employees that live in these areas. A small number of LANL employees commute to LANL from the west along SR-4 (DOE 2015c|p. 3-95|).

No recent traffic studies have been completed and no recent LOS ratings are available for LANL site roadways or for principal public routes accessing the site (LANL 2019d|p. 67|). Traffic metrics were estimated for 2022 for Pajarito Road, within the LANL site from the New Mexico Department of Transportation (NMDOT 2023). Pajarito Road would provide the primary vehicular access to TA-55, where most project activities would be expected to occur. Traffic data for the other principal routes into Los Alamos County were also obtained from the New Mexico Department of Transportation and are summarized in Table 3-16. Workers also commute using local public transit buses and via bicycle (DOE 2011b|EIS-350, Section 3.13|).

Table 3-16. 2009–2022 Annual Average Daily Traffic for Principal LANL Access Routes

Access Route	AADT 2009[(a)]	AADT 2016[(a)]	AADT 2019[(a)]	AADT 2020[(a)]	AADT 2022[(a)]	2009–2022 % Change	2022 % Trucks[(a)(b)]	2009 LOS[(c)]
SR-4 at Bandelier Park Entrance	681	1,988	2,145	1,913	976	43	6	A
Pajarito Road - East	9,302	10,869	11,730	10,463	12,438	34	5	D
Jemez Road - East	9,358	5,006	5,402	5,986	7,115	-24	5	D
Jemez Road- West	NA	NA	11,730	10,463	8,161	NA	5	NA
SR-502 at Canyon View Rd.	20,734	20,428	16,302	13,319	13,841	-33	13	C
SR-502 at Los Alamos/Santa Fe County Line	12,256	13,024	12,004	9,807	10,607	-13	8	A
Pajarito Road - West	NA	NA	10997	9062	10771	NA	6	NA

AADT = annual average daily traffic; LANL = Los Alamos National Laboratory; LOS = level of service; NA = not available; SR = State Route.

(a) DOE 2015c|p. 3-96|

(b) Trucks are used for movement of materials for SPDP.

(c) NMDOT 2023

3.2.10 LANL Infrastructure

Site infrastructure includes the basic resources and services required to support planned construction and operations activities and the continued operation of existing facilities. For the purposes of this SPDP EIS, infrastructure is defined as transportation, electricity, fuel, water, and sewage. Table 3-17 presents information about the LANL site-wide infrastructure and capacity.

Table 3-17. LANL Site Infrastructure Usage and Capacity

Resource	Usage	Capacity	Available Capacity
Transportation - Roads (mi)	83[(a)]	NA	NA
Transportation - Railroads (mi)	0	NA	NA
Electricity - Power consumption (MWh/yr)	747,871[(b)]	1,471,680[(c)]	723,809
Electricity - Peak load demand (MW)	108[(b)]	168[(c)]	60
Fuel - Natural gas (million ft^3/yr)	1,742 - LANL[(d)] 1,018 - other users[(d)]	8,070[(d)]	5,310
Water (million gal/yr)	269[(e)]	542[(e)]	273
Sanitary Wastewater Treatment (million gal/yr)	124.4[(f)]	220[(f)]	95.6

EIS = environmental impact statement; FY = fiscal year; LANL = Los Alamos National Laboratory; NA = not applicable.

(a) Source: LANL 2023a|Section 2.15.3, Figure 2-8|. LANL has approximately 83 mi of paved roads.

(b) Source: LANL 2023a|Section 2.7.3.1|. The Los Alamos Power Pool supplies power to LANL and Los Alamos County, where resources are consolidated. In FY 2023, LANL is forecasted to consume 613,934 MWh of the total Power Pool consumption, and 87 MW of the peak load demand.

(c) Capacity values are for the entire service area, which includes LANL and other Los Alamos County users (DOE 2018j|Figure 3-13|).

(d) Other Los Alamos County usage data and capacity data are from DOE 2015c|Table 3-42|; LANL usage data are from calendar year 2020 (LANL 2023a|Section 2.7.3.4|). Site capacity includes both LANL and other Los Alamos County users.

(e) Water consumption volumes are from calendar year 2019 (LANL 2021b|Table 3-22, p. 3-20|). Site capacity is from DOE 2018j|Figure 3-11|.

(f) Sanitary wastewater treatment usage is the average annual LANL discharge under the National Pollutant Discharge Elimination System permit for years 2008 through 2021 (LANL 2023a|Section 2.16.3|). Site capacity is from DOE 2018j|Section 3.2.10.6|.

Sources: DOE 2015c; LANL 2017e; DOE 2018j; LANL 2021b; LANL 2023a.

3.2.10.1 Transportation

LANL is accessed by road; there is no rail or water access to the site. The site is ringed by SR-4 on the south and east sides, SR-501 (West Jemez Road) on the northeast side, and SR-502 on the north side (Figure 3-1). Approximately 83 mi of paved roads have been developed on the site; the main road providing access to the technical areas of interest is Pajarito Road. The nearest interstate highway is I-25 at Santa Fe, New Mexico, approximately 39 mi by road via SR-502 (east) and US-84 (south).

3.2.10.2 Electricity

To support the site's energy sustainability, LANL is continuing to make improvements to meet the growing demand for electricity, while incorporating energy conservation practices. Infrastructure is being replaced along with existing energy sources to maximize energy production and delivery and minimize releases of GHGs (LANL 2022c|p. 3-9 to 3-10|). Major strategies have included replacing the current LANL steam plant with a new, more energy-efficient combined heat and power plant, installing a new transmission line, reconductoring existing lines, and installing a 10 MW photovoltaic project (NNSA 2019).

Electrical service to the LANL site is supplied through a cooperative arrangement between DOE and Los Alamos County known as the Los Alamos Power Pool. Import capacity is limited by the thermal rating of the transmission lines; DOE indicated the import capacity is currently 116 megavolt amperes (MVA), which could increase to 200 MVA after installation of the new transmission line (LANL 2023a|Section 2.7.3.3). The Power Pool peak, which combines both the LANL and Los Alamos County highest peak, was forecasted for 108 MW in FY 2023 and is projected to increase every year to 180 MW in FY 2033, with LANL peak load demand being 160 MW (LANL 2023a|Section 2.7.3.1|).

LANL plans to upgrade several electrical generation and distribution systems. The installation of a 10 MW photovoltaic array located in TA-16, with minor inclusion of TA-8, would increase baseload onsite power generation (NNSA 2019) with an efficient, sustainable, and resilient source of power. Distribution system upgrades include reconductoring transmission lines and adding four onsite 10 MVA circuits (DOE 2018j|Section 2.1.2.3|). LANL has proposed replacing the TA-03 power plant with a combined-cycle/combined heat and power plant that would provide up to 40 MW on average to LANL (DOE 2018j|Sections 4.2.10.1, 4.2.10.2|). A third transmission line is planned to be constructed across the Santa Fe National Forest property to provide higher-capacity electrical power, built with a 200 MW rating and operating at up to 155 MW (DOE 2018j|Section 2.4.4, p. 48|). This transmission line upgrade would be sufficient to meet the projected LANL peak power demand of 160 MWs in FY 2033 (LANL 2023a|Table 2-9|).

LANL and Los Alamos County have well-established planning processes for electricity supply systems that account for the growth associated with LANL and the surrounding community. Power planning documents consider the current and future use of ongoing high-demand projects at LANL such as its Advanced Simulation and Computing program and Los Alamos Neutron Science Center (LANL 2017c).

3.2.10.3 Fuel

LANL receives natural gas from the Public Service Company of New Mexico (DOE 2018j|Section 3.11.1|). The natural gas service site capacity is 8,070 million ft^3/yr (DOE 2015c|Table 3-42|). LANL site-wide usage reported for the 2020 calendar year indicates consumption of natural gas fuel was 1,046 million ft^3/yr (LANL 2023a|Section 2.7.3.4|). The 2015 SPD SEIS (DOE 2015c|Table 3-42) identified other users in the Los Alamos County service area used 1,018 million ft^3/yr of natural gas. The available unused capacity is 6,006 million ft^3/yr.

Other fuels, such as oil, diesel, and gasoline are used at LANL. These fuels are brought onsite as needed.

3.2.10.4 Water

Water at LANL is supplied by Los Alamos County, which has the capacity to provide 542 million gal/yr. As discussed in Section 3.2.3 of this EIS, annual water consumption at LANL has decreased by more than 100 million gal since 2012 (DOE 2018j|p. 106|). LANL water consumption was approximately 269 million gal in 2019 (LANL 2021b|Table 3-22, p. 3-20|). To support the site's water sustainability, LANL has reduced the potable water intensity (gallons used per gross square foot) by 14 percent as of FY 2018 and plans to reduce the usage by 36 percent by FY 2025 compared to FY 2007 (LANL 2019b|Table 3-2, p. 3-15|). LANL water use steadily declined from 445 million gal in 2012 to the present use levels as a result of conservation and wastewater reclamation (DOE 2018j|Figure 3-11, p. 104-106|).

LANL and Los Alamos County also have well-established planning processes for water supply systems that account for the growth associated with LANL and the surrounding community. LANL and Los Alamos County also collaborate on long-range water supply plans (DOE 2018j|p. 108-109|).

3.2.10.5 Sewage

Sanitary wastewater, generated within TA-55 and TA-52, is treated at the TA-46 SWSP. The SWSP is designed to treat up to 220 million gal/yr of wastewater (DOE 2015c|Section 3.2.10.6|). The SWSP and other sewage treatment plants are grouped as "non-key facilities" in the LANL Site-Wide EIS (DOE 2008a|Section S.5.3|) and supplement analyses; the total wastewater volume associated with non-key facilities was 77 million gal in 2015 and 73 million gal in 2016 (DOE 2018j|Figure 3-7, p. 75|). A portion of the treated SWSP effluent is pumped to the Sanitary Effluent Reclamation Facility, where it is treated for reuse as cooling-tower makeup water. The total LANL discharge under the NPDES for years 2008 through 2019 averages 125.6 million gal/yr (LANL 2023a|Section 2.16.3|). Available unused sanitary wastewater capacity at the SWSP is 94.4 million gal/yr.

3.2.11 LANL Waste Management

Waste management includes minimization, characterization, treatment, storage, and disposal of solid and liquid waste generated by ongoing NNSA and DOE activities. LANL wastes are managed in accordance with a variety of Federal and State regulations, applicable to specific waste types and their radiological and nonradiological contents (see Section 5.0). Waste management operations track waste-generating processes, waste quantities, chemical and physical characteristics, regulatory status, compliance with applicable treatment and disposal standards, and final disposition. All waste is managed and tracked from the point of generation through final storage and disposition using the Laboratory's Waste Compliance and Tracking System (LANL 2023a|Section 2.12|).

Table 3-18 provides the annual solid waste generation rates for LANL for 2021 and the average over a 12-year period (2009−2021). TRU liquid wastes are not included in this table but are addressed in Section 3.2.11.1.

Table 3-18. Annual Solid Waste Generation Rates for LANL

Waste Type	2021	2009–2021 12-Year Average
CH-TRU and MTRU (m^3/yr)	210	180
LLW (m^3/yr)	4,300	7,900
MLLW (m^3/yr)	260	340
Hazardous waste (MT/yr)	1,400	2,300
Nonhazardous waste (MT/yr)	8,700	7,000

CH-TRU = contact-handled transuranic; LANL = Los Alamos National Laboratory; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; MTRU = mixed transuranic.
Note: Values have been rounded to two significant figures.
Source: LANL 2023a|Sections 2.12.3.1, 2.12.3.2, 2.12.3.3, 2.12.3.4|.

3.2.11.1 Transuranic and Mixed Transuranic Waste

Transuranic waste is defined by the WIPP LWA; Public Law 102-579) as radioactive waste containing more than 100 nanocuries (3,700 becquerels) of alpha-emitting transuranic isotopes per gram of waste, with half-lives greater than 20 years, except for: (1) high-level (radioactive) waste (HLW); (2) waste that the Secretary of Energy has determined, with the concurrence of the Administrator of the EPA, does not need the degree of isolation required by the 40 CFR Part 191 disposal regulations; or (3) waste that the NRC has approved for disposal on a case-by-case basis in accordance with 10 CFR Part 61.

TRU waste is further categorized, per the WIPP LWA, according to the following criteria: (1) CH-TRU waste has a surface dose rate not greater than 200 millirem per hour, and (2) remote-handled TRU waste has a surface dose rate of 200 millirem per hour or greater.

CH-TRU and mixed transuranic wastes are currently packaged at the Transuranic Waste Facility in TA-63 for disposal at the WIPP facility. This facility performs the radiological TRU waste characterization activities currently conducted at the site (LANL 2023a|Section 1.7.2|; LANL 2017f). The Transuranic Waste Facility can currently store 1,240 drums if stacked three drums high.[14] In addition the TA-55 Storage Pad can accommodate 2,455 drums for a total of 3,695 drums (LANL 2023a|Section 2.12.3|).

The RLWTF upgrade project began in 2008 and is ongoing (LANL 2023a|Section 1.7.4|). A new Transuranic Liquid Waste Facility was designed for 30,000 L/yr of liquid TRU waste and was completed in 2018 (LANL 2023a|Section 2.12.3|). Liquid TRU wastes are solidified prior to shipment offsite for disposal. These wastes are treated in sequential steps to remove and reduce the radioactive components of the liquid waste stream. Among the steps are neutralization, precipitation, filtration, ion exchange, and reverse osmosis. The sequence depends on the characteristics of the waste stream (DOE 2008a).

3.2.11.2 Low-Level Radioactive and Mixed Low-Level Radioactive Waste

Solid LLW is radioactive waste that is not HLW; spent nuclear fuel; TRU waste; byproduct material (as defined in Section 11e. [2] of the *U.S. Atomic Energy Act* of 1954, as amended), or naturally occurring radioactive material (DOE 2021h).

MLLW is waste that contains both source, special nuclear, or byproduct material subject to the *U.S. Atomic Energy Act* of 1954, as amended, and a hazardous component subject to *Resource Conservation and Recovery Act* (RCRA), as described in Section 3.3.11.3.

DOE and its predecessor agencies have generated LLW from a variety of activities, including weapons production, nuclear reactor operations, environmental restoration activities, and research. LLW may consist of items such as miscellaneous job control waste, equipment, plastic sheeting, gloves, and soils that are contaminated with radioactive materials. The LLW category can also include waste streams from large-scale waste management operations. In accordance with DOE Manual 435.1-1, Chg 3 (DOE 2021h), radioactive waste shall be treated, stored, and in the case of LLW, disposed of at the site where the waste is generated, if practical, or at another DOE facility.

Solid LLW and MLLW from LANL are typically disposed of offsite at facilities such as the NNSS or permitted commercial facilities (DOE 2015c|p. 3-104|; LANL 2023a|Section 2.12.3|). Liquid LLW and MLLW are currently treated onsite at the Low-Level Waste Treatment Facility, which is operating and is capable of handling 5 million L/yr of LLW liquid (LANL 2023a|Section 2.12.3|).

3.2.11.3 Nonradiological Waste

Nonradiological waste generated at LANL includes solid hazardous waste and solid nonhazardous waste.

Nonradioactive hazardous waste generally is any solid, liquid, or contained gaseous material (compressed gas cylinder) that is characteristically hazardous; is a listed hazardous waste, as defined by 40 CFR Part 261; and/or is any environmental medium that contains a listed hazardous waste. For the purposes of this SPDP EIS, hazardous waste is described as waste that is regulated under the RCRA; 42 U.S.C. § 6901 et seq.). It includes solvents, chemicals, acids, and solids such as laboratory trash. RCRA gives the EPA the authority to regulate hazardous waste from cradle to grave, including generation, transportation, treatment, storage, and disposal of nonradioactive hazardous waste. Some construction and demolition debris can contain asbestos and would require disposal in permitted hazardous waste

[14] An increase to 1,440 drums at the Transuranic Waste Facility is possible pending constraints from the LANL hazardous waste permit, inventory of material at risk (MAR), criticality controls, and material accountability.

landfills (LANL 2023a|Section 2.12.3.2|). Two additional types of waste are considered: toxic waste that is regulated under the *Toxic Substances Control Act* (TSCA) (15 U.S.C. § 2601 et seq.) and includes wall sealants and paint, and universal waste, which is mostly light bulbs.

In the ROD for the Department of Energy's Waste Management Program: Treatment of Non-wastewater Hazardous Waste (63 FR 41810, August 1998), DOE decided to continue to use offsite facilities for treatment and disposal of major portions of this waste.

Table 3-18 provides the solid hazardous waste generation rates for LANL (LANL 2023a|Section 2.12.3.2|). The amount of waste could vary significantly from year to year depending upon the environmental restoration and decommissioning and decontamination activities being performed.

Solid nonhazardous waste refers to waste that is neither hazardous nor radioactive and consists of two categories: (1) municipal and (2) construction and demolition. Municipal-type waste is generally referred to as sanitary waste and is commonly disposed of in municipal sanitary landfills. Construction and demolition waste consists of bulky debris-and rubble-type waste. RCRA also establishes a framework for managing solid nonhazardous waste.

3.2.12 LANL Environmental Justice

Environmental justice concerns the environmental impacts that proposed actions may have on minority and low-income populations,[15] and whether such impacts are disproportionate to those on the population as a whole in the area within a 50 mi radius of PF-4 (Figure 3-4). This area includes portions of 8 counties and 16 Pueblo and Tribal lands. DOE will continue to implement its environmental justice requirements and obligations in accordance with requirements in EO 12898 (59 FR 7629), EO 14096 (88 FR 25251)[16], guidance from the CEQ (CEQ 1997), and DOE's Environmental Justice Strategy (DOE 2017c).

In accordance with CEQ guidance, meaningfully greater minority populations are identified where either the racial or ethnic minority population of the affected area exceeds 50 percent, or the racial or ethnic minority population percentage of the affected area is meaningfully greater than the racial or ethnic minority population percentage in the general population or other appropriate unit of geographic analysis (CEQ 1997|p. 25|). For LANL, a meaningfully greater minority population percentage relative to the general population of the State and surrounding counties would exceed the 50 percent threshold defined by CEQ. Therefore, 50 percent is used to identify areas that have meaningfully greater minority populations surrounding the LANL site. To evaluate the potential impacts on populations in closer proximity to the LANL, additional radial distances of 5, 10, and 20 mi were analyzed. Table 3-19 shows the composition of the 50-mi radius surrounding PF-4 at each of these radial distances. This area includes minority and low-income populations that reside in 8 counties and 16 Pueblo and Tribal lands.

[15] CEQ's 1997 Environmental Justice Guidance Under the *National Environmental Policy Act* defined minority as "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" (EJ IWG 2019). CEQ developed this guidance to further assist Federal agencies with their NEPA procedures so that environmental justice concerns under EO 12898 are effectively identified and addressed.

[16] EO 14096 was issued in April 2023, and substantially updates what characteristics identify communities with environmental justice concerns and how environmental impacts are judged to affect these communities. While Federal Departments develop internal guidance to fully comply with this EO, NNSA has followed existing guidance based on EO 12898 for EJ impact assessments under NEPA for this action.

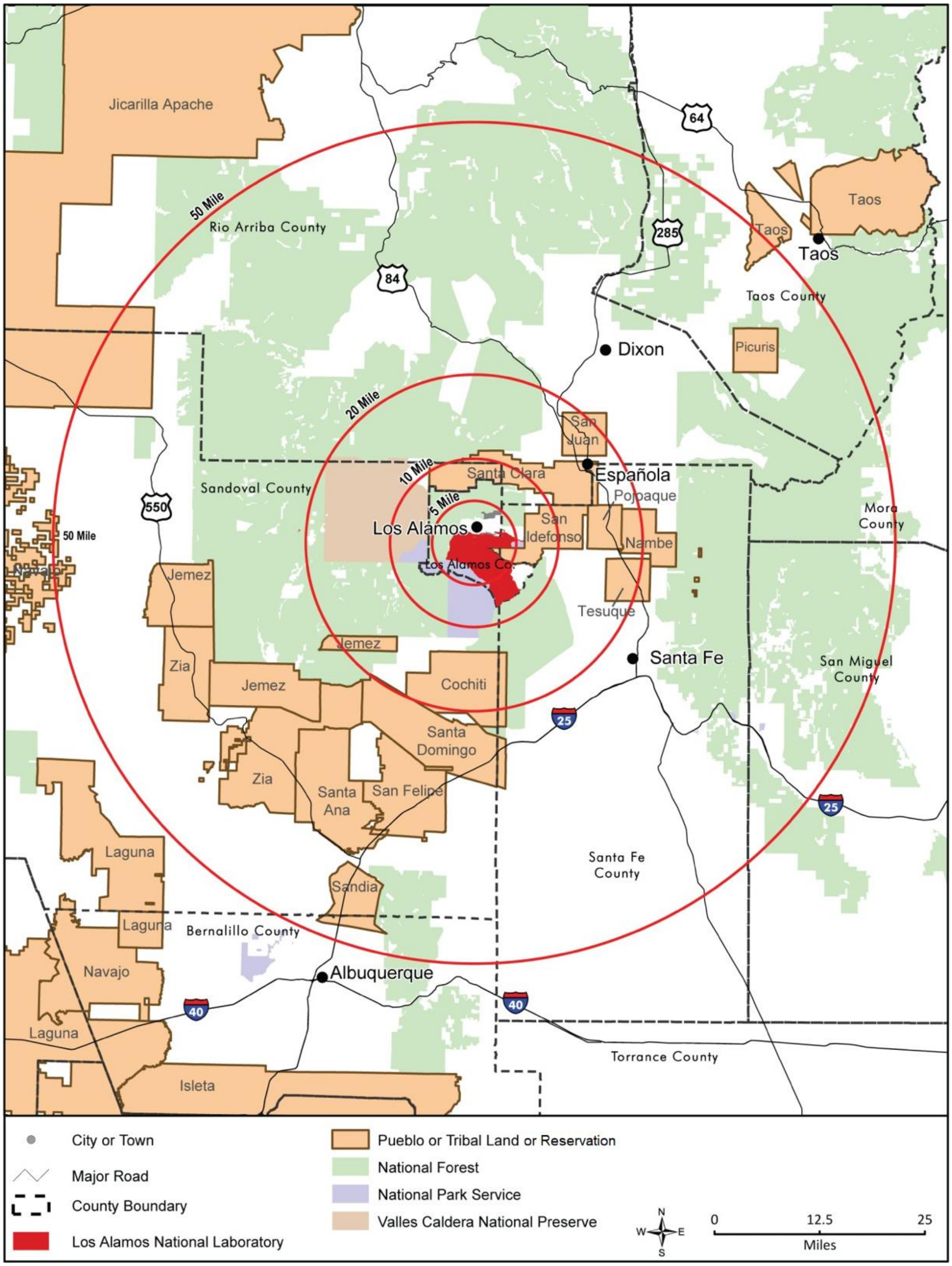

Figure 3-4. Pueblos, Tribal Lands, and Reservations within 50 mi of LANL

Table 3-19. Estimated Populations in the Potentially Affected Area Surrounding LANL

Population Group	5 Miles Pop.	5 Miles % of Total	10 Miles Pop.	10 Miles % of Total	20 Miles Pop.	20 Miles % of Total	50 Miles Pop.	50 Miles % of Total
White Alone	10,079	61.1	16,685	55.4	25,415	32.9	185,993	41.7
Black or African American[(a)]	174	1.1	240	0.8	391	0.5	6,086	1.4
Hispanic or Latino[(b)]	3,193	19.3	7,923	26.3	41,417	53.7	205,307	46.0
Native American or Alaska Native[(a)]	1,447	8.8	2,988	9.9	6,821	8.8	26,952	6.0
Other Non-Hispanic Minority[(a)]	1,613	9.8	2,266	7.5	3,114	4.0	22,156	5.0
Total Minority[(b)]	6,427	38.9	13,417	44.6	51,743	67.1	260,501	58.3
Total Population	16,506	100.0	30,102	100.0	77,158	100.0	446,494	100.0
Low-Income[(c)]	2,618	15.9	6,097	20.3	22,980	29.8	122,811	27.5

LANL = Los Alamos National Laboratory; NNSA = National Nuclear Security Administration; Pop. = population.
(a) Non-Hispanic persons.
(b) Includes all Hispanic persons regardless of race.
(c) NNSA defines low-income as households below 2 times the Federal poverty level.
Notes: The percent of totals may not add because of rounding of individual values and totals. The potentially affected area is the area within a 50 mi radius of the site.
Sources: USCB 2021f; USCB 2021l.

Based on the 2020 Census, the 2020 total population residing within 50 mi of LANL was approximately 446,494, over 54 percent of which are considered members of a minority population.[17] Block-level spatial resolution (the smallest geographic area used by the U.S. Census Bureau) was used in this analysis for Los Alamos County to allow identification of populations that reside in close proximity to the LANL site boundary. Of the 371 blocks in Los Alamos County, 55 (14.8 percent) were identified as containing meaningfully greater minority populations (USCB 2020). Of the 295 block groups in the remainder of the LANL 50 mi radius, approximately 245 (83.1 percent) were identified as containing meaningfully greater minority populations.

Table 3-19 characterizes the race/ethnicity of the population at various radial distances from the LANL site. The areas within 5 mi of PF-4 contain the lowest percentage of minority populations. The overall composition of the 50 mi radius is predominantly nonminority within the first 10 mi. The area within 20 mi contains the highest concentration of minority populations in the 50 mi radius. The percent of minority populations decreases slightly in the area within 50 mi but remains high.

The Hispanic or Latino population is the largest minority population within each radial distance. Figure 3-5 displays the blocks and block groups identified as having meaningfully greater minority and low-income populations, respectively, surrounding PF-4.

[17] The total population identified in this section uses 2020 Census Bureau data and is not consistent with the total population analyzed in Section 3.2.8.1 for doses to the offsite population. Section 3.2.8.1 uses data obtained from the LANL Annual Site Environmental Reports, which uses 2010 Census Bureau values.

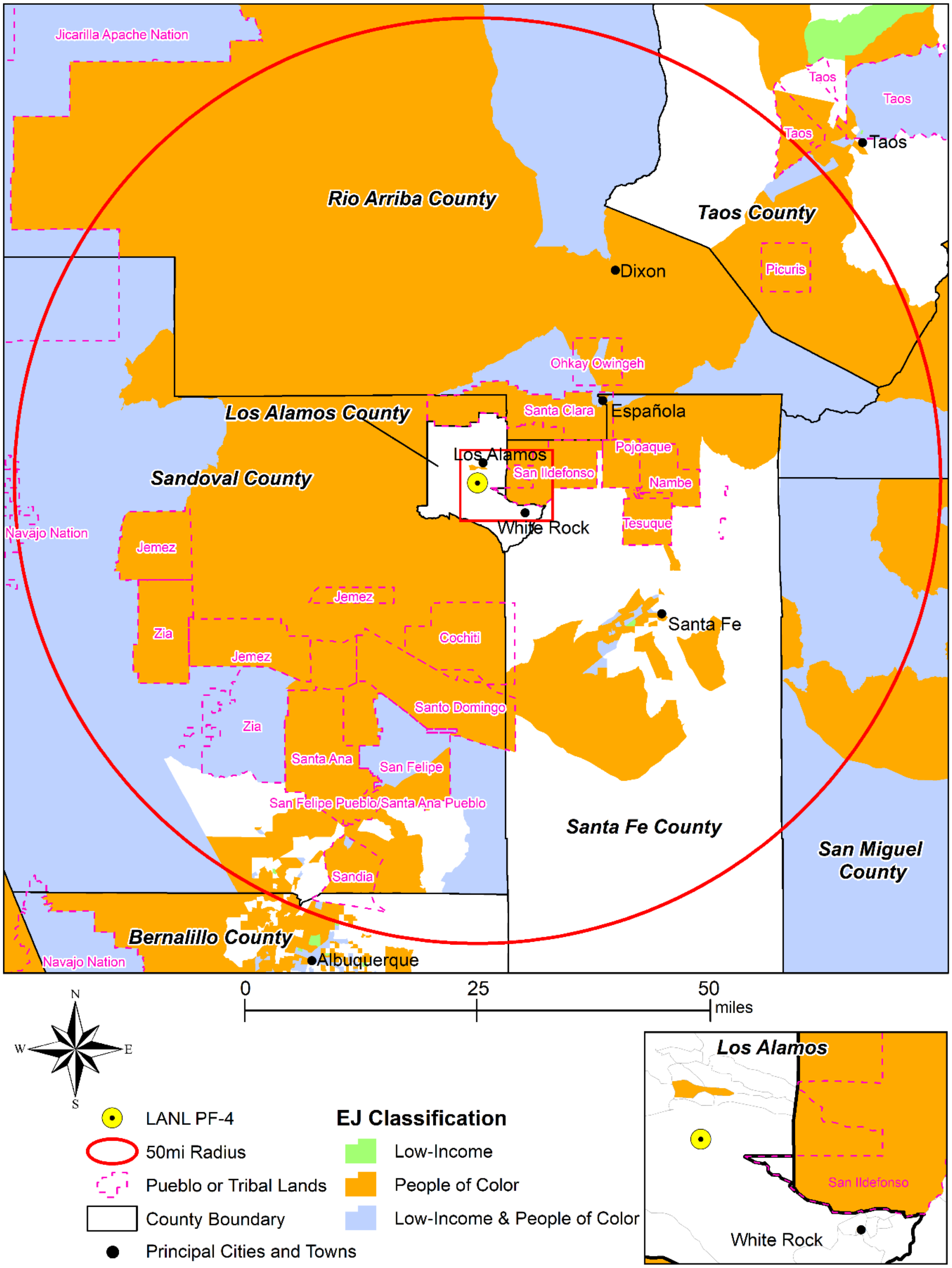

Figure 3-5. Meaningfully Greater Minority and Low-Income Populations Surrounding LANL

The ACS 2017–2021 5-year estimates were used to identify low-income populations in the potentially affected area. The 2017–2021 ACS 5-year estimates show that the average low-income population of New Mexico is 39.1 percent and the average low-income population of the counties within the 50 mi radius surrounding PF-4 is 27.5 percent (122,811 people) (calculated from USCB 2021l).

Meaningfully greater low-income populations are identified using the same methodology described for the identification of minority populations but using NNSA's definition of low-income as those living below twice the Federal poverty level. For estimating low-income population, meaningfully greater is defined for block groups as 20 percentage points above the population percentage in the general State population or 50 percent, whichever is most inclusive. The State percentage is over 39 percent, therefore, the threshold of 50 percent is used to identify areas that have meaningfully greater low-income populations surrounding the LANL site (PF-4). Meaningfully greater low-income populations were identified using block-group level spatial resolution. Although nearly all Census block groups contain people living below twice the Federal poverty level, of the 312 block groups within 50 mi of PF-4, 122 (39.1 percent) contain meaningfully greater low-income populations.

3.3 Savannah River Site

This section describes the SRS environment in general and specifically K-Area and F-Area where the activities described in Section 2.1 would occur. Information about E-Area is included in specific resource areas when reference is made to either facility modifications (e.g., cultural resources) or when support facilities located in those areas are described (e.g., waste management resources).

3.3.1 SRS Land Use and Visual Resources

The DOE-owned SRS is located on approximately 310 mi^2 (198,072 ac) in a generally rural area of South Carolina, about 15 mi southeast of Augusta, Georgia, and 12 mi south of Aiken, South Carolina (SRNS 2020b|p. 1-3|). It is bordered by the Savannah River to the southwest and includes portions of three South Carolina counties: Aiken, Allendale, and Barnwell (SRNS 2020b|p. 1-1 to 1-3|). The site has been divided into five management areas as shown in Figure 3-6, based on existing biological and physical conditions, operations capability, and suitability for mission objectives (SRNS 2023d|Figure 5|).

Figure 3-6 shows SRS's location, facility areas, and wildlife management areas (DOE 2019c|Figure 2|). In total, approximately 10 percent of the site is developed (SRNS 2018|p. 1–8|). The major SRS facilities are contained within the 38,444 ac Industrial Core Management Area (DOE 2015c|p. 3–4|). F-Area, which covers approximately 364 ac, is within the Industrial Core Management Area and is highly developed (DOE 2015c|p. 3-6|).

K-Area covers 130 ac near the center of SRS (SRNS 2023d|Figure 3|). K-Area is one of five SRS reactor areas with the original mission of producing material for the U.S. nuclear weapons program, however, the K-Area production reactor is in a shutdown condition and has no restart capability (DOE 2015c|p. 3-6|).

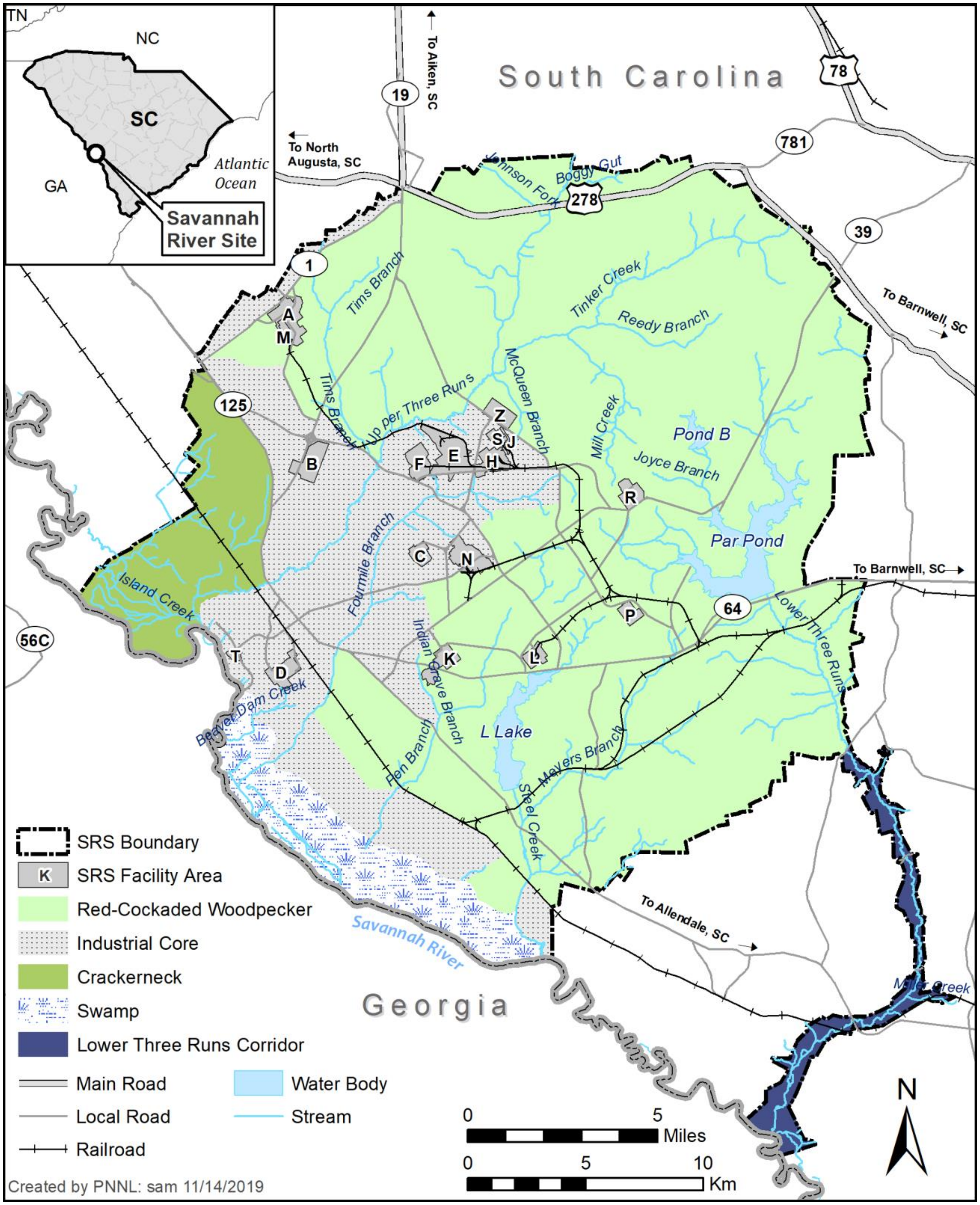

Figure 3-6. SRS Location, Facility Areas, and Wildlife Management Areas

Fields and forest are the predominant visual resources surrounding SRS, although there are some limited industrial and residential areas. The landscape is characterized by upland hills and wetlands (DOE 2015c|p. 3-6|). Vegetation includes bottomland hardwood forests, scrub-oak and pine forests, and forested wetlands (see Section 3.3.6). At night, the facilities dispersed throughout SRS are brightly lit. Generally, these facilities are not visible offsite because of rolling terrain, typical hazy atmospheric conditions, and heavy vegetation that prevent their being seen from offsite (DOE 2015c|p. 3-6|). Typical terrain and K-Area facilities are shown in Figure 3-7. Industrial facilities within F-Area and K-Area are consistent with a BLM Class IV Visual Resource Contrast rating, in which management activities dominate the view and are the focus of viewer attention (DOE 2015c|p. 3-6|). Both K-Area and F-Area consist of large concrete structures, smaller office and support buildings, trailers, and parking lots. The structures typically range in height from approximately 10 ft to 100 ft (DOE 2015c|p. 3-7|).

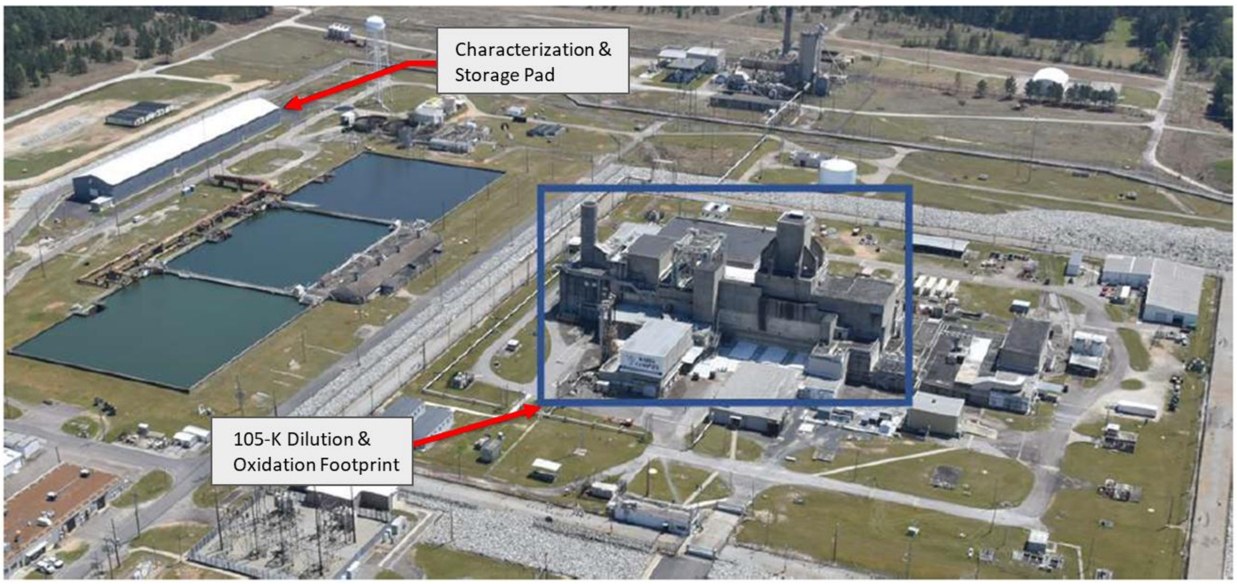

Figure 3-7. Aerial View of K-Area at SRS (SRNS 2023d)

3.3.2 SRS Geology and Soils

Geologic resources are consolidated or unconsolidated earth materials, including ore and aggregate materials, fossil fuels, and significant landforms. Soil resources are the loose surface materials of the Earth in which plants grow, usually consisting of disintegrated rock, organic matter, and soluble salts.

3.3.2.1 Geology

SRS is located in the Atlantic Coastal Plain physiographic province, which extends from the coast to the Fall Line where the crystalline rocks of the Piedmont province dip beneath the coastal plain sedimentary units. The Fall Line is located approximately 25 mi northwest of SRS. The geology of the region and SRS are described in the 2015 SPD SEIS (DOE 2015c|Section 3.1.2.1|), SRS Pit Production EIS (DOE 2020a|Section 3.2|), and by Denham (Denham 1999). The Atlantic Coastal Plain sediments at SRS are approximately 600 to 1,400 ft thick (DOE 2002a|p. 3-1|). The sedimentary sequence near the center of SRS consists of various sand, silt, and clay beds, and some limestone. The youngest deposits on SRS are fine to coarse sands associated with Savannah River stream terraces and tributary stream alluvium. Geologic conditions in K-Area and F-Area are consistent with those found throughout SRS, including the occurrence of "soft zones" (i.e., areas of sand containing calcium carbonate subject to dissolution by water, encountered in boreholes throughout SRS). Soft zones at SRS are limited in areal extent, less than approximately 15 ft thick, and are poorly interconnected. The most well-developed soft zone in K-Area is approximately 50 ft wide by 200 ft long (DOE 2015c|p. 3-9|). Soft zones at SRS are stable under static conditions and have withstood the effects of past earthquakes (DOE 2020a|p. 3-10|).

The only known faults within a 200 mi radius of SRS capable of producing a significant earthquake are within the Charleston seismic zone (located approximately 70 mi southeast of SRS) (NRC 2005a|p. 3-4|). Since 1973, 42 minor earthquakes (ranging in magnitude from 1.5 to 4.1) have been recorded within a 62 mi radius of the center of SRS (USGS 2021b), including 5 that occurred within or near the SRS boundary. Earthquakes capable of producing structural damage are not likely to originate in the vicinity of SRS (DOE 1999b|p. 3-149|).

The latest probabilistic horizontal PGA map from the USGS, used to indicate seismic hazard, shows a PGA between 0.2 and 0.3 *g* at the center of SRS (USGS 2019). The PGA values cited are based on a 2 percent probability of exceedance in 50 years. This corresponds to an annual occurrence probability of approximately 1 in 2,500. No evidence of seismically induced liquefaction has been discovered at SRS (NRC 2005b|p. 1-24, 1-25|). Estimates of the total potential ground surface settlements from design-basis earthquake loading of the soft zones were between 1.4 and 1.75 in. at K-Area (DOE 2015c|p. 3-9|). Because soft zone occurrence increases to the southeast across SRS, soft zone settlement in F-Area is expected to be similar and is not expected to destabilize building foundations (DOE 2020a|p. 4-9|).

There are no volcanic hazards at SRS. The area has not experienced volcanic activity within the last 230 million years. Future volcanism is not expected because SRS is located along the passive continental margin of North America.

The mixed sands, gravels, and clays commonly found beneath SRS are widespread and therefore are of limited commercial value. A possible exception might be well-sorted quartz sand, which is valuable as a filtration medium, an abrasive, and engineering backfill. No sizable, economically valuable deposits of quartz sand are evident at the surface or in the shallow subsurface in K-Area, and no viable geologic resources occur in F-Area other than small gravel deposits (DOE 2015c|p. 3-10|).

3.3.2.2 Soils

The Natural Resources Conservation Service identifies 28 soil series occurring on SRS, grouped into seven broad soil associations (Rogers 1990|p. 62-82,127|). Generally, sandy soils that are excessively or well-drained occupy the uplands and ridges, and loamy-clayey soils that are poorly to moderately well-drained occupy the stream terraces and floodplains. Undisturbed soils near K-Area are generally nearly level to sloping and are well-drained. Some undisturbed soils near F-Area are more steeply sloped toward Upper Three Runs Creek. Soils along the nearby stream drainages are generally of lower permeability. Two primary soil map units near K-Area and F-Area are classified as prime farmland (NRCS 2018b; NRCS 2021). The soils at SRS are considered acceptable for standard construction techniques (DOE 1999b|p. 3-151|).

Most soils within the fence lines of K-Area and F-Area have been disturbed to accommodate buildings, parking lots, and roadways. Disturbed soils within these areas are considered to be urban land covered by structures or udorthents (NRCS 2018b; NRCS 2021). Udorthents are well-drained, heterogeneous soil materials that are the spoil or refuse from excavations and major construction activities, and they are often heavily compacted.

Past activities have resulted in soil contamination at SRS. Soil sampling is carried out at locations across the SRS site, at the site perimeter, and at offsite locations as part of the surveillance monitoring (SRNS 2022c|p. 5-11|). Soil samples were collected at 19 locations in 2021, including in F-Area but not in K-Area. Radionuclides detected above background levels included cesium-137, plutonium-238 and plutonium-239, americium-241, and curium-244 (SRNS 2022c|p. D-11|). The maximum plutonium-239 activity of 0.143 pCi/g was detected in F-Area (SRNS 2022c|p. D-11|). Dose assessments for all pathways considering exposure to contaminated soils were below applicable limits (SRNS 2022c|pp. 6-15 to 6-19|).

3.3.3 SRS Water Resources

Water resources encompass the sources of water that are useful or potentially useful to plants, animals, and humans in a particular area. Unless otherwise indicated, water resources information in this section is summarized from the 2015 SPD SEIS (DOE 2015c), from Wike et al. 2006 for surface water, and from Denham (Denham 1999) for groundwater.

3.3.3.1 Surface Water

The Savannah River is the principal surface-water feature in the SRS region; it forms the southwestern border of SRS for approximately 35 river miles (SRNS 2022c|p. 1-3|). During the period from 2005 to 2020, the average monthly river flow at SRS ranged from 4,880 ft^3/s in November to 7,350 ft^3/s in March, with a minimum monthly flow of 3,891 ft^3/s in November 2012 (USGS 2021c). Surface-water drainage on SRS occurs via five main streams that originate on, or pass through, the site. These streams—Upper Three Runs, Fourmile Branch, Pen Branch, Steel Creek, and Lower Three Runs—flow generally northeast to southwest and discharge to the Savannah River, with the exception of Pen Branch, which discharges to the Savannah River floodplain swamp. No streams or tributaries at SRS are federally designated Wild and Scenic Rivers or State-designated Scenic Rivers (SCDNR 2018).

Project alternatives would take advantage of existing developed areas and infrastructure located well inside the SRS boundary. K-Area surface topography is flat to gently sloping over the developed areas, and drainage occurs to Pen Branch and its major tributary, Indian Grave Branch (Wike et al. 2006|p. 4-103|). The topography of F-Area is similar, with drainage from the northern portion to Upper Three Runs, while the southern portion of F-Area is within the Fourmile Branch watershed (Wike et al. 2006|p. 4-3, 4-65|). Pen Branch drains an area of 21 mi^2 and had average monthly flows of 9.3 to 28 ft^3/s near the Savannah River from 1998 to 2002 (USGS 2018c). For comparison, average monthly flows over the same period were 141 to 254 ft^3/s in Upper Three Runs (drainage area of 203 mi^2) (USGS 2018a) and 12 to 21 ft^3/s in Fourmile Branch (drainage area of 22 mi^2) near the Savannah River (USGS 2018b). Existing facilities in K-Area and F-Area are located at elevations well above the streams to which drainage occurs and are outside the 100-year floodplain (FEMA 2018a; FEMA 2018b). The annual probability of flooding in K-Area and F-Area was estimated to be significantly less than 1 in 100,000 (DOE 2015c|p. 3-12|).

The Savannah River from SRS to near the City of Savannah is classified as a freshwater source (Class FW) that is suitable for primary- and secondary-contact recreation, drinking water supply (after conventional treatment), fishing and the survival and propagation of a balanced indigenous aquatic community of fauna and flora, and industrial and agricultural uses (SCDHEC 2021b; SCDHEC 2014|p. 34|). The Savannah River along SRS (as well as upstream and downstream from the site) is listed by the South Carolina Department of Health and Environmental Control as impaired for fish consumption because of mercury contamination (SCDHEC 2020|p. 52|). Upper Three Runs, Fourmile Branch, and Lower Three

Runs are listed by the State as impaired for recreational use (swimming) because of E. coli contamination (SCDHEC 2020|p. 52, D-24|). The nearest downstream water intake on the Savannah River is approximately 90 river miles from SRS.

In 2021, 28 industrial wastewater outfalls and 36 industrial stormwater outfalls were operated and monitored under the SRS NPDES permits (SRNS 2022c|p. 4-4 to 4-8|), including three industrial wastewater outfalls and one stormwater outfall in K-Area, and four industrial wastewater outfalls and two stormwater outfalls in F-Area. No exceptions to the permit requirements were reported for the 2021 monitoring of the outfalls in K-Area or F-Area (SRNS 2020b|p. 4-7, 4-8|). One exceedance of the permit limit for daily maximum flow was recorded at a wastewater outfall in K-Area during 2021 (SRNS 2022c|p. 4-7|). NPDES permits are discussed further in Sections 5.1 and 5.3.2.

Releases of radionuclides in liquid effluents (including direct releases and shallow groundwater migration from seepage basins and the Solid Waste Disposal Facility) were 424 Ci during 2019, 519 Ci in 2020, and 483 Ci in 2021, more than 99.9 percent of which were from tritium (SRNS 2020b|p. 5-15|; SRNS 2021c|p. 5-13|; SRNS 2022c|p. 5-13|). Stormwater basin surveillance monitoring in 2021 resulted in a maximum tritium activity of 46,800 pCi/L in an E-Area basin (SRNS 2022c|p. 5-17|). Maximum tritium in the F-Area Pond 400, which would receive stormwater runoff from Building 226-F (SRPPF), was 3,540 pCi/L in 2021 (SRNS 2022c|p. 5-17|). Tritium was detected in 2021 in all five primary streams on SRS, and the average tritium activity in Pen Branch was reported to be 8,020 pCi/L (SRNS 2022c|p. 5-18|). The average tritium activity in Fourmile Branch (17,100 pCi/L) was slightly less than the drinking water standard (20,000 pCi/L), and the average tritium activity in Upper Three Runs was 739 pCi/L (SRNS 2022c|p. 5-18|). Estimated tritium releases and average activity in Pen Branch and Fourmile Branch have generally decreased over the last 10 years (SRNS 2022c|p. 5-18, 5-19|). Gross alpha activities did not exceed the screening level (15 pCi/L) in any of the streams during 2021 monitoring (SRNS 2022c|p. 5-18|). Average tritium activity observed in Savannah River samples downstream of SRS was less than 260 pCi/L (SRNS 2022c|p. 5-20|). Radionuclide levels monitored during 2021 at two offsite drinking water sources (using Savannah River water) and at 10 onsite drinking water sources (including the A-Area water treatment plant) were below drinking water standards for all radionuclides (SRNS 2022c|p. D-19 to D-21|); average tritium activity in the Savannah River at the downstream drinking water location was 235 pCi/L (SRNS 2022c|p. 5-25, 5-26|).

3.3.3.2 Groundwater

The SRS groundwater flow system is characterized by four major aquifers separated by lower-permeability confining units. The uppermost (water table) aquifer occurs at depths from ground surface at seeps along streams, to 160 ft below ground surface at topographic highs (SRNS 2011|p. 7-2|); recharge to the aquifer occurs from infiltration of precipitation at the land surface. Water movement in the water table aquifer is predominantly in a horizontal direction toward local discharge zones along the headwaters and midsections of streams, with some percolation to deeper aquifers. The water table at K-Area is encountered approximately 70 ft below the ground surface and about 100 ft below ground surface at F-Area (SRNS 2012|p. 21|). Groundwater in the water table aquifer flows generally southwest toward Indian Grave Branch in K-Area and toward either Upper Three Runs or Fourmile Branch in F-Area (SRNS 2012|p. 21|). The underlying confined aquifers are the Gordon (or Lost Lake), Crouch Branch, and McQueen aquifers, and they extend through the depth of the Atlantic Coastal Plain sediments (SRNS 2011|p. 7-2, 7-3|), which are 600 to 1,400 ft thick at SRS (see Section 3.3.2.1). Flow in the confined aquifers is generally toward the Savannah River. Groundwater velocities at SRS range from several inches to several feet per year in confining units and from tens to hundreds of feet per year in aquifers (DOE 2015c|p. 3-14|).

Groundwater monitoring at SRS is used to evaluate groundwater quality, contaminant discharge from groundwater to streams, and the potential for groundwater contaminants to move offsite, as well as to manage remediation efforts (SRNS 2017b). Trichloroethylene and tritium were observed in SRS groundwater during 2021 at concentrations above or near the limits of the drinking water standards at operating areas across the site (SRNS 2022c|p. 7-8 to 7-10|). Groundwater contamination is most prevalent in the water table aquifer. Groundwater contamination at K-Area is a result of activities associated with the reactor at this site. Maximum groundwater contaminant concentrations in K-Area during 2021 significantly exceeded water quality standards for tritium and were above or near water quality standard limits for trichloroethylene and tetrachloroethylene (SRNS 2022c|p. 7-9|). Groundwater contamination at F-Area is a result of separations and waste management activities. Maximum groundwater contaminant concentrations in F-Area during 2021 exceeded water quality standards for tritium, trichloroethylene, gross alpha, and nonvolatile beta (SRNS 2021c|p. 7-9|). Contamination of deeper aquifers is of most concern in the A- and M-Areas, where trichloroethylene has been detected in the Gordon and Crouch Branch aquifers, and in the E-, F-, and H-Areas, where tritium has been detected in the Gordon aquifer (SRNS 2012|p. 28-33|). Groundwater contamination from SRS operations does not extend beyond SRS boundaries (SRNS 2020b|p. 7-5 to 7-12|; SRNS 2022c|p. 7-5 to 7-13|).

All SRS aquifers meet the conditions under the *South Carolina Pollution Control Act* (SC Code § 48-1-10 et seq.) for classification as underground sources of drinking water (SCDHEC 2014). This classification determines the applicable water quality standards, which are not currently met in all areas of SRS as described above. Groundwater in and around SRS is used extensively for domestic, industrial, and municipal purposes. In 2021, groundwater withdrawals in Allendale, Aiken, and Barnwell Counties for all uses were 25 percent of total (surface water and groundwater) withdrawals (SCDHEC 2022|p. 70|). Groundwater withdrawals for water supply use, were 58 percent of total water supply withdrawals in the three counties during 2021 (SCDHEC 2022|p. 70|). No aquifers in the SRS region are designated by the EPA as sole-source aquifers.

The A-Area domestic water system supplies treated water to most of SRS from two 600 to 900 ft deep wells in A-Area, each having a capacity of 1,500 gpm and drawing water from the Crouch Branch (Tuscaloosa) aquifer (SRNS 2023d|Section 21|). The top of the Crouch Branch aquifer is typically 350 to 500 ft below ground surface; the thickness of the aquifer varies from 100 to more than 350 ft (SRNS 2011|p. 7-3|). As a result of facility shutdowns, SRS staff reductions, and water supply system upgrades and consolidation, there has been a major decline in water use since annual reporting of SRS groundwater usage began in 1983. Groundwater use at SRS in 2021 (including drinking water and process water uses) was 2.51 million gpd (SRNS 2022c|p. 7-14|), which is less than 2 percent of the 2021 total water withdrawals, and less than 6 percent of the 2021 groundwater withdrawals, for Aiken, Barnwell, and Allendale Counties. All samples from the SRS A-Area domestic water system collected and analyzed in 2021 met South Carolina Department of Health and Environmental Control and EPA drinking water quality standards (SRNS 2022c|p. 7-14|).

3.3.4 SRS Meteorology and Air Quality

Air quality is defined by the degree to which the ambient air is pollution-free (i.e., free of smoke, dust, smog, and other gaseous impurities). Site meteorology, the climate and weather of the region, plays an important role in determining air quality.

3.3.4.1 Meteorology

Mean maximum temperatures in Augusta, Georgia (located about 15 mi northwest of SRS), range from 60°F (16°C) to 94°F (34°C), and mean minimum temperatures range from 35°F (1.8°C) to 72°F (22°C) (NOAA 2021e). Average annual precipitation is 44 in. (NOAA 2021e).

Thunderstorms cause several occurrences of high wind each year (DOE 2015c|p. 3-20|). Between January 1950 and January 2021, hurricanes affected South Carolina on 11 days (NOAA 2021c) and hurricanes affected Georgia on 9 days (NOAA 2021b). In the same time span, 40 tornadoes and 15 flash floods were reported in Aiken County (NOAA 2021a). From 1955 through 2020, there were 372 thunderstorm wind events, high wind events, and strong wind events as well as 78 hail events in Aiken County (SCDNR 2021).

3.3.4.2 Air Quality

SRS is located within the Augusta-Aiken Air Quality Control Region (#053) (DOE 2015c|p. 3-20|). The area encompassing SRS is classified as in attainment for all criteria pollutants under the NAAQSs (EPA 2023a). SRS is considered a major source of nonradiological air emissions and operates under a CAA Part 70 Operating Permit, which regulates stationary sources that have the potential to emit ≥5 T/yr of any criteria pollutant (SRNS 2022c|p. 3-16 to 3-17|). The SRS Title V Part 70 Operating Permit (TV-0080-0041) was issued January 19, 2021 and was effective April 1, 2021 (SCDHEC 2021a). The current Title V permit does not identify facility-wide annual emission limits; rather it includes emission limits in pounds per hour that are used for modeling analyses to demonstrate compliance with ambient air standards for criteria pollutants and HAPs. SRS emissions have dropped below the threshold that requires an annual air emissions inventory; therefore, SRS reports on a 3-year cycle rather than annually for Permit TV-0080-0041 (SRNS 2022c|Section 3.3.6.4|). The last emissions inventory report was submitted for 2020 air emissions. Table 3-20 provides the annual air pollutant emissions that occurred at SRS in 2020.

Table 3-20. SRS 2020 Annual Air Pollutant Emissions

Pollutant	2020 SRS Emissions (T/yr)
Nitrogen oxides[(a)]	95.89124
Sulfur oxides	6.30179
Carbon monoxide	51.2285
Particulate matter	12.31771
Particulate $matter_{10}$	8.94714
Particulate $matter_{2.5}$	7.10598
Volatile organic compounds[(a)]	35.99085

SRS = Savannah River Site.

(a) Ozone (O_3), a criteria pollutant, is commonly produced from the degradation of nitrogen oxides and volatile organic compounds emissions.

Source: SRNS 2021a|Page 1/95|.

Table 3-21 provides the annual HAP emissions that occurred at SRS in 2020.

Table 3-21. SRS Hazardous 2020 Annual Hazardous Air Pollutant Emissions

HAPs	2020 Hazardous Air Pollutant Emissions (T/yr)
Nitric acid	18.45445
Tetrachloroethylene	6.55542
Trichloroethylene	3.56987
Toluene	0.45551
Sodium hydroxide	0.0688
Total HAPs/other emissions	34.46

HAP = hazardous air pollutant; SRS = Savannah River Site.
Source: SRNS 2021a|Pages 1/95 through 5/95|.

3.3.5 SRS Noise

Noise is unwanted sound that interferes or interacts negatively with the human or natural environment. Noise may disrupt normal activities, diminish the quality of the environment, or if loud enough, cause discomfort and even hearing loss. Section 3.2.5 describes methodology associated with assessing environmental noise impacts.

Common sources of noise in the developed areas of SRS include industrial equipment, which is used primarily Monday through Friday from 7:00 a.m. to 5:00 p.m. (SRNS 2023d|Section 14.1|). Noise sources in the undeveloped areas of the site included vehicles, rail operations, and environmental noise (e.g., birds, wind) (DOE 2015c|p. 3-23|). The primary sources of noise that reach offsite members of the public are related to the transportation of people and materials/supplies to and from the site (i.e., personal vehicles, trucks, trains, and helicopters) (DOE 2015c|p. 3-23|).

Barnwell County regulations for residential noise set the limit at no more than 60 dBA during daytime hours (7:00 a.m. to 10:00 p.m.), and no more than 50 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.). Commercial and industrial noise limits are for 24 hours and are 65 dBA and 70 dBA, respectively (Barnwell County Ord. 2013-5-295). The Barnwell County noise limits are generally representative of those in other counties including Aiken County (Aiken County Ord. 22 2021) and Allendale County. Typical noise levels in developed areas of SRS range between 50 and 60 dBA, with the exception of some intermittent equipment that has higher noise levels (e.g., HVAC systems) reaching as high as 70 dBA (SRNS 2023d|Section 14.7|). The closest offsite location relative to where project activities occur serves as the location for the closest human receptor to SRS noise-producing equipment. The distance is 5.5 mi to the nearest offsite location from K-Area (SRNS 2023d|Section 14.3|) and 5.8 mi to the nearest offsite location from F-Area (DOE 2020a|Section 3.1.1.2|).

3.3.6 SRS Ecological Resources

Ecological resources include terrestrial (see Section 3.3.6.1), aquatic (see Section 3.3.6.2), and wetland (see Section 3.3.6.3) habitat types, and include common wildlife and plant species and federally listed threatened and endangered species (see Section 3.3.6.4).

3.3.6.1 Terrestrial Resources

Approximately 90 percent of SRS consists of natural and managed forests that the U.S. Forest Service-Savannah River plants, maintains, and harvests (SRNS 2022c|p. 1-3, 1-5|). The remaining 10 percent of SRS is industrial (SRNS 2022c|p. 1-5|). Forest habitat includes mixed pine-hardwoods, sandhills pine savanna, bottomland hardwoods, and swamp floodplain. Biodiversity at SRS is extensive (SREL 2018a|p. 1|); about 1,500 species of plants, more than 100 species of reptiles and amphibians, more than 250 species of birds, nearly 100 species of fish, and about 50 species of mammals are known to occur on the site (SREL 2018a|p. 1|; (SRNS 2022c|p. 1-5|). Common wildlife species on SRS are identified in the 2020 Pit Production EIS (DOE 2020a|p. 3-32|; Wike et al. 2006|p. 3-44 to 3-45|).

Most of the land within K-Area was once farmed (DOE 2005|p. A-2|), but it has been developed for industrial use (DOE 2015c|p. 3-25|) since its acquisition by the U.S. Government in 1951. The ecology of K-Area is affected by industrial activities and infrastructure, including roads, buildings, and vegetation maintenance (periodic mowing) around structures. The habitat in K-Area is managed grassy meadow (DOE 2005|p. 13|), and likely supports the plant species documented as occurring in meadow areas during the field survey of K-Area habitats conducted in 2005 (DOE 2005|p. A-3|). Thirty-six wildlife species are documented as occurring in K-Area, and are mostly found in open, nonforested habitats (Wike et al. 2006|p. 3-38 through 3-41; Table 3-13|).

F-Area is a highly developed and industrialized landscape that covers approximately 364 ac near the center of the site (DOE 2005|p. 4|; DOE 2015c|p. 3-6|). Forty-two wildlife species are documented as occurring in F-Area (Wike et al. 2006|p. 3-38 through 3-41; Table 3-13|). However, the area contains no native vegetation and only small patches of grass lawns, and it is unlikely that wildlife would be present in it (DOE 2020a|p. 3-32|).

3.3.6.2 Aquatic Resources

The Savannah River bounds SRS on the southwest for 35 river miles (Figure 3-6) and includes an extensive network of tributaries and floodplain swamps. SRS also encompasses various ponds and lakes (SRNS 2021c) (Figure 3-6). The biota of the Savannah River and its tributaries is described by Wike et al. 2006. While surface water is prevalent on SRS, it is unlikely to be found in K- or F-Areas as the areas have been developed for industrial use (DOE 2015c|p. 3-25|). Additionally, the existing facilities in K- and F-Area are located at elevations well above the streams to which drainage occurs (see Section 3.3.3.1).

3.3.6.3 Wetlands

Wetlands compose about 49,000 ac on SRS, roughly 25 percent of the site (SRNS 2022c|p. 3-20|). More than 400 isolated wetlands occur on SRS, many of which are Carolina Bays (SRNS 2017a|p. 1-8, 13|)—natural shallow depressions fed largely by rain and shallow groundwater (SREL 2018b|p. 1|; SRNS 2022c|p. 1-5|). Although wetlands are prevalent on SRS (FWS 2018), no wetlands occur in K-Area (DOE 2005|p. 7, 15|) or in F-Area (DOE 2015c|p. 3-25|).

3.3.6.4 Threatened and Endangered Species

SRS provides habitat for four species that are currently federally listed under the *Endangered Species Act* and one species that is a candidate for listing: the gopher tortoise (candidate – *Gopherus polyphemus*), smooth purple coneflower (endangered – *Echinacea laevigata*), pondberry (endangered – *Linderna melissifolia*), wood stork (threatened – *Mycteria americana*), and red-cockaded woodpecker (endangered – *Picoides borealis*). Only the red-cockaded woodpecker occurs near K-Area (SREL 2018c|p. 1|; (SREL 2018d|p. 1|; SRNS 2022c|p. 1-5|; Tuberville et al. 2007|p. 12-13|; 81 FR 87246). The red-cockaded woodpecker and smooth purple coneflower occur near F-Area (DOE 2020a|p. 3-37|; DOE 2020a|Section 3.5.3, Figure 3-9, p. 3-37|).

F and K-Areas are located within a red-cockaded woodpecker habitat management area and the nearest colonies are 3 to 4 mi to the northeast of F-Area (DOE 2005|p. A-5|; DOE 2020a|Figure 3-9, p. 3-37|; DOE 2015c|p. 3-25, Figure 3-1|). K-Area provides marginally suitable nesting habitat and suitable foraging habitat for the species, except that it is currently too far from existing colonies to be used (DOE 2005|p. A-5|). The closest population of the smooth purple coneflower occurs about 2 mi from the F-Area (DOE 2020a|Section 3.5.3, Figure 3-9, p. 3-37|).

Red-cockaded woodpeckers typically prefer to forage on and nest in old-growth (>30 years old) living long-leaf pine trees, although they have also been observed to use recently dead or dying pines (Franzreb 2004). The red-cockaded woodpecker also prefers large-diameter (>24 cm diameter at breast height; [Franzreb 2004]) trees. The smooth purple coneflower typically occurs in open woods, cedar barrens, along the road, on clear cut areas, on bluffs composed of dry limestone, or in power line rights-of-way (SREL 1998; FWS 2011). The smooth purple coneflower also prefers abundant sunlight and minimal competition from other plant species (SREL 1998; FWS 2011). The species also requires periodic disturbances, such as fire, to reduce competition from other plants (SREL 1998; FWS 2011). In F-Area, populations have been documented on Burma Road and in a power line right-of-way along Road B-9 (SREL 1998).

SRS provides habitat for at least 40 plant species that are of State or regional concern (SRNS 2022c|p. 1-5|). None of the 36 wildlife species potentially occurring in K-Area (see Section 3.3.6.1) are State-listed species (SCDNR 2015). Based on a field review conducted in 2005 (DOE 2005|p. A-2, A-9|), no species listed by the Federal or State governments at that time were found within the then-proposed 210 ac K-Area boundary expansion (DOE 2005|p. 12|). None of the 42 species potentially occurring in F-Area (see Section 3.3.6.1) are State-listed species (SCDNR 2015), and no threatened or endangered plant species are known to occur there (DOE 2020a|Table 3-9|, DOE 2015c|p. F-40|).

3.3.7 SRS Human Health

Safety and health requirements for DOE workers are governed by 10 CFR Part 851 and 10 CFR Part 835, which establish requirements for a worker safety and health program. Additionally, DOE has put forth orders, such as the *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees* (DOE Order 440.1B Chg 4 2022b), *Integrated Safety Management* (DOE Order 450.2 Chg 1 2017), and *Radiation Protection of the Public and the Environment* (DOE Order 458.1 Chg 4 2020), that dictate facility and programmatic safety requirements. Every site in the DOE Complex has established programs to maintain effective occupational and public health. These programs include elements such as facility safety and conduct of operations that are intended to guard against impacts from radiological, chemical, biological, and physical hazards. This EIS analysis addresses occupational human health and acute and chronic exposure of the public to ionizing radiation and hazardous chemicals.

3.3.7.1 Radiation Exposure and Risk

Primary sources and levels of background radiation exposure to individuals in the vicinity of SRS are assumed to be the same as those to an average individual in the U.S. population. These exposures are listed in Table 3-22. The background radiation doses presented here are unrelated to SRS operations. Annual background radiation doses to individuals are not expected to change significantly over time.

Table 3-22. Radiation Exposure of Individuals in the SRS Vicinity Unrelated to SRS Operations[(a)]

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

SRS = Savannah River Site.
(a) An average for the United States.
Sources: SRNS 2021c; NCRP 2009|Table 1.1, p. 12|.

Releases of radionuclides to the environment from SRS operations provide another source of radiation to which individuals in the vicinity of SRS could be exposed. Types and quantities of radionuclides released from SRS operations are listed in the annual SRS environmental reports. The annual doses to the public from releases of radioactive materials (2017–2021) and the annual doses over this 5-year period are presented in Table 3-23. These doses are below the radiation dose limits established in DOE Order 458.1 (Chg 4 2020) and are much lower than background radiation. Doses to the offsite population were calculated by SRS for the annual dose reports from 2017–2021 based on approximately 781,000 persons within 50 mi in 2017-2018, and 803,370 persons in 2019-2021 (SRNS 2018; SRNS 2019c; SRNS 2020b; SRNS 2021c; SRNS 2022c).[18]

Table 3-23. Annual Radiation Doses to the Public from SRS Operations for 2017–2021[(a)]

Year	Maximally Exposed Individual (rem)[(b)]	Population within 50 Miles (person-rem)[(c)]
2017	0.00025	4.4
2018	0.00027	6.0
2019	0.00018	2.8
2020	0.00036	4.2
2021	0.00030	4.0
2017–2021 Total (average)	**0.00136 (0.00027)**	**21.4 (4.3)**

SRS = Savannah River Site.
(a) Doses are the total from all air and liquid release pathways.
(b) A representative person is a hypothetical individual receiving a dose that is representative of the more highly exposed individuals in the population (SRNS 2014|p. 6-1 to 6-4|). SRS reports values for a representative person, rather than a maximally exposed individual. DOE Order 458.1 (Chg 4 2020) establishes an all-pathways dose limit of 100 mrem/yr to individual members of the public.
(c) For atmospheric releases and liquid releases (irrigation), the population within 50 mi was about 781,060 (2017-2018) and 803,370 (2019-2021). For liquid releases (non-irrigation), downstream water users in Port Wentworth, Georgia, and Beaufort, South Carolina (about 98 river miles downstream) are used in the annual environmental report assessments.
Sources: SRNS 2022c; SRNS 2021c; SRNS 2020b; SRNS 2019c; SRNS 2018|Tables 6-5a, b and 6-6|.

[18] Chapter 8 of the LANL Annual Site Environmental Reports used 2010 Census Bureau data, which does not reflect more recent Census Bureau values presented in Section 3.2.12.

Using a risk estimator of 0.0006 LCFs per rem or person-rem (DOE 2003a), the risk of LCF to the maximally exposed member of the public from releases of radioactive material from SRS operations from 2017–2021 was very low (8×10^{-7}). The number of excess LCFs projected in the population living within 50 mi of SRS during that period was 0 (0.013).

SRS workers receive the same dose as the general public from background radiation, but they could also receive an additional dose from working in facilities with nuclear materials. Table 3-24 presents the annual individual and collective worker doses from SRS operations from 2017–2021. Individual worker doses are below the regulatory limit of 10 CFR Part 835 "Occupational Radiation Protection." The projected number of excess LCFs in the exposed workforce would be 0 (0.41) from the 690 person-rem collective radiation dose received from 2017–2021.

Table 3-24. Radiation Dose to SRS Workers from Onsite Releases and Direct Radiation by Year from Operations 2017–2021

Occupational Personnel	2017	2018	2019	2020	2021	5 years
Average dose for radiation worker with a measurable dose (rem)[(a)]	0.039	0.031	0.035	0.027	0.030	0.032[(b)]
Total worker dose (person-rem)	170	130	130	110	150	690
Number of workers receiving a measurable dose	4,400	4,100	3,700	4,200	5,000	21,400

DOE = U.S. Department of Energy; SRS = Savannah River Site.

(a) No standard is specified for an "average radiation worker," but the radiation dose limit for an individual worker is 5 rem/yr (10 CFR Part 835). DOE's goal is to maintain radiological exposure as low as reasonably achievable. DOE has therefore established the Administrative Control Level of 2 rem/yr; the site contractor sets facility administrative control levels below the DOE level (DOE 2017b|p. 2-3|).

(b) The 5-year average is the total collective dose during the 5-year period (690 person-rem) divided by the total number of workers during the period (21,400).

Sources: DOE 2018a|Exhibit 3-13|; DOE 2021f|Exhibit 3-12|; DOE 2021g|Exhibit 3-12|; DOE 2022g|Exhibit 3-12|; DOE 2023d|Exhibit 3-12|.

A description of the radiation environment, including background exposures and radiological releases and doses, is presented in the annual SRS environmental report (SRNS 2022c). The concentrations of radioactivity in various environmental media (including air, water, and soil) in the site region (onsite and offsite) are also presented in that report.

3.3.7.2 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 or food, which may contain hazardous chemicals that can be ingested; and other environmental media that may expose people to hazardous chemicals by their contact with the media. Hazardous chemicals can cause cancer and noncancerous health effects. Hazardous chemicals used for the SPDP capabilities at SRS are typically present only in very small quantities.

For the offsite public, inhalation is the primary hazard. The release of hazardous chemicals to the atmosphere is controlled through compliance with permit requirements and is verified by environmental monitoring information and inspection of mitigation measures.

Workers may be exposed to hazardous materials by inhaling contaminants in the workplace environment or by direct contact. Workers are protected from workplace chemical hazards through institutional training related to hazardous materials specific to their work activities and as appropriate the use of protective equipment, monitoring, materials substitution, and engineering and management controls.

3.3.7.3 Health Effects Studies

In 2014, ATSDR released a public health assessment for offsite air contamination from SRS and concluded that the levels of contamination in the environment around SRS, primarily resulting from releases of tritium, are low (ATSDR 2014). From 1993–2010, tritium was estimated to have contributed from 22–89 percent of the total estimated offsite all pathway dose (ATSDR 2014|Table 5, p. 36|). Radiation doses to the maximally exposed individual (MEI) for 1993–2010 for all radioactive sources and pathways ranged from 0.0387–0.11 mrem/yr (ATSDR 2014|Table 5|). This range for the all-pathways dose from inhalation, ingestion, and external exposures is below both the allowable EPA Maximum Contaminant Level of 4 mrem/yr for beta/photon emitters from manmade radionuclides in drinking water (65 FR 76708|Table I-4, p. 76722|) and the 10 mrem/yr atmospheric release dose limit established by 40 CFR 61.92 for the MEI. ATSDR found that 1993–2010 emissions of radioactive materials, including tritium, from SRS were at levels unlikely to cause adverse health effects for the general population (ATSDR 2014|p. 91|).

In 2007, ATSDR issued an assessment of groundwater migration to offsite areas and surface-water contamination at SRS from 1993–2005 (ATSDR 2007). ATSDR concluded that 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 (ATSDR 2007|p. 73|). ATSDR further concluded there is no evidence of 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.

In 2012, ATSDR concluded that exposure of the general population to radioactive contaminants in biota (i.e., agricultural crops and farm products) near SRS from 1993–2008 would not have been at a level that would have produced adverse health effects (ATSDR 2012|p. 113|). The range of maximum hypothetical exposures was 15–27 mrem/yr (ATSDR 2012|Table 33|).

For a summary of earlier health effects studies for SRS conducted by the ATSDR, National Institute for Occupational Safety and Health, the Centers for Disease Control and Prevention, and the Radiation and Public Health Project, refer to Section 3.1.6.3 of the 2015 SPD SEIS (DOE 2015c).

The National Cancer Institute makes available national, State, and county mortality rates (latent fatal cancer rates) of various types of cancer (NCI 2022b). These data do not associate these rates with any specific causes, e.g., facility operations or human lifestyles. Table 3-25 presents mortality and incidence rates for the United States, South Carolina, Georgia, and the four counties adjacent to SRS for all cancers and the organ with the highest mortality, the lung and bronchus. The percent mortality for lung and bronchus ranges from 60 percent to 86 percent. This is higher than the percent mortality for all cancers. Additional information about cancer incidence and mortality in the vicinity of SRS is available in the State cancer profiles (https://statecancerprofiles.cancer.gov/index.html) for South Carolina and Georgia (NCI 2022b).

Table 3-25. Cancer Mortality and Incidence Rates[(a)] for the United States, South Carolina, Georgia, and Counties Adjacent to the SRS, 2015–2019

Location	All Cancers Mortality	All Cancers Incidence	All Cancers Percent Mortality	Lung and Bronchus Mortality	Lung and Bronchus Incidence	Lung and Bronchus Percent Mortality
United States	152.4	449.4	33.9%	36.7	56.3	65.2%
South Carolina	161.5	443.8	36.4%	41.0	61.2	67.0%
Aiken County (SC)[(b)]	162.7	393.6	41.3%	38.4	49.3	77.9%
Barnwell County (SC)[(b)]	195.4	415.4	47.0%	57.0	66.2	86.1%
Allendale County (SC)[(b)]	177.5	394.1	45.0%	41.3	58.1	71.1%
Georgia	156.7	468.6	33.4%	39.1	59.8	65.4%
Burke County (GA)	158.9	511.1	31.1%	46.4	77.8	59.6%

GA = Georgia; SC = South Carolina; SRS = Savannah River Site.
(a) Age-adjusted mortality rates; cases per 100,000 persons per year.
(b) Savannah River Site is located in Aiken, Barnwell, and Allendale Counties.
Source: NCI 2022b.

3.3.7.4 Accidents

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

Federally permitted releases comply with legally enforceable licenses, permits, regulations, or orders. If an unpermitted release to the environment of an amount greater than, or equal to, a reportable quantity of a hazardous substance (including radionuclides) occurs, the Emergency Planning and Community Right-to-Know Act of 1986, CERCLA, Clean Water Act, and the CAA require notification be sent to the National Response Center and applicable State agencies. In preparing this analysis, NNSA 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 5 years for which data are available; no unplanned radiological releases were reported (SRNS 2018|p. 3-3|; SRNS 2019c|p. 3-3|; SRNS 2020b|p. 3-3|; SRNS 2021c|p. 3-3|; SRNS 2022c|p. 3-3|).

The 2015 SPD SEIS presented similar results (no reported releases) for a 5-year period (i.e., 2007–2011) (DOE 2015c|Section 3.1.6.4|). Unplanned radioactivity releases to the environment occurred during earlier site operations. The SPD EIS presents a discussion of historical unplanned releases (DOE 1999b|Section 3.5.4.4|).

As discussed in Section 3.3.7.2, hazardous chemicals used for the SPDP capabilities at SRS are typically present only in very small quantities, and therefore no significant accident releases are expected.

3.3.7.5 Emergency Preparedness

As described in Section 3.2.7.5, all DOE sites maintain an emergency management program that allows the site to facilitate an effective response to emergencies, including hazardous releases that could have offsite consequences or environmental impacts.

3.3.8 SRS Cultural and Paleontological Resources

Cultural resources are human imprints on the landscape, and DOE views cultural resources as being archaeological materials (artifacts) and sites from pre-European contact, historic, or ethnohistoric periods that are located on or beneath the ground surface; standing structures that are over 50 years old or represent a major historical theme or era; cultural and natural places, certain natural resources, and sacred objects that are important to Native Americans and other ethnic groups; and American folklife traditions and arts (DOE 2015c). Paleontological resources, as defined in the *Paleontological Resources Preservation Act* (16 U.S.C. § 470aaa), are any fossilized remains, traces, or imprints of organisms, preserved in or on the Earth's crust, that are of paleontological interest and that provide information about the history of life on Earth.

3.3.8.1 Cultural Resources

SRS is required to comply with Federal historic and cultural resources compliance requirements in addition to those required by NHPA Section 106 (54 U.S.C. § 306101) and NEPA (42 U.S.C. § 4321 et seq.). The complete list of laws and regulations can be found in Section 5.0.

The three general categories of cultural resources addressed in this section, as defined in Section 3.2.8.1, include archaeological resources (pre-European contact resources, historic structure ruins, and debris), historic-era buildings and structures (standing buildings and structures), and TCPs. Archaeological resources and historic-era buildings and structures are grouped together for the ensuing discussion.

Archaeological resources at SRS are managed through a Programmatic Memorandum of Agreement between the DOE Savannah River Operations Office, South Carolina SHPO, and the Advisory Council on Historic Preservation (SRARP 2016). DOE uses this agreement to identify archaeological resources, assess their eligibility for listing in the NRHP, and consult with the South Carolina SHPO to develop mitigation plans for affected resources (SRARP 2016). Guidance on the management of archaeological resources at SRS is included in the *Archeological Resource Management Plan of the Savannah River Archeological Research Program* (SRARP 2016). DOE has written a PA for the preservation, management, and treatment of NRHP-eligible structures constructed during SRS's operational history that are contributing to the SRS Cold War Historic District (DOE et al. 2020). As a result, the *Savannah River Site's Cold War Built Environment Cultural Resources Management Plan* was developed and contains the decision process for managing NRHP-eligible Cold War historic properties (DOE et al. 2020).

As of 2018, 36.4 percent of surveyable land has been surveyed (70,458 ac of 193,276 ac) for archaeological resources and for identification of historic-era resources that date prior to 1950. By 2004, 100 percent of Cold War era resources constructed between 1950 and 1989 were inventoried (SRNS 2023d|p. 28|).

3.3.8.1.1 Archaeological Resources and Historic-Era Buildings and Structures

A total of 2,043 archaeological sites have been identified at SRS as of 2018; there are 1,303 pre-European contact-era sites and 740 historic-era archaeological sites (SRNS 2023d|Section 7|).

At SRS, seven historic buildings/structures that date prior to 1950 have been identified and determined to be NRHP-eligible (SRNS 2023d|Section 7|). There are 232 buildings and structures that were determined to contribute to the NRHP-eligible SRS Cold War Historic District and therefore are also

NRHP-eligible (DOE et al. 2020). The District includes a landscape, sites, buildings, and structures constructed between 1950 and 1989.

Within K-Area, 20 Cold War buildings and structures are eligible for listing in the NRHP (DOE et al. 2020). In the F-Area, 40 buildings are eligible as part of the Cold War Historic District (DOE et al. 2020).

SRS consulted with the Tribes in association with the treatment of its Cold War Historic District cultural resources. SRS initiated consultation with the Alabama-Quassarte Tribal Town, Kialegee Tribal Town, Thlopthlocco Tribal Town, Eastern Band of Cherokee, Muscogee Nation, and the United Keetoowah Band. The Muscogee Nation participated in the consultation but did not sign the PA (SRNS 2023d|Section 7|).

3.3.8.1.2 Traditional Cultural Properties

Laws, Executive Orders, and DOE policy require consultation with Native American Tribes that have ancestral/historic ties to SRS. For SRS, this includes the following groups: the Alabama-Quassarte Tribal Town, Kialegee Tribal Town, Thlopthlocco Tribal Town, Eastern Band of Cherokee, Muscogee Nation, and the United Keetoowah Band. The existence of TCPs is unknown but would be addressed by DOE Savannah River Field Office through NHPA Section 106 (54 U.S.C. § 306101) consultation with the Tribes. Although no formally documented TCPs have been identified on SRS, Native American resources in the region include the remains of villages or townsites, ceremonial lodges, burials, cemeteries, and natural areas containing traditional plants used in religious ceremonies and for medicinal purposes (DOE 1999b).

3.3.8.2 Paleontological Resources

Paleontological materials from the SRS area date largely from the Eocene Age (54 to 39 million years ago) and include fossilized plants, invertebrate fossils, giant oysters (*Crassostrea gigantissima*), other mollusks, and bryozoa. With the exception of the giant oysters, all other fossils are fairly widespread and common; therefore, the assemblages have low research potential or scientific value (DOE 2015c|p. 3-36|). Paleontological resources are unlikely to be found within K- and F-Areas because of the highly disturbed nature of these areas (DOE 2015c|p. 3-36|).

3.3.9 SRS Socioeconomics

In this SPDP EIS, "socioeconomics" refers to the relationship between the economic activity associated with the alternatives and the impacts on the ROI. Socioeconomic impacts may be defined as the environmental consequences in terms of potential demographic and economic changes.

Table 3-26 provides residence information for SRS employees that live in the ROI. In 2022, 10,943 persons were directly employed at SRS and 9,287 (approximately 85 percent) reside in the four-county ROI. Direct onsite employment accounts for approximately 4.6 percent of employment in the ROI. In 2022, 239,114 people were employed in the SRS ROI (calculated from BLS 2023a).

Table 3-26. Distribution of Employees by Place of Residence in the SRS ROI in 2022

County	Number of Employees	Percent of Total Site Employment
Aiken, SC	5,855	53.5
Barnwell, SC	586	5.4

County	Number of Employees	Percent of Total Site Employment
Columbia, GA	1,571	14.4
Richmond, GA	1,275	11.7
ROI Total	**9,287**	**84.9**

GA = Georgia; ROI = region of influence; SC = South Carolina; SRS = Savannah River Site.
Source: SRNS 2023d.

Indirect and induced employment generated by SRS operations has been calculated using a weighted average of employment multipliers estimated using the IMPLAN economic impact model (calculated from IMPLAN 2021). IMPLAN was calibrated to produce the SRS direct employment number by modeling the impact of the annual budget allocation and scaling the locally expended portion accordingly. This method resulted in an estimated SRS total employment multiplier of approximately 1.83. Therefore, the direct employment of 9,287 at SRS would generate indirect and induced employment of 7,690 within the ROI, resulting in total employment of 16,977, or approximately 7.1 percent of the employment in the ROI.

3.3.9.1 Regional Economic Characteristics

Between 2010 and 2022, the civilian labor force in the ROI increased by 2.9 percent to 239,114. At the same time, the number of unemployed people decreased by 63.8 percent—reflecting the economic recovery after the recession of 2008–2010. The unemployment rate declined by 6.3 percentage points from 9.8 percent to 3.5 percent. Georgia and South Carolina experienced similar trends in unemployment rates, decreasing by 7.7 and 8.1 percentage points, respectively (calculated from BLS 2023a|Local Area Unemployment Statistics|). Table 3-27 illustrates the change in unemployment rates in the ROI, Georgia, and South Carolina from 2010 to 2022.

Table 3-27. Unemployment Rates in the SRS ROI, Georgia, and South Carolina in 2010 and 2022

Year	SRS ROI	Georgia	South Carolina
2010	9.8	10.7	11.3
2022	3.5	3.0	3.2

ROI = region of influence; SRS = Savannah River Site.
Source: BLS 2023a.

From 2010 to 2023, the median family income (HUD 2023a) in the ROI increased by an average of 0.1 percent per year, from $76,569 to $77,358 in 2023 dollars. Real median family income was adjusted from the nominal values using the Bureau of Labor Statistics Consumer Price Index for All Urban Consumers (BLS 2023). This indicates that although job growth has been strong, real income has minimal growth over this period, and there may be similar stress on household finances for the average family, compared to previous years.

3.3.9.2 Population and Housing

In 2021, the population in the ROI was estimated to be 548,892 (calculated from USCB 2021n). From 2011 to 2021, the total population in the ROI increased at an average annual rate of approximately 0.9 percent, which was lower than the growth rate in both Georgia and South Carolina. Over the same time period, the total population of Georgia increased at an average annual rate of approximately 1.0 percent, to 10,625,615 people. South Carolina experienced an increase of approximately 1.0 percent annually to 5,078,903 people in 2021. The populations of the ROI, Georgia, and South Carolina are shown in Table 3-28.

Table 3-28. Total Population of the SRS ROI, Georgia, and South Carolina in 2010 and 2021

Year	SRS ROI	Georgia	South Carolina
2010	507,322	9,687,653	4,625,364
2021	548,892	10,625,615	5,078,903

ROI = region of influence; SRS = Savannah River Site.
Sources: USCB 2011c; USCB 2011a; calculated from USCB 2021q and USCB 2021n.

Housing stock statistics from the U.S. Census Bureau report (USCB 2021b, USCB 2021h, USCB 2021i) estimated the 2021[19] housing occupancy by type (owned or rented). Of interest for impact analysis is the capacity of the ROI to absorb any new housing demand projected by the project. As of 2021, the ROI had 236,107 housing units of which 83.2 percent were occupied and 16.8 percent were vacant. Of the estimated 39,646 vacant units, 8,501 were estimated to be vacant rental units or 3.6 percent of the housing stock. All other vacant housing makes up 13.2 percent of the stock, or 31,145 units in the ROI. These values are higher than the State-level estimates for Georgia and South Carolina. In Georgia, an estimated 11.2 percent of the stock is vacant, while 15.0 percent of the stock in South Carolina is vacant. Vacant rental stock makes up 2.7 percent of the stock in Georgia and 2.9 percent in South Carolina. The distribution of housing units in the SRS ROI, Georgia, and South Carolina in 2021 is presented in Table 3-31.

From 2011 to 2021, the median home value in the SRS ROI (calculated from USCB 2021j) increased by an average of 2.51 percent per year, from $116,375 to $150,125 in 2020 dollars, which is similar to the growth rate in South Carolina and Georgia (see Table 3-29). Over the same period, the median home value in South Carolina increased by 2.79 percent per year, from $137,000 to $181,800, and the median home value in Georgia increased by 2.52 percent per year, from $160,200 to $206,700. From 2011 to 2021 the percent of households determined to be cost-burdened (defined as housing costs requiring more than 30 percent of income) decreased by 5.2 percent, from 32.9 percent to 27.7 percent within the SRS ROI (calculated from USCB 2021r). During the same time, the percent of cost-burdened households in South Carolina decreased by 5.0 percent from 32.5 percent to 27.5 percent, and the percent in Georgia decreased by 6.8 percent from 36.9 percent to 30.1 percent (see Table 3-30).

Table 3-29. Median Home Value in the SRS ROI, Georgia, and South Carolina in 2011 and 2021

Year	SRS ROI	South Carolina	Georgia
2011	$116,375	$137,000	$160,200
2021	$150,125	$181,800	$206,700

ROI = region of influence; SRS = Savanah River Site.
Sources: Calculated from data in USCB 2021j, USCB 2021k.

[19] As of March 2023, the 2021 data are the most recent available data.

Table 3-30. Percent of Cost Burdened Households in the SRS ROI, Georgia and South Carolina in 2011 and 2021

	SRS ROI		South Carolina		Georgia	
Income Range	**2011**	**2021**	**2011**	**2021**	**2011**	**2021**
Under $20,000	79.8%	81.8%	76.8%	79.3%	82.5%	84.0%
$20,000-34,999	52.1%	57.7%	48.3%	54.7%	60.0%	64.8%
$35,000-49,999	31.0%	30.7%	26.9%	33.1%	38.8%	45.7%
$50,000-74,999	12.9%	12.4%	14.4%	15.4%	22.4%	22.1%
$75,000-99,999	3.4%	2.6%	6.0%	3.3%	7.7%	4.3%
Overall	**32.9%**	**27.7%**	**32.5%**	**27.5%**	**36.9%**	**30.1%**

SRS = Savannah River Site; ROI = region of influence.
Sources: Calculated from data in USCB 2021r, USCB 2021s.

Table 3-31. Distribution of Housing Units in the SRS ROI, Georgia, and South Carolina in 2021

	South Carolina		Georgia		SRS ROI	
2021 Housing Units	**Number**	**%**	**Number**	**%**	**Number**	**%**
Total Housing Units	2,325,248	100.0	4,375,039	100.0	236,107	100.0
Occupied Housing Units	1,976,447	85.0	3,885,371	88.8	196,461	83.2
Owner Occupied	1,390,017	59.8	2,506,873	57.3	131,517	55.7
Renter Occupied	586,430	25.2	1,378,498	31.5	64,944	27.5
Vacant Housing Units	348,801	15.0	489,668	11.2	39,646	16.8
Vacant Rental Units	66,366	2.9	117,530	2.7	8,501	3.6
All Other Vacant Units	282,435	12.1	372,138	8.5	31,145	13.2

ROI = region of influence; SRS = Savannah River Site.
Note: Percent of totals may not add because of rounding of individual values and totals.
Source: Calculated from data in USCB 2021e.

3.3.9.3 Local Traffic

In addition to the South Carolina Department of Transportation, the Lower Savannah Council of Governments Transportation Department collects and maintains data about the efficiency of the transportation system in the region surrounding SRS. As described in Section 3.2.9.3, road performance is measured using LOS ratings. LOS ratings range from "A" to "F," with "A" being the best travel conditions and "F" being the worst. Most planners aim for LOS C. At LOS C, roads are below, but close to, capacity and traffic generally flows at the posted speed.

Table 3-32 lists the annual average daily traffic statistics for several routes used to access the site. Traffic levels have shifted over time, depending on the route. The route with the most traffic is SR-125 between Jackson, South Carolina, and the site, with over 8,000 annual average daily traffic is relatively stable year to year. The other routes see much smaller volumes, but notably traffic accessing the site from the east on SR-64 has increased 60 percent since 2017. Although LOS determinations have not been reported for these access routes, in terms of the impacts on LOS of higher baseline traffic, the increases are not likely sufficient to cause a decline in the LOS of those routes, because sufficient capacity likely still exists (LSCOG 2017).

Table 3-32. 2009–2021 Annual Average Daily Traffic for Principal SRS Access Routes

Access Route	AADT 2009	AADT 2012	AADT 2017	AADT 2019	AADT 2021	Change (%) 2009-2021
SR-125: Barnwell County Line to SRS Gate	2,700	2,700	2,500	2,200	2,500	-7.4
SR-125: Barnwell to Allendale County Line	1,800	1,900	2,200	1,700	1,750	-2.8
SR-125: Jackson, SC to SRS Gate	10,900	12,800	10,800	11,200	8,900	-18.3
SR-278 and Woodland Road	1,950	1,900	2,100	2,200	1,950	0.0
SR-278: Whiskey Road to Barnwell County Line	3,700	4,100	4,500	4,400	4,000	8.1
SR-64: Snelling, SC to SRS Gate	1,150	1,550	1,000	2,100	1,600	39.1

AADT = Annual Average Daily Traffic; SC = South Carolina; SR = State Route; SRS = Savannah River Site.
Source: Calculated from data in SCDOT 2023|Site-wide data for 2009, 2012, 2017, 2019 and 2021| .

3.3.10 SRS Infrastructure

Site infrastructure includes the basic resources and services required to support planned construction and operations activities and the continued operation of existing facilities. For the purposes of this SPDP EIS, infrastructure is defined as transportation, electricity, fuel, water, and sewage. Table 3-33 presents the SRS site-wide infrastructure current usage and, if available, the infrastructure capacity and present use attributed to K-Area and F-Area.

Table 3-33. SRS Infrastructure Usage and Capacity

Resource	Usage	Capacity	Available Capacity
Transportation - Primary and secondary roads (mi)	1,230[a]	NA	NA
Transportation - Railroads (mi)	32[a]	NA	NA
Electricity - Power consumption (MWh/yr)	320,000[b][c]	4,400,000[a]	4,080,000
Electricity - Peak load (MW)	60[d]	500[a]	440
Fuel - Diesel and oil (gal/yr) (A-, F-, and K-Areas)	425,722[e]	NA[f]	NA
Steam (million lb/yr)	571[b][g]	2,628[b]	2,057
Water (million gal/yr)	288[b][h]	788[b][i]	500[i]
Sewage - K-Area (million gal/yr)[j]	0.795[b]	8.76[b]	7.97
Sewage - CSWTF (million gal/yr)	115[k]	383[a]	268

CSWTF = Central Sanitary Wastewater Treatment Facility; FY = fiscal year; NA = not applicable; SRS = Savannah River Site.
(a) Data are from DOE 2015c|Table 3-19|.
(b) Data are from SRNS 2023d|electricity and steam from Section 12; water and sewage resources from Section 21|.
(c) In FY 2017, F-Area consumed 46,000 MWh (DOE 2020a|Table 3-11|).
(d) Present peak load usage at SRS is 60 MW, of which 10 MW are used for activities in F-Area (DOE 2020a|Table 3-11|).
(e) Fuel usage results from estimated oil use (DOE 2015c|Table 3-19) and present diesel use (SRNS 2023d|Section 12|). Current use at F-Area is 718 gal/year (DOE 2020a|Table 3-11|).
(f) Capacity is generally not limited, because the delivery frequency can be increased to meet demand (DOE 2015c|p. 3-40|).
(g) In FY 2017, K-Area consumed 7.5 million lb of steam, and consumption is projected to continue at this level (SRNS 2023d|Section 12|.
(h) K-Area consumes 3 million gal (SRNS 2023d|Section 21|) of water. F-Area consumed 61 million gal of water while constructing a major facility during this time period (DOE 2015c|Table 3-20|).
(i) Two 1,500 gpm (788 million gal/yr) wells supply water to the A-Area treatment plant; capacity is provided for normal operations using one 1,500 gpm well, but maximum capacity could be 3,000 gpm if both wells operated (SRNS 2023d|Section 21.1|).
(j) Data are specific to K-Area.
(k) Data are specific to the CSWTF (SRNS 2019a|p. 410|).
Sources: DOE 2015c; SRNS 2023d; DOE 2020a; SRNS 2019a.

3.3.10.1 Transportation

The transportation infrastructure providing access to and within SRS is described in the 2015 SPD SEIS (DOE 2015c). US-278 and South Carolina SRs 19, 39, 64, 125, and 781 provide road access to SRS. US-278 runs from North Augusta, South Carolina, east-southeast across the north part of the site to Barnwell, South Carolina, then south to Allendale, South Carolina. US-301 crosses the Savannah River south of the site and intersects US-278 at Allendale, South Carolina. SR-19 runs south from Aiken, South Carolina, intersecting US-278 at the northern site boundary. SR-125 crosses the southwest part of the site as it runs southeast from North Augusta to Allendale. SR-64 runs east from the site to Barnwell, South Carolina. The nearest interstate highways are I-20 approximately 24 mi north of the site via Aiken, South Carolina, and I-520, which is a beltway around Augusta, Georgia, to North Augusta, South Carolina, approximately 20 mi northwest of the site. I-20 is the major east-west transportation route between Augusta, Georgia, and Aiken, South Carolina; I-520 intersects I-20 about 5 mi north of North Augusta. A major expansion of the I-20 bridge over the Savannah River and Augusta Canal between Augusta and North Augusta began in 2019 (GDOT 2020). The bridges are currently parallel two-lane structures that will be expanded to a single large six-lane structure (three lanes in each direction).

On the site, surface roads and railroads connect K-Area and F-Area to other SRS areas (E-, H-, and S-Areas). Rail service in the area is provided by the Norfolk Southern Railway and CSX Transportation. On SRS, about 32 mi of track are currently used, mostly to move material between site operating areas (DOE 2015c|Section 3.1.8.2).

3.3.10.2 Electricity

Most of the electrical power at SRS is supplied by Dominion Energy (formerly South Carolina Electric and Gas Company) offsite coal-fired and nuclear generating plants. Projected site use for FYs 2019–2024 is 320,000 MWh/yr, well below historic levels when many more facilities operated across the site (SRNS 2023d|Section 12.7|). The 2015 SPD SEIS identified the available capacity of the South Carolina Electric and Gas Company electrical system (now operated by Dominion Energy) as 4.4 million MWh/yr with a peak load capacity of 500 MW; SRS's peak load was estimated to be 60 MW (DOE 2015c|Section 3.1.9|).

3.3.10.3 Fuel

The site is projected to use 571 million lb of steam in FY 2019, of which 7.5 million lb would be used in K-Area. The site capacity to produce steam is 300,000 lb/hr, or approximately 2,600 million lb/yr; one steam generating unit is located in K-Area and can produce 10,500 lb/hr (SRNS 2023d). The 684-G Biomass Cogeneration Facility that produces steam at a daily average rate of 85,000 lb/hr supplies steam to the F-Area (DOE 2020a|Section 3.7.5|). Diesel fuel, gasoline, and propane are used to fuel diesel generators, heavy equipment, and transport vehicles; these fuels are also brought onsite as needed. Natural gas is not currently used at SRS (SRNS 2023d|Section 12|).

3.3.10.4 Water

SRS has three large domestic water supply systems and a total capacity to supply 2.95 billion gal/yr (DOE 2015c|p. 3-15|). K-Area and F-Area would be supplied from the A-Area supply system. The A-Area supply system supplies most of the site and has a maximum capacity of 1.58 billion gal/yr when two wells are operating, but it normally operates one well at 788 million gal/yr (SRNS 2023d). Present demand on the A-Area water system is 288 million gal/yr, of which 3.0 million gal/yr is used by K-Area SRNS 2023d|Section 12.7|) and 61 million gal/yr is consumed by the F-Area (DOE 2020a|Section 3.7.3).

3.3.10.5 Sewage

Sanitary wastewater treatment is provided by several plants on SRS. The large Central Sanitary Wastewater Treatment Facility (CSWTF) treats 97 percent of the sanitary wastewater generated at SRS, and the remaining balance of sanitary wastewater is treated at three smaller independent facilities located in D-Area, K-Area, and L-Area (DOE 2020a|Section 3.7.4). The sanitary wastewater treatment systems, including the CSWTF and other facilities has a treatment capacity of 383 million gal/yr, of which 30 percent of its capacity, or 115 million gal/yr, are currently needed by the site (SRNS 2019a|Section 12.3.1|). The K-Area Sanitary Wastewater Treatment Plant is currently underused: average usage through May 2019 was 0.795 million gal/yr, whereas its treatment capacity is 8.76 million gal/yr (SRNS 2023d|Section 12.7|). However, the K-Area wastewater treatment plant is beyond its 30-year service life and during periods of heavy precipitation, its piping network conveys stormwater to the plant. The addition of stormwater has resulted in the plant's daily discharge exceeding its NPDES-permitted limit four times in the last 10 years (2008–2017) (SRNS 2019a|Section 12.3.2|). Several options for plant improvement were evaluated as part of standard infrastructure improvement planning SRNS 2019b). A project currently underway will route wastewater from K-Area to the CSWTF and decommission the K-Area wastewater treatment plant (SRNS 2023d|Section 21|). This will result in a larger capacity for wastewater from the K-Area.

3.3.11 SRS Waste Management

This section defines the different types of waste that are generated at SRS. Waste management includes minimization, characterization, treatment, storage, and disposal of solid and liquid waste generated by ongoing DOE activities. The SRS Solid Waste Management Facility in E-Area provides storage, characterization, processing, and shipment of waste. Hazardous, TRU, and mixed waste are disposed of offsite (SRNS 2020c|Section 2.1|).

Table 3-34 provides waste generation rates for SRS (site-wide). The site-wide waste generation rates from activities at SRS do not include universal waste (55 m^3/yr) and TSCA waste (1 m^3/yr) (SRNS 2023d|Section 15.7|).

Table 3-34. Annual Waste Generation Rates at SRS

Waste Type	SRS Site-wide
CH-TRU (m^3/yr)	370
LLW (m^3/yr)	10,000
MLLW (m^3/yr)	400
Hazardous (m^3/yr)	58[(a)]
Nonhazardous waste (m^3/yr)	11,000
Liquid LLW (L/yr)	76,000,000

CH-TRU = contact-handled transuranic; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; SRS = Savannah River Site.

(a) Does not include 1 m^3/yr *Toxic Substances Control Act* waste (wall sealants and paint) and 95 T/yr of universal waste (light bulbs).

Note: Values have been rounded to two significant figures.

Source: SRNS 2023d|Sections 15.7, 17.8|.

3.3.11.1 Transuranic and Mixed Transuranic Waste

All CH-TRU and mixed transuranic wastes are ultimately shipped to the WIPP facility for disposal. If generated as part of maintenance activities the mixed transuranic waste would be segregated for disposal. Current site characterization and storage facilities for CH-TRU wastes are located in E-Area. CH-TRU wastes are characterized and certified prior to shipment to the WIPP facility (DOE 2015c|p. 3-50|).

3.3.11.2 Low-Level Radioactive and Mixed Low-Level Radioactive Waste

SRS facilities generate solid and liquid LLW. LLW is stored on concrete or gravel pads in E-Area. The SRS E-Area Low-Level Radioactive Waste Disposal Facility has one slit trench in the Solid Waste Disposal Facility that could accept solid LLW for disposal because it is currently not capped. The Low-Activity Waste Vault is an at-grade concrete structure in E-Area that can accept solid LLW (SRNS 2020c|Section 2.3.2.9|). MLLW is stored in E-Area and could be disposed at either NNSS or a commercial facility (DOE 2020a|Section 2.1.4|). Liquid LLW may be treated using the Effluent Treatment Facility to minimize waste volume (DOE 2020a|Section 3.9.3.1|).

3.3.11.3 Nonradiological Waste

Nonradiological waste generation at SRS includes hazardous waste, universal waste, TSCA waste, and nonhazardous waste (e.g., solid sanitary waste and construction and demolition debris) (DOE 2015c; SRNS 2023d|Section 15.1|).

Hazardous waste is described as waste that is regulated under the RCRA (42 U.S.C. § 6901 et seq.). It includes solvents, chemicals, acids, and solids such as laboratory trash. Toxic waste is regulated under the TSCA (15 U.S.C. § 2601 et seq.) and includes wall sealants and paint. Hazardous waste and TSCA waste are accumulated onsite at permitted locations prior to offsite disposal at Clean Harbors, a licensed commercial facility (SRNS 2023d|Section 15.8|). Universal waste consists of light bulbs and is disposed of at various offsite recycling facilities SRNS 2023d|Section 15.8|). Nonhazardous waste (solid sanitary waste and construction and demolition waste) that is not recycled at offsite locations is disposed of at the Three Rivers landfill, which is located within the SRS boundary (DOE 2015c|p. 3-51; SRNS 2023d|Section 15.8|). SRS contributes a small fraction of the waste disposed in the Three Rivers landfill (TRSWA 2021).

3.3.12 SRS Environmental Justice

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. The area within a 50 mi radius of SRS includes parts of 28 counties throughout Georgia and South Carolina as measured from K-Area and F-Area. NNSA will implement its environmental justice requirements and obligations as discussed in Section 3.2.12.

The racial/ethnic minority population percentage is 48.6 in Georgia and 36.9 in South Carolina (USCB 2021g). The more inclusive threshold of 50 percent is used to identify areas of meaningfully greater minority populations surrounding SRS. To evaluate the potential impacts on populations closer to the proposed area at SRS, additional radial distances of 10, 20, and 50 mi from the affected K-Area and F-Area facilities were analyzed. Table 3-35 shows the composition of the ROI surrounding K-Area facilities at each of these distances. No populations reside within the 5 mi radius of the facilities analyzed.

Table 3-35. Estimated Populations in the Potentially Affected Area Surrounding the SRS

Population Group	10 Miles Pop.	10 Miles % of Total	20 Miles Pop.	20 Miles % of Total	50 Miles Pop.	50 Miles % of Total
White Alone	12,175	56.6	93,759	55.1	490,494	54.2
Black or African American[(a)]	6,790	31.6	60,022	35.3	316,107	34.9
Hispanic or Latino[(b)]	1,232	5.7	8,668	5.1	51,862	5.7
Native American or Alaska Native[(a)]	9	0.0	137	0.1	1,079	0.1
Other Non-Hispanic Minority[(a)]	1,286	6.0	7,453	4.4	45,139	5.0
Total Minority[(b)]	9,317	43.4	76,280	44.9	414,187	45.8
Total Population	21,492	100.0	170,039	100.0	904,681	100.0
Low-Income[(c)]	8,406	39.1	67,703	39.8	313,433	35.3

NNSA = National Nuclear Security Administration; Pop. = population; SRS = Savannah River Site.

(a) Non-Hispanic persons.

(b) Includes all Hispanic persons regardless of race.

(c) NNSA defines low-income as households below 2 times the Federal poverty level.

Notes: The percent of totals may not add because of rounding of individual values and totals. The potentially affected area is the area within a 50 mi radius of the site.

Sources: USCB 2021f; USCB 2021g.

The 2021 total estimated population residing within 50 mi of SRS is nearly 905,000, of which over 45 percent would be considered members of a minority population.[20] Of the 668 block groups within the 50 mi radius, approximately 460 (68.9 percent) were identified as containing meaningfully greater minority populations (USCB 2021f).

The overall composition of the projected populations within every radial distance is predominantly nonminority. The concentration of minority populations is greatest within the full 50 mi radius compared to the shorter radial distances. The Black or African American population is the largest minority group within every radial distance; it constitutes approximately 35 percent of the total population within 50 mi. The Hispanic or Latino population constitutes about 5.1 to 5.7 percent of the total population at each radial distance. Figure 3-8 displays the block groups identified as having meaningfully greater minority and low-income populations surrounding SRS.

Meaningfully greater low-income populations are identified using the same methodology described for LANL in Section 3.2.12. The 2021 ACS 1-year estimates show the average low-income population percentage is 33.5 percent in South Carolina and 32.2 percent in Georgia (calculated from USCB 2021m). Thus, the threshold low-income population percentage of 50 percent in both States was used to identify areas that have meaningfully greater low-income populations surrounding SRS. Of the 668 block groups within 50 mi of SRS, 435 (65.1 percent) contain meaningfully greater low-income populations.

[20] The total population identified in this section uses 2021 Census Bureau data and is not consistent with the total population analyzed in Section 3.3.7.1 for doses to the offsite population. Section 3.3.7.1 uses data obtained from the SRS Annual Site Environmental Reports, which uses 2010 Census Bureau values.

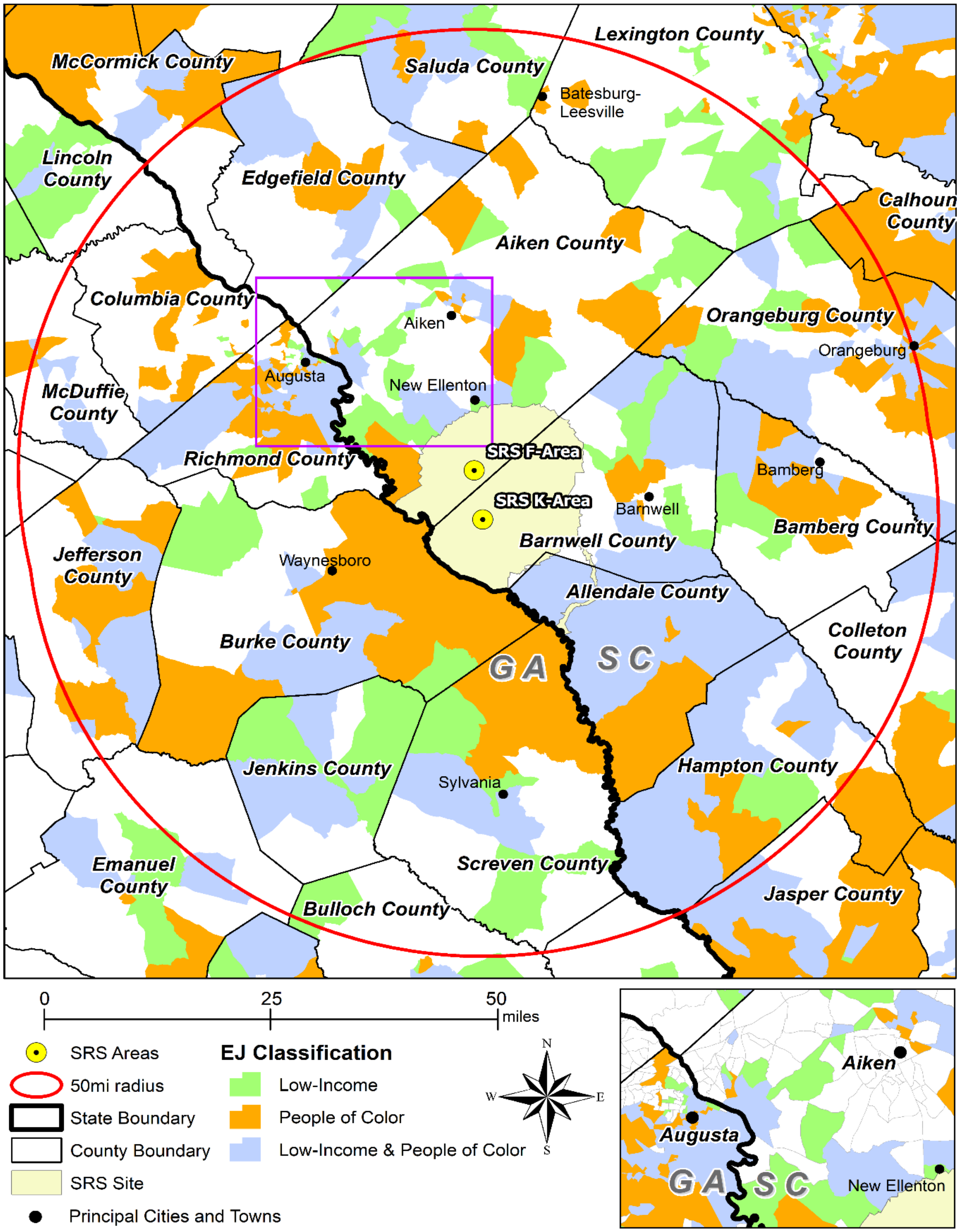

Figure 3-8. Meaningfully Greater Minority and Low-Income Populations Surrounding SRS

3.4 Y-12 National Security Complex

The Y-12 is located on the DOE Oak Ridge Reservation (ORR) in Oak Ridge, Tennessee. As one of the DOE major production facilities, Y-12 has been the primary site for enriched uranium processing and storage, and one of the primary manufacturing facilities for maintaining the U.S. nuclear weapons stockpile (DOE 2011a|Section 1.0|).

The ORR is in eastern Tennessee, approximately 25 mi west of Knoxville. The Y-12 area on the ORR covers about 5,428 ac. The main area of Y-12 is largely developed and encompasses 811 ac, including approximately 580 buildings. The land surrounding the main area of Y-12 is used primarily for a buffer area as well as for environmental restoration and waste management activities (67 FR 11296).

The *Final Site-Wide Environmental Impact Statement for the Y-12 National Security Complex* (DOE 2011a), as supplemented (DOE 2018i), provides a description of the affected environment for activities at Y-12; the Oak Ridge Annual Site Environmental Report for calendar year 2021 (ORNL 2022) provides additional environmental, land use, and population information about the site.

3.5 Waste Isolation Pilot Plant

The WIPP facility is the only deep geologic repository for permanent disposal of long-lived TRU waste in the United States. The WIPP facility began operations in 1999, after the preparation of the *Final Environmental Impact Statement for the Waste Isolation Pilot Plant* (DOE 1997|p. 1-5|) ROD was made. Current information regarding environmental resources, including site hydrology and groundwater monitoring at WIPP, can be found in the *Waste Isolation Pilot Plant Annual Site Environmental* Report for 2021 (DOE 2022j). The Annual TRU Waste Inventory Report reports that the total amount of TRU waste disposed through the cutoff date in 2021 was 71,200 m^3 (DOE 2022b|p. 24, Table 3-3|). The WIPP repository configuration consists of eight disposal panels, four along each side of the north-south main access ways and panel-equivalents 9 and 10. Panel-equivalents 9 and 10 are located in the north-south main access drifts between the eight disposal panels (Figure 3-9). Equivalent Panel 9 has been closed to protect WIPP workers. Each of the panels consists of seven waste disposal rooms, each approximately 300 ft long, 13 ft high, and 33 ft wide (DOE 1997). DOE's CBFO is also planning to replace underutilized disposal capacity (in panels 1, 7, and 9) by adding two new TRU waste disposal panels (replacement panels 11 and 12) to the repository layout (DOE 2021b, DOE 2021i). Additional information regarding the replacement panels 11 and 12 is found in Section 4.1.5.

The WIPP LWA (Public Law 102-579) established the mission of the WIPP facility for disposal of TRU waste generated by *U.S. Atomic Energy Act* defense activities, in accordance with certain limitations set by statute.[21]

[21] WIPP LWA restrictions include the following:

- The total capacity of the WIPP facility by volume is limited to 6.2 million ft^3 (175,600 m^3).
- Neither HLW nor spent nuclear fuel may be transported to or emplaced at the WIPP facility.
- No remote-handled transuranic (RH-TRU) waste received at the WIPP facility may have a surface dose rate in excess of 1,000 rem/hr.
- No more than 5 percent by volume of the RH-TRU received at the WIPP facility may have a surface dose rate in excess of 100 rem/hr.
- RH-TRU received at the WIPP facility shall not exceed 23 curies per liter maximum activity level (averaged over the volume of the canister).
- The total curies of RH-TRU received at the WIPP facility shall not exceed 5,100,000 curies.

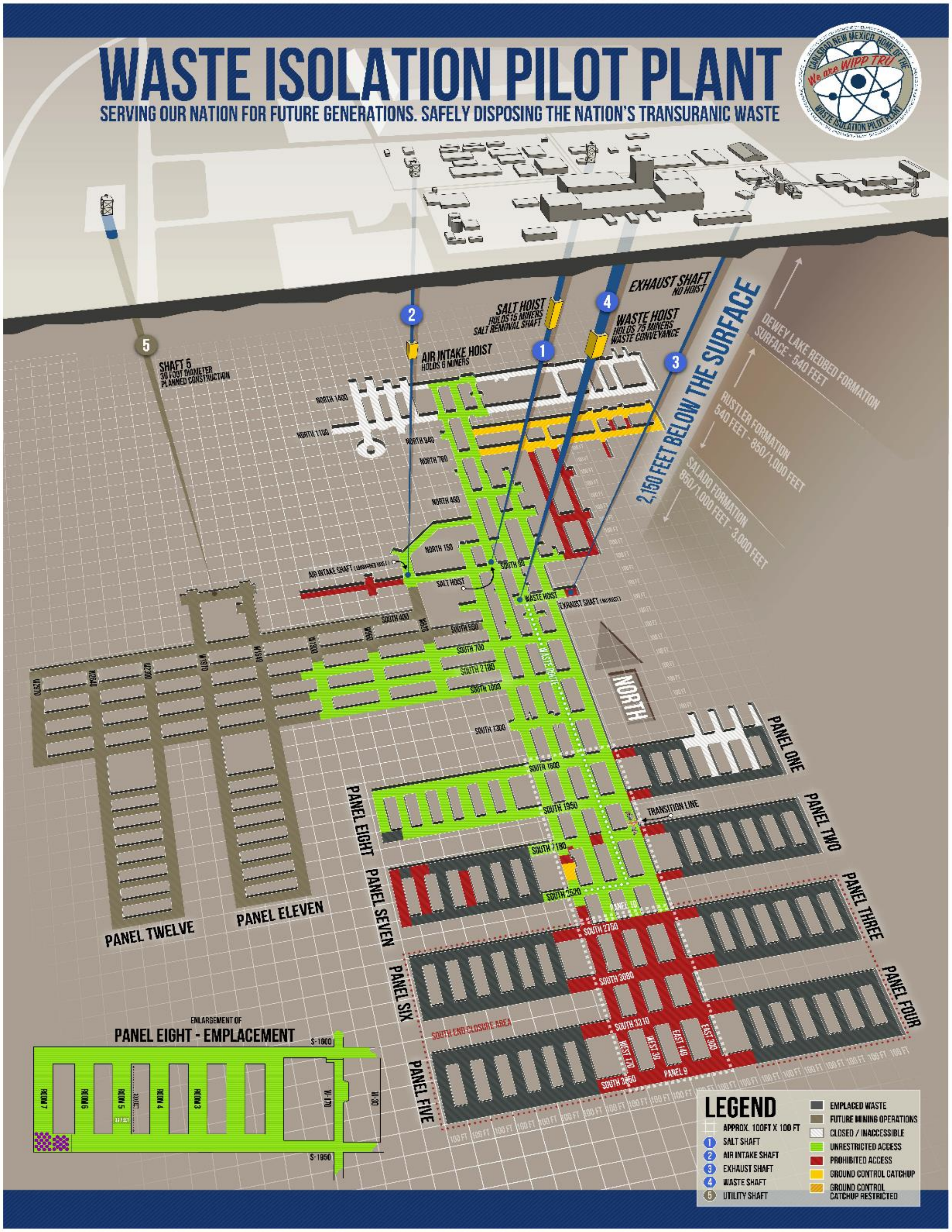

Figure 3-9. Schematic of the WIPP Facility

On October 30, 1992, the President signed into law the WIPP LWA, transferring responsibility for management of the withdrawal area from the Secretary of the Interior to the Secretary of Energy and permanently withdrawing the land and reserving it for uses associated with the purposes of the WIPP facility (Public Law 102-579). As required by the WIPP LWA, DOE prepared a Land Management Plan published in 1993 and reprinted with minor changes in 2021 (DOE 2021j). DOE's WIPP Land Management Plan incorporates the restrictions of the WIPP LWA and the DOE Memorandum of Understanding with the BLM. The Land Management Plan establishes management objectives and planned actions for the use of the withdrawn land until the end of the decommissioning phase. The plan promotes the concept of multiple-use management for the surface area of the withdrawn land and establishes a goal of minimizing land use restrictions where possible.

In the ROD for the DOE's WIPP Disposal Phase (63 FR 3624), DOE decided to dispose of up to 175,600 m^3 of TRU waste generated by defense activities at the WIPP facility after preparation (i.e., treatment, as necessary, including packaging) to meet the WIPP WAC (63 FR 3624). In 2004, DOE revised the 1998 WIPP ROD to include disposal of TRU waste containing PCBs, previously excluded in the 1998 WIPP ROD, at the WIPP facility (69 FR 39456).

Additional details can be found in the 1990 Final Supplemental EIS (DOE 1990) and the WIPP SEIS (DOE 1997).

3.5.1 Repository Characteristics

The WIPP facility is located in southeastern New Mexico; the nearest town, Loving, New Mexico, is 18 mi away. Most of the land within 30 mi of the WIPP facility is owned by the Federal government or the State of New Mexico. Most of the land surrounding the WIPP facility is used for grazing, and lesser amounts are used for oil and gas extraction and potash mining. Within 50 mi of the site, there is dryland farming, irrigated farming, and some forest, wetland, and urban land (DOE 1997|p. 4-1, 4-2|).

The WIPP facility land withdrawal area encompasses 10,240 ac and extends at least 1 mi beyond any WIPP facility underground development (DOE 1997|p. 4-2|). The DOE-owned WIPP facility land withdrawal area is divided into four areas, each of which has varying levels of access control. Portions of the WIPP facility land withdrawal area are unfenced to allow livestock grazing, and within the outermost portions of the WIPP facility land withdrawal area, the land is managed under the traditional public land use concept of multiple uses. Mining and drilling for purposes other than support of the WIPP facility project, however, are restricted (DOE 1995).

The WIPP facility is located in a region that has a semiarid climate. The Pecos River is located about 20 mi from the WIPP facility and is the main surface-water resource in the vicinity.

The strongest earthquake on record within 180 mi of the WIPP facility was the Valentine, Texas, earthquake of August 16, 1931; it had an estimated Richter magnitude of 6.4. Since 1990, at least two seismic events have occurred that were recorded at the WIPP facility. The Rattlesnake Canyon Earthquake in January 1992 had a Richter magnitude of 5.0, and the Alpine Texas Earthquake in April 1995 had a Richter magnitude of 5.3. Neither of these events had any effect on structures at the WIPP facility (DOE 1997).

3.5.2 Repository Subsurface Characteristics

The WIPP repository (Figure 3-9) is located 2,150 ft below the ground surface in the Salado Formation, a massive, bedded salt (halite) formation that is thick (about 2,000 ft) and laterally extensive. The Salado halite units have very low permeability to fluid flow, which impedes groundwater flow into and out of the repository (NWP 2019; DOE 1997).

4.0 ENVIRONMENTAL CONSEQUENCES

This section provides a description of the potential environmental consequences of the actions described in this *Surplus Plutonium Disposition Program Environmental Impact Statement* (SPDP EIS). Additional details about the potential environmental consequences are provided in Appendix C. Operating facilities already exist for some aspects of the overall dilute and dispose strategy, and this SPDP EIS evaluates the impacts of augmentation of existing capabilities and installation of equipment for capabilities at facilities where they do not currently exist. The Base Approach Sub-Alternative and the SRS NPMP Sub-Alternative would add additional equipment at LANL to expand the current PDP capability. The SRS NPMP Sub-Alternative would add capabilities at SRS for NPMP either inside Building 105-K or in a modular system adjacent to Building 105-K. The All LANL Sub-Alternative would also add equipment and a facility for C&P. The All SRS Sub-Alternative would install a PDP capability at either Building 226-F (SRPPF) or Building 105-K at SRS.

The analysis of the impacts of construction, modification, and operation of each capability and facility as presented in this section is based on the best information available at the time of publication of this SPDP EIS as provided by LANL and SRS (LANL 2023a; SRNS 2023d). The information is further supplemented based on facility characteristics described in previous EISs and technical reports. The facility characteristics are further summarized in Appendix B of this SPDP EIS.

NNSA estimated operations durations for this SPDP EIS based on anticipated throughputs from NNSA operating experience and estimates of the capabilities of new or modified equipment. The estimated time periods for construction and modification, throughputs, and estimated operations durations used for the analyses in this SPDP EIS are provided in Appendix B. NNSA used conservative assumptions so that impact analyses do not underestimate impacts.

The assumed throughputs and durations used for the impact analyses are based on current plans and schedules and may be different from the schedules actually achieved.[22] However, NNSA conducted an additional analysis of the impacts of operation at LANL based on the assumption that an off-normal event would occur that would temporarily disrupt processing and thus impact the schedule for delivery of plutonium oxide for dilution. The analysis assumed that the processing rate of 2 MT/yr would temporarily increase to 2.5 MT/yr for a nominal year, although it is anticipated that the duration of the increased processing rate would more likely be on the order of months. The increase in throughput would be handled by increasing the number of shifts for processing but would rely on existing staff at LANL rather than hiring additional staff. The analysis showed that project impacts would remain the same for processing the 34 MT of surplus plutonium even though temporary increases in impacts may occur related to water use, infrastructure, dose to workers or the public, or waste generated during the assumed nominal year of an increased processing rate. If an extended disruption in processing occurs, the assumed project completion of 2050 could be in jeopardy.

Off-normal events could also occur that would disrupt processing and thus impact the schedule for processing activities at SRS. However, the maximum throughput at SRS was assumed to be 2.5 MT/yr for PDP and NPMP and thus an increased processing rate was not evaluated.

[22] Any future dates cited in this SPDP EIS are for purposes of analysis only.

4.1 Impacts from Alternatives

The impacts of the construction, modification, and operation activities under the Preferred and No Action Alternatives summarized in Section 2.1 are evaluated in this section or are brought forward from prior NEPA analyses where impacts were evaluated. Section 4.1 is organized by site, resource area, and then alternative. This structure enables the reader to see and compare all the impacts for a particular site in one section of the document.

4.1.1 Pantex

As described in Sections 2.1.1.2.1 and 2.1.2.1, the activities that would occur at Pantex for both the Preferred and No Action Alternatives are within the bounds of activities analyzed in previous NEPA documents (CNS 2019; DOE 2018f) and are therefore not reanalyzed in this SPDP EIS. As discussed in the 2018 Pantex SA (DOE 2018f), NNSA evaluated maintaining and routinely surveilling pits at Pantex. This evaluation included activities related to packaging and shipping pits to transfer onsite or ship to offsite locations. Integration of additional packaging lines would not require construction of new facilities and therefore remains within the bounds of activities analyzed previously (CNS 2019).

4.1.2 Los Alamos National Laboratory

Activities at LANL analyzed in this SPDP EIS occur under three of the four sub-alternatives of the Preferred Alternative and under the No Action Alternative as indicated in Table 4-1. Activities that take place at SRS are identified in gray italicized text in Table 4-1 and are discussed in Section 4.1.3. The All SRS Sub-Alternative is not shown, because no activities would occur at LANL. The impacts of transportation between sites for both alternatives are discussed in Section 4.1.6.

Table 4-1. Roadmap for Interpreting Impact Tables Displaying Alternative/Sub-Alternative Capabilities Conducted at LANL

Capability	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP Sub-Alternative	Preferred Alternative All LANL Sub-Alternative	No Action Alternative LANL NPMP Option
PDP	**LANL**	**LANL**	**LANL**	*No PDP*
NPMP	**LANL**	*(SRS)*	**LANL**	**LANL**[(a)]
Dilution	*(SRS)*	*(SRS)*	**LANL**	*(SRS)*
C&P	*(SRS)*	*(SRS)*	**LANL**	*(SRS)*

C&P = characterization and packaging; LANL = Los Alamos National Laboratory; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site.
(a) Under the No Action Alternative, NPMP could occur at LANL or SRS.

4.1.2.1 LANL Land Use and Visual Resources

Changes in land use and visual resources affect the character and aesthetics of the visual landscape. Consideration of changes in the patterns and densities of land use and changes in the quality of visual resources are included in this evaluation (DOE 2015c|p. 6-10|). This section presents the anticipated impacts of the Preferred and No Action Alternatives on land use and visual resources at LANL. Detailed land use impacts by capability during construction activities are presented in Table C-2 in Appendix C.

Environmental impacts from construction areas are minimized through the proposed site selection process discussed in the LANL Sustainable Design Guide (LANL 2002b; LANL 2023a).

During operations for both alternatives, no additional ground disturbance would occur. Therefore, operations would not result in any new impacts on land use other than the continuing commitment of land for industrial use. Impacts on land use and visual resources at LANL from operations are not discussed further.

4.1.2.1.1 Preferred Alternative

The land use and visual resource impacts from construction activities for the Preferred Alternative at the LANL site are described below. Construction activities are not expected to significantly alter the night lighting because the requirements for the *New Mexico Night Sky Protection Act* have been incorporated into LANL engineering standards (LANL 2023a|Section 2.9.3|). The *New Mexico Night Sky Protection Act* (NMSA 1978 § 74.12.1 et seq.) promotes safety, conserves energy, and preserves New Mexico's dark sky by minimizing the influence of artificial light for astronomy pursuits (LANL 2023a|Section 2.9.3|).

Base Approach and SRS NPMP Sub-Alternatives

The total land area disturbed at LANL during construction under the Base Approach and SRS NPMP Sub-Alternatives would be about 5.1 ac, a small fraction of the land available at LANL (40 mi^2 [25,563 ac]) (see Table 2-3). Construction in TA-55 would include a 10,800 ft^2 LSC, a 4,620 ft^2 security portal, and a 4,100 ft^2 weather enclosure, along with laydown areas, parking areas, and road extensions (LANL 2023a|Figures 1-11|). Because the new facilities in TA-55 would be consistent with existing land use, and construction would disturb only previously disturbed areas, development of this land would have only minimal effects on land use. Construction in TA-52 would include an office building (12,000 ft^2) and warehouse (18,000 ft^2), along with laydown areas, parking areas, and road extensions (LANL 2023a|Figure 1-12|). The construction of the new facilities in TA-52 would affect land use and require removal of mature vegetation from undisturbed areas. However, the impacts are expected to be minor because of the relatively small size of the undisturbed area that would need to be disturbed (LANL 2023a|Section 2.8.1|).

As viewed by the public, the impact on visual resources from the proposed construction is expected to be minimal. The proposed development, much like the previous development, would occur away from the LANL boundary and the onsite roads are closed to the public (LANL 2023a|2.9.3|). The nearest offsite public receptor for the PF-4 in TA-55 is 920 m north-northeast at the Elk Ridge community. The distance from the TA-52 warehouse to the nearest Pueblo de San Ildefonso boundary is about 800 m east (LANL 2023a|Section 2.10.3|). A viewshed analysis was conducted for the proposed construction at PF-4 in TA-55 and for the office building and warehouse in TA-52 (LANL 2023a|Figure 2-7|). From the perspective of the Elk Ridge community, the construction of new facilities would occur over a relatively small part of the viewscape of existing buildings and therefore would not noticeably alter the existing viewscape from each offsite receptor. The new facilities would also be structurally similar to and blend in the with the existing viewscape. Moreover, the construction within TA-55 blends with that within TAs-35, -48, -50, and -63 when seen from the Santa Fe National Forest lands at higher elevations to the west (DOE 2015c|p. 3-59|). From the perspective of the San Ildefonso land the construction of new facilities in TA-55 would be largely blocked by the view of the existing PF-4 building. The construction of buildings in TA-52 would be noticeable and visual impacts may occur when viewing westward from the Pueblo de San Ildefonso. These impacts are addressed further in Section 4.1.2.8.1.

All LANL Sub-Alternative

C&P at LANL under the All LANL Sub-Alternative would include construction of a new 20,000 ft^2 (0.46 ac) DHF and an additional 7,000 ft^2 (0.16 ac) for entry and exit roadways (LANL 2023a|Figure 1-11|). The total land disturbed would be the same as that under the Base Approach Sub-Alternative. The DHF would be built in the same location and on the same footprint as the laydown area that would be used for construction/modification activities under the Base Approach Sub-Alternative. Initially this location would be used as the laydown area under the All LANL Sub-Alternative, and then later the DHF would be constructed at the same location. Construction of the DHF is consistent with the existing land use and would not provide noticeable differences in visual impact (LANL 2023a|Section 2.9.2|).

4.1.2.1.2 No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur in PF-4 using existing equipment, thus no construction activities or ground disturbance would occur. There would be no impacts associated with land use or visual resources from activities at LANL under the No Action Alternative.

4.1.2.2 LANL Geology and Soils

Impacts on geology and soils can result from disturbance of geologic and soil materials during land-clearing, grading, and excavation activities, and from the use of geologic and soil materials during facility construction. Activities that disturb geologic and soil materials include excavating rock and soil, filling excavations, soil mixing, and soil compaction. These activities can occur while constructing buildings, parking lots, and roadways. Geologic and soil materials used during building and road construction include crushed stone, sand, gravel, and soil.

This section presents the anticipated impacts of the Preferred and No Action Alternatives on geologic and soil material resources at LANL. Detailed impacts related to geologic materials and soils by capability during construction activities are presented in Table C-3 in Appendix C.

Construction activities at LANL would be regulated under the Construction General Permit (discussed further in Section 5.3.1), which would require that a stormwater pollution prevention plan (SWPPP) be prepared for each construction site. Best management practices (BMPs), such as use of silt fences, straw bales, geotextiles, and re-vegetation, would be specified in the plan(s) to control erosion at the construction sites and limit the transport of soil materials in runoff. The LANL stormwater best management practices manual (LANL 2011) discusses revegetation options and inspection and maintenance procedures.

Operation of facilities under the Preferred and No Action Alternatives would involve little or no use of geologic and soil materials at LANL. Therefore, impacts on geology and soil resources at LANL from operations would be minimal and are not discussed further in this section.

4.1.2.2.1 Preferred Alternative

The impacts related to the disturbance and use of geologic and soil materials during construction under the Preferred Alternative at the LANL site are described below.

Base Approach and SRS NPMP Sub-Alternatives

Construction at LANL would require excavations to depths of 10 ft for the security portal, LSC, office building, and warehouse, while soil disturbance would occur to a depth of 3 ft for the weather enclosure and to 6 ft for the security portal road extension (LANL 2023a|Section 2.6|). Other construction activities, such as the use of temporary structures, laydown areas, and parking areas, would disturb soils to a depth of 1 ft or less (LANL 2023a|Section 2.6|). Road extensions for the office building were assumed to require soil disturbance to a depth of 6 ft. The total volume of geologic and soil materials at LANL excavated for all construction activities would be about 26,000 yd^3. A portion of these materials would be used to supply needed construction materials and backfill. The total volume of sand, gravel, backfill, and crushed stone required during construction would be about 30,000 yd^3 (LANL 2023a|Section 2.13|). The total quantity of these materials represents a small percentage of regionally plentiful resources (USGS 2016|p. 33.4|) and would be unlikely to adversely affect the region's geologic resources.

The total area of soils affected by construction would be about 5.1 ac (see Section 4.1.2.1). All of the affected area in TA-55 (about 3.5 ac) is land that has been previously disturbed and is either unvegetated or sparsely vegetated. Construction of the office building, warehouse, and associated parking areas would affect about 3.6 ac of previously disturbed and undisturbed soils in TA-52 (including a 0.2 ac laydown area) (LANL 2023a|Sections 1.1.2, 2.8|). The portion of TA-52 on which the buildings and associated parking would be constructed is undisturbed and may contain mature vegetation. Excavated soil would be re-used as part of the construction activities or would be stored at LANL for other uses (LANL 2023a|Section 2.6|). Because the area of previously undisturbed soils affected by construction would be small, and BMPs would be used to control erosion at construction sites, the activities would have a minimal impact on the region's soil resources.

All LANL Sub-Alternative

Impacts from construction of the security portal, LSC, office building, warehouse, and weather enclosure required for PDP would be the same as those described above for the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative. Modifications in PF-4 to provide a capability for dilution would not result in construction-related impacts on geology or soils.

Construction of a DHF to support C&P at LANL would require excavation of about 7,400 yd^3 of soil and rock to a depth of about 10 ft (LANL 2023a|Section 2.6|) for the building and excavation of about 1,600 yd^3 of soil and rock for the DHF road extension. The DHF road extension covers an area of 7,000 ft^2 (LANL 2023a|Section 2.8|) and is assumed to require excavation to a depth of about 6 ft. The total volume of geologic and soil materials at LANL excavated for all construction activities would be about 35,000 yd^3. A portion of these materials may be used to supply needed construction materials and backfill. The DHF would require about 11,000 yd^3 of geologic materials, and the total volume of sand, gravel, backfill, and crushed stone required during construction at LANL for the All LANL Sub-Alternative would be about 41,000 yd^3 (LANL 2023a|Section 2.13|). The total quantity of these materials represents a small percentage of regionally plentiful resources (USGS 2016|33.4|) and would have a minimal impact on the region's geologic resources.

The total area of soils affected by all construction activities for the All LANL Sub-Alternative would be about 5.1 ac, most of which have been previously disturbed. Because the area of previously undisturbed soils affected by construction would be small, and BMPs would be used to control erosion at construction sites, the Preferred Alternative would have a minimal impact on the region's soil resources.

4.1.2.2.2 No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur in PF-4 using existing equipment. Thus, no construction activities or ground disturbance would occur and there would be no impacts associated with geology or soils from activities at LANL under the No Action Alternative.

4.1.2.3 LANL Water Resources

Impacts on surface-water and groundwater resources during construction and operation can occur because of ground disturbance and land use changes that affect the volume, timing, and pattern of stormwater runoff and/or groundwater recharge, and that may affect the transport of contaminants offsite. Water use during project activities and water use by project personnel for potable and sanitary purposes may affect the availability and sustainability of water resources. Impacts would be considered significant if they resulted in any of the following:

- degradation or impairment of water resource quantity or quality (introduction of chemical materials or sediments into the water resource) that violates Federal and/or State regulations, permits, or water-quality standards
- changes in surface and/or subsurface drainage features that noticeably alter watercourses, system recharge or drainage patterns, and/or exceed the capacity of existing stormwater management systems
- increases in water consumption that may compromise the availability of the water resource

This section presents the anticipated impacts of the Preferred and No Action Alternatives on the potentially affected water resources at LANL. Infrastructure impacts related to water use and sanitary wastewater discharges are presented in Table 4-10 and Table 4-11 in Section 4.1.2.10 and also in Appendix C by capability during construction (see Table C-9) and operation (see Table C-10).

No water would be withdrawn from surface water at the LANL site under either alternative. Water use to support construction and operation activities would be provided by the existing groundwater source (LANL 2023a|Sections 2.7, 2.16|). There would be no direct release of contaminated, industrial effluents to surface water or groundwater during construction or operations at LANL (DOE 2015c|F-37, F-38|; LANL 2023a|Section 2.16|). Sanitary wastewater would be appropriately treated before discharge. Construction activities would be regulated under the Construction General Permit (discussed further in Section 5.3.1), which would require that a SWPPP be prepared for each construction site (LANL 2023a|Section 2.16|). BMPs would be specified to control stormwater runoff from the construction sites to reduce impacts on water quality. Regular inspection of control measures would be required to assure they operate as intended (DOE 2015c|p. F-36|). No discharge of dredged or filled materials into the waters of the United States is planned as part of the proposed project.

4.1.2.3.1 Preferred Alternative

The impacts on surface-water and groundwater resources under the Preferred Alternative at the LANL site are described below.

Base Approach and SRS NPMP Sub-Alternatives

All outdoor construction water use would be for soil moisture and dust control (LANL 2023a|Section 2.16|). Major construction projects (the LSC, office building, and warehouse) would take 2 years and require a maximum of 830,000 gal/yr during the first year of construction for each project and 52,000 gal/yr during the second year (LANL 2023a|Section 2.16|). Because major construction projects would start in the same year, the maximum outdoor construction water use would be about 2.5 million gal/yr during the peak year (LANL 2023a|Section 2.16|).

Maximum indoor construction water use for potable and sanitary purposes was assumed to be equal to the 55,000 gal/yr sanitary wastewater discharge for construction workers inside PF-4. The maximum annual water use for construction would then be 2.6 million gal/yr—the sum of maximum indoor and outdoor uses. Water would be supplied by the Los Alamos Water Supply System, which obtains water from the regional aquifer (see Section 3.2.3.2). The maximum amount of water required during the peak year of construction would be less than 1 percent of the total water used at LANL during 2019 (about 269 million gal). This small increase in groundwater withdrawal would have a minimal impact on the regional aquifer.

Treated sanitary wastewater discharges during construction would be a maximum of 55,000 gal annually generated by construction workers inside buildings (construction workers outside of PF-4 would use portable toilets) (LANL 2023a|Section 2.16|), and would represent less than a 0.1 percent increase in the total volume of effluent discharged to Sandia Canyon (minimum discharge of 58.1 million gal/yr during 2017 to 2020, see Section 3.2.3.1).

Stormwater runoff would be managed and discharged in compliance with existing regulations and facility permits that require SWPPPs, BMPs to control runoff, and monitoring of stormwater runoff quality. Compliance with the *Energy Independence and Security Act*, Section 438 (42 U.S.C. § 17094) will prevent a significant increase in stormwater runoff volume and velocity. In addition, the land area affected would be a small fraction of the areas currently contributing runoff to the affected canyons. No more than about 0.7 ac in TA-55 (the area occupied by the LSC, security portal, weather enclosure, and parking areas) and 1.8 ac in TA-52 (the area occupied by the office building, warehouse, and parking areas) would become impervious. The affected area would be less than 1 percent of the total TA-55 area. About 2.6 percent of the TA-52 area would be affected, including conversion of about 1 ac from undisturbed land to impervious surface (the warehouse and adjacent parking areas). Because the area affected by operations would be a small fraction of the total area of the affected watershed(s) and stormwater would be managed in adherence with applicable regulations, only minor changes in surface-water flows in the canyons adjacent to TA-55 or TA-52 are expected.

Treated sanitary wastewater discharges during operations were estimated to be about 1.7 million gal during the year of peak operations staffing. This value was based on sanitary facility usage (LANL 2023a|Section 2.16.1.2|) and a peak operations staffing of 395 workers (LANL 2023a|Section 1.4|). This discharge of treated sanitary wastewater would be less than 3 percent of the total volume of effluent discharged to Sandia Canyon (minimum discharge of 58.1 million gal/yr during 2017 to 2020, see Section 3.2.3.1). This relatively small increase in discharge to Sandia Canyon would have no adverse effect on water quality.

Process water use during PDP would be minor, totaling less than 300 gal annually (LANL 2023a|Section 2.16|). The primary use of water during operations would be for potable and sanitary use by staff, with the total use (for process and potable/sanitary purposes) approximately 1.7 million gal annually during the year of peak staffing (assumed to be the same as the wastewater use described above). The total annual volume of water required during operations would be less than 1 percent of the total water used at the LANL site during 2019 (about 269 million gal). The small increase in groundwater withdrawal required to supply this water would have a minimal impact on the regional aquifer.

All LANL Sub-Alternative

Construction of a dilution capability at LANL would occur in the same facility as the PDP without increasing the peak number of indoor workers above that considered for the Base Approach Sub-Alternative. Construction of a C&P capability at LANL would require additional outside workers to construct the DHF in TA-55, but those workers would use portable toilets (LANL 2023a|Section 2.16|). As a result, potable or sanitary water use and wastewater discharge under this sub-alternative are bounded by that considered for the Base Approach Sub-Alternative.

Construction of the DHF would require additional outside water use of about 420,000 gal during the first year of construction and 26,000 gal during the second year (LANL 2023a|Section 2.16|). Peak annual outdoor water use would not increase beyond that described above for the Base Approach Sub-Alternative, because, although the DHF is considered a major construction project, it would not be started until the second year of construction for the other major projects (the LSC, office building, and warehouse) (LANL 2023a|Section 2.16|). Therefore, total water uses and wastewater discharges for the All LANL Sub-Alternative would be bounded by the Base Approach Sub-Alternative. The impacts of water use on the regional aquifer would be minimal and no adverse effects on water quality in Sandia Canyon would occur.

Similar to the Base Approach Sub-Alternative, stormwater runoff would be managed and discharged in compliance with existing regulations and facility permits and the land area affected would be a small fraction of the areas currently contributing runoff to the affected canyons. The DHF would increase the impervious area in TA-55 by about 0.6 ac in addition to the 0.7 ac occupied by the PDP support structures (the security portal, weather enclosure, the LSC, and parking areas); the total affected area would be less than 2 percent of the total TA-55 area. Because the area affected by operations would be a small fraction of the total area of the affected watershed(s) and stormwater would be managed in adherence with applicable regulations, only minor changes in surface-water flows in the canyons adjacent to TA-55 or TA-52 are expected.

NNSA estimates that 154 additional staff would be required for dilution and C&P (LANL 2023a|Section 1.4|). This would increase wastewater discharge by about 850,000 gal during the year of peak operations staffing based on sanitary facility usage (LANL 2023a|Section 2.16|). The total treated sanitary wastewater discharges during operation of the All LANL Sub-Alternative would therefore be no more than 2.5 million gal annually. This is no more than about 4 percent of the total volume of effluent discharged to Sandia Canyon (minimum discharge of 58.1 million gal/yr during 2017 to 2020; see Section 3.2.3.1). This relatively small increase in treated discharge to Sandia Canyon would have a minimal effect on water quality.

Operational activities associated with dilution would not require additional process water use beyond the approximately 300 gal annually required for the Base Approach Sub-Alternative. The primary use of water during operations would be for potable and sanitary use and would involve an additional 850,000 gal beyond the Base Approach Sub-Alternative during the peak staffing year, with the total annual water use for All LANL Sub-Alternative operations being no more than 2.5 million gal based on the expected workforce (see Section 4.1.2.9). The total annual volume of water required during operations would be less than 1 percent of the total water used at LANL during 2019 (about 269 million gal). The small increase in groundwater withdrawal required to supply this water would have a minimal impact on the regional aquifer.

4.1.2.3.2 No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur in PF-4 using existing equipment, thus no construction activities would occur. There would be no water resources impacts associated with construction activities at LANL under the No Action Alternative.

Because operations activities for the No Action Alternative would take place within existing facilities, there would be no change in stormwater runoff and no water-quality impacts on the adjacent canyons. However, an additional 147 staff would be needed under the No Action Alternative (see Section 4.1.2.9). Treated sanitary wastewater discharges during operations would be about 600,000 gal during the year of peak use, which is about 1 percent of the total volume of effluent discharged to Sandia Canyon (minimum discharge of 58.1 million gal/yr during 2017 to 2020; see Section 3.2.3.1). This relatively small increase in discharge to Sandia Canyon would have no adverse effect on water quality. Total water use for process and potable/sanitary purposes (also about 600,000 gal/yr) required during operations would be about 0.2 percent of the total water used at the LANL site during 2019 (about 269 million gal), which would have a minimal impact on the regional aquifer. Data for 2019 are used to reflect pre-pandemic normal operations, conditions that are assumed to return during the impact analysis period of this SPDP EIS.

4.1.2.4 LANL Air Quality

Impacts on air quality can result from the release of nonradioactive air pollutant emissions during construction and operation and transportation activities at LANL. This includes air emissions of criteria pollutants, HAPs, and GHGs. Air quality impacts are assessed by comparing the expected emissions of criteria pollutants from construction and operation activities at LANL to the approved site air permit emission levels. Impacts would be considered significant if estimated emissions exceed existing permit levels.

The EPA's final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (40 CFR 93.150–93.165) requires a conformity determination for projects that exceed emission threshold limits in nonattainment areas. However, a conformity determination is not required for the alternatives in this SPDP EIS because LANL is within an area that attains all NAAQSs (see Section 3.2.4.2).

This section presents the anticipated impacts of the Preferred and No Action Alternatives on air quality in the vicinity of LANL. The estimated criteria pollutant emissions for construction for the Preferred Alternative and No Action Alternative are summarized in Table 4-2. Detailed estimated criteria pollutant emissions by capability are presented in Table C-4 in Appendix C. The impacts of radioactive air pollutants are evaluated in Section 4.1.2.7, Human Health. Air quality impacts related to the transportation of materials and waste are discussed in Sections 4.1.6.4.4 and 4.1.6.3.4, respectively.

Table 4-2. Estimated Peak Annual Criteria Air Pollutant Emissions at LANL During Construction/ Modification Activities for the Preferred and No Action Alternatives (T/yr)[(a)]

Pollutant	Preferred Alternative[(a)] Base Approach and SRS NPMP Sub-Alternative[(b)]	Preferred Alternative[(a)] All LANL Sub-Alternative	No Action Alternative[(a)]	2022 LANL Facility-Wide Emissions	Title V LANL Facility-Wide Permit Limit
NO_x	20	25	(c)	46.3	245
SO_x	1.7	2.2	(c)	1.4	150
CO	11	14	(c)	26.0	225
PM_{10}	1.8	2.3	(c)	5.3	120
$PM_{2.5}$	1.7	2.2	(c)	3.5	120
VOCs	2.9	3.7	(c)	14.3	200

CO = carbon monoxide; LANL = Los Alamos National Laboratory; NO_x = nitrogen oxides; NPMP = non-pit metal processing; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SO_x = sulfur oxides; SRS = Savannah River Site; VOC = volatile organic compound.

(a) A roadmap is provided in Table 4-1 to help orient readers to the activities that would occur at LANL for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.

(b) The construction/modification impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.

(c) No construction/modification activities at LANL are anticipated for the No Action Alternative.

Note: Numbers are rounded to two significant digits for the alternatives and three significant digits for the LANL emissions and the Title V facility-wide permit.

Sources: Construction emissions are calculated from LANL 2023a|Sections 1.3, 2.2| according to the peak construction year. 2020 Calculated LANL emissions and Title V facility-wide permit levels are from LANL 2023a|Table 2-2|.

4.1.2.4.1 Preferred Alternative

The construction and operation impacts on air quality from the Preferred Alternative at the LANL site are described below.

Base Approach and SRS NPMP Sub-Alternatives

Construction of the PDP capability at LANL would result in short-term increases in air pollutant concentrations from the use of fossil fuel-powered nonroad equipment, on-road heavy-duty trucks, and worker commuter vehicles (LANL 2023a|Section 2.2.1.1|). Equipment and vehicles that perform earthmoving and demolition activities on unpaved and paved surfaces also would generate fugitive dust (particulate matter less than 2.5 microns in diameter [$PM_{2.5}$] and particulate matter less than 10 microns in diameter [PM_{10}]) emissions. DOE would use water application and other engineering and management practices during construction to minimize fugitive dust.

The annual construction emissions estimated for the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be less than the facility-wide Title V air permit limits and are not considered significant.

The mobile and intermittent operation of construction emission sources would result in dispersed concentrations of air pollutants adjacent to construction activities. The transport distance of construction emissions from TA-55 or TA-52 to the nearest public receptor (approximately 900 m) (LANL 2023a|Figure 1-4, Section 2.2.3|) would produce further dispersion and inconsequential concentrations of air pollutants beyond the LANL property boundary. Air pollutant concentrations generated by construction activities would not result in LANL emissions exceeding any NAAQS and New Mexico State ambient air quality standards. As discussed in Section 3.2.4.2, Los Alamos County is in attainment for all criteria pollutants.

Combustion of fossil fuels in construction equipment and trucks also would emit nonradiological HAPs. HAPs from diesel internal combustion engines compose approximately 15 and 3 percent, respectively, of total volatile organic compounds and PM_{10} emissions (CARB 2018). As mentioned above for criteria pollutants, the mobile and intermittent operation of construction emission sources would result in very low concentrations of HAPs beyond the LANL site boundary.

Operations associated with PDP and NPMP are not expected to produce additional criteria pollutants because these constituents would not be handled or produced during process operations and no additional diesel generators would be required (LANL 2023a|Section 2.2.1.1|). NPMP would result in emissions of less than 3 lb/yr of hydrochloric acid (LANL 2023a|Section 2.2.1.1|), which is under the permit limit of 8 T/yr shown in Table 3-3. The 395 workers required during peak operation activities reflect a 2.5 percent increase over the staff population of 15,554 in 2023 (LANL 2023a|Sections 1.4.1, 2.14|). The additional intermittent commuter vehicle emissions associated with these workers would not substantially contribute to offsite ambient pollutant concentrations. Intra-site shipments of CH-TRU job control waste from PF-4 to the Transuranic Waste Facility (TWF) (a distance of approximately 2 mi) would not substantially contribute to offsite ambient pollutant concentrations when compared to the shipment distances for CH-TRU job control waste between LANL and the WIPP facility shown in Table 4-32.

<u>All LANL Sub-Alternative</u>

These construction activities are similar to those described for the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative, with the addition of the DHF construction.

The annual construction emissions estimated for the All LANL Sub-Alternative would be less than the facility-wide Title V air permit limits (see Table 4-2) and are not considered significant. As discussed for the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative, no adverse impacts are anticipated beyond the LANL site boundary.

Operations associated with PDP and NPMP are not expected to produce additional criteria pollutants because these constituents would not be handled or produced during process operations (LANL 2023a|Section 2.2.1|), as described under the Base Approach and SRS NPMP Sub-Alternatives. There would be no criteria pollutants emitted during operations associated with dilution and C&P (LANL 2023a|Section 2.2.1.1|). The 549 workers required during peak operation activities reflect a 3.5 percent increase over the staff population of 15,554 in 2023 (LANL 2023a|Sections 1.4.1, 1.4.2, 2.14|). The additional intermittent commuter vehicle emissions associated with these workers would not substantially contribute to offsite ambient pollutant concentrations.

4.1.2.4.2 No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur in PF-4 using existing equipment, thus no construction activities would occur. There would be no impacts associated with construction at LANL under the No Action Alternative.

Operations associated with NPMP are not expected to produce additional criteria pollutants because these constituents would not be handled or produced during process operations, as described under the Base Approach and SRS NPMP Sub-Alternatives (LANL 2023a|Section 2.2.1.1|). The 147 workers required during peak operation activities reflect a 0.9 percent increase over the staff population of 15,554 in 2023 (LANL 2023a|Section 2.14|). The additional intermittent commuter vehicle emissions associated with these workers would not substantially contribute to offsite ambient pollutant concentrations.

4.1.2.4.3 Greenhouse Gases

Table 4-3 presents estimates of annual GHG emissions in units of carbon dioxide equivalent (CO_2e; defined in detail in Section 4.2.4.2) that would occur from construction activities for the Preferred and No Action Alternatives at LANL. Similar to the discussion above regarding criteria and HAPs, onsite process operations at LANL would result in no additional GHG emissions. GHG emissions from the transport of materials and wastes by truck for each alternative are presented in Section 4.1.6. The annual GHG emissions from LANL construction under the Preferred Alternative would be no more than about 1 percent of the FY 2020 total annual GHG emissions for LANL (200,000 CO_2e). Section 4.2.4.2 presents the cumulative analysis of GHGs emitted from proposed construction and transportation activities.

Table 4-3. Carbon Dioxide Equivalent Emissions at LANL During Construction/Modification and Operations for the Preferred and No Action Alternatives

Activity	Preferred Alternative[a] Base Approach and SRS NPMP Sub-Alternative[b]	Preferred Alternative[a] All LANL Sub-Alternative	No Action Alternative[a]
Construction (MT/yr)	1,800	2,300	(c)
Operations (MT/yr)	(d)	(d)	(d)

FY = fiscal year; NPMP = non-pit metal processing; LANL = Los Alamos National Laboratory; SRS = Savannah River Site.
(a) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.
(b) The impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.
(c) No construction/modification activities are anticipated in the No Action Alternative.
(d) No additional emissions are anticipated from process operations at LANL (LANL 2023a|Section 2.2|).
Note: Numbers are rounded to two significant digits.
Sources: Construction/modification emissions are calculated based on data from LANL 2023a|Sections 1.3, 2.2|.

4.1.2.5 LANL Noise

Impacts from noise (unwanted sound) generated during construction and operation activities can affect workers and the public. This section presents the anticipated impacts of the Preferred and No Action Alternatives on noise levels at and in the vicinity of LANL.

4.1.2.5.1 Preferred Alternative

The construction and operation noise impacts under the Preferred Alternative at the LANL site are described below.

Base Approach and SRS NPMP Sub-Alternatives

The Base Approach and SRS NPMP Sub-Alternatives would increase noise levels temporarily in and near the construction areas of TA-55 and TA-52 from construction activities, and around LANL as a whole from increased construction traffic traveling to the technical areas. Typical noise levels for each type of expected construction equipment 50 ft from the source are listed by the U.S. Department of Transportation (DOT 2006|Table 9.9|; LANL 2023a|Section 2.2.1.1.1|). Guidance for combining noise levels from multiple pieces of construction equipment (WSDOT 2020|p. 7.15, 7.16, 7.17, Table 7-4|) was applied, resulting in a conservative 93 dBA source level, and it was assumed that noise decreases by approximately 7.5 dBA per doubling of distance from the source under soft site conditions (unpacked earth with forest vegetation) (WSDOT 2020|p. 7.8, 7.24|).

The location of the nearest offsite human receptor (Elk Ridge Mobile Home Park) to PF-4 in TA-55 is about 1,000 m north-northeast (LANL 2023a|Section 2.10.3|). Construction noise originating at TA-55 would attenuate to below 50 dBA (LANL 2023a|Section 2.10.1|) at the southern perimeter of Elk Ridge Mobile Home Park, which would be below the Los Alamos County regulatory noise level of 65 dBA for daytime residential exposure and 53 dBA for nighttime residential exposure (Los Alamos County Ord. No 18-73|Chapter 18/Article III/Sec. 18-73|). Consequently, negligible impacts on the public from construction equipment noise are expected. For TA-52, the nearest offsite receptor for the proposed office building and warehouse is 1,790 m northwest of the Elk Ridge Mobile Home Park (LANL 2023a|Section 2.10.3|); therefore, noise would also attenuate to below 50 dBA, which would be below the Los Alamos County regulatory noise level.

In addition, approximately 116 additional workers would travel to and from LANL during construction (see Table 4-8), an increase of less than 1 percent over the 19,497 existing workers (see Section 3.2.9). The level of highway noise depends upon traffic volume and speed (WSDOT 2020|p. 7.9|). Assuming the ratio of traffic volume increases at a ratio similar to that of the extra workers to existing workers (e.g., approximately 1 percent), the increase in noise levels produced to account for the traffic volume of the extra workers would be less than 10 dBA more than the noise levels produced by the traffic volume of the existing workers traveling at the same speed (WSDOT 2020|p. 7.10-11, Table 7-3|). Therefore, noise impacts on the public from increased travel to and from LANL during construction are not expected.

Operation-related activities associated with the Base Approach and SRS NPMP Sub-Alternatives would produce noise levels similar to those that currently occur during normal operational activities at TA-55 (i.e., ambient noise levels, 62 dBA) and TA-52 (i.e., 51 dBA) (LANL 2023a|Section 2.10|) and would be much lower than those noted above for construction. Additionally, noise impacts from operations on public receptors at Elk Ridge Mobile Home Park are not expected. The number of extra workers traveling to and from LANL during operations would be approximately 395 (see Table 4-9), an increase of approximately 2 percent over the 19,497 existing workers (see Section 3.2.9). Assuming the traffic volume increases at a ratio similar to that of extra workers to existing workers (e.g., approximately 3 percent), the increase in noise levels produced to account for the traffic volume of the extra workers would be less than 10 dBA more than the noise levels produced by the traffic volume of the existing workers traveling at the same speed (WSDOT 2020|p. 7.10-11, Table 7-3|). Based on the less than 10 dBA increase criterion noted above for construction traffic, there would a be negligible impact on noise produced from increased travel to and from LANL during operations, and noise impacts on the public are not expected.

All LANL Sub-Alternative

Construction activities at LANL under the All LANL Sub-Alternative would increase noise levels temporarily in and near the construction areas of TA-55 and TA-52. Noise impacts from the All LANL Sub-Alternative would be similar to those described under the Base Approach Sub-Alternative, with the addition of the DHF construction. Similar types of construction equipment would be used. Therefore, noise impacts would not be expected for a member of the public (LANL 2023a|Section 2.10.2|).

The number of extra workers traveling to and from LANL during construction would be approximately 139 (see Table 4-8), an increase of less than 1 percent over the 19,497 existing workers (see Section 3.2.9). Similar to the discussion of the Base Approach Sub-Alternative, there would be a negligible impact on noise produced by increased travel to and from LANL during operations, and noise impacts on the public are not expected.

Operation activities at LANL under the All LANL Sub-Alternative would also be similar to those described under the Base Approach Sub-Alternative. Therefore, noise impacts would not be expected for members of the public.

The number of extra workers traveling to and from LANL during operation would be approximately 549 (see Table 4-9), an increase of about 3 percent over the 19,497 existing workers (see Section 3.2.9). Similar to the discussion of the Base Approach Sub-Alternative, there would be a negligible impact on noise produced by increased travel to and from LANL during operations, and noise impacts on the public are not expected.

4.1.2.5.2 No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur in PF-4 using existing equipment. Therefore, no construction activities at LANL would occur. There would be no noise impacts associated with construction at LANL under the No Action Alternative.

Because operation activities for the No Action Alternative would take place within existing facilities and given the distance to the nearest offsite receptor, members of the public would not be affected by noise based on NPMP activities at LANL. In addition, NPMP activities are not expected to increase existing noise levels to occupational workers.

There would be 147 additional workers traveling to and from LANL during peak operation activities, an increase of less than 1 percent over the staff population of 19,497 (LANL 2023a|Section 2.14|). Similar to the discussion of the Base Approach Sub-Alternative, there would be a negligible impact on noise produced by increased travel to and from LANL during operations, and noise impacts on the public are not expected.

4.1.2.6 LANL Ecological Resources

Impacts on ecological resources can result from physical habitat disturbance, such as land clearing, grading, excavation, and erosion and sedimentation, and from other forms of habitat disturbance such as human presence, noise, and light. Habitat loss may affect an individual organism’s ability to breed, feed, shelter, or migrate, and may affect populations and species.

This section presents the anticipated impacts of the Preferred and No Action Alternatives on ecological resources at the LANL site with a focus on terrestrial and wetland resources. Aquatic resources are not considered because surface water does not occur in TA-55 or TA-52 at locations where construction would occur (LANL 2023a|Section 1.1.2|). The adjacent canyons that could receive minor stormwater discharge from project areas in TA-55 and TA-52 have only ephemeral or intermittent flows and do not support fish populations (DOE 2015c|p. 3-83|), and aquatic invertebrate communities are likely absent or limited.

4.1.2.6.1 Preferred Alternative

The impacts from construction and operations on ecological resources for the Preferred Alternative at the LANL site are described below.

Base Approach and SRS NPMP Sub-Alternatives

The total area affected by construction under the Base Approach and the SRS NPMP Sub-Alternatives would be 5.1 ac with construction occurring in TA-55 and TA-52, as discussed in Section 4.1.2.1.1. There is no difference in the total land area required or the location of the facilities for these two sub-alternatives (LANL 2023a|Sections 1.1.2, 2.8|).

Terrestrial Resources

Construction – The total land area potentially affected by construction activities at LANL in TA-55 would be 3.5 ac (see Section 4.1.2.2). The potentially affected habitats in TA-55 have relatively low biological resource value (see Section 3.2.6.1). The total area potentially disturbed in TA-52 would be 2.1 ac (LANL 2023a|Sections 1.1.2, 2.8|).

Most of the land disturbance in TA-55 would occur where forest habitat and other vegetation are sparse (Figure 2-6 and Figure 2-7) because of prior disturbance. Utilities for the new facilities in TA-55 would be installed within the rights-of-way of existing utility lines (LANL 2023a|Section 2.7.3.2|). Thus, there would be no new land disturbance associated with utility installation (LANL 2023a|Section 2.7.3.2|). Consequently, the overall effects of habitat disturbance would be minor.

In TA-52, the office building, warehouse, and associated parking areas, would be located on undisturbed land (LANL 2023a|Section 2.5.1.1|), with conversion of about 1 ac from undisturbed land to impervious surface (see Section 4.1.2.3.1). The construction would require the removal of approximately 50 to 70 ponderosa pine trees and/or large shrubs (LANL 2023a|Section 2.5.1.1|). Some wildlife present in the facility footprint and construction support areas could suffer direct mortality, disturbance, and displacement. However, the removal of trees and shrubs would take place outside the period from May 15 through July 31 to avoid disturbance of active migratory bird nests (LANL 2023a|Section 2.5.1.1|). While mortality and nonlethal disturbance may affect some individual organisms, local species populations are not expected to be adversely affected because land conversion and temporary construction impacts would occur in relatively small areas in TA-55 and TA-52, and because similar wildlife habitat occurs elsewhere in the vicinity of the project areas on the LANL site. Thus, the effects of habitat disturbance on wildlife would be localized and minor.

Wildlife (especially bird) responses to noise are variable and may range from habituation to varying degrees of avoidance (Caltrans 2016|p. 38,79,81|; AMEC 2005; Larkin 1996|p. 1, 2|). Noise would occur from construction equipment and from the additional construction workers traveling to and from

LANL. As discussed in Section 4.1.2.5.1, incremental noise impacts from additional construction workers traveling to and from LANL are not expected to be noticeable and therefore would not affect wildlife.

Animal-vehicle accidents in Los Alamos County most commonly involve mule deer and elk are the second most commonly involved species (Bennett et al. 2014|p. 15|). Animal-vehicle accidents are known to occur along Pajarito Road (Bennett et al. 2014|p. 16|). The baseline number of average daily vehicle trips (ADTs) along Pajarito Road is estimated to be 6,774 (see Table 3-16). The number of additional workers during construction would be 116 (see Table 4-8). The maximum estimated number of additional ADTs during these years would be 232 (conservatively assuming two trips/day-person and no carpooling or use of mass transit), or about 3.4 percent over the baseline ADT. These small increases in traffic along Pajarito Road during construction and operations would not substantially increase the risk of animal-vehicle accidents.

New Mexico Night Sky Protection Act (74-12-1 to 74-12-10 NMSA 1978 [New Mexico Night Sky Protection Act]) requirements have been incorporated into LANL engineering standards (LANL 2023a|Section 2.9.3|). Because of light fixture shielding required by the Act and the resulting downward projection of light rays, any effects of nighttime lighting on nearby wildlife during construction are expected to be negligible. Some nearby wildlife may experience such effects that would be intermittent and temporary during periods of construction, and thus negligible in their overall impact on individuals and populations.

NNSA assumes that BMPs commonly used at LANL will continue to protect ecological resources. These include use of previously disturbed areas for construction when possible; 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; high-efficiency particulate air (HEPA) filters and ventilation systems; and preconstruction characterization/surveys of the site (DOE 2020a|Table 4-30, p. 4-78, 4-81|).

Operations – The number of additional workers during operation peak years would be 395 (see Table 4-9). The maximum estimated number of additional ADTs during these years would be 790 (conservatively assuming two trips/day-person and no carpooling or use of mass transit), or about 11.7 percent over the baseline ADT. There would be no habitat disturbance during operations and any increased noise, light, or traffic from facility operations are expected to pose minimal impacts on wildlife.

Wetland Resources

Construction – Wetlands may be adversely affected by the discharge of stormwater containing sediment into canyon bottoms (see Section 3.2.6.3). The proposed warehouse area in TA-52 would discharge to Ten Site Canyon and Cañada del Buey, both of which are tributaries to Mortandad Canyon, where there is a wetland (see Section 3.2.6.2) (LANL 2023a|Section 2.16.3|; LANL 2012|p. 11|). The laydown area northwest of the fence and the laydown area adjacent to PF-4 in TA-55 would discharge to Mortandad Canyon above the wetland described in Section 3.2.6.3 (LANL 2023a|Section 2.16.3|). The two structures in TA-55 (LSC and weather enclosure) would discharge to the TA-55 detention pond and Middle-Mortandad stormwater controls (see Section 3.2.6.3) (LANL 2023a|Section 2.16.3|). Current data do not indicate the existence of any wetlands in the canyons adjacent to TA-52 (LANL 2023a|Section 2.16.3|).

Compliance with the Construction General Permit and the *Energy Independence and Security Act*, Section 438 (42 U.S.C. § 17094), would prevent a significant increase in stormwater runoff volume and velocity and would thus minimize sediment contribution from the project area in TA-55 (LANL 2023a|Section 2.16.3|). This, plus the beneficial effects of the Middle-Mortandad stormwater controls (see Section 3.2.6.3), would minimize impacts on the wetlands in Mortandad Canyon, either via the flow of sediment through the detention pond and Middle-Mortandad controls or via flow from upgradient of the wetland. Consequently, any impacts on the wetland in Mortandad Canyon are expected to be minor. This would be in accordance with the requirements for the least environmentally damaging practicable alternative (USACE 2014).

Operations – During operations, stormwater runoff would be managed and discharged in compliance with regulations and facility permits, which would prevent significant stormwater runoff, as discussed in the previous paragraph for construction. Thus, any effects on the wetlands in Mortandad Canyon during operation are expected to be negligible.

Threatened and Endangered Species

The following discussion and associated analyses described below for the Mexican spotted owl and the Jemez Mountains salamander is in accordance with the results of an Endangered Species Act (ESA) Section 7 consultation. The project received Section 7 ESA concurrence from the U.S. Fish and Wildlife Service regarding impacts on the Mexican spotted owl and the Jemez Mountains salamander. The project mitigations focused on reducing lighting and noise impacts. Specifically, (1) project activities will incorporate the New Mexico Night Sky Protection Act standards for all new lighting and, where possible, retrofit existing light sources so that lighting does not illuminate adjacent undeveloped habitat; and (2) all outdoor building support components, such as emergency generators, air compressors, and air conditioners, will be sited such that the orientation is directed away from canyon edges, or they will be fully enclosed to reduce noise levels (LANL 2023a).

Construction – There is core and buffer habitat for the federally threatened Mexican spotted owl in TA-55, and an active nest site is located 0.75 mi east of PF-4 (TA-55) in Mortandad Canyon (LANL 2023a|Section 2.5.1|). However, the nest is located far enough away from construction activities in TA-55 that noise, light, or development activities would not affect the nest (LANL 2023a|Section 2.5.1|). The 3.5 ac identified for construction in TA-55 have been previously disturbed, support sparse vegetation, have been fragmented by development, and are now separated from core and buffer habitat to the south in Twomile Canyon and Pajarito Canyon by Pajarito Road. The small size of the forested parcel, its location within fragmented and degraded habitat, and its close proximity to the TA-55 industrial areas reduce its suitability for the owl and the likelihood that its removal would affect the suitability of buffer habitat for the species outside the project area. However, the project area in TA-52 is located in undeveloped core and buffer habitat, and suitable owl habitat would be removed with the removal of the ponderosa pine trees (LANL 2023a|Sections 2.5.1, 2.5.1.1|).

The federally endangered Jemez Mountains salamander also has designated habitat in Pajarito Canyon, although there are no requirements or mitigations associated with this habitat (LANL 2023a|Section 2.5.1|). The Jemez Mountains salamander has not been observed in Twomile Canyon (LANL 2017d|p. 7|). The designated core habitat in Pajarito Canyon is 0.6 mi south of PF-4 (TA-55) and about 0.7 mi southwest of the proposed TA-52 project area (LANL 2023a|Section 2.5.1|). There would be no habitat disturbance (including sediment deposition) in Pajarito Canyon from construction at either TA-55 or TA-52 (LANL 2023a|Section 2.16.1.1|).

There is no information available about the effects of artificially produced light on Mexican spotted owls (Hathcock et al. 2017|p. 11|). However, light is considered to be one of the most important habitat components for the species (Hathcock et al. 2017|p. 13|). A long-term change in light levels within core habitat for the Mexican spotted owl is considered a habitat alteration for the species if it increases average light levels by ≥0.05 foot-candles (fc) at night (Hathcock et al. 2017|p. 13|). Changes in light levels are measured at the core area boundary if the source is outside the core area, or at 10 m (33 ft) from the source if the source is inside the undeveloped core area (Hathcock et al. 2017|p. 13|). The approximate distance from the project area in TA-55 to the nearest core habitat boundary located to the south in Twomile Canyon and Pajarito Canyon is 1,000 ft. The proposed TA-52 project locations are in undeveloped core and buffer habitat for the Mexican spotted owl (LANL 2023a|Section 2.10.1|). As such, the project area is located on suitable habitat (LANL 2023a|Section 2.5.1|). It is assumed that long-term changes in light levels could occur during construction or operations; however, nighttime construction lighting would likely be more intense (to enable outdoor work at night) than operations lighting. DOE could restrict construction lighting in TA-55 and apply similar restrictions for construction lighting in TA-52 (LANL 2023a|Section 2.5.1.1|). Potential restrictions that could be considered would include light shielding (i.e., a downward projection of light), and restriction directions (i.e., redirections to avoid sensitive habitats) (LANL 2023a|Section 2.5.1.1|). Even with mitigations, light restrictions in TA-52 may still alter the habitat; however, this would be evaluated in the future ESA Section 7 consultation.

Noise is likewise considered to be one of the most important habitat components for the Mexican spotted owl (Hathcock et al. 2017|p. 13|). A long-term change in noise levels within core habitat for the owl is considered a habitat alteration for the species if it increases average noise levels by ≥6 dBA during any portion of the 24-hour day (Hathcock et al. 2017|p. 13|). Ambient noise levels within 0.25 mi of a developed area are assumed to be 51 dBA. The nearest core boundary to TA-55 is 1,000 ft south at the end of Pajarito Canyon. The noise levels would attenuate to below 50 dBA at 1,000 ft. This would not trigger any requirements to protect wildlife (LANL 2023a|Section 2.10.1|), because 51 dBA is similar to the average measured noise levels at the boundary of similar core habitat in Mortandad Canyon (Sandia-Mortandad Canyon Area of Environmental Interest) (Hansen 2005|p. 17|). However, during construction the noise levels in TA-52 are anticipated to be up to 91 dBA. Because construction would occur on undisturbed land (i.e., there are no previous buildings), noise would not attenuate to below 57 dBA. To achieve a noise level of 57 dBA, the distance from the source would need to be 1,440-ft. A radius of 1,440 ft around the construction area of the buildings at TA-52 would affect approximately 98.2 ac of core habitat and 133.0 ac of buffer habitat.

Several different types of construction equipment would be operated at these locations (LANL 2023a|Section 2.2.1.1.1|). Chainsaws would likely be employed to remove trees. Chainsaw operation greater than or equal to 250 m (about 820 ft) and 75 m (about 250 ft) from Mexican spotted owls during the nesting and non-nesting season, respectively, did not elicit a flush response (Delaney et al. 1999|p. 67, Table 3|). Thus, notwithstanding any habitat differences that might affect the propagation or perception of noise reported in that study versus at the core habitat area boundary outside TA-55, construction would be unlikely to cause a flush response from any owls at the core habitat boundary, because it is located about 200 ft farther than the no-flush distances reported by Delaney et al. (Delaney et al. 1999). Likewise, because chainsaws generate noise levels similar to those of the construction equipment evaluated in Section 4.1.2.5 (about 85 dBA at 50 ft from the source [DOT 2006|Table 9.1|]), construction noise would be unlikely to cause a flush response from any owls at the core habitat area boundary outside TA-55. However, for TA-52, chainsaw operation and construction activity noise are likely to cause a flush response from non-nesting and nesting owls because it would occur in the core and buffer habitat for the Mexican spotted owl. For example, Delaney et al. (Delaney et al. 1999) reported that at a distance of less than 30 m (about 98.5 ft) and less than 60 m (about 197 ft) during non-nesting and nesting seasons, respectively, flush responses were elicited.

Sensitive species potentially occurring on the LANL site are listed in LANL's *2021 Annual Site Environmental Report* (LANL 2022c|Table 2-13|) and comprise species listed by the State of New Mexico. The sensitive species most likely to use project site habitat in TA-55 and TA-52 would be tree- and shrub-nesting avian species such as the loggerhead shrike (*Lanius ludovicianus*) and gray vireo (*Vireo vicinior*), and tree-roosting bat species such as the western small-footed myotis (*Myotis ciliolabrum melanorhinus*) and long-legged bat (*Myotis volans interior*). Avoiding habitat alterations during the nesting season between June 1 and July 31, and avoiding removal of standing dead trees during the summer months are considered BMPs for bird and bat species, respectively, as recommended in the *Sensitive Species Best Management Practices Source Document* (LANL 2020c|p. 8,11,12,14|). As noted previously, removal of trees/shrubs in TA-52 would take place outside the period from May 15 through July 31, thereby avoiding most potential construction impacts on nesting birds and roosting bats. Use of masticators for tree removal outside of the nesting and roosting season will have minimal impact to sensitive species.

Mitigation measures to reduce potential ecological impacts and the benefiting resources are noted in Table 4-4.

Table 4-4. LANL Mitigation Measures to Reduce Potential Ecological Impacts

Mitigative Action	Benefiting Ecological Resource
Land-clearing timing – would take place outside May 15–July 31 (LANL 2023a|Section 2.5.1.1|)	Active nests of migratory birds and tree-roosting bats (LANL 2015c|p. 8|; LANL 2020b|p. 5|)
Light shielding – facilitates downward (rather than upward or lateral) projection of light (LANL 2023a|Section 2.5.1.1|)	Nocturnal wildlife (New Mexico Night Sky Protection Act (NMSA 1978)
Lighting restriction – redirection of lighting in TA-55 to avoid sensitive habitats (LANL 2023a|Section 2.5.1.1|)	Mexican spotted owl and its core habitat in Pajarito Canyon (Pajarito Area of Environmental Interest) (Hathcock et al. 2017|p. 18|)
Lighting direction – redirection of lighting in TA-52 as appropriate to avoid sensitive habitats (LANL 2023a|Section 2.5.1.1|)	Mexican spotted owl and its core habitat in Pajarito Canyon (Pajarito Area of Environmental Interest) (Hathcock et al. 2017|p. 18|)

LANL = Los Alamos National Laboratory; TA = Technical Area.

<u>Operations</u> – The background noise during normal operational activities (i.e., ambient noise level for projects in developed areas) is 62 dBA at TA-55 and 51 dBA at TA-52 (i.e., ambient noise level for projects within 0.25 mi of developed areas; LANL 2023a|Sections 2.10.1, 2.10.3|), which are below the Los Alamos County daytime thresholds. For TA-52 during operation, a noise attenuation of 62 dBA from the buildings to 57 dBA (i.e., 51 dBA plus a long-term change in noise levels within core habitat of 6 dBA (LANL 2015d|p. 14|), would occur at less than 100 ft (30 m). This would affect a much smaller radius and acreage of core and buffer habitat than during construction, less than 4 ac of core habitat and less than 5 ac of buffer habitat.

Light restrictions in TA-52 (even with mitigations) may not achieve the intended result of no alteration of core habitat because the project area is in undeveloped core habitat and light levels may not decrease to <0.05 fc above average nighttime light levels within 10 m (33 ft) of the source. Anticipated operation light levels and average nighttime light levels in undeveloped core habitat are currently unknown.

NNSA anticipates that the impacts on threatened and endangered species during operations would be minor. However, the analyses for the Mexican spotted owl and the Jemez Mountains salamander are general and provisional and would be resolved definitively in future ESA Section 7 consultation if a decision is made to implement this alternative.

<u>All LANL Sub-Alternative</u>

Activities at LANL under the All LANL Sub-Alternative would include construction and operation of the same facilities discussed for the Base Approach and SRS NPMP Sub-Alternatives and also construction and operation of the DHF in TA-55.

<u>Terrestrial Resources</u>

<u>Construction</u> – Construction would increase noise levels temporarily in and near the construction areas of TA-55. Noise impacts from All LANL Sub-Alternative would be similar to those described previously under the Base Approach and the SRS NPMP Sub-Alternatives, but with the addition of the DHF construction. The same type of construction equipment would be used for the DHF as that described above for the two previous sub-alternatives, resulting in similar noise levels (LANL 2023a|Section 2.2.1.1.1|). Construction of the DHF is expected to increase noise and nighttime light levels only slightly above those previously described.

The number of additional workers during construction would be 139 (see Table 4-8). The maximum estimated number of additional ADTs during these years would be 278 (conservatively assuming two trips/day-person and no carpooling or use of mass transit), or about 4.1 percent over the baseline ADT. These small increases in traffic along Pajarito Road during construction and operations would not substantially increase the risk of animal-vehicle accidents.

<u>Operations</u> – The number of additional workers during operation peak years would be 549 (see Table 4-9). The maximum estimated number of additional ADTs during these years would be 1,098 (conservatively assuming two trips/day-person and no carpooling or use of mass transit), or about 16.2 percent over the baseline ADT. There would be no habitat disturbance during operations and any increased noise, light, or traffic from facility operations are expected to pose minimal impacts on wildlife. Noise and nighttime light levels during operation of the DHF are expected to be similar to the baseline noise and light levels of existing facilities in TA-55 and would impose no incremental impacts on wildlife.

<u>Wetland Resources</u>

<u>Construction</u> – The proposed location of the DHF may feature similar concerns about discharge runoff into canyon bottoms. However, the Mid-Mortandad controls would manage runoff in a manner similar to that described for the Base Approach and SRS NPMP Sub-Alternatives. Therefore, the effects on wetland resources would be minor.

<u>Operations</u> – During operations, stormwater runoff would be managed and discharged in compliance with regulations and facility permits. This would prevent significant stormwater runoff and would thus minimize sediment contribution to the wetlands in Mortandad Canyon, either via the flow of sediment through the detention pond and Middle-Mortandad controls or via flow from upgradient of the wetland. Thus, any effects on the wetlands in Mortandad Canyon during operations are expected to be negligible.

Threatened and Endangered Species

Construction – The DHF would be built in a highly industrial and previously disturbed area adjacent to the current PF-4 building and would not require removal of vegetation. It would not trigger any noise restriction requirements to protect wildlife (LANL 2023a|Section 2.10.2|). Other concerns about threatened and endangered species would be the same as those described for the Base Approach and SRS NPMP Sub-Alternatives. Therefore, the effects on such species would be minor.

Operations – Potential effects on such species would be the same as those described under the Base Approach and SRS NPMP Sub-Alternatives.

4.1.2.6.2 No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur in PF-4 using existing equipment, thus no construction activities would occur. There would be no impacts on terrestrial resources, wetland resources, or listed species associated with construction at LANL under the No Action Alternative. There would be no habitat disturbance during operations and any increased noise, light, or traffic from facility operations are expected to pose minimal impacts.

4.1.2.7 LANL Human Health

This section presents the analyses of anticipated radiological human health impacts resulting from activities associated with the Preferred and No Action Alternatives. Human health impacts may occur during construction and normal operational activities, and from impacts of postulated accidents. This section also summarizes impacts from chemical use including postulated chemical accidents, and from intentional destructive acts. Other sources of risk to human health are also evaluated in this SPDP EIS. Nonradiological impacts are addressed in Section 4.1.2.4 for air quality and Section 4.1.2.5 for noise.

Human health risks from construction, normal operations, and facility accidents are considered for individual receptors and population groups. Depending on the source of exposure (and whether normal or accidental conditions are being considered), these receptors and population groups include involved and noninvolved workers, the offsite population, and a MEI member of the public within the offsite population.

An **involved worker** is someone directly or indirectly involved with surplus plutonium disposition operations who may receive an occupational radiation dose from direct radiation (i.e., neutron, x-ray, beta, or gamma) or from radionuclides released to the environment. Direct exposure from handling plutonium materials within a facility would be the chief source of occupational exposure for onsite workers (primarily from gamma radiation emitted by americium-241).

A **noninvolved worker** is a site worker outside of the facility who would not be subject to direct radiation exposure but could be incidentally exposed to emissions from the surplus plutonium facilities if they occurred.

The **offsite population** comprises members of the general public who live within 50 mi of the facility being evaluated.

The **MEI** is a hypothetical individual at a location of public access that would result in the highest exposure; considered to be located at the site boundary at LANL and SRS for both the Preferred and No Action Alternatives.

Estimates of the radiation dose received by workers and members of the public were developed and used to determine potential radiological impacts on human health. LANL (LANL 2023a) has developed estimates of dose to workers and the public that provide a basis for the radiation dose estimates in this SPDP EIS. Radiation doses are estimated and converted to the risk of a LCF using a factor of 0.0006 LCF per rem (DOE 2003a). The LCF provides an indication of the impact to human health for both workers and the public. For individuals, this provides a measure of the risk of an LCF occurring for that individual. For populations, multiplying this risk factor by the estimated person-rem provides an estimate of the number of excess LCFs that could occur in the exposed population. For doses equal to or greater than 20 rem resulting from an acute exposure from an accident, the risk estimator is doubled (ICRP 1991).[23] However, the risk estimator is not doubled for doses estimated for normal operations. This approach to calculating radiological impacts is applicable in Section 4.1.2.7.1 for impacts of normal operations including both construction and operations, and in Section 4.1.2.7.2 for impacts of radiological accidents.

Data from previous evaluations, along with supplemental information provided by LANL, were used to evaluate the impacts from normal operations on an individual worker, the population of involved workers, the MEI, and the offsite population.

4.1.2.7.1 Construction Activities and Normal Operations

This section presents the potential radiation dose and radiological impacts from construction activities and normal operations at LANL resulting from activities associated with the Preferred and No Action Alternatives. Normal operations do not include postulated accidents (see Section 4.1.2.7.2). The evaluation of dose and human health impacts is based primarily on information provided by LANL (LANL 2023a).

The anticipated radiation dose and radiological impacts from the Preferred and No Action Alternatives are summarized in Table 4-5 for construction activities and in Table 4-6 for operations. Detailed radiological impacts by capability are presented in Tables C-5 and C-6 in Appendix C.

Radiation dose and human health impacts on workers and the public are evaluated for both construction and operations. Calculation of radiation dose is the basis for human health impacts, determined as the risk of an LCF to an individual, or the number of LCFs in an exposed population. The LCFs for a specific project stage (i.e., construction or operations) are calculated differently. Construction impacts depend on the number of workers, the annual dose rate, and the duration of the construction in years. Operations impacts also depend on the number of workers and the annual dose rate but are determined based on a work throughput, such as a certain number of metric tons of material processed per year.

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[23] DOE considers LCFs <0.5 to be 0. The rounded LCF value is provided in the tables and the text, followed by the calculated value in parentheses.

Table 4-5. Radiation Dose and Impacts at LANL During Construction/Modification for the Preferred and No Action Alternatives

Receptor (units)	**Preferred Alternative[a]** **Base Approach and SRS NPMP Sub-Alternatives[b]**		**Preferred Alternative[a]** **All LANL Sub-Alternative**		**No Action Alternative[a]**	
	Dose	**LCF**	**Dose**	**LCF**	**Dose**	**LCF**
Worker – Dose Rate (rem/yr)[c]	0.38	(d)	0.38	(d)	None[e]	(d)
Worker – Construction Dose (rem and LCF risk)	2.3	0.001	3.0[f]	0.002	None[e]	None[e]
Workforce – Construction Collective Dose (person-rem and number of LCFs)[g]	13	0 (0.008)	16[f]	0 (0.01)	None[e]	None[e]
Public – MEI Dose (rem and LCF risk)	(h)	(h)	(h)	(h)	None[e]	None[e]
Public – Population Dose (person-rem and number of LCFs)	(h)	(h)	(h)	(h)	None[e]	None[e]

LANL = Los Alamos National Laboratory; LCF = latent cancer fatality; MEI = maximally exposed individual; NPMP = non-pit metal processing; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL under each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.
(b) The construction/modification impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.
(c) Shows the highest dose to an individual construction worker.
(d) LCFs cannot be derived for dose rates to individuals.
(e) No construction/modification activities are anticipated for the No Action Alternative.
(f) Dose for the All LANL Sub-Alternative includes project dose from the full duration of the Base Approach construction activities and the additional 2 years of construction for the Drum Handling Facility (see construction project durations in Appendix B, Table B-1).
(g) The LCF is calculated by using a risk estimator of 0.0006 fatal cancers per rem or person-rem. The rounded LCF value is provided, followed by the calculated value in parentheses for the workforce collective dose.
(h) Doses and LCFs to the public and the MEI from construction activities were not calculated because doses and corresponding LCFs to workers at the site were extremely low and the expectation is that a negligible dose and corresponding LCF would be received by noninvolved workers, the MEI, and other members of the public.

Note: Numbers are rounded to one or two significant digits.
Source: LANL 2023a.

Table 4-6. Radiation Dose and Impacts at LANL During Operations for the Preferred and No Action Alternatives

	Preferred Alternative[a] Base Approach and SRS NPMP Sub-Alternatives[b]		Preferred Alternative[a] All LANL Sub-Alternative		No Action Alternative[a]	
Receptor (units)	**Dose**	**LCF**	**Dose**	**LCF**	**Dose**	**LCF**
Worker – Dose Rate[c] (rem/yr)	0.45	(d)	0.66	(d)	0.45	(d)
Worker – Operational Dose (rem and LCF risk) for entire project duration	7.7	0.005	11	0.007	8.1[e]	0.005
Workforce – Operational Collective Dose (person-rem and number of LCFs)[f] for entire project duration	2,000	1 (1.2)	3,100	2 (1.8)	780	0 (0.46)
Public – MEI dose rate[g] (rem/yr)	2.9×10^{-6}	(d)	6.4×10^{-6}	(d)	7.1×10^{-7}	(d)
Public – MEI Dose (rem and LCF risk) for entire project duration	0.000047	3×10^{-8}	0.00011	6×10^{-8}	0.000013	8×10^{-9}
Public – Population Dose (person-rem and number of LCFs)[f] for entire project duration	0.16	0 (0.0001)	0.37	0 (0.0002)	0.044	0 (0.00003)

LANL = Los Alamos National Laboratory; LCF = latent cancer fatality; MEI = maximally exposed individual; NPMP = non-pit metal processing; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL under each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.

(b) The operations impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.

(c) Shows the highest dose to an individual worker.

(d) LCFs cannot be derived for dose rates to individuals.

(e) The worker project dose is higher for the No Action Alternative then the Base Approach because the throughput rate is lower for the No Action and thus the operator is at the glovebox for a longer period of time to process the full amount of material.

(f) The LCF is calculated by using a risk estimator of 0.0006 fatal cancers per rem or person-rem. The rounded LCF value is provided, followed by the calculated value in parentheses.

(g) Dose rate to the MEI at 2 MT/year for Preferred Alternative; 0.4 MT/year for No Action Alternative.

Note: Numbers are rounded to one or two significant digits.

Sources: LANL 2023a; McNaughton and Burgandy 2012.

The maximally exposed worker was selected for the capability with the highest dose rate and would be exposed at the base dose rate for the entire duration of the activity (process durations are shown in Appendix B, Table B-2). For example, under the Preferred Alternative the worker is assumed to be present for the entire duration required to process the entire 34 MT, and under the No Action Alternative the worker is present for the entire duration to process up to 7.1 MT. The throughput per year can vary to fit project needs but the total risk or total number of LCFs can be consistently determined. Radiation dose and radiological impacts from construction and normal operations are discussed in more detail below under each sub-alternative. Annual radiation doses are also reported in the tables below because they can be useful for comparing to the regulatory dose limits.

Estimates of radiation dose and radiological impacts to the public are made for the MEI and for the population within 50 mi of LANL. Dose to the MEI, located 1,018 m north-northeast from PF-4, could occur from small, routine airborne releases. Dose to the offsite 50-mi population is based on the 2010 census population of approximately 343,000 persons (LANL 2022b, Table 8-2), to maintain consistency with Section 3.2.7.1 and between the SRS and LANL analyses. Based on the calculation of dose, there is no impact on the public from construction (see Table 4-5), and a very small increase in radiation doses to the surrounding population from operations but no expectation of any LCFs for any of the alternatives or sub-alternatives (see Table 4-6). The surrounding population grew to 446,494 in 2020 (Table 3-19) and population dose to this larger population is estimated to increase by less than 10 percent from that analyzed in Table 4-6 (LANL 2023a). The corresponding increase in fractional LCF would be very small and the number of expected LCFs in the population from operations would remain 0 (see Table 4-6). This analysis of MEI and population dose credits the use of HEPA filtration as limiting releases from normal operations.

Air permitting would be evaluated prior to operation to verify that the selected alternative would be compliant for potential releases of radioactive materials. LANL would determine whether planned emissions require a modification to existing facility permits to meet National Emission Standards for Hazardous Air Pollutants as promulgated in 40 CFR Part 60 and 40 CFR Part 63. More information about permitting is provided in Section 5.3.1 of this SPDP EIS. All annual doses to the MEI from the air pathway would be less than 0.01 mrem/yr and lower than all applicable limits (LANL 2023a|App A and B|).

Preferred Alternative

The evaluation of dose and human health impacts from the Preferred Alternative at LANL during normal operations is based on information provided by LANL (LANL 2023a).

The individual worker is the "maximally exposed" worker for each applicable capability (e.g., dilution) for each alternative and sub-alternative. This worker would be exposed at the base dose rate for the entire duration of the activity (process durations are shown in Appendix B, Table B-2). For example, under the Preferred Alternative the worker is assumed to be present for the entire duration required to process the entire 34 MT, and under the No Action Alternative the worker is present for the entire duration to process 7.1 MT.

Base Approach and SRS NPMP Sub-Alternatives

The Preferred Alternative would require modifications of PF-4, and the additional facilities described in Section 2.1.1.2.2 would be constructed. The estimated risk of an LCF to an individual worker would be 0.001 (or 1 chance in a thousand of an LCF) and the number of LCFs in the exposed worker population would be 0 (0.008) from construction and modification activities. As noted above, there would be no public exposure and no impacts from construction.

A dose rate of 0.45 rem/yr to workers is assumed for workers participating in PDP and NPMP operations at LANL for the Base Approach Sub-Alternative and for PDP for the SRS NPMP Sub-Alternatives. For the project duration, the risk of LCF to an individual worker would be low (0.005 or 5 chances in 1000 of an LCF). The estimated number of LCFs for the population of LANL involved workers over the project duration would be 1 (1.2) for the full project duration.

No impacts are expected on the MEI or on the population. The risk of an LCF for the MEI over the project duration would be very low (3×10^{-8} or 3 chances in 100 million of an LCF). The estimated number of LCFs in the exposed public population within a 50 mi radius would be 0 (0.0001 or 1 chance in ten thousand) for the entire duration of operations.

<u>All LANL Sub-Alternative</u>

The same construction activities for PDP and NPMP activities for the Base Approach Sub-Alternative as discussed in the previous section would also occur for the All LANL Sub-Alternative, but there would be additional modifications in PF-4, as discussed in Section 2.1.1.2.2, to support dilution activities under this sub-alternative. The risk of an LCF to an individual construction worker would be low (0.002 or 2 chances in one thousand). The estimated number of LCFs in the exposed population of construction workers would be 0 (0.01 or 1 chance in a hundred).

During operations under the All LANL Sub-Alternative workers the worker dose rates for PDP and NPMP, dilution, and C&P activities are 0.45, 0.66, and 0.28 rem/year, respectively, for an involved worker under each of the activities. The highest risk of LCF to an individual worker would be from dilution, but the estimated risk is still low (0.007 or 7 chances in one thousand of an LCF). The estimated number of LCFs for the entire exposed worker population from the All LANL Sub-Alternative over the life of the project would be 2 (1.8), for the full project duration.

The public (MEI and population) would also be exposed to radiation from the All LANL Sub-Alternative. The estimated total risk to the MEI would be very low (6×10^{-8} or 6 chances in a hundred million). The estimated number of LCFs in the exposed population within a 50 mi radius would be 0 (0.0002 or two chances in ten thousand) for the entire duration of operations.

<u>No Action Alternative</u>

No construction or modification activities at LANL would be associated with NPMP of up to 7.1 MT. Thus, there would be no exposure or risk of LCF associated with construction or modification at LANL under the No Action Alternative.

The estimated risk of LCF to a worker would occur from NPMP at a radiation dose of 0.45 rem/yr and would be low (0.005 or 5 chances in one thousand). The estimated number of LCFs for involved workers during the full duration of NPMP operations in the exposed worker population from NPMP was estimated to be 0 (0.46 or less than 1 chance in two). There are fewer exposed workers, but the exposure occurs over a slightly longer period of time at the reduced processing rate of 0.4 MT/yr. The radiological exposure to the public from NPMP operations was also scaled for the current assessment of processing a total of 7.1 MT of non-pit surplus plutonium. The estimated risk of LCF to the public MEI would be very low (8×10^{-9} or 8 chances in one billion). The estimated number of LCFs for the exposed population within a 50 mi radius would be 0 (0.00003 or 3 chances in one hundred thousand) for the entire duration of operations (process durations are shown in Appendix B, Table B-2).

4.1.2.7.2 Facility Radiological Accidents

This section presents the potential radiological consequences of activities at LANL associated with both the Preferred Alternative and the No Action Alternative. The postulated accidents selected for this SPDP EIS and the analysis assumptions are those used in LANL TA55-DSA-2021-R0, *TA-55 Documented Safety Analysis* (LANL 2021c), augmented to reflect proposed capabilities or facilities as appropriate (e.g., characterization and packaging facilities). Details about the assumptions and methods used to evaluate the impacts on human health from postulated accidents are summarized in Appendix D of this SPDP EIS. Appendix D of this SPDP EIS also provides the following information:

- Version 4.2 of the MELCOR Accident Consequence Code System was used to evaluate the impacts on the MEI, offsite population, and onsite noninvolved worker from postulated accidents.
- The 50-mi population distributions were projected to the year 2040, which was selected as a representative year for full-scale operations and overestimates the average population size during the project.
- A discussion of the meteorological data that was used for the analysis.
- Inhalation dose coefficients from Federal Guidance Report (FGR) 13 were used instead of those from FGR 11 (EPA 2002; EPA 1988).
- Isotopic information for pit and/or non-pit material (LANL 2023a).

Accident frequencies are grouped into the bins of “anticipated,” “unlikely,” “extremely unlikely,” and “beyond extremely unlikely,” with estimated annual frequencies (DOE 2014a).

Accident Frequencies

Frequency Bin	Estimated Probability Per Year
Anticipated	Is greater than 1×10^{-2}
Unlikely	Is between 1×10^{-2} and 1×10^{-4}
Extremely Unlikely	Is between 1×10^{-4} and 1×10^{-6}
Beyond Extremely Unlikely	Is less than or equal to 1×10^{-6}

The accident descriptions are those used in the LANL TA-55 DSA (LANL 2021c), augmented to reflect new systems or facilities, and SPDP material at risk (MAR). Each of the facilities in which plutonium disposition activities would occur has been (or would be) designed and operated to reduce the likelihood or consequence of these accidents. Documented safety analyses (DSAs) have been prepared for a number of the facilities evaluated in this EIS. Consistent with their purpose, source terms and other assumptions used for bounding DSA frequency and consequence estimates are conservative and safety controls were developed based on these assumptions. For these EIS analyses, consistent, conservative, but not overly bounding, assumptions were used across facilities and sites so that fair comparisons could be made of accident risks between alternatives. However, in all cases, sufficient safety controls (10 CFR Part 830) would be in place so that significant accidental releases are eliminated, reduced in frequency, mitigated to reduce the consequences by implementing a combination of preventive or mitigative measures. If safety controls are fully credited, then the consequences of an accident would likely be much less than those reported in this SPDP EIS.

For each postulated accident, impacts are estimated for three receptors: a noninvolved worker, an MEI, and the offsite population. The population distribution was derived using the same base census data as used in the 2015 SPD SEIS (DOE 2015c) but projecting to the year 2040 (USCB 2021d). Consequences for these receptors were estimated without regard for emergency response measures (e.g., evacuation, sheltering). In addition, none of the released radionuclides were assumed to have been removed from the plume by deposition. Thus, the reported consequences are conservative. That is, they are likely higher than those that might actually occur if an accidental release happened. Doses were estimated for postulated accidents occurring within the TA-55 boundary at LANL.

The consequences for workers directly involved in the processes under consideration are not quantified. The uncertainties involved in quantifying accident consequences for an involved worker are quite large because of the high sensitivity of results to assumptions (e.g., plume dispersion within a short distance). No major consequences for the involved worker are expected from leaks, spills, or smaller fires because involved workers should be able to evacuate immediately or be unaffected by the events. Explosions could result in immediate injuries from flying debris, as well as the uptake of radioactive materials. If a criticality occurred, workers in the immediate vicinity could receive high to fatal radiation exposures from the initial burst. The dose would depend on the magnitude of the criticality, the worker's distance from the criticality, and the amount of shielding provided by intervening structures and equipment. Severe earthquakes (beyond the facility design basis) could also have substantial consequences, ranging from workers being killed by debris from collapsing structures to high radiation doses from the uptake of radionuclides.

The following discussion presents the consequences of the bounding accidents resulting from operational and natural phenomena-related accidents for both alternatives. For this evaluation, the bounding natural phenomena event analyzed was a design-basis earthquake. Because of their extremely low probability, events designated as "Beyond-Extremely-Unlikely" are not described in the following sections but are included in Appendix D.

Impacts are presented in terms of the number of LCFs for offsite population and LCF risk for the noninvolved worker and MEI, based on the projected radiological doses. Impacts are provided for all the locations where plutonium disposition activities would occur for each of the three receptors (noninvolved worker, MEI, and offsite population). The potential consequences of the bounding postulated operational and natural phenomena-caused accidents and external events at LANL under the Preferred Alternative and No Action Alternative are presented in Table 4-7 for the three receptors.

Preferred Alternative

The radiological accident impacts of the Preferred Alternative at LANL during operations are described below.

Base Approach Alternative and SRS NPMP Sub-Alternative

The Base Approach Alternative includes facility accidents associated with PDP and NPMP in the PF-4 Building in TA-55. The SRS NPMP Sub-Alternative includes only facility accidents associated with PDP in the PF-4 Building in TA-55 at LANL. An LCF risk of less than 1 is expected for an individual receptor and less than 1 LCF for the general population for analyzed design-basis accidents resulting in an environmental release under this option.

Table 4-7. Bounding Radiological Accident Impacts at LANL During Facility Operations for the Preferred and No Action Alternatives

Receptor	Bounding Operational and Natural Event Scenarios[a]	Preferred Alternative[b] Base Approach Sub-Alternative		Preferred Alternative[b] SRS NPMP Sub-Alternatives		Preferred Alternative[b] All LANL Sub-Alternative		No Action Alternative[b]	
		Dose (rem or person-rem)	LCF[c][d]	Dose (rem or person-rem)	LCF[c][d]	Dose (rem or person-rem)	LCF[c][d]	Dose (rem or person-rem)	LCF[c][d]
Noninvolved Worker (rem and LCF risk)	Operational	80	1×10^{-1}	27	3×10^{-2}	80	1×10^{-1}	80	1×10^{-1}
	NPH/External	71	8×10^{-2}	51	6×10^{-2}	71	8×10^{-2}	30	4×10^{-2}
MEI (rem and LCF risk)	Operational	7.5	4×10^{-3}	2.5	2×10^{-3}	7.5	4×10^{-3}	7.5	4×10^{-3}
	NPH/External	6.6	4×10^{-3}	4.8	3×10^{-3}	6.6	4×10^{-3}	2.8	2×10^{-3}
Population[e][f] (person-rem and number of LCFs)	Operational	$3.8\times10^{+2}$	0 (2×10^{-1})	$1.3\times10^{+2}$	0 (8×10^{-2})	$3.8\times10^{+2}$	0 (2×10^{-1})	$3.8\times10^{+2}$	0 (2×10^{-1})
	NPH/External	$3.4\times10^{+2}$	0 (2×10^{-1})	$2.4\times10^{+2}$	0 (1×10^{-1})	$3.4\times10^{+2}$	0 (2×10^{-1})	$1.4\times10^{+2}$	0 (9×10^{-2})

LANL = Los Alamos National Laboratory; LCF = latent cancer fatality; MEI = maximally exposed individual; NNSA = National Nuclear Security Administration; NPH = Natural Phenomena Hazard (i.e., earthquake); NPMP = non-pit metal processing; SRS= Savannah River Site.

(a) Accident scenarios are consistent with DOE 2015c.

(b) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.

(c) The LCF is calculated by using a risk estimator of 0.0006 fatal cancers per rem or person-rem. For estimated individual doses equal to or greater than 20 rem, the risk estimated was doubled. The estimated risk is NOT doubled for population doses. NNSA considers LCFs <0.5 to be 0. The rounded LCF value is provided, followed by the calculated value in parentheses.

(d) The MEI and the noninvolved worker scenarios each assume 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. Thus, the value represents the risk of an LCF in an individual and the number of LCFs in an exposed population.

(e) Impacts on the populations within a 50 mi radius of the postulated release site.

(f) Population doses are presented as person-rem.

Note: Numbers are rounded to two significant digits.

Sources: See methodology and sources described in Appendix D and values in Tables D-3, D-5, D-7, and D-9.

All LANL Sub-Alternative

The All LANL Sub-Alternative includes all facility accidents associated with PDP, NPMP, dilution, and C&P operations being performed at LANL. An LCF risk of less than 1 is expected for an individual receptor and less than 1 LCF for the general population for analyzed design-basis accidents resulting in an environmental release under this option.

No Action Alternative

Facility accidents associated with NPMP of up to 7.1 MT of non-pit surplus plutonium in PF-4 in TA-55 were considered for the No Action Alternative. An LCF risk of less than 1 is expected for an individual receptor and less than 1 LCF for the general population for analyzed design-basis accidents resulting in an environmental release under this option.

4.1.2.7.3 Chemical Usage and Facility Accidents

This section presents the potential consequences of chemical usage and chemical accidents from construction and facility operations under the Preferred and No Action Alternatives. Small quantities of chemicals used during operation would be stored at PF-4 in TA-55, and no bulk quantities would be needed to support the surplus plutonium disposition activities. The hazards associated with these chemicals are well understood and because of their small quantities (far below the threshold quantities set by EPA [40 CFR 68.130]), they can be managed using standard hazardous material and/or chemical handling programs (DOE 2015c). Chemical exposure to workers during pit disassembly can vary as a result of the composition of pit types, and there is a potential for exposure to beryllium. LANL monitors for beryllium (LANL 2023a) and is required to follow the regulations laid out in 10 CFR 850, "Chronic Beryllium Disease Prevention Program." Additional information on the beryllium program is found in Table 5-1.

Under alternatives with construction activities, larger amounts of chemicals such as diesel fuel and lubricants for construction equipment would be expected (LANL 2023a). Hazards associated with these chemicals are well known and are standard hazards with the construction industry. For the All LANL Sub-Alternative, although large quantities of adulterant would be needed, it consists of nonhazardous inorganic materials (NNSA 2022).

Accidents related to construction and operations involving hazardous chemicals would primarily present a risk to the involved worker in the immediate vicinity of the accident. DOE safety programs are in place to minimize the risks to workers from both routine operations and accidents involving these materials.

Because of the small quantities of hazardous chemicals at risk and the distance to the site boundary from facilities that support the disposition of surplus plutonium, hazardous chemicals would pose minimal hazards to public health in an accident.

4.1.2.7.4 Intentional Destructive Acts

NNSA has prepared a classified analysis of the potential impacts of intentional destructive acts as part of this SPDP EIS. Substantive details of intentional destructive act scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by enemies to plan attacks.

DOE's strategy for the mitigation of environmental impacts resulting from intentional destructive acts has three distinct components: 1) prevent or deter successful attacks, 2) plan and provide timely and adequate response to emergency situations, and 3) progress to recovery through long-term response in the form of monitoring, remediation, and support for affected communities and their environments.

Although NNSA believes that the security force and systems of security controls would prevent a successful intentional destructive act, the classified analyses of such an act consider the potential impacts of a successful attack on facilities and during transportation. Depending on the intentional destructive act, impacts could be similar to or exceed the impacts of other accidents analyzed in this SPDP EIS. Classified analyses of intentional destructive acts related to plutonium operations at LANL and transportation were presented in a classified analysis of the 2015 SPD SEIS (DOE 2015c); the LANL information in that analysis originated from the classified analysis for the 2008 *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (DOE 2008a). Information from those prior analyses and analyses specific to the alternatives evaluated in this SPDP EIS are included in the classified analysis for this SPDP EIS. The classified analysis presents calculated consequences for the noninvolved worker, MEI, and offsite population in terms of physical injuries, radiation doses, and LCFs.

4.1.2.8 LANL Cultural and Paleontological Resources

Impacts on cultural resources (i.e., archaeological resources, historic-era buildings, and TCPs) and paleontological resources, can occur as a result of ground-disturbing activities and building alterations. Furthermore, viewsheds associated with TCPs could be indirectly affected by the introduction of visual alterations to the surrounding environment. This section presents the anticipated impacts of the Preferred and No Action Alternatives on the potentially affected cultural resources at LANL.

In addition to the NEPA analysis presented here, LANL would also address impacts through NHPA Section 106 consultation with the SHPO, Tribes, and interested groups as appropriate, or as specified in PAs (see Section 5.0).

Impacts from constructions for the Preferred and No Action Alternatives and the sub-alternatives are discussed in the sections below. However, no impacts on cultural resources are expected from operations because there would be no ground-disturbing activities and no building modifications to NRHP-eligible historic properties. As operations proceed, cultural resources staff would review activities that have the potential to affect cultural resources through the Laboratory's Integrated Review Tool program and would monitor resources that are vulnerable (LANL 2017a; LANL 2023a|Section 2.3.3|). Thus, impacts from operations are not discussed further.

Important paleontological resources are not known to occur within the project area in TA-55 and are rarely found on the LANL site, as discussed in Section 3.2.7. Most ground-disturbing activities for the Preferred and No Action Alternatives would occur on previously disturbed soil. Therefore, no impacts on paleontological resources from construction and operation at LANL are expected, and this subject is not discussed further.

4.1.2.8.1 Preferred Alternative

The impacts from construction on cultural resources for each of the sub-alternatives for the Preferred Alternative are described below.

Base Approach Sub-Alternative and SRS NPMP Sub-Alternative

Archaeological Resources and Historic-Era Buildings and Structures

All ground-disturbing activities have the potential to affect archaeological resources and historic-era buildings and structures. The proposed siting for the office building, warehouse, and associated parking areas in TA-52 area have been surveyed for cultural resources. A survey has been completed in accordance with U.S. Department of the Interior standards (36 CFR Part 61). Several archaeological sites are located adjacent to and downslope from the proposed construction areas, including an archaeological site that has already been determined to be eligible for listing in the NRHP, with concurrence by the New Mexico State Historic Preservation Officer (LANL 2023a|Section 2.3.1|). The remaining archaeological sites have not been evaluated for eligibility for listing in the National Register. While outside of potential construction areas, impacts on archaeological sites are possible from stormwater and soil erosion as a result of the creation of nonpermeable surfaces by the proposed facilities in TA-52 (LANL 2023a|Section 2.3.1|). If potentially impacted, the archaeological sites of undetermined eligibility status, would be evaluated for eligibility and submitted to the New Mexico SHPO for concurrence (LANL 2023a|Section 2.3.1|). Potential impacts to NRHP eligible sites from construction activities in TA-52 will be addressed in accordance with the Section 106 process and addressed in accordance with the CRMP and PA. If construction would have an adverse effect, then "consultation with the New Mexico SHPO and culturally affiliated Tribes would be required to develop a strategy to address these potential impacts before construction can begin" (LANL 2023a|Section 2.3.1|).

Demolition and alteration of buildings (interior or exterior) would potentially affect historic-era buildings and structures. This includes PF-4 in TA-55, which has been evaluated and is awaiting recommendations to determine if it is eligible for listing in the NRHP. TA-55 has other historic buildings that are potentially eligible for listing in the NRHP. As discussed in Section 3.2.8, the evaluation report and recommendation for eligibility to the NRHP were submitted by DOE/NNSA to the New Mexico State Historic Preservation Office in 2023 for final determination of historic eligibility (LANL 2023a|Section 2.3.1|).

In addition to the footprint for new construction and areas set aside for modification activities, additional ground disturbance may occur if additional infrastructure is needed such as power, water, sewer, or other. Before construction begins, and per the CRMP and PA, cultural resources staff would review activities that have the potential to affect cultural resources through the Laboratory's Integrated Review Tool program and monitor resources that are vulnerable (LANL 2023a|Section 2.3.3|; LANL 2017a). For this reason, no impacts are expected for archaeological resources.

Traditional Cultural Properties

Potential visual impacts to TCPs near TA-52 may occur when looking westward from the Pueblo de San Ildefonso. The NHPA Section 106 process as defined in the PA, including consultation with Tribes, would be completed by DOE/NNSA Los Alamos Field Office (LANL 2023a|Section 2.3.1|). This consultation will provide the opportunity to discuss potential impacts to the TCP viewshed.

All LANL Sub-Alternative

The All LANL Sub-Alternative is similar to the Base Approach Sub-Alternative, but the All LANL Sub-Alternative includes construction of the DHF located in TA-55 near the PF-4 building. Ground-disturbing construction and building demolition and alteration activities for the All LANL Sub-Alternative are similar to those discussed above, so the same considerations and potential impacts apply for archaeological resource and historic buildings and structures. Construction would be within developed areas so no known impacts on TCPs are expected.

4.1.2.8.2 No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur using the same equipment in PF-4 that is used for PDP; thus, no construction or modification activities at LANL would occur. Therefore, there would be no impacts on cultural resources.

4.1.2.9 LANL Socioeconomics

Socioeconomic impacts result from the direct employment of construction and operations workers and the impacts of any resultant population changes on local housing resources or vehicular traffic conditions in the LANL ROI. As described in Section 3.2.9, the LANL ROI consists of the seven-county area including Los Alamos, Rio Arriba, Sandoval, Santa Fe, Taos, San Miguel, and Mora Counties in New Mexico.

Table 4-8 and Table 4-9 provide summaries of the socioeconomic impacts anticipated at LANL under the Preferred Alternative and No Action Alternatives for construction impacts and operation impacts, respectively. Detailed economic impacts by capability are presented in Tables C-7 and C-8 in Appendix C. The total economic impacts reported are the sum of direct, indirect, and induced economic impacts. Employment impacts are reported as the number of full- or part-time jobs. Earnings impacts include the wages, salaries, and benefits paid to workers. Output impacts are the effects of the combination of all economic activity occurring in the local ROI economy.

The activities considered under each alternative as described in Section 2.1.1.2.2, would occur over multiple years in the future. Staffing and expenditures would vary by year of activity. To bound the analysis, NNSA selected the year to model for impacts in which staffing and expenditures would be highest. The impacts reported represent maximum annual impacts anticipated for any single year. During most project years, impacts would be lower.

Table 4-8. Peak-Year Economic Impacts at LANL During Construction/Modification for the Preferred and No Action Alternatives

Impact Indicator (Units)	Preferred Alternative[(a)] Base Approach and SRS NPMP Sub-Alternatives[(b)]	Preferred Alternative[(a)] All LANL Sub-Alternative	No Action Alternative[(a)]
Direct Employment (FTE in peak year)	116	139	(c)
Total ROI Employment (Jobs in peak year)	221	263	(c)
Direct Earnings ($Million in peak year)	19.4	23.2	(c)
Total ROI Earnings ($Million in peak year)	23.6	28.2	(c)
Direct Output ($Million in peak year)	20.3	24.2	(c)

Impact Indicator (Units)	Preferred Alternative[(a)] Base Approach and SRS NPMP Sub-Alternatives[(b)]	Preferred Alternative[(a)] All LANL Sub-Alternative	No Action Alternative[(a)]
Total ROI Output ($Million in peak year)	36.3	43.3	(c)

FTE = full-time equivalent (employee); LANL = Los Alamos National Laboratory; NPMP = non-pit metal processing; ROI = region of influence; SRS= Savannah River Site.
(a) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.
(b) The construction/modification impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.
(c) No construction/modification activities are anticipated for the No Action Alternative.
Source: Calculated from LANL 2023a|derived from Table 2-27|.

Table 4-9. Peak-Year Economic Impacts at LANL During Operations for the Preferred and No Action Alternatives

Impact Indicator (Units)	Preferred Alternative[(a)] Base Approach and SRS NPMP Sub-Alternatives[(b)]	Preferred Alternative[(a)] All LANL Sub-Alternative	No Action Alternative[(a)]
Direct Employment (FTE in peak year)[(c)]	395[(d)]	549[(d)]	147[(d)]
Total ROI Employment (Jobs in peak year)	1,301	1,794	376
Direct Earnings ($Million in peak year)	458.1	513.7	83.6
Total ROI Earnings ($Million in peak year)	627.3	703.1	114.2
Direct Output ($Million in peak year)	1,276.5	1,428.8	228.9
Total ROI Output ($Million in peak year)	1,851.3	2,072.7	332.9

FTE = full-time equivalent (employee); LANL = Los Alamos National Laboratory; NPMP = non-pit metal processing; ROI = region of influence; SRS= Savannah River Site.
(a) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.
(b) The operations impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.
(c) The variation in the number of staff anticipated at each site (LANL or SRS) for equivalent processing activities varies based on the equipment that would be used at each site for processing activities.
(d) Direct employment staffing levels for operations activities for the Base Approach and SRS NPMP Sub-Alternatives were obtained from Table 1-3, project total staffing for Year 26. Staffing for the All LANL Sub-Alternative includes the staffing for dilution (114 staff for maximum year) and 40 staff for C&P activities, obtained from Table 1-4. Staffing for the No Action Alternative was obtained from Table 1-3 for Year 4 with a throughput of 400 kg/yr and totals 147 staff members (LANL 2023a).
Source: Calculated from LANL 2023a|derived from Sections 1.4.1, 1.4.2|.

4.1.2.9.1 Regional Economic Characteristics

This section presents the regional economic impacts from the Preferred and No Action Alternatives at LANL. The impacts include the direct, indirect, and induced economic impacts that would result from project activities. Employment, labor income, and industry output metrics are discussed in this section. As project-related direct expenditures are made in the ROI, these dollars begin to circulate in the economy. As funds are expended to pay employees and to buy goods and services, the recipients then make purchases, causing successive rounds of local spending, until the original expenditures eventually exit the ROI. Economic multipliers are estimated to capture the effects of these rounds of spending that occur within the ROI (see Section 3.2.9). Economic impacts in the LANL ROI were estimated using the IMPLAN model (IMPLAN 2021) to capture the indirect and induced impacts resulting from the direct peak-year activities occurring at the site. For each sub-alternative, the effects of direct labor and non-labor expenditures were modeled, and the total effects of the direct employment and material expenditures were estimated.

Preferred Alternative

The socioeconomic impacts from the Preferred Alternative at LANL relative to construction and operations are described below for each sub-alternative.

Base Approach and SRS NPMP Sub-Alternatives

The economic impacts of construction activities for the Base Approach and SRS NPMP Sub-Alternatives include the staffing and expenditures required for new facilities and modifications to existing facilities. At the peak of construction activities, the economic impacts would be minor in the context of the ROI economy, with 116 direct construction jobs created (LANL 2023a|derived from Section 2.14|). This would create a total employment impact of 221 jobs in the ROI, which would amount to only a minor impact, and the related impacts on labor income and output also would be minor.

The economic impacts from operations under the Base Approach and SRS NPMP Sub-Alternatives, would be similar (LANL 2023a|Section 1.4.1|). At the peak of operations, when project employment and expenditures are highest, 395 operations workers would be employed. Labor expenditures and non-labor costs, including materials costs are shown in Table 4-9. These direct impacts translate to a total impact of 1,301 jobs in the ROI and over $1.8 billion in total industry output. The total employment impact of 1,301 jobs represents approximately 0.7 percent of the current ROI workforce of 196,129 and would be projected to represent a smaller proportion of the future ROI workforce. These impacts would be minor in the context of the ROI economy.

All LANL Sub-Alternative

The economic impacts of the All LANL Sub-Alternative include the staffing and expenditures required for new facilities and modifications to existing facilities. At the peak of these construction activities the economic impacts would be minor in the context of the ROI economy. This would create a total employment impact of nearly 200 jobs in the ROI, which would amount to only a minor impact, and the related impacts on labor income and output would be minor.

At the peak of operations, when project employment and expenditures are highest, about 549 operations workers would be employed (LANL 2023a|Sections 1.4.1, 1.4.2|). Labor expenditures and non-labor costs, including materials costs are shown in Table 4-9. These direct impacts translate to a total impact of 1,794 jobs in the ROI and nearly $2.1 billion in total industry output. The direct labor income impact would result in a total income impact of over $703 million in the ROI. The total employment impact of 1,794 jobs represents 0.9 percent of the ROI workforce and would be projected to represent a smaller proportion of the future ROI workforce. These impacts would be minor in the context of the ROI economy.

No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur in PF-4 using existing equipment, thus no construction activities at LANL would occur. There would be no regional economic impacts associated with construction at LANL under the No Action Alternative.

The 147 workers required during peak operation activities (LANL 2023a|Section 1.4.1|) reflect a 1.0 percent increase over the staff population of 14,283 in 2023 (Section 3.2.9). The direct labor income impact would result in a total income impact of $332.9 million in the ROI.

4.1.2.9.2 Population and Housing

As a result of the economic activity generated by project-related expenditures, workers may relocate to the ROI. In some cases, workers may have families that also would relocate. Relocating workers and families would require available housing resources.

Preferred Alternative

The population- and housing-related socioeconomic impacts of the Preferred Alternative at LANL relative to construction and operations are described in this section for each sub-alternative.

As discussed previously, only minor numbers of construction workers are anticipated for the sub-alternatives in the Preferred Alternative. LANL construction activities are not likely to result in new workers relocating to the ROI. Thus, no population changes or impacts on housing availability would be expected under any of the sub-alternatives.

Base Approach and SRS NPMP Sub-Alternatives

As discussed previously, the peak-year aggregate impact of operation activities would result in 1,301 jobs in the ROI during that year, which represents about 0.7 percent of the current ROI workforce of 196,129. Expected future ROI workforce growth would reduce this percentage. Some portion of LANL operations workers would be expected to relocate to the ROI from other parts of the country, and some ROI jobs created by expenditure impacts at LANL may also involve workers relocating from other areas. Relocating workers would settle in all counties of the ROI, likely in proportion to the current LANL workforce residence pattern. Thus, 43.5 percent of the relocating workers (as many as 566) would be expected to settle in Los Alamos County, splitting between Los Alamos or White Rock. Current housing statistics reported in Section 3.2.9 suggest that the ROI and Los Alamos County, specifically, have unmet housing needs, and this influx may further tighten the housing market and increase the unmet housing need.

All LANL Sub-Alternative

The peak-year aggregate impact of operation activities would result in 1,794 jobs in the ROI that year, which represent about 0.9 percent of the current ROI workforce of 196,129. Expected future workforce growth would reduce this percentage. Some portion of LANL operations workers would be expected to relocate to the ROI from other parts of the country, and some ROI jobs created by expenditure impacts at LANL may also involve workers relocating from other areas. Relocating workers would settle in all counties of the ROI, likely in proportion to the current LANL workforce residence pattern. Thus, 43.5 percent of the relocating workers (as many as 780) would be expected to settle in Los Alamos County, splitting between Los Alamos or White Rock. Current housing statistics reported in Section 3.2.9

suggest that although the current housing market in the ROI is tightening in general (discussed further under cumulative impacts in Section 4.2.3.1.4), the ROI and Los Alamos County, specifically, have unmet housing needs and this influx may further tighten the housing market and increase the unmet housing need.

No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur in PF-4 using existing equipment; thus, no construction activities at LANL would occur. There would be no population and housing-related impacts associated with construction at LANL under the No Action Alternative.

The peak-year aggregate impact of operation activities would result in 376 jobs, which represent about 0.2 percent of the current ROI workforce of 196,129. These numbers would be minimal in relation to the anticipated future workforce in the ROI. Thus, related population and housing impacts are not expected.

4.1.2.9.3 Traffic

As a result of the increases in direct employment at LANL, traffic on local public roads would be expected to increase. Given the small relative increases in employment expected, when compared to the ROI total workforce, traffic impacts throughout the ROI generally would be minimal but traffic on local public roads accessing LANL would be expected to increase.

Pajarito Road is the principal roadway on the LANL site used for accessing TA-55 and related areas. The annual average daily traffic for weekday trips anywhere along the length of Pajarito Road between State Route 4 in White Rock and Diamond Drive was 10,771 in 2022.

Preferred Alternative

The traffic-related socioeconomic impacts of the Preferred Alternative at LANL relative to construction and operations are described below for each approach and sub-alternative.

Base Approach and SRS NPMP Sub-Alternatives

Traffic impacts at LANL would be tied to increased staffing levels and expected periodic construction-related deliveries. The total direct staffing impact at LANL would be up to 116 new construction workers, which could lead to as many as 232 additional trips made on Pajarito Road when accessing the construction areas during the peak year of activity or a 2.2 percent increase in traffic on that route. Some increase in periodic construction vehicle traffic also would be expected during the peak of construction activity. The current LOS value of this route is not known, but it likely would not be affected by this minor increase in traffic. Together, the various construction options would create a total employment impact of 221 jobs in the ROI, which amount to only a minor impact, and the related impacts on labor income and output would be minor. The related traffic impacts within the ROI would be negligible.

The addition of 395 jobs on the site in the peak year, would result in a maximum of 790 additional trips per day, or a 7.3 percent increase in traffic on Pajarito Road, given 2022 traffic volumes. The current LOS value of this route is not known, but there likely would be a small impact on the LOS from this small increase in traffic. Outside of the LANL site, additional trips expected as a result of the total employment impacts of 1,301 new jobs would be dispersed on the various routes available and would represent only a minimal traffic or LOS impact in the ROI.

<u>All LANL Sub-Alternative</u>

Traffic impacts at LANL would be slightly higher than for the Base Approach Sub-Alternative. The current LOS value of this route is not known, but it likely would not be affected by this minor increase in traffic. Together, the various construction options would create a total employment impact of about 263 jobs in the ROI, which amount to only a minor impact, and the related traffic impacts within the ROI would be negligible.

The addition of 549 jobs on the site in the peak year during operational activities would result in a maximum of 1,098 additional trips per day, or a 10.2 percent increase in traffic on Pajarito Road, given 2022 traffic volumes. The current LOS value of this route is not known, but there likely would be a small impact on the LOS from this small increase in traffic. Outside of the LANL site, additional trips expected as a result of the total employment impacts of 1,794 new jobs would be dispersed on the various routes available and would represent a small traffic or LOS impact.

No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur in PF-4 using existing equipment, so no construction activities at LANL would occur. There would be no traffic-related socioeconomic impacts associated with construction at LANL under the No Action Alternative.

The addition of 147 peak-year jobs during operational activities would result in a maximum of 294 additional trips per day, which would be dispersed among several potential access routes or a 2.4 percent increase in traffic on Pajarito Road, given 2022 traffic volumes. The current LOS value of this route is not known, but there likely would be a small impact on the LOS from this small increase in traffic. Outside of the LANL site, additional trips expected as a result of the total employment impacts of 376 new jobs would be dispersed on the various routes available and would represent a small traffic or LOS impact.

4.1.2.10 LANL Infrastructure

This section presents the anticipated infrastructure demand for electricity, fuel, water, and sewage treatment during construction and operation activities for each alternative at LANL, as well as the percentage of the available capacity represented by that demand. Water use and sewage generation rates are shown in the tables, but a more detailed discussion of both is found in Section 4.1.2.3. Utilities and fuels that have no appreciable usage are not presented. Heating oil, gasoline, or steam would not be required for construction or for operations, and natural gas needs would be minimal (LANL 2023a|Section 2.7.1.1|) and are not discussed further. Construction of additional onsite transportation infrastructure is not needed to support the Preferred or No Action Alternatives and, therefore, is not discussed further. Intra-site transportation infrastructure requirements to transport job control waste would be minor. Traffic impacts on routes to the LANL site are presented in Section 4.1.2.9.3 and impacts related to transportation of radioactive and construction materials are presented in Section 4.1.6.3.

Table 4-10 and Table 4-11 present the anticipated impacts of utility and fuel usage at LANL for construction and operations, respectively, for the Preferred and No Action Alternatives. Detailed infrastructure impacts by capability are presented in Table C-9 and C-10 in Appendix C.

Table 4-10. Infrastructure Impacts at LANL During Construction/Modification for the Preferred and No Action Alternatives (with percent of available capacity)

Impact Indicator (Units)	Preferred Alternative[a] Base Approach and SRS NPMP Sub-Alternatives[b]	Preferred Alternative[a] All LANL Sub-Alternative	No Action Alternative[a]	Available Capacity
Electricity Use (MWh/yr)	160 (<1)	160 (<1)	(c)	720,000
Electricity Peak Load (MW)	0.02 (<1)	0.02 (<1)	(c)	60
Fuel Use (gal/yr)[d]	54,000 (NA)	69,000 (NA)	(c)	NA
Water Use (million gal/yr)	2.6[e] (<1)	2.6[e] (<1)	(c)	270
Sewage Generation (million gal/yr)	0.055 (<1)	0.055 (<1)	(c)	96

LANL = Los Alamos National Laboratory; NA = not applicable; NPMP = non-pit metal processing; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.

(b) The construction/modification impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.

(c) No construction/modification activities are anticipated at LANL for the No Action Alternative.

(d) Diesel fuel is only used for construction activities and is delivered as needed.

(e) The most conservative water requirements for the Preferred Alternative is the water usage for the construction activities in Year 5, which is 2.6 million gal (LANL 2023a|Section 2.16.1.1|). This amount bounds the total water needs for construction for all of the sub-alternatives. Thus, the water needs for the construction of the Drum Handling Facility for the All LANL Sub-Alternative are bounded by those of the Base Approach Sub-Alternative.

Notes: Numbers are rounded to two significant digits. Parenthetical values are percent of available capacity.

Source: LANL 2023a.

Table 4-11. Infrastructure Impacts at LANL During Operations for the Preferred and No Action Alternatives (with percent of available capacity)

Impact Indicator (Units)	Preferred Alternative[a] Base Approach and SRS NPMP Sub-Alternatives[b]	Preferred Alternative[a] All LANL Sub-Alternative	No Action Alternative[a][c]	Available Capacity
Electricity Use (MWh/yr)	2,400 (<1)	3,100 (<1)	910 (<1)	720,000
Electricity Peak Load (MW)	0.39 (<1)	0.53 (<1)	0.10 (<1)	60
Fuel Use (gal/yr)[d]	0 (NA)	0 (NA)	0 (NA)	NA
Water Use (million gal/yr)	1.7 (<1)	2.5 (<1)	0.61 (<1)	270
Sewage Generation (million gal/yr)	1.7 (1.7)	2.5 (2.6)	0.61 (<1)	96

LANL = Los Alamos National Laboratory; NA = not applicable; NPMP = non-pit metal processing; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.

(b) The operations impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.

(c) For the No Action Alternative, operations at LANL for processing up to 7.1 MT of non-pit surplus plutonium would be within the scope of current and ongoing operations, so no changes to infrastructures are anticipated. The Base Approach Sub-Alternative assumes 395 workers, whereas the No Action Alternative assumes 147 workers (see Table 4-9). The differences would be at most 37 percent (147/395) of those identified for operations under the Base Approach and SRS NPMP Sub-Alternatives.

(d) No diesel or other types of fuel use are anticipated during operations other than for transportation as discussed in Section 4.1.6 (LANL 2023a|Section 2.7.2|)

Notes: Numbers are rounded to two significant digits. Parenthetical values are percent of available capacity.

Sources: LANL 2023a; LANL 2013b.

4.1.2.10.1 Preferred Alternative

The infrastructure impacts from construction and operations for each of the sub-alternatives of the Preferred Alternative, are described below.

Base Approach Sub-Alternative and SRS NPMP Sub-Alternative

Electricity use during construction activities inside PF-4 would depend on electrical equipment and battery-powered hand tools and as a result would be minimal. No diesel fuel would be required for modifications inside PF-4. Diesel fuel would be required for construction equipment used outside PF-4 for construction of support facilities. Diesel fuel would be delivered to the site as needed, so there would be no limit on capacity (LANL 2023a|Section 2.7.1.1|).

Operations activities would require electrical use inside PF-4 similar to the electrical use estimated in the *Data Call to Support the Surplus Plutonium Disposition Supplemental EIS* (LANL 2013b). Electricity consumption activities outside PF-4 includes operations of the LSC, office building, and warehouse. Total electrical consumption for operations would result in a small increase in electricity demand. No diesel fuel would be needed for facility operations as no additional diesel generators are required (LANL 2023a|Sections 2.7.1.2, 2.7.2|).

All LANL Sub-Alternative

Total electricity required for construction and modification activities under the All LANL Sub-Alternative would be identical to those described previously under the Base Approach Sub-Alternative.

Total electricity consumption for operations activities would be similar to those of the Base Approach Sub-Alternative but would also include electricity needed for dilution and C&P operation activities. This would result in a small impact on available site capacity. No diesel fuel would be needed for facility operations as no additional diesel generators are required (LANL 2023a|Section 2.7.2).

4.1.2.10.2 No Action Alternative

NPMP of up to 7.1 MT of non-pit surplus plutonium would occur in PF-4 using existing equipment, so no construction or modification activities would occur. There would be no infrastructure-related impacts associated with construction or modification at LANL under the No Action Alternative.

An additional 147 staff would be required under the No Action Alternative, and as a result the amount of electricity, fuel, water, and sewage would at most be a fraction (37%) of that identified under the Base Approach Sub-Alternative, which assumed 395 workers, as shown in Table 4-11.

4.1.2.11 LANL Waste Management

This section presents the impacts on radioactive, hazardous, and nonhazardous waste management capabilities at the LANL site for the Preferred and No Action Alternatives. The waste management impacts related to construction and operation of capabilities are summarized in Table 4-12 and Table 4-13 for construction and operations, respectively. Waste management capacity at LANL is discussed in Section 4.1.2.11.3. Detailed waste management impacts by capability are presented in Tables C-11 and C-12 in Appendix C.

As discussed in Section 3.2.11, waste would be either disposed of at other DOE facilities or at commercial waste disposal facilities. This SPDP EIS does not consider potential environmental impacts related to the commercial waste disposal facilities identified in Section 3.2.11. The impacts from waste disposal at these facilities were considered as part of the licensing, permitting, and approval process for the disposal facilities. Impacts from disposal of TRU waste at the WIPP facility are discussed in Section 4.1.5. The potential environmental impacts related to disposal of LLW and MLLW at the NNSS are discussed in the *Final Site-Wide EIS for Continued Operation of the DOE/NNSA NNSS and Off-Site Locations in the State of Nevada* (DOE 2013a).

4.1.2.11.1 Preferred Alternative

The waste impacts from the Preferred Alternative at LANL relative to construction and operations are described below.

Base Approach and SRS NPMP Sub-Alternative

The construction activities for the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative are essentially the same. Modifications in uncontaminated areas would not generate radioactive waste although hazardous and nonhazardous waste would be generated. Radioactive waste would be generated during the decontamination and modification activities that would occur as part of updating and expanding the processing rooms in PF-4, as discussed in Section 2.1.1.2.2, to increase the capacity of pit disassembly and processing of 34 MT of plutonium (LANL 2023a).

The operational activities for the two sub-alternatives differ in that the NPMP is considered to occur at LANL for the Base Approach Sub-Alternative and at SRS for the SRS NPMP Sub-Alternative. However, for both sub-alternatives a full 34 MT of plutonium would be processed in PF-4. The amount of waste produced by the SRS NPMP Sub-Alternative would be somewhat less than the amount of waste produced by the Base Approach Sub-Alternative since the disassembly step for processing pit plutonium is not required for non-pit surplus plutonium.

Radioactive waste generated during PDP and NPMP activities includes CH-TRU waste that would be generated as job control waste during the construction and operation activities at LANL, as shown in Table 4-12. Job control waste includes CH-TRU waste such as gloves from gloveboxes, room trash, and waste from inside the gloveboxes (LANL 2023a|Section 2.12.1.2|), as well as LLW, MLLW, liquid LLW, and hazardous and nonhazardous waste. Liquid LLW would be treated at the RLWTF located in TA-50. The CH-TRU job control waste would be taken to the TWF in TA-63 and prepared for shipment to the WIPP facility (LANL 2023a|Section 1.7.2|).

The amount of liquid LLW that would be generated during PDP and NPMP operations (LANL 2023a|Section 2.12.1.2|) would be minimal compared to the annual site generation rate of 20 million L/yr (see Table 4-13). Currently, all LLW liquids are processed onsite at the RLWTF located in TA-50 (LANL 2013b|p. 20|).

Minimal amounts of universal waste (light bulbs) and TSCA waste (ballasts) would be generated during activities in PF-4. These wastes are stored onsite but are ultimately managed by offsite facilities (e.g., Clean Harbors, U.S. Ecology).

Table 4-12. Total Waste Generation at LANL During Construction/Modification for the Preferred and No Action Alternatives

Impact Indicator (Units)	Preferred Alternative[(a)] Base Approach and SRS NPMP Sub-Alternatives[(b)]	Preferred Alternative[(a)] All LANL Sub-Alternative	No Action Alternative[(a)]
CH-TRU Waste (job control waste) (m^3)	69	110	(c)
LLW (m^3)	360	560	(c)
MLLW (m^3)	4.8	7.4	(c)
Liquid LLW (L)	0	0	(c)
Solid Hazardous Waste (m^3)	2.4	3.1	(c)
Solid Nonhazardous Waste (m^3)	210	280	(c)

CH-TRU = contact-handled transuranic; LANL = Los Alamos National Laboratory; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NPMP = non-pit metal processing; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.

(b) The construction/modification impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.

(c) No construction/modification activities at LANL are anticipated for the No Action Alternative.

Note: Numbers are rounded to two significant digits.

Source: Calculated from LANL 2023a.

Table 4-13. Total Waste Generation at LANL During Operations for the Preferred and No Action Alternatives

Impact Indicator (Units)	Preferred Alternative[(a)] Base Approach and SRS NPMP Sub-Alternatives[(b)]	Preferred Alternative[(a)] All LANL Sub-Alternative	No Action Alternative[(a)]
CH-TRU Waste (diluted plutonium oxide) (m^3 and CCOs)	0	1,500 m^3 113,400 CCOs	0
CH-TRU Waste (job control waste) (m^3)	670	1,600	59
LLW (m^3)	3,200	17,000	280
MLLW (m^3)	42	89	3.7
Liquid LLW (L)	65,000	65,000	0
Solid Hazardous Waste (m^3)	6.6	6.8	0.7
Solid Nonhazardous Waste (m^3)	1,500	1,500	150

CCO = criticality control overpack (container); CH-TRU = contact-handled transuranic; LANL = Los Alamos National Laboratory; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NPMP = non-pit metal processing; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.

(b) The operations impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.

Note: Numbers except CCOs are rounded to two significant digits.

Source: Calculated from LANL 2023a.

All LANL Sub-Alternative

The construction activities for this sub-alternative support pit disassembly and processing, NPMP, as well as dilution and C&P. Construction estimates include construction of the DHF and are presented in Table 4-10.

In addition to the waste quantities discussed under the Base Approach Sub-Alternative, the All LANL Sub-Alternative includes wastes generated during the dilution and C&P activities. CH-TRU job control waste would be taken to the TWF for preparation for shipment to the WIPP facility. The diluted plutonium oxide CH-TRU waste would be characterized and packaged in the DHF and shipped to the WIPP facility from TA-55 (LANL 2023a|Section 1.8|). The dilution process would generate approximately 113,400 CCO containers (1,500 m^3) over the duration of the entire project that would be sent to the WIPP facility through the DHF (see Table 4-13). The shipment of this amount of CH-TRU waste would not affect the normal waste process systems at LANL, because it would be shipped through the DHF that would be built specifically to handle shipment of this quantity of waste from the dilution process (LANL 2023a|Sections 1.8, 2.12.2|).

4.1.2.11.2 No Action Alternative

There would be no construction activities at LANL associated with NPMP of up to 7.1 MT of non-pit surplus plutonium. Thus, there would be no waste management impacts associated with construction at LANL under the No Action Alternative.

Operations to process the 7.1 MT of non-pit surplus plutonium are within the scope of current and ongoing operations at LANL. The 7.1 MT of non-pit surplus plutonium oxidized at LANL is part of the 34 MT considered under the Base Approach Sub-Alternative and as a result the amount of waste produced, would be a fraction (approximately 21 percent) of that used for the Base Approach Sub-Alternative, as shown in Table 4-13. This estimate is bounding since the amount of waste that is generated during NPMP is less than the amount generated during PDP as discussed under the Base Approach Sub-Alternative.

4.1.2.11.3 Waste Management Capacity

Table 4-14 provides the total annual waste storage or treatment capacity as well as the site-wide annual waste-generation rates at LANL for each type of waste. Waste management capabilities at the LANL site are described in Section 3.2.11. Table 4-14 provides the percentage of the total site capacity that is generated during operations for each of the alternatives.

The quantity of diluted plutonium oxide CH-TRU waste is not included in Table 4-14 because the diluted plutonium oxide CH-TRU shipments would be processed through the DHF built specifically to handle these CH-TRU shipments under the All LANL Sub-Alternative.

It is assumed that all LLW and MLLW generated at the LANL site would be sent offsite for disposal at the NNSS or a commercial disposal facility such as EnergySolutions in Utah or Waste Control Specialists in Texas (LANL 2023a|Section 2.12.3|).

Table 4-14. Annual Waste-Generation Rates at LANL During Operations for the Preferred and No Action Alternatives as a Percentage of the Waste Management Facility Capacity

Impact Indicator	Total Annual Waste Storage or Treatment Capacity (m^3/yr)	Average Site-Wide Annual Waste Generation for years 2009 to 2021 (m^3/yr)	Onsite Treatment or Storage Location	Percent of Waste Management Facility Capacity for the Preferred Alternative[(a)(b)] Base Approach and SRS NPMP Sub-Alternatives (%)	Percent of Waste Management Facility Capacity for the Preferred Alternative[(a)(b)] All LANL Sub-Alternative (%)	Percent of Waste Management Facility Capacity for the No Action Alternative[(a)(b)] (%)
CH-TRU	620	170	TA-55 & TRU Waste Facility	4	13	0.7
LLW	6,200	7,900	PF-4 & TA-55	1.7	14	0.3
MLLW	3,400	340	PF-4 & TA-55	0.04	0.10	0.01
Liquid LLW	20,000,000[(c)]	5,000,000[(c)]	RLWTF	0.01	0.02	0
Solid Hazardous Waste	2,800	2,300	PF-4 & TA-55	0.02	0.02	0.002
Solid Nonhazardous waste	2,600	7,000	Offsite Disposal	2.2	2.2	0.45

CH-TRU = contact-handled transuranic; LANL = Los Alamos National Laboratory; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NPMP = non-pit metal processing; PF-4 = Plutonium Facility 4; RLWTF = Radioactive Liquid Waste Treatment Facility; SRS = Savannah River Site; TA = Technical Area; TRU = transuranic.

(a) A roadmap is provided in Table 4-1 in Section 4.1.2 to help orient readers to the activities that would occur at LANL for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative.

(b) Waste generations rates used are average annual rates of waste generation.

(c) Units for Liquid LLW are liters per year (L/yr) not cubic meters per year (m^3/yr).

Note: Numbers are rounded to one or two significant digits.

Sources: Calculated from LANL 2023a; DOE 2015c.

The quantities of all categories of projected waste generated during operations at LANL would represent small percentages of the currently authorized storage capacities and assumptions related to limited residence time for waste storage, and as such would be manageable under the current waste management system. These waste quantities would represent even smaller fractions of the available disposal capacity at NNSS or at commercial facilities authorized or licensed for LLW or MLLW disposal.

4.1.2.12 LANL Environmental Justice

Environmental justice impacts are those health or environmental effects determined to have disproportionately high and adverse impacts on racial or ethnic minority populations or low-income populations, compared to the general population. Estimates of entire populations and minority and low-income subsets of populations in the vicinity of LANL have been characterized and are presented in Section 3.2.12. Resource areas having a nexus to environmental justice populations in close proximity to the LANL site include human health and socioeconomics.

The analysis of radiological human health impacts in Section 4.1.2.7.1 shows that none of the alternatives being considered contribute to an appreciable risk to offsite populations of developing an LCF, as indicated in Table 4-6 for normal operations and Table 4-7 for postulated radiological accidents. Therefore, no disproportionally high and adverse human health impacts on racial or ethnic minority populations or low-income populations are expected under any alternative being considered, including for both construction and operations impacts.

The expected socioeconomic impacts associated with each of the alternatives being considered would be minimal in the context of the ROI economy, as discussed in Section 4.1.2.9. Most of the impacts would be considered beneficial economic impacts. Potential minor adverse impacts include increased traffic on or near the LANL site and minor increases in demand for community services and infrastructure, but these would not be "high and adverse" impacts. Therefore, no disproportionally high and adverse socioeconomic impacts on racial or ethnic minority populations or low-income populations are expected under any alternative being considered, including for both construction and operations impacts.

4.1.3 Savannah River Site

Activities at SRS analyzed in this SPDP EIS occur within three of the four sub-alternatives of the Preferred Alternative and the No Action Alternative, as indicated in Table 4-15. Activities that take place at LANL are identified in gray italicized text and are discussed in Section 4.1.2. The All LANL Sub-Alternative is not shown, because no activities would occur at SRS. The impacts of transportation between sites for both alternatives are discussed in Section 4.1.6.

The construction activities for the dilution and C&P capabilities at SRS were evaluated in the 2015 SPD SEIS (DOE 2015c) and are not considered to be a part of the action evaluated in this SPDP EIS. As a result, the construction activities for dilution and C&P are not discussed further in this section.

Manufacturing of the modular system discussed under the SRS NPMP Sub-Alternative would occur at an offsite location and the system would be transported to SRS for installation. The impacts related to the manufacturing process are not included in this SPDP EIS.

Table 4-15. Roadmap for Interpreting Impact Tables Displaying Alternative/Sub-Alternative Capabilities Conducted at SRS

Capability	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP Sub-Alternative	Preferred Alternative All SRS Sub-Alternative	No Action Alternative SRS NPMP Option
PDP	*(LANL)*	*(LANL)*	**SRS**	*(No PDP)*
NPMP	*(LANL)*	**SRS**	**SRS**	**SRS[(a)]**
Dilution	**SRS**	**SRS**	**SRS**	**SRS**
C&P	**SRS**	**SRS**	**SRS**	**SRS**

C&P = characterization and packaging; LANL = Los Alamos National Laboratory; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site.
(a) Under the No Action Alternative, NPMP could occur at LANL or SRS.

4.1.3.1 SRS Land Use and Visual Resources

Land use and visual resources are evaluated to assess the change in the character and aesthetics of the visual landscape. Both changes in the patterns and densities of land use and changes in the quality of visual resources are included in this evaluation. This section presents the anticipated impacts of the Preferred and No Action Alternatives on land use and visual resources at SRS. Detailed land use impacts by capability during construction activities are presented in Table C-14 in Appendix C. Environmental impacts from construction activities would be minimized through the site selection process at SRS (SRNS 2022b; SRNS 2000).

During operations for both alternatives, no additional ground disturbance would occur. Therefore, operations would not result in any new impacts on land use, other than the continuing commitment of land for industrial use. Impacts on land use and visual resources at SRS from operations are not discussed further.

4.1.3.1.1 Preferred Alternative

The land use and visual resource impacts from construction activities of the Preferred Alternative are described below.

Base Approach Sub-Alternative

There would be no construction activities at SRS associated with the Base Approach Sub-Alternative.

SRS NPMP Sub-Alternative

In the SRS NPMP Sub-Alternative, NPMP could occur inside Building 105-K or in a modular system adjacent to Building 105-K. If NPMP occurred in Building 105-K, no exterior structures would be constructed at SRS under the SRS NPMP Sub-Alternative (SRNS 2023d|Section 13.1|), so there would be no construction impacts on land use or visual resources. If NPMP occurred in modular systems, full concrete pads and a perimeter security barrier over of an area of 14,450 ft^2 (0.3 ac) would be constructed adjacent to Building 105-K (SRNS 2023d|Section 13.2|). All of the affected area has been previously disturbed (SRNS 2023d|Section 1|). Construction of the modular systems in this area would be consistent with the existing land use and would result in a view typical of an industrial site. Thus, construction of the modular systems would have negligible impacts on land use and visual resources.

All SRS Sub-Alternative

Under the All SRS Sub-Alternative, a PDP and NPMP capability would be constructed in Building 226-F (SRPPF) with construction of associated support facilities in F-Area at SRS or inside Building 105-K in the disassembly basin area with construction of additional support facilities in K-Area. The total land area affected by construction in either F-Area or K-Area would be about 20 ac of previously disturbed land, as discussed in Section B.1.3.1 of Appendix B. All of the affected areas in F-Area or K-Area are on land that has been previously disturbed and is either unvegetated or sparsely vegetated.

As discussed in the EIS for Plutonium Pit Production at SRS (DOE 2020a|Table 2-5|) because F-Area and K-Area are in the interior of SRS, these activities would not be noticeable at or beyond the SRS boundary (5.8 mi and 5.5 mi away, respectively) (DOE 2020a|Section 3.1.1.2|; SRNS 2023d|Section 3.1|). Public views of the construction or facilities within F-Area and K-Area are restricted by heavily wooded areas and by the nature of the terrain bordering segments of State Highway 125 and U.S. Highway 278 (DOE 2020a|Section 3.1.2.2|). Both State Highway 125 and U.S. Highway 278 pass through the SRS site boundary (DOE 2020a|Figure 1-1|). F-Area and K-Area are also not visible from the Savannah River. Observers of the construction would find these activities similar to the past construction activities or other developed areas at SRS. Construction of the PDP and NPMP capability in F-Area or K-Area would be consistent with the existing land use and would have negligible impacts on land use and visual resources.

4.1.3.1.2 No Action Alternative

Construction of the NPMP capability could occur inside Building 105-K. There would be no construction or modification activities external to buildings that would occur at SRS under the No Action Alternative (SRNS 2023d|Section 13.1|). Thus, there would be no impacts associated with land use or visual resources from activities at SRS under the No Action Alternative.

4.1.3.2 SRS Geology and Soils

Impacts on geology and soils can result from disturbance of geologic and soil materials during land-clearing, grading, and excavation activities, and from the use of geologic and soil materials during facility construction. Activities that disturb geologic and soil materials include excavating rock and soil, filling excavations, soil mixing, and soil compaction. These activities can occur while constructing buildings, parking lots, and roadways. Geologic and soil materials used during building and road construction include crushed stone, sand, gravel, and soil.

This section presents the anticipated impacts of the Preferred and No Action Alternatives at SRS on geologic and soil material resources at SRS. Detailed impacts related to geologic materials and soils by capability during construction activities are presented in Table C-15 in Appendix C.

Operation of facilities under the Preferred and No Action Alternatives would involve little or no use of geologic and soil materials at SRS. Therefore, impacts on geology and soil resources at SRS from operations would be minimal and are not discussed further in this section.

4.1.3.2.1 Preferred Alternative

The impacts related to the disturbance and use of geologic and soil materials during construction of the Preferred Alternative are described below.

Base Approach Sub-Alternative

There would be no construction activities at SRS associated with the Base Approach Sub-Alternative. Thus, there would be no impacts associated with construction on geologic and soil material resources from activities at SRS under the Base Approach Sub-Alternative.

SRS NPMP Sub-Alternative

In the SRS NPMP Sub-Alternative, NPMP could occur inside Building 105-K or in a modular system adjacent to Building 105-K. Activities to install equipment in Building 105-K in K-Area to support NPMP would not require ground disturbance or use of geologic and soil materials (SRNS 2023d|Sections 11 and 18|). Installing modular systems in K-Area for the NPMP would require excavation to a depth of about 1 ft to construct a 4,500 ft^2 concrete pad (SRNS 2023d|Section 11|). All of the area affected by the modular systems is land that has been previously disturbed and currently consists of unvegetated, gravel surfaces. No geologic resources would be required to install the modular systems (SRNS 2023d|Section 18|).

All SRS Sub-Alternative

Construction of PDP and NPMP capabilities using Building 226-F (SRPPF) or Building 105-K are assumed to require excavation for support facilities over a total area of no more than 10 ac. An excavation depth of 10 ft was assumed for all support facilities. Other construction activities (laydown areas, parking, etc., if needed) are assumed to require no additional excavation. Based on these values, the total volume of geologic and soil materials at SRS excavated for all construction activities would be about 160,000 yd^3. The total volume of sand, gravel, and crushed stone required during construction would be about 353,000 T based on the estimate for the 2015 SPD SEIS (DOE 2015c|p. F-31|), reduced by one-third to account for a reduced footprint (equivalent volume of 260,000 yd^3 using an estimated average geologic material density of 100 lb/ft^3). The geologic resources required to construct the PDP and NPMP capability would be the same whether the construction activities would occur in F-Area or K-Area. The total quantity of sand and gravel would be less than 5 percent of the annual production for South Carolina (USGS 2016). However, these construction materials would likely be supplied over more than 1 year of the 8-year construction period. In addition, it is assumed that a portion of the required geologic resources would be supplied from the geologic materials excavated during construction. Therefore, the total quantity of geologic materials required for construction represents a small percentage of regionally plentiful resources and would have a small impact on the region's geologic resources.

The total area of soils affected by construction would be about 20 ac, all of which is land that has been previously disturbed and is either unvegetated or sparsely vegetated (see Section 4.1.3.1.1). Construction activities would be regulated under the SRS stormwater general permit (see Section 5.3.2), which would require that facility-specific measures be taken under the SWPPPs to minimize the effects of stormwater runoff. BMPs, such as the use of silt fences, straw bales, geotextiles, and re-vegetation, would be specified in the SWPPPs to control erosion at the construction sites and limit the transport of soil materials in runoff (DOE 2015c|p. 4-93|). Because the area of previously undisturbed soils affected by construction would be small, and BMPs would be used to control erosion at construction sites, the activities would have a minimal impact on the region's soil resources.

4.1.3.2.2 No Action Alternative

There would be no construction or modification activities external to buildings that would occur at SRS under the No Action Alternative (SRNS 2023d|Section 3.1|). Thus, there would be no impacts associated with geology or soils from activities at SRS under the No Action Alternative.

4.1.3.3 SRS Water Resources

Impacts on surface-water and groundwater resources during construction and operation can occur because of ground disturbance and land use changes that affect the volume, timing, and pattern of stormwater runoff and/or groundwater recharge, and that may affect the transport of contaminants offsite. Water use during project activities and water use by project personnel for potable and sanitary purposes may affect the availability and sustainability of water resources. Impacts would be considered significant if they resulted in any of the following:

- degradation or impairment of water resource quantity or quality (introduction of chemical materials or sediments into the water resource) that violates Federal and/or State regulations, permits, or water-quality standards
- changes in surface and/or subsurface drainage features that noticeably alter watercourses, system recharge or drainage patterns, and/or exceed the capacity of existing stormwater management systems
- increases in water consumption that may compromise the availability of the water resource.

This section presents the anticipated impacts of the Preferred and No Action Alternatives on the potentially affected water resources at SRS. Infrastructure impacts related to water use and sanitary wastewater discharges are presented in Table 4-24 and Table 4-25 in Section 4.1.3.10 and in Appendix C by capability during construction (see Table C-21) and operation (see Table C-22).

There would be no water withdrawals from surface water at SRS under either alternative; water use to support construction and operation activities would be provided by the existing groundwater source (SRNS 2023d|Section 21|). There would be no direct release of contaminated, industrial effluents to surface water or groundwater during construction or operations at SRS (DOE 2015c|F-37, F-38, G-29, H-10|; SRNS 2023d|Section 21|). Sanitary wastewater would be appropriately treated before discharge.

Construction activities that could affect stormwater runoff would be regulated under the SRS stormwater general permit (discussed in Section 5.3.2), which would require that facility-specific measures be taken under the SWPPP to minimize the effects of runoff. BMPs, such as silt fences, straw bales, geotextiles, and re-vegetation, would be specified in the plan(s) to control erosion and stormwater runoff from the construction sites. No discharge of dredged or filled materials into the waters of the United States is planned as part of the proposed project.

4.1.3.3.1 Preferred Alternative

The construction and operation impacts on water resources from the Preferred Alternative at SRS are described below.

Base Approach Sub-Alternative

There would be no construction or modification activities at SRS associated with the Base Approach Sub-Alternative. Thus, there would be no impacts associated with construction on water resources from activities at SRS under the Base Approach Sub-Alternative.

Water for operations would be obtained from the A-Area groundwater wells (SRNS 2023d|Section 21|). Dilution and C&P activities in K-Area would require no water for processing purposes. Increase in water use during operation of the Base Approach Sub-Alternative at SRS would be for potable and sanitary use by staff (SRNS 2023d|Section 12.3|). Water use during operations would increase in proportion to the increase in staffing. The increase in annual water use for operation of the dilution capability would be about 3 million gal/yr during the year of peak staffing (SRNS 2023d|Section 12.3|). C&P activities would require an increase of about 0.6 million gal/yr during the peak staffing year (SRNS 2023d|Section 12.6|). The maximum increase in water use required during operation of the Base Approach Sub-Alternative would therefore be about 4 million gal/yr, which is less than 0.5 percent of the total groundwater used at SRS (2.51 million gpd in 2021; see Section 3.3.3.2). The small increase in groundwater withdrawal required to supply water for the Base Approach Sub-Alternative operations is within the available capacity of the wells and would have a minimal impact on the aquifer.

Increases in treated wastewater discharges during operation are conservatively assumed to be the same as the increases in water use described above (SRNS 2023d|Sections 12.3, 12.6|)—a total of about 4 million gal/yr (11,000 gpd). A project underway will pump K-Area wastewater to the SRS CSWTF, which is currently operating at about 30 percent of its design capacity (SRNS 2023d|Section 21.1|). This would increase the CSWTF flow rate (about 115 million gal/yr) by less than 4 percent. The CSWTF discharges to Fourmile Branch. The total wastewater discharge from Base Approach Sub-Alternative operations would be a negligible increase in the average flow rate in Fourmile Branch (less than 0.2 percent of the lowest average monthly flow, as described in Section 3.3.3.1).

SRS NPMP Sub-Alternative

In the SRS NPMP Sub-Alternative, NPMP could occur in Building 105-K or in a modular system adjacent to Building 105-K. Dilution and C&P would take place in K-Area as outlined under the Base Approach Sub-Alternative. In the Building 105-K option, construction activities would include only interior modifications to provide the NPMP capability (SRNS 2023d|Section 1|). Total construction water use in K-Area would increase by 2 gpm (about 1 million gal/yr or 2,900 gpd) during construction of the NPMP capability to account for the increase in staffing levels and other (currently undefined) construction purposes (SRNS 2023d|Section 21.1|). Non-potable water use for construction would be minimal (SRNS 2023d|Section 21.1|). Water for construction would be obtained from the A-Area groundwater wells, and the amount required would be less than 0.2 percent of the total groundwater used at SRS (2.51 million gpd in 2021). This small increase in groundwater withdrawal is within the available capacity of the wells and would have a minimal impact on the aquifer.

Treated wastewater discharges during construction of the NPMP capability would increase by 2 gpm—a total of about 1 million gal/yr (2,900 gpd). This would increase the CSWTF flow rate by less than one percent. The total wastewater discharge from construction would not be a noticeable increase in the average flow rate in Fourmile Branch.

Installing modular systems for the NPMP activities would require disturbing an area of 14,450 ft^2 (0.3 ac) (SRNS 2023d|Section 13.2|). All of the affected area is land that has been previously disturbed and currently consists of unvegetated, gravel surfaces. As a result, minor changes in stormwater runoff from the K-Area are expected. Installing the modular systems would increase water use and treated wastewater discharge by about 1 gpm (SRNS 2023d|Section 21.2|), and impacts would be bounded by the construction of the NPMP capability in Building 105-K.

Impacts on water resources for operations under the SRS NPMP Sub-Alternative would include those described for dilution and C&P activities under the Base Approach Sub-Alternative. Operation of the NPMP capability would require no water for processing purposes but would require additional water for potable and sanitary use by staff (SRNS 2023d|Section 12.4|). The increase in annual water use for operation of the NPMP capability would be about 1 million gal during the year of peak staffing (SRNS 2023d|Section 12.4|). The maximum increase in total water use required during operation of the SRS NPMP Sub-Alternative would be about 5 million gal/yr, which is about 0.6 percent of the total groundwater used at SRS (2.51 million gpd in 2021). The small increase in groundwater withdrawal required to supply water for SRS NPMP Sub-Alternative operations is within the available capacity of the wells and would have a minimal impact on the aquifer.

Increases in treated wastewater discharges during operation are conservatively assumed to be the same as the increases in water use described above (SRNS 2023d|Section 12.4|)—a total of about 5 million gal/yr (13,700 gpd). This would increase the CSWTF flow rate by less than 5 percent. The total wastewater discharge from operations would be a negligible increase in the average flow rate in Fourmile Branch (less than 0.2 percent of the lowest average monthly flow, as described in Section 3.3.3.1).

Operation of modular systems for the NPMP activities would decrease the number of staff by about 15 percent compared to the operation of the NPMP capability in Building 105-K, with a comparable decrease in water use and wastewater discharge. The water resources impacts for the modular system option would therefore be bounded by, and slightly lower than, the impacts discussed above for the Building 105-K option.

All SRS Sub-Alternative

Construction of PDP and NPMP capabilities in Building 226-F (SRPPF) or in Building 105-K at SRS for the All SRS Sub-Alternative would affect about 20 ac of land, all of which has been previously disturbed and is either unvegetated or sparsely vegetated (see Section 4.1.3.1.1). Construction would occur over many years (DOE 2012c|p. 14, 68|) with less than the total of 20 ac assumed to be disturbed at any one time. Stormwater during construction would discharge from existing F-Area outfalls (DOE 2015c|p. 4-95|). Construction of the PDP capability in K-Area would require a new stormwater discharge outfall and permit (DOE 2015c|p. F-33|). Because the area affected by construction has been previously disturbed and would be limited at any one time during the period of construction, and because stormwater runoff and erosion from construction sites would be managed to reduce offsite effects, construction activities are not expected to significantly increase runoff from F-Area or K-Area or have significant effects on the water quality of Upper Three Runs, Fourmile Branch, or Pen Branch.

Water use for construction of a PDP capability in Building 226-F (SRPPF), including potable and sanitary use for construction workers, was estimated to be 1.1 million gal/yr and would be supplied by the A-Area groundwater wells (DOE 2015c|p. F-46, PDC option|). Water use for construction of a PDP capability in Building 105-K could require an additional 0.9 million gal/yr during grouting of the disassembly basin. Maximum construction water use for PDP in K-Area could therefore be 2 million gal/yr. For either option, the amount of water required for construction of the All SRS Sub-Alternative would be no more than about 0.2 percent of the total groundwater used at SRS (2.51 million gpd in 2021). This small increase in groundwater withdrawal is within the available capacity of the wells and would have a minimal impact on the aquifer.

Wastewater discharge during construction of the All SRS Sub-Alternative would be a maximum of 1.1 million gal/yr (3,000 gpd) for PDP in F-Area or K-Area and would be treated at the CSWTF. This amount of wastewater is about one percent of the current sanitary wastewater treated at the CSWTF (115 million gal/yr, Section 3.3.10.5). The total wastewater discharge from construction would be a minor increase in the CSWTF discharge and would not noticeably increase the average flow rate in Fourmile Branch nor significantly affect Fourmile Branch water quality.

Changes in stormwater runoff from F-Area or K-Area during operations under the All SRS Sub-Alternative would be small because the land area affected would be small. Less than 20 ac would be occupied by buildings, parking areas, and landscaping, most of which could become impervious. The affected area would cover about 5 percent of the 364 ac occupied by F-Area, but it represents a negligible fraction of the Upper Three Runs watershed area and about 0.1 percent of the Fourmile Branch watershed area. The affected area would cover no more than 15 percent of the 130 ac occupied by K-Area, and it represents less than 0.2 percent of the Pen Branch watershed area. Stormwater runoff would be managed and discharged in compliance with existing regulations and facility permits that require SWPPPs, BMPs to control runoff, and monitoring of stormwater runoff quality. Only minor changes in surface-water flows in Upper Three Runs, Fourmile Branch, and Pen Branch are expected because stormwater would be managed and the area affected by operations is a small fraction of the total area of the affected watershed(s).

Process water use for PDP and NPMP operations is expected to be minor, about 2,300 gal/yr (DOE 2015c|p. F-36|). Water use during operations involves primarily potable and sanitary use for workers and would be proportional to the number of staff. Compared to the Base Approach Sub-Alternative, operation of the PDP and NPMP capabilities at SRS would require about 40 percent more staff (see C-20) and about 5 million gal/yr. Therefore, water use for operations under the All SRS Sub-Alternative would be a maximum of about 9 million gal/yr, which would be supplied by the A-Area groundwater wells. The amount of water required for operations would be about 1 percent of the total groundwater used at SRS (2.51 million gpd in 2021) and would be about 3.1 percent of the estimated domestic water use at SRS (320 million gal/yr; DOE 2020a|p. 3-43|), which primarily comes from the A-Area wells. This increase in groundwater withdrawal from the A-Area wells would have some minor effects on the aquifer (e.g., groundwater levels would be lowered within the region influenced by the wells). However, the increase in water use is a small fraction (less than 0.1 percent) of regional groundwater use (total SRS water use is about 5 percent of regional groundwater withdrawals; see Section 3.3.3.2) and is within the available capacity of the wells.

Wastewater discharge during operation of the All SRS Sub-Alternative would be a maximum of 9 million gal/yr (about 25,000 gpd) and would be treated at the CSWTF, whether the PDP capability is located in F-Area or K-Area (DOE 2015c|p. F-36|). Nine million gal/yr of wastewater is about 8 percent of the current sanitary wastewater treated at the CSWTF, which is about 115 million gal/yr (Section 3.3.10.5). The total wastewater discharge from operation would be a small increase in the CSWTF discharge and would be a minimal increase in the average flow rate in Fourmile Branch (less than 0.5 percent of the lowest average monthly flow as described in Section 3.3.3.1). Because the wastewater would be treated and the discharge would be permitted under the terms of the existing National Pollutant Discharge Elimination System permit (No. SC0000175), the wastewater discharge would have a small impact on Fourmile Branch water quality.

4.1.3.3.2 No Action Alternative

Impacts on water resources during construction or modification under the No Action Alternative would be the same as those described for the SRS NPMP Sub-Alternative for modification activities for Building 105-K.

Water use and treated wastewater discharge rates during operations for the No Action Alternative would be reduced from those described in the SRS NPMP Sub-Alternative because of the reduced amount of material being processed through dilution and C&P for up to 7.1 MT of non-pit surplus plutonium compared to the full 34 MT of combined surplus pit and non-pit plutonium. Water and wastewater use for dilution and C&P under the No Action Alternative were estimated to be a fraction (7.1/34, or about 21 percent) of the water and wastewater use described above for the Base Approach Sub-Alternative. Water use and wastewater discharge for dilution would be about 630,000 gal/yr and C&P would require about 130,000 gal/yr. Maximum total water use and wastewater discharge would be about 1.8 million gal/yr for No Action Alternative operations (the sum of NPMP, dilution, and C&P uses). This water use would be less than 0.2 percent of the total groundwater used at SRS during 2019 (2.51 million gpd in 2021) and would have a minimal impact on the A-Area wells and aquifer.

Treated wastewater discharge during operation of the No Action Alternative would increase by a maximum of 1.8 million gal/yr (4,900 gpd). This would increase the CSWTF flow rate by less than 2 percent. The total wastewater discharge from the No Action Alternative operations would not be a noticeable increase in the average flow rate in Fourmile Branch and would have a minimal impact on Fourmile Branch water quality.

4.1.3.4 SRS Air Quality

Impacts on air quality can result from the release of nonradioactive air pollutant emissions during construction, operation, and transportation activities. This includes air emissions of criteria pollutants, HAPs, and GHGs. Air quality impacts are assessed by comparing expected emissions of criteria pollutants from construction and operation activities at SRS to recent site-wide air emission levels. The SRS site-wide emission levels are low enough that they do not exceed levels that would require a Title V permit for these pollutants. Therefore, using these emission levels as indicators of significance is conservative. If projected emissions would exceed an indicator threshold, further analysis was conducted to determine whether impacts would be significant. In such cases, if emissions would not contribute to an exceedance of an ambient air quality standard, then impacts would not be significant.

The EPA's final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (40 CFR 93.150–93.165) requires a conformity determination for projects that exceed emission minimum threshold limits in nonattainment areas. However, a conformity determination is not required for the alternatives in this SPDP EIS because SRS is within an area that attains all NAAQSs (see Section 3.3.4.2).

This section presents the anticipated impacts of the Preferred and No Action Alternatives on air quality in the vicinity of SRS. The estimated air pollutant emissions at SRS during construction and operations for each alternative are summarized in Table 4-16 and Table 4-17, respectively. Detailed estimated criteria air pollutant emissions by capability are presented in Table C-16 in Appendix C. The impacts of radioactive air pollutants are evaluated in Section 4.1.3.7. Air quality impacts related to the transportation of materials and waste are discussed in Sections 4.1.6.4.4 and 4.1.6.3.4, respectively.

Table 4-16. Estimated Criteria Air Pollutant Emissions at SRS During Construction for the Preferred and No Action Alternatives (T/yr)

Pollutant	Preferred Alternative[(a)] Base Approach Sub-Alternative	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (Modular NPMP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative[(a)]	2020 SRS Emissions
NO_x	(b)	(c)	(d)	23	26	(c)	96
SO_x	(b)	(c)	(d)	0.049	0.085	(c)	6.3
CO	(b)	<0.001	(d)	29	30	<0.001	51
PM_{10}	(b)	<0.001	(d)	5.5	5.9	<0.001	9.0
$PM_{2.5}$	(b)	<0.001	(d)	5.0	5.4	<0.001	7.1
VOCs	(b)	0.94	(d)	4.7	4.8	0.94	36

CO = carbon monoxide; NO_x = nitrogen oxide; NPMP = non-pit metal processing; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SO_x = sulfur oxide; PDP = pit disassembly and processing; SRS = Savannah River Site; VOC = volatile organic compound.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. Note that the All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(b) No construction/modification activities are anticipated.

(c) No emissions expected.

(d) Emissions from the installation of the modular system are expected to be greater than those identified for building modification activities, but substantially less than those estimated for the construction of the F-Area PDP Option.

Note: Numbers are rounded to two significant digits.

Sources: Emissions under the Base Approach and SRS NPMP Sub-Alternatives are based on SRNS 2023c. Emissions under the All SRS F-Area and K-Area PDP Option Sub-Alternatives are from DOE 2012c|Table 2.4-4|. Emissions under the All SRS K-Area PDP Option Sub-Alternative also include emissions from SRNS 2010, calculated per SCDHEC 2018a. SO_x based on diesel sulfur content of 15 ppm. SRS 2020 emissions are from SRNS 2021a|Page 1/95|.

Table 4-17. Estimated Criteria Air Pollutant Emissions at SRS During Operations for the Preferred and No Action Alternatives (T/yr)

Pollutant	Preferred Alternative[(a)] Base Approach Sub-Alternative	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (Modular NPMP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative[(a)]	2020 SRS Emissions
NO_x	0.061	0.12	0.12	39	39	0.12	96
SO_x	<0.001	0.002	0.002	0.019	0.019	0.002	6.3
CO	0.54	1.1	1.1	11	11	1.1	51
PM_{10}	0.031	0.063	0.063	1.0	1.0	0.063	9.0
$PM_{2.5}$	0.031	0.063	0.063	0.69	0.68	0.063	7.1
VOCs	0.23	0.47	0.47	1.2	1.2	0.47	36

CO = carbon monoxide; NO_x = nitrogen oxide; NPMP = non-pit metal processing; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; PDP = pit disassembly and processing; SO_x = sulfur oxide; SRS = Savannah River Site; VOC = volatile organic compound.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to help orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. Note that the All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

Note: Numbers are rounded to two significant digits.

Sources: Emissions under the Base Approach and SRS NPMP Sub-Alternatives are based on SRNS 2023c, scaled for 2.5 MT/yr throughput. SO_x values were adjusted for ultra-low sulfur diesel emission factors. Emissions under the All SRS F-Area and K-Area PDP Option Sub-Alternatives include emissions from the Base Approach Sub-Alternative and values from DOE 2012c|Table 2.2-7|. SRS 2020 emissions are from SRNS 2021a|Page 1/95|.

4.1.3.4.1 Preferred Alternative

The impacts from construction and operation on air quality from the Preferred Alternative at SRS are described below.

Base Approach Sub-Alternative

There would be no construction or modification activities at SRS associated with the Base Approach Sub-Alternative.

Operations associated with dilution would use an emergency diesel generator (SRNS 2023c). The generator would operate as an intermittent emergency unit and therefore would not operate more than 500 hr/yr. In addition to generator emissions, operations associated with dilution would include the use of gloveboxes, which are expected to produce negligible criteria pollutant and nonradiological HAP emissions (less than 0.0001 T/yr of PM_{10} or combined HAPs emissions). Gloveboxes would have HEPA filters that minimize particulate emissions (SRNS 2023c).

As shown in Table 4-17, combined operations associated with the Base Approach Sub-Alternative at SRS are estimated to produce criteria pollutant emissions that are less than 3 percent of the annual air emissions of any pollutant emitted by the SRS facility in 2020 and therefore would not be significant. The 522 workers (see Table 4-23) required during peak operation activities equate to 4.8 percent of the current SRS workforce (SRNS 2023d|Section 19.7|). The additional commuter vehicle emissions associated with these workers would not substantially contribute to offsite ambient pollutant concentrations.

SRS NPMP Sub-Alternative

In the SRS NPMP Sub-Alternative, NPMP could occur inside Building 105-K or in a modular system adjacent to Building 105-K.

Emissions from building modification activities primarily would be attributed to paving, welding, and application of epoxy/enamel coatings (see Table 4-16) (SRNS 2023c). These emissions would be less than 1 percent of the annual air emissions of any pollutant emitted by the SRS facility in 2020 and therefore would not be significant. Estimated volatile organic compound emissions from epoxy/enamel coatings would be a maximum of 0.94 T/yr, which is less than 3 percent of SRS 2020 volatile organic compound emissions of 36 T/yr. Epoxy/enamel coating could emit up to 0.05 T/yr of a single HAP. Welding could emit lead (a maximum of 0.25 T/yr; a criteria pollutant and HAP) and HAPs, such as cobalt (a maximum of 0.19 T/yr), manganese (a maximum of 0.03 T/yr), and nickel (a maximum of 0.27 T/yr). When more accurate information becomes available prior to construction, SRS would determine if welding emissions would be substantial enough to limit their annual usage. Paving activities also would generate HAPs. The total estimated HAPs (SRNS 2023c) for building modification activities would amount to 2.3 percent of the total HAPs emitted by SRS in 2020 (SRNS 2021a|Pages 1-5/95|). Therefore, these minor amounts of emissions would not be significant.

Emissions from installation of a modular system primarily would occur from construction of a concrete pad and perimeter security barrier. SRS would use BMPs, such as water application, to minimize fugitive dust during construction activities. Emissions from installation of the modular system are expected to be greater than those identified for building modification activities, but substantially less than those estimated for construction of the F-Area PDP Option (see Table 4-16). These minor amounts of emissions would not be significant.

Workers (SRNS 2023d|Sections 19.2, 19.1|) required during peak construction activities for installation of a modular system (30 workers) or building modifications (70 workers) would be less than 1 percent of the current SRS workforce (SRNS 2023d|Section 19.7|). The additional commuter vehicle emissions associated with these workers would not substantially contribute to offsite ambient pollutant concentrations.

NPMP operations from either facility in K-Area (Building 105-K or a modular system), including the operation of gloveboxes and electric furnaces, would produce only minor amounts of particulate matter emissions (SRNS 2023c). NPMP would also include use of a diesel generator that would emit criteria pollutants (SRNS 2023c). The diesel generator would operate intermittently for standby emergency. Operation of an emergency diesel-powered generator burning virgin fuel oil would not result in any substantial emissions of HAPs (SRNS 2023c).

Operations associated with the dilution of plutonium would include the use of gloveboxes, which are expected to produce negligible criteria pollutant and nonradiological HAP emissions (less than 0.0001 T/yr of PM_{10} or combined HAPs emissions) (SRNS 2023c). Gloveboxes would have HEPA filters that minimize particulate emissions (SRNS 2023c). Operations associated with dilution of plutonium would also use an emergency diesel generator (SRNS 2023c). The generator would operate as an intermittent emergency unit and therefore would not operate more than 500 hr/yr.

Table 4-17 shows that combined operations associated with the SRS NPMP Sub-Alternative at SRS are estimated to produce criteria pollutant emissions that are less than half the annual air emissions of any pollutant emitted by the SRS facility in 2020 and therefore would not be significant. In addition, the 635 workers (see Table 4-23) required during peak operation activities (560 peak annual workers for the modular system option) equates to 5.8 percent of the current SRS workforce (SRNS 2023d|Section 19.7|). The additional commuter vehicle emissions associated with these workers would not substantially contribute to offsite ambient pollutant concentrations.

All SRS Sub-Alternative

Under the All SRS Sub-Alternative, a PDP and NPMP capability would be constructed in Building 226-F (SRPPF) with construction of associated support facilities in F-Area or in Building 105-K in the disassembly basin area. Estimated emissions associated with construction and modification activities would be up to 75 percent ($PM_{2.5}$) of the annual air emissions of any pollutant emitted site-wide at the SRS facility in 2020 and therefore would not exceed the significance threshold (see Table 4-16).

Operations for the All SRS Sub-Alternative would include PDP and NPMP activities in F-Area or K-Area and dilution and C&P of 34 MT of plutonium in K-Area. Operations for the PDP and NPMP activities in F-Area would require a ventilation system with a sand filter and/or a HEPA filtration system. Operations for the PDP and NPMP capability in K-Area would also require a ventilation system with HEPA filters. The ventilation system controls would preclude the spread of particulates or hazardous materials to the outside environment (DOE 2012c|Section 2.2.2|). The primary source of emissions from PDP and NPMP activities would occur from four backup diesel generators.

Operations associated with the dilution of plutonium would include the use of gloveboxes, which are expected to produce negligible criteria pollutant and nonradiological HAP emissions (SRNS 2023c).

Gloveboxes would have HEPA filters that minimize particulate emissions (SRNS 2023c). Operations associated with dilution of plutonium would also use an emergency diesel generator (SRNS 2023c). The generator would operate as an intermittent emergency unit and therefore would not operate more than 500 hr/yr

Operation activities for the All SRS Sub-Alternative F-Area option include transporting material between F-Area and K-Area. There are assumed to be a total of 425 shipments over 13 years for an average of 33 shipments per year over a 15.2 mi round-trip. Emissions associated with intra-site transportation were assessed and included in the All SRS Sub-Alternative F-Area option. This activity would generate negligible amounts of annual air emissions when compared to the shipment distances assessed for this Sub-Alternative as shown in Table 4-33. As shown in Table 4-17, the combined operations associated with the All SRS Sub-Alternative at SRS are estimated to produce criteria pollutant emissions that would not exceed 41 percent of the annual air emissions of any pollutant (NO_x) emitted by the SRS facility in 2020 and therefore would not exceed the significance threshold. The 1,016 workers required during peak operation activities (see Table 4-23) reflect an 9.3 percent increase over the staff population of 10,943 (SRNS 2023d|Section 19.7|). The additional intermittent commuter vehicle emissions associated with these workers would not substantially contribute to offsite ambient pollutant concentrations.

4.1.3.4.2 No Action Alternative

Air quality impacts from construction or modification activities for the No Action Alternative would be the same as those described for the SRS NPMP Sub-Alternative for building modification activities for Building 105-K.

Operational emissions and resulting ambient impacts for the No Action Alternative would be less than those described above for SRS NPMP Sub-Alternative because of the reduced amount of material being processed through dilution and C&P for up to 7.1 MT of non-pit surplus plutonium compared to the full 34 MT of combined surplus pit and non-pit plutonium analyzed in the Base Approach Sub-Alternative. Emissions associated with dilution activities are expected to produce negligible non-radiological HAPs. In addition, fewer workers are anticipated during peak operations for the No Action Alternative than for the SRS NPMP Sub-Alternative. The 212 workers required during peak operation activities (see Table 4-23) reflect a 1.9 percent increase over the staff population of 10,943 (SRNS 2023d|Section 19.7|). The additional intermittent commuter vehicle emissions associated with these workers would not substantially contribute to offsite ambient pollutant concentrations.

4.1.3.4.3 Greenhouse Gases

Table 4-18 presents estimates of annual GHG emissions in units of cCO_2e(defined in detail in Section 4.2.4.2) that would occur during construction and onsite operation activities for the Preferred and No Action Alternatives at SRS. GHG emissions from the transport of materials and wastes by truck for each alternative are presented in Sections 4.1.6.3.4 and 4.1.6.4.4. The annual GHG emissions for onsite construction or operations at SRS would range from no impact from Base Approach construction to 36 percent of the 2019 total annual GHG emissions for SRS (22,000 CO_2e). Section 4.2.4.2 presents the cumulative analysis of GHGs emitted from proposed construction and operational activities.

Table 4-18. Carbon Dioxide Equivalent Emissions at SRS During Construction/Modification and Operations for the Preferred and No Action Alternatives (MT/yr)

Activity	Preferred Alternative[(a)] Base Approach Sub-Alternative	Preferred Alternative[(a)] SRS NPMP Sub-Alternative[(b)]	Preferred Alternative[(a)] All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative[(a)]
Construction – SRS	(c)	0.082	4,300	7,800	0.082
Operation – SRS	97	190	1,900	1,900	190

NPMP = non-pit metal processing; PDP = pit disassembly and processing; SPDP EIS = Surplus Plutonium Disposition Program Environmental Impact Statement; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to help orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options include NPMP at the site of the PDP capability.

(b) Emissions from installation of the modular system are expected to be greater than those identified for building modification activities, but substantially less than those estimated for construction of the F-Area PDP Option.

(c) No construction/modification activities are anticipated.

Note: Numbers are rounded to two significant digits.

Sources: Construction and operation emissions are calculated from data in Table B-2 of this SPDP EIS as well as SRNS 2023c and DOE 2012c|Tables 2.4-4, Table 2.4-7|.

4.1.3.5 SRS Noise

Impacts from noise (unwanted sound) generated during construction and operation activities can affect workers and the public. This section presents the anticipated impacts of the Preferred and No Action Alternatives on noise levels at and in the vicinity of SRS.

4.1.3.5.1 Preferred Alternative

The construction and operation noise impacts from the Preferred Alternative are described below.

Base Approach Sub-Alternative

There would be no construction or modification activities at SRS associated with the Base Approach Sub-Alternative.

Operation activities associated with dilution and C&P under the Base Approach Sub-Alternative would produce noise levels similar to those that currently occur during normal activities in K-Area (SRNS 2023d|Section 14|). K-Area is located 5.5 mi from the SRS boundary; therefore, noise impacts on the public from operations at SRS are not expected.

The number of extra workers traveling to and from SRS during operations would be as many as 522 (see Table 4-23)—an increase of approximately 5 percent over the 10,339 existing workers (see Section 3.3.9). The level of highway noise depends upon traffic volume and speed (WSDOT 2020|p. 7.9|). Assuming the traffic volume increases at a similar ratio to that of extra workers to existing workers (e.g., approximately 5 percent), the increase in noise levels produced to account for the traffic volume of the extra workers would be less than 10 dBA more than the noise levels produced by the traffic volume of the existing workers traveling at the same speed (WSDOT 2020|p. 7.10-11, Table 7-3|). Based on the less than 10 dBA increase criterion noted in Section 4.1.2.5 for construction traffic, no noticeable noise would be produced by increased traffic traveling to and from SRS during operations, and noise impacts on the public would be below regulatory limits.

SRS NPMP Sub-Alternative

In the SRS NPMP Sub-Alternative, NPMP could occur inside Building 105-K or in a modular system adjacent to Building 105-K. If NPMP occurred in a modular system, minimal construction activities would be required to install the modular systems. Given the construction activities, and the distance to the site boundary (5.5 mi), noise impacts would not be noticeable to members of the public.

The number of additional workers traveling to and from SRS for construction of the NPMP capability in Building 105-K would be as many as 78 (see Table 4-22), an increase of less than 1 percent over the 10,339 existing workers (SRNS 2023d|Section 19.1|) (see Section 3.3.9). The number of additional workers traveling to and from SRS for construction for the modular system option would be as many as 30 (see Table 4-22), an increase of less than 0.5 percent over the 10,339 existing workers (SRNS 2023d|Section 19.2|) (see Section 3.3.9). There would be no discernable difference to the public in the level of noise from the increased travel to and from SRS during construction.

The number of additional workers traveling to and from SRS for operation of the Building 105-K option of the SRS NPMP Sub-Alternative would be as many as 635 (see Table 4-23), an increase of about 6.1 percent over the 10,339 existing workers (SRNS 2023d|Section 19.4|) (see Section 3.3.9). The number of additional workers traveling to and from SRS for the modular system option of the SRS NPMP Sub-Alternative during operations would be 560 people (Table 4-23), which is an increase of approximately 5.4 percent over the 10,339 existing workers (SRNS 2023d|Section 19.5|) (see Section 3.3.9). There would be no discernable difference to the public in the level of noise from the increased travel to and from SRS during operations.

All SRS Sub-Alternative

Under the All SRS Sub-Alternative, a PDP and NPMP capability would be constructed in Building 226-F (SRPPF) or in Building 105-K in the disassembly basin area, along with construction of associated support facilities. Noise during construction could include sounds made by several types of construction equipment, including loaders, backhoes, scrapers, and paving equipment, and would affect the immediate construction area and the vicinity of SRS as a whole (SRNS 2023d|Section 14.1|). Given the distance to the site boundary and building shielding, there would be no discernable difference to the public in the level of noise from the construction activities.

The number of additional workers traveling to and from SRS for the construction of the All SRS Sub-Alternative would be as many as 525 (see Table 4-22) for either F-Area or K-Area, an increase of approximately 5 percent over the 10,339 existing workers (see Section 3.3.9). There would be a negligible impact on noise produced by increased travel to and from SRS during construction, and noise impacts on the public are not expected.

For operations in the All SRS Sub-Alternative, given the distance to the site boundary and building shielding (5.5 mi for K-Area and 5.8 mi for F-Area), there would be no discernable difference to the public in the level of noise from operations.

The number of additional workers traveling to and from SRS for the operation of the All SRS Sub-Alternative would be as many as 1,016 (see Table 4-23), an increase of about 9.8 percent over the 10,339 existing workers (see Section 3.3.9). There would be a negligible impact on noise produced by increased travel to and from SRS during operations, and noise impacts on the public are not expected.

4.1.3.5.2 No Action Alternative

Noise impacts from construction or modification activities for the No Action Alternative would be negligible. An additional 78 workers traveling to and from SRS under the No Action Alternative (see Table 4-22), represents an increase of less than 1 percent over the 10,339 existing workers (see Section 3.3.9). There would be a negligible impact on noise produced by increased travel to and from SRS during operations, and noise impacts on the public are not expected.

Noise impacts from operation activities for the No Action Alternative would be less than those described for the SRS NPMP Sub-Alternative because fewer workers are anticipated during peak operations for the No Action Alternative than for the SRS NPMP Sub-Alternative (i.e., 212 workers; Table 4-23 in Section 4.1.3.9).

4.1.3.6 SRS Ecological Resources

Impacts on ecological resources can result from physical habitat disturbance, such as land clearing, grading, excavation, and erosion and sedimentation, and from other forms of habitat disturbance such as human presence, noise, and light. Habitat loss may affect an individual organism's ability to breed, feed, shelter, or migrate, and may affect populations and species.

This section presents the anticipated impacts of the Preferred and No Action Alternatives on ecological resources at SRS with a focus on terrestrial and wetland resources. Aquatic resources and wetlands are not considered because surface water and wetlands do not occur in locations in K-Area or F-Area where construction would occur (DOE 2015c).

Operations would occur inside the buildings. There would be no habitat disturbance during operations and any increased noise, light, or traffic from facility operations are expected to pose minimal impacts on terrestrial resources and wildlife, including threatened and endangered species. The impacts from operations discussed for the alternatives below pertain specifically to the impacts related to worker traffic.

4.1.3.6.1 Preferred Alternative

The impacts from construction and operations on ecological resources for the Preferred Alternative are described below.

<u>Base Approach Sub-Alternative</u>

There would be no construction or modification activities at SRS associated with the Base Approach Sub-Alternative.

<u>Operations</u> – Animal-vehicle accidents at SRS most commonly involve white-tailed deer (Kilgo et al. 2020). Using the most traveled segment of road at SRS, SR-125: Jackson, South Carolina to SRS Gate (see Table 3-32), the baseline number of ADTs was estimated to be 11,200 (see Table 3-32). The number of additional workers during operation peak years would be 350 (see Table 4-23). The

maximum estimated number of additional ADTs during these years would be 700 (conservatively assuming two trips/day-person and no carpooling or use of mass transit), or about 6.3 percent over the baseline ADT. Traffic from facility operations is expected to pose minimal impacts on wildlife.

SRS NPMP Sub-Alternative

In the SRS NPMP Sub-Alternative, NPMP could occur inside Building 105-K or in a modular system adjacent to Building 105-K.

Terrestrial Resources

Construction – No new land disturbance activities would be necessary to support construction of the NPMP activities at SRS in Building 105-K. Building modifications would be undertaken either inside or immediately adjacent to Building 105-K (in a previously disturbed area) for placement and integration of the modular system (SRNS 2023d|Section 3.1, 3.2|). The land area required for operation of the modular systems, including the modules and a perimeter security barrier, is approximately 14,450 ft^2 in a 170 ft × 85 ft configuration (SRNS 2023d|Section 3.2| and Appendix B).

Effects from construction and installation of the modular system may result in increased noise levels during preparations for and installation of the modular system adjacent to Building 105-K. However, these levels are expected to be temporary and have negligible impacts on wildlife.

Wildlife (especially bird) responses to noise are variable and may range from habituation to varying degrees of avoidance (Caltrans 2016|p. 38, 79, 81|; AMEC 2005; Larkin 1996|p. 1, 2|). Noise would be caused by construction equipment and the additional construction workers traveling to and from SRS. As discussed in Section 4.1.3.5, incremental noise impacts from additional construction workers traveling to and from SRS are not expected to be noticeable and therefore would not affect wildlife.

Animal-vehicle accidents may occur. The busiest segment of road, SR-125: Jackson, South Carolina to SRS Gate, is estimated to be 11,200 ADTs; see Table 3-32). The number of additional workers during construction would be up to 70 (see Table 4-22). The maximum estimated number of additional ADTs during these years would be up to 140 (conservatively assuming two trips/day-person and no carpooling or use of mass transit), or about 1.3 percent over the baseline ADT. These small increases in traffic during construction would not substantially increase the risk of animal-vehicle accidents.

Operations – The number of additional workers during operations would be up to 448 (see Table 4-23). The maximum estimated number of additional ADTs during these years would be 896 (conservatively assuming two trips/day-person and no carpooling or use of mass transit), or 8.0 percent over the baseline ADT. These small increases in traffic during operations would not substantially increase the risk of animal-vehicle accidents.

Threatened and Endangered Species

As discussed in Section 3.3.6.4, no critical habitat for threatened and endangered species exists on SRS. K-Area is located within the red-cockaded woodpecker Supplemental Management Area, although it is located near the Industrial Core Management Area (DOE 2015c|p. 3-25, Figure 3-1|; DOE 2020a|p. 3-33; Figure 3-5|). K-Area is heavily industrialized and too far from existing colonies to be used by the species (DOE 2005|p. A-5|). No other State or Federally listed species are known to exist in the area. Thus, the impacts on listed species from construction are expected to be negligible.

All SRS Sub-Alternative

A PDP and NPMP capability could be constructed in Building 226-F (SRPPF) in F-Area or in Building 105-K in the disassembly basin area in K-Area, with construction of associated support facilities in F-Area or K-Area, respectively.

Terrestrial Resources

Construction – As described in Section 4.1.3.1.1, the total land area affected by construction of the PDP and NPMP capability in either area is approximately 20 ac. Land in both F-Area and K-Area has been previously disturbed and is either considered industrial or was cleared of forest in the past and is now semi-disturbed grassland. This land would be affected by construction in F-Area for buildings and for temporary construction and laydown areas (e.g., warehouse, administrative support buildings, etc.) associated with the PDP and NPMP activities (DOE 2012c|Table 2.4-1|). Of that 20 ac, a building footprint of 10 ac (not including Building 226-F) is assumed for support buildings, parking lots, and other infrastructure.

BMPs commonly used at SRS would continue to be used to protect ecological resources including use of previously disturbed areas for construction when possible; 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; preconstruction characterization/surveys of site (DOE 2020a|Table 4-30, p. 4-78, 4-81 to 4-82|).

Construction would increase noise levels temporarily in and near the construction areas of F-Area or K-Area. Noise would be caused by construction equipment and the additional construction workers traveling to and from SRS. As discussed in Section 4.1.3.5, incremental noise impacts from additional construction workers traveling to and from SRS are not expected to be noticeable and therefore would not affect wildlife.

The maximum estimated number of additional ADTs during these years would be 1,050 (conservatively assuming two trips/day-person and no carpooling or use of mass transit), or about 9.4 percent over the baseline ADT. However, F-and K-Areas are highly developed and industrialized landscapes, and it is unlikely that wildlife would be present there. Thus, any impacts on wildlife populations are expected to be temporary and negligible.

Operations –All operations would be conducted inside the facilities, except when transporting material and waste.

The number of additional workers during operations would be 844 (see Table 4-23). The maximum estimated number of additional ADTs during these years would be 1,688 (conservatively assuming two trips/day-person and no carpooling or use of mass transit), or about 15 percent over the baseline ADT. These small increases in traffic during construction would not substantially increase the risk of animal-vehicle accidents.

Threatened and Endangered Species

As discussed in Section 3.3.6.4, no critical habitat for threatened and endangered species exists on SRS. Additionally, no listed species are known to forage, breed, nest, or occur in F-Area or K-Area near the likely locations of construction, modification, or operations (SRNS 2023d|Section 9.0|; DOE 2020a|p. 4-27|). The nearest cluster of red-cockaded woodpeckers is about 3–4 mi northeast of F-Area (DOE

2020a|p. 3-37|). K-Area is heavily industrialized and too far from existing colonies to be used by the species (DOE 2005|p. A-5|).

However, potentially suitable habitat for the smooth purple coneflower exists in the 20 ac where construction would occur at F-Area (see Section 3.3.6.4) and an extant population exists within 2 mi (DOE 2020a|Section 3.5.3, Figure 3-9, p. 3-37|). If smooth purple coneflowers were found through surveys, the mitigation measures would be the same as those described in the Pit Production EIS. Plants would be salvaged prior to construction and transplanted to another location (DOE 2020a|Table 4-30, p. 4-78, 4-81 to 4-82|). It is also assumed that BMPs are currently being used for the protection of managed species, such as limiting soil erosion, and additional mitigation measures would be the same as those discussed in the Pit Production EIS (DOE 2020a|p. 4-78|).

4.1.3.6.2 No Action Alternative

The No Action Alternative ecological impacts from construction, modification, or operations would be the same as the ecological impacts from the SRS NPMP Sub-Alternative for Building 105-K.

4.1.3.7 SRS Human Health

This section presents the analyses of anticipated radiological human health impacts resulting from activities associated with the Preferred and No Action Alternatives. Human health impacts may occur during construction and normal operational activities, and from postulated accidents. This section also summarizes impacts from chemical use including postulated chemical accidents and intentional destructive acts. Other sources of risk to human health are also evaluated in this SPDP EIS. Nonradiological impacts are addressed in Section 4.1.3.4 4.1.2.4for air quality and Section 4.1.3.5 for noise.

Human health risks from construction, normal operations, and facility accidents are considered for several individual receptors and population groups. Depending on the source of exposure (and whether normal or accidental conditions are being considered), these receptors and population groups include involved and noninvolved workers, the offsite population, and the MEI. Definitions of involved and noninvolved workers, offsite population, and the MEI are found in the text box below.

> An **involved worker** is someone directly or indirectly involved with surplus plutonium disposition operations who may receive an occupational radiation dose from direct radiation (i.e., neutron, x-ray, beta, or gamma) or from radionuclides released to the environment. Direct exposure from handling plutonium materials within a facility would be the chief source of occupational exposure for onsite workers (primarily from gamma radiation emitted by americium-241).
>
> A **noninvolved worker** is a site worker outside of the facility who would not be subject to direct radiation exposure but could be incidentally exposed to emissions from the surplus plutonium facilities if they occurred.
>
> The **offsite population** comprises members of the general public who live within 50 mi of the facility being evaluated.
>
> The **MEI** is a hypothetical individual at a location of public access that would result in the highest exposure; considered to be located at the site boundary at LANL and SRS for both the Preferred and No Action Alternatives.

Estimates of the radiation dose received by workers and members of the public are developed and used to determine potential radiological impacts on human health. SRS (SRNS 2023d) has developed estimates of dose to workers and the public that provide a basis for the radiation dose estimates in this SPDP EIS. Radiation doses are estimated and converted to risk of "latent cancer fatality" or LCF risk using a factor of 0.0006 LCF per rem (DOE 2003a). The LCF provides an indication of the impact to human health for both workers and the public. For individuals, this provides a measure of the risk of an LCF occurring. For populations, multiplying this risk factor by the estimated person-rem provides an estimate of the number of excess LCFs that could occur in the exposed population. For doses equal to or greater than 20 rem resulting from an acute exposure from an accident, the risk estimator is doubled (ICRP 1991).[24] However, the risk estimator is not doubled for doses estimated for normal operations. This approach to calculating radiological impacts is applicable in the following discussions for impacts of normal operations including both construction and operations, and for impacts of radiological accidents.

Data from previous evaluations, along with supplemental information provided by SRS, were used to evaluate the impacts from normal operations on the individual and population of involved workers, the MEI, and the offsite population.

4.1.3.7.1 Construction Activities and Normal Operations

This section presents the potential radiation dose and impacts from construction activities and normal operations at SRS resulting from activities associated with the Preferred and No Action Alternatives. Normal operations do not include postulated accidents (see Section 4.1.3.7.2 below). The evaluation of dose and human health impacts is based on information provided by SRS (SRNS 2023d).

The anticipated radiation dose and radiological impacts from the Preferred and No Action Alternatives is summarized in Table 4-19 for construction activities and in Table 4-20 for operations. Detailed radiological impacts by capability are presented in Tables C-17 and C-18 in Appendix C.

Radiation dose and radiological impacts on workers and the public are estimated for both construction and operations. Calculation of radiation dose is the basis for human health impacts, determined as the risk of an LCF to an individual, or the number of LCFs in an exposed population. The number of LCFs for a specific project stage (i.e., construction or operations) are calculated differently. Construction impacts depend on the number of workers, the annual dose rate, and the duration of the construction in years. Operations impacts also depend on the number of workers and the annual dose rate, but are determined based on an operations throughput, such as a certain number of metric tons of material processed per year.

The individual worker is the "maximally exposed" worker for each applicable capability (e.g., dilution) for each alternative and sub-alternative. This worker would be exposed at the base dose rate for the entire duration of the activity (process durations are shown in Appendix B, Table B-2). For example, under the Preferred Alternative the worker is assumed to be present for the entire duration required to process the entire 34 MT, and under the No Action Alternative the worker is present for the entire duration to process up to 7.1 MT. The throughput per year can vary to fit project needs but the total risk or total number of LCFs can be consistently determined. Radiation dose and radiological impacts from construction and normal operations are discussed in more detail below under each sub-alternative. Annual radiation doses are also reported in the tables below because they can be useful for comparing to the regulatory dose limits.

[24] DOE considers LCFs <0.5 to be 0. The rounded LCF value is provided in tables and text, followed by calculated parentheses.

Table 4-19. Radiation Dose and Impacts at SRS During Construction/Modification for the Preferred and No Action Alternatives

	Preferred Alternative[(a)] Base Approach Sub-Alternative		Preferred Alternative[(a)] SRS NPMP Sub-Alternative (105-K NPMP Option)		Preferred Alternative[(a)] SRS NPMP Sub-Alternative (Modular NPMP Option)		Preferred Alternative[(a)] All SRS Sub-Alternative (F-Area PDP Option)		Preferred Alternative[(a)] All SRS Sub-Alternative (K-Area PDP Option)		No Action Alternative[(a)]	
Receptor (units)	**Dose**	**LCF**	**Dose**	**LCF**	**Dose**	**LCF**	**Dose**	**LCF**	**Dose**	**LCF**	**Dose**	**LCF**
Worker – Dose Rate (rem/yr)[(b)]	None[(c)]	None[(c)]	0.03	(d)	0	(d)	0	(d)	0.13	(d)	0.03	(d)
Worker – Construction Dose (rem and LCF risk)	None[(c)]	None[(c)]	0.075	0.00005	0	0	0	0	0.19	0.0001	0.075	0.00005
Workforce – Construction Collective Dose (person-rem and number of LCFs)[(e)]	None[(c)]	None[(c)]	1.1	0 (0.0007)	0	0	0	0	5.3	0 (0.003)	1.1	0 (0.0007)
Public – MEI Dose (rem and LCF risk)	None[(c)]	None[(c)]	(f)	(f)	0	0	0	0	0.000054	3×10^{-8}	(f)	(f)
Public – Population Dose (person-rem and number of LCFs)[(e)]	None[(c)]	None[(c)]	(f)	(f)	0	0	0	0	2.7	0 (0.002)	(f)	(f)

LCF = latent cancer fatality; MEI = maximally exposed individual; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(b) Shows the highest dose to an individual construction worker.

(c) No construction/modification activities are anticipated.

(d) LCFs cannot be derived from dose rates to individuals.

(e) The LCF is calculated by using a risk estimator of 0.0006 fatal cancers per rem or person-rem. The rounded LCF value is provided, followed by the calculated value in parentheses.

(f) Doses and LCFs to the public and the MEI from construction activities were not calculated because doses and corresponding LCFs to workers at the site were extremely low and the expectation is that a negligible dose and corresponding LCF would be received by noninvolved workers, the MEI, and other members of the public.

Note: Numbers are rounded to one or two significant digits.

Source: SRNS 2023d.

Table 4-20. Radiation Dose and Impacts at SRS During Operations for the Preferred and No Action Alternatives

	Preferred Alternative[(a)] Base Approach Sub-Alternative		Preferred Alternative[(a)] SRS NPMP Sub-Alternative (105-K NPMP Option)		Preferred Alternative[(a)] SRS NPMP Sub-Alternative (Modular NPMP Option)		Preferred Alternative[(a)] All SRS Sub-Alternative (F-Area PDP Option)		Preferred Alternative[(a)] All SRS Sub-Alternative (K-Area PDP Option)		No Action Alternative[(a)]	
Receptor (units)	**Dose**	**LCF**	**Dose**	**LCF**	**Dose**	**LCF**	**Dose**	**LCF**	**Dose**	**LCF**	**Dose**	**LCF**
Worker – Dose Rate (rem/yr)[(b)]	0.63	(c)	0.63	(c)	0.63	(c)	0.63	(c)	0.63	(c)	0.63	(c)
Worker – Operational Dose (rem and LCF risk) for entire project duration	8.6	0.005	11	0.007	8.6	0.005	8.6	0.005	8.6	0.005	11	0.007
Workforce – Operational Collective Dose (person-rem and number of LCFs)[(d)] for entire project duration	2,100	1 (1.2)	2,900	2 (1.7)	2,300	1 (1.4)	4,000	2 (2.4)	4,000	2 (2.4)	1,400	1 (0.86)
Public – MEI Dose Rate for entire project duration (rem/yr)	1×10^{-7}	(c)	1×10^{-7}	(c)	1×10^{-7}	(c)	2×10^{-7}	(c)	2×10^{-7}	(c)	4×10^{-8}	(c)
Public – MEI Dose (rem and LCF risk)	2×10^{-6}	9×10^{-10}	2×10^{-6}	1×10^{-9}	2×10^{-6}	1×10^{-9}	3×10^{-6}	2×10^{-9}	3×10^{-6}	2×10^{-9}	6×10^{-7}	4×10^{-10}
Public – Population Dose (person-rem and number of LCFs)[(d)] for entire project duration	0.08	0 (0.00005)	0.09	0 (0.00006)	0.09	0 (0.00006)	0.14	0 (0.00008)	0.14	0 (0.00008)	0.03	0 (0.00002)

LCF = Latent cancer fatality; MEI = maximally exposed individual; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3, to help orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(b) Shows the highest dose to an individual worker.

(c) LCFs cannot be derived for dose rates to individuals.

(d) The LCF is calculated by using a risk estimator of 0.0006 fatal cancers per rem or person-rem. The rounded LCF value is provided, followed by the calculated value in parentheses.

Notes: Numbers are rounded to two significant digits. See Table C-18 in Appendix C for a more detailed breakout of dose categories.

Source: SRNS 2023d.

Estimates of radiation dose and radiological impacts to the public are made for the MEI and for the population within 50 mi of SRS. Dose to the MEI, located about 4,200 m south-southeast of K-Area, or 6,200 m west-southwest of F-Area (SRNS 2023d), would occur from small, routine airborne releases. Dose to the offsite population is based on 803,370 persons within 50 mi, as discussed in Section 3.3.7. The surrounding population is expected to grow resulting in a corresponding increase in LCFs, however, based on the calculation of dose, there is no impact for most sub-alternatives, a very small impact for the All SRS Sub-Alternative on the public from construction (see Table 4-19) and a very small increase in radiation doses to the surrounding population from operations with no expectation of any LCFs for any of the alternatives or sub-alternatives (see Table 4-20). Because the results in Table 4-19 are very low, no excess LCFs would be expected if an updated and increased population estimate were to be used in the dose evaluations. This analysis of MEI and public dose credits the use of HEPA filtration as limiting releases of radionuclides from normal operations. Further, because all of the public doses and potential impacts are very low, detailed information is not provided under the sub-alternatives below.

Air permitting would be evaluated prior to operations to verify that the alternative would be compliant for potential releases of radioactive materials. SRS would determine whether planned emissions require a modification to existing facility permits to meet National Emission Standards for Hazardous Air Pollutants set by the EPA for air pollutants that are not covered by NAAQSs, as promulgated in 40 CFR Part 61 and Part 63. More information about permitting is provided in Section 5.3.2 of this SPDP EIS. All annual doses to the MEI from the air pathway would be less than 0.01 mrem/yr and lower than all applicable limits (SRNS 2022a).

Preferred Alternative

The radiation dose and radiological impacts from the Preferred Alternative at SRS during normal operations for construction (see Table 4-19) and operations (see Table 4-20) are described below. The evaluation of dose and human health impacts is based on information provided by SRS (SRNS 2023d).

Base Approach Sub-Alternative

This sub-alternative includes dilution and C&P of 34 MT in K-Area at SRS. There would be no or very low doses to the public for construction and operations.

The capability for dilution is already being installed in Building 105-K and the capability for C&P currently exists. There would be no construction under this sub-alternative and so there would be no dose or impacts to construction workers or the public.

Dilution workers would receive the highest dose rate under this sub-alternative—a dilution operator could receive 0.63 rem/yr. A smaller number of radiological control workers could be exposed at a lower rate (0.44 rem/yr) (SRNS 2023d). C&P operators (0.27 rem/yr) and radiological control workers (0.12 rem/yr) would be exposed at a lower level than for dilution (SRNS 2023d); for C&P operations, Central Characterization Program workers assigned from the WIPP facility would also be exposed (0.15 rem/yr) (SRNS 2020a; SRNS 2023b). Based on the dose received by the population of involved workers conducting dilution and C&P activities under this sub-alternative, the estimated number of LCFs would be 1 (1.2) for the project duration.

SRS NPMP Sub-Alternative

This sub-alternative includes NPMP of up to 7.1 MT, dilution of 34 MT, and then C&P of that 34 MT. Dilution and C&P would take place in K-Area as outlined under the Base Approach Sub-Alternative. There would be no or very low doses to the public for construction and operations.

There are two options for NPMP, either inside Building 105-K or in a modular system adjacent to Building 105-K. If the Building 105-K option were selected, construction activities would include building modifications lasting 2.5 years and 15 involved workers who could receive 30 mrem/yr (SRNS 2023d). A low risk of LCF (0.0007 or 7 chances in ten thousand) would be expected for the 105-K construction workers. If the modular system option were selected, minimal construction activities would be required to install the modular system adjacent to Building 105-K (SRNS 2023d). The installation would take place outside of Building 105-K and workers would receive only K-Area background radiation, considered to be negligible with no associated risk of LCF (0). There would be no radiation exposures to members of the public from construction modifications, no LCFs, hence, no dose or impacts to the public.

During NPMP operations, the operator would be exposed at 0.63 rem/yr at both throughput rates of 0.4 (in 105-K) and 0.6 MT/yr (in modular) to process 7.1 MT of non-pit surplus plutonium. An NPMP operator under the Building 105-K option would have the highest risk of LCF but it would below (0.007 or 7 chances in a thousand). Dilution and C&P operations under this sub-alternative would be identical to those under the Base Approach Sub-Alternative for 34 MT of throughput. Based on the dose received by the population of involved workers conducting NPMP, dilution, and C&P activities under this sub-alternative, the estimated number of LCFs would be 2 (1.7) for the Building 105-K option and 1 (1.4) for the modular system option for the project duration.

All SRS Sub-Alternative

This sub-alternative adds a PDP and NPMP capability but also includes the capability for dilution and C&P of 34 MT. The PDP capability could be added in either F-Area Building 226-F (SRPPF) or in K-Area Building 105-K. There would be no or very low doses to the public for construction and operations.

Construction of the PDP and NPMP capability under the F-Area option would include construction in Building 226-F (SRPPF) and associated support facilities; the K-Area option construction would be in Building 105-K in the disassembly basin area. In F-Area, the construction activities would occur in clean or new facilities and no dose is expected to construction workers or the public. In K-Area, no LCF (0.003) would be expected in the construction worker population. Some low levels of exposure to the public could occur from preparatory activities prior to construction in K-Area. The risk of LCF to the MEI would be very low (3×10^{-8}) with no excess LCFs expected in the exposed population (0.002).

The radiation dose and impacts of combined PDP and NPMP at SRS are based on those proposed for LANL under the Base Approach Sub-Alternative and scaled for SRS throughput. Dilution and C&P operations under this sub-alternative would be identical to those under the Base Approach Sub-Alternative for 34 MT of throughput. Based on the dose received by the population of involved workers conducting PDP and NPMP, dilution, and C&P activities under this sub-alternative, the estimated number of LCFs would be 2 (2.4) for at either location (F-Area or K-Area) over the project duration.

No Action Alternative

The No Action Alternative would include NPMP, dilution, and C&P for up to 7.1 MT of non-pit surplus plutonium. There would be no or very low doses to the public during construction and operations.

Similar building modification activities to the SRS NPMP Sub-Alternative would occur at Building 105-K for the No Action Alternative. Radiation dose and radiological impacts would also be the same. A low risk of LCF (0.0007) would be expected for the 105-K construction workers. No dose or impacts to the public would occur.

Both NPMP and dilution operators would receive a radiation dose of 0.63 rem/yr and would have the highest exposure of any workers, but the risk of LCFs would still be low (0.007 or 7 chances out of a thousand). Based on the dose received by the population of involved workers conducting NPMP, dilution, and C&P activities under the No Action Alternative, there could be 1 excess LCF (0.9) for the project duration.

4.1.3.7.2 Facility Radiological Accidents

This section presents the potential radiological consequences of activities at SRS associated with both the Preferred Alternative and the No Action Alternative. The postulated accidents selected for this SPDP EIS and the analysis assumptions are those used in SRS WSRC-SA-2002-00005, *K-Area Complex Documented Safety Analysis* (SRNS 2021b), augmented to reflect new systems or facilities as appropriate (e.g., pit disassembly and processing). Appendix D of this SPDP EIS also provides the following information:

- Version 4.2 of the MELCOR Accident Consequence Code System code was used.
- The 50-mi population distributions were projected to the year 2040, which was selected as a representative year for full-scale operations and overestimates the average population size during the project.
- A discussion of the meteorological data that was used for the analysis.
- Inhalation dose coefficients from FGR 13 were used instead of those from FGR 11 (EPA 2002 and EPA 1988).
- Isotopic information for pit and/or non-pit material (SRNS 2023d).

Accident frequencies are grouped into the bins of “anticipated,” “unlikely,” “extremely unlikely,” and “beyond extremely unlikely,” with estimated annual frequencies as defined in DOE 2014a.

Accident Frequencies

Frequency Bin	Estimated Probability Per Year
Anticipated	Is greater than 1×10^{-2}
Unlikely	Is between 1×10^{-2} and 1×10^{-4}
Extremely Unlikely	Is between 1×10^{-4} and 1×10^{-6}
Beyond Extremely Unlikely	Is less than or equal to 1×10^{-6}

The accident descriptions are those used in the SRS K-Area Complex DSA (SRNS 2021b), augmented to reflect new systems or facilities, and SPDP MAR. Each of the facilities in which SPDP activities would occur has been (or would be) designed and operated to reduce the likelihood of these accidents occurring. DSAs have been prepared for a number of the facilities evaluated in this EIS. Consistent with their purpose, source terms and other assumptions used for bounding DSA frequency and consequence estimates are conservative, and safety controls were developed based on these assumptions. For these EIS analyses, consistent, conservative, but not overly bounding assumptions were used across facilities and sites so that fair comparisons could be made of accident risks between alternatives. However, in all cases, sufficient safety controls (10 CFR Part 830) would be in place so that significant accidental releases are eliminated, reduced in frequency, or mitigated to reduce the consequences by implementing a combination of preventive or mitigative measures. If safety controls are fully credited, then the consequences of an accident would likely be much less than those reported in this SPDP EIS.

For each postulated accident, impacts are estimated for three receptors: a noninvolved worker, an MEI, and the offsite population. The population distribution was derived using the same base census data as used in the 2015 SPD SEIS (DOE 2015c) but projecting to the year 2040 (USCB 2021d). Consequences for these receptors were estimated without regard for emergency response measures (e.g., evacuation, sheltering). In addition, none of the released radionuclides were assumed to have been removed from the plume by deposition. Thus, the reported consequences are conservative. That is, they are likely higher than those that might actually occur if an accidental release happened. Doses were estimated for postulated accidents at both of the SRS locations where surplus plutonium disposition activities would occur (F-Area and K-Area).

The consequences for workers directly involved in the processes under consideration are not quantified. The uncertainties involved in quantifying accident consequences for an involved worker are quite large because of the high sensitivity of results to assumptions (e.g., plume dispersion within a short distance). No major consequences for the involved worker are expected from leaks, spills, or smaller fires because involved workers should be able to evacuate immediately or be unaffected by the events. Explosions could result in immediate injuries from flying debris, as well as the uptake of radioactive materials. If a criticality occurred, workers in the immediate vicinity could receive high to fatal radiation exposures from the initial burst. The dose would depend on the magnitude of the criticality, the worker's distance from the criticality, and the amount of shielding provided by intervening structures and equipment. Severe earthquakes (beyond the facility design basis) could also have substantial consequences, ranging from workers being killed by debris from collapsing structures to high radiation doses from the uptake of radionuclides.

The following discussion presents the consequences of the bounding accidents resulting from operational and natural phenomena-related accidents for both alternatives. For this evaluation, the bounding natural phenomena event analyzed is a design-basis earthquake. Because of the uncertainty associated with extremely low probability events designated as "Beyond-design-basis," are not described in the following sections, but they are included in Appendix D.

Impacts are presented in terms of number of LCFs for offsite population and LCF risk for the noninvolved worker and MEI, based on the projected radiological doses. Impacts are provided for all the locations where SPDP activities would occur for each of the three receptors (50-mi population, MEI, and a noninvolved worker). The potential consequences of the bounding postulated operational and natural phenomena-caused accidents or external events under the Preferred Alternative and No Action Alternative are presented in Table 4-21 for the offsite population, the MEI, and the noninvolved worker.

Table 4-21. Bounding Radiological Accident Impacts at SRS During Facility Operations for the Preferred and No Action Alternatives

Receptor	Location	Preferred Alternative(a)(b) Base Approach Sub-Alternative		Preferred Alternative(b) SRS NPMP Sub-Alternative (105-K NPMP Option)		Preferred Alternative(b) SRS NPMP Sub-Alternative (Modular NPMP Option)		Preferred Alternative(b) All SRS Sub-Alternative (F-Area PDP Option)		Preferred Alternative(a)(b) All SRS Sub-Alternative (K-Area PDP Option)		No Action Alternative(b)	
		Dose (rem or person-rem)(c)	LCF(d)(e)(f)	Dose(rem or person-rem)(c)	LCF(d)(e)(f)	Dose (rem or person-rem)(c)	LCF(d)(e)(f)	Dose(rem or person-rem)(c)	LCF(d)(e)(f)	Dose (rem or person-rem)(c)	LCF(d)(e)(f)	Dose (rem or person-rem)(c)	LCF(d)(e)(f)
Noninvolved Worker (rem and LCF risk)	Operational K-Area	1.8	1×10^{-3}	6.6	4×10^{-3}	23	3×10^{-2}	1.8	1×10^{-3}	6.6	4×10^{-3}	6.6	4×10^{-3}
	Operational F-Area	NA	NA	NA	NA	NA	NA	5.8	3×10^{-3}	NA	NA	NA	NA
	NPH/External K-Area	2.9	2×10^{-3}	6.8	4×10^{-3}	4.7	3×10^{-3}	2.9	2×10^{-3}	6.8	4×10^{-3}	2.5	1×10^{-3}
	NPH/External F-Area	NA	NA	NA	NA	NA	NA	6.0	4×10^{-3}	NA	NA	NA	NA
MEI (rem and LCF risk)	Operational K-Area	0.063	4×10^{-5}	0.18	1×10^{-4}	0.62	4×10^{-4}	6.3×10^{-2}	4×10^{-5}	0.18	1×10^{-4}	0.18	1×10^{-4}
	Operational F-Area	NA	NA	NA	NA	NA	NA	0.24	1×10^{-4}	NA	NA	NA	NA
	NPH/External K-Area	0.11	6×10^{-5}	0.19	1×10^{-4}	0.13	8×10^{-5}	0.11	6×10^{-5}	0.19	1×10^{-4}	0.068	4×10^{-5}
	NPH/External F-Area	NA	NA	NA	NA	NA	NA	0.25	1×10^{-4}	NA	NA	NA	NA
Population(g)(h) (person-rem and number of LCFs)	Operational K-Area	50	0 (3×10^{-2})	$1.4\times10^{+2}$	0 (8×10^{-2})	$4.8\times10^{+2}$	0 (3×10^{-1})	50	0 (3×10^{-2})	$1.4\times10^{+2}$	0 (8×10^{-2})	$1.4\times10^{+2}$	0 (8×10^{-2})
	Operational F-Area	NA	NA	NA	NA	NA	NA	$2.0\times10^{+2}$	0 (1×10^{-1})	NA	NA	NA	NA
	NPH/External K-Area	83	0 (5×10^{-2})	$1.5\times10^{+2}$	0 (9×10^{-2})	$1.0\times10^{+2}$	0 (6×10^{-2})	83	0 (5×10^{-2})	$1.5\times10^{+2}$	0 (9×10^{-2})	53	0 (3×10^{-2})
	NPH/External F-Area(i)	NA	NA	NA	NA	NA	NA	$2.0\times10^{+2}$	0 (1×10^{-1})	NA	NA	NA	NA

LCF = latent cancer fatality; MEI = maximally exposed individual; NA = not applicable; NPH = Natural Phenomena Hazard; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site.

(a) Accident scenarios are consistent with DOE 2015c.

(b) A roadmap is provided in Table 4-15 in Section 4.1.3 to orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(c) The doses were normalized to absorption class M.

(d) The LCF is calculated by using a risk estimator of 0.0006 latent fatal cancers per rem or person-rem. For estimated individual doses equal to or greater than 20 rem, the risk estimated was doubled. The estimated risk is NOT doubled for population doses. NNSA considers LCFs <0.5 to be 0. The rounded LCF value is provided, along with the calculated value in parentheses.

(e) If the dose is >400 rem, it is assumed to result in a fatality, otherwise it is an LCF.

(f) The MEI and the noninvolved worker scenarios each assume 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. Thus, the value represents the risk of an LCF in an individual and the number of LCFs in an exposed population.

(g) Impacts on the populations within a 50 mi radius of the postulated release site.

(h) Population doses are presented as person-rem.

(i) Based on material analyzed in the SRS Pit Production EIS (DOE 2020a).

Note: Numbers are rounded to two significant digits.

Sources: See methodology and sources described in Appendix D and values in Tables D-4, D-6, D-8, and D-10.

Preferred Alternative

The radiological accident impacts of the Preferred Alternative at SRS are described below.

Base Approach Sub-Alternative

The Base Approach Sub-Alternative includes all facility accidents associated with SRS dilution and C&P in Building 105-K and the K-Area Complex (KAC). An LCF risk of less than 1 is expected for an individual receptor and less than 1 LCF for the general population for analyzed design-basis accidents resulting in an environmental release under this option.

SRS NPMP Sub-Alternative

The SRS NPMP Sub-Alternative includes all facility accidents associated with SRS processing of up to 7.1 MT of non-pit in Building 105-K and dilution and C&P of 34 MT in Building 105-K and KAC.

Evaluation of the SRS NPMP Sub-Alternative includes facility accidents associated with non-pit processing in modular systems adjacent to Building 105-K.

An LCF risk of less than 1 is expected for an individual receptor and less than 1 LCF is expected for the general population for analyzed design-basis accident resulting in an environmental release under this option.

All SRS Sub-Alternative

The All SRS Sub-Alternative includes all facility accidents associated with SRS PDP of 34 MT surplus pit and non-pit plutonium at either a modified Building 105-K or Building 226-F (SRPPF) and also with SRS dilution and C&P in Building 105-K and the KAC.

An LCF risk of less than 1 is expected for an individual receptor and less than 1 LCF for the general population for analyzed design-basis accidents resulting in an environmental release under this option.

No Action Alternative

Radiological accidents under the No Action Alternative would be the same as or lower than those described for the SRS NPMP Sub-Alternative depending on the activities occurring during the sub-alternative.

4.1.3.7.3 Chemical Usage and Facility Accidents

This section presents the potential consequences of chemical use and chemical accidents related to SRS construction and facility operations under the Preferred and No Action Alternatives. Only small quantities of hazardous chemicals would be during operation and no bulk storage of these chemical quantities would be needed to support the surplus plutonium disposition activities. The hazards associated with these chemicals are well understood and because of their small quantities there are no chemical hazards requiring chemical accident analysis for SPDP activities (SRNS 2023d|Section 6.1|). Although large quantities of adulterant would be needed, it consists of nonhazardous inorganic materials (NNSA 2022).

Chemical exposure to workers during pit disassembly during the All SRS Sub-Alternative, can vary as a result of the composition of pit types, including the potential for exposure to beryllium. SRS would monitor for beryllium as discussed in Section 4.1.2.7.3 and adhere to the regulations in 10 CFR 850, "Chronic Beryllium Disease Prevention Program." Additional information on the beryllium program is found in Table 5-1.

Accidents related to construction and SPDP operations involving hazardous chemicals would primarily present a risk to the involved worker in the immediate vicinity of the accident. DOE safety programs are in place to minimize the risks to workers from both routine operations and accidents involving these materials and are implemented as part of normal work control programs.

Because of the small quantities of hazardous chemicals at risk and the distance from plutonium disposition facilities to the site boundary, there would be minimal risk of chemical exposure to the surrounding population from accidents.

4.1.3.7.4 Intentional Destructive Acts

NNSA has prepared a classified analysis of the potential impacts of intentional destructive acts as part of this SPDP EIS. Substantive details of intentional destructive act scenarios, security countermeasures, and potential impacts are not released to the public because disclosure of this information could be exploited by enemies to plan attacks.

NNSA's strategy for the mitigation of environmental impacts resulting from intentional destructive acts has three distinct components: (1) prevent or deter successful attacks, (2) plan and provide timely and adequate response to emergency situations, and (3) progress to recovery through long-term response in the form of monitoring, remediation, and support for affected communities and their environments.

Although NNSA believes that the security force and systems of security controls would prevent a successful intentional destructive act, the classified analyses of such an act consider the potential impacts of a successful attack on facilities and during transportation. Depending on the intentional destructive act, impacts could be similar to or exceed the impacts of accidents analyzed in this SPDP EIS. Classified analyses of intentional destructive acts related to plutonium operations at SRS and transportation were presented in a classified analysis of the 2015 SPD SEIS (DOE 2015c). Information from those prior analyses and analyses specific to the alternatives evaluated in this SPDP EIS are included in the classified analysis of this SPDP EIS. The classified analysis calculates consequences for the noninvolved worker, MEI, and population in terms of physical injuries, radiation doses, and LCFs.

4.1.3.8 SRS Cultural and Paleontological Resources

Impacts on cultural resources (i.e., archaeological resources, historic buildings, and TCPs) and paleontological resources could occur as a result of ground-disturbing activities and building alterations. Any alternative that includes these activities has potential to impact resources. Also, viewsheds and landscapes associated with significant TCPs could be indirectly affected by the introduction of visual alterations to the surrounding environment. This section presents the anticipated impacts of the Preferred and No Action Alternatives on the potentially affected cultural resources at SRS.

In addition to the NEPA analysis presented here, DOE sites would also address impacts through NHPA Section 106 consultation with the SHPO, Tribes, and interested parties as appropriate, or as specified in PAs (see Section 5.0).

No impacts on cultural resources are expected from operations because there would be no ground-disturbing activities, no building modifications to NRHP-eligible historic properties, and no TCPs have been identified; thus, no impacts on cultural or historic resources are expected. Activities perceived as posing a potential threat to archaeological resources would be monitored (SRARP 2016). Thus, impacts from operations are not discussed further.

Important paleontological resources are not known to occur within the K-Area or F-Area project areas, as discussed in Section 3.3.8. Therefore, no impacts on paleontological resources from construction and operation at SRS are expected, and this subject is not discussed further.

4.1.3.8.1 Preferred Alternative

The impacts from construction on cultural resources for each of the sub-alternatives from the Preferred Alternative are described below.

Base Approach Sub-Alternative

The capability for dilution is being installed in Building 105-K and the capability for C&P currently exists. There would be no construction or modification activities at SRS associate with the Base Approach Sub-Alternative. Thus, there would be no impacts associated with construction on cultural resources from activities at SRS under the Base Approach Sub-Alternative.

SRS NPMP Sub-Alternative

As discussed in Section 4.1.3.1, no construction activities outside of Building 105-K would be needed for installation of the NPMP in the building. However, the installation of a modular system adjacent to Building 105-K would require placement of a concrete pad in a previously disturbed area. The Archaeological Resource Management Plan has processes that would identify whether additional surveying would be needed due to the proximity of archaeological resources (SRARP 2016) in this area or in other locations that may require ground disturbance for support systems. Activities perceived as posing a potential threat to resources would be monitored by cultural resources staff (SRARP 2016).

Alteration of buildings (interior or exterior) have the potential to affect historic-era buildings and structures and their environment. Building 105-K is the only building identified for modification or use under the SRS NPMP Sub-Alternative. Building 105-K is not on the list of eligible Cold War properties and has been the subject of previous NEPA analysis (DOE 2015c; DOE et al. 2020).

Laws, Executive Orders, and DOE policy require consultation with Native American Tribes that have ancestral/historic ties to the site of SRS. The existence of TCPs is unknown but would be addressed by DOE through NHPA Section 106 (54 U.S.C. § 306101) consultation with the Tribes.

All SRS Sub-Alternative

It is assumed that modifications would be made to Building 226-F (SRPPF) or Building 105-K and the surrounding area, as would additional excavation and construction of support buildings for PDP and NPMP in F-Area or K-Area. This includes new or modified utilities including, but not limited to, additional power and or water. It is assumed that the project area for excavation of buildings or utilities to support construction of PDP and NPMP capabilities in F-Area or K-Area would be encompassed by area previously analyzed for the Pit Disassembly and Conversion Facility or pit disassembly and conversion in K-Area (DOE 2015c; DOE 2012c).

As discussed in Section 3.3.8.1, in compliance with Title 36 of the *Code of Federal Regulations* Part 800 (36 CFR Part 800), cultural resources at SRS are managed under the terms of a PA between DOE, the South Carolina State Historic Preservation Office, and the Advisory Council on Historic Preservation (DOE et al. 2020|Section 3.6.2|). The existing SRS Archaeological Resource Management Plan and PA would be followed for any modifications, alterations to, or demolition of existing structures (DOE et al. 2020).

Because extensive ground disturbance would occur in F-Area or K-Area, including the addition of infrastructure or utilities to support modification of Building 226-F (SRPPF) and Building 105-K, the Archaeological Resource Management Plan processes would be used to identify whether additional surveying would be needed because of the proximity of archaeological resources (SRARP 2016). Activities perceived as posing a potential threat to resources would be monitored by cultural resources staff (SRARP 2016).

4.1.3.8.2 No Action Alternative

Impacts on all cultural resources during construction or modification activities under the No Action Alternative for installing a NPMP capability would be the same as those described for the SRS NPMP Sub-Alternative for modifications in Building 105-K.

4.1.3.9 SRS Socioeconomics

Socioeconomic impacts result from the direct employment of construction and operations workers and the impacts of any resultant population changes on local housing resources or vehicular traffic conditions in the SRS ROI. As described in Section 3.3.9, the SRS ROI includes Aiken and Barnwell Counties in South Carolina and Columbia and Richmond Counties in Georgia.

Table 4-22 and Table 4-23 provide summaries of the socioeconomic impacts anticipated at SRS under the Preferred and No Action Alternatives construction/modifications and operations, respectively. Detailed economic impacts by capability are presented in Tables C-19 and C-20 in Appendix C. Total economic impacts reported are the sum of direct, indirect, and induced economic impacts. Employment impacts are reported as the number of full- or part-time jobs. Earnings impacts include the wages, salaries, and benefits paid to workers. Output impacts are the effects of the combination of all economic activity occurring in the local ROI economy.

The activities considered under each alternative as described in Section 2.1.1.2.3, would occur over multiple years in the future. Staffing and expenditures would vary by year of activity. To bound the analysis, NNSA selected the year to model for impacts in which staffing and expenditures would be highest. The impacts reported represent maximum annual impacts anticipated for any single year. During most project years, impacts would be lower.

Table 4-22. Peak-Year Economic Impacts at SRS During Construction/Modification for the Preferred and No Action Alternatives

Impact Indicator (Units)	Preferred Alternative[(a)] Base Approach Sub-Alternative	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (Modular NPMP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (F-Area NPMP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative[(a)]
Direct Employment (FTE in peak year)	(b)	78[(c)]	30[(c)]	525[(c)]	525[(c)]	78[(c)]
Total ROI Employment (Jobs in peak year)	(b)	197	69	1,446	1,446	197
Direct Earnings ($Million in peak year)	(b)	19.5	7.5	131.3	131.3	19.5
Total ROI Earnings ($Million in peak year)	(b)	24.3	7.9	176.7	176.7	24.3
Direct Output ($Million in peak year)	(b)	19.3	6.3	168.5	168.5	19.3
Total ROI Output ($Million in peak year)	(b)	37.1	12.1	306.8	306.8	37.1

FTE = full-time equivalent (employee); NPMP= non-pit metal processing; PDP = pit disassembly and processing; ROI = region of influence; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(b) No construction/modification activities are anticipated.

(c) Direct employment numbers for the SRS NPMP Sub-Alternative are from Section 19.1 for the 105-K NPMP option and Section 19.2 for the Modular NPMP option (SRNS 2023d (SRNS 2023d|Sections 19.1 and 19.2|). The direct employment numbers for the All SRS Sub-Alternative are derived from DOE 2015c|Table F-8| and DOE 2012c|Table 2.4-2| for the total highest year after subtracting the construction workers for the separate Non-Pit project. It is assumed in this SPDP EIS that the NPMP capability will be included in the PDP capability for the All SRS Sub-Alternative options. The direct employment numbers for the No Action Alternative are identical to those from the SRS NPMP Sub-Alternative 105-K NPMP option.

Sources: Calculated from data in SRNS 2023d; DOE 2012c|Table 2.4-2|; DOE 2015c|Table F-8|.

Table 4-23. Peak-Year Economic Impacts at SRS During Operations for the Preferred and No Action Alternatives

Impact Indicator (Units)	Preferred Alternative[(a)] Base Approach Sub-Alternative	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (Modular NPMP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative[(a)]
Direct Employment (FTE in peak year)[(b)]	522[(c)]	635[(c)]	560[(c)]	1,016[(c)]	1,016[(c)]	212[(c)]
Total ROI Employment (Jobs in peak year)	1,460	1,753	1,559	3,585	3,585	567
Direct Earnings ($Million in peak year)	141.2	172.1	149.0	350.3	350.3	57.7
Total ROI Earnings ($Million in peak year)	151.3	182.9	162.0	437.2	437.2	60.1
Direct Output ($Million in peak year)	204.8	237.7	215.9	505.0	505.0	70.3
Total ROI Output ($Million in peak year)	344.0	403.2	364.0	883.6	883.6	122.5

FTE = full-time equivalent (employee); LANL = Los Alamos National Laboratory; NPMP= non-pit metal processing; PDP = pit disassembly and processing; ROI= region of influence; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to help orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(b) The variation in the number of staff anticipated at each site (LANL or SRS) for equivalent processing activities varies based on the equipment that would be used at each site for processing activities.

(c) Direct employment staffing levels for operations activities for the Base Approach were obtained from Section 19.3 of SRNS 2023d for the Dilution capability (295 staff) and for the C&P capability (55 staff). Staffing for the SRS NPMP Sub-Alternative is the same as the Base Approach Sub-Alternative for the Dilution and C&P capabilities but with an additional 98 staff for the NPMP capability in the Building 105-K and 33 staff for the Modular System (SRNS 2023d|Section 19.5|). Staffing for both options of the All SRS Sub-Alternative are scaled from the number of workers for PDP at LANL based on the difference in assumed throughput (2.5 MT/yr at SRS versus 2 MT/yr at LANL) and then added to the estimates for the Dilution Capability and C&P Capability as given for the Base Approach Sub-Alternative. Staffing for the No Action Alternative was scaled to 7.1 MT from the values provided for the Base Approach Sub-Alternative, and added to the value provided for the NPMP in Building 105-K.

Sources: Calculated from data in SRNS 2023d; DOE 2012c; DOE 2015c.

4.1.3.9.1 Regional Economic Characteristics

This section presents the regional economic impacts of the Preferred and No Action Alternatives at SRS. The impacts include the direct, indirect, and induced economic impacts that result from project activities. Employment, labor income, and industry output metrics are discussed in this section. As project-related direct expenditures are made in the ROI, these dollars begin to circulate in the economy. As funds are expended to pay employees and to buy goods and services, the recipients then make purchases, causing successive rounds of local spending, until the original expenditures eventually exit the ROI. Economic multipliers are estimated to capture the effects of these rounds of spending that occur within the ROI (see Section 3.3.9). The economic impacts were estimated using the IMPLAN model (calculated from IMPLAN 2021) to capture the indirect and induced impacts resulting from the direct peak-year activities occurring at SRS. For each sub-alternative, the effects of direct labor and non-labor expenditures were modeled, and the total effects of the direct employment and material expenditures were estimated.

<u>Preferred Alternative</u>

The socioeconomic impacts from the Preferred Alternative at SRS relative to construction and operations are described below for each approach and sub-alternative.

<u>Base Approach Sub-Alternative</u>

There would be no construction or modification activities at SRS associated with the Base Approach Sub-Alternative. Thus, there would be no impacts associated with construction on economic resources from activities at SRS under the Base Approach Sub-Alternative.

At the peak of operations, when project employment and expenditures are highest, 522 operations workers would be employed (SRNS 2023d|Section 19.3|). Labor expenditures and non-labor costs, including materials costs, are shown in Table 4-23. These direct impacts translate to a total impact of 1,460 jobs in the ROI and $344 million in total industry output. The total employment impact of 1,460 jobs represents 0.6 percent of the current ROI employed workforce of 239,114 and would be projected to represent a smaller proportion of the future ROI workforce. These impacts would be minor in the context of the ROI economy.

<u>SRS NPMP Sub-Alternative</u>

Modification of Building 105-K or the addition of modular units for NPMP adjacent to Building 105-K would have minimal economic impacts in the SRS ROI. Peak-year impacts include creation of 78 construction jobs tied to Building 105-K modifications or an addition of 30 jobs during installation of the modular units (SRNS 2023d|Sections 19.1, 19.2|). These direct construction jobs in turn would lead to a total employment impact of 197 or 69 jobs, respectively, in the SRS ROI. The total labor income impacts and the total output impacts are shown in Table 4-22. These are minimal impacts in the context of the SRS ROI economy.

At the peak of operations, when project employment and expenditures are highest, there would be 635 workers if operations occurred in Building 105-K, or 560 operations workers if operations occurred in the modular system adjacent to Building 105-K (SRNS 2023d|Section 19.3, 19.5|). These 635 direct workers in turn would lead to a total employment impact of 1,753 jobs in the SRS ROI. The total labor income impacts the total output impact are shown in Table 4-23 and are minor impacts in the context of the SRS ROI economy. If the modular system were to be chosen, the impacts would be substantially smaller.

All SRS Sub-Alternative

Installing a capability for PDP and NPMP in Building 226-F (SRPPF) or in Building 105-K and developing support facilities would generate 525 direct construction jobs at SRS (DOE 2012c|Table 2.4-2; DOE 2015c|Table F-8|), which in turn would lead to a total employment impact of more than 1,446 jobs in the SRS ROI economy. The total labor income impact and total output impact in the SRS ROI economy are shown in Table 4-22. Although 1,446 jobs would be created by this sub-alternative, the economic impacts would still be minor in the context of the SRS economy and their relative effect on the economy would continue to decline with time as the ROI economy continues to grow.

At the peak of operations, when project employment and expenditures are highest, 1,016 operations workers would be employed for the All SRS Sub-Alternative capabilities. This includes 494 workers for PDP in either Building 226-F or in Building 105-K (scaled to 2.5 MT/yr based on PDP activities at LANL (LANL 2023a|Section 1.4.1, Year 26|) and 522 workers for dilution and C&P in K-Area facilities (DOE 2015c|Table F-8|). These direct impacts translate to a total impact of 3,585 jobs in the ROI The total labor expenditures and non-labor costs, including materials costs, and total industry output are shown in Table 4-23. The total employment impact of 3,585 jobs represents nearly 1.5 percent of the current ROI employed workforce of 239,114 and would be projected to represent a smaller proportion of the future ROI workforce. Though relatively small in comparison to the size of the SRS ROI economy, the indirect and induced economic impacts are likely to be noticeable. Although 1,016 jobs at SRS is over 9 percent of the current site workforce, these impacts would be minor in the context of the wider ROI economy.

No Action Alternative

A capability would be constructed at Building 105-K for NPMP. At the peak of construction activities related to NPMP at Building 105-K, approximately 78 construction workers would be employed. Construction would create a total employment impact of 197 jobs in the ROI, which amount to only a minor impact, and the related impacts on labor. The capabilities for dilution and C&P currently exist or are currently being developed.

Operational activities for NPMP and dilution would occur in Building 105-K. C&P would also occur in the K-Area. At the peak of activities at SRS, when project employment and expenditures are highest, 212 operations workers would be employed in K-Area facilities. Labor expenditures and non-labor costs, including materials costs are shown in Table 4-23. The total employment impact of 567 jobs represents just over 0.2 percent of the current ROI employed workforce of 239,114 and would be projected to represent a smaller proportion of the future ROI workforce. These impacts would be minimal in the context of the ROI economy.

4.1.3.9.2 Population and Housing

As a result of the economic activity generated by project-related expenditures, workers may relocate to the ROI. In some cases, workers may have families that also would relocate. Relocating workers and families would require available housing resources.

Preferred Alternative

The population- and housing-related socioeconomic impacts of the Preferred Alternative at SRS relative to construction and operations are described below for each sub-alternative.

Base Approach Sub-Alternative

There would be no construction or modification activities at SRS associated with the Base Approach Sub-Alternative. Thus, no population changes or impacts on housing availability would be expected from construction activities at SRS under the Base Approach Sub-Alternative.

As discussed above, operation activities under this alternative would result in an estimated 1,460 peak-year jobs in the ROI, which represents about 0.6 percent of the current workforce of 239,114. Expected future workforce growth would reduce this percentage. Some portion of SRS operations workers would be expected to relocate to the ROI from other parts of the country and some ROI jobs created by expenditure impacts at SRS may also involve workers relocating from other areas. However, these numbers would be minimal in relation to the anticipated future workforce in the ROI. Thus, only minor related population and housing impacts are expected. Relocating workers would settle in all counties of the ROI, likely in proportion to the current SRS workforce residence pattern. Thus, 53.5 percent of the relocating workers (as many as 781) would be expected to settle in Aiken County. Current housing statistics reported in Section 3.3.9 suggest that the ROI and Aiken County, specifically, have sufficient housing capacity to handle this influx, and only minor population and housing impacts would be expected.

SRS NPMP Sub-Alternative

Minimal construction work would be required to support K-Area facility modifications for NPMP in either Building 105-K or in a modular system placed adjacent to Building 105-K. SRS construction activities are likely to result in few new workers relocating to the ROI. Thus, no noticeable population changes or impacts on housing availability would be expected.

Operation activities under this alternative would result in an estimated 1,753 peak-year jobs in the ROI if operations occurred in Building 105-K, which represents about 0.7 percent of the current ROI workforce. Expected future workforce growth would reduce this percentage. Some portion of SRS operations workers would be expected to relocate to the ROI from other parts of the country and some ROI jobs created by expenditure impacts at SRS may also involve workers relocating from other areas. However, these numbers would be minimal in relation to the anticipated future workforce in the ROI. Thus, impacts would be similar to those under the Base Approach Sub-Alternative.

All SRS Sub-Alternative

Construction activities under the All SRS Sub-Alternative would result in an estimated 1,446 peak-year jobs in the ROI, which represents about 0.6 percent of the current ROI workforce. Expected future workforce growth would reduce this percentage. Most SRS construction workers would be expected to come from within the ROI and not from other parts of the country and few ROI jobs created by expenditure impacts at SRS would involve workers relocating from other areas. However, these numbers would be minimal in relation to the anticipated future workforce in the ROI. Thus, only minor related population and housing impacts are expected.

Operation activities under this alternative would result in an estimated 3,585 peak-year jobs in the ROI, which represents about 1.5 percent of the current ROI workforce. Expected future workforce growth would reduce this percentage. Some portion of SRS operations workers would be expected to relocate to the ROI from other parts of the country and some ROI jobs created by expenditure impacts at SRS may also involve workers relocating from other areas. Thus, 53.5 percent of the relocating workers (as many as 1,918) would be expected to settle in Aiken County. Current housing statistics reported in Section 3.3.9 suggest that the ROI has more than sufficient housing capacity to handle this influx, and only minor population and housing impacts would be expected.

No Action Alternative

As described above, minimal construction work would be required to develop a capability for NPMP at Building 105-K. SRS construction activities are not likely to result in new workers relocating to the ROI. Thus, no population changes or impacts on housing availability would be expected.

As discussed above, operation activities under the No Action Alternative would result in an estimated 567 peak-year jobs in the ROI, which represents a fraction of a percent of the ROI current workforce of 239,114. These numbers would be minimal in relation to the anticipated future workforce in the ROI. Thus, related population and housing impacts are not expected.

4.1.3.9.3 Traffic

As a result of the increases in direct employment at SRS, traffic on local public roads would be expected to increase. Given the small relative increases in employment expected, when compared to the ROI total workforce, traffic impacts throughout the ROI generally would be minimal, but traffic on local public roads accessing SRS would be expected to increase. The traffic impacts on these routes are discussed in this section.

Preferred Alternative

The traffic-related socioeconomic impacts of the Preferred Alternative at SRS relative to construction and operations are described below for each approach and sub-alternative.

Base Approach Sub-Alternative

No construction activities are required at SRS for the Base Approach Sub-Alternative (SRNS 2023d|Section 1|). Thus, there would be no traffic impacts under the Base Approach Sub-Alternative.

The addition of 522 peak-year jobs for dilution and C&P operational activities would result in a maximum of 1,044 additional trips per day, which would be dispersed among several potential access routes. As described in Section 3.3.9, there is excess traffic capacity on the routes accessing SRS and only negligible impact on LOS values would be expected. Outside of SRS, additional trips expected as a result of the total employment impacts would be dispersed on the various routes available and would represent only a minimal traffic or LOS impact in the ROI.

SRS NPMP Sub-Alternative

The addition of up to 78 employees during construction would result in a maximum of 156 additional trips per day, which would be dispersed among several potential access routes. As described in Section 3.3.9, there is excess traffic capacity on the routes accessing SRS and only a negligible impact on

LOS values would be expected. Outside of SRS, additional trips expected as a result of the total employment impacts would be dispersed on the various routes available and would represent only a minimal traffic or LOS impact in the ROI.

The addition of 560 peak-year jobs during operational activities would result in a maximum of 1,120 additional trips per day, which would be dispersed among several potential access routes. As described in Section 3.3.9, there is excess traffic capacity on the routes accessing SRS and only negligible impact on LOS values would be expected. Outside of SRS, additional trips expected as a result of the total employment impacts would be dispersed on the various routes available and would represent only a minimal traffic or LOS impact in the ROI.

<u>All SRS Sub-Alternative</u>

The addition of 525 employees during construction would result in a maximum of 1,050 additional trips per day, which would be dispersed among several potential access routes. As described in Section 3.3.9, there is excess traffic capacity on the routes accessing SRS and only a negligible impact on LOS values would be expected. Outside of SRS, additional trips expected as a result of the total employment impacts of 1,446 new jobs would be dispersed on the various routes available and would represent a minor traffic or LOS impact in the ROI.

The addition of 1,016 peak-year jobs during operational activities would result in a maximum of 2,032 additional trips per day, which would be dispersed among several potential access routes. As described in Section 3.3.9, there is excess traffic capacity on the routes accessing SRS and only a small impact on LOS values would be expected. Outside of SRS, additional trips expected as a result of the total employment impacts would be dispersed on the various routes available and would represent only a minor traffic or LOS impact in the ROI.

<u>No Action Alternative</u>

Only minor numbers of construction workers are anticipated during construction of the NPMP capability at Building 105-K. Construction activities are not likely to result in new workers relocating to the ROI. Thus, no traffic impacts on the major public routes in the ROI would be expected, nor would changes in LOS values be expected. Access to SRS is accomplished via several routes, which serve to disperse traffic impacts. The current LOS values of these routes are not known, but they would not likely be affected by this minimal increase in traffic.

The addition of 212 peak-year jobs during operational activities would result in a maximum of 424 additional trips per day, which would be dispersed among several potential access routes. As described in Section 3.3.9, currently there is excess traffic capacity on the routes accessing SRS. Assuming the number of additional trips would be proportionally distributed among the potential access routes, some potentially noticeable impacts on LOS values would be expected, but would not be expected to degrade the LOS rating below LOS C from current ratings of LOS A. Outside of SRS, additional trips expected as a result of the total employment impacts would be dispersed on the various routes available and would represent only a minimal traffic or LOS impact.

4.1.3.10 SRS Infrastructure

This section presents the anticipated infrastructure demands for electricity, fuel, water, and sewage treatment during construction and operations activities for each alternative at SRS, as well as the percentage of the available capacity represented by that demand. Utilities and fuels that have no appreciable use for an alternative are not presented. Additional onsite road and rail infrastructure are not needed to support the Preferred or No Action Alternatives and, therefore, are not discussed further. Traffic impacts on routes to SRS are presented in Section 4.1.2.9 and impacts related to transportation of radioactive and construction materials are presented in Section 4.1.6.4.

Table 4-24 and Table 4-25 present the anticipated impacts of utility and fuel use at SRS for construction and operations, respectively, for the Preferred and No Action Alternatives. Detailed infrastructure impacts by capability are presented in Tables C-21 and C-22 in Appendix C.

Water use and sewage generation is shown in the tables, but a more detailed discussion for both is found in Section 4.1.3.3. Utilities and fuels that are not used appreciably are not discussed or presented. Natural gas, heating oil, or steam would not be needed for construction or operations (SRNS 2023d|Section 12|) and are not discussed further in this section.

4.1.3.10.1 Preferred Alternative

This section discusses the infrastructure impacts of the construction and operation activities associated with the Preferred Alternative at SRS, as shown in Table 4-24 and Table 4-25.

Base Approach Sub-Alternative

There would be no construction or modification activities at SRS associated with the Base Approach Sub-Alternative, and consequently, there would be no infrastructure impacts.

During operations, a small increase in electrical power would be required for lighting and operation of equipment and support facilities for the dilution and C&P processes (SRNS 2023d|Section 12.3, 12.6|). Fuel needs include propane for forklifts and diesel fuel to operate a new 200 kW standby generator that would be installed to provide additional backup power for the dilution processing operation (SRNS 2023d|Section 12.3|). Fuel supply would not be an impact on SRS because fuel (diesel fuel, gasoline, and propane) would be delivered, as needed, thus there would be no limit on capacity (DOE 2015c|Section 3.1.9|). The need for sewage treatment assumes that water used by staff for operations would be discharged to the Sanitary Wastewater Treatment Plant (SWTP), resulting in a significant impact on available capacity. A project is proposed to route wastewater from the K-Area into the CSWTF. Until this project is completed, wastewater from dilution and C&P operational activities will continue to flow to the K-Area SWTP.

SRS NPMP Sub-Alternative

Construction of facilities for the SRS NPMP Sub-Alternative would occur at K-Area in either Building 105-K or for a modular system adjacent to Building 105-K. Infrastructure impacts are discussed for the installation of the modular system at SRS. Electrical power would be supplied by gas or diesel-driven generators or the existing KAC feed through temporary connections. There would be a small increase in electricity demand for the construction efforts to install a NPMP system in Building 105-K or a modular NPMP system adjacent to Building 105-K. Gasoline and diesel fuel would be needed to run generators and air compressors used during construction (SRNS 2023d|Sections 12.1, 12.2|). Fuel supply would not be impacted because diesel fuel and gasoline would be delivered to the site as needed.

Table 4-24. Infrastructure Impacts at SRS During Construction/Modification for the Preferred and No Action Alternatives (with percent of available capacity)

Impact Indicator (Units)	Preferred Alternative[(a)] Base Approach Sub-Alternative	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (Modular NPMP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative[(a)]	Available Capacity
Electricity Use (MWh/yr)	(b)	minimal	minimal	16,000 (<1)	16,000 (<1)	minimal	4,080,000
Electricity Peak Load (MW)	(b)	minimal	minimal	1.8 (<1)	1.8 (<0.1)	minimal	440
Fuel Use (gal/yr)[(c)]	(b)	4,000 (NA)	750 (NA)	300,000 (NA)	540,000 (NA)	4,000 (NA)	NA
Water Use (million gal/yr)	(b)	1 (<1)	0.5 (<1)	1.1 (<1)	2 (<1)	1 (<1)	500
Sewage Generation (million gal/yr)	(b)	F-Area NA (NA) K-Area 1 (13)	F-Area NA (NA) K-Area 0.5 (7)	F-Area 1.1 (<1) K-Area NA (NA)	F-Area NA (NA) K-Area 1.1 (14)	F-Area NA (NA) K-Area 1 (13)	F-Area 268 K-Area 8

NA = not applicable; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(b) No construction/modification activities are anticipated.

(c) Fuel use would involve a combination of diesel fuel and gasoline.

Notes: Numbers are rounded to two significant digits. Parenthetical values are percent of available capacity.

Sources: SRNS 2023d; DOE 2015c|Table F-26|; SRNS 2010; ACI 2013.

Table 4-25. Infrastructure Impacts at SRS During Operations for the Preferred and No Action Alternatives (with percent of available capacity)

Impact Indicator (Units)	Preferred Alternative[a] Base Approach Sub-Alternative	Preferred Alternative[a] SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative[a] SRS NPMP Sub-Alternative (Modular NPMP Option)	Preferred Alternative[a] All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative[a] All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative[a]	Available Capacity
Electricity Use (MWh/yr)	11,000 (<1)	13,000 (<1)	14,000 (<1)	52,000 (1.3)	52,000 (1.3)	4,100 (<1)	4,080,000
Electricity Peak Load (MW)	1.6 (<1)	1.8 (<1)	1.9 (<1)	6.3 (1.4)	6.3 (1.4)	0.53 (<1)	440
Fuel Use (gal/yr)[b][c]	7,200 (NA)	14,000 (NA)	14,000 (NA)	180,000 (NA)	180,000 (NA)	3,000 (NA)	NA
Water Use (millions of gal/yr)	3.6 (<1)	4.6 (<1)	4.6 (<1)	8.6 (1.7)	8.6 (1.7)	1.8 (<1)	500
Sewage Generation (millions of gal/yr)	F-Area NA (NA) K-Area 3.6 (46)	F-Area NA (NA) K-Area 4.6 (58)	F-Area NA (NA) K-Area 4.6 (58)	F-Area 5 (2) K-Area 3.6 (46)	F-Area NA (NA) K-Area 8.6 (108)	F-Area NA (NA) K-Area 1.8 (22)	F-Area 268 K-Area 8

C&P = characterization and packaging; NA = not applicable; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to help orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(b) Fuel usage is a combination of diesel fuel and gasoline. The operation of generators is estimated for 100 hours for testing, but as a conservative measure, diesel fuel usage is based on 500 hours per year consistent with the assumption for air quality impacts (DOE 2012c|Section 2.2.3, Table 2.2-7|).

(c) Propane is required for C&P operations (1,600 lb/yr), which is supplied, as needed, and is not reflected in the table. For the No Action Alternative, a fraction (7.1/34 or 21%) of the propane use would be required (334 lbs/yr). Steam, natural gas, and coal are not required for any alternative.

Notes: Numbers are rounded to two significant digits. Parenthetical values are percent of available capacity.

Sources: SRNS 2023d; DOE 2012c|Section 2.2.3, Table 2.2-7|; DOE 2015c|Table F-27|.

NPMP operations would occur in Building 105-K or in the modular system adjacent to Building 105-K. Dilution and C&P would take place in Building 105-K as outlined under the Base Approach Sub-Alternative. The infrastructure needs would be similar but vary somewhat with the number of workers anticipated in each location. Electricity would be needed for NPMP, dilution, and C&P processing activities, resulting in a small impact on available capacity. Diesel fuel would be required to operate the two new 200 kW generators in either Building 105-K or the modular system that would provide backup power. Propane would be required for C&P operations. Fuel supply would not be affected because diesel fuel and gasoline would be delivered to the site as needed. The wastewater that would be generated during operational activities would be directed to the K-Area SWTP. The wastewater generated from operation activities results in a significant impact on available capacity. A project is proposed to route wastewater from the K-Area into the CSWTF. Until completed, wastewater from NPMP, dilution, and C&P activities would flow to the K-Area SWTP.

All SRS Sub-Alternative

Under the All SRS Sub-Alternative, a PDP and NPMP capability would be constructed in Building 226-F (SRPPF) with construction of associated support facilities in F-Area or in K-Area at SRS. The infrastructure affected by the construction of the PDP and NPMP capability in F-Area or K-Area include electricity, fuel (gasoline and diesel), water and wastewater. Electrical power would be required for the construction and installation of gloveboxes and support systems in F-Area or K-Area to enable processing of surplus pit and non-pit plutonium metal, requiring a small impact on available capacity. Gasoline and diesel fuel would be needed to run generators and air compressors used during construction. Fuel use for construction of the PDP capability in F-Area is estimated to be the same as that estimated to construct a similar PDP capability in Building 105-K (DOE 2015c|Section F.7, Table F-26|). In K-Area, diesel fuel would be used by evaporators that would be used to evaporate water from the disassembly basin (SRNS 2010), in addition to construction of the PDP capability, which is based on the 2015 SPD SEIS (DOE 2015c|Section F.7, Tables F-26|) annual fuel use value, scaled to 20 ac of disturbed land (see Section 4.1.3.1). The fuel supply infrastructure would not be affected because diesel fuel and gasoline are delivered to the site as needed.

PDP and NPMP operations would occur in either F-Area or K-Area at SRS. Dilution and C&P would take place in K-Area as outlined under the Base Approach Sub-Alternative. During operations, a small increase in electrical power would be required for lighting and operation of equipment and support facilities for the PDP and NPMP, dilution, and C&P processes. The electricity consumption for PDP and NPMP operations would be similar to the electricity demand for operation of the PDP in Building 105-K, evaluated in the 2015 SPD SEIS (DOE 2015c|Section F.7, Table F-27|). Diesel fuel would be needed to operate a 200 kW standby generator for the dilution processing operations (SRNS 2023d|Section 12.3|) and for PDP and NPMP operations, which were estimated to operate based on a similar PDP capability in Building 105-K that was evaluated in the 2015 SPD SEIS (DOE 2015c|Section F.7, Table F-27|). If PDP and NPMP occur in F-Area, the All SRS Sub-Alternative also includes minor fuel needs for transporting material from PDP at F-Area to K-Area for dilution activities. The fuel supply infrastructure would not be affected because diesel fuel, gasoline, and propane would be delivered to the site as needed. Wastewater discharge for operations for PDP and NPMP, dilution, and C&P in K-Area would be directed to the K-Area SWTP. Wastewater discharge during operation of PDP and NPMP in F-Area would be treated at the CSWTF (see Section 4.1.3.3). Values in Table 4-25 reflect the two separate wastewater treatment facilities. A project is proposed to route wastewater from the K-Area into the CSWTF. Until completed, wastewater from the K-Area will continue to flow to K-Area SWTP. If PDP and NPMP occur in K-Area, wastewater discharge during operation of the All SRS Sub-Alternative will result in an exceedance of the K-Area SWTP capacity. Selection of this alternative would require completion of a project to expand the K-Area wastewater capacity or connect to the CSWTF.

4.1.3.10.2 No Action Alternative

Infrastructure-related impacts during construction or modification for the No Action Alternative would be the same as those described for the SRS NPMP Sub-Alternative for modification activities for Building 105-K.

Impacts related to infrastructure during operations for the No Action Alternative would be less than those from the SRS NPMP Sub-Alternative because of the reduced amount of material being processed through dilution and C&P activities. For the No Action Alternative, up to 7.1 MT of non-pit surplus plutonium will be processed as compared to the full 34 MT of combined surplus pit and non-pit plutonium. For the No Action Alternative, operation of dilution and C&P activities would result in a fraction (7.1/34 or 21%) of the resources impacted in the Base Approach Sub-Alternative, which are presented in Table 4-24 and Table 4-25 of this EIS.

4.1.3.11 SRS Waste Management

This section presents analysis of the impacts on radioactive, hazardous, and nonhazardous waste management capabilities at SRS for the Preferred and No Action Alternatives. The waste management impacts related to construction and operation of capabilities under both alternatives at SRS are summarized in Table 4-26 and Table 4-27 for construction/modifications and operations, respectively. Waste management capacity at SRS is discussed in Section 4.1.3.11.3. Detailed waste management impacts by capability are presented in Tables C-23 and C-24 in Appendix C.

As discussed in Section 3.3.11, waste would be either disposed of at the WIPP facility, onsite at SRS, or at commercial waste disposal facilities. Impacts from disposal of TRU waste at the WIPP facility are discussed in Section 4.1.5. This SPDP EIS does not consider potential environmental impacts related to commercial waste disposal facilities identified in Section 3.3.11. The impacts from waste disposal at these facilities were considered as part of the licensing, permitting, and approval process for the disposal facilities (e.g., Solid Waste Disposal Facility, Low Activity Waste Vault) (SRNS 2020c).

SRS indicates that construction/modification activities and daily operations and activities do not produce hazardous waste, although it may be created during nonroutine maintenance activities (SRNS 2023d|Section 15|). Waste regulated under the TSCA (15 U.S.C. § 2601 et seq. (1976)) is produced during modification activities such as removal of wall sealant (SRNS 2023d|Section 15|). Small amounts of universal waste, such as light bulbs, are also generated. Nonhazardous waste includes nonradioactive and nonhazardous construction-related waste.

Table 4-26. Total Waste Generation at SRS During Construction/Modification for the Preferred and No Action Alternatives

Impact Indicator (Units)	Preferred Alternative(a) Base Approach Sub-Alternative	Preferred Alternative(a) SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative(a) SRS NPMP Sub-Alternative (Modular NPMP Option)	Preferred Alternative(a) All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative(a) All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative(a)
CH-TRU Waste (job control waste) (m^3)	(b)	110	0	0	0	110
LLW (m^3)	(b)	0	0	0	12,000	0
MLLW (m^3)	(b)	0	0	0	210	0
Liquid LLW (L)	(b)	0	0	0	0	0
Solid Hazardous Waste (m^3)(c)	(b)	0	0	45	6,600	0
Solid Nonhazardous waste (m^3)	(b)	66	66	1,000	6,900	66

CH-TRU = contact-handled transuranic; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site; TSCA = *Toxic Substances Control Act*.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(b) No construction/modification activities are anticipated.

(c) Solid Hazardous Waste does not include TSCA waste or universal waste. TSCA waste generated during construction/modification for the NPMP capability is 28 m^3 and universal waste is 0.416 m^3 (SRNS 2023d|Section 15|).

Note: Numbers are rounded to two significant digits.

Sources: Calculated from SRNS 2023d.

Table 4-27. Total Waste Generation at SRS During Operations for the Preferred and No Action Alternatives

Impact Indicator (Units)	Preferred Alternative[(a)] Base Approach Sub-Alternative	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative[(a)] SRS NPMP Sub-Alternative (Modular NPMP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative[(a)] All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative[(a)]
CH-TRU Waste (diluted plutonium oxide) (m^3 and CCOs)	1,500 m^3 113,400 CCOs	1,500 m^3 113,400 CCOs	1,500 m^3 113,400 CCOs	1,500 m^3 113,400 CCOs	1,500 m^3 113,400 CCOs	310 m^3 24,000 CCOs
CH-TRU Waste (job control waste) (m^3)	1,400	1,500	1,600	2,000	2,000	170
LLW (m^3)	19,000	22,000	23,000	23,000	23,000	2,400
MLLW (m^3)[(b)]	0	0	0	42	42	0
Liquid LLW (L)	0	0	0	65,000	65,000	0
Solid Hazardous Waste (m^3)[(c)]	0	0	0	6.6	6.6	0
Solid Nonhazardous waste (m^3)	13,000	14,000	14,000	14,000	14,000	1,600

CCO = criticality control overpack (container); CH-TRU = contact-handled transuranic; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site; TSCA = *Toxic Substances Control Act*.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to help orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(b) MLLW generation rates are based on values reported by LANL because this reflects the expected process for PDP at SRS (LANL 2023a).

(c) Solid Hazardous Waste does not include TSCA waste or universal waste. TSCA waste generated during NPMP operations is negligible. Universal waste generation is 1.0 m^3 for dilution and 0.3 m^3 for NPMP activities (SRNS 2023d|Section 15|).

Note: Numbers except CCOs are rounded to two significant digits.

Sources: Calculated from SRNS 2023d; LANL 2023a.

4.1.3.11.1 Preferred Alternative

The waste impacts from the Preferred Alternative at SRS relative to construction and operations are described below.

Base Approach Sub-Alternative

The capability for dilution is currently being installed in Building 105-K and the capability for C&P currently exists. There would be no construction for the Base Approach Sub-Alternative and no waste would be generated.

The dilution process would generate approximately 113,400 CCOs of diluted plutonium oxide CH-TRU waste that would be sent to the WIPP facility over the entire project (27 years) (SRNS 2023d|Section 20.1|). The shipment of this amount of diluted plutonium oxide CH-TRU waste would not affect the normal waste process capability in E-Area at SRS because it is processed at the Characterization and Storage Pad in K-Area (SRNS 2023d|Section 20.1|).

Radioactive waste includes CH-TRU waste that would be generated as job control waste during the construction/modification and operation activities at SRS, as shown in Table 4-26. CH-TRU job control waste from dilution activities would include empty feed cans, convenience cans, and containers, plastic from bagout operations and tooling, and other maintenance equipment. A small amount of mixed CH-TRU waste would consist of lead-lined gloves that are used to reduce radiation dose to glovebox operators. The volume of diluted plutonium oxide CH-TRU waste is considered separately from the job control waste.

LLW consists of waste that is used inside the process rooms but outside of the gloveboxes, as well as various filters. No MLLW is anticipated to be generated on a routine basis (SRNS 2023d|Section 17.3|). No liquid LLW is anticipated from dilution activities (SRNS 2023d|Section 3.1|).

No radioactive waste would be generated during C&P operations because the diluted plutonium would be in sealed containers (SRNS 2023d|Section 17.6|).

Small amounts of hazardous waste would be generated during normal operations of dilution and C&P processes at K-Area; however, some maintenance practices, such as parts change-out, could occasionally generate hazardous compounds, which would be handled in accordance with established procedures. Universal waste generation would continue during operations because light bulbs would continue to be replaced as needed. No TSCA waste would be expected during normal operations; however, as with hazardous waste, unplanned maintenance activities could generate waste containing polychlorinated biphenyls, which would be handled in accordance with established procedures (SRNS 2023d|Section 15|).

SRS NPMP Sub-Alternative

Construction for the SRS NPMP Sub-Alternative to support the NPMP activities would occur at K-Area in either Building 105-K or in a modular system adjacent to Building 105-K. The construction of the modular system would take place offsite, and no waste generation is anticipated during installation of the modular system because it would be designed for minimal needs for external facilities. The only exception is nonhazardous waste, which was assumed to be similar to the amount generated during modifications in Building 105-K.

NPMP operations within the modular system would be similar to those of the glovebox lines in Building 105-K with several exceptions. The throughput is estimated to be 0.6 MT/yr, which is an increase of 0.2 MT/yr above that for the process in Building 105-K. In addition, the process in the modular system is anticipated to involve removal of the outer containers in the process room rather than in the glovebox, thereby resulting in decreased amounts of TRU waste but increased amounts of LLW.

All SRS Sub-Alternative

Under the All SRS Sub-Alternative, a PDP and NPMP capability would be constructed in Building 226-F (SRPPF) with construction of associated support facilities in F-Area or in Building 105-K in the disassembly basin area, while support facilities would be constructed in the vicinity of the main buildings. Dilution and C&P would take place in K-Area as outlined under the Base Approach Sub-Alternative. No radiological waste is anticipated during construction in F-Area because all construction activities would take place away from facilities that contain radioactive materials (SRNS 2023d). Radiological waste would be generated during facility decontamination and preparation activities within Building 105-K.

Operations under this alternative are like that of the SRS NPMP Sub-Alterative, however the pit disassembly and processing would be carried out at SRS. These activities could occur at either F-Area or K-Area. All other activities would occur within K-Area.

4.1.3.11.2 No Action Alternative

Waste management impacts during construction or modification for the No Action Alternative would be the same as those described for the SRS NPMP Sub-Alternative for modification activities at Building 105-K.

Waste management impacts during operations for the No Action Alternative would be less than those for the SRS NPMP Sub-Alternative because of the reduced amount of material being processed through dilution and C&P for up to 7.1 MT of non-pit surplus plutonium compared to the full 34 MT of combined surplus pit and non-pit plutonium.

4.1.3.11.3 Waste Management Capacity

Table 4-28 provides the total annual waste storage or treatment capacity as well as the site-wide annual waste-generation rates at SRS for each type of waste. Waste management capabilities at SRS were previously described in Section 3.3.11 (see Table 3-34). For each of the alternatives the waste generated is a small fraction (<3 percent) of the total waste storage or treatment capacity of SRS.

Under all alternatives, it is assumed that all LLW and MLLW generated at SRS would be disposed onsite or at an offsite permitted facility. The waste quantities would represent a small fraction of the available disposal capacity at these facilities. The quantities of all nonradiological waste generated during operation activities would also represent small fractions of the site-wide generation rates and the available capacity at disposal facilities.

Table 4-28. Annual Waste-Generation Rates at SRS During Operations for the Preferred and No Action Alternatives as a Percentage of the Waste Management Facility Capacity

Impact Indicator	Total Annual Waste Storage or Treatment Capacity (m³/yr)	Future Site-Wide Annual Waste Generation (m³/yr)	Onsite Storage Location	Percent of Waste Management Facility Capacity for the Preferred Alternative[a][b] Base Approach Sub-Alternative (%)	Percent of Waste Management Facility Capacity for the Preferred Alternative[a][b][c] SRS NPMP Sub-Alternative (%)	Percent of Waste Management Facility Capacity for the Preferred Alternative[a][b] All SRS Sub-Alternative (F-Area PDP Option) (%)	Percent of Waste Management Facility Capacity for the Preferred Alternative[a][b] All SRS Sub-Alternative (K-Area PDP Option) (%)	Percent of Waste Management Facility Capacity for the No Action Alternative[a][b] (%)
CH-TRU	13,000	370	Storage pads, then shipped to the WIPP facility	0.39	0.5	0.59	0.59	0.48
LLW	37,000	10,000	E-Area Solid Waste Management Facility	1.9	2.6	2.3	2.0	2.4
MLLW	300	400	E-Area for storage, then shipped offsite	0	0	0.58	0.58	0
Liquid LLW	590,000,000[d]	76,000,000[d]	Effluent Waste Treatment Facility	0	0	0	0	0
Solid Hazardous Waste	300	58	Temporary storage, then shipped onsite/offsite for disposal	0	0	0.1	0.1	0
Solid Nonhazardous waste	4,200,000	11,000	Temporary storage, then shipped onsite/offsite for disposal	0.011	0.014	0.011	0.011	0.01

CH-TRU = contact-handled transuranic; LLW = low-level radioactive waste; MLLW = mixed low-level radioactive waste; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

(a) A roadmap is provided in Table 4-15 in Section 4.1.3 to help orient readers to the activities that would occur at SRS for each of the sub-alternatives of the Preferred Alternative as well as the No Action Alternative. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(b) Alternative capacities are based upon annual averages.

(c) One set of values is listed for the SRS NPMP Sub-Alternative rather than two. The values displayed are the higher waste generation rate from the two SRS NPMP Sub-Alternative options (Building 105-K NPMP and modular system NPMP).

(d) Units for Liquid LLW are liters per year (L/yr) not cubic meters per year (m³/yr).

Note: Numbers are rounded to two significant digits.

Source: Calculated from SRNS 2023d.

4.1.3.12 SRS Environmental Justice

Environmental justice impacts are those health or environmental effects determined to have disproportionately high and adverse impacts on racial or ethnic minority populations or low-income populations, compared to the general population. Estimates of entire populations and minority and low-income subsets of populations in the vicinity of SRS have been characterized and are presented in Section 3.3.12. Resource areas having a nexus to environmental justice populations in close proximity to SRS include human health and socioeconomics.

The analysis of radiological human health impacts in Section 4.1.3.7.1 shows that none of the alternatives being considered contributes an appreciable risk to offsite populations of developing an LCF, as indicated in Table 4-20 for normal operations and Table 4-21 for postulated radiological accidents. Therefore, no disproportionally high and adverse human health impacts on racial or ethnic minority populations or low-income populations are expected under any alternative being considered, including for both construction and operations impacts.

The expected socioeconomic impacts associated with each of the alternatives being considered would be minimal in the context of the ROI economy, as discussed in Section 4.1.3.9. Most of the impacts would be considered beneficial economic impacts. Potential minor adverse impacts include increased traffic on or near SRS and minimal increases in demand for community services and infrastructure, but these would not be "high and adverse" impacts. Therefore, no disproportionally high and adverse socioeconomic impacts on racial or ethnic minority populations or low-income populations are expected under any alternative being considered, including any related to construction and operations impacts.

4.1.4 Y-12 National Security Complex

The activities described in Section 2.1.1.2.4 that would occur at Y-12 under the Preferred Alternative are within the bounds of activities analyzed in the *Final Site-Wide Environmental Impact Statement for the Y-12 National Security Complex* (DOE 2011a), as supplemented (DOE 2018i), and are therefore not reanalyzed in this SPDP EIS.

4.1.5 Waste Isolation Pilot Plant

As described in Sections 2.1.1.2.5 and 2.1.2.4, the WIPP facility is the only waste repository authorized for permanent disposal of TRU waste generated by *U.S. Atomic Energy Act* defense activities. TRU and mixed TRU wastes must meet WIPP WAC before they can be shipped to and disposed of at the WIPP facility (DOE 2022i). The activities that would occur at the WIPP facility (e.g., receiving, unloading, and waste transfer and disposal) for both the Preferred and No Action Alternatives are within the bounds of activities analyzed in previous NEPA documents (DOE 1997|Section 3.1.3|), and therefore not reanalyzed in this SPDP EIS.

CH-TRU waste would be generated during activities associated with the Preferred and No Action Alternatives by blending the plutonium oxide and adulterant. Job control waste as CH-TRU waste would also be generated during activities associated with each of the alternatives. All CH-TRU waste generated by the alternatives in this SPDP EIS would meet the WAC for disposal at the WIPP facility.

DOE's CBFO has initiated strategic planning initiatives to support the disposal of defense-generated TRU waste from throughout the DOE Complex. In December 2018, a permit modification request for the

WIPP facility Hazardous Waste Facility Permit was approved by the NMED; it clarified the mixed TRU waste disposal volume reporting. Under the approved disposal volume reporting approach for the WIPP LWA (Public Law 102-579), the WIPP LWA TRU waste volume is based on the container's internal volume for containers that are directly loaded, and for overpacked containers, it is based on the volume of the innermost waste container being disposed (NMED 2018).

CBFO is also planning to replace underutilized disposal capacity (in panels 1, 7, and 9) by adding two new TRU waste disposal panels (replacement panels 11 and 12) to the repository layout (DOE 2021b). Additional TRU waste disposal panels (replacement panels 11 and 12) are required to accommodate the remaining WIPP facility TRU waste volume capacity stipulated under the WIPP LWA, regardless of whether the Preferred Alternative is implemented for the 34 MT of plutonium analyzed in this SPDP EIS. DOE issued an SA (DOE 2021i) for the 5-year site-wide WIPP facility evaluation as well as to address the excavation of underground replacement panels for the disposal of TRU waste. Because the WIPP facility is regulated by numerous regulatory agencies (as delineated in Section 9 of the WIPP LWA of 1992, Public Law 102-579, as amended by Public Law 104-201 [*Waste Isolation Pilot Plant Land Withdrawal Amendment Act*]), DOE submitted a Permit Modification Request to the NMED to modify the Hazardous Waste Facility Permit to include the two replacement panels (DOE 2021b). This Permit Modification Request was subsequently consolidated with the Permit Renewal Application. NMED issued the final WIPP renewal permit on October 4, 2023. The permit became effective on November 3, 2023 (NMED 2023a).

In the *Final Environmental Impact Statement Waste Isolation Pilot Plant* (WIPP EIS) (DOE 1980) and two supplemental EISs issued in 1990 (DOE 1990) and 1997 (DOE 1997), DOE analyzed the development, operation, and transportation activities associated with the WIPP facility. DOE determined that the operation of the WIPP facility during the period when it would be accepting TRU waste shipments from around the DOE Complex could be accomplished safely. After final facility closure and sealing of the shafts to the underground facility, the WIPP facility would not be expected to contribute to any impact on human health over the regulatory period of 10,000 years following its decommissioning, as long as the repository was not disturbed (DOE 1997). WIPP facility disposal operations would result in small increases (less than 2 percent) in the annual average concentrations of criteria air pollutants; some short-term concentrations could be higher but would not exceed the regulatory limits (DOE 1997|p. 5-5, 5-6|). Radiological impacts from TRU waste disposal operations at the WIPP facility are expected to result in 0 (3×10^{-4}) LCFs for the population within 50 mi (DOE 1997|p. 5-29|) and a LCF risk of 3×10^{-7} to a hypothetical member of the public who is located in an area of public access that results in the highest exposure (DOE 1997|p. 5-29|). TRU waste disposal operations at the WIPP facility could result in an LCF risk of less than 1 to the involved worker population, and 0 (4×10^{-4}) LCFs would be anticipated among the noninvolved worker population (DOE 1997|p. 5-29 to 5-32|).

In the ROD associated with the WIPP SEIS (DOE 1997) (63 FR 3624), DOE announced its decision that the WIPP facility would begin accepting TRU waste for disposal. DOE also announced that it would dispose of up to 175,600 m^3 (6.2 million ft^3) of TRU waste generated by defense activities after preparation to meet the WIPP WAC. Since then, DOE continued to comply with the NEPA implementing regulations, in 10 CFR 1021.330(d), and published 12 SAs related to the 1997 WIPP SEIS (DOE 2021c). In each case, DOE found that the changes did not represent a substantial change relevant to environmental concerns; nor were there significant new circumstances or information relevant to environmental concerns (DOE 2021i).

Once TRU waste is packaged for disposal, it is characterized to assure that it meets the WIPP WAC before it can be shipped to and disposed of at the WIPP facility. General WIPP facility activities, including receiving, unloading, transferring, and disposal of waste, were analyzed and described further in the WIPP SEIS (DOE 1997|Section 3.1.3|). The WIPP SEIS and subsequent SAs provide the NEPA documentation for disposal of the diluted plutonium oxide CH-TRU waste at the WIPP facility.

Activities related to the transportation of the TRU waste to the WIPP facility are under the jurisdiction of DOE's CBFO for the entire DOE Complex. However, the transportation impacts that are directly related to the alternatives discussed in this SPDP EIS (i.e., transportation of diluted plutonium oxide CH-TRU waste and associated CH-TRU job control waste from LANL and SRS to the WIPP facility) are analyzed and described in Appendix E and Section 4.1.6.

In response to concerns related to the disposal of surplus plutonium CH-TRU waste at the WIPP facility, DOE commissioned studies by Sandia National Laboratories (SNL) that addressed the long-term performance of the WIPP facility based on a projected inventory estimate that includes the quantity of diluted plutonium oxide CH-TRU waste that is analyzed in this EIS (SNL 2018). Results of the SNL studies are summarized in Section 4.1.5.2.

4.1.5.1 Waste Management

Table 4-29 summarizes the amount of CH-TRU job control waste that would be sent to the WIPP facility from each site during construction activities for the Preferred and No Action Alternatives.

Table 4-30 summarizes the number of CCOs of diluted plutonium oxide CH-TRU waste and the job control CH-TRU waste that would be sent during operations activities by each site for the Preferred and No Action Alternatives. LANL and SRS have estimated that 113,400 CCOs (1,500 m^3) of diluted plutonium oxide CH-TRU waste would be sent to the WIPP facility with an input of 34 MT of plutonium (LANL 2023a|Section 2.12.1.2|; SRNS 2023d|Section 20.1|). CH-TRU waste for emplacement at the WIPP facility under the No Action Alternative is approximately 20 percent of the Preferred Alternative because of the lower amount of material that would be processed. This table also provides the amount of CH-TRU job control waste shipped to the WIPP facility as projected under the Preferred and the No Action Alternatives.

The inventory anticipated to be sent to the WIPP facility for disposal from the SPDP mission is a total of 34 MT surplus plutonium. Surplus plutonium proposed for disposal at WIPP via the dilute and dispose strategy is less than 2 percent of WIPP's approved capacity under the WIPP LWA (SRNS 2023a). DOE's CBFO is responsible for the evaluation, if needed, of any impacts this inventory might have on the WIPP facility operations as discussed in the WIPP SEIS (DOE 1997) and subsequent SAs listed in Appendix A. No operational impacts are anticipated because TRU waste similar to this inventory has previously been safely shipped and disposed of at the WIPP facility.

Table 4-29. Maximum Quantity of CH-TRU Job Control Waste Sent to the Waste Isolation Pilot Plant from LANL and SRS During Construction/Modification for the Preferred and No Action Alternatives

Waste Type	Site	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP Sub-Alternative[(a)]	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP Option)[(b)]	Preferred Alternative[(a)] All SRS Sub-Alternative (K-Area PDP Option)[(b)]	No Action Alternative[(a)]
CH-TRU Waste (job control waste) (m^3)	LANL	69	69	110	NA	NA	(c)
	SRS	(c)	110	NA	0	0	110
	Total	**69**	**170[(d)]**	**110**	**0**	**0**	**110**

CH-TRU = contact-handled transuranic; LANL = Los Alamos National Laboratory; NA = not applicable; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SPDP EIS = Surplus Plutonium Disposition Program Environmental Impact Statement; SRS = Savannah River Site.

(a) One set of values is listed for the SRS NPMP Sub-Alternative rather than two. The values displayed are the higher waste generation rate from the two SRS NPMP Sub-Alternative options (Building 105-K NPMP and modular system NPMP).
(b) The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.
(c) No construction/modification activities are anticipated.
(d) This column does not sum to the total due to rounding of individual values and total.

Notes: Values represent the maximum for quantity for each site. Total CH-TRU Waste quantity would be bounded by 1,100 m^3. Numbers are rounded to two significant digits.
Sources: Table 4-12 and Table 4-26 of this SPDP EIS.

Table 4-30. Maximum Numbers of CCOs and Maximum Quantity of CH-TRU Job Control Waste Sent to the Waste Isolation Pilot Plant from LANL and SRS During Operations for the Preferred and No Action Alternatives

Waste Type	Site	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP Sub-Alternative[(a)]	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP Option)[(b)]	Preferred Alternative All SRS Sub-Alternative (K-Area PDP Option)[(b)]	No Action Alternative
CH-TRU Waste (diluted plutonium oxide) (m^3 and CCOs)	**LANL**	0	0	1,500 m^3 113,400 CCOs	NA	NA	0[(c)]
	SRS	1,500 m^3 113,400 CCOs	1,500 m^3 113,400 CCOs	NA	1,500 m^3 113,400 CCOs	1,500 m^3 113,400 CCOs	310 m^3 24,000 CCOs
CH-TRU Waste (job control waste) (m^3)	**LANL**	670	670	1,600	NA	NA	59[(d)]
	SRS	1,400	1,600	NA	2,000	2,000	170[(d)]
	Total	**2,100**	**2,300**	**1,600**	**2,000**	**2,000**	**200[(d)]**

CCO = criticality control overpack (container); CH-TRU = contact-handled transuranic; LANL = Los Alamos National Laboratory; NA = not applicable; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SPDP EIS = Surplus Plutonium Disposition Program Environmental Impact Statement; SRS = Savannah River Site.

(a) One set of values is listed for the SRS NPMP Sub-Alternative rather than two. The values displayed are the higher waste generation rate from the two SRS NPMP Sub-Alternative options (Building 105-K NPMP and modular system NPMP).
(b) The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.
(c) Under both the No Action Alternative LANL NPMP Option and SRS NPMP Option, no diluted plutonium oxide CH-TRU waste would be generated at LANL. Dilution would occur at SRS.
(d) Under the No Action Alternative LANL NPMP Option, CH-TRU job control waste would be generated at LANL and SRS, but under the No Action Alternative SRS NPMP Option, CH-TRU job control waste would only be generated at SRS. The maximum amount of CH-TRU job control waste under the No Action Alternative would be 200 m^3, which is comprised of CH-TRU job control waste from LANL NPMP, SRS dilution, and SRS C&P. See more detail in Table C-35.

Notes: Numbers except CCOs are rounded to two significant digits. Columns may not sum to totals due to rounding of individual values and totals.
Sources: Table 4-13 and Table 4-27 of this SPDP EIS.

4.1.5.2 Performance Assessment

The long-term disposal standards of 40 CFR Part 191 Subparts B and C are designed to protect human health and the environment from releases of radioactive material for a 10,000-year time period, beginning when the repository is closed and the access shafts are sealed. The 40 CFR Part 191 requirements specify that releases of radionuclides to the accessible environment must be unlikely to exceed specific limits for 10,000 years after disposal. The accessible environment defined in 40 CFR 191.12 includes the land surface and the subsurface beyond the WIPP facility site boundary. The specific release limits are based on the estimated amount of TRU waste in the repository at the time of closure. DOE assesses the likelihood that the WIPP facility would meet these release limits through a process known as a performance assessment, as defined in 40 CFR 191.12.

Proof of the future performance of a disposal system is not to be had, in the ordinary sense of the word, in situations that deal with much shorter time frames. Instead, what is required is a reasonable expectation, on the basis of the record before the implementing agency (including results of the performance assessment), that compliance with 40 CFR 191.13(a) will be achieved. A reasonable expectation standard is used in 40 CFR Part 191 because the long time period involved, and the nature of the natural and human-made events and processes lead to uncertainties about future repository performance. DOE’s performance assessment is a probabilistic analysis that considers both subjective (epistemic) uncertainty and stochastic (aleatory) uncertainty. For example, DOE used a probability distribution of radionuclide solubility limits as a model input so uncertainties are accounted for in the calculations.

Long Term Repository Performance is modeled by the Performance Assessment. As defined in 40 CFR 191.12, performance assessment means an analysis that: (1) Identifies the processes and events that might affect the disposal system; (2) examines the effects of these processes and events on the performance of the disposal system; and (3) estimates the cumulative releases of radionuclides, considering the associated uncertainties caused by all significant processes and events. The EPA regulations (40 CFR 194.41) only allow DOE to take credit for active institutional controls (e.g., facility guarding, evaluation of land use in the area, post operational monitoring, land reclamation, and maintenance of fences and buildings) preventing inadvertent human intrusion (deep drilling) in the Performance Assessment for only 100 years after final facility closure. EPA regulations (40 CFR 194.33 & 194.41) require DOE to assume society loses all knowledge of the WIPP facility at one hundred years after final facility closure (no credit in the Performance Assessment for active institutional controls preventing drilling into the repository beyond 100 years) and requires DOE to assume and model inadvertent human intrusion (drilling) into the repository at the current elevated drilling rate in the Delaware Basin located in Southern New Mexico and Western Texas for the remainder of the regulatory time period (9,900 years). In addition to active institutional controls, the EPA Regulations at 40 CFR 194.43 allow DOE to propose a credit for Passive Institutional Controls after final facility closure to reduce the likelihood of inadvertent human intrusion in the performance assessment. A credit must be based on the proposed effectiveness of Passive Institutional Controls over time and would take the form of reduced likelihood in the performance assessment of human intrusion over several hundred years.

SNL completed a new performance assessment calculation called the Surplus Plutonium Disposition (SNL SPD) analysis (SNL 2018) for this SPDP EIS. The analysis approach compared an earlier performance assessment calculation (the Abandonment of Panel Closures in the South [APCS]) analysis (SNL 2018|p. 17|) to the SNL SPD analysis that uses a waste stream associated with the Preferred Alternative. The SNL SPD analysis includes an assumption that 42.2 MT of surplus plutonium TRU waste is disposed at the WIPP facility (SNL 2018|p. 13|), which includes the 6 MT of surplus plutonium that DOE already decided in the 2016 ROD to dilute and dispose of at the WIPP facility (81 FR 19588).

Additionally, DOE submitted a Compliance Recertification Application in 2019 (DOE 2019d; Zeitler 2019). This the fourth recertification application submitted to the EPA in accordance with the provisions of the WIPP LWA and is DOE's documentation of the WIPP facility's continued compliance with the applicable final radioactive waste disposal standards in 40 CFR Part 191 and the recertification criteria in 40 CFR Part 194. The EPA completed its review of the 2019 CRA. On May 3, 2022 EPA determined that the DOE continues to meet all applicable requirements of the final disposal regulations and the WIPP Compliance Criteria and recertified the WIPP facility (87 FR 26126).

The 2019 Compliance Recertification Application inventory estimates did not include a waste stream representing the 34 MT of surplus plutonium TRU waste because there was no final NEPA decision on the SPDP 34 MT. The 34 MT will be included in a future performance assessment compliance calculation and will be submitted to the EPA after NNSA has issued a ROD regarding the SPDP mission.

4.1.5.3 Total Releases

SNL was directed to perform a preliminary analysis on the 34 MT surplus plutonium TRU waste as input to this EIS, which in turn will inform NNSA's decision. The performance assessment approach calculates multiple "futures" using different plausible combinations of assumptions and model input parameters for comparison to the reasonable expectation standard in 40 CFR Part 191. Summary statistics from these futures are compared to the regulation that requires no more than a 0.1 probability (1 in 10 chances) that releases exceed 1 EPA unit and no more than a 0.001 probability (1 in 1,000 chances) that the releases exceed 10 EPA units (40 CFR Part 191). A comparison of the statistics for the overall mean for total releases (in EPA units) obtained for the APCS and the SNL SPD analyses is shown in Table 4-31 (SNL 2018). At a probability of 0.1, values obtained for the mean total release and upper 95 percent confidence interval for mean total release for the SNL SPD analysis are increased in comparison to the APCS analysis (50 percent and 48 percent, respectively). At a probability of 0.001, the mean total release and upper 95 percent confidence level for mean total release are lower for the SNL SPD analysis than for the APCS analysis (27 percent and 36 percent, respectively). The SNL SPD analysis shows with a 95 percent level of statistical confidence that the mean of the population of complementary cumulative distribution functions (CCDFs) meets the containment requirements of 40 CFR 191.13.

Table 4-31. Statistics for the Overall Mean Total Releases in EPA Units at Probabilities of 0.1 and 0.001 for the APCS and SNL SPD Analyses

Probability	Release Limit	Analysis	Mean Total Release	Lower 95% Confidence Limit Mean Total Release	Upper 95% Confidence Limit Mean Total Release
0.1	1	APCS	0.0727	0.0641	0.0826
0.1	1	SNL SPD	0.1090	0.0974	0.1219
0.001	10	APCS	1.3622	0.7132	1.8264
0.001	10	SNL SPD	0.9904	0.7814	1.1652

APCS = Abandonment of Panel Closures in the South; SNL SPD = Sandia National Laboratories Surplus Plutonium Disposition analysis.
Source: SNL 2018|p. 147|.

While mean total releases at the 0.1 probability level have increased by 50 percent for the SNL SPD analysis compared to the APCS analysis, the calculated mean total releases at both probability levels remain below the regulatory limits. However, the SNL SPD analysis is not a DOE performance assessment compliance calculation to meet 40 CFR Part 191 and 40 CFR Part 194. Instead, the analysis is planned for use as input to this SPDP EIS, which in turn will inform NNSA's decision SNL 2018|p. 169|.

4.1.6 Transportation Impacts

As described in Section 2.1.1.2.6 for the Preferred Alternative and Section 2.1.2.5 for the No Action Alternative, the impacts from transportation activities would not occur at one specific site, but instead would occur along the transportation route. This section presents the methodology and assumptions used and the impacts evaluated related to offsite transportation for the Preferred and No Action Alternatives including those during construction and operations as appropriate. The transportation of radioactive materials and waste could result in radiological and nonradiological impacts and air quality impacts. Nonradiological impacts would result from shipment of construction materials and nonradioactive wastes. Radiological impacts are those associated with the effects of low levels of radiation emitted during incident-free transportation and the effects of the accidental release of radioactive materials and are expressed as additional LCFs. Nonradiological impacts are independent of the nature of the cargo being transported and are expressed as traffic accident fatalities resulting only from the physical forces that accidents could impart to humans. Air quality impacts from increased criteria pollutant and GHG emissions could also occur when transporting materials and wastes.

Table 4-32 presents truck transport activity data and air pollutant emissions for the Preferred and No Action Alternatives. Table 4-33 presents risks of transporting radioactive materials and waste for the Preferred and No Action Alternatives. Table 4-34 presents estimated impacts from hazardous waste and construction material transport. Appendix E contains a more detailed description of the analysis and results of the human health effects from transportation.

Onsite shipment of radioactive materials and wastes would occur at both LANL and SRS. At LANL, the onsite shipments of TRU waste to the TRU waste facility are currently conducted as part of site operations. At SRS, onsite shipment of radioactive materials and wastes would also occur as part of site operation. In general, these shipments would not affect any members of the public because roads between processing areas are closed to the public; therefore, shipments would only affect onsite workers. Shipments of TRU waste, LLW, and MLLW at SRS are currently conducted as part of site operations and have no discernable impact on noninvolved workers. The transport of radioactive materials and wastes under the alternatives is not expected to significantly increase the risk to these workers. For OST shipments, onsite transport activities are coordinated to occur during non-peak traffic periods, further limiting the risk of noninvolved worker exposure. All involved workers (drivers and escorts) are monitored, and the maximum annual dose to a transportation worker would be administratively limited to 2 rem (10 CFR Part 835; DOE-STD-1098-2017 [DOE 2017b]).

Table 4-32. Truck Transport Activity Data and Air Pollutant Emissions for the Preferred and No Action Alternatives

Activity/Pollutant	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative SRS NPMP Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP Option)[(a)(b)]	Preferred Alternative All SRS Sub-Alternative (K-Area PDP Option)[(b)]	No Action Alternative
Number of shipments	5,563	6,183	5,563	4,900	4,900	1,144[(c)]
Two-way kilometers traveled (million)	23.1	13.8	23.1	24.1	24.1	5.40
CO (T)	51.2	29.8	50.7	54.0	54.0	12.2
NO_2 (T)	28.9	17.3	28.9	30.3	30.3	6.78
PM_{10} (T)	1.69	0.99	1.68	1.78	1.78	0.40
$PM_{2.5}$ (T)	0.29	0.17	0.28	0.30	0.30	0.07
SO_2 (T)	0.17	0.10	0.17	0.18	0.18	0.04
VOCs (T)	2.25	1.26	2.20	2.41	2.41	0.55
GHGs (MT)	22,000	12,900	21,900	23,200	23,200	5,220

CO = carbon monoxide; GHG = greenhouse gas; LANL = Los Alamos National Laboratory; NO_2 = nitrogen dioxide; NPMP = non-pit metal processing; PDP = pit disassembly and processing; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; SRS = Savannah River Site; SO_2 = sulfur dioxide; SPDP EIS = Surplus Plutonium Disposition Program Environmental Impact Statement; VOC = volatile organic compound.

(a) Includes onsite transportation between F-Area and K-Area. There are an assumed 425 shipments for a total of 6,460 two-way miles (10,400 two-way kilometers).

(b) The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

(c) Maximum number of shipments for the two No Action Alternative options; see Table 4-33.

Note: Numbers are rounded to three significant digits for all values except the number of shipments.

Sources: Shipments and number travel distances from Table 4-33 and Table 4-34 of this SPDP EIS. Emissions calculated based on travel distances and emission factors from Argonne National Laboratory (ANL 2022).

Table 4-33. Radiological and Nonradiological Risks of Transporting Radioactive Materials and Waste for the Preferred and No Action Alternatives

Alternative and Location (Site) of Capability	Number of Shipments	One-Way Kilometers Traveled (million)	Incident-free Crew Dose (person-rem)	Incident-free Crew Risk (LCFs)[a]	Incident-free Population Dose (person-rem)	Incident-free Pop. Risk (LCFs)[a]	Accident Radiological Risk (LCFs)[a]	Accident Nonrad. Risk (traffic fatalities)[a]
Preferred Alternative – Base Approach Sub-Alternative: PDP at LANL and Dilution at SRS	5,563	12	300	0 (0.2)	320	0 (0.2)	0 (0.0001)	1 (0.6)
Preferred Alternative – Base Approach Sub-Alternative: NPMP at LANL and Dilution at SRS	1,144	2.7	68	0 (0.04)	75	0 (0.05)	0 (7×10^{-5})	0 (0.1)
Preferred Alternative – All LANL Sub-Alternative: PDP and Dilution at LANL	6,183	6.9	130	0 (0.08)	140	0 (0.08)	0 (1×10^{-6})	0 (0.3)
Preferred Alternative – All LANL Sub-Alternative: NPMP and Dilution at LANL	1,269	1.7	32	0 (0.02)	38	0 (0.02)	0 (2×10^{-5})	0 (0.06)
Preferred Alternative – SRS NPMP Sub-Alternative: PDP at LANL and Dilution at SRS	5,563	12	300	0 (0.2)	320	0 (0.2)	0 (0.0001)	1 (0.6)
Preferred Alternative – SRS NPMP Sub-Alternative: NPMP at SRS and Dilution at SRS	814	2.2	59	0 (0.04)	58	0 (0.03)	0 (5×10^{-5})	0 (0.1)
Preferred Alternative – All SRS Sub-Alternative: PDP and Dilution at SRS	4,900	12	330	0 (0.2)	350	0 (0.2)	0 (6×10^{-5})	1 (0.6)
Preferred Alternative – All SRS Sub-Alternative: NPMP and Dilution at SRS	814	2.2	59	0 (0.04)	58	0 (0.03)	0 (5×10^{-5})	0 (0.1)
No Action Alternative: NPMP at LANL and Dilution at SRS[b]	1,055 –1,144	2.5 – 2.7	65 – 68	0 (0.04)	64 – 75	0 (0.04) – 0 (0.05)	0 (5×10^{-5}) – 0 (7×10^{-5})	0 (0.1)
No Action Alternative: NPMP and Dilution at SRS[b]	741 – 830	2 – 2.2	58 – 61	0 (0.03) – 0 (0.04)	48 – 59	0 (0.03) – 0 (0.04)	0 (3×10^{-5}) – 0 (5×10^{-5})	0 (0.1)

LANL = Los Alamos National Laboratory; LCF = latent cancer fatality; nonrad. = nonradiological; NPMP = non-pit metal processing; PDP = pit disassembly and processing; Pop. = population; SRS = Savannah River Site.

(a) Risk is expressed in terms of latent cancer fatalities, except for the nonradiological risk, which refers to the number of traffic accident fatalities. Both are the expected fatalities based on the statistical data (e.g., latent cancer fatalities per unit dose absorbed, and the traffic fatalities per 100 million kilometers traveled). Radiological risk is calculated for one-way travel, while nonradiological risk is calculated for two-way travel. Accident dose risk can be calculated by dividing the risk values by 0.0006 (DOE 2003a). The values are rounded to one non-zero digit.

(b) The range in the number of shipments, one-way kilometers traveled, and incident-free and accident impacts is due to the assumed origin of the non-pit surplus plutonium.

Note: Crew doses are for truck drivers, assumed to be two drivers per transport.

Source: See methodology and sources described in Appendix E.

Table 4-34. Estimated Impacts from Hazardous Waste and Construction Material Transport

Material	Number of Shipments	Total Distance Traveled (two-way kilometers)	Number of Accidents	Traffic Fatality Risk
Construction Materials	43,000	4,300,000	3.3	0.2
Hazardous Waste	450	1,800,000	1.0	0.04

SEIS = supplemental environmental impact statement; SPD = surplus plutonium disposition; SPDP EIS = Surplus Plutonium Disposition Program Environmental Impact Statement; WIPP = Waste Isolation Pilot Plant.
Note: Numbers are rounded to two significant digits.
Source: DOE 2015c|Section E.9, Tables E-13, E-14|. The cited values represent the maximum impacts in the 2015 SPD SEIS WIPP Alternative, where surplus plutonium would be diluted and disposed at the WIPP facility. These impacts were used as the maximum impacts for the Preferred Alternative in this SPDP EIS.

4.1.6.1 Methodology and Assumptions

Transportation packages containing radioactive materials emit low levels of radiation; the amount of radiation depends on the characteristics of the transported materials and the amount of shielding provided by the package. For incident-free transportation, NNSA estimated the potential human health impacts of the radiation field surrounding the transportation packages for transportation workers and the general population along the route (termed off-traffic or off-link), as well as for people sharing the route (termed in-traffic or on-link), at rest areas, and at other stops along the route.

Transportation accidents involving radioactive materials (plutonium, uranium, or radioactive wastes) present both nonradiological and radiological risks to workers and the public. Nonradiological impacts of transportation accidents include traffic accident fatalities. The radiological impact of a specific accident is expressed in terms of probabilistic risk (i.e., dose risk), which is defined as the accident probability (i.e., accident frequency) multiplied by the accident consequences (i.e., dose). The overall radiological risk is obtained by summing the individual radiological risks for a range of accidents. The analysis of accident risks considers a spectrum of accident severities ranging from high-probability accidents of low severity (e.g., a fender bender) to hypothetical high-severity accidents having low probabilities of occurrence.

In addition to calculating the radiological risks that would result from accidents during transportation of radioactive materials and wastes, this SPDP EIS assesses the highest consequences of a maximum reasonably foreseeable accident having a radioactive release frequency greater than 1×10^{-7} (1 chance in 10 million) per year in an urban, suburban, or rural population area along the route. Therefore, this consequence would only be evaluated for the specific route segment (e.g., rural, suburban, or urban) if its likelihood of a postulated accident of radioactive release is greater than 1×10^{-7} per year.

Incident-free radiological health impacts are expressed in terms of additional LCFs. Radiological health impacts from accidents are also expressed as additional LCFs, and nonradiological accident risk as additional immediate (traffic) fatalities.[25]

[25] LCFs associated with radiological exposure were estimated by multiplying the occupational (worker) and public dose by a dose conversion factor of 0.0006 LCFs per rem or person-rem of exposure (DOE 2003a).

For each alternative, transportation impacts were evaluated for the transport of the following (as applicable to each alternative):

- pits from Pantex to LANL or SRS
- byproduct material from SRS to LANL
- HEU from LANL or SRS to the Y-12 at the ORR in Tennessee
- surplus plutonium from LANL to SRS and from SRS to LANL
- CH-TRU waste (including diluted plutonium oxide CH-TRU waste) from LANL and SRS to the WIPP facility in New Mexico
- LLW and MLLW from LANL and SRS to offsite Federal or commercial disposal facilities
- adulterant from a commercial vendor assumed to be located 3,000 mi (4,800 km) from either LANL or SRS
- construction materials to LANL and SRS
- hazardous waste from LANL and SRS to an offsite treatment, storage, and disposal facility.

Appendix E contains more details about transportation routes and their characteristics, the number of shipments, transportation packages and their contents, and transportation modes.

4.1.6.2 Summary of Impacts

The sections below summarize, for each alternative, the transportation impacts of shipping radioactive materials and waste, construction materials, and hazardous wastes.

4.1.6.3 Preferred Alternative

Under the Preferred Alternative, four scenarios were evaluated:

- The Base Approach Sub-Alternative involved the disassembly and processing of surplus pit plutonium at LANL, the processing of non-pit surplus plutonium at LANL, and the dilution of surplus pit and non-pit plutonium at SRS.
- The All LANL Sub-Alternative involved the disassembly and processing of surplus pit plutonium at LANL, the processing of non-pit surplus plutonium at LANL, and the dilution of surplus pit and non-pit plutonium at LANL.
- The SRS NPMP Sub-Alternative involved the disassembly and processing of surplus pit plutonium at LANL, the processing of non-pit surplus plutonium at SRS, and the dilution of surplus pit and non-pit plutonium at SRS.
- The All SRS Sub-Alternative involved the disassembly and processing of surplus pit plutonium at SRS, processing of non-pit surplus plutonium at SRS, and the dilution of surplus pit and non-pit plutonium at SRS.

Disposal would take place at the WIPP facility. In addition, construction materials would be shipped from offsite commercial vendors to LANL and SRS, and hazardous wastes would be shipped from LANL and SRS to offsite commercial waste management facilities.

As shown in Table 4-33, for the four scenarios involving the disassembly and processing of pits, NPMP, dilution, and disposition of surplus pit and non-pit plutonium, the number of shipments would range from 4,900 to 6,183 for cases involving the disassembly and processing of 34 MT of surplus pit plutonium, and from 814 to 1,269[26] for cases involving the processing of up to 7.1 MT of non-pit surplus plutonium. As shown in Table 4-34, under the Preferred Alternative, there would be 43,000 truck shipments of construction materials and 450 truck shipments of hazardous waste, for additional details see Section 4.1.6.3.3, below.

4.1.6.3.1 Impacts of Incident-Free Transportation

Impacts on the transportation crew and the public would be as follows:

- Crew: Transport of radioactive materials and waste associated with any of the four scenarios evaluated under this alternative likely would result in 0 LCFs (0.08 to 0.2) among crew members for cases involving the disassembly and processing of 34 MT of surplus pit plutonium, and 0 LCFs (0.02 to 0.04) for cases involving the processing of up to 7.1 MT of non-pit surplus plutonium. Analyses assume that there are two crew members (vehicle drivers) per transport.
- Public: The cumulative dose to the general population associated with any of the options evaluated under this alternative likely would result in 0 LCFs (0.08 to 0.2) from transport of radioactive materials and waste under this alternative for cases involving the disassembly, processing, and dilution of 34 MT of pit plutonium, and 0 LCFs (0.02 to 0.05) for cases involving the NPMP and dilution of up to 7.1 MT of non-pit surplus plutonium.

4.1.6.3.2 Impacts of Transportation Accidents

For radioactive materials and waste shipped under the Preferred Alternative, the maximum reasonably foreseeable truck transportation accident having the highest consequence would involve the truck transport of pit plutonium oxide between LANL and SRS (see Appendix E, Table E–9). For cases involving the disassembly and processing of 34 MT of pit plutonium, the probability of the maximum reasonably foreseeable truck accident would be up to 2.0×10^{-7} per year in a suburban area, or 1 chance in 5 million each year. The consequences of the maximum reasonably foreseeable truck accident in terms of population dose in a suburban area would be about 7,900 person-rem,[27] resulting in up to 5 LCFs among the exposed population (see Appendix E, Table E–9). However, when the annual frequency of the accident occurring is taken into account, the number of LCFs in the exposed population would be 0 (9×10^{-7}).

For cases involving the processing of up to 7.1 MT of non-pit surplus plutonium, the probability of the maximum reasonably foreseeable truck accident would be up to 2.4×10^{-6} per year in a rural area, or 1 chance in about 420 thousand each year. The consequences of the maximum reasonably foreseeable

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[26] The minimum and maximum transportation impacts do not necessarily correspond to the minimum and maximum number of shipments because of the distances traveled, i.e., more shipments traveling over shorter distances may result in lower transportation impacts than fewer shipments traveling over longer distances. For example, the 1,269 truck shipments from LANL include 455 shipments of LLW/MLLW to a disposal facility over a short distance.

[27] The 7,900 person-rem (up to 5 LCFs) is applicable to the Base Approach and the SRS NPMP Sub-Alternatives. The impacts for the All LANL Sub-Alternative would be 15 person-rem (with no expected LCFs) and 1.1×10^{-7} per year frequency, and the impacts for the All SRS Sub-Alternative would be 110 person-rem (with no expected LCFs) and 5.0×10^{-7} per year frequency.

truck accident in terms of population dose in a rural area would be about 820 person-rem, resulting in about 0.5 additional LCFs among the exposed population. However, when the annual frequency of the accident occurring is taken into account, the increased risk of a single LCF in the exposed population would be 0 (1×10^{-6}).

Estimates of total transportation accident dose risks for all projected accidents involving all materials and waste shipments, regardless of material and waste type, likely would not result in 0 (1×10^{-6} to 1×10^{-4}) LCFs for cases involving the disassembly and processing of 34 MT of pit plutonium, and 0 LCFs (2×10^{-5} to 7×10^{-5}) LCFs for cases involving the processing and dilution of up to 7.1 MT of non-pit surplus plutonium.

Transportation activities under this alternative could result in 1 (0.3 to 0.6) nonradiological fatality due to traffic accidents for cases involving the disassembly, processing, and dilution of 34 MT of pit plutonium, and 0 (0.06 to 0.1) nonradiological fatality due to traffic accidents for cases involving the processing and dilution of up to 7.1 MT of non-pit surplus plutonium.

4.1.6.3.3 Impacts of Construction Materials and Hazardous Waste Transport

Table 4-34 summarizes the impacts of construction material and hazardous waste transports for the Preferred Alternative, which considers the construction of a PDP facility (2015 SPD SEIS [DOE 2015c]). These values are considered to be the maximum impacts for the construction material and the related hazardous wastes transport in this SPDP EIS. This is because, the analyses in the 2015 SPD SEIS (DOE 2015c) are based on the construction of a new PDP facility in the SRS F-Area or K-Area, and in this SPDP EIS the PDP facility at SRS would use portions of the existing infrastructures leading to a smaller overall material needs and impacts. Nevertheless, as shown in Table 4-34, the impacts of transporting construction materials and hazardous waste to an offsite disposal or recycle facility are expected to result in no traffic fatalities (0.04 to 0.2).

4.1.6.3.4 Air Quality Impacts of Construction Materials and Hazardous Waste Transport – Preferred Alternative

Table 4-32 presents total criteria pollutant and GHG emissions estimated for the transport of materials and waste by diesel-powered trucks (and escort vehicles) between Pantex, LANL, SRS, the WIPP facility, and any other location pertaining to the Preferred Alternative. The intra-site transportation of waste and plutonium oxide (under the All SRS Sub-Alternative between F-Area and K-Area) as discussed previously in this EIS is very small in comparison to the offsite transportation data shown in Table 4-33. Transportation activity data (number of shipments and kilometers traveled) used in the analysis were obtained from Table 4-33 and Table 4-34. There would be a negligible addition to regional air pollutant concentrations because air emissions associated with transportation would be spread across many years of project activities and thousands of kilometers of roadways.

4.1.6.4 No Action Alternative

Under the No Action Alternative, four scenarios were evaluated: NPMP of plutonium at LANL or SRS, followed by dilution of plutonium oxide at SRS. Under these scenarios, construction materials would be shipped from offsite commercial vendors to SRS, radioactive wastes from LANL and SRS to offsite Federal or commercial disposal facilities, and hazardous wastes from LANL and SRS to offsite commercial waste management facilities.

As shown in Table 4-33, under the No Action Alternative, there would be 741 to 1,144 truck shipments of radioactive materials and waste. Under the No Action Alternative, because of the use of an existing facility (e.g., Building 105-K at SRS), there would be a small number of shipments of construction materials to SRS. The impact of this transport would be negligible, given the estimates provided in Table 4-33 for the Preferred Alternative, which considers the construction of the plutonium disassembly and processing facility (2015 SPD SEIS [DOE 2015c]).

4.1.6.4.1 Impacts of Incident-Free Transportation

Impacts on the transportation crew and the public would be as follows:

- Crew: Transport of radioactive materials and waste likely would result in 0 (0.03 to 0.04) LCFs among crew members. Analyses assume that there are two crew members would be present in each vehicle (truck drivers) per transport.
- Public: The cumulative dose to the general population likely would result in 0 (0.03 to 0.05) LCFs from transport of radioactive materials and waste.

4.1.6.4.2 Impacts of Transportation Accidents

As described previously, two sets of analyses were performed for the evaluation of radiological transportation accident impacts: impacts of maximum reasonably foreseeable accidents (accidents having radioactive release probabilities greater than 1×10^{-7} [1 chance in 10 million] per year) and impacts of a range of accidents (total transportation accidents).

For maximum reasonably foreseeable transportation accidents, probabilities were calculated for all route segments (i.e., rural, suburban, and urban), and maximum consequences were determined for the route shipments that had a likelihood-of-release frequency exceeding 1 in 10 million per year. For the No Action Alternative, the maximum reasonably foreseeable transportation accident that had the highest consequence would involve truck transport of non-pit surplus plutonium between LANL and SRS (see Appendix E, Table E–9).

The probability of the occurrence of the maximum reasonably foreseeable truck accident involving this material would be up to 2.4×10^{-6} per year in a rural area, or 1 chance in about 420,000 each year. The consequences of the maximum reasonably foreseeable truck accident in terms of population dose in a rural area would be about 820 person-rem, resulting in about 0.5 additional LCFs among the exposed population. However, when the annual frequency of the accident occurring is taken into account, the increased risk of a single LCF in the exposed population would be essentially 0 (1×10^{-6}).

Estimates of total transportation accident dose risks for all projected accidents involving all materials and waste shipments, regardless of material or waste type associated with the two scenarios evaluated for the No Action Alternative are expected to result in 0 (3×10^{-5} to 7×10^{-5}) LCFs. Transportation activities under this alternative could result in 0 (0.1) nonradiological fatality due to a traffic accident.

4.1.6.4.3 Impacts of Construction Materials and Hazardous Waste Transport

As indicated earlier in this section, under the No Action Alternative a very small number of construction material shipment would be needed. The impact of this transport would be negligible, given the estimates provided in Table 4-34 for the Preferred Alternative, which considers the construction of plutonium disassembly and processing facility (2015 SPD SEIS [DOE 2015c]).

4.1.6.4.4 Air Quality Impacts of Construction Materials and Hazardous Waste Transport – No Action Alternative

Table 4-32 presents criteria pollutant and GHG emissions estimated for the transport of materials and waste by diesel-powered trucks (and escort vehicles) between Pantex, LANL, SRS, the WIPP facility, and any other locations pertaining to the No Action Alternative. Transportation activity data used in the analysis were obtained from Table 4-33 and Table 4-34. There would be a negligible addition to regional transportation emissions because criteria pollutant emissions associated with transportation would be spread across the many years of project activities and would be dispersed across thousands of kilometers of roadways.

4.2 Cumulative Impacts

The CEQ regulations define cumulative impacts as "the impact on the environment which results from the incremental impact of the 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" (40 CFR 1508.7; EPA 1999).

Cumulative impacts 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) (Spaling 1994). The geographic area over which past, present, and reasonably foreseeable future actions could contribute to cumulative impacts is dependent on the nature of the activity and the type of resource impacted.

4.2.1 Methodology and Assumptions

In general, the following approach was used to estimate cumulative impacts for this SPDP EIS:

- The ROIs for each resource area where impacts associated with the alternatives and sub-alternatives analyzed in this SPDP EIS may occur were described (see Table 3-1). For some resource areas the ROIs are nationwide (for example climate change, transportation, and disposal of TRU waste at the WIPP facility).
- The affected environment and baseline conditions were identified, including the effects of past actions (see Section 3.0).
- Past, present, and reasonably foreseeable future actions and the effects of those actions were identified (see Section 4.2.2).
- The impacts described in Section 4.1 in combination with the additive effects of past, present, and reasonably foreseeable actions (see Section 3.0 and Section 4.2.2) were assessed.

Cumulative impacts were assessed by combining the effects of activities for each of the alternatives and sub-alternatives assessed in this SPDP EIS 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 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. However, the effects were combined irrespective of the time and location of the impact, to encompass any uncertainties in the projected activities and their effects. This approach produces a conservative estimation of cumulative impacts for the activities considered.

For each alternative or sub-alternative, at each site, the impacts described in Section 4.1 were considered to determine if they have the potential to substantially contribute to cumulative impacts. Any impacts considered to be negligible to minor that would not substantially add to baseline conditions discussed in Section 3.0 are not discussed further unless they required further explanation.

4.2.2 Past, Present, and Reasonably Foreseeable Future Actions

In addition to the actions related to the alternatives and sub-alternatives evaluated in this SPDP EIS, other actions that may contribute to cumulative impacts at LANL and SRS include onsite and offsite projects conducted by Federal, State, and local governments; the private sector; or individuals that are within the ROIs of the actions considered in this SPDP EIS. Information about present and future actions was obtained from a review of site-specific plans and NEPA documents to determine if current or proposed projects could contribute to environmental impacts at the potentially affected sites.

Past, present, and reasonably foreseeable projects in the ROIs at LANL, SRS, and the WIPP facility are listed in Table 4-35. Source documents presenting the NEPA assessments, if completed, and any associated ROD are referenced for each project as appropriate. In some cases, additional references discussing other cumulative impact analyses or providing the status of the project may be included. For projects that are categorical exclusions, the appropriate documentation is also referenced, because categorical exclusions are defined by the CEQ to be actions that “do not individually or cumulatively have a significant effect on the human environment” (10 CFR Part 1021).

Table 4-35 does not include past, present, and reasonably foreseeable future projects at Pantex or Y-12 because the activities that would occur at Pantex and Y-12 for both the Preferred and No Action Alternatives are within the bounds of activities analyzed in previous NEPA documents and these NEPA documents include a cumulative analysis (CNS 2019; DOE 2018f; DOE 2011a; DOE 2018i).

Maintenance and repair of buildings and infrastructure (e.g., utilities and roads) at LANL and SRS are an ongoing process. Therefore, maintenance and repair activities at PF-4 at LANL and the KAC at SRS could contribute to cumulative impacts. However, NNSA anticipates that the contribution of these construction activities to cumulative impacts would be small because most activities would be of limited size and of short duration. In addition, these activities are generally covered by one of the categorical exclusions in the DOE *National Environmental Policy Act Implementing Procedures* (10 CFR Part 1021, Appendix B), and therefore, as stated in 10 CFR 1021.410 “…do not individually or cumulatively have a significant effect on the human environment.” As a result, they are not evaluated further.

The proposed project to develop a fast-neutron spectrum VTR to enable testing and evaluation of nuclear fuels, materials, sensors, and instrumentation for use in advanced reactors would occur at the Idaho National Laboratory (DOE 2022e; 87 FR 47400). The VTR EIS evaluated the option of performing VTR fuel production at SRS. However, the VTR is in the early stages of design, and although a Final EIS and ROD have been issued, the ROD did not select a location for VTR fuel production, and the details related to making surplus plutonium available as a VTR feedstock are not currently known. Further, the use of surplus plutonium in VTR fuel would not be considered a cumulative impact for SPDP but rather would be another disposition pathway for part of the 34 MT that is considered in this EIS. For this reason, the VTR is not factored into cumulative impacts.

Additional projects that could potentially contribute to cumulative impacts in a specific resource area at a specific site are also described in the cumulative impact sections in Section 4.2.3. Cumulative impacts on the Global Commons are analyzed in Section 4.2.4.

Table 4-35. Projects and Other Actions Considered in the Cumulative Impacts Analysis

<table>
<tr><th>Project Name</th><th>Summary of Project</th><th>Location(s)</th><th>Project Status</th><th>Source Document(s)</th></tr>
<tr><td colspan="5">Multiple Locations</td></tr>
<tr><td>NNSA Complex Transformation (DOE/EIS-0236-S4)</td><td>Project to transform the DOE nuclear weapons complex by reducing the size, increasing efficiency and security, and improving ability to respond to changes in national security requirements.</td><td>Pantex
LANL
SRS
other NNSA sites</td><td>Ongoing</td><td>DOE 2019a
73 FR 77644
85 FR 70598
LANL 2023a|Section 2.18|</td></tr>
<tr><td>Disposal of GTCC LLW and GTCC-Like Waste (DOE/EIS-0375)</td><td>Project related to construction and operation of a new facility or facilities or use of an existing facility or facilities for the disposal of GTCC LLW and GTCC-like waste.</td><td>LANL
SRS
WIPP facility
other NNSA sites</td><td>Proposed</td><td>DOE 2016a
DOE 2018c</td></tr>
<tr><td colspan="5">Los Alamos National Laboratory and Vicinity</td></tr>
<tr><td>Pit Production Mission (DOE/EIS-0380-SA-06)</td><td>Project to produce plutonium pits at a rate of not less than 30 pits per year with additional surge capacity as needed. The SA evaluates the potential environmental impacts of producing up to 80 pits per year at LANL. Would require construction of support buildings for offices, parking, and training built near TA-55.</td><td>PF-4 and TA-55</td><td>Design/ Construction</td><td>DOE 2020b
85 FR 54544
LANL 2023a|Section 2.18|</td></tr>
<tr><td>LANL Site-Wide EIS</td><td>DOE is preparing a new LANL Site-Wide EIS that will analyze the potential environmental impacts of the reasonable alternatives for the continued operation of LANL for the next 15 years. This will replace the previous Site-Wide EIS (DOE 2008a).</td><td>LANL</td><td>Ongoing</td><td>87 FR 51083</td></tr>
<tr><td>Analytical Chemistry and Materials Characterization (DOE/EIS-0350-SA-2; DOE/EA-2052)</td><td>Relocation of the analytical chemistry and materials characterization activities from the Chemistry Metallurgy Research Building and the RLUOB. DOE prepared an environmental assessment (DOE 2018g) that evaluated recategorization of the RLUOB to a material at risk limited hard</td><td>PF-4 and TA-55</td><td>Ongoing</td><td>DOE 2015a
DOE 2018g
DOE 2020b|Section 4.3.2|
LANL 2023a|Sections 1.1, 1.6|</td></tr>
</table>

Project Name	Summary of Project	Location(s)	Project Status	Source Document(s)
	category 3 nuclear facility, which would result in modifications to RLUOB but fewer modifications to PF-4. No changes to the structure of either building are required for the relocation of the analytical chemistry and materials characterization activities.			
RLWTF Upgrade (DOE/EIS-0380)	Project to upgrade RLWTF to collect, store, treat, and dispose of LLW, industrial wastewater, and liquid TRU waste. Upgrades include two replacement facilities, a Low-Level RLWTF and a Transuranic Liquid Waste Facility. Construction of a replacement low-level RLWTF began in 2015 and was completed in 2018, however, the new facility will not be used for an estimated 6 years because of needed post-project modifications. The design of the replacement TRU Liquid Waste Facility was completed during CY 2017; a re-design began in 2019 and continues.	TA-50	Ongoing	LANL 2023a|Section 2.18| DOE 2018j|p. 44| DOE 2008a
Environmental Testing Facility	Project to consolidate existing environmental testing capabilities at LANL for plutonium and non-nuclear weapons components that are designed at LANL. NNSA is considering constructing a facility and upgrading existing infrastructure in either TA-55 or TA-11.	TA-55 or TA-11	Proposed	DOE 2020b|Section 4.3.3|
Protective Force Training Facility	The Protective Force Training Facility would be constructed in TA-46 to replace the existing Protective Force Training Facility in the Los Alamos town site and move Protective Force personnel closer to LANL areas. The building would be collocated with other protective force training facilities.	TA-46	Proposed	DOE 2018j|p. 34|

Project Name	Summary of Project	Location(s)	Project Status	Source Document(s)
Support Office Buildings	Project to construct support buildings that would provide offices, training and development, cafeteria services, parking, and warehouse space.	Areas considered include TA-48, TA-50, TA-52, TA-55, and TA-63	Design/ Construction	DOE 2018j|p. 22| LANL 2023a|Section 2.18|
Parking Structure[(a)(b)]	Project to construct two multilevel parking structures in TA-03 and TA-50 containing approximately 450 and 470 spaces, respectively.	TA-03, TA-50	Completed	LAFO 2019a LAFO 2019b LANL 2023a|Sections 2.15.1.1, 2.18| DOE 2018j|p. 22|
Chromium Plume Control Interim Measure and Plume Center Characterization	Project to implement an interim measure to control plume migration of chromium contaminated groundwater in Mortandad Canyon. DOE is preparing an EA to evaluate alternatives for a Corrective Measures Evaluation Report.	Aquifer beneath Mortandad Canyon	Ongoing	DOE 2015b DOE 2015d DOE 2018j|Section 3.15.2.1| DOE 2023b
Forest and Vegetation Management[(a)(b)]	The updated 5-Year Wildlife Management Plan describes specific forest management treatments that could occur on undeveloped LANL land. The treatments would occur in response to continued risk of wildfire as well as changing environmental conditions and new forest management techniques.	Undeveloped LANL land (approximately 11,000 acres)	Ongoing	LANL 2023a|Section 2.18|
Crossroads (ATS-3) Supercomputer System[(b)]	Project to replace Trinity, the first ATS (ATS-1). First production use of Crossroads occurred in April 2023. Installation occurs in phases and will be completed around October 2023	TA-3	Ongoing	LANL 2019c LANL 2023a|Section 2.18|
Photovoltaic Array (DOE/EA-2101)[(b)]	Project to install a 10 MW solar photovoltaic power array and associated transmission line within an existing transmission line corridor. The proposed location is on approximately 55 ac of which around 50 ac are within a previously disturbed area that was used as a borrow pit.	TA-8, TA-16	Proposed	DOE 2018j|p. 38| NNSA 2019|p. 1| LANL 2023a|Section 2.18|

Project Name	Summary of Project	Location(s)	Project Status	Source Document(s)
Footprint Reduction Program	The purpose of the Footprint Reduction Program is to shut down and remove aging facilities. This program has dismantled or salvaged over a million square feet of aging facilities and structures since 2008.	LANL	Ongoing	LANL 2023a|Section 2.18|
Conveyances and transfer of DOE Land and Properties (DOE/EIS-0293)	Transfer of approximately 3,400 ac to date to comply with Public Law 105-119. Currently scheduled end date is 2032.	North of LANL and on northern border	Ongoing	Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Act 1998 DOE 1999a DOE 2018j|p. 57| LANL 2023a|Section 2.18|
New Transmission Line	Project to construct a third transmission line to provide additional capacity, operating up to 155 MW and built with a 200 MW rating. Parts of this project would be located both onsite and offsite. As of June 2023, a draft environmental assessment is being prepared and new routes on SFNF and BLM lands are under consideration. Project information is available at https://environment.lanl.gov/epcu/	From the Public Service Company of New Mexico Norton Line Station to the Southern TA substation; across Santa Fe National Forest	Proposed	DOE 2018j|p. 48| LANL 2023a|Section 2.18|
Electrical Transmission and Distribution System Upgrade[b]	Project to upgrade the transmission and distribution system to increase power import capacity and improve onsite transmission and distribution capacity. Electrical transmission and distribution system with four 10-megavolt amperes circuits. The upgrade would run from the western Technical Area substation and the eastern Technical Area to increase power delivery for supercomputing at the Metropolis Center. Another 10-megavolt ampere substation would provide 1.5-kilovolt tie between the eastern technical areas and the TA-03 substations. It would	LANL	Proposed	DOE 2018j|p. 35| LANL 2023a|Section 2.18|

Project Name	Summary of Project	Location(s)	Project Status	Source Document(s)
	provide full system redundancy by connecting the Eastern Technical Area substation and the TA-03 substation.			
Reconductor existing Norton and Reeves Transmission Lines	Project to remove and replace wires and conductors on existing transmission lines to increase capacity to 200 MW.	South and east of LANL	Proposed	DOE 2018j|p. 35| LANL 2023a|Section 2.18|
Fiber Optic Cable Installation[b]	Project to install approximately 16 mi of new fiber cable using both underground and collocation of the line on the existing PNM transmission line.	LANL and Santa Fe National Forest	Proposed	LANL 2023a|Section 2.18|
East Jemez Road Intersection Upgrade[a]	Design of a project to realign the intersection at NM 4 and East Jemez Road and change the intersection to a 4-way adding more lanes and increasing merge lane lengths. The Bandelier National Monument Tsankawi Unit parking area is under construction near the NM-4 and East Jemez Road intersection.	Los Alamos County	Anticipated to start in 2023	DOE 2022c 3AEGreen 2018 LANL 2023a|Section 2.18| DOI 2014
NM 30 Improvements[b]	Project for physical, operational and safety improvements to reduce congestion and delays on NM 30 between NM 502 and the US-84/285 intersection in Española, NM.	Rio Arriba and Santa Fe Counties	Proposed	DOE 2020b|Section 4.3.4.3|
Los Alamos Canyon Bridge Refurbishment Project[b]	Project to address corrective maintenance of the traffic deck, superstructure, and substructure of the Los Alamos Canyon Bridge.	LANL	Proposed	LANL 2023a|Section 2.18|
Manhattan Project National Historical Park (DOI 2010 adopted as DOE/EA-1868 in February 2011)	National Historical Park, established in 2014, to preserve important Manhattan Project sites; may include rehabilitation of existing facilities and construction of new visitor facilities.	LANL and North of LANL	Ongoing	DOI 2010 DOE 2018j|p. 150| LANL 2023a|Section 2.18|
Bandelier National Monument[b]	Projects to repair damaged roads, bridges, and other park infrastructure.	South of LANL	Ongoing	DOE 2018j|p. 150| LANL 2023a|Section 2.18|
Valles Caldera National Preserve[b]	The Valles Caldera National Preserve was established in 2014. Activities are likely to include management, maintenance and	West of LANL	Ongoing	DOE 2018j|p. 150| LANL 2023a|Section 2.18|

Project Name	Summary of Project	Location(s)	Project Status	Source Document(s)
	conservation activities, and construction of new visitor facilities.			
Camp May Water Pipeline Project[b]	Project to install a water pipeline, four pump stations, and a new water tank adjacent to the existing Pajarito 4 Tank on West Road. Majority of water transmission line and three pump stations are on land under U.S. Forest Service jurisdiction. A short segment of the pipeline is in Los Alamos County land. The new tank, fourth pump and a short segment of the pipeline are located on DOE land.	West of LANL and TA-62	Proposed	USDA 2021 LANL 2023a|Section 2.18| DOE 2022f
Savannah River Site and Vicinity				
Pit Production Mission (DOE/EIS-0541)	Repurposing of the partially constructed MFFF to produce a minimum of 50 war reserve pits a year and to develop a short-term surge capacity of not less than 80 war reserve pits a year. Operations would begin in 2030.	F-Area	Design	DOE 2020a SRNS 2023d|Section 21|
H-Canyon processing of Spent Nuclear Fuel (DOE/EIS-0279, DOE/EIS-0279-SA-01, DOE/EIS-0218-SA-06, and DOE/EIS-0279-SA-07)	Program that is projected to operate through 2024, and possibly through 2040, to receive, dissolve, and process spent nuclear fuel. It includes the Accelerated Basin De-inventory mission that transfers spent nuclear fuel from L-Basin to H-Canyon for conventional processing with no uranium recovery. DOE would use the processing capabilities within H-Canyon to dissolve the spent nuclear fuel for immobilization of the resulting liquid radioactive waste at the Defense Waste Processing Facility.	H-Canyon	Ongoing	DOE 2000b DOE 2013b DOE 2022h 87 FR 23504 SRNS 2023d|Section 21|
KAC processing 6 MT of non-pit surplus plutonium for disposal at the WIPP facility	Program that is currently processing 6 MT of non-pit surplus plutonium using the dilute and dispose strategy in the KIS glovebox.	K-Area	Ongoing	DOE 2015c 80 FR 80348 81 FR 19588 SRNS 2023d|Section 21|

Project Name	Summary of Project	Location(s)	Project Status	Source Document(s)
K-Area tie into the SRS Central Sanitary Wastewater Treatment Facility	Proposed project to tie in the KAC wastewater system not the SRS Central Wastewater Treatment Facility. Pumping the sanitary wastewater from KAC will require approximately 21,000 ft of forced main piping and two new lift stations	K-Area	Design Complete	SRNS 2019b SRNS 2023d|Section 21|
Tritium Finishing Facility (DOE/EA-2151)	Project to replace key capabilities in H-Area. This is a 1950s vintage building that presents a potential risk to the tritium mission. Two new buildings would be added and Building 249-H and a portion of Building 234-7H would be renovated. Three warehouses would be removed, one warehouse replaced, and utilities and infrastructure upgrades made as needed to support the facilities.	H-Area	Design/Early Site Preparation	DOE 2021d DOE 2021e SRNS 2023d|Section 21|
EnergySolutions LLW Disposal facility	Project to process and dispose of commercial LLW.	~8 mi E of F- and H-Areas	Ongoing	DOE 2015c SRNS 2023d|Section 21|
Disposal of decommissioned, defueled ex-Enterprise (CVN 65)	Proposed disposal of the decommissioned, defueled ex-Enterprise (CVN 65) aircraft carrier, including its associated naval reactor plants. Preferred Alternative include disposal of LLW at Waste Control Specialists, EnergySolutions, and SRS.	E-Area	Final EIS published	DON 2023

Project Name	Summary of Project	Location(s)	Project Status	Source Document(s)
Commercial Disposal of SRS Contaminated Process Equipment (DOE/EA-2154)	Proposed disposal of certain SRS-contaminated process equipment at a commercial LLW disposal facility outside of South Carolina (licensed by either the NRC or an Agreement State pursuant to the NRC's regulations).	Determining a disposal pathway for contaminated process equipment that cannot be disposed of at SRS.	Final EA published. Finding of No Significant Impact	DOE 2023c 88 FR 46785
Alvin W. Vogtle Electric Generating Plant	Project for ongoing operation of Units 1 and 2, and construction of Units 3 and 4; two Westinghouse AP1000 nuclear reactors (1,117 MW each). Unit 3 entered commercial operation in July 2023. Unit 4 is expected to be online by late in the fourth quarter of 2023 or the first quarter of 2024.	~11 mi SW of F- and H-Areas	Ongoing	NRC 2011 NRC 2012 WNN 2022 SRNS 2023d|Section 21| Georgia Power 2023a Georgia Power 2023b
Starmet (previously known as Carolina Metals, Inc.)[(b)]	Project to process uranium-contaminated metal. Construction related to this project is not expected to impact transportation to and from SRS, and annual monitoring reports indicate that the decommissioning activities do not noticeably affect radiation levels in the air or water in the vicinity of SRS. Therefore, this project is not included in this cumulative impact assessment.	~15 mi SE of F- and H-Areas	Closed – Decommissioning is ongoing	SCDHEC 2017 SRNS 2023d|Section 21| NRC 2021b
I-20 Augusta Canal and Savannah River Bridges[(b)]	Georgia and South Carolina DOT have agreed to replace the existing I-20 Augusta Canal and Savannah River Bridges (currently two 2-lane structures) with a 6-lane bridge (3 lanes in each direction). Construction was initiated in January 2019 and is expected to be complete in 2023. Construction related to this project is not expected to impact transportation to and from SRS. Therefore, this project is not included in this cumulative impact assessment.	~25 mi NW of SRS	Ongoing	GDOT 2018 GDOT 2019 SRNS 2023d|Section 21|

Project Name	Summary of Project	Location(s)	Project Status	Source Document(s)
U.S. Cyber Command Center, Fort Gordon	U.S. Department of Defense Initiative with significant influx of personnel (1,200 workers) into the Augusta metro area.	About 30 mi NW of SRS	Completed July 2020	Bynum 2020 ARCYBER 2020
The WIPP facility and Vicinity, including New Mexico Highways/Transportation				
WIPP facility - Replacement Panels (DOE/EIS-0026-SA-12)	Project to excavate and use two replacement panels. The two replacement panels address underutilized disposal capacity and protect WIPP facility workers by avoiding the abandoned portions of the repository.	WIPP facility	Ongoing	DOE 2021i
WIPP Facility – New air supply shaft (Shaft #5) and Safety Significant Confinement Ventilation System (new Filter Building)	Project to connect a new shaft (Shaft #5) to the existing underground and construct a new Filter Building on the surface to allow for increased ventilation airflow into the WIPP underground for concurrent mining, maintenance, and TRU waste emplacement operations to take place.	WIPP facility	Ongoing	NMED 2023b DOE 2023e DOE 2023a
Interim Storage Partners LLC Consolidated Interim Storage Facility	Project to construct and operate the Waste Control Specialists LLC's Consolidated Interim Storage Facility. A license to construct and operate was granted by the NRC as indicated in a notice in the *Federal Register* on September 17, 2021. If constructed and operated, these facilities would store spent fuel from commercial nuclear reactors and would contribute to cumulative impacts of transportation in the region.	Andrews County, Texas, 5 mi east of Eunice, New Mexico, and 36 mi east of the WIPP facility	Design	NRC 2021a|Sections 5.1.1.2, 5.3| 86 FR 51926
Holtec International Consolidated Interim Storage Facility	Holtec International proposes to construct and operate a consolidated interim storage facility. An application was submitted to the NRC on March 30, 2017. The Final Environmental Impact Statement was completed in July 2022. If constructed and operated, these facilities would store spent fuel from commercial nuclear reactors and	Lea County, New Mexico, approximately 32 mi east of Carlsbad New Mexico, and about 34 mi west of Hobbs, New	Proposed	NRC 2022 85 FR 16150

Project Name	Summary of Project	Location(s)	Project Status	Source Document(s)
	would contribute to cumulative impacts of transportation in the region.	Mexico. The WIPP facility is located approximately 16 mi south of the proposed project area.		

ATS = Advanced Technology System; BLM = Bureau of Land Management; CY = calendar year; DOE = U.S. Department of Energy; DOT = U.S. Department of Transportation; EIS = environmental impact statement; GTCC = Greater-Than-Class; KAC = K-Area Complex; KIS = K-Area Interim Storage; LANL = Los Alamos National Laboratory; LLW = low-level radioactive waste; MFFF = Mixed-Oxide Fuel Fabrication Facility; NM = New Mexico; NNSA = National Nuclear Security Administration; NRC = U.S. Nuclear Regulatory Commission; NW = northwest; ORNL = Oak Ridge National Laboratory; Pantex = Pantex Plant; PF-4 = Plutonium Facility 4; PNM = Public Service Company of New Mexico; RLUOB = Radiological Laboratory/Utility/Office Building; RLWTF = Radioactive Liquid Waste Treatment Facility; SA = Supplement Analysis; SE = southeast; SFNF = Santa Fe National Forest; SPDP = Surplus Plutonium Disposition Program; SRS = Savannah River Site; SW = southwest; TA =Technical Area; TRU = transuranic; VTR = Versatile Test Reactor; WIPP = Waste Isolation Pilot Plant.

(a) It has been determined that this action is categorically excluded from the *National Environmental Policy Act*.

(b) This action is not expected to affect the actions that are discussed in this SPDP EIS.

4.2.3 Cumulative Impacts by Site

Cumulative impacts are evaluated for activities at LANL (see Section 4.2.3.1) and SRS (see Section 4.2.3.2), for CH-TRU waste disposal at the WIPP facility (see Section 4.2.3.3), and for transportation (see Section 4.2.3.4). Pit production and processing activities at LANL and SRS are some of the most significant contributors to future cumulative impacts.

This analysis of cumulative impacts does not include a separate section on the activities at Pantex or Y-12, because the activities that would occur at Pantex and Y-12 for both the Preferred and No Action Alternatives are within the bounds of activities analyzed in previous NEPA documents as discussed in Section 4.2.2 (CNS 2019; DOE 2018f; DOE 2018i; DOE 2011a). Because the cumulative impacts at Pantex and Y-12 have been assessed previously and would not change appreciably, they are not discussed further in this section.

4.2.3.1 Los Alamos National Laboratory

Cumulative impacts are evaluated for the Preferred and No Action Alternatives at LANL. As described in Section 4.1.2 and summarized in Section 2.4, impacts from the surplus plutonium disposition activities evaluated in this SPDP EIS on land use and visual resources, air quality, noise, geology and soils, water resources, human health (chemical use) and waste management at LANL, would be negligible to minor. These actions would not substantially contribute to cumulative impacts. Therefore, cumulative impacts on these resource areas are not discussed further. Cumulative impacts on ecological resources, human health, cultural and paleontological resources, socioeconomics, infrastructure, and environmental justice require more explanation and are discussed below. The cumulative impacts on transportation, including the portions at LANL, are evaluated in Section 4.2.3.4.

4.2.3.1.1 Ecological Resources

Impacts on ecological resources in the project area in TA-55 would be minor, assuming that the appropriate work windows and BMPs (as described in Section 4.1.2.5) are implemented. The impacts in the project area TA-52 analyzed in this SPDP EIS should be considered preliminary because they would be assessed in further detail during an ESA Section 7 consultation if a decision is made to implement this option. The Biological Opinion associated with the Section 7 consultation includes associated mitigation measures that would have design implications such as nighttime lighting and noise levels for the adjacent habitat (LANL 2023a|Section 2.5.1|). The summary of pertinent mitigations is: 1) project activities will incorporate the New Mexico Night Sky Protection Act standards for all new lighting and, where possible, retrofit existing light sources so that lighting does not illuminate adjacent undeveloped habitat; and 2) all outdoor building support components, such as emergency generators, air compressors, and air conditioners, will be sited such that the orientation is directed away from canyon edges, or they will be fully enclosed to reduce noise levels. These mitigations are expected to benefit both ESA-listed and non-listed species. Habitat use by the Mexican spotted owl occurs in the canyons (LANL 2022c|p. 3-22 through 3-24|), whereas past and present industrial development at LANL has occurred on the plateau. As a result, SPDP activities are not expected to substantially contribute to cumulative impacts on ecological resources.

4.2.3.1.2 Human Health

The cumulative impacts analysis for human health focuses on the onsite involved workers and offsite public.

Cumulative radiological health effects on involved workers are based on radiation doses and presented as excess LCFs in the workforce and the risk of an LCF to the maximally exposed worker. Cumulative radiological health effects on the public in the vicinity of LANL are also based on radiation doses and presented as excess LCFs in the offsite population and to a hypothetical MEI (defined in Section 4.1.2.7).

Table 4-36 presents estimated cumulative worker doses and LCFs for involved workers. The 20,000 person-rem cumulative worker dose corresponds to 12 (11.8) LCFs in the worker population from other past, present, and reasonably foreseeable future activities at LANL, including activities proposed under the Preferred Alternative. Other projects are assumed to last 30 years to estimate cumulative impacts. Activities proposed under the Preferred Alternative account for about 15 percent (1.8 of 11.8) of the projected LCFs in the LANL involved workforce.

Table 4-36. Cumulative Radiation Dose and Impacts on LANL Workers

Activity (lasting 30 years)	Involved Workforce Dose (person-rem)	Involved Workforce LCFs[(a)]
2008 LANL SWEIS – Expanded Operations Alternative[(b)]	16,000	10 (9.8)
RLUOB[(b)]	250	0 (0.15)
SPDP EIS alternatives[(c)]		
Base Approach and SRS NPMP Sub-Alternatives	2,000	1 (1.2)
All LANL Sub-Alternative	3,100	2 (1.8)
No Action Alternative	780	0 (0.5)[(a)]
Total[(d)]	**20,000**	**12 (11.8)**

EIS = environmental impact statement; LANL = Los Alamos National Laboratory; LCF = latent cancer fatality; NNSA = National Nuclear Security Administration; NPMP = non-pit metal processing; RLUOB = Radiological Laboratory/Utility/Office Building; SPDP = Surplus Plutonium Disposition Program; SRS = Savannah River Site; SWEIS = site-wide environmental impact statement.

(a) LCFs are calculated using a conversion of 0.0006 LCFs per rem or person-rem (DOE 2003a). NNSA considers LCFs <0.5 to be 0. Values in the table may be rounded up to 0.5 but are considered to be 0 if the non-rounded value is <0.5.
(b) All values taken from 2015 SPD SEIS (DOE 2015c) adjusted for duration of 30 years.
(c) Values are from Table 4-6 of this SPDP EIS. The highest value is included in the total.
(d) The total collective dose and LCFs are based on the LANL SWEIS for expanded operations, the RLUOB, the 2015 SPD SEIS, and the All LANL Sub-Alternative.

Notes: Numbers are rounded to two significant digits. Columns may not sum to totals due to rounding of individual values and totals.
Sources: DOE 2003a; DOE 2020b, DOE 2015c.

Table 4-37 presents the estimated cumulative radiation dose to and radiological health effects on the public MEI and population within 50 mi (80 km). Except for activities at LANL, no other activities in the area surrounding LANL are expected to result in radiological impacts to the public.

Activities proposed for the alternatives described in this SPDP EIS could result in a cumulative population dose of less than 0.4 person-rem/yr with no associated LCFs (0.0004). The projected cumulative population dose from other past, present, and reasonably foreseeable activities at LANL is 1,100 person-rem/yr with one associated LCF (0.67). The projected population dose and LCFs are based on an assumption of 30 years of project activities. For perspective, the annual doses to the same local population from naturally occurring radioactivity (500 mrem per person; see Section 3.2.7.1, Table 3-5) would be about 170,000 person-rem annually or 5.2 million person-rem over 30 years, from which about 3,100 LCFs would be inferred.

Activities proposed for alternatives described in this SPDP EIS could result in a cumulative dose to the offsite MEI as high as 0.0001 rem from the project duration with a low risk of LCF (6×10^{-8}). The cumulative dose to the offsite MEI from past, present, and reasonably foreseeable future activities over 30 years is 0.25 rem. The cumulative risk of an LCF to the MEI from all projects is low, 0.0001, or about 1 in 10,000. This estimate assumes that the same MEI is exposed to all the LANL activities over all times and from all locations. Preparation of surplus pit plutonium for potential WIPP facility disposal under the Preferred Alternative is not expected to result in substantial cumulative public doses and risks in the LANL ROI.

Table 4-37. Cumulative Radiation Dose and Impacts on the Public at LANL

Activity (lasting 30 years)	Population Dose (person-rem)	Population LCFs[a]	MEI Dose (rem)	MEI Risk of LCF[a]
LANL SWEIS – Expanded Operations Alternative[b]	1,100	1 (0.65)	0.25	0.0001
RLUOB[b]	29	0 (0.018)	0.0025	1×10^{-6}
SPDP EIS Alternatives[c]				
Base Approach and SRS NPMP Sub-Alternatives	0.16	0 (0.0001)	0.00005	3×10^{-8}
All LANL Sub-Alternative	0.37	0 (0.0002)	0.00011	6×10^{-8}
No Action Alternative	0.044	0 (0.00003)	0.00001	8×10^{-9}
Total[d]	**1,100**	**1 (0.67)**	**0.25**	**0.0002**

EIS = environmental impact statement; LANL = Los Alamos National Laboratory; LCF = latent cancer fatality; MEI = maximally exposed individual; NNSA = National Nuclear Security Administration; NPMP = non-pit metal processing; RLUOB = Radiological Laboratory/Utility/Office Building; SPDP = Surplus Plutonium Disposition Program; SRS = Savannah River Site; SWEIS = site-wide environmental impact statement.

(a) LCFs are calculated using a conversion of 0.0006 LCFs per rem or person-rem (DOE 2003a). NNSA considers LCFs <0.5 to be 0. For the MEI, it is the risk of an LCF occurring in that hypothetical individual.

(b) All values taken from DOE 2020b|Table 4-3|, adjusted for duration of 30 years.

(c) Values are from Table 4-6 of this SPDP EIS. The highest value is included in the total.

(d) The total dose and LCFs are based on the LANL SWEIS for reduced operations, the Radiological Laboratory/Utility/Office Building, the 2015 SPD SEIS , and the All LANL Sub-Alternative.

Notes: Numbers are rounded to two significant digits. Columns may not sum to totals due to rounding of individual values and totals.

Sources: DOE 2003a; DOE 2020b.

Cumulative radiological consequences of severe accidents at LANL include the accidents evaluated for Natural Phenomena Hazard, as discussed in Section 4.1.2.7.2, that are based on the total facility inventory. This inventory does not change based on the alternative or the sub-alternative.

The dose to the non-involved worker from the cumulative radiological consequences of severe accidents at PF-4 at LANL is 1,400 rem with a LCF risk of 1 (1.7). The dose to the MEI is 130 rem with a LCF risk of 0.2. The population dose is 6,800 person-rem with 4 (4.1) LCFs.

4.2.3.1.3 Cultural and Paleontological Resources

The cultural and paleontological resources analysis focuses on areas of construction within the LANL site, because this is where archaeological and paleontological resources could be disturbed and where historic and Manhattan Project/Cold War buildings and structures could be altered. The areas identified for construction are covered by legal agreement documents and CRMP that have SHPO concurrence. These guidance documents outline how to identify, evaluate, and mitigate adverse effects on NRHP-eligible historic properties. The guidance outlined in these documents would dictate the process for assessing potential cumulative impacts from the alternatives that have the potential impacts on resources, in combination with impacts from other activities in the ROI.

As described in Section 4.1.2.8, several archaeological sites were identified adjacent to and downhill from TA-52. Because these sites are outside the proposed construction and operation areas affected by either the Preferred or No Action Alternative, no impacts are expected. Because most construction work would occur in previously disturbed areas, and archaeological resources have not been identified in undisturbed land areas planned for construction, neither the Preferred nor No Action Alternative would substantially contribute to cumulative impacts on archaeological or paleontological resources within the LANL ROI. Because construction is in previously developed areas, additional impacts on possible TCP viewsheds are unlikely.

The only known potentially NRHP-eligible cultural resources, for either alternative that could be affected by construction or operation are PF-4 and NRHP-eligible archaeological sites located adjacent to and downhill from the area proposed for construction in TA-52. Guidance documents (PA and CRMP) address identification, evaluation, and mitigation of NRHP-eligible resources. DOE/NNSA Los Alamos Field Office would complete NHPA Section 106. Cultural resources are nonrenewable, and adverse effects result in a permanent removal of important attributes of the resource. For this reason, impacts from any activity on or near any NRHP-eligible or potentially eligible resources (such as PF-4 or the archaeological site) that would cause an adverse effect as defined by NHPA Section 106, under either the No Action or the Preferred Alternative, or any other action, would substantially contribute to cumulative impacts within the LANL ROI.

4.2.3.1.4 Socioeconomics

The cumulative impacts analysis describes the potential socioeconomic impacts of the Preferred and No Action Alternatives, in combination with other past, present, and reasonably foreseeable future activities in the ROI by examining the impacts on housing and community services as indicators of cumulative impacts caused by changes in employment.

Current employment at LANL (approximately 19,497 in 2023) closely aligns with the trajectory of anticipated employment between 2005 and 2011 reported in the 2008 LANL *Final Site-Wide Environmental Impact Statement for Continued Operation of Los Alamos National Laboratory, Los Alamos, New Mexico* (2008 LANL SWEIS [DOE 2008a]|Section 5.8.1.2|), under the LANL Expanded Operations alternative. The pit production mission identified in Table 4-35 is expected to add 400 full-time equivalent employees to the LANL site staff and an additional 575 indirect jobs in the seven-county LANL ROI (DOE 2020b|p. 49|). The number of new workers that could directly support this mission could be as many as 1,500 (LANL 2023a|Section 2.18|).

Activities proposed under the Preferred Alternative including the sub-alternatives in this SPDP EIS could produce peak-year direct employment for operations between 395 and 549 workers. By comparison, nearly 195,000 people were employed in the LANL ROI in 2023. In the ROI, in addition to the direct jobs, an estimated additional 906 to 1,245 indirect and induced jobs could be created (see Table 4-9) under the Preferred Alternative and the No Action Alternative, respectively. Potential additional employment from activities associated with the Preferred Alternative, including sub-alternatives at LANL are unlikely to greatly stress community services in the ROI in isolation. The additional employment may further tighten the housing market and increase unmet housing need. No impacts would be expected from the No Action Alternative.

The combination of the pit production mission identified in Table 4-35 and the peak-year impacts of the Preferred Alternative including the sub-alternatives in this SPDP EIS could result in between 1,895 and 2,049 jobs at LANL (13.3 to 14.3 percent of the 2023 LANL workforce), with an additional 1,957 to 2,450 indirect and induced jobs across the ROI (1.0 to 1.3 percent of ROI employment). These direct impacts would minimally increase traffic and community infrastructure impacts in the immediate Los Alamos area, depending on how many of the new workers would choose to reside there or elsewhere in the ROI. The current ROI housing market is tightening and upward pressure on home prices and rents from the cumulative influx of new workers from these activities, if trends continue, may lead to housing supply challenges. The additional indirect and induced impacts would be spread more evenly across the ROI, but also would contribute to the impacts felt in the Los Alamos area. Therefore, SPDP activities could be expected to contribute to cumulative socioeconomic impacts on housing in the LANL ROI.

4.2.3.1.5 Infrastructure

This section presents the cumulative impacts on the electricity and water supply infrastructure at LANL during operations. Electricity and water use during construction is not considered further in this section because usage would be minimal, would be for a limited duration, and portions would be supplied by self-contained (e.g., generators) or offsite sources (e.g., water trucks). Fuel usage is not considered in this section because large quantities of fuels would not be needed, and fuels would be delivered as needed; there is no limit on site capacity. Wastewater is not considered in this section because the usage has minimal impact on site capacity.

Table 4-35 identifies several projects that would demand the same infrastructure resources as the disposition of surplus plutonium. The projects that would impact infrastructure are shown in Table 4-38. The electricity and water requirements from past, present, and reasonably foreseeable actions identified in Table 4-35 were evaluated for cumulative impacts.

Table 4-38. Annual Cumulative Infrastructure Impacts from Operations at LANL

Activity	Electricity Consumption (MWh/yr)	Water Usage (millions of gal/yr)
Existing LANL Site Activities[(a)]	750,000	270
Other Onsite Activities[(b)]		
CMRR AC and MC Capabilities[(c)(d)]	160,000	16
Radiological Laboratory/Utility/Office Building[(e)]	160,000	0.39
Estimated impacts for production of 30-80 pits/yr[(f)]	5,300–14,000	8.2
Subtotal – Baseline Plus Other Actions	**1,100,000**	**290-295**
SPDP EIS Alternatives[(g)]		
Base Approach and NPMP Sub-Alternatives	2,400	1.7
All LANL Sub-Alternative	3,100	2.5
No Action Alternative	910	0.61
Total	**1,100,000**	**290-300**
Total Site Capacity[(a)]	**1,500,000**	**540**

AC = Analytical Chemistry; CMRR = Chemistry and Metallurgy Research Building Replacement; EIS = environmental impact statement; LANL = Los Alamos National Laboratory; MC = Materials Characterization; NPMP = non-pit metal processing; SPDP = Surplus Plutonium Disposition Program; SWEIS = site-wide environmental impact statement.

(a) From Section 3.2.10 of this SPDP EIS.

(b) Future actions are based on actions identified in the Final Supplement Analysis of the 2008 SWEIS for LANL Plutonium Operations (DOE 2020b) and LANL 2023a|Section 2.18|.

(c) From 2015 SPD SEIS cumulative data (DOE 2015c|Table 4-44|).

(d) From infrastructure impacts for Chemistry and Metallurgy Research Building Replacement Project at LANL (DOE 2015a |Section 4.1.3).
(e) Electricity needs for operations would be slightly more, but same type of AC and MC operations as those evaluated in CMRR EIS (DOE 2018d|Section 4.13|).
(f) Infrastructure requirements vary for each alternative (30 pits/yr or 80 pits/yr as a surge) (DOE 2020b|Tables 2-3, 3-1|), but the highest value is shown in the subtotal.
(g) Values are from Table 4-10 of this SPDP EIS. The highest value is included in the total.
Notes: Numbers are rounded to two significant digits. Columns may not sum to totals due to rounding of individual values and totals.
Sources: LANL 2023a; DOE 2015c; DOE 2015a; DOE 2018d; DOE 2020b.

To evaluate cumulative impacts, the annual utility demands for the Preferred Alternative and No Action Alternatives were added to the existing and reasonably foreseeable future actions at LANL (see Table 4-38). Because electrical consumption at LANL was projected to exceed the 2008 LANL SWEIS bounding limit of 120 MW by 2021, additional electrical infrastructure is anticipated to be required after 2022 (DOE 2018j|Section 4.2.10|). A new TA-03 power plant will provide up to 40 MW on average to LANL, and a new substation in TA-03 will increase capacity from 233 MW to 256 MW (DOE 2018j|Sections 4.2.10.1, 4.2.10.2|). Water from the Sanitary Effluent Reclamation Facility would satisfy some existing water needs and contribute to overall water reduction goals (DOE 2018j|Section 4.2.10|). The impact on the electricity and water supply infrastructure would be reduced with the additional electrical capacity and reduced water usage. Either alternative would slightly increase overall site usage of electricity and water but would not contribute substantially to cumulative impacts at LANL.

4.2.3.1.6 Environmental Justice

Cumulative environmental justice impacts occur when the net effect of past, present, and reasonably foreseeable future projects or activities in the ROI result in disproportionately high and adverse human health and environmental effects on minority or low-income populations. As described in Section 4.1.2.12, analyses for the Preferred and No Action Alternatives indicate no high and adverse human health and environmental effects on the population within 50 mi of LANL. Also, as described in Section 4.2.3.1.2, the activities evaluated in this SPDP EIS are not expected to substantively add to cumulative impacts on human health to any member of the general public. Therefore, SPDP activities are not expected to substantially contribute to cumulative environmental justice impacts.

During previous DOE NEPA analyses, concerns were expressed that impacts on indigenous populations surrounding LANL may be greater than those on the general population as a consequence of their cultural affiliation with the natural environment. Based on analyses in the 2008 LANL SWEIS (DOE 2008a), dose analyses were performed for several specific receptors. That analysis indicated that a special pathways receptor is separate from the MEI. This receptor is an offsite resident living near LANL who adopts traditional living habits (consumes all components of his or her diet from locally produced foods and increased amounts of fish deer and elk from areas surrounding LANL, drinks surface water, and is exposed to contaminated soils and sediments from outdoor activities on or near LANL) who would receive a higher dose than the rest of the populations living in the same area (up to an additional 4.5 millirem/yr) from these pathways. These doses are dominated by the biological uptake of legacy contamination. This dose is approximately 1 percent of the dose from background radiation, as discussed in Section 3.2.8.1, and the risks associated with exposures from LANL activities would be small (DOE 2015c|Section 4.5.2.9.2|). The cumulative dose would be well below the 100 mrem/yr all-pathways dose criterion for protection of members of the public (DOE Order 458.1 Chg 4 2020) and therefore would not result in disproportionately high and adverse effects on a minority or low-income group. Environmental monitoring for special pathways would continue to evaluate whether exposure to special receptors are minimized in accordance with DOE Order 458.1.

4.2.3.2 Savannah River Site

Cumulative impacts were evaluated for the Preferred and No Action Alternatives at SRS. As described in Section 4.1.3, and summarized in Section 2.4, impacts from surplus plutonium disposition activities evaluated in this SPDP EIS on land use and visual resources, air quality, noise, geology and soils, water resources, human health (chemical use), and waste management at SRS would be negligible to minor. These actions would not substantially contribute to cumulative impacts. Therefore, cumulative impacts on these resource areas are not discussed further. Cumulative impacts on ecological resources, human health, cultural and paleontological resources, socioeconomics, infrastructure, and environmental justice, are discussed below. The impacts of transportation, including the portions at SRS, affect areas between the sites and are evaluated in Section 4.2.3.4.

4.2.3.2.1 Ecological Resources

K-Area is highly developed and industrialized. Impacts on ecological resources in the project area in K-Area (including PDP in K-Area) would be minor, assuming the appropriate work windows and BMPs (as described in Section 4.1.3.6) are implemented if the new modular system is installed adjacent to Building 105-K. F-Area is also a highly developed and industrialized landscape. However, potentially suitable habitat for the smooth purple coneflower exists and an extant population exists within 2 mi of the project area (as described in Section 4.1.3.6). If habitat is suitable and the species is identified within the construction footprint, and assuming mitigation measures such as those described in Section 4.1.3.6 are implemented, impacts on ecological resources would be negligible to minor. As a result, SPDP activities are not expected to substantially contribute to cumulative impacts on ecological resources.

4.2.3.2.2 Human Health

The cumulative impacts analysis for human health focuses on the onsite involved workers (radiation workers) and offsite public.

Cumulative radiological health effects on involved workers are based on radiation doses and are presented as excess LCFs in the workforces. Cumulative radiological health effects on the public in the vicinity of SRS are also based on radiation doses, with cumulative impacts expressed as excess LCFs in the offsite population and cumulative risk to a hypothetical MEI (defined in Section 4.1.2.7).

Table 4-39 presents estimated cumulative radiation dose and excess LCFs for the involved workforce at SRS. Other projects and activities included here are assumed to last 30 years. A total of 17,000 person-rem would be the cumulative radiation dose, with an expectation of 10 (10.3) excess LCFs in the worker population from other past, present, and reasonably foreseeable future activities at SRS including activities proposed under the Preferred Alternative.

Table 4-40 presents the estimated cumulative radiation dose to and health effects on the public from activities at SRS and activities at the Alvin W. Vogtle Electric Generating Plant (currently operating Units 1 and 2 as well as future operating Units 3 and 4) located across the Savannah River from SRS. Other projects and activities are assumed to last 30 years for the purposes of estimating cumulative impacts.

The cumulative radiation dose to the exposed population within 50 mi from all activities is 880 person-rem with an expectation of one (0.53) excess LCF. The contribution to the population dose from the activities proposed for the alternatives described in this SPDP EIS would be up to 0.14 person-rem with no expected LCFs (0.00008). For perspective, the annual doses to the same local population from naturally occurring radioactive sources (about 300 mrem per person; see Section 3.3.7, Table 3-22) would be about 240,000 person-rem, from which approximately 150 LCFs would be inferred annually, or about 4,400 LCFs over 30 years.

Table 4-39. Cumulative Radiation Dose to and Impacts on SRS Workers

Activity	Involved Workforce Dose (person-rem)	Involved Workforce LCFs[(a)]
Existing site activities (2012–2016 baseline)[(b)]	3,300	2 (2.0)
Other DOE Actions Evaluated in the *Surplus Plutonium Disposition Supplemental Environmental Impact Statement*[(c)]	1,800	1 (1.1)
Spent Nuclear Fuel from domestic and international research reactors[(d)]	1,200	1 (0.74)
Disposition of 6 MT (dilution and C&P)[(e)]	810	0 (0.49)
Estimated dose for production of 50 to 80 pits/yr[(f)]	5,400–6,000	3–4 (3.2–3.6)
SPDP EIS Alternatives[(g)]		
Preferred - Base Approach Sub-Alternative	2,100	1 (1.2)
Preferred SRS NPMP Sub-Alternative	2, 300–2,900	1–2 (1.4–1.7)
All SRS Sub-Alternative	4,000	2 (2.4)
No Action Alternative	1,400	1 (0.9)
Total[(h)]	**17,000**	**10 (10.3)**

C&P = characterization and packaging; DOE = U.S. Department of Energy; EIS = environmental impact statement; LCF = latent cancer fatality; NNSA = National Nuclear Security Administration; NPMP = non-pit metal processing; SEIS = supplemental environmental impact statement; SPD = surplus plutonium disposition; SPDP = Surplus Plutonium Disposition Program; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

(a) LCFs calculated using a conversion of 0.0006 LCFs per rem or person-rem (DOE 2003a). NNSA considers LCFs <0.5 to be 0.

(b) Dose from past and current activities is from Section 3.2.7 of this SPDP EIS; assumed duration of 30 years.

(c) Contribution from High-Level Radioactive Waste Salt Processing Facility and tank closure is from the 2015 SPD SEIS (DOE 2015c|p. 4-124, Table 4-39|); assumed duration of 30 years.

(d) Dose value from the alternative that results in the greatest combined impact for construction and operations (DOE 2017d|p. 4-27, Table 4-15|); assumed duration of 30 years.

(e) Based on Table C-30 for the 2015 SPD SEIS WIPP Alternative, scaled from 13.1 MT to 6 MT (DOE 2015c); assumed duration of 30 years.

(f) Based on the estimated dose for production of 50 to 80 pits/yr (DOE 2020a|Table 5-6|); assumed duration of 30 years.

(g) Values are from Table 4-20 of this SPDP EIS. The highest value is included in the total.

(h) The total collective dose and LCFs are the sum of existing site activities, other DOE actions evaluated in the 2015 SPD SEIS, activities related to spend nuclear fuel from domestic and international research reactors, disposition of 6 MT of surplus plutonium, estimated dose for production of 80 pits/yr, and the All SRS Sub-Alternative. In cases where there is a range, the highest value is included in the total.

Notes: Numbers are rounded to two significant digits. Columns may not sum to totals due to rounding of individual values and totals.

Sources: DOE 2003a; DOE 2015c; DOE 2017d; DOE 2020a.

Table 4-40. Cumulative Radiation Dose to and Impacts on the Public at the SRS

Activity	Population Dose (person-rem)	Population LCFs[a]	MEI Dose (rem)	MEI Risk of LCF[a]
Existing site activities (2013–2017 Baseline)[b]	45	0 (0.027)	6×10^{-6}	4×10^{-9}
Other DOE Actions Evaluated in *Surplus Plutonium Disposition Supplemental Environmental Impact Statement*[c]	540	0 (0.32)	9×10^{-6}	5×10^{-9}
Spent Nuclear Fuel from domestic and international research reactors[d]	230	0 (0.14)	3×10^{-6}	2×10^{-9}
Disposition of 6 MT (dilution and C&P)[e]	3.0	0 (0.002)	3×10^{-5}	2×10^{-8}
Estimated dose for production of 50-80 pits/yr[f]	0.001–0.002	0 (6×10^{-7}–9×10^{-7})	2×10^{-8}	9×10^{-12}–1×10^{-11}
SPDP EIS Alternatives[g]				
Base Approach Sub-Alternative	0.076	0 0.00005)	2×10^{-6}	9×10^{-10}
SRS NPMP Sub-Alternative	0.092	0 (0.00006)	2×10^{-6}	1×10^{-9}
All SRS Sub-Alternative	0.14	0 (0.00008)	3×10^{-6}	2×10^{-9}
No Action Alternative	0.032	0 (0.00002)	6×10^{-7}	4×10^{-10}
Total for SRS[h]	**820**	**0 (0.49)**	**0.00005**	$\mathbf{3\times10^{-8}}$
Vogtle Electric Generating Plant[i]	60	0 (0.036)	0.072	0.00004
Total[j]	**880**	**1 (0.53)**	**0.072**	**0.00004**

C&P = characterization and packaging; DOE = U.S. Department of Energy; EIS = environmental impact statement; LCF = latent cancer fatality; MEI = maximally exposed individual; NNSA = National Nuclear Security Administration; NPMP = non-pit metal processing; SEIS = supplemental environmental impact statement; SPD = surplus plutonium disposition; SPDP = Surplus Plutonium Disposition Program; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

(a) LCFs are calculated using a conversion of 0.0006 LCFs per rem or person-rem (DOE 2003a). NNSA considers LCFs <0.5 to be 0.
(b) Dose from past and current activities is derived from Section 3.2.7 of this SPDP EIS.
(c) Contribution from High-Level Radioactive Waste Salt Processing Facility, tank closure (DOE 2015c|p. 4-123, Table 4-38|).
(d) Dose values from the alternative that results in the greatest impact (DOE 2017d|p. 4-26, Table 4-14|).
(e) Based on Table C-29 for the 2015 SPD SEIS WIPP Alternative, scaled from 13.1 MT to 6 MT (DOE 2015c).
(f) Based on the estimated dose for production of 50 to 80 pits/yr (DOE 2020a|Table 5-5|). The highest value is included in the Total.
(g) Values are from Table 4-20 of this SPDP EIS. The highest value is included in the total.
(h) Total dose and LCFs are based on existing site activities, other DOE actions evaluated in the 2015 SPD SEIS, activities related to spent nuclear fuel from domestic and international research reactors, disposition of 6 MT of surplus plutonium, estimated dose for production of 80 pits/yr, and the All SRS Sub-Alternative.
(i) Contribution from Vogtle Electric Generating Plant existing Units 1 and 2, and Units 3 and 4 located across the Savannah River from SRS (SNOC 2007|Tables 5.4-8, 5.4-9|).
(j) Assumed to be the same MEI for all activities at SRS and the Vogtle Plant.

Notes: Numbers are rounded to two significant digits. Columns may not sum to totals due to rounding of individual values and totals.

Sources: DOE 2003a; DOE 2015c; DOE 2017d; DOE 2020a; SRNS 2023d; SNOC 2007.

Activities proposed for the alternatives described in this SPDP EIS could result in a cumulative dose to the offsite MEI as high as 3×10^{-6} rem from the project duration with low risk of LCF (2×10^{-9}). The cumulative dose to the offsite MEI from past, present, and reasonably foreseeable future activities over 30 years is 0.072 rem. The cumulative risk of LCF to the MEI from all projects is low, 0.00004, or about 4 in 100,000. This estimate assumes that the same MEI is exposed to all SRS and Vogtle activities over all times and from all locations.

Cumulative radiological consequences of severe accidents at SRS include the accidents evaluated for Natural Phenomena Hazard, as discussed in Section 4.1.3.7.2, that are based on the total facility inventory. This inventory does not change based on the alternative or the sub-alternative. For the K-Area, the dose to the non-involved worker from the cumulative radiological consequences of severe accidents is 290 rem with a LCF risk of 0.3, and the dose in F-Area is 270 rem with a LCF risk of 0.3. The dose to the MEI for K-Area is 8.0 rem with a LCF risk of 0.005 and the dose in F-Area is 11 rem with a LCF risk of 0.007. The population dose is 6,200 person-rem with 4 (3.7) LCFs in K-Area and 9,000 person-rem with 5 (5.4) LCFs in F-Area.

4.2.3.2.3 Cultural and Paleontological Resources

Although guidance documents (PA and CRMP) address identification, evaluation, and mitigation of NRHP-eligible resources and the DOE/NNSA SRS Field Office will complete the NHPA Section 106 process accordingly. Cultural resources are nonrenewable, and adverse effects result in permanent removal of important attributes of the resource. As described in Section 4.1.3.8, the only known potentially NRHP-eligible cultural resource, for either alternative that could be affected by construction or operation, is Building 105-K in K-Area. Adverse impacts from any action on any NRHP-eligible or potentially eligible historic resource would substantially contribute to cumulative impacts within the SRS ROI.

4.2.3.2.4 Socioeconomics

The cumulative impacts analysis describes the potential socioeconomic impacts from the Preferred and No Action Alternatives, in combination with other past, present, and reasonably foreseeable future activities in the ROI by examining the impacts on housing and community services as indicators of cumulative impacts caused by changes in employment.

Cumulative employment at SRS from past, present, and reasonably foreseeable future actions is expected to grow beyond the current level of nearly 11,000 persons. Some of the employment would occur at different times and may not be additive (DOE 2015c|Section 4.5.3.4.1|). The Plutonium Pit Production project (listed in Table 4-35) indicates that an additional 1,830 to 2,015 SRS workers would be needed beginning in 2030 (DOE 2020a|Table 4-11|). With this and other projects, the SRS worker population might reasonably increase to beyond 13,000 during the period of SPDP activities or about 30 percent. By comparison, approximately 240,000 people were employed in the SRS ROI in 2022. Activities proposed under the Preferred and No Action Alternatives in this SPDP EIS could produce peak-year direct employment of about 1,016 and 212, respectively. In addition to the direct jobs in the ROI, an estimated additional 2,569 and 355 indirect and induced jobs could be created under the Preferred and No Action Alternatives, respectively (see Table 4-23). Anticipated fluctuations in ROI employment from activities at SRS could result in stress on housing and community services in the ROI, depending on the timing of the employment growth and localized housing demand within the ROI. Traffic impacts on SRS access routes related to the growing onsite workforce likely would be noticeable but would depend on the route.

In addition to the activities at SRS, construction and start-up operations for Units 3 and 4 at the Vogtle Plant currently employs over 7,000 workers locally (Georgia Power 2022). Although the Vogtle Plant is located outside the SRS ROI for socioeconomic impacts in nearby Burke County, the impacts associated with activities at the Vogtle Plant would affect conditions in Richmond and Columbia Counties in Georgia, which are included in the SRS ROI and the Vogtle ROI. Both adverse and beneficial socioeconomic impacts are anticipated from construction at the Vogtle Plant. The NRC has determined that these positive and negative impacts both would be small to moderate (DOE 2015c|Section

4.5.3.4.1|). An additional 1,200 soldiers and civilian workers associated with the Cyber Command Center at Fort Gordon also contribute to cumulative socioeconomic impacts because these workers and families add to demand for local housing and community services in the greater Augusta area.

Additional development projects outside of the SRS activities listed in Table 4-35 are relatively small projects and would not employ large workforces or require substantial relocation of workers from outside the ROI. Such projects would not place additional stress on SRS operations or the capacity of the ROI to absorb minor impacts.

The greater Augusta metropolitan area is a large and diverse economic region. The cumulative effects of the projects listed in Table 4-35, in combination with the All SRS Sub-Alternative all contribute to noticeable socioeconomic impacts in the SRS ROI. The relative size of the cumulative impacts is small in relation to the overall size of the local economy and much capacity exists to absorb these impacts. Also, local governments are aware of the activities listed in Table 4-35 and would reasonably be assumed to factor anticipated economic growth into planning processes. Therefore, SPDP activities are not expected to substantially contribute to additional cumulative socioeconomic impacts in the SRS ROI.

4.2.3.2.5 Infrastructure

This section presents the cumulative impacts on the electricity and water supply infrastructure at SRS during operations. Electricity and water use during construction/modifications is not considered further in this section because usage would be for a limited duration and would be less than 1 percent of the available site capacity in any year of construction/modification. Portions could also be supplied by self-contained (e.g., generators) or offsite sources (e.g., water trucks). Fuel usage (propane, diesel, and gasoline) is also not considered in this section because large quantities of fuels would not be necessary, and fuels are delivered as needed; there is no limit on site capacity.

Table 4-41 lists onsite operational activities that could demand the same resources as the alternatives evaluated in this SPDP EIS, many of which are ongoing activities that may end before the activities evaluated in this SPDP EIS begin. Offsite activities are ongoing activities that would not contribute to impacts on SRS utility capacity and therefore are not included in Table 4-41. The utility usage for existing site activities in Table 4-41 is expected to bound the present and reasonably foreseeable actions at SRS.

To evaluate cumulative impacts, the largest annual electricity and water demand from the SPDP alternatives was added to the amounts used by existing site activities and projected for reasonably foreseeable future activities. As shown in Table 4-41, total cumulative electrical and water usage would not approach or exceed SRS capacities.

Table 4-41. Annual Maximum Cumulative Infrastructure Impacts from Operations at the SRS

Activity	Electricity Consumption (MWh/yr)	Water Usage (millions of gal/yr)
Existing site activities[(a)]	320,000	290
Other Onsite Activities		
High-Level Radioactive Waste Salt Processing[(b)]	24,000	27
Tank Closure[(b)]	0	1.6
Estimated impacts for production of 50-80 pits/yr[(c)]	≤30,000	12–13

Activity	Electricity Consumption (MWh/yr)	Water Usage (millions of gal/yr)
Subtotal – Baseline Plus Other Actions[c]	**370,000**	**330**
SPDP EIS Alternatives[d]		
Base Approach Sub-Alternative	11,000	3.6
SRS NPMP Sub-Alternative	14,000	4.6
All SRS Sub-Alternative	52,000	8.6
No Action Alternative	4,100	1.8
Total	**430,000**	**340**
Total Available Capacity[a]	**4,400,000**	**790**

EIS = environmental impact statement; NPMP = non-pit metal processing; SRS = Savannah River Site; SEIS = supplemental environmental impact statement; SPD = surplus plutonium disposition; SPDP = Surplus Plutonium Disposition Program.

(a) From Section 3.2.10.1 of this SPDP EIS.

(b) 2015 SPD SEIS cumulative data (DOE 2015c|Table 4-43|).

(c) Operation infrastructure requirements for each alternative (50 pits/yr or 80 pits/yr as a surge) (DOE 2020a|Table 4-10|), but highest value is shown in the total.

(d) Values are from Table 4-25 of this SPDP EIS. The highest value is included in the total.

Notes: Numbers are rounded to two significant digits. Columns may not sum to totals due to rounding of individual values and totals.

Sources: DOE 2020a; DOE 2015c; SRNS 2023d.

4.2.3.2.6 Environmental Justice

Cumulative environmental justice impacts occur when the net effect of past, present, and reasonably foreseeable future projects or activities in the ROI results in disproportionately high and adverse human health and environmental effects on minority or low-income populations. As described in Section 4.1.3.12, analyses for the Preferred and No Action Alternatives indicate no high and adverse human health and environmental effects on the population within the SRS ROI. Also, as described in Section 4.1.3.7, the activities evaluated in this SPDP EIS are not expected to substantively add to cumulative impacts on human health for any member of the general public. Additional projects discussed in Section 4.2.3.2.2 do not contribute significantly to the human health of members of the general public. Therefore, SPDP activities are not expected to substantially contribute to cumulative environmental justice impacts from implementing the Preferred and No Action Alternatives at SRS. Environmental monitoring for special pathways would continue to evaluate whether exposure to special receptors are minimized in accordance with DOE Order 458.1.

4.2.3.3 Cumulative Impacts of Transuranic Waste Disposal at the WIPP facility

The WIPP facility is the only permanent disposal option in the United States for TRU waste generated by *U.S. Atomic Energy Act* defense activities. Thus, the ability to send TRU waste to the WIPP facility is dependent on the availability of capacity at the WIPP facility. The WIPP LWA specifies a TRU waste disposal volume capacity of 6.2 million ft^3 (175,600 m^3).

The Annual TRU Waste Inventory Report (ATWIR) is an estimate of TRU waste inventory stored or projected to be generated. It serves as an annual estimate of the TRU waste inventory for potential disposal at the WIPP facility and documents the TRU waste estimates that may be considered in future Performance Assessments for Compliance Recertification Applications submitted to the EPA. However, before any new TRU waste streams that are in the ATWIR can be shipped and disposed of at the WIPP facility the TRU waste must be shown to be compliant with the WIPP WAC by passing a waste certification audit and oversight from EPA and NMED. The ATWIR estimates are also used for technical analyses, strategic planning, and NEPA analyses. The TRU Waste Inventory Profile Reports (Appendices A and B of the ATWIR) reflect the information reported by the TRU waste generator/storage sites. The TRU waste inventory estimates in the ATWIR have inherent uncertainties and therefore the inventory estimates change annually. The TRU waste inventory estimates typically change due to factors, such as: updates or revisions to site treatment plans, waste minimization activities, packaging adjustments, technical and planning changes, etc.

As of the data collection cutoff date for the 2022 ATWIR, approximately 71,200 m^3 of TRU waste were disposed at the WIPP facility (DOE 2022b|Table 3-3|). Other proposed actions since publication of the current ATWIR could change the TRU waste inventory for potential disposal at the WIPP facility. These actions would be incorporated, as appropriate, in future ATWIR TRU waste inventory estimates.

The maximum total CH-TRU job control waste estimated to potentially be generated during operations over the life of the Preferred Alternative ranges from 1,600 to 2,300 m^3 as shown in Table 4-30. Smaller amounts up to 170 m^3 would be generated during construction activities (see Table 4-29). All sub-alternatives of the Preferred Alternative would generate 1,500 m^3 of CH-TRU waste in the form of diluted plutonium oxide (see Table 4-30). The No Action Alternative would generate 310 m^3 of diluted plutonium oxide CH-TRU waste. For the diluted plutonium oxide CH-TRU waste in CCOs, the maximum TRU waste volume estimates in this document represent TRU waste volume estimates and not the volume of the overpack disposal container(s).

CH-TRU waste volume estimates, such as those provided in NEPA documents, cannot be used to determine compliance with the WIPP LWA total TRU waste disposal volume capacity limit. The defense TRU waste estimates in the ATWIR change annually. Compliance with the WIPP LWA disposal capacity limit is demonstrated by proven and audited procedures and processes implemented for the WIPP facility by DOE's CBFO. CBFO monitors and tracks the actual TRU waste volume emplaced at the WIPP facility to verify compliance with the WIPP LWA and would take action as appropriate in a timely and appropriate manner to meet the needs of the DOE Complex.

4.2.3.4 Transportation Cumulative Impacts

The assessment of cumulative transportation impacts for past, present, and reasonably foreseeable future actions concentrates on offsite transportation throughout the Nation that would result in potential radiation exposure to the transportation workers and the general population. Cumulative radiological impacts from transportation are estimated using the collective dose to the workers and the general population, because dose can be directly related to LCFs using a cancer risk coefficient.

The comprehensive transportation cumulative impacts analysis presented in the 2015 SPD SEIS (DOE 2015c|Section 4.5.3.7|) is incorporated in this SPDP EIS. The analysis included historical shipments, reasonably foreseeable future actions, and general radioactive materials transportation that was not related to any particular action. The timeframe of the 2015 SPD SEIS impacts analysis begins in 1943 and extends to 2073.

Table 4-42 below provides impacts on transportation workers and the general population from transportation activities considered in this SPDP EIS, in addition to the cumulative impacts estimated in the 2015 SPD SEIS (DOE 2015c) and additional past, present, and reasonably foreseeable future actions. For the Preferred and No Action Alternatives evaluated in this SPDP EIS, doses to the worker and the general population would be less than 330 and 350 person-rem, respectively, and no LCFs (0.2) would be expected. When combined with past, present, and reasonably foreseeable future actions, the collective worker dose was estimated to be 430,000 person-rem (260 LCFs). The collective general population dose was estimated to be 440,000 person-rem (260 LCFs). The impacts from the Preferred and No Action Alternatives evaluated in this SPDP EIS would represent less than 1 percent of the total transportation doses or LCFs.

Table 4-42. Cumulative Transportation Impacts for this SPDP EIS

Category	Collective Worker Dose (person-rem)	Collective General Population Dose (person-rem)
Historical[a]	49	25
Past, Present, and Reasonably Foreseeable Future Actions (DOE)[a][b]	30,000	37,000
Additional Reasonably Foreseeable Future Actions (DOE)		
Permanent Disposal or Interim Storage of Spent Nuclear Fuel[c]	5,600–5,900	1,100–1,200
Final Greater-Than-Class C EIS[d]	180	68
WIPP Supplement Analysis[e]	490	380
Production of Tritium in a Commercial Light Water Reactor[f]	25–60	2.7–12
Liquid Highly Enriched Uranium Shipments from Canada[g]	17	10
Santa Susana Field Laboratory Remediation[h]	3.0	0.89
Acceptance and Disposition of Spent Nuclear Fuel Containing U.S.-Origin Highly Enriched Uranium from the Federal Republic of Germany[i]	0.12–11	0.54–4.7
Sister Rod Shipments[j]	0.27	0.75
Project Pele [k]	1.2	2.2
Disposition of Depleted Uranium Oxide Conversion Product[l]	150–280	220–720
Plutonium Pit Production at SRS[m]	580–900	330–460
Total Past, Present, and Reasonably Foreseeable Future Actions (DOE)	**37,000–38,000**	**39,000–40,000**
Past, Present, and Reasonably Foreseeable Future Actions (non-DOE)[a]	5,400	61,000
General Radioactive Materials Transportation (1943-2073)[n]	380,000	340,000
Transportation Impacts in this SPDP EIS[o]		
Preferred Alternative (34 MT Pu)	130–330	140–350
Preferred Alternative (7.1 MT Pu)	32–68	38–75
No Action Alternative	58–68	48–75
Total (Maximum)	**430,000**	**440,000**
Total LCFs[p]	**260**	**270**

DOE = U.S. Department of Energy; EIS = environmental impact statement; INL = Idaho National Laboratory; LCF = latent cancer fatalities; Pu = plutonium; SPDP = Surplus Plutonium Disposition Program; SRS = Savannah River Site; WIPP = Waste Isolation Pilot Plant.

(a) Historical shipments are shipments that occurred in the past (DOE 2015c|Table 4-48, p. 4-136 and 4-137|).
(b) Does not include the doses from shipping Greater-Than-Class C waste (DOE 2015c|Table 4-48, p. 4-136 and 4-137|).
(c) For the purposes of the transportation cumulative impacts analysis, DOE considered the Yucca Mountain, Nevada, repository site as a surrogate destination for an interim storage facility or a permanent repository (DOE 2008b|Table 8-14, p. 8-44|).
(d) Sources: DOE 2016a|Table 4.3.9-1, p. 4-68 and 4-69| and DOE 2018c|p. 3-20|.
(e) Source: DOE 2009|Table 2, p. 5|.
(f) Calculated from LCFs (DOE 2016b|Table F-12, p. F-17|).

(g) Source: DOE 2013b|p. A-11|. Calculated from LCFs (DOE 2013b|p. A-11|).
(h) Source: DOE 2018e|Table H-9, p. H-31|.
(i) Source: DOE 2017d|Table 4-28, p. 4-68|.
(j) Source: DOE 2015f|Table 3-1, p. 24|. Calculated from LCFs.
(k) Source: DOE 2022d|Table 5.3-13|
(l) Source: DOE 2020c|Table 4-51, p. 4-93, for the highest impacts using rail or truck shipments.
(m) Source: DOE 2020a|Table 5-7, for 50 to 80 pits per year with 50 years of operation.
(n) General radioactive material transportation is not related to a particular action; for example, shipments of radiopharmaceuticals to nuclear medicine laboratories and shipments of commercial low-level radioactive waste to commercial disposal facilities (DOE 2015c|Table 4-48, p. 4-136 and 4-137|).
(o) From Section 4.1.6 of this SPDP EIS. Ranges of impacts do not necessarily correspond to the same sub-alternatives. The highest value is included in the total.
(p) Total LCFs are calculated assuming 0.0006 LCFs per person-rem of exposure (DOE 2003a).
Notes: Numbers are rounded to two significant digits. Columns may not sum to totals due to rounding of individual values and totals.

To place these numbers in perspective, the National Center for Health Statistics indicates that the number of cancer deaths in the United States in 2019 was about 599,600 (Xu et al. 2021). The total number of LCFs (among the workers and general population) estimated to result from radioactive material transportation over the period between 1943 and 2073 is about 520, or an average of about 4 LCFs per year. The transportation related LCFs represent about 0.0007 percent of the overall annual number of cancer deaths, which is an extremely small fraction of the total number of deaths from cancer in a year. Note that the majority of the cumulative risks to workers and the general population would be due to the general transportation of radioactive material unrelated to activities evaluated in this SPDP EIS.

4.2.4 Global Commons Cumulative Impacts

This section describes the potential for cumulative impacts on ozone depletion and global climate change, both from the proposed action and also on the locations encompassed by the proposed action.

4.2.4.1 Effects of the Project Alternatives on Ozone Depletion

Construction and operation activities would be accomplished using materials and equipment that would be compliant with applicable ozone-depleting substances (ODSs) laws and regulations. DOE works to reduce its use of ODSs complex-wide, based on Federal directives and DOE Order 436.1 (2011), *Departmental Sustainability*. The Preferred and No Action Alternatives are not expected to use substantial quantities of ODSs as regulated under 40 CFR Part 82, "Protection of Stratospheric Ozone." Emissions of ODSs would be very small and would represent a negligible contribution to the destruction of the Earth's protective ozone layer.

4.2.4.2 Effects of the Project Alternatives on Climate Change

GHGs are gases that trap heat in the atmosphere by absorbing outgoing infrared radiation. The accumulation of GHGs in the atmosphere regulates the Earth's temperature. GHG emissions occur both from natural processes and anthropogenic activities (resulting from or produced by human beings). The most common GHGs emitted from natural processes and human activities include carbon dioxide (CO_2), methane, and nitrous oxide. Other GHGs do not occur naturally and result only from human activities. The main source of GHGs from human activities is the combustion of fossil fuels, such as coal, crude oil (including gasoline, diesel fuel, and heating oil), and natural gas (USGCRP 2018).

The Intergovernmental Panel on Climate Change (IPCC) was created in 1988 by the World Meteorological Organization and the United Nations Environment Programme. The IPCC provides regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation. The IPCC's latest comprehensive assessment is the Sixth Assessment Report, Climate Change 2022: Impacts, Adaptation and Vulnerability (Pörtner et al. 2022). The Sixth Assessment provides current knowledge about the observed impacts and projected risks of climate change. The IPCC's Fifth Assessment Report, Climate Change 2014 (IPCC 2014), reports on the findings from the ICPP's comprehensive assessment of climate change. One of the conclusions of the report is that anthropogenic GHG emissions have increased since the pre-industrial era and are now higher than ever. According to the IPCC Fifth Assessment report, the increase in GHG emissions has led to atmospheric concentrations of CO_2, methane, and nitrous oxide that are unprecedented in at least the last 800,000 years, and for the anthropogenic CO_2 emitted between 1750 and 2011, approximately half of the emissions occurred in the last 40 years (IPCC 2014|SPM 1.2 p. 4|). Emissions of CO_2 from fossil fuel combustion and industrial processes contributed about 78 percent of the total GHG emissions increase from 1970 to 2010 (IPCC 2014|p. 5|). The effects of GHGs, combined with other anthropogenic factors, are a major cause of the increase in global average surface temperature from 1951 to 2010 (IPCC 2014|p. 5|). Changes in the global water cycle, including retreat of glaciers, increased surface melting of the Greenland ice cap, Arctic sea-ice loss, and mean sea level rise are also attributed to anthropogenic influences (IPCC 2014|p. 5|).

Climate change has been attributed to impacts on physical systems, biological systems, and human and managed systems. Impacts on physical systems include those on glaciers, snow, ice, permafrost, rivers, lakes, floods, and drought, coastal erosion, and sea level effects. Impacts on biological systems include terrestrial ecosystems, marine ecosystems, and wildfire. Impacts on human and managed systems include those on food production, livelihoods, health, and economics (IPCC 2014|p. 7, Figure SPM.4|).

Further, there are observed global-scale changes in both the frequency and intensity of daily temperature extremes that can be at least partially attributed to human influence. This includes the probability of heat waves at some locations, as well as increased mortality associated with heat-related conditions and decreased mortality associated with cold-related conditions (IPCC 2014|p. 8|).

In the area surrounding LANL, climate variability on the Pajarito Plateau has resulted in periods of increased precipitation followed by severe drought, resulting in an increase in wildfire and wildfire risk in the region. The reduction of vegetation due to wildfires increases the risk of flooding and erosion from monsoon rains. In addition, observed changes within the Southwest region (e.g., Arizona, California, Colorado, Nevada, New Mexico, and Utah) include a reduction in winter snowpack and lower stream flows in major drainage basins (USGCRP 2017). The Southwest region that encompasses LANL is at risk from increasing temperatures, hydrological drought, tree death, wildfires, and decreases in potable water supply in the future (USGCRP 2018|p. 1101-1184|).

At SRS, South Carolina has not experienced the same increase in temperature as other states in the nation. However, the U.S. Global Change Research Program predicts that annual average temperatures will increase from 3 to 6 degrees Fahrenheit by 2100, based on both low and high global GHG emission scenarios (USGCRP 2018|p. 42|). In addition, average precipitation for each season will increase over the long-term, with the highest increase of 10 to 20 percent occurring in winter (USGCRP 2017|p. 217|). Predictions of climate change impacts to South Carolina include (1) an increase in extreme rainfall events, which will increase flood risks in low-lying regions; (2) an increase in urban heat and vector-borne disease; and (3) more frequent extreme heat episodes and changing seasonal climates, which are expected to increase wildfires and exposure-linked health impacts and economic vulnerabilities in the agricultural, timber, and manufacturing sectors (USGCRP 2018|p. 743-808|).

Atmospheric levels of GHGs and their resulting effects on climate change are due to innumerable sources of GHGs across the globe. The direct environmental effect of GHG emissions is an increase in global temperatures, which indirectly causes numerous environmental and social effects. Therefore, the ROI for potential GHG impacts would be global.

Each GHG is assigned a global warming potential (GWP). The GWP is the ability of a gas or aerosol to trap heat in the atmosphere over a given period of time. The GWP rating system is standardized to CO_2, which has a value of one. For example, methane has a GWP of 25 over 100 years, which means that it has a global warming effect that is 25 times greater than CO_2 on an equal-mass basis (EPA 2021|Table ES-1, p. E-3|). To simplify GHG analyses, total GHG emissions from a source are often expressed as a CO_2e, which is calculated by multiplying the emissions of each GHG by its GWP and summing the results to produce a single, combined emission rate representing all GHGs.

Table 4-43 presents estimates of total direct GHG emissions in units of CO_2e that would occur from construction and operation activities, transport of waste and materials by diesel-powered trucks and escort vehicles for the Preferred and No Action Alternatives. Truck transport activities would generate a substantial portion of total GHG emissions for each alternative. Emissions from operations would occur over a period of up to 27 years and they would add to global GHG emissions. As GHG emissions from these actions are produced from the combustion of gasoline and diesel fuels, CO_2 comprises over 99 percent of CO_2e emissions, with the remainder consisting of nitrous oxide and methane (ANL 2022; LANL 2023a). These emissions would produce a negligible contribution to future climate change, the effects of which are identified above. To minimize GHG emissions from the project alternatives, proposed emission sources would comply with applicable local and State regulations and GHG policies, and for mobile sources, Federal vehicle clean fuels, mileage efficiencies, and emissions regulations. In addition, DOE policies would promote the minimization of proposed GHG emissions, such as (1) DOE Order 413.3B, which requires new construction and major building renovations to meet the U.S. Green Building Council's Leadership in Energy and Environmental Design Gold certification without an approved waiver, and (2) the DOE Energy Sustainability Plan (DOE 2022a), which lays out a plan for the DOE to transition to carbon pollution-free energy sources, a zero-emissions fleet, and a net-zero building portfolio.

Table 4-43 also presents estimates of the social cost of GHG (SC-GHG) for each project alternative. The SC-GHG is the monetary value (in dollars) of the net harm to society associated with adding GHG emissions to the atmosphere (IWG 2021). In principle, it includes the value of all predicted climate change impacts, including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased natural disasters, disruption of energy systems, environmental migration, and the value of ecosystem services.

The range of SC-GHG values listed for each sub-alternative in Table 4-43 is due to different discount rates, as presented in IWG 2021. The estimated SC-GHG for the SPDP sub-alternatives ranges from \$100,000 for the No Action Alternative calculated at the 5 percent discount rate up to \$13,000,000 for the All SRS Sub-Alternative K-Area Option calculated at the 3 percent discount rate at the 95th percentile.

Table 4-43. Total Carbon Dioxide Equivalent Emissions at LANL and SRS During Construction, Operation, and Transportation Activities for the Preferred and No Action Alternatives

Activity (unit)	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP Sub-Alternative (Modular NPMP Option)	Preferred Alternative All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP Option)	Preferred Alternative All LANL Sub-Alternative	No Action Alternative
Construction–LANL (MT)	3,900	3,900	3,900	(a)	(a)	5,000	(a)
Operations–LANL (MT)	(b)	(b)	(b)	(b)	(b)	(b)	(b)
Construction–SRS (MT)	(a)	0.25	(c)	35,000	38,000	(a)	0.25
Operation–SRS (MT)	2,600	3,900	3,900	26,000	26,000	(d)	3,900
Transportation (MT)	20,000	20,000	20,000	21,000	21,000	12,000	4,800
Transportation Escort Vehicles (MT)[(e)]	1,500	1,400	1,400	1,700	1,700	690	400
Total Emissions (MT)	**28,000**	**30,000**	**30,000**	**84,000**	**87,000**	**18,000**	**9,000**
Social Cost of GHG Emissions ($)[(f)]	360,000-4,100,000	370,000-4,300,000	370,000-4,300,000	1,100,000-12,000,000	1,100,000-13,000,000	230,000-2,600,000	110,000-1,300,000

GHG = greenhouse gas; LANL = Los Alamos National Laboratory; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SPDP EIS = Surplus Plutonium Disposition Program Environmental Impact Statement; SRS = Savannah River Site.

(a) No construction/modification activities are anticipated.

(b) No additional GHG emissions are anticipated from operations at LANL (LANL 2023a|Section 2.2.1.2|).

(c) Emissions from installation of the modular system are expected to be greater than those identified for building modification activities, but substantially less than those estimated for construction of the F-Area PDP Option.

(d) No operations at SRS.

(e) Assumes two escort vehicles for the transportation of plutonium pits, undiluted plutonium oxide, and uranium oxide.

(f) As described in the IWG 2021, the social cost of GHGs is the "monetary value of the net harm to society associated with adding a small amount of that GHG to the atmosphere in a given year." This calculation was made by multiplying the total GHG emissions by the discount rates listed on Table ES-1 of IWG 2021, based on the life of the project (2023-2050).

Notes: Numbers are rounded to two significant digits. Columns may not sum to totals due to rounding of individual values and totals. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

Sources: LANL construction emissions are calculated based on data in LANL 2023a|Sections 1.3, 2.2|. SRS construction and operations emissions are calculated from data in SRNS 2023d; DOE 2012c|Tables 2.4-4, 2.2-7|; EPA 2021|Table ES-1, p. E-3|. Transportation emissions are calculated based on miles traveled from Table 4-33 and Table 4-34 of this SPDP EIS and emission factor from Argonne National Laboratory (ANL 2022).

Indirect effects, which are caused by an action but occur later in time or farther in distance (88 FR 1196), are expected to result in additional emissions. Although estimates for direct GHG emissions were developed for each project alternative, there is uncertainty in evaluating indirect emissions levels and the relationship between GHG sources and sinks over an extended time frame or distance. Climate change effects resulting from GHG emissions are global in scale, and there is no guidance for how to quantify the extent of indirect emissions. Therefore, the EIS did not estimate indirect emissions.

Environmental justice communities located near LANL and SRS (Sections 3.2.12 and 3.3.12) may experience disproportionate impacts from climate change by the effects discussed above. In areas surrounding LANL, drought would negatively impact subsistence farming, which occurs in the neighboring pueblos. Communities located within canyons near LANL and low-lying areas near SRS could be subject to increased flooding and potential displacement. In accordance with Executive Order 14008 (86 FR 7619), LANL and SRS provided input or developed plans and programs in support of DOE's conservation action plan. The plans include options for addressing climate change within the neighboring communities by creating parks and outdoor opportunities, supporting tribally led conservation, expanding conservation habitats, and creating jobs by investing in restoration (SRNS 2022c|Section 2.4.5|, LANL 2022c|p. 2-41|). In addition, DOE proposes in their 2021 Climate Adaptation and Resilience Plan to coordinate with tribal, state, and local governments, as well as Federal agencies, to provide communities near DOE sites with climate and extreme weather information and resources necessary to implement climate adaptation and mitigation measures (DOE 2021a). Implementation of these measures would mitigate climate change impacts to environmental justice communities nearby LANL and SRS.

4.2.4.3 Effects of Climate Change on the Project Alternatives

Change in resilience is the effect of climate change on a proposed project. There are projected climate change effects on specific sites associated with this SPDP EIS, as discussed above for SRS and LANL. Due to siting criteria, DOE plutonium facilities are not located in floodplains, are hardened and therefore resistant to severe weather damage (including damage from tornadoes, high winds, hail, and lightning) and wildfire, and because of their safety posture, have robust electrical backup systems in the event of power loss.

Current operations at SRS and LANL factor in their respective climates. However, the exacerbation of these conditions in the future could impede proposed activities during extreme events. In the *2022 Climate Adaptation and Resilience Plan* (DOE 2022a), DOE described the priority actions planned to promote climate change adaptation and resilience at DOE sites. Priorities include reducing energy and water needs for site operations. This would decrease vulnerabilities resulting from power supply and water restrictions caused by extreme storm events, droughts, and wildfires. To increase energy resilience, DOE is working to modernize the electrical distribution system at SRS by updating and building more resilient transformers, transmission lines, and associated equipment. At LANL, planning is underway for a 6–8 MW photovoltaic electric generating station. DOE is also committed to promoting energy and environmental justice by increasing awareness at its sites and in neighboring communities about cost-effective, energy-resilient energy solutions. LANL is working with DOE and energy programs to create economic opportunities for surrounding communities (DOE 2022a). Lastly, as part of their adaptive process, DOE routinely monitors climate change analyses and, where appropriate, implements measures to make project facilities more resilient to future climate impacts.

LANL and SRS also address sustainability efforts and goals through site sustainability plans. LANL has implemented heating and ventilation upgrades, installed electric vehicle charging stations, insulated steam pits, added light-emitting diode bulbs, motion sensing, and solar lighting in parking lots and garages, and updated engineering standards to incorporate more comprehensive sustainable design criteria (LANL 2022c|Chapter 3|). Proactive efforts continue to be made at LANL to identify mitigation strategies and minimize the effects of climate events on the site. SRS has increased electricity consumption from renewable resources, reduced non-potable water intensity, reduced petroleum use, increased alternative fuel use, and upgraded utility systems (SRNS 2022c|Section 2.3|). SRS also uses modeling to assess the impacts of future climate change on site buildings and workers (SRNS 2022c|2.3.11|).

4.3 Deactivation, Decontamination, and Decommissioning

Facility disposition upon cessation of operations would be performed in compliance with applicable DOE, other Federal agency, and State requirements. The management of DOE physical assets, including the facilities addressed in this SPDP EIS would be subject to the requirements of DOE Order 430.1C (DOE Order 430.1C Chg 2 2020), Real Property and Asset Management, and related Orders. After operations, the facilities would be dispositioned in accordance with a process that begins once NNSA determines that a facility is no longer needed to support program missions and declares it surplus. Depending on regulatory determinations, decisions about some facilities may require consideration of the CERCLA. General and site-specific discussions of deactivation, decontamination, and decommissioning (DD&D) activities are provided in this section.

4.3.1 General Process

NNSA would design and operate surplus plutonium disposition capabilities in anticipation of the eventual activities required for DD&D. Multiple steps would be taken to prevent and minimize chemical and radionuclide contamination. Protective coatings would be applied to the concrete to reduce contamination absorption into the concrete. In some cases, stainless steel cell and area liners could be provided to facilitate contamination removal. Ventilation could also be provided in processing areas to minimize airborne contamination. Process functions would be compartmentalized, and equipment would be designed to minimize areas where radioactive materials can accumulate. Further description of the DD&D process is found in Section 4.6 of the 2015 SPD SEIS (DOE 2015c).

Once facilities are deemed surplus to the program mission, the DD&D process begins. Deactivation begins with the removal of all feed materials—including chemicals and any remaining surplus plutonium—from the facilities to leave them in a low-cost condition for surveillance and maintenance. Deactivation includes wiping down and sweeping out the gloveboxes and processing equipment to gather any residual plutonium, performing a nuclear material control and accountability inventory, and accounting for all special nuclear material. Deactivation may also include removal and replacement of HEPA filters or other maintenance activities to assure that all special nuclear material is accounted for. The hazard categorization of the facility could then be reevaluated. Facilities would continue to be surveyed after the initial deactivation effort to assure that any contamination is contained, and worker and public safety is maintained. A formal closeout for decommissioning in accordance with the Multi-Agency Radiation Survey and Site Investigation Manual (NRC/EPA/DOE 2000) would be conducted after final status surveys are completed. The surveys demonstrate whether deactivation and decontamination efforts were successful. Closeout activities may include inspections of support systems (e.g., HVAC and water systems) to determine if they can be re-used.

A quantitative analysis of the DD&D activities cannot be conducted for this SPDP EIS because it is not known at this time which facilities or equipment would be deemed surplus upon completion of either the Preferred Alternative or the No Action Alternative. Regardless of which alternative is chosen, DD&D activities would follow an established process. Once proposals concerning DD&D activities are developed, NNSA would at that time undertake additional NEPA analysis, as appropriate. The sections below summarize information for each site regarding DD&D related to the Preferred Alternative.

This discussion includes DD&D of the surplus plutonium disposition capabilities; it does not include DD&D of the larger multiple-use structures such as PF-4 at LANL and F-Area or K-Area at SRS, within which the surplus plutonium disposition capabilities would be located.

4.3.2 Pantex Plant

Portions of facilities at Pantex would be used temporarily to support surplus plutonium disposition activities. Once the facility's surplus plutonium disposition mission is complete, it would undergo a period of deactivation and stabilization in accordance with applicable DOE, other Federal agency, and State requirements, and a CERCLA review, as necessary. However, no decontamination or decommissioning activities are anticipated as part of either alternative (CNS 2019), because no contamination is expected, and it is likely the equipment and space used for packaging and container storage would be transitioned to other uses.

4.3.3 Los Alamos National Laboratory

No LANL facilities were proposed for demolition upon completion of the activities related to disposition of the 34 MT of surplus plutonium (LANL 2023a|Section 2.4.1|), but general DD&D activities of deactivation and stabilization at LANL are described in this section. Major activities would include complete de-inventory of accountable material, flushing and cleaning of equipment, and disconnection of utilities from certain equipment. SPDP equipment and dedicated areas would be placed in a stable condition requiring minimal surveillance and referred to as "cold, dark, and dry." At the end of this period, these areas would be maintained in a safe, minimal surveillance condition until a decision about their ultimate disposition is reached. No decision about the ultimate disposition would be made until the required review process (which may include the CERCLA process) has been completed (DOE 2015c).

When the processing mission is completed, deactivation of the operations area would allow for the decontamination stage to commence by putting the area into a safe mode. These activities are anticipated to take approximately 4 years (LANL 2023a|Section 2.4.1|). All material would be accounted for to allow decontamination. The gloveboxes and processing equipment would be wiped down and cleaned, if it was determined that the item could be disposed of as LLW. LLW or demolition waste items may be size reduced to achieve a disposal cost saving. Some items would be disposed of as TRU waste and would not require the same level of cleaning as items slated for low-level waste disposal. These items would be packaged in containers for disposal at the WIPP facility (LANL 2023a|Section 2.4.1|). The waste streams (i.e., CH-TRU waste and solid or liquid low-level waste) generated at LANL during pit disassembly and processing DD&D activities are anticipated to be small percentages of the current waste generation for the Preferred and No Action Alternatives.

4.3.4 Savannah River Site

Decommissioning of the surplus plutonium disposition capabilities at K-Area is expected to be similar to that of other glovebox lines that have been decommissioned at SRS in the past.

Decontamination in K-Area would involve cleaning accessible residual contamination on equipment and within processing areas to reduce the hazard potential for personnel that would be walking in these spaces in the future (SRNS 2023d|Section 8|). Decontamination would not involve inaccessible surfaces of gloveboxes and equipment (fans, filter housings, etc.), which could be highly contaminated. C&P activities would require little or no decontamination because those activities would only handle closed containers of diluted plutonium oxide CH-TRU waste (SRNS 2023d|Section 8|).

Decommissioning of the surplus plutonium disposition capabilities at F-Area is expected to be similar to that at other glovebox lines that have been decommissioned at SRS in the past. If NNSA decides to conduct additional activities in Building 226-F (SRPPF) and/or in other nearby facilities used to support SPDP, then the decontamination and decommissioning of these facilities would be delayed. However, if the end of SPDP PDP operations occurs before the cessation of operations for the pit production activities, then the PDP activities would be deactivated but the decontamination and decommissioning activities would be delayed in Building 226-F (SRPPF) until after cessation of operations for pit production (DOE 2020a|Section 4.14|). Buildings or structures outside of Building 226-F (SRPPF) that support PDP for SPDP could be decontaminated and dismantled as appropriate during pit production activities.

Prior to the initiation of any decontamination and decommissioning activities for Building 226-F (SRPPF), the facility operator would prepare a detailed plan for NNSA approval (DOE 2020a|Section 4.14|).

4.3.5 Y-12 National Security Complex

Portions of facilities at Y-12 would be used to store HEU prior to disposition, as part of Y-12's larger mission. Decontamination and decommissioning activities at Y-12 are addressed as part of the *Final Site-Wide Environmental Impact Statement for the Y-12 National Security Complex* (DOE 2011a; DOE 2001), as supplemented (DOE 2018i).

4.3.6 Waste Isolation Pilot Plant

As described in the WIPP SEIS (DOE 1997), once the facility achieves a capacity of 175,600 m^3 of TRU waste, DOE plans to close the repository and DD&D would begin. DD&D activities would take up to 10 years. DOE could decommission the site in a manner that would allow for safe, permanent disposition of surface and underground facilities. The planned repository sealing system would consist of natural and engineered barriers that would prevent water from entering the repository and impede contaminated gases or brines from migrating out. For more details regarding the shaft sealing system components, refer to the WIPP SEIS (DOE 1997).

Decontamination of equipment and facilities at the WIPP facility would be performed as necessary. Usable equipment would be removed, and surface facilities dismantled. Any salt remaining would be sold or disposed of in accordance with the *Materials Act* of 1947 (DOE 1997|p. 3-15|). Areas occupied by the salt pile, surface facilities, and areas overlying the disposal panel area would be restored. DOE would use active controls, monitoring, and passive controls to prevent access by unauthorized persons. The EPA disposal regulations (at 40 CFR 194.41) for the WIPP repository (40 CFR Part 194) limit DOE to only take 100 years of credit for active institutional controls in performance assessment for deterring human intrusion (drilling). However, DOE believes their active institutional controls program will remain in place and be effective for hundreds if not thousands of years. A berm would be constructed around the perimeter of the closure area to identify its closure and impede access. DOE would also take steps (e.g., use permanent markings) to inform and warn subsequent generations about the radioactive waste buried in the area. Further details can be found in the WIPP SEIS (DOE 1997|p. 3-15|).

4.4 Irreversible and Irretrievable Commitments of Resources

This section describes the irreversible and irretrievable commitments of resources that have been identified under each alternative. A commitment of resources is irreversible when the primary or secondary impacts limit the availability of the resource for use in the future. Irreversible commitments primarily apply to the impacts of the use of nonrenewable resources or those that are renewable only over long periods of time. A commitment of resources is irretrievable when resources that are used or consumed are neither renewable nor recoverable for future use (DOI 2019|p. 8-18 to 8-19). As listed below, the resource areas assessed for irreversible and irretrievable commitments are land, labor, utilities (electricity, fuel, and water), chemicals, materials, and gases that are associated with implementing the Preferred Alternative and No Action Alternative, as described in Section 2.1 of this EIS. The irretrievable and irreversible resources associated with the construction and operational activities of the Preferred and No Action Alternatives are further discussed and the amounts consumed are presented in Table 4-44 (construction at LANL), Table 4-45 (operations at LANL), Table 4-46 (construction at SRS), Table 4-47 (operations at SRS), and Table 4-48 (transportation).

- **Land.** The disturbance and re-disturbance of land for construction of new buildings, parking structures, and roads would be an irreversible commitment. During operations, land occupied by SPDP facilities would not be available for other uses. When facilities performing SPDP activities reach end of life, the land may not be restored to its original condition, therefore limiting future uses. The land could be irreversibly committed and restricted from some potential future uses because of remaining buildings, structures, or contamination. Likewise, land used for waste disposal would be unavailable for many future uses.
- **Labor.** The commitment of labor during construction and operation activities for SPDP activities would be irreversible and irretrievable for the SPDP duration. The labor consumed by this program would not be available for other uses.
- **Infrastructure.** The irretrievable commitment of infrastructure resources during construction and operation of the facilities required for the proposed actions would include electricity, fuel (diesel or gasoline) for construction equipment and transportation vehicles, and water for process equipment and staff. Facility wastewater, industry waste streams, and stormwater runoff would be managed and disposed of in compliance with the NPDES permit limits and requirements. There would not be a direct release of contaminated effluents to groundwater or surface water. To the extent water is recoverable, its recovery has been designed into the facility planning process.
- **Materials.** The irreversible and irretrievable commitment of material resources during the construction of new buildings and operation of the PDP, dilution, and C&P activities includes materials that cannot be recovered or recycled and materials that could be consumed or reduced to unrecoverable forms of waste. Materials used during construction would include wood, concrete, sand, gravel, plastics, wires, steel, aluminum, and other metals. Specific types or quantities of materials are identified based on construction and operational estimates known to date associated with construction scope and operational needs. Materials that otherwise cannot be recovered or recycled using current technologies, would be irretrievably lost. However, none of these construction resources is in short supply and all of them would be readily available in the vicinity of LANL and SRS. While irretrievable, consumption of operating supplies, miscellaneous chemicals, and gases would not constitute a permanent drain on local resources 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 on regulations, economics, and need. Each item would be considered individually at the time a recovery or recycle decision is made. The adulterant material used during the dilution process would not be recoverable or retrievable.

Table 4-44. Irreversible and Irretrievable Commitments of Construction Resources at LANL

Resource Area	Resource	Preferred Alternative Base Approach and SRS NPMP Sub-Alternatives	Preferred Alternative All LANL Sub-Alternative[(a)]	No Action Alternative
Land	Undisturbed Land (ac)	1.6	1.6	(b)
	Disturbed Land (ac)[(c)]	3.5	3.5	(b)
Labor	Full-time equivalents[(d)] (person years)	400	500	(b)
Utilities	Electricity (MWh)	1,300	1,300	(b)
	Diesel fuel (gal)	110,000	140,000	(b)
	Water (gal)	3,600,000	4,100,000	(b)
Materials	Asphalt (ft^2)	3,100	4,300	(b)
	Concrete (yd^3)	2,100	2,800	(b)
	Crushed stone, sand, and gravel (yd^3)	30,000	41,000	(b)
	Lumber (linear feet)	1,100	5,800	(b)
	Steel (T)	700	900	(b)

DHF = Drum Handling Facility; EIS = environmental impact statement; LANL = Los Alamos National Laboratory; NPMP = non-pit metal processing; SPDP = Surplus Plutonium Disposition Program; SRS = Savannah River Site.

(a) The value provided for pit disassembly and processing (PDP) is considered to be bounding for dilution construction involving Plutonium Facility 4 (PF-4) facility.

(b) No construction/modification activities are anticipated at LANL for the No Action Alternative.

(c) Table 2-3 of this SPDP EIS identifies 0.94 ac of laydown areas in TA-55 for the Base Approach and SRS NPMP Sub-Alternatives that would also be used for the DHF for the All LANL sub-alternative.

(d) Number of full-time equivalent employees for the duration of construction was obtained from LANL 2023a|Section 1.3|.

Note: Numbers are rounded to two significant digits.

Source: LANL 2023a.

Table 4-45. Irreversible and Irretrievable Commitments of Operational Resources at LANL

Resource Area	Resource	Preferred Alternative Base Approach and SRS NPMP Sub-Alternatives[(a)]	Preferred Alternative All LANL Sub-Alternative	No Action Alternative[(b)]
Labor	Full-time equivalents[(c)] (person years)	8,000	11,000	3,000
Utilities	Electricity (MWh)	66,000	84,000	24,000
	Water (gal)	45,000,000	68,000,000	16,000,000
Chemicals	Sodium hydroxide (L)	68	68	25
	Nitric acid (L)	160	160	60
	Sodium nitrate (g)	6,800	6,800	2,500
	Sodium sulfate (g)	6,800	6,800	2,500
	Sulfuric acid (L)	54	54	20
Materials	Adulterant (MT)	NA	380	NA
	Steel (T)	NA	12,000[(d)]	NA
	PVC (kg)	NA	8,500	3,100
Gases/ Fluids	Argon/hydrogen (m^3)	120	120	NA
	Argon liquid (m^3)	15,000	15,000	5,400
	Helium gas (m^3)	1,500	1,500	570
	Helium liquid (m^3)	4,800	4,800	1,800
	Phosphate-buffered saline solution (L)	5,100	5,100	1,900
	Nitrogen gas (m^3)	390	390	140
	Nitrogen liquid (m^3)	620	620	230
	Oxygen liquid (m^3)	1,900	1,900	710

LANL = Los Alamos National Laboratory; NA = not applicable; NPMP = non-pit metal processing; PVC = polyvinyl chloride; SRS = Savannah River Site.

(a) The impacts associated with the Base Approach Sub-Alternative and SRS NPMP Sub-Alternative would be the same.

(b) Because operations to process up to 7.1 MT of non-pit surplus plutonium are assumed to be within the scope of current and ongoing operations at LANL, no changes to current irretrievable and irreversible resources are anticipated. The affected resources are based on assuming 147 workers and scaling values to 37% of the values from Base Approach Sub-Alternative, which assumed 395 workers.

(c) Full-time equivalent employees for the total duration of operations period (LANL 2023a|Section 1.4.1 for Base Approach Sub-Alternative and Section 1.4.2 for All LANL Sub-Alternative|).

(d) Steel used to support dilution activities under the All LANL Sub-Alternative is assumed to be the same amount as estimated for SRS (SRNS 2023d|Section 18.3|).

Note: Numbers are rounded to two significant digits.

Sources: LANL 2023a; SRNS 2023d; LANL 2013b.

Table 4-46. Irreversible and Irretrievable Commitments of Construction Resources at SRS

Resource Area	Resource	Preferred Alternative Base Approach Sub-Alternative[(a)]	Preferred Alternative SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP Sub-Alternative (Modular NPMP Option)	Preferred Alternative All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative[(b)]
Land Use	Undisturbed Land (ac)[(c)]	NA	0	0	0	0	0
	Disturbed Land (ac)[(c)]	NA	0	0.3	20	20	0
Labor	Full-time equivalents[(d)] (person years)	NA	470	240	4,200	4,200	470
Utilities	Electricity (MWh)	NA	minimal	minimal	130,000	130,000	minimal
	Diesel fuel (gal)[(e)]	NA	9,000	500	2,400,000	4,300,000	9,000
	Gasoline (gal)[(e)]	NA	15,000	250	included in diesel fuel value	included in diesel fuel value	15,000
	Water (thousands of gal)	NA	6,300	530	8,800	16,000	6,300
Materials	Asphalt (ft^2)	NA	0	0	29,000	29,000	0
	Concrete (yd^3)	NA	0	170	48,000	48,000	0
	Crushed stone, sand, and gravel (yd^3)	NA	0	0	390,000	390,000	0
	Lumber (linear feet)	NA	0	0	minimal	minimal	0
	Steel (T)	NA	390	0	6,000	6,000	390

NA = not applicable; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SPD = Surplus Plutonium Disposition; SPDP EIS = Surplus Plutonium Disposition Program Environmental Impact Statement; SEIS = Supplemental Environmental Impact Statement; SRS = Savannah River Site.

(a) No construction/modification activities are anticipated at SRS for the Base Approach. Impact of construction of equipment required for the dilution and C&P activities was evaluated in 2015 SPD SEIS (DOE 2015c).

(b) No Action Alternative involves construction and operation of a NPMP System at SRS.

(c) No undisturbed land is affected.

(d) Labor impacts (person years) were derived using peak number of full-time equivalent employees obtained from Table 4-23 of this SPDP EIS multiplied by the construction duration in years.

(e) Fuel usage for the All SRS Sub-Alternative combines both diesel fuel and gasoline.

Notes: Values are rounded to two significant figures. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.

Sources: SRNS 2023d; DOE 2012c; DOE 2015c; LANL 2023a.

Table 4-47. Irreversible and Irretrievable Commitments of Operational Resources at SRS

Resource Area	Resource	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP Sub-Alternative (105-K NPMP Option)	Preferred Alternative SRS NPMP Alternative (Modular NPMP Option)	Preferred Alternative All SRS Sub-Alternative (F-Area PDP Option)	Preferred Alternative All SRS Sub-Alternative (K-Area PDP Option)	No Action Alternative[(a)]
Labor	Full-time equivalents[(b)] (person years)	13,000	14,000	13,000	19,000	20,000	2,800
Utilities	Electricity (MWh)	310,000	330,000	340,000	840,000	920,000	53,000
	Diesel Fuel[(c)] (gal)	52,000	76,000	76,000	2,300,000	2,600,000	36,000
	Propane (lb)	43,000	43,000	43,000	43,000	43,000	4,300
	Water (1,000 gal)	98,000	110,000	110,000	200,000	220,000	23,000
Chemicals[(d)]	Nitric acid (L)	NA	NA	NA	160	160	NA
	Sodium hydroxide (L)	NA	NA	NA	70	70	NA
	Sodium Nitrate (g)	NA	NA	NA	6,800	6,800	NA
	Sodium Sulfate (kg)	NA	NA	NA	6,800	6,800	NA
	Sulfuric acid (L)	NA	NA	NA	50	50	NA
Materials	Adulterant (MT)	380	380	380	380	380	80
	Steel (T)	12,000	12,000	12,000	12,000	12,000	2,600
	PVC (kg)	11,000	11,000	11,000	15,000	15,000	2400
Gases/ Fluids	Argon/ hydrogen (m^3)	NA	NA	NA	120	120	NA
	Argon liquid (m^3)	NA	NA	NA	15,000	15,000	NA
	Helium gas (m^3)	NA	NA	NA	1,500	1,500	NA
	Helium liquid (m^3)	NA	NA	NA	4,800	4,800	NA
	Phosphate-buffered saline solution (L)	NA	NA	NA	5,100	5,100	NA
	Nitrogen gas (m^3)	NA	NA	2,300,000[(e)]	400[(e)]	400[(e)]	NA
	Nitrogen liquid (m^3)	NA	NA	NA	620	620	NA
	Oxygen liquid (m^3)	NA	NA	NA	1900	1900	NA

EIS = environmental impact statement; LANL = Los Alamos National Laboratory; NA = not applicable; NPMP = non-pit metal processing; PDP = pit disassembly and processing; PVC = polyvinyl chloride; SPDP = Surplus Plutonium Disposition Program; SRS = Savannah River Site.

(a) The No Action Alternative involves construction and operation of a NPMP capability at SRS.

(b) Labor impacts (person-years) was derived using the peak number of full-time equivalent employees identified in Table 4-23 of this SPDP EIS multiplied by the operation duration in years.

(c) Fuel uses for the All SRS Sub-Alternative combines both diesel fuel and gasoline. The other sub-alternatives use diesel fuel only.
(d) Chemical resources were estimated for the All SRS Sub-Alternative using information from PDP at LANL (LANL 2023a).
(e) Nitrogen gas would be used for NPMP in the SRS NPMP Sub-Alternative Modular NPMP Option and for PDP operations in the All SRS Sub-Alternative F-Area and K-Area PDP Options.
Notes: Values are rounded to two significant figures. The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.
Sources: LANL 2023a; SRNS 2023d.

The transport of material and waste between the five DOE sites (LANL, SRS, the WIPP facility, Y-12, and Pantex) results in the irreversible and irretrievable commitments of gasoline and diesel fuel resources. Mileage estimates are based on those presented in Section 4.1.6 and Table 4-32. Diesel fuel consumption is based on mileage and fuel efficiency for combination trucks. Gasoline consumption is based on mileage and fuel efficiency for two support vehicles for OST transport routes. Table 4-48 presents the irretrievable and irreversible commitments for transportation.

Table 4-48. Irreversible and Irretrievable Commitments of Transportation Resources

Resource (unit)	Preferred Alternative Base Approach Sub-Alternative	Preferred Alternative SRS NPMP Sub-Alternative (105-K NPMP and Modular Options)	Preferred Alternative All LANL Sub-Alternative	Preferred Alternative All SRS Sub-Alternative (F-Area PDP Option)[a]	Preferred Alternative All SRS Sub-Alternative (K-Area PDP Option)[a]	No Action Alternative (LANL NPMP Option)[b]
Distance Traveled (millions of miles)[c]	14	14	8.6	15	15	3.4
Diesel fuel (millions of gal)[d]	2.5	2.5	1.5	2.6	2.6	0.58
Gasoline fuel millions of gal)[e]	0.72	0.72	0.43	0.75	0.75	0.17

LANL = Los Alamos National Laboratory; NPMP = non-pit metal processing; PDP = pit disassembly and processing; SRS = Savannah River Site.
(a) The All SRS Sub-Alternative F-Area and K-Area PDP Options also include NPMP at the site of the PDP capability.
(b) NPMP could occur at LANL or SRS under the No Action Alternative. The numbers shown above are for the LANL NPMP option, which bounds the distance traveled, diesel, and gasoline fuel commitments for the SRS NPMP option of the No Action Alternative.
(c) Estimates are based on roundtrip mileage presented in Section 4.1.6 and Table 4-32.
(d) Based on 5.8 mpg diesel for combination trucks (ORNL 2016|p. 126|).
(e) Based on 20 mpg gasoline for large sports utility vehicles (ORNL 2016|p. 347, 52, 57, 62, and 72|). Gasoline consumption is based on two support vehicles for Office of Secure Transportation transport.
Note: Values are rounded to two significant figures.

4.5 Relationship between Local Short-Term Uses of the Environment and the Maintenance and Enhancement of Long-Term Productivity

This section describes the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity.

As described in Section 4.1.2.1, land would be disturbed at LANL to construct new facilities or modify existing facilities. A total of 5.1 ac would be disturbed at LANL, under the Preferred Alternative for the Base Approach and SRS NPMP Sub-Alternatives during construction. The same amount would be disturbed under the All LANL Sub-Alternative because the footprint for the additional facility (DHF) being built for this sub-alternative overlaps one of the laydown areas in TA-55 for the Base Approach and SRS NPMP Sub-Alternatives. The majority of the land use is in previously disturbed areas but the office building and warehouse in TA-52 would require the removal of mature vegetation from previously undisturbed areas.

As described in Section 4.1.3.1, at SRS, under the Preferred Alternative Base Approach Sub-Alternative and No Action Alternative, no new buildings or exterior structures would be constructed and hence, no land would be disturbed. Under the SRS NPMP Sub-Alternative, 0.3 ac would be disturbed during construction/installation of the modular system largely for the placement of concrete pads and a security barrier. A total of 20 ac would be used for construction of support facilities and laydown areas for modifications in Building 226-F (SRPPF) or in Building 105-K for the All SRS Sub-Alternative.

SPDP operations would not adversely affect the long-term productivity of the land because the proposed operations would be located in existing developed areas and would be compatible with historic activities at both LANL and SRS. After the operational life of the plutonium facilities, NNSA could deactivate, decontaminate, and decommission the facilities in accordance with applicable regulatory requirements and then close them in place or restore the areas occupied by the facilities to brownfield sites that would be available for other industrial uses. Appropriate CERCLA and/or NEPA reviews would be conducted before initiation of DD&D actions. In all likelihood, none of the sites would be restored to a natural terrestrial habitat. DD&D processes are described in Section 4.3.

As described in Sections 4.1.2.3 and 4.1.3.3, groundwater would be used to meet water needs during the construction and operation periods at LANL and SRS. After use, treatment, and discharge, much of this water would be released through permitted outfalls into surface-water bodies. The withdrawal, use, and treatment of water are not likely to affect the long-term productivity of water resources.

As described in Sections 4.1.2.4 and 4.1.3.4, air emissions associated with implementation of any of the alternatives would add pollutants to the air in the LANL and SRS ROIs. Air pollutant concentrations generated by construction activities for all sub-alternatives would not result in LANL emissions exceeding any NAAQSs and New Mexico State ambient air quality standards. Estimated emissions during construction activities for the All SRS Sub-Alternative (highest impacts occurring at SRS from any sub-alternative) are not considered to be significant. Estimated emissions from operations activities associated with the All SRS Sub-Alternative (highest of the sub-alternatives) were also not considered to be significant. Estimates of additional intermittent commuter vehicle emissions associated with construction and operations workers were also not considered to substantially contribute to offsite ambient pollutant concentrations. Similarly, as described in Sections 4.1.2.7 and 4.1.3.7, emissions associated with implementation of any of the alternatives would add small amounts of radiological constituents to the environment in the LANL and SRS ROIs. During the operations period, these emissions would result in additional radioactive exposure or air loading, but they are not expected to affect compliance by LANL or SRS with radiation exposure or air quality standards. No significant residual environmental effects on long-term environmental productivity are expected.

As described in Sections 4.1.2.11 and 4.1.3.11, and Appendix B Sections B.1.2.4 and B.1.3.5, the management and disposal of wastes would require energy and space at treatment, storage, or disposal facilities at LANL (e.g., TWF in TA-63 for job control waste, the RLWTF in TA-50 for liquid waste) and SRS (e.g., E-Area Solid Waste Management Facility for job control waste, the Three Rivers Regional Landfill for nonhazardous waste). Land used at SRS for LLW and solid waste disposal would require a long-term commitment of terrestrial resources.

For the No Action Alternative, land use, water use, air quality, and waste disposal requirements would be significantly less than the abovementioned estimates for the Preferred Alternative. This is in part because the total amount of material processed for the No Action Alternative is 7.1 MT versus 34 MT for the Preferred Alternative, but also because PDP is considered for the Preferred Alternative, but it is not a part of the No Action Alternative. The No Action Alternative would generally have smaller short-term impacts than the Preferred Alternative. However, the No Action Alternative would also defer a decision about, and therefore, defer the impacts of disposition of a substantial quantity of surplus plutonium. Storage of that plutonium would have long-term impacts.

4.6 Incremental Impacts of Processing Additional Surplus Plutonium

In addition to the amounts of surplus plutonium analyzed for disposition in this SPDP EIS, NNSA may, in the future, identify additional quantities of surplus plutonium that could be processed for disposition using the facilities and capabilities analyzed in this SPDP EIS.[28] This section describes the potential impacts of processing such quantities of surplus plutonium. Any need for further NEPA analysis related to the potential impacts of handling, transporting, or processing specific quantities of such additional plutonium would be addressed as part of, and at the time of, the planning process for its disposition.

Section 4.1.2 for LANL and Section 4.1.3 for SRS present the impacts of construction and operation of the plutonium capabilities evaluated in this SPDP EIS. The analyses for operations are based on a set of assumptions and estimates under which the plutonium facilities described for each of the alternatives would each operate for a given number of years to process a given quantity of surplus plutonium (see Appendix B, Table B-2). The actual operating period for each facility would depend on the combination of facilities used for plutonium processing, and their throughputs. If a future decision is made, pursuant to an appropriate disposition planning process, to address additional surplus plutonium, then some plutonium disposition facilities could be required to operate for longer periods of time than those analyzed in this SPDP EIS. Processing additional surplus plutonium at the specified annual throughput rates would not change the annual impacts of operation but would extend the impacts described in this SPDP EIS for affected facilities further out in time. The contributions attributable to those facilities toward total cumulative lifecycle impacts, such as those for total worker and population dose and LCFs, and total waste generation, would increase in proportion to the extended processing time. These impacts can be estimated from the analyses provided for facility operations by adding additional years of operation.

Extending the operating period of a facility or facilities to process additional surplus plutonium may also result in the need to replace process equipment and perform additional maintenance. Most of these activities would be a part of the normal operations of the facility and would not result in substantial additional impacts. Some activities, such as replacing an entire glovebox line, could require additional NEPA documentation.

[28] For example, in the future, additional surplus plutonium could be declared excess to U.S. defense needs.

4.7 Incremental Impacts of Processing Plutonium at Reduced Rates or of Constructing and Operating Smaller Surplus Plutonium Disposition Capabilities

As described in Section 4.1.2 for LANL and Section 4.1.3 for SRS, the plutonium capabilities addressed under each of the alternatives for this SPDP EIS are each assumed to operate for a given number of years to process a given quantity of surplus plutonium. The operating periods of the plutonium capabilities, however, would be extended 1) if surplus plutonium were processed at reduced throughput rates, 2) if smaller capabilities with reduced throughput were constructed, or 3) if interruptions to the process occurred, reducing the throughput rates for a period of time. NNSA has estimated operational durations based upon anticipated throughputs in this SPDP EIS (as discussed in Appendix B) to complete the 34 MT mission in FY 2050. Reduced rates of processing or the use of smaller surplus plutonium disposition capabilities could result in NNSA being unable to complete the 34 MT mission by FY 2050. In addition, delays in construction, modifications to capabilities, and other issues not considered in this EIS could also delay the mission beyond 2050.

In the first case, the construction impacts would be the same as those described in Section 4.1.2 for LANL and Section 4.1.3 for SRS. For a given total quantity of processed plutonium, however, annual operational impacts would be comparable to or smaller than those described in Section 4.1.2 for LANL and Section 4.1.3 for SRS. For example, if the plutonium throughput at PF-4 were smaller than the annual quantities assumed for the Preferred Alternative addressed in this SPDP EIS, then the annual operational impacts would be comparable to or smaller than those described, although PF-4 would operate longer to process the same total quantity of plutonium. Facilities that support PF-4 operations would also operate longer.

Impacts on some resource areas would occur only during plutonium processing. For these resource areas, the annual impacts could be reduced if the plutonium were processed at a reduced rate, but the total impacts of processing a given quantity of surplus plutonium would not appreciably change if the processing schedule were extended. This includes impacts from hazardous and radioactive waste management, human health risk, facility accidents during plutonium processing, impacts from waste transportation, and environmental justice. For example, if the plutonium processing rate in PF-4 were slowed and the processing period was extended by 2 years, the total doses and LCFs for workers and the public from facility operation would likely remain unchanged, even though the annual doses and LCFs would decrease.

Impacts on some resource areas are less dependent on plutonium processing throughput; that is, some level of impact would occur whenever a capability is operational, but the reduction in the impact is not scaled based on the amount of throughput, although the impacts could be reduced to some degree. Examples include air quality for criteria pollutants, nonhazardous waste management, socioeconomics, facility accidents not associated with plutonium processing, transportation impacts from employee commuting trips, and infrastructure. For example, some air quality impacts from criteria pollutant emissions associated with building heating and emergency generator testing would continue as long as a capability is operational. Likewise, impacts from nonhazardous waste management and impacts on infrastructure would occur to some extent as long as personnel continue to use facilities and generate nonhazardous waste. Extending operations by 2 years would conservatively mean that these types of impacts would continue for 2 years longer.

In the second case, in which smaller surplus plutonium disposition capabilities would be constructed and would have reduced plutonium throughputs, construction and annual operational impacts would both be generally reduced compared to the impacts described in Section 4.1.2 for LANL and Section 4.1.3 for

SRS. But because the plutonium processing throughput of the capabilities would be reduced, their operating periods would be extended to process the same amount of surplus plutonium. This would apply to all plutonium capabilities under consideration in this SPDP EIS.

Construction and modification impacts would be reduced if smaller capabilities were constructed. There would be less land disturbance and, therefore, less potential for impacts on air quality, land use, geology and soils, water resources, noise, ecological resources, and cultural resources; less construction employment; less construction waste generation; fewer construction resources needed (including materials, utilities, and personnel); and smaller impacts from transportation of waste and construction materials. The reduction in impacts would be generally proportional to the reduction in the amount of land disturbed, reduction in the amounts of construction materials and resources needed, and reduction in construction employment. Also, the time required for construction might be reduced, and the capabilities could start operations at an earlier date.

Annual operational impacts would be reduced if smaller capabilities were operated. For most resource areas, the impacts would be similar to those described in the first case where surplus plutonium would be processed at reduced rates in full-sized facilities. Although the impacts are likely to be similar, the use of smaller facilities that are running at or near capacity is likely to be more efficient. For example, energy use would likely be lower because the capability would occupy a smaller space and involve less equipment. For other resource areas such as human health, where impacts are strongly dependent on plutonium throughput, the impacts would likely be similar for a given throughput rate. Also, although the annual impacts would be reduced (e.g., less annual worker dose or generation of radioactive waste), the total impacts of processing the same amount of surplus plutonium would likely be similar. For example, although the annual doses to workers would be reduced, assuming a lower plutonium throughput in a smaller capability, the total dose to the worker population for the entire campaign would likely be similar to the total dose from processing the same quantity of plutonium at a higher throughput.

For the third case, if significant interruptions occur in PDP, dilution, C&P, or in shipping material between capabilities (such as between PDP and dilution within a given site, or shipping material between the sites) then the throughput would be reduced or stopped for a period of time. The schedule for resuming normal throughput would depend on the cause of the interruption and the complexity involved in resolving any issues and resuming the normal processing schedule. For example, if an event occurred that reduced the throughput for PDP at either LANL or SRS or if a significant interruption related to the ability to receive and dispose of the waste occurs at the WIPP facility, then dilution would be reduced or stopped until the supply of oxidized plutonium was increased or until the WIPP facility was able to receive additional TRU waste. Delays in construction or modifications of facilities could result in impacts that would be similar to those described in this case.

The throughput considered in the analysis in this EIS for dilution at SRS is high enough to accommodate temporary slowdowns in the processing. As discussed in Section 4.1.2, the analysis of impacts at LANL assumed that its processing rate of 2 MT/yr could temporarily increase to 2.5 MT/yr for a nominal year. However, it is anticipated that the duration of the increased processing rate would more likely be on the order of months. The increase in throughput is anticipated to be handled by increasing the number of shifts for processing thus relying on existing staff at LANL rather than hiring additional staff. The analysis showed that project impacts would remain the same for processing the 34 MT of surplus plutonium even though temporary increases in impacts may occur related to water use, infrastructure, dose to workers or the public, or waste generated during the assumed nominal year of the increased processing rate.

5.0 REGULATIONS, PERMITS, AND CONSULTATIONS

Activities for the disposition of surplus plutonium must be performed in a manner that protects public health, safety, and the environment through compliance with all applicable Federal, State, and local laws, regulations, and other requirements. Laws, regulations, Executive Orders, and DOE Orders are described in Section 5.1. Other regulatory activities, environmental permits, and consultations are described in Sections 5.2, 5.3, and 5.4, respectively.

This section identifies the statutory requirements and environmental standards that are applicable to the activities for the disposition of surplus plutonium addressed in this SPDP 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 levels. Federal agencies, such as DOE, receive additional direction about complying with executive policy through Executive Orders. In addition, DOE has established regulations and management directives (DOE Orders) that are applicable to DOE activities, facilities, and contractors. Regulations often include requirements for permits and consultations, which provide an in-depth, facility-specific review of the activities proposed.

5.1 Laws, Regulations, Executive Orders, and U.S. Department of Energy Orders

Multiple Federal agencies regulate specific aspects of nuclear materials management for the disposition of surplus plutonium. The EPA regulates many aspects, including air emissions, hazardous waste management, water quality, and emergency management. In many cases, the EPA has delegated all or part of its environmental protection authorities to States, including New Mexico, Texas, Tennessee, and South Carolina, but retains oversight authority. In this delegated role, the NMED, the Texas Commission on Environmental Quality (TCEQ), Tennessee Department of Environment and Conservation, and the South Carolina Department of Health and Environmental Control (SCDHEC) regulate air emissions, discharges to surface water and groundwater, drinking water quality, and hazardous and nonhazardous waste treatment, storage, and disposal.

DOE imposes its own standards on many aspects of nuclear materials management through regulations, Orders, and contract requirements related to facility design and operation, radioactive waste management, and health and safety, including radiation protection. The U.S. Department of Transportation regulates commercial transportation of hazardous and radioactive materials.

As described in Section 2.1, there would be small amounts of land disturbance at both LANL and SRS. Based on the location and description of alternatives in Section 2.1, the following statutory requirements were considered but determined not to be applicable to the activities for the disposition of surplus plutonium addressed in this SPDP EIS, and are not described in detail:

- *Farmland Protection Policy Act* of 1981, as amended (7 U.S.C. § 4201 et seq.), Title 7 of the *Code of Federal Regulations* Part 658 (7 CFR Part 658)
- Conformity to State or Federal Implementation Plans or Transportation Plans, Programs, and Projects Developed, Funded, or Approved Under Title 23 U.S.C. or the Federal Transit Laws. 40 CFR Part 93, Subpart A

- Dredge and Fill Permits. 40 CFR Part 230, 33 CFR Parts 320 through 330, South Carolina Regulation 19-450
- Compliance with Floodplain and Wetland Environmental Review Requirements, 10 CFR Part 1022
- Executive Order 11990, *Protection of Wetlands* (42 FR 26961)
- Executive Order 11988, *Floodplain Management* (42 FR 26951)
- Texas Administrative Code, Title 31 Part 2 Chapter 69, *Resource Protection*, Subchapters A through K (31 TAC 2-69 [TAC 31-2-69])
- *Bald and Golden Eagle Protection Act*. 16 U.S.C. § 668-668d
- *Fish and Wildlife Coordination Act of 1934*. 16 U.S.C. § 661 et seq.

Table 5-1 lists the environmental laws, regulations, and other requirements applicable to DOE's proposed action for the disposition of surplus plutonium.

Table 5-1. Environmental Laws, Regulations, Executive Orders, and U.S. Department of Energy Orders[(a)]

Law, Regulation, Executive Order, DOE Order	Description
Environmental Quality	
National Environmental Policy Act of 1969 (NEPA) 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 through 1508	Define 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	Establishes procedures for implementing the provisions of NEPA.
Fiscal Responsibility Act of 2023	Establishes requirements for federal agencies related to implementation of NEPA.
Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions 10 CFR Part 51	Provide procedures for implementing NEPA, as amended. Contain environmental protection regulations applicable to the U.S. Nuclear Regulatory Commission's (NRC's) domestic licensing and related regulatory functions.
Executive Order 11514, *Protection and Enhancement of Environmental Quality* (03/05/1970) 35 FR 4247	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) 59 FR 7629	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.

Law, Regulation, Executive Order, DOE Order	Description
Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (04/21/1997) 62 FR 19885	Requires each Federal agency to identify and assess any environmental health risks and safety risks that may disproportionately affect children and to verify that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health or safety risks.
Executive Order 13834*, Efficient Federal Operations* (05/17/2018) 83 FR 23771	Focuses on meeting statutory requirements to improve efficiency, optimize performance, eliminate unnecessary use of resources, and protect the environment.
Executive Order 13985*, Advancing Racial Equity and Support for Underserved Communities Through the Federal Government* (01/20/2021) 86 FR 7009	Requires Federal agencies to take proactive steps to diagnose and eliminate barriers to equal opportunity for underserved communities.
Executive Order 13990*, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis (2021)* (01/20/2021) 86 FR 7037	Directs Federal agencies to take a variety of actions to promote consideration of the social cost of greenhouse gases.
Executive Order 14008*, Tackling the Climate Crisis at Home and Abroad (2021)* (01/27/21) 86 FR 7619	Directs Federal agencies to take actions to address climate change.
Executive Order 14096*, Revitalizing Our Nation's Commitment to Environmental Justice for All (2023)* (04/26/23) 88 FR 25251	Establishes a policy to pursue a whole-of-government approach to environmental justice.
DOE Order 231.1B, *Environment, Safety and Health Reporting* (Change 1, 11/28/2012)	Defines requirements for 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.
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 to adequately protect 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 NEPA, the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500 through 1508), and the DOE NEPA Implementing Procedures (10 CFR Part 1021).
National Nuclear Security Administration (NNSA) Policy (NAP) 451.1, *National Environmental Policy Act Compliance Program* (04/14/2018)	Establishes NNSA's expectations for implementing NEPA, the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR Parts 1500 through 1508).
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.

Law, Regulation, Executive Order, DOE Order	Description
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. The EPA has delegated authority for most *Clean Air Act* provisions to NMED for activities in New Mexico and South Carolina Department of Health and Environmental Control (SCDHEC) for activities in South Carolina, both of which would issue permits or modify permits as needed for the proposed surplus plutonium disposition activities at LANL or SRS, respectively, as appropriate. 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 20.2.70 NMAC 20.2.72 NMAC 20.2.74 NMAC	Govern 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 20.2.3 NMAC TDEC Chapter 1200-3-3 (TDEC 2006)	Include 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 20.2.77 NMAC	Stipulate Federal, South Carolina, and New Mexico 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 61-62.63 20.11.64 NMAC TDEC Chapter 1200-3-11 (TDEC 2018a)	Provide 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.
Prevention of Significant Deterioration of Air Quality 40 CFR 51.166 EPA 2010a EPA 2010b EPA 2018 SC Regulation 61-62.5, Standard 7 20.2.74 NMAC	Establishes the program designed to maintain air quality in areas already in compliance with ambient air quality standards (attainment areas). The regulation requires comprehensive preconstruction review and the application of best available control technology to major stationary sources.
New Mexico Air Quality Control Act NMSA 1978 § 74.2 (2002) 20.2 NMAC (revised 10/31/2002)	Establishes air quality standards and permitting processes for sources of air contaminants. Also requires an operating permit for major producers of air pollutants and imposes emission standards for hazardous air pollutants. Pertains to activities at LANL that are permitted by the State.

Law, Regulation, Executive Order, DOE Order	Description
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.
Tennessee Air Quality Act Tennessee Air Pollution Control Regulations – TDEC Chapter 1200-3-1 (TDEC 2001)	Permits required to construct, modify, or operate an air contaminant source; sets fugitive dust requirements. Pertains to activities at Y-12 that are permitted by the State.
Texas Clean Air Act Title 30 of the TAC, Chapter 101 through Chapter 122 [30 TAC §101-§122 and §305, 25 TAC §295 (Asbestos only)].	Controls the release of regulated emissions to the atmosphere and provides for the maintenance of ambient air quality. Pertains to activities at Pantex 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 NMED and SCDHEC (except for NPDES permits in New Mexico).
National Pollutant Discharge Elimination System 40 CFR Part 122 SC Regulation 61-9.122 [SC R61-9 2019] TDEC Chapter 0400-40-05 (TDEC 2018b)	Provides regulations that define the permitting requirements for point-source discharges of pollutants to waters of the United States. The permits establish effluent limits to meet water quality standards. The NPDES Program is administered by the EPA in the State of New Mexico.
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 ft^2 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 NMAC 20.6.2.2001, 2002, 2003	Provides an opportunity for a State to review and certify a Federal permit or license for an activity that results in discharges to navigable waters.
New Mexico Water Quality Act (Subsection C of Section 74-6-4 NMSA 1978) NMAC Title 20 "Environmental Protection," Chapter 6 "Water Quality," Part 4 "Standards for Interstate and Intrastate Surface Waters" (Effective 08/11/2017)	Establishes water quality standards and requires a permit prior to the construction or modification of a water discharge source.
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).

Law, Regulation, Executive Order, DOE Order	Description
Texas Water Code 30 TAC §205-§299, §305, §309, §317, and §319	Regulates the quality of water discharged to waters of the State of Texas and governs public water supplies.
Safe Drinking Water Act 42 U.S.C. § 300f et seq.	Addresses the quality of drinking water in public water systems. EPA has delegated primary enforcement authority to NMED and SCDHEC.
New Mexico Environmental Improvement Act NMSA 1978 § 74.1	Establishes the State program related to compliance with the *Federal Safe Drinking Water Act*.
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 20.7.10 NMAC TDEC Chapter 0400-45-01 (TDEC 2019)	Defines the standards for maximum contaminant levels for pollutants in drinking water. These standards 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. A 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.
New Mexico Ground Water Protection Act NMSA Chapter 74, Article 6B, "Groundwater Protection"	Establishes New Mexico standards for protection of groundwater from leaking underground storage tanks.
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.
Endangered Plant Species (New Mexico) NMSA 1978 § 75-6-1	Governs the listing and protection of endangered plant species in New Mexico. The statute requires obtaining a permit to transplant an endangered species plant in order to enhance the survival and propagation of the species.
Endangered Plant Species List and Collection Permits (New Mexico) 19.21.2 NMAC (revised 11/30/2006)	Establishes the list of State-designated endangered plant species.
Wildlife Conservation Act (New Mexico) NMSA 1978 § 17.2.37 et seq. Protected Wildlife Species and Game Fish Defined NMSA 1978 § 17-2-3	Regulates the listing of threatened or endangered wildlife species and protection of endangered wildlife species. Describes the need for a permit when removing an endangered species to alleviate or prevent damage to property or to protect human health.

Law, Regulation, Executive Order, DOE Order	Description
List of Threatened and Endangered Species (New Mexico) 19.33.6 NMAC	Requires establishment and biennial updating of the list of State-designated threatened and endangered wildlife species.
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 Regulation 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 are listed as endangered by the State.
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) (DOI 2017).
Hawks, vultures, and owls; taking, possessing, trapping, destroying, maiming or selling prohibited; exception by permit; penalty NMSA 1978 § 17-2-14	Prohibits take, attempts to take, possess, trap, ensnare, injure, maim, or destroy any of the species of hawks, owls, and vultures, except under specific conditions.
Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (01/10/2001) 66 FR 3853	Requires Federal agencies to avoid or minimize the adverse impacts 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 FWS implements the Order targeting the conservation and management of migratory birds and their habitats (DOE and FWS 2013).
Executive Order 13112, *Invasive Species* (02/03/1999) 64 FR 6183	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.
New Mexico Night Sky Protection Act 74-12-1 to 74-12-10 NMSA 1978	Requires that outdoor lighting be fitted with shielding that directs light downward, rather than upward or laterally. Preserves and enhances New Mexico's dark sky while also promoting safety, conserving energy, and preserving the environment for astronomy and wildlife.
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 National Historic Preservation Act (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.

Law, Regulation, Executive Order, DOE Order	Description
New Mexico Cultural Properties Act NMSA 1978 § 18-6-1 through 18-6-23	Establishes the State Historic Preservation Office and requirements to prepare an archaeological and historic survey and consult with the State Historic Preservation Officer.
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.
Tennessee Native American Cemetery Removal and Reburial TDEC Chapter 0400-9-1 (TDEC 1999)	Provides guidance for the removal and reinternment of Native American human remains that may be encountered during construction excavation.
Archeological Resources Protection Act of 1979 16 U.S.C. § 470aa et seq.	Protects archaeological resources and sites on Federal and Native American lands.
Archeological 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 those proposed for plutonium disposition at SRS.
American Antiquities Act of 1906 54 U.S.C. § 320301 et seq.	Protects Native American 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.
Paleontological Resources Preservation Act 16 U.S.C. § 470aaa	Directs the U.S. Department of Agriculture (U.S. Forest Service) and the U.S. Department of the Interior (National Park Service, Bureau of Land Management, Bureau of Reclamation, and FWS) to implement comprehensive paleontological resource management programs. It provides for the preservation, management, and protection of paleontological resources on Federal lands under their jurisdiction. Paleontological resources can be found within an archaeological context or setting and would be managed and protected as a cultural resource.
Carl Levin and Howard P. "Buck" McKeon National Defense Authorization Act for Fiscal Year 2015 H.R. 3979, Sec. 3039, Manhattan Project National Historical Park	Establishes the Manhattan Project National Historical Park as a unit of the National Park System, which shall consist of specified facilities, lands, or interests in one or more eligible areas or parts of such areas in Oak Ridge, Tennessee; Los Alamos, New Mexico; and the Hanford Site, north of Richland, Washington. Requires inclusion of the B Reactor National Historic Landmark at Hanford.
Executive Order 11593, *Protection and Enhancement of the Cultural Environment* (05/13/1971; 36 FR 8921)	Requires preservation of historic and archaeological information prior to construction activities such as those associated with the proposed surplus plutonium disposition facilities.
Executive Order 13287, *Preserve America* (03/03/2003; 68 FR 10635)	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 (NRHP).
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 NRHP.
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 Native American lands of the United States.
American Indian Religious Freedom Act of 1978 42 U.S.C. § 1996	Protects and preserves for Native Americans 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 Native American 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 surplus plutonium disposition facilities.
Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (11/06/2000; 65 FR 67249)	Requires consultation and coordination with Native American Tribes prior to taking actions that affect federally recognized Tribal governments.
Executive Order 13007, *Indian Sacred Sites* (05/24/1996; 61 FR 26771)	Requires Federal agencies to accommodate, to the extent practicable, access to Native American sacred sites and avoid adverse impacts on such sites.
Executive Order 13195, *Trails for America in the 21st Century* (01/18/2001; 66 FR 7391)	Requires Federal agencies—to the extent permitted by law and where practicable, and in cooperation with Tribes, States, local governments, and interested citizen groups—to protect, connect, promote, and assist trails of all types throughout the United States.
Presidential Memorandum, *Government-to-Government Relations With Native American Tribal Governments* (04/29/1994; 59 FR 22951)	Related to principles that executive departments and agencies are to follow in their interactions with Native American tribal governments.
DOE Policy 141.1, *Department of Energy Management of Cultural Resources* (5/2/01, Certified 01/28/2011, DOE Policy 141.1 2011)	Related to integration of cultural resource management into the mission and activities of DOE programs and field elements.

Law, Regulation, Executive Order, DOE Order	Description
DOE Order 144.1, *Department of Energy American Indian Tribal Government Interactions and Policy* (Change 1, 11/06/2009 [2009])	Communicates departmental, programmatic, and field responsibilities for interacting with American Indian governments and transmits the DOE's American Indian and Alaska Native Tribal Government Policy and its guiding principles, the Framework for Implementation of the Policy.
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 the 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. The New Mexico Hazardous Waste Bureau administers the RCRA program in New Mexico.
New Mexico Solid Waste Act NMSA 1978 § 74-9-1 through 43 20.9 NMAC (revised 11/27/2001)	Requires a permit prior to construction or modification of a solid-waste disposal facility.
Texas Solid Waste Disposal Act (TSWDA) 30 TAC §305, §327, §334, and §335.	Governs the generation, storage, handling, treatment, and disposal of solid waste, including hazardous waste.
Hazardous Waste Management Regulations 40 CFR Parts 260 through 273 SC Regulation 61-79 (revised 05/28/2010) 20.4.1 NMAC	Governs the generation, transportation, treatment, storage, and disposal of hazardous waste.
New Mexico Hazardous Waste Act NMSA 1978 § 74-4	Defines requirements for an application for a permit pursuant to the *New Mexico Hazardous Waste Act*.
New Mexico Hazardous Waste Management 20.4.1.500 NMAC	Incorporates the requirements of the regulations of the EPA set forth in 40 CFR Part 264, except as otherwise provided in the section.
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.
Tennessee Hazardous Waste Management Act TDEC Chapter 0400-12-01 (TDEC 2022)	Regulates the generation, transportation, treatment, storage, and disposal of hazardous waste in Tennessee.
Federal Facility Compliance Act of 1992 42 U.S.C. § 6961 et seq.	Waives sovereign immunity for Federal facilities under the RCRA and requires DOE to conduct an inventory and develop a treatment plan for mixed wastes.
Federal Facility Compliance Act Consent Order October 1995 (issued to both DOE and LANL) (NMED 1995), amended 05/20/1997 (NMED 1997)	Enforces the *Federal Facility Compliance Act* and requires compliance with the approved LANL Site Treatment Plan, which documents the development and use of treatment capacities and technologies, as well as use of offsite facilities for treating mixed radioactive waste stored at LANL.
Compliance Order on Consent, February 2017[a] (NMED 2017)	Requires investigations of known or potentially contaminated sites at LANL and cleanup in accordance with a specified process and schedule. An Order on Consent was entered into by the State of New Mexico and DOE.

Law, Regulation, Executive Order, DOE Order	Description
Byproduct Material 10 CFR Part 962	Defines byproduct material as identified in the *Atomic Energy Act* of 1954, as amended and clarifies that the hazardous portion of mixed radioactive waste is subject to the 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.
Waste Isolation Pilot Plant (WIPP) Land Withdrawal Act of 1992 Public Law 102-579, as amended by Public Law 104-201, Division C, Title XXXI, Subtitle F	Establishes a national program for the disposal of transuranic (TRU) waste at the WIPP facility in New Mexico. Prior to sending any CH-TRU (contact-handled TRU) waste from LANL or SRS to the WIPP facility, DOE must determine whether the waste meets all statutory and regulatory requirements for disposal at the WIPP facility.
DOE National Security and Military Applications of Nuclear Energy Authorization Act of 1980 Public Law 96-164, 93 Stat. 1259	Includes information related to the authorization basis of the WIPP facility for the disposal of certain Federal radioactive wastes exempted from regulation by the NRC.
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 surplus plutonium disposition activities.
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.
Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations 40 CFR Part 194	Specifies criteria for the certification or any recertification, or subsequent actions related to the terms or conditions of certification of the WIPP facility's compliance with the disposal regulations found at 40 CFR Part 191 and pursuant to Section 8(d)(1) and Section 8(f) of the *WIPP Land Withdrawal Act*.
Executive Order 12580, *Superfund Implementation* (01/23/1987; 52 FR 2923)	Delegates responsibility to a Federal agency for hazardous substance response activities when the release is from, or the sole source of the release is located in, any facility or vessel under the control of that agency.
DOE Order 435.1, *Radioactive Waste Management* (Change 2, 01/11/2021)	Defines requirements for managing DOE radioactive waste in a manner that is protective of worker and public health and safety, and the environment.

Law, Regulation, Executive Order, DOE Order	Description
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 surplus plutonium disposition activities at SRS. DOE has issued a series of Orders to establish a system of standards and requirements for safe operation of DOE facilities.
Rules of General Applicability to Domestic Licensing of Byproduct Material 10 CFR Part 30	Governs domestic licensing of byproduct material under the *Atomic Energy Act* of 1954, as amended.
Domestic Licensing of Source Material 10 CFR Part 40	Establishes procedures and criteria for the issuance of licenses to receive the title to, deliver, receive, possess, use, or transfer source materials.
Domestic Licensing of Production and Utilization Facilities 10 CFR Part 50	Establishes procedures and criteria for the licensing of production and utilization facilities. Nuclear reactors are licensed under this regulation.
Licenses, Certifications, and Approvals for Nuclear Power Plants 10 CFR Part 52	Establishes procedures for issuance of early site permits, standard design certifications, combined licenses, standard design approvals, and manufacturing licenses for nuclear power facilities licensed under Section 103 of the Atomic Energy Act of 1954, as amended (68 Stat. 919, "Commercial Licenses"), and Title II (88 Stat. 1242) of the Energy Reorganization Act of 1974.
Price-Anderson Amendments Act and Regulations for Indemnification and Limitation of Liability 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.
National Defense Authorization Act for Fiscal Year 2002 Public Law 107-107, 50 U.S.C. § 2567	Establishes requirements for consultation regarding any DOE decisions or plans related to the disposition of surplus defense plutonium and defense plutonium materials located at SRS.
Procedural Rules for DOE Nuclear Activities 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.
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 surplus plutonium disposition facilities.
DOE Order 410.2, *Management of Nuclear Materials* (Change 1, 04/10/2014)	Establishes requirements for the lifecycle management of nuclear materials within DOE.
DOE Order 425.1D, *Verification of Readiness to Start Up or Restart Nuclear Facilities* (Change 2, 10/04/2019)	Establishes requirements for DOE for verifying readiness for startup of new nuclear facilities and for the restart of existing nuclear facilities that have been shut down.

Law, Regulation, Executive Order, DOE Order	Description
DOE Order 426.2, *Personnel Selection, Training, Qualification, and Certification Requirements for DOE Nuclear Facilities* (Change 1, 07/29/2013)	Establishes selection, training, qualification, and certification requirements for contractor personnel who can impact the safety basis through their involvement in the operation, maintenance, and technical support of Hazard Category 1, 2, and 3 nuclear facilities.
DOE Order 433.1B, *Maintenance Management Program for DOE Nuclear Facilities* (Change 1, 03/12/2013)	Defines 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* (Change 4, 09/15/2020)	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)	Establishes a program for efficiently and effectively meeting DOE's 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* (Change 3, 09/23/2021)	Establishes responsibilities for the DOE Safeguards and Security Program and requirements for program planning and management.
Worker Safety and Health	
Occupational Safety and Health Act of 1970 29 U.S.C. § 651 et seq.	Regulates worker and workplace safety to provide 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	Establishes the standards to protect workers from hazards encountered in the workplace (Part 1910) and at the construction site (Part 1926).
Standards for Protection Against Radiation 10 CFR Part 20	Establish the standards for protection against ionizing radiation from NRC-licensed activities, covering both workers and the public.
Worker Safety and Health Program 10 CFR Part 851	Defines controls and monitoring of hazardous materials to limit worker exposure 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.
Chronic Beryllium Disease Prevention Program 10 CFR Part 850	The DOE established a chronic beryllium disease prevention program to reduce the number of workers currently exposed to beryllium in the course of their work at DOE facilities managed by DOE or its contractors, minimize the levels of, and potential for, exposure to beryllium, and establish medical surveillance requirements for early detection of the disease.

Law, Regulation, Executive Order, DOE Order	Description
New Mexico Radiation Protection Act NMSA 1978 § 74-3 20.3 NMAC (revised 04/30/2009)	Establishes State requirements for worker protection.
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* (Change 3, 11/14/2019)	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 Cognizant System Engineer Program.
DOE Order 430.1C, *Real Property Asset Management* (Change 2, 09/17/2020)	Establishes a data-driven, risk-informed, performance-based approach to the life-cycle management of real property assets that aligns the real property portfolio with DOE mission needs.
DOE Order 440.1B, *Worker Protection Program for DOE (Including the National Nuclear Security Administration) Federal Employees* (Change 4, 05/02/2022)	Establishes the framework for an effective worker protection program that will reduce or prevent injuries, illnesses, and accidental losses by providing federal workers with a safe and healthful workplace.
Transportation	
Hazardous Materials Transportation Act of 1975 49 U.S.C. § 5101 et seq.	Provides the U.S. Department of Transportation (DOT) 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 through 185 49 CFR Part 385 49 CFR Part 397	Establish DOT requirements for classification, packaging, hazard communication, incident reporting, handling, and transportation of hazardous materials; hazardous materials safety permits; and driving and parking rules.
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* (Change 1, 06/10/2022)	Establishes safety requirements for the proper packaging and transportation of DOE offsite shipments and onsite transfers of radioactive and other hazardous materials.
DOE Order 460.2B, *Departmental Materials Transportation Management* (06/10/2022)	Establishes requirements and responsibilities for management of DOE materials transportation for the safe, secure, and efficient transportation of materials, both hazardous and nonhazardous, for offsite shipments.
DOE Order 461.1C, *Packaging and Transportation for Offsite Shipment of Materials of National Security Interest* (Change 1, 10/04/2019)	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 DOT 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 for the safe use of TSS, non-TSS government-, and contractor-owned and/or leased resources.

Law, Regulation, Executive Order, DOE Order	Description
Emergency Management	
Emergency Planning and Community Right-to-Know Act of 1986 42 U.S.C. § 11001 et seq.	Establishes an emergency response system to help local communities protect public health and safety and the environment from unplanned releases of hazardous materials. LANL and SRS are required to provide the needed information to local and State emergency response planning authorities regarding operations at LANL and SRS. This would include the proposed surplus plutonium disposition facilities once operational, or additional activities that may take place in existing facilities, as appropriate.
New Mexico Hazardous Chemicals Information Act NMSA Chapter 74, Article 4E-1	Implements the hazardous chemical information and toxic release reporting requirements of the *Emergency Planning and Community Right-to-Know Act* of 1986 (also known as Title III of the *Superfund Amendments and Reauthorization Act*) for covered facilities in New Mexico.
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 surplus plutonium disposition facilities, 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 plutonium disposition capabilities.
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 [53 FR 47491)	Establishes the 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.
Environmental Oversight and Monitoring Agreement in Principle Between DOE and the State of New Mexico, 2005	Provides DOE support for State activities in environmental oversight, monitoring, access, and emergency response at LANL. DOE awards periodic grants to continue this agreement.
DOE Order 151.1D, *Comprehensive Emergency Management System* (Change 1, 10/04/2019)	Establishes policy and assigns and describes roles and responsibilities for the DOE Emergency Management System.
DOE Order 153.1A, *Departmental Nuclear Emergency Support Team Capabilities* (11/17/2022)	Establishes radiological/nuclear incident response capability requirements and responsibilities for DOE. Provides the basic management structure and principles for responding to radiological/nuclear incidents, accidents, or other emergencies.

CFR = *Code of Federal Regulations*; CH-TRU = contact-handled transuranic; DOE = U.S. Department of Energy; DOT = U.S. Department of Transportation; EPA = U.S. Environmental Protection Agency; FR = *Federal Register*; FWS = U.S. Fish and Wildlife Service; LANL = Los Alamos National Laboratory; NAP = National Nuclear Security Administration Policy;

NEPA = *National Environmental Policy Act*; NHPA = *National Historic Preservation Act*; NMAC = New Mexico Administrative Code; NMED = New Mexico Environment Department; NMSA = New Mexico Statutes Annotated; NNSA = National Nuclear Security Administration; NPDES = National Pollutant Discharge Elimination System; NRC = U.S. Nuclear Regulatory Commission; NRHP = National Register of Historic Places; RCRA = *Resource Conservation and Recovery Act*; SC = South Carolina; SCDHEC = South Carolina Department of Health and Environmental Control; SRS = Savannah River Site; TAC = Texas Administrative Code; TDEC = Tennessee Department of Environment and Conservation; TSS = Transportation Safeguards System; TRU = transuranic; TSWDA = *Texas Solid Waste Disposal Act*; U.S.C. = *United States Code*; WIPP = Waste Isolation Pilot Plant; Y-12 = Y-12 National Security Complex.

(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.

5.2 Regulatory Activities

The proposed surplus plutonium disposition facilities must 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 at each of the proposed sites.

5.2.1 Pantex Plant

As described in Sections 2.1.1.2.1 and 2.1.2.1 of this SPDP EIS, no physical or operational changes are proposed for the Pantex. Regulations governing the storage, handling, and transport of pits at Pantex would continue to apply to these activities, and this does not represent a change from current operating procedures for this site. Federal and State regulations governing these activities are included in Table 5-1.

With specific regard to State requirements, in accordance with the *Texas Clean Air Act*, the TCEQ and the Texas Department of State Health Services manage and control the release of regulated emissions to the atmosphere and provide for the maintenance of ambient air quality (30 TAC §101-§122 and §305; 25 TAC §295 [asbestos only). TCEQ regulates the quality of water discharged to waters of the State of Texas and governs public water supplies (30 TAC §205-§299, §305, §309, §317, and §319). TCEQ also governs the generation, storage, handling, treatment, and disposal of solid waste, including hazardous waste, through the *Texas Solid Waste Disposal Act* (30 TAC §305, §327, §334, and §335).

5.2.2 Los Alamos National Laboratory

Any expanded existing or new surplus plutonium disposition capabilities would be designed, constructed, and operated in accordance with DOE regulations and requirements, and any appropriate NRC regulations. The major DOE design criteria may be found in DOE Orders 420.1C, Change 3 (2019), *Facility Safety*, and 430.1C, Change 2 (2020), *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 operation 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, DOE would prepare a safety evaluation report to evaluate the proposed safety basis and controls for the new facilities and would obtain approval of the Program Secretarial Officer or designee.

The quantity of plutonium or other special nuclear materials to be processed or stored would be used to determine the applicable regulations, and may trigger compliance 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 20, "Standards for Protection Against Radiation"; 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 Order 458.1, *Radiation Protection of the Public and the Environment* (DOE Order 458.1 Chg 4 2020), and 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 NMED.

5.2.3 Savannah River Site

The regulations described in Section 5.2.2 for the design, construction, and safety of LANL facilities, and specifically nuclear facilities and radiation management, would also apply to expanded or new facilities at SRS. The protection of the environment from chemical risks is regulated by EPA and SCDHEC.

5.2.4 Y-12 National Security Complex

As described in Section 2.1.1.2.4 of this SPDP EIS, no physical or operational changes are proposed for the Y-12. Regulations governing the storage, handling, and disposition of HEU at Y-12 would continue to apply to these activities, and this does not represent a change from current operating procedures for this site. Federal and State regulations governing these activities are included in Table 5-1.

With specific regard to State requirements, in accordance with the *Tennessee Air Quality Act*, the Tennessee Department of Environmental Quality regulates the release of regulated emissions to the atmosphere and provides for the maintenance of ambient air quality (TDEC Chapter 1200-3-3 [TDEC 2006], TDEC Chapter 1200-3-11 [TDEC 2018a], TDEC Chapter 1200-3-1 [TDEC 2001]). TDEC regulates the quality of water discharged to waters of the State of Tennessee and governs public water supplies (TDEC Chapter 0400-40-05 [TDEC 2018b], TDEC Chapter 0400-45-01 [TDEC 2019]). TDEC also governs the generation, storage, handling, treatment, and disposal of solid waste, including hazardous waste, through the *Tennessee Hazardous Waste Management Act* (TDEC Chapter 0400-12-01 [TDEC 2022]).

5.2.5 Waste Isolation Pilot Plant

The WIPP LWA (Public Law 102-579, 106 Stat. 4777, 1992 governs operations at the WIPP facility, as amended by Public Law 104-201, 1996). This Act and the *DOE National Security and Military Applications of Nuclear Energy Authorization Act* of 1980 (Public Law 96-164, 93 Stat. 1259) provide the authorization basis for the WIPP facility to dispose of contact-handled and remote-handled transuranic waste. The WIPP LWA required EPA to certify the WIPP facility's compliance with the long-term disposal regulations of 40 CFR Part 191, "Environmental Radiation Protection for Management and Disposal of Spent Nuclear Fuel, High-Level, and Transuranic Radioactive Wastes," Subparts B and C, prior to the commencement of disposal operations. DOE submitted the Compliance Certification Application in October 1996, demonstrating compliance with the disposal standards and the criteria for compliance established at 40 CFR Part 194, "Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations." EPA certified the WIPP facility's compliance with these regulations in May 1998, and disposal operations subsequently began on March

26, 1999 (82 FR 33106). The submittal of a Compliance Recertification Application for the WIPP facility is required by Section 8(f) of the WIPP LWA to occur not later than 5 years after initial receipt of TRU waste for disposal at the repository, and every 5 years thereafter until the decommissioning of the facility is completed. DOE's third recertification application was submitted in March 2014 and was approved by EPA on July 13, 2017 (82 FR 33106). On March 26, 2019, DOE officially submitted the fourth Compliance Recertification Application for the WIPP facility to EPA (DOE 2019d). The Compliance Recertification Application was approved by EPA on May 3, 2022 (87 FR 26126). DOE's fifth compliance recertification application is required to be submitted to EPA no later than March 26, 2024.

Much of the TRU waste disposed of at the WIPP facility is TRU mixed waste, meaning that it contains both hazardous and radioactive components. Therefore, the WIPP facility must comply with the RCRA to dispose of TRU mixed waste. Under the RCRA, which amended the *Solid Waste Disposal Act* of 1965, EPA defines and identifies hazardous waste; establishes standards for its transportation, treatment, storage, and disposal; and requires permits for persons engaged in hazardous waste activities. Section 3006 of the RCRA allows States to establish and administer these permit programs with EPA approval. NMED is authorized by EPA to implement the hazardous waste program in New Mexico pursuant to the *New Mexico Hazardous Waste Act* (New Mexico Statutes Annotated [NMSA] 1978 § 74-4-1 et seq.). The technical standards for hazardous waste treatment, storage, and disposal facilities in New Mexico are outlined in 20.4.1.500 *New Mexico Administrative Code*, which adopts, by reference, 40 CFR Part 264, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities." The hazardous waste management permitting program is administered through 20.4.1.900 *New Mexico Administrative Code*, which adopts, by reference, 40 CFR Part 270, "EPA Administered Permit Programs: The Hazardous Waste Permit Program." NMED issued the initial WIPP facility Hazardous Waste Facility Permit on October 27, 1999 (DOE 2000a). The Hazardous Waste Facility Permit authorized the WIPP facility to receive, store, and dispose of CH-TRU mixed waste. On March 31, 2020, the Permittees submitted a 10-Year Permit Renewal Application (DOE 2020d). On October 6, 2020 the NMED indicated that the 10-Year Permit Renewal Application was administratively complete and therefore, the WIPP facility can continue to operate under the existing Hazardous Waste Facility Permit while NMED processes the renewal application (NMED 2020). NMED issued the final WIPP renewal permit on October 4, 2023. The permit became effective on November 3, 2023 (NMED 2023a).

Before any CH-TRU waste from surplus plutonium disposition activities at LANL or SRS can be sent to the WIPP facility for disposal, LANL and SRS must 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 DOE's CBFO Quality Assurance Program Document (DOE 2017e). A TRU waste generation site (e.g., SRS) is required to submit these program documents to the CBFO for review and approval prior to their implementation (DOE 2017e). The TRU waste generation site would then certify that each container of TRU waste they intend to transport to the WIPP facility meets the most current WAC (DOE 2022i).

In this SPDP EIS, DOE is considering the possibility of disposing 34 MT of diluted plutonium oxide CH-TRU waste in CCO containers at the WIPP facility. The effort to develop and license the CCOs for WIPP facility disposal is not dependent on a ROD for this SPDP EIS. In June 2014 and November 2015, respectively, the NRC issued revised certificates of compliance for the TRUPACT-II (NRC 2014) and HalfPACT (NRC 2020) containers that authorized their use for transporting CCOs. Acceptance of CCOs for disposal at the WIPP facility was subsequently approved. Practices for waste receipt, handling, and disposing of a 7-pack of CCOs would be essentially identical to those currently employed at the WIPP facility for a typical 7-pack of 55-gal drums of CH-TRU waste.

5.3 Permits

Many of the activities addressed by this SPDP EIS would be performed within existing structures in developed areas of the LANL site and SRS, would use existing infrastructure, and would operate under existing permits. The need for new permits or modifications to existing permits would depend on the alternative selected. Prior to project implementation of either alternative, 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 obtained.

Hazardous waste management activities at LANL and SRS are regulated under the RCRA Part A/Part B permits. In the case of CH-TRU waste being shipped to the WIPP facility for disposal under either alternative, the waste would need to meet the applicable requirements of the WIPP WAC and the waste analysis plan in the WIPP Hazardous Waste Facility Permit.

5.3.1 Los Alamos National Laboratory

LANL complies with all permits that are required for lab operations, as summarized in the *Los Alamos National Laboratory 2021 Annual Site Environmental Report* (LANL 2022c). Drinking water at LANL is regulated by NMED under the *New Mexico Environmental Improvement Act* (NMSA 1978 § 74-1) and the *Federal Safe Drinking Water Act* (42 U.S.C. § 300f et seq.). It is unlikely that activities at TA-55 would require any change in existing permits from the local Los Alamos water utility because the change in water use would be minimal.

Wastewater discharges at LANL are also regulated under the NPDES Program, administered by EPA. If any construction is required in support of the surplus plutonium disposition activities at LANL, stormwater would be managed under the LANL NPDES Construction General Permit program. An NOI and a Storm Water Pollution Prevention Plan would address facility-specific stormwater control measures. The NPDES Industrial Storm Water Permit Program at LANL regulates stormwater discharges from identified regulated industrial activities and their associated facilities, including PF-4.

Changes in air emissions resulting from disposition of surplus plutonium activities at LANL could necessitate modifications to the Title V permit. Permit revisions, if needed, would be made based on consultations with NMED prior to startup of operations.

5.3.2 Savannah River Site

SRS complies with more than 400 environmental permits covering air quality, water quality and wetlands, hazardous waste, sanitary waste, and underground storage tanks. The *Savannah River Site Environmental Report 2021* contains a compilation of permits for the site (SRNS 2022c). 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 that may be required related to expanded or new facilities at SRS.

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 surplus plutonium disposition facilities and associated buildings, stormwater would be managed under the SRS general stormwater permit. An (NOI) and a Storm Water Pollution Prevention Plan would address new 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 would be required for both the construction and operations phases for these new 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 surplus plutonium disposition activities could necessitate modifications to the Title V permit. If an alternative using K-Area for NPMP, dilution, or C&P is selected, consultations would be initiated with SCDHEC to determine what air quality permit changes would be needed to address a new source of radioactive emissions.

5.4 Consultations

LANL and SRS have site-specific procedures, guidelines, and plans for federally threatened or endangered species, habitat, and cultural resources.

Consultations with other Federal, State, and local agencies and federally recognized Native American groups are usually conducted prior to the disturbance of any land and are usually related to biotic, cultural, and Native American resources. Past consultations including government to government are summarized in Table 5-2.

Federal agencies are required to consider the effects of their undertakings on historic properties in consultation with State Historic Preservation Office, Tribal Historic Preservation Office, federally recognized Indian Tribes, and interested members of the public per NHPA Section 106 and implementing regulations at 36 CFR 800. In addition to NHPA Section 106 consultation responsibilities, other laws (i.e., the *American Indian Religious Freedom Act*, *Native American Graves Protection and Repatriation Act*), Executive Orders (i.e., Executive Order 13175) (65 FR 67249), and DOE policy (i.e., DOE Order 144.1, Change 1 [2009]) require DOE to consult with Native American Tribes that have ancestral/historic ties to the sites and area. Each field office has procedures and processes they follow to comply with this process. For LANL, this is the Cultural Resources Management Plan (LANL 2017a) *and the Programmatic Agreement among the U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Field Office, the New Mexico State Historic Preservation Office and the Advisory Council on History Preservation Concerning Management of the Historic Properties of Los Alamos National Laboratory, Los Alamos, New Mexico* (LANL 2017b, LANL 2022a). For SRS, this includes the Archaeological Programmatic Memorandum of Agreement [SRARP 2016|Appendix C|]) and the PA for the Cold War Historic District (DOE et al. 2020).

Inadvertent discoveries with Native American association at DOE sites would be handled in accordance with the requirements of 43 CFR Part 10, "Native American Graves Protection and Repatriation Regulations," and 36 CFR 800.13, "Post-review discoveries," regarding Native American human remains, funerary objects, objects of cultural patrimony, and sacred objects.

Table 5-2. Past Government-to-Government Consultations and Recent Briefings with Native American Tribal Governments

Site	Activity	Group
LANL	Consultation for LANL activities	San Ildefonso Pueblo[a] Cochiti Pueblo[a] Jemez Pueblo[a] Santa Clara Pueblo[a] Acoma Pueblo Santa Ana Pueblo Hopi Tribe Mescalero Apache Jicarilla Apache
LANL	Expressed Interest in land use issues at LANL[b]	Acoma Pueblo Santa Ana Pueblo Hopi Tribe Mescalero Apache
LANL	Attended briefing on the SPDP EIS	San Ildefonso Pueblo Santa Clara Pueblo San Felipe Pueblo Isleta Pueblo Cochiti Pueblo Jemez Pueblo All Pueblo Council of Governors Abt Associates
SRS	Consulted during production of the 1999 SPD EIS	National Council of the Muskogee Creek Ma Chis Lower Alabama Creek Indian Tribe Indian People's Muskogee Tribal Town Confederacy Pee Dee Indian Association Yuchi Tribal Organization United Keetoowah Band
SRS	Consulted during treatment of SRS Cold War Historic District	Eastern Band of Cherokee Alabama-Quassarte Tribal Town Muscogee Nation Kialegee Tribal Town Thlopthlocco Tribal Town United Keetoowah Band

EIS = environmental impact statement; LANL = Los Alamos National Laboratory; SPDP = Surplus Plutonium Disposition Program; SRS = Savannah River Site.

(a) 1992 Accords member with the U.S. Department of Energy (DOE). The Accords established a government-to-government relationship and provided for the sharing of information regarding environmental issues related to DOE's Los Alamos facilities, which are near the pueblos (LANL 2017a).

Sources: LANL 2023a|Section 2.3.3.3|; DOE 1999b.

5.4.1 Consultations Related to Proposed Activities at LANL

LANL has site-specific procedures, guidelines, and plans for federally threatened or endangered species habitat and cultural resources.

Because of the vicinity of the TA-52 project area to Mexican spotted owls and the Jemez Mountain salamander, the project area would be assessed in a Section 7 consultation under the *Endangered Species Act*. This would include preparation and submission of a biological assessment, following provisions of 50 CFR Part 402 (Section 7), "Interagency Cooperation – Endangered Species Act of 1973, as amended."

DOE is required to consult with Native American Tribes that have ancestral/historic ties to the LANL site and area. This includes the following groups: the four accord pueblos of San Ildefonso, Cochiti, Jemez, and Santa Clara; Acoma Pueblo, Santa Ana Pueblo; the Hopi Tribe; the Mescalero Apache; and Jicarilla Apache. The Hopi Tribe, the Pueblo of Santa Ana, the Mescalero Apache, and the Pueblo of Acoma have expressed interest in land use issues on the LANL site (LANL 2023a|Section 2.3.3.3|). DOE entered into accords in 1992 with four pueblos (Cochiti, Jemez, San Ildefonso, and Santa Clara) that formalized government-to-government relationships between DOE and the four pueblos. These accords are renewed periodically (LANL 2017a).

As discussed in Section 1.7, NNSA invited 24 Native American groups with ties to the land on or in the vicinity of the SRS and LANL sites to participate in government-to-government consultations and offered briefings on the SPDP EIS. The initial briefing meeting was held on December 6, 2022. It was attended by six tribal nations (San Ildefonso, Santa Clara, San Felipe, Isleta, Cochiti, and Jemez, including a governor [San Ildefonso] and two lt. governors [San Ildefonso and Santa Clara]), and representatives from two organizations that support tribes (All Pueblo Council of Governors and Abt Associates). The Pueblo de San Ildefonso requested an additional briefing/consultation meeting to discuss the program and potential impacts of SPDP. The meeting with the San Ildefonso Pueblo leadership, attorneys, and seven representatives from the Pueblo de San Ildefonso was held on January 31, 2023.

5.4.2 Consultations Related to Proposed Activities at the Savannah River Site

Constructing/modifying and operating facilities in support of the Preferred and No Action Alternatives in K-Area or F-Area are not expected to have any impact on federally listed threatened and endangered species. SRS provides habitat for four species that are currently federally listed under the *Endangered Species Act* and one species that is a candidate for listing, but only the red-cockaded woodpecker is found near K-Area and F-Area, and the smooth purple coneflower occurs near F-Area (DOE 2020a|Section 3.5.3, Figure 3-9, p. 3-37|).

Although from 1985 through 2020 active red-cockaded woodpecker clusters at SRS increased from 3 to 145 due to successful habitat restoration (SRNS 2021c|Section 3.3.8.4|), there are no colonies of this species in K-Area or F-Area. The nearest red-cockaded woodpecker colony is located 4 mi east of K-Area (DOE 2005|p. A-5|; DOE 2015c|3-25, Figure 3-1|). The nearest cluster of red-cockaded woodpeckers is about 3–4 mi northeast of F-Area (DOE 2020a|p. 3-37|). Although K-Area is located within a red-cockaded woodpecker Supplemental Management Area, it is currently too far from existing colonies to be used by the species. F-Area is similarly too far from the cluster of red-cockaded woodpeckers to be used by the species.

Potentially suitable habitat for the smooth purple coneflower exists in the 20 ac where construction would occur at F-Area (see Section 3.3.6.4) and an extant population exists within 2 mi (DOE 2020a|Section 3.5.3, Figure 3-9, p. 3-37|). Surveys should be conducted to evaluate whether the habitat is suitable for the smooth purple coneflower, and if so, if the species is present. If the habitat is determined to be suitable and the species is found, mitigation measures and best management practices would be used, as described in Section 4.1.3.6.1.

No threatened or endangered species are known to forage, breed, nest, or occur in the F-Area near the likely locations of construction, modification, or operations (see Section 4.1.2.6). As discussed in Section 4.1.2.6, no species listed by the Federal or State governments are present in the portion of K-Area planned to be disturbed, and land in F-Area likely to be used for modifications has been previously developed for industrial use. If new information reveals effects of the Preferred and No Action Alternatives that may affect threatened or endangered species, consultation would be initiated.

Six Native American groups with ties to the SRS vicinity were consulted during preparation of the SPD EIS (DOE 1999b). These groups included the National Council of the Muskogee Creek, the Ma Chis Lower Alabama Creek Indian Tribe, the Indian People's Muskogee Tribal Town Confederacy, the Pee Dee Indian Association, the Yuchi Tribal Organization, Inc., and the United Keetoowah Band. Native American representatives have identified concerns related to the *American Indian Religious Freedom Act* within the central Savannah River Valley, specifically with respect to some sensitive Native American resources and plants traditionally used in ceremonies and as medicinal plants. However, no significant concerns were raised by Native American groups through the Surplus Plutonium Disposition Final Environmental Impact Statement consultation process (DOE 1999b). DOE initiated Tribal consultation with the Eastern Band of Cherokee, Alabama-Quassarte Tribal Town, Muscogee Nation, Kialegee Tribal Town, Thlopthlocco Tribal Town, and the United Keetoowah Band regarding the treatment of the Cold War Historic District at SRS (SRNS 2023d|Section 7|).

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[29] This SPDP EIS was prepared in accordance with the requirements of 10 CFR Part 830, Subpart A, "Quality Assurance Requirements" and DOE Order 414.1D, Chg 2 "Quality Assurance". An ASME/NQA-1-2012 compliant quality assurance program was applied to the review and reporting activities; supporting calculations followed a stringent software verification and validation program.

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7.0 GLOSSARY

NNSA has provided this glossary to assist readers in the interpretation of terms used in this SPDP EIS. The glossary includes definitions of technical and regulatory terms specific to this EIS. The main source of definitions in this glossary is the *Surplus Plutonium Disposition Final Supplemental Environmental Impact Statement* (DOE 2015c).

acceptable knowledge – The documentation of all known information on how a transuranic (TRU) waste stream was created and managed. This includes chemical compatibility evaluations and a basis of knowledge document to verify that appropriate measures are taken to prevent hazard-characteristic wastes. Methods of characterization may include radiological characterization using nondestructive assay (NDA) or dose-to-curie methods, and visual confirmation using real-time radiography or visual examination methods.

accident – An unplanned event or sequence of events resulting in undesirable consequences, such as the release of radioactive or hazardous material to the environment.

acute exposure – A single, short-term exposure to radiation, a toxic substance, or other stressors that may result in biological harm. Pertaining to radiation, the exposure incurred during and shortly after a radiological release. Acute exposure involves the absorption or intake of a relatively large amount of radiation or radioactive material.

adulterant – A substance added to plutonium oxide to reduce plutonium concentration and inhibit plutonium recovery. The adulterant contains nonhazardous inorganic materials.

Advisory Council on Historic Preservation – An independent agency of the U.S. government that promotes the preservation, enhancement, and productive use of the nation's historic resources.

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 because of potential harmful effects on human health and welfare.

Air Quality Control Region – An area designated by a State or the U.S. Environmental Protection Agency (EPA) 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.

alternative – With respect to the disposition of surplus plutonium, a discrete sequence of actions carried out in a group of facilities that accomplishes the U.S. Department of Energy's (DOE) purpose and need.

alluvial groundwater – An aquifer comprising unconsolidated material deposited by water, typically occurring adjacent to rivers.

ambient air – The atmosphere external to buildings around humans, other animals, plants, and structures.

ambient air quality standards – Regulations prescribing the levels of airborne pollutants that may not be exceeded during a specified time within a defined area. (See National Ambient Air Quality Standards [NAAQS].)

Amended Record of Decision (AROD) – A modification to some aspect of a decision published in an earlier Record of Decision (ROD). The environmental impacts of the modification may be evaluated in a supplement analysis (SA) or in a supplemental or new environmental impact statement (EIS). (See Record of Decision.)

americium – A radioactive metal of the actinide series of atomic number 95 that does not occur naturally but can be produced artificially by bombarding plutonium with high-energy neutrons.

aquifer – A body of rock or sediment that is capable of transmitting groundwater and yielding usable quantities of water to wells or springs.

archaeological resources – physical properties that remain from past human activities, including features and artifacts reflecting specific activities, including the remaining ruins of buildings and structures. Pre-European contact -era resources are physical properties that remain from human activities that pre-date written records. Historic-era archaeological resources are generally considered to be those that post-date the existence of written records.

archaeological site – Any location where humans have altered the terrain or discarded artifacts during pre-European contact or historic times.

Area of Environmental Interest (AEI) – A designated area at Los Alamos National Laboratory (LANL) managed for federally threatened or endangered species protection, consisting of core habitat and buffer habitat. (See core habitat and buffer habitat.)

artifact – An object produced or shaped by humans and of archaeological or historical interest.

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 rather a process for minimizing doses to as far below limits as is practicable.

assay – The testing of a metal or ore to determine its ingredients and quality.

attainment area – An area that the U.S. Environmental Protection Agency (EPA) has designated as being in compliance with one or more of the National Ambient Air Quality Standards (NAAQS) for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone, lead, and particulate matter (PM). An area may be in attainment for some pollutants but not for others. (See National Ambient Air Quality Standards, nonattainment area, and particulate matter.)

average individual – A hypothetical receptor, for use in determining potential consequences during normal operations, whose dose is determined by dividing the population dose by the number of individuals.

background noise (ambient noise) – Any sound other than the sound being monitored (primary sound). Background noise is a form of noise pollution or interference.

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* (NEPA) evaluations, baseline is defined as the existing environmental conditions to which impacts of the proposed action and its alternatives can be compared.

basin – Geologically, a circular or elliptical downwarp in whose center younger beds occur. Topographically, an area that drains through a common outlet.

best management practice (BMP) – A method that has been determined to be the most effective and practical means of preventing or reducing non-point source [water] pollution. Non-point source indicates that the pollution is from many diffuse sources.

beryllium – An extremely lightweight element with the atomic number 4. It is metallic and used in reactors as a neutron reflector.

beyond-design-basis accident – This term is used to discuss accident sequences that are possible but were not fully considered in the design process because they were judged to be too unlikely. (In that sense, they are considered beyond the scope of design-basis accidents [e.g., fire, earthquake, spill, explosion] for which a nuclear facility must be designed and built to withstand.) Because the regulatory process strives to be as thorough as possible, "beyond-design-basis" accident sequences are analyzed to fully understand the capability of a design. These accidents are typically very low-probability, but high-consequence events. (See design-basis accident.)

block – A 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.

buffer habitat – At Los Alamos National Laboratory (LANL), a designated area within an Area of Environmental Interest (AEI), which protects core habitat from undue disturbance and habitat degradation. (See Area of Environmental Interest and core habitat.)

byproduct material – Byproduct material 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.

cancer – The name given to a group of diseases characterized by uncontrolled cellular growth, with the cells having invasive characteristics such that the disease can be transferred from one organ to another.

canyon – As used at the Savannah River Site (SRS), a large heavily shielded concrete building containing a remotely operated plutonium and uranium processing facility. May also be used to refer to canyons as geologic features.

carbon dioxide (CO_2) – A colorless, odorless gas that is a normal component of ambient air and a product of fossil fuel and biomass combustion, animal expiration, the decay of animal or vegetable matter, and industrial processes. It is the principal manmade greenhouse gas (GHG) that may affect the Earth's radiative balance and is the reference gas against which other greenhouse gases (GHGs) are measured. It is an asphyxiant at concentrations of 10 percent or more and has other health effects with exposure at lower concentrations (e.g., hyperventilation, vision damage, lung congestion, central nervous system injury, abrupt muscle contractions, elevated blood pressure, and/or shortness of breath).

carbon monoxide (CO) – A colorless, odorless gas that is toxic because of the formation of carboxyhemoglobin in the bloodstream, if breathed in high concentrations over an extended period.

Carolina bay – A closed, elliptical depression capable of holding water and common to South Carolina. A Carolina bay is a type of wetland. (See wetlands.)

characterization and packaging (C&P) of diluted plutonium oxide contact-handled transuranic (CH-TRU) waste – After dilution, the composition of the plutonium in diluted oxide form is analyzed or "characterized" using radiography and nondestructive assay analysis. The purpose of the characterization process is to verify that the resulting diluted plutonium oxide, which is packaged as CH-TRU waste, complies with the Waste Isolation Pilot Plant (WIPP) Waste Acceptance Criteria (WAC) for disposal. Throughout this Surplus Plutonium Disposition Program (SPDP) Environmental Impact Statement (EIS), characterization and packaging of diluted plutonium oxide CH-TRU waste is often written as "characterization and packaging" or "C&P."

***Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA) Reportable Quantity** – For each CERCLA hazardous substance, the U.S. Environmental Protection Agency (EPA) has established a reportable quantity. For radionuclides, reportable quantities are expressed in curies and serve as reporting triggers.

***Code of Federal Regulations* (CFR)** – A publication in codified form of all Federal Regulations in force.

Cold War Historic District – A historic District named in the National Register of Historic Places (NRHP) for its cultural resources that are representative of the Cold War period. (See Cultural Resources and National Register of Historic Places.)

collective dose – As used in this report, the term "collective dose" is the sum of doses to all individuals in a population for a given period of time. The time period is typically 1 year, but can be specified as any duration (e.g., a project lifetime). The term "collective" is used in conjunction with the type of population, e.g., total workforce or persons residing within 50 mi of a site. Collective dose is expressed in units of person-rem.

conformity – Conformity is defined in the *Clean Air Act* (CAA) 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 (NAAQS), 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.

Construction General Permit – A permit that authorizes the discharge of stormwater (and certain non-stormwater discharges) from construction sites that disturb 1 acre or more of land, and from smaller sites that are part of a larger, common plan of development.

contact-handled transuranic waste (CH-TRU) – Radioactive waste or waste packages whose external dose rate is low enough to permit contact handling by humans during normal waste management activities. CH-TRU waste has a surface dose rate less than or equal to 200 mrem/hr. (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.

convenience can – A general use can for moving miscellaneous material through gloveboxes that has a slip-fit lid. Materials of construction are tin-coated steel, aluminum, or stainless steel.

conversion – An operation for changing material from one form, use, or purpose to another.

core habitat – At Los Alamos National Laboratory (LANL), a designated area within an Area of Environmental Interest (AEI) that is considered essential for the existence of federally threatened or endangered species. (See Area of Environmental Interest and buffer habitat.)

Council on Environmental Quality (CEQ) regulations – Regulations at 40 CFR Parts 1500–1508 that direct Federal agencies in complying with the procedures of and achieving the goals of the *National Environmental Policy Act* (NEPA).

criteria pollutant – An air pollutant that is regulated under the National Ambient Air Quality Standards (NAAQS). The U.S. Environmental Protection Agency (EPA) 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 (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone, lead, and two size classes of particulate matter (PM) (less than 10 micrometers in diameter, and less than 2.5 micrometers 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 (FWS) or the National Marine Fisheries Service following the procedures outlined in the *Endangered Species Act* (ESA) 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 under which a system undergoes a sustained nuclear chain reaction. A chain reaction is a reaction that initiates its own repetition. In nuclear fission, a chain reaction occurs when a neutron induces a nucleus to fission and the fissioning nucleus releases one or more neutrons, which induce other nuclei to fission.

criticality control overpack (CCO) – A standard 55-gallon drum containing a criticality control container (CCC). The CCC consists of a stainless steel pipe body welded to a bottom blind flange and upper slip-on flange bolted to a blind flange lid with a gasket. The CCC is held in place in the CCO by laminated plywood dunnage assemblies. Fourteen CCOs may be shipped within the TRUPACT-II transportation container.

cultural resources – Protected resources, including archaeological sites, architectural features, traditional-use areas, and Native American 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 becquerels, which is a unit derived from the International System of Units describing one disintegration per second); also, a quantity of any radionuclide or mixture of radionuclides having 1 curie of radioactivity.

deactivation – The placement of a facility in a radiologically and industrially safe shutdown condition that is suitable for a long-term surveillance and maintenance phase prior to final decontamination and decommissioning.

decay (radioactive) – The decrease in the amount of any radioactive material with the passage of time, due to spontaneous nuclear disintegration (i.e., emission from atomic nuclei of charged particles, photons, or both).

decibel (dB) – A unit for expressing the relative intensity of sound 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 (dBA), a frequency-weighted noise unit, is widely used. The dBA scale corresponds approximately to the frequency response of the human ear and thus correlates well with loudness.

decibel A-weighted scale (dBA) – The most common weighting that is used in noise measurement and assessment, which cuts off the lower and higher frequencies the average person cannot hear.

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.

de minimis – A property condition that does not pose a threat to human health or the environment.

depleted uranium – Uranium whose content of the fissile isotope uranium-235 is less than 0.7 percent (by weight) found in natural uranium, so that it contains more uranium-238 than natural uranium.

deposition – In geology, the laying down of potential rock-forming materials, i.e., sedimentation; in atmospheric transport, the settling out on ground and building surfaces of atmospheric aerosols and particles ("dry deposition") or their removal from the air to the ground by precipitation ("wet deposition" or "rainout").

design-basis – For nuclear facilities, an adjective for information that identifies the specific functions to be performed by a structure, system, or component and the specific values (or ranges of values) chosen for controlling parameters for reference bounds for design. These values may be (1) restraints derived from generally accepted, state-of-the-art practices for achieving functional goals; (2) requirements derived from analysis (based on calculation or experiment) of the effects of a postulated accident for which a structure, system, or component must meet its functional goals; or (3) requirements derived from Federal safety objectives, principles, goals, or requirements.

design-basis accident – An accident postulated for the purpose of establishing functional and performance requirements for safety structures, systems, and components. (See beyond-design-basis accident.)

dilution of plutonium oxide – The plutonium oxide from surplus pit and non-pit metal processing (NPMP) is diluted in a set of dilution gloveboxes by blending the plutonium oxide with an adulterant to reduce the plutonium concentration and inhibit plutonium recovery. The dilution process is also termed "downblending." Throughout this Surplus Plutonium Disposition Program (SPDP) Environmental Impact Statement (EIS) dilution of plutonium oxide is often written as "dilution."

direct employment – The number of jobs required to implement an alternative.

dismantlement – The process of taking apart a nuclear warhead and removing the subassemblies, components, and individual parts. This may also include dismantling a facility or dedicating it to other purposes.

disposition – For radiological materials, this is a process of disposal that results in conversion to a form that is substantially and inherently more proliferation-resistant than the original form.

dissolution – The chemical dispersal (i.e., dissolving) of a solid throughout a liquid medium.

domestic water – Water originating from human sanitary water use.

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 dose is 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 because it more closely shows the effects of radiation on humans. (See dose equivalent.)

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.

earnings – Wages and benefits received by workers for services performed.

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 (FWS) or the National Marine Fisheries Service following the procedures outlined in the *Endangered Species Act* (ESA) and its implementing regulations (50 CFR Part 424). The lists of endangered species can be found in 50 CFR 17.11 for wildlife, 50 CFR 17.12 for plants, and 50 CFR 222.23(a) for marine organisms. (See critical habitat and threatened species.)

enriched uranium – Uranium whose content of the fissile isotope uranium-235 is greater than the 0.7 percent (by weight) found in natural uranium. (See highly enriched uranium and low-enriched uranium.)

environmental assessment (EA) – A concise public document that a Federal agency prepares under the *National Environmental Policy Act* (NEPA) to provide sufficient evidence and analysis to determine whether a proposed agency action would require preparation of an Environmental Impact Statement (EIS) or a Finding of No Significant Impact (FONSI). A Federal agency may also prepare an EA to aid its compliance with NEPA when no EIS is necessary, or to facilitate preparation of an EIS when one is necessary.

environmental impact statement (EIS) – The detailed written statement that is required by *National Environmental Policy Act* (NEPA) Section 102(2)(C) for a proposed major Federal action significantly affecting the quality of the human environment. A U.S. Department of Energy (DOE) EIS is prepared in accordance with applicable requirements of the Council on Environmental Quality (CEQ) NEPA regulations in 40 CFR Parts 1500–1508, and DOE NEPA regulations in 10 CFR Part 1021. The statement includes, among other information, discussions of the environmental impacts of the proposed action and reasonable alternatives, adverse environmental effects that cannot be avoided if the proposal is implemented, the relationship between short-term uses of the human environment and enhancement of long-term productivity, and any irreversible and irretrievable commitments of resources.

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.)

ephemeral stream – A stream that has flowing water for brief periods in response to rainfall.

escarpment – A steep slope or long cliff that forms as a result of faulting or erosion and separates two relatively level areas of different elevations.

fault – A fracture or a zone of fractures within a rock formation along which vertical, horizontal, or transverse slippage has occurred.

Federal Register – A daily publication of the U.S. Federal government that issues proposed and final administrative regulations of Federal agencies.

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 (EA) has no potential to have a significant effect on the human environment and, thus, will not require preparation of an Environmental Impact Statement (EIS). (See environmental assessment and EIS.)

fissile material – Although sometimes used as a synonym for fissionable material, this term has acquired a more restricted meaning; namely, any material fissionable by low-energy (i.e., thermal or slow) neutrons. Fissile materials include uranium-233 and -235, and plutonium-239 and -241.

fission – A nuclear transformation that is typically characterized by the splitting of a heavy nucleus into at least two other nuclei, the emission of one or more neutrons, and the release of a relatively large amount of energy. Fission of heavy nuclei can occur spontaneously or be induced by neutron bombardment. Heavy nuclei are defined as the nuclei of an atom with a high atomic number that has lost electrons yielding a highly charged particle.

fission products – Nuclei (i.e., fission fragments) formed by the fission of heavy elements and the nuclides formed by the fission fragments' radioactive decay.

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, the area that has at least a 1 percent chance of being inundated by a flood in any given year. Such an area is also sometimes called a 100-year floodplain.

fugitive dust – Small particles suspended in the air that arise from the mechanical disturbance of granular material exposed to the air, the source of which is primarily the Earth's soil. Common sources of fugitive dust include unpaved roads, agricultural tilling operations, aggregate storage piles, and heavy construction. Dust generated from such open sources is termed "fugitive" because it is not discharged to the atmosphere in a confined flow stream.

geologic resources – Earth materials, including ore and aggregate materials, fossil fuels, and significant landforms.

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.

geologic repository – An excavated, underground facility that is designed, constructed, and operated for safe and secure permanent disposal of high-level radioactive waste.

glovebox – An 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.

greenhouse gas (GHG) – Any gas that absorbs infrared radiation (the portion of the electromagnetic spectrum that extends from the red end of the visible-light range to the microwave range) emitted from Earth's surface and reradiates it back to Earth's surface. Carbon dioxide, methane, and water vapor are the most important greenhouse gases.

groundwater – Water below the ground surface in a zone of saturation.

groundwater recharge – The process whereby water moves downward from surface water to groundwater.

half-life (radiological) – Time in which one-half of the atoms of a particular radionuclide disintegrate into another nuclear form. Half-lives for specific radionuclides vary from millionths of a second to billions of years.

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 (CAA)*. 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 under the *Resource Conservation and Recovery Act*, a waste must be a solid waste 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 (EPA) in 40 CFR 261.31–33.

high-efficiency particulate air (HEPA) 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.

highly enriched uranium (HEU) – 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. (See enriched uranium and low-enriched uranium.)

historic resources – Archaeological sites, architectural structures that post-date the existence of written records, specifically after the arrival of the first Europeans in the Americas. Historic buildings include buildings or other structures constructed more than 50 years ago and buildings that have been evaluated for eligibility for listing in the National Register of Historic Places (NRHP).

immobilization – A process by which plutonium is converted to a chemically stable solid form for disposal.

incident-free – Normal transport or operation.

incidence rate – The number of new cases of a disease divided by the number of persons at risk for the disease.

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.

interim storage – Safe, secure storage supportive of continuing operations until long-term storage or disposition actions are implemented.

intermittent stream – A stream that has flowing water during the wet season but is normally dry during summer.

involved worker – A worker directly or indirectly involved with surplus plutonium disposition operations who may receive an occupational radiation dose from direct radiation (i.e., neutron, x-ray, beta, or gamma) or from radionuclides released to the environment. Direct exposure from handling plutonium materials within a facility would be the chief source of occupational exposure for onsite workers (primarily from gamma radiation emitted by americium-241).

ionizing radiation – Particles (alpha, beta, neutrons, and other subatomic particles) or photons (i.e., gamma, x-rays) emitted from the nucleus of unstable atoms as a result of radioactive decay. Such radiation is capable of displacing electrons from atoms or molecules in the target material (such as biological tissues), thereby producing ions.

irradiate – The process of exposing an object to radiation, such as ionizing radiation.

irretrievable commitment of resources – Use or consumption of materials in such a way that they could not, by practical means, be recycled or restored for other uses.

irreversible commitment of resources – Resources that would be irreparably changed by construction or operation of a proposed project and that could not be restored at some later time to their prior state.

isotope – Any of two or more variations of an element in which the nuclei have the same number of protons (and thus the same atomic number), but different numbers of neutrons so that their atomic masses differ. Isotopes of a single element possess almost identical chemical properties, but often different physical properties (e.g., carbon-12 and -13 are stable; carbon-14 is radioactive).

job control waste – Plastic sheeting, paper, small pieces of wood and metal, glass, gloves, protective clothing, and/or pieces of small equipment that were used in a radioactive process.

land use – The use of terrestrial areas for various purposes such as agriculture, forestry, mining, house building, industry, recreation, nature preservation, government activities (such as military bases), etc. Land use assessments evaluate the effects of a proposed project on existing patterns and densities of land use.

latent cancer fatalities (LCF) – Deaths caused by cancer resulting from and occurring sometime after exposure to ionizing radiation or other carcinogens.

lifecycle cost – All the anticipated costs associated with a project or program alternative throughout its life, including costs from pre-operations through operations to the end of the alternative.

low-enriched uranium – Uranium whose content of the fissile isotope uranium-235 has been increased through enrichment to more than 0.7 percent but less than 20 percent by weight. Most nuclear power reactor fuel contains low-enriched uranium containing 3 to 5 percent uranium-235. (See enriched uranium and highly enriched uranium.)

low-income population – Individuals or households having an annual household income at or below twice the Federal Poverty Level, as characterized in the American Community Survey (ACS), 2016–2020 5-year Estimates, Summary Table C17002. (See environmental justice and minority population.)

low-level radioactive waste (LLW) – Radioactive waste that is not classified as high-level radioactive waste, transuranic (TRU) waste, used nuclear fuel, or byproduct tailings from processing of uranium or thorium ore. LLW is discussed in this Surplus Plutonium Disposition Program (SPDP) Environmental Impact Statement (EIS) in both solid LLW and liquid LLW forms.

material at risk (MAR) – 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 entry hood – A respiratory inlet covering that allows the transfer of a radiation source into a glovebox while preventing radioactive contamination.

maximally exposed individual (MEI) – A hypothetical individual who, because of realistically assumed proximity, activities, and living habits, would receive the highest radiation dose, taking into account all pathways, from a given event, process, or facility.

megawatt – A unit of power equal to 1 million watts. Megawatt-thermal is commonly used to define heat produced, while megawatt-electric defines electricity produced.

Memorandum of Understanding (MOU) – A formal agreement between two or more parties.

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" refers to individuals who are members of the following population groups: Native American 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 Native Americans), where the population experiences common conditions of environmental exposure or effect. Minority populations exist where either (1) the racial/ethnic minority population of the affected area exceeds 50 percent, or (2) the racial/ethnic minority population percentage of the affected area is meaningfully greater than in the general population or other appropriate unit of geographic analysis (typically the State). (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 via 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 (MLLW) – Waste that contains both hazardous waste, as defined under the *Resource Conservation and Recovery Act* (RCRA), and source, special nuclear, or byproduct material subject to the *Atomic Energy Act*.

mixed oxide (MOX) – Reactor fuel made with a physical blend of different fissionable materials, such as uranium dioxide and plutonium dioxide.

mixed transuranic (TRU) waste – Waste that contains both nonradioactive hazardous waste and transuranic waste, as defined in this glossary.

National Ambient Air Quality Standards (NAAQS) – 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 (EPA) must establish the criteria for setting these standards, the regulated pollutants are called criteria pollutants. 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 – Emissions standards set by the U.S. Environmental Protection Agency (EPA) for air pollutants that are not covered by National Ambient Air

Quality Standards (NAAQS) 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. National Emission Standards for Hazardous Air Pollutants 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 (HAP).)

National Nuclear Security Administration (NNSA) – The National Nuclear Security Administration is a semi-autonomous agency within the U.S. Department of Energy (DOE). It is responsible for enhancing national security through the military application of nuclear science.

National Pollutant Discharge Elimination System (NPDES) – A provision of the *Clean Water Act* (CWA) that prohibits discharge of pollutants into waters of the United States unless a special permit is issued by the U.S. Environmental Protection Agency (EPA), a State, or, where delegated, a Tribal government on a Native American reservation. The National Pollutant Discharge Elimination System 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 the direction of the Secretary of the Interior. Districts, sites, buildings, structures, and objects are included in the NRHP because of their importance in American history, architecture, archaeology, culture, or engineering. Properties included in 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 in the NRHP are found in 36 CFR Part 60.

natural phenomena hazard – A category of events (e.g., earthquake, severe wind, tornado, flood, and lightning) that must be considered in the U.S. Department of Energy (DOE) facility design, construction, and operations, as specified in DOE Order 420.1B.

nitrogen oxides (NO_x) – The oxides of nitrogen, primarily nitrogen oxide and nitrogen dioxide, produced by the combustion of fossil fuels. Nitrogen dioxide emissions constitute an air pollution issue because they contribute to acid deposition and the formation of atmospheric ozone.

noise – Noise is unwanted sound that interferes or interacts negatively with the human or natural environment. Noise may disrupt normal activities, diminish the quality of the environment, or if loud enough, cause discomfort and even hearing loss.

nonattainment area – An area that the U.S. Environmental Protection Agency (EPA) has designated as not meeting (i.e., not being in attainment of) one or more of the National Ambient Air Quality Standards (NAAQS) for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), ozone, lead, or both sizes of particulate matter (PM) (i.e., that with an aerodynamic diameter less than or equal to 10 or 2.5 micrometers). 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, semi- solid, 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.

noninvolved worker – A site worker outside the facility who would not be subject to direct radiation exposure but could be incidentally exposed to emissions from the surplus plutonium facilities if they occurred.

non-pit metal processing (NPMP) – Non-pit surplus plutonium in metal form that is oxidized in furnaces located in gloveboxes to form plutonium oxide. Processing the non-pit surplus plutonium can take place in the same gloveboxes or in different gloveboxes than those used for processing the pit plutonium. Some of the identified non-pit surplus plutonium is already in an oxide form and does not need to be processed prior to dilution.

non-pit surplus plutonium – The term "non-pit surplus plutonium" refers to plutonium that is not in the metal pit form that is the core of a nuclear weapon. It is also referred to as "non-pit surplus metal." Non-pit surplus plutonium may be in metal or oxide form or may be associated with other materials that were used in the process of manufacturing and fabricating plutonium for use in nuclear weapons. The non-pit surplus plutonium discussed in this Surplus Plutonium Disposition Program (SPDP) Environmental Impact Statement (EIS) was in some phase of the production cycle when the Cold War ended and the United States ceased production of plutonium. Some non-pit surplus plutonium was generated during research and development activities that support weapons production.

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 (EIS). The U.S. Environmental Protection Agency (EPA) Notice of Availability is the official public notification of an EIS; a U.S. Department of Energy (DOE) Notice of Availability is an optional notice used to provide information to the public.

Notice of Intent (NOI) – A public announcement that an Environmental Impact Statement (EIS) 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 EIS should address.

nuclear facility – A facility that is subject to requirements intended to control potential nuclear hazards. Defined in U.S. Department of Energy (DOE) directives as any nuclear reactor or any other facility whose operations involve radioactive materials in such form and quantity that a significant nuclear hazard potentially exists to the employees and/or the general public.

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.

nuclear 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.

nuclear weapon – The general name given to any weapon in which the explosion results from the energy released by reactions involving atomic nuclei.

Office of Secure Transportation (OST) Transporter – A U.S. Department of Energy (DOE) asset managed and operated by the National Nuclear Security Administration (NNSA), Office of Secure Transportation. The asset is a network of specially modified transport vehicles, special agents and other personnel, and specialized infrastructure that provide for the safe and secure movement of weapons, weapon components, and selected materials for DOE, the U.S. Department of Defense, and other customers, within the continental United States.

offsite population – Members of the general public who live within 50 mi of the facility being evaluated.

outfall – The discharge point of a drain, sewer, or pipe into a body of water.

oxidation – The combination of an element with oxygen wherein the element's atoms lose electrons and positive charge (i.e., valence) is increased.

oxide – A compound formed when an element (e.g., plutonium) is bonded to oxygen.

ozone – The tri-atomic form of oxygen (O_3), 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 verify compliance with U.S. Department of Transportation (DOT) 49 CFR Parts 171–180 and NRC 10 CFR Part 71 regulations.

paleontological resources – Any fossilized remains, traces, or imprints of organisms, preserved in or on the Earth's crust, excluding those associated with cultural resources. (See cultural resources.)

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 in diameter; $PM_{2.5}$ includes only those particles equal to or less than 2.5 micrometers in diameter. Particulate matter can result in increased respiratory symptoms, decreased lung function, aggravated asthma, development of 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.

perched groundwater – A body of groundwater of small lateral dimensions separated from an underlying body of groundwater by an unsaturated zone.

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 central core of a nuclear weapon that principally contains plutonium or enriched uranium.

pit disassembly and processing (PDP) – The process by which surplus plutonium pits are disassembled to segregate the plutonium from other materials. The plutonium is oxidized in furnaces located in gloveboxes to form plutonium oxide. Pit disassembly and processing only occurs for the Preferred Alternative of this Environmental Impact Statement (EIS). This term is synonymous with the historical usage of "pit disassembly and conversion (PDC)." LANL currently processes up to 400 kg of actinides (including surplus plutonium) a year within their Advanced Recovery and Integrated Extraction System (ARIES) capability.

plume – The elongated volume of contaminated air or water originating at a pollutant source such as an outlet pipe, a smokestack, or a hazardous waste disposal site. A plume eventually diffuses into a larger volume of less-contaminated material as it is transported away from the source.

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.

pollution prevention – The use of materials, processes, and practices that reduces or eliminates the generation and release of pollutants, contaminants, hazardous substances, and waste into land, water, and air. For the U.S. Department of Energy (DOE), this includes recycling activities.

potable water – Water that is fit to drink (i.e., meets *Safe Drinking Water Act* maximum contaminant levels).

prime farmland – 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 (*Farmland Protection Policy Act* of 1981, 7 United States Code [U.S.C] 4201 et seq.). Land classified as prime farmland includes crop land, pastureland, rangeland, 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.

process – Any method or technique designed to change the physical or chemical character of the product.

Program of Record – A directed, funded effort that provides a new, improved, or continuing material, weapon, or information system or service capability in response to an approved need.

Programmatic Environmental Impact Statement (Programmatic EIS) – A broadly scoped document that evaluates the environmental impacts of a Federal program. Programmatic EISs may be prepared, and are sometimes required, for broad Federal actions such as the adoption of new agency programs or regulations. Agencies shall prepare Programmatic EISs for broad actions so that they are relevant to policy and are timed to coincide with meaningful points in agency planning and decision-making.

Programmatic Agreement (PA) – A documented formal agreement between a Federal agency, a State Historic Preservation Office (SHPO), and the national Advisory Council on Historic Preservation, as well as other possible organizations that assists the Federal agency in complying with the requirements of Section 106 of the National Historic Preservation Act (NHPA) (54 U.S.C. § 306108) and its implementing regulations (36 CFR Part 800). The PA may outline a review process for cultural resources, list activities that are exempt from review, and give standard mitigation measures that may be used to resolve adverse effects. (See State Historic Preservation Office and Advisory Council on Historic Preservation.)

proliferation – The spread of nuclear, biological, or chemical capabilities and the weapons (i.e., missiles) capable of delivering them.

Proposed Action – A plan that contains sufficient detail about the intended action to be taken, or that will result, to allow alternatives to be developed and environmental impacts of the intended action to be analyzed.

radiation – See ionizing radiation.

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.

radioactivity –

> Defined as a process: The spontaneous transformation of unstable atomic nuclei, usually accompanied by the emission of ionizing radiation.
>
> Defined as a property: The property of unstable nuclei in certain atoms to spontaneously emit ionizing radiation during nuclear transformations.

radionuclide – A radioactive element characterized according to its atomic mass and atomic number. Radionuclides can be manmade or naturally occurring, have a long life, and have potentially adverse effects on the human body.

radon – A radioactive element of atomic number 86 that occurs naturally in the environment. It is a decay product of radium. Exposures to large concentrations of radon can cause lung cancer in humans.

reasonably foreseeable future actions – As defined in 43 CFR Part 46], Federal and non-Federal activities not yet undertaken, but sufficiently likely to occur, that a Responsible Official of ordinary prudence would take such activities into account in reaching a decision.

receptor – A member of the public (or an individual of a wildlife population) that receives stimuli.

Record of Decision (ROD) – A public document that records a Federal agency's decision(s) concerning a proposed action for which the agency has prepared an Environmental Impact Statement (EIS). The ROD is prepared in accordance with the requirements of the Council on Environmental Quality (CEQ) *National Environmental Policy Act* (NEPA) 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 (ROI) – The physical area that bounds the environmental, sociological, economic, or cultural features of interest for the purpose of analysis.

rem – See roentgen equivalent man.

remote-handled transuranic waste (RH-TRU) – In general, this refers to radioactive waste that must be handled at a distance to protect workers from unnecessary exposure. RH-TRU waste has a surface dose rate greater than 200 mrem/hr. (See contact-handled transuranic waste (CH-TRU).)

repository – A facility for disposal of radioactive waste.

reprocessing – The process of chemically separating used (spent) reactor fuel into uranium, transuranic elements, and fission products.

rift – A linear zone where the lithosphere (rigid outer part of the Earth, consisting of crust and upper mantle) is being pulled apart.

risk – 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.

risk assessment (chemical or radiological) – The qualitative and quantitative evaluation performed in an effort to define the risk posed to human health or the environment by the presence, potential presence, or use of specific chemicals or radionuclides.

roentgen – A unit of exposure to ionizing x-ray or gamma radiation equal to or producing 1 electrostatic unit of charge per cubic centimeter of air.

roentgen equivalent man (rem) – A unit of dose equivalent. The dose equivalent in rem equals the absorbed dose in rad in tissue multiplied by the appropriate quality factor and possibly other modifying factors. Rem refers to the dose of ionizing radiation that will cause the same biological effect as one roentgen of x-ray or gamma ray exposure. One rem equals 0.01 sieverts.

runoff – The portion of rainfall, melted snow, or irrigation water that flows across the ground surface and eventually enters streams.

sanitary wastes – Nonhazardous, nonradioactive liquid and solid wastes generated by normal housekeeping activities.

sanitary wastewater – Water discharged from sinks, showers, kitchens, or other non-industrial operations, but not from commodes. Also referred to as “gray water.”

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 (EIS) 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 (NOI) to prepare an EIS. The public scoping process is that portion of the process during which the public is invited to participate. The U.S. Department of Energy’s (DOE) 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 (DOE) or contractor facilities, property, and equipment.

sediment – Naturally occurring material that is broken down by processes of weathering and transported by erosion.

sedimentary – Formed by the deposition of sediment.

seismic – Pertaining to any Earth vibration, especially that of an earthquake.

shielding – In radiation protection, any material or obstruction (e.g., bulkhead, wall, or other structure) that absorbs radiation, and thus tends to protect personnel or materials from the effects of ionizing radiation. In lighting, an obstruction on light fixtures that directs light rays in order to minimize the harmful effects of light pollution.

shutdown – The condition in which a U.S. Department of Energy (DOE) facility has ceased operation.

socioeconomics (social economics) – The social science that studies how economic activity affects and is shaped by social processes.

soil liquefaction – Ground failure or loss of strength that causes solid soil to behave temporarily as a liquid.

soil resources – The loose surface materials of the Earth in which plants grow.

solid waste – For purposes under the *Resource Conservation and Recovery Act* (RCRA), 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 sewage or irrigation return flows or industrial discharges, which are point sources subject to permits under Section 402 of the *Clean Water Act* (CWA). 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.

sound pressure level – The ratio of absolute sound pressure to a reference level (usually the lowest intensity sound that can be heard by most people) that is measured in decibels (dB).

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 Commission [U.S. Nuclear Regulatory Commission]…determines to be special nuclear material, but does not include source material; or (2) any material artificially enriched by any of the foregoing, but does not include source material."

stabilization – Treatment, packaging, and removal of hazardous and radioactive materials related to facility safety and environmental security.

stabilize – To convert a compound, mixture, or solution to a nonreactive form.

stakeholder – A party potentially affected by a decision made as the result of a *National Environmental Policy Ac*t (NEPA) review.

State Historic Preservation Office (SHPO) – State office charged with the identification and protection of pre-European contact and historic resources in accordance with the *National Historic Preservation Act* (NHPA).

stormwater – Stormwater runoff, snow melt runoff, and surface runoff and drainage [40 CFR 122.26(b)(13)].

Stormwater Pollution Prevention Plan (SWPPP) – A site-specific document that identifies potential sources of stormwater pollution at a construction site, describes practices for reducing pollutants in stormwater discharges, and identifies procedures for complying with the terms and conditions of a Construction General Permit.

sulfur dioxide (SO_2) – A heavy, pungent colorless gas formed by 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 (SA) – A document prepared under the U.S. Department of Energy's (DOE) *National Environmental Policy Act* (NEPA) Implementing Guidelines [10 CFR 1021.314(c)] to provide the information about and analysis of proposed activities necessary to determine whether a supplemental or new Environmental Impact Statement (EIS) is required.

Supplemental Environmental Impact Statement (Supplemental EIS) – A document prepared as a supplement to an EIS and 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.

surplus plutonium – Plutonium that has no identified programmatic use within the U.S. Department of Energy (DOE) and does not fall into one of the categories of national security reserves.

Technical Area (TA) – A designated area of the Los Alamos National Laboratory (LANL) site dedicated to developing solutions to national security issues through the application of scientific capabilities.

tectonic – Related to the structure of the Earth's crust and the large-scale processes within it.

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 (FWS) or the National Marine Fisheries Service following the procedures set out in the *Endangered Species Act* (ESA) 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.)

throughput – The amount of material moving through a process or a system in a given amount of time (commonly a year).

total effective dose equivalent – The sum of the effective dose equivalent from external radiation exposure and the 50-year committed effective dose equivalent from internal radiation exposure.

toxic air pollutants – See hazardous/toxic air pollutants.

Traditional Cultural Property (TCP) – A property that is eligible for inclusion in the National Register of Historic Places (NRHP) based on its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community. (See National Register of Historic Places.)

Transuranic (TRU) – Of, related 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 (TRU) waste – Radioactive waste that is not classified as high-level radioactive waste and that contains more than 100 nanocuries per gram of alpha-emitting transuranic isotopes with half-lives greater than 20 years, except for waste that the U.S. Department of Energy (DOE) has determined, with the concurrence of the U.S. Environmental Protection Agency (EPA), does not need the degree of isolation called for by 40 CFR Part 191; or waste that the U.S. Nuclear Regulatory Commission (NRC) has approved for disposal case-by-case in accordance with 10 CFR Part 61 (DOE Order 435.1). (See also contact-handled and remote-handled transuranic waste [CH-TRU and RH-TRU].)

treatment – An operation necessary to prepare material for storage, disposal, or transportation.

tritium – A radioactive isotope of the element hydrogen whose nucleus contains two neutrons and one proton.

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 that is designed to protect and retain its contents under transportation accident conditions. (See Packaging).

uranium – A radioactive, metallic element with the atomic number 92; the heaviest naturally occurring element. Uranium has 14 known isotopes, of which uranium-238 is the most abundant in nature. Uranium-235 is commonly used as a fuel for nuclear fission, and uranium-238 is transformed into fissionable plutonium-239 following its capture of a neutron in a nuclear reactor.

U.S. Nuclear Regulatory Commission (NRC) – An independent agency of the United States government that is responsible for ensuring the safe use of radioactive materials for beneficial civilian purposes while protecting people and the environment.

viewshed – The extent of the area that may be viewed from a particular location. Viewsheds are generally bounded by topographic features such as hills or mountains.

visual resources – Natural and manmade features that give a landscape its character and aesthetic quality.

visual resource management (VRM) – A process devised by the Bureau of Land Management (BLM) to assess the aesthetic quality of a landscape, and consistent with the results of that analysis, to design proposed activities in ways 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 (VOC) – 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 (EPA) as having negligible photochemical reactivity.

wastewater – Water originating from human sanitary water 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* (CWA) (33 U.S.C. 1251 et seq.), 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.

weapons-grade plutonium – Plutonium manufactured for weapons application. Weapons-grade plutonium is largely plutonium-239 and contains no more than 7 percent of plutonium-240, as defined in the U.S. Department of Energy (DOE) Factsheet, "Additional Information Concerning Underground Nuclear Weapon Test of Reactor-Grade Plutonium." A different range is used in the *Agreement between the Government of the United States of America and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Cooperation*: a ratio of plutonium-240 to plutonium-239 no greater than 0.10; approximately equal to 9 percent plutonium-240.

weathering – The process by which rock is dissolved, worn away, or broken down.

wetlands – Areas 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).

Wild and Scenic River – A waterway designated as such by Congress under the *Wild and Scenic Rivers Act* (Public Law 90-542; 16 U.S.C. 1271 et seq.), that belongs to the National Wild and Scenic Rivers System.

8.0 REFERENCES

This section provides citations for all references used in this SPDP EIS and includes URLs for references that are available on the Internet at the time of publication. NNSA recognizes that URLs may change or become broken links over time due to the dynamic nature of the Internet. NNSA is committed to maintaining existing links to our NEPA documents and references to the extent possible. If a link to an NNSA document becomes broken, NNSA will endeavor to fix the link in a timely manner. References that are not available online are available from NNSA upon request if NNSA determines that they may be released to the public (e.g., they contain no classified information or otherwise protected materials). Please see the Cover Sheet of this SPDP EIS for details about how to request additional information.

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